Century. Nationalism and Journalism in Afghanistan: A study of Seraj ul-akhbâr (1911-1918); 1979; 307 pp., 14 pls.


X Gh. Gnoli and A.V. Rossi (eds.), Iranica; 1979; VIII-456 pp., 54 pls.

SOUTH ASIAN ARCHAEOLOGY
1983

Papers from the
Seventh International Conference of the Association of South Asian Archaeologists in Western Europe, held in the Musées Royaux d'Art et d'Histoire, Brussels

edited by
JANINE SCHOTSMANS and MAURIZIO TADDEI

Volume I

NAPLES 1985
PROCEEDINGS OF PREVIOUS CONFERENCES


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PREFACE

The Seventh International Conference of the Association of South Asian Archaeologists in Western Europe was held in the Musées Royaux d'Art et d'Histoire, Brussels, from 4th to 8th July 1983.

Monsieur René De Roo, Director of the Musées Royaux, welcomed the hundred participants coming from Austria, Belgium, Denmark, the Federal Republic of Germany, Finland, France, Great Britain, India, Italy, the Netherlands, and the United States.

The Musées Royaux d'Art et d'Histoire are nearly 150 years old, having been created by royal order on the 8th August 1835, under the name of Musée d'Armes Anciennes, d'Armures, d'Objets d'Art et de Numismatique, 'dans l'intérêt des études historiques et des arts'. In 1838, the numismatic collections were given to the Royal Library created by royal order on the 19th June 1837. On the 25th March 1847, by royal order the Museum became the Musée Royal d'Armures, d'Antiquité et d'Ethnologie, the eighth museum in Europe to have an 'Ethnology' department.

The first objects coming from South Asia were already received in 1845 and if we read the second catalogue published about the collections in 1864 by Theodore Juste, at the time Director of the Museum (the first edition was published in 1854 by the first Director of the Museum, A.G.B. Schayes), we are quite surprised by the amount of objects received or acquired coming from the South-Asian regions, and by their variety and quality. These objects were at first exhibited among what was left from the Arsenal Royal, already opened to the public in 1409 by Antoine de Bourgogne (1406-1415), on the ground floor of the Palais de l'Industrie and, after 1847, in the Porte de Hal, the only surviving gate from the old walls of Brussels which had been acquired by the State in 1842.
In 1889, a part of the collection was moved and displayed in the Palais du Cinquantenaire, built for the 1880 International Exhibition organized on the occasion of the fiftieth anniversary of Belgium. Only the second and third sections were moved, the first section — Arms, Armours and Artillery — being still now exhibited in the Porte de Hal, which is at present under renovation. The second and third sections became, in 1889, the Musées Royaux des Arts Décoratifs et Industriels, in 1912 the Musées Royaux du Cinquantenaire, and finally in 1929, the Musées Royaux d’Art et d’Histoire.

I wish to thank the Commissariat Général des Relations Internationales de la Communauté Française and of the Vlaamse Gemeenschap for their financial support which made it possible to hold our Seventh Conference in Belgium.

All our thanks to the musées Royaux d’Art et d’Histoire, to their Director Mr R. de Roo, and all the staff of the Museum for their cooperation and assistance; our heartfelt thanks go also to all the Chairmen of the different sessions.

We are most grateful to Dr I.C. Glover and his students, to the Institute of Archaeology of the University of London and the Fine Arts Department of Thailand for bringing to Brussels the exhibition on ‘Thailand: Archaeological Finds from Ban Dan Ta Phet, an Indian Contact Site in Western Thailand’; to Mr T.R. Blurton for displaying photographs and documents on ‘Vijayanagara, the Royal Centre Where Kings and Gods Meet’; to Mrs C. Talon-Noppe for welcoming us at the Musée Royal de Mariemont and guiding us around the exhibition ‘La Voix des Tambours: pour une archéologie du Vietnam’.

The Proceedings of the Seventh International Conference of South Asian Archaeologists in Western Europe are dedicated to the memory of Prof. Dr J.E. van Lohuizen-de Leeuw, her untimely death being such a loss for us all, whether archaeologists or art historians. Many of us have been able to do better work thanks to the sound advice she was always so generously ready to give, and to the scholarly example she set.

We are grateful to her husband Dr Jan van Lohuizen for undertaking the sad task of going through her papers to find material for the Obituary by Dr Raymond Allchin which is included in this volume, and for providing us with a copy of the manuscript of the paper mentioned below. In this volume we
include part of a text by Joan van Lohuizen-de Leeuw on Pāhārpur, read by her at the Musée Guimet, Paris on 7th March, 1983 (‘Unesco’s Masterplan for the antiquities of Bangladesh — Bagherat and Pāhārpur’). This formed the basis of her paper given to the Brussels conference, but she added many new details in the course of her lecture which are not included in the text. Thanks to Dr Jan van Lohuizen we can be sure that our text is the core of her Brussels paper, as he found a copy of the Paris typescript on which she had written ‘Brussels, « The Recent Excavations at Pāhārpur », pp. 9-18’, and had made some minor alterations.

Some colleagues who read papers at Brussels were unable to send them for publication. Among them Dr C. Jarrige and Dr R.H. Meadow had to withdraw for various reasons, while J. Irwin’s paper ‘The True Chronology of Asokan Pillars’ has already been published in Artibus Asiae XLIV, 1983, pp. 247-65.

I wish to thank Professor Maurizio Taddei most heartily for the tremendous work accomplished as coeditor, and the Dipartimento di Studi Asiatici of the Istituto Universitario Orientale, Naples (Director: Prof. A. Tamburello) for so generously undertaking the publication of these Proceedings at its expense, in the same series in which the Proceedings of our Fourth Conference were also published.

Janine Schotsmans

Musées Royaux d’Art et d’Histoire, Brussels, January 1985
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<td>ABIA</td>
<td>Annual Bibliography of Indian Archaeology</td>
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<tr>
<td>AION</td>
<td>Annali [dell']Istituto (Universitario) Orientale di Napoli</td>
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<tr>
<td>ASIAR</td>
<td>Annual Reports [of the] Archaeological Survey of India</td>
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<td>BEFEO</td>
<td>Bulletin de l'École Française d'Extrême-Orient</td>
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<td>BSOAS</td>
<td>Bulletin of the School of Oriental and African Studies</td>
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<td>CAJ</td>
<td>Central Asiatic Journal</td>
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<td>EI</td>
<td>Epigraphia Indica</td>
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<tr>
<td>IAR</td>
<td>Indian Archaeology — A Review</td>
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<tr>
<td>JASB</td>
<td>Journal of the Asiatic Society of Bengal</td>
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<td>JBBRAS</td>
<td>Journal of the Bombay Branch of the Royal Asiatic Society</td>
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<td>JISOA</td>
<td>Journal of the Indian Society of Oriental Art</td>
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<td>JNSI</td>
<td>Journal of the Numismatic Society of India</td>
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<tr>
<td>JRAI</td>
<td>Journal of the Royal Anthropological Institute</td>
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<td>JRAS</td>
<td>Journal of the Royal Asiatic Society of Great Britain and Ireland</td>
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<tr>
<td>JUPHS</td>
<td>Journal of the U.P. Historical Society</td>
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<tr>
<td>MASI</td>
<td>Memoirs of the Archaeological Survey of India</td>
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<td>MDAFA</td>
<td>Mémoires de la Délégation Archéologique Française en Afghanistan</td>
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<td>RE</td>
<td>Pauly's Realencyclopädie der classischen Altertumswissenschaft. Stuttgart</td>
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<td>SAA 1971</td>
<td>South Asian Archaeology, ed. N. Hammond. Papers from the First International Conference of South Asian Archaeologists held in the University of Cambridge. London 1973</td>
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<td>ZDMG</td>
<td><em>Zeitschrift der Deutschen Morgenländischen Gesellschaft</em></td>
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<td>AV</td>
<td>Atharvaveda</td>
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<td>RV</td>
<td>Rgveda</td>
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Volume I
Johanna Engelberta van Lohuizen-de Leeuw (1919-1983)

Johanna Engelberta van Lohuizen-de Leeuw died suddenly, as the result of a cerebral haemorrhage, in December, 1983. Her untimely death deprives the Association of South Asian Archaeologists in Western Europe of one of their most active members and deprives the world of a leading authority on the art of India and Southeast Asia, while still at the height of her powers and with many plans for future research.

Johanna (known to many of her friends as Joan) was born in Amsterdam in 1919, the only child of Willem Carel de Leeuw and Margareta Lievina Muller. Soon after her birth her father went to America for business purposes, taking his family with him, and her early childhood was spent there. She returned to her native land when her parents decided that she should have her education in the Netherlands. Her interest in archaeology arose while still at school. Her university career began at Leiden with the study of Indo-Iranian and emphasis on the art of South and Southeast Asia, and in 1941 she took the Candidaathsexamen. Soon after the outbreak of the Second World War she transferred to the University of Utrecht, taking her Doctoraal in 1945 and completing her Ph.D. in 1949. From 1943-51 she taught Sanskrit at Groningen; adding to this in 1946 teaching of the ancient history and culture of Indonesia in Utrecht. In 1951 a major upheaval occurred when she was appointed University Lecturer in Indian Art and Archaeology in Cambridge, and for the next eight years she remained in this post; adding thereto a visiting lectureship in Indonesian archaeology at the Sorbonne from 1957 onwards. Her years in Cambridge witnessed an important stage in her development, since she now began to make a series of field trips, first to the countries of South Asia and later
also South-east Asia. They also marked the beginning of new international contacts which were to play an important role in her subsequent career. In 1957 she became Membre Correspondant de l’Ecole Française d’Extrême-Orient.

1959 marks the next major turning point in her life. In this year she returned to Amsterdam as Professor of Archaeology, Protohistory, Ancient History and Art History of South and Southeast Asia, and at once set about planning the Institute of South and Southeast Asian Archaeology of which she became the first Director. For the next seventeen years she devoted a major part of her seemingly unlimited energies to the promotion of this Institute, working simultaneously — at first almost single-handed — as lecturer, administrator and fund raiser, and laying the foundations of an extensive library and photographic archive. Members of the Association will recall with pleasure our second conference held in the Institute in 1973. During these years she still found time for many other activities, supervising a number of research students, visiting other Universities to act as examiner — with characteristic thoroughness — for several Ph.D. theses, and serving on an important UNESCO Mission which set in train the project for the preservation of Mohenjo-daro. About this time she became Vice Chairman of the Society of Friends of Asiatic Art in Amsterdam, and a member of the Board of ‘Cultuurgeschiedenis Nederlanders Overzee’, dedicated to the preservation of monuments built by the Dutch in former overseas territories.

1976 marks another turning point and ushers in the last stage of her career. In this year she was suddenly deprived of the Directorship of the Institute she had founded and built up, creating a situation which until her death remained unresolved. It must seem extraordinary to observers in the world outside that one of Europe’s leading scholars in the field could be thus ejected by a ‘kitchen revolution’, and that her University was either powerless or unwilling to intervene! For her it must have been a tremendous disappointment to see the Institute for which she had worked so hard suddenly transformed, and all that she had sought to do over-turned. She continued to occupy her Chair in Amsterdam University up to her death.

If any good came of these melancholy events it must be that she was all at once freed from the burdens the Institute had
involved, and was able to devote herself again to the reading and writing she had sacrificed on this account. In 1977-78 she spent a year as Visiting Fellow in St. Edmund’s House, Cambridge, where the quiet, friendly atmosphere of a scholarly society, and the renewed communion with a number of old friends helped her to adjust to the new circumstances. They helped too to provide fresh focal points for her creative energies. Now, too, she was again able to use her freedom to continue her fieldwork in many parts of Asia and to travel all over Europe, giving lectures and attending conferences and seminars.

Joan van Lohuizen’s writing covers four decades and includes a wide range of subjects in several languages (she seems to have been equally at home in speaking and writing in Dutch, English, German and French). It is perhaps a result of her devotion to her teaching duties that the total volume is not greater, and that apart from her magnum opus, *The Scythian Period*, and a number of exhibition catalogues, most of her written work is in the form of articles. A full bibliography up to 1982 has been recently published in the *Saras Bulletin* (1983). Her art historical method was straightforward and pragmatic: she used epigraphy and inscriptions as aids to dating, and sought to establish relative age and stylistic relationship on the basis of a minute and precise examination of detail. Her knowledge of both Buddhist and Hindu iconography was profound. All these things are to be found already fully developed in *The Scythian Period*, 1949, where she boldly tackled some of the great and long disputed problems associated with the art of Mathurā and Gandhāra during the Kuśāna period. These were themes to which she returned many times in later papers; contributing in 1960 a valuable paper on ‘The date of Kaniṣka and some recently published images’ to the Conference on the date of Kaniṣka (published in 1968); an original and stimulating discussion of ‘Gandhāra and Mathurā: their cultural relationship’ to a symposium held in Los Angeles in 1970 (published in 1972); and perhaps most important of all a paper ‘New evidence with regard to the origin of the Buddha image’ in *South Asian Archaeology* 1979 (published in 1981). Other recurring themes in her writing dealt with aspects of Buddhist architecture and sculpture from both India and Sri Lanka, and from several countries of Southeast Asia. In this field she made contributions too numerous to cite: but in almost every one
there was the same evidence of original thought, fresh insights and fresh synthesis. Typical examples are her study of the ‘Stūpa in Indonesia’ (1980) read at the Heidelberg seminar on the Stūpa — its religious, historical and architectural significance; and her report on ‘The pre-Muslim antiquities of Sind’, with its important new light on the dating of the remains from Mirpur Khas (South Asian Archaeology 1975 [1979]). Her mastery of the identification and description of works of art is seen at its best in the descriptive catalogue of Indische Skulpturen der Sammlung von der Heydt (Zurich, 1964). Almost her only excursions into more narrowly archaeological matters were her inaugural address ‘De Protohistorische Culturen van Voor-Indië en hun Datering’ (Leiden, 1960) and her contributions to the cause of preserving Mohenjo-daro and other monuments. Indeed, one may feel that the sum total of her published works does scant justice to the great breadth and depth of her knowledge of almost every facet of South and Southeast Asian art: her opinion was continually sought by colleagues on all manner of problems, and it was rare for such questioners to come away empty handed. She was an indefatigable worker and it was to be expected that after her retirement much more would have flowed from her pen.

The supervision of research students is one of the more rewarding aspects of any University teacher’s work; but for someone of Joan's temperament it is also one of the most demanding. She required of her students the same exacting degree of accuracy and perfection which she demanded of her own work: and as a consequence she often involved herself in giving far more time and effort than would normally be called for in such a relationship. A further reward of such labour is to see the final results of doctoral theses revised and published: the series Studies in South Asian Culture, published in a number of fine volumes by Brill of Leiden, contained several outstanding pieces of work by her former students, both from Amsterdam and elsewhere. Her positive assistance was extended unstintingly to many students who were not her own. Visitors from abroad wishing to discuss their research or some special problems with her would find that she went to great lengths to make their stay in Amsterdam fruitful. In such ways she was generous almost to a fault in giving her time and knowledge.
Her final years were closely involved with the establishment of the Ancient India and Iran Trust. In the mid-seventies my wife and I planned to set up a trust fund to promote the study of South Asian archaeology in Britain; our early experiences led us to decide that the fund should be independent of other institutions. At about this time we were joined by Professor Sir Harold Bailey, who was seeking a way to keep together in Britain his unrivalled library on the history of the Indo-Iranian languages. In February, 1977 Joan van Lohuizen wrote to me to say that she had no confidence in the future prospects of our subjects in Amsterdam and was altering her will in favour of some institution in Cambridge. We replied telling her of our plans, and she immediately expressed an interest. Following this, the outcome of our discussions, which took place during her year at St. Edmund’s House, was the establishment of the Ancient India and Iran Trust, in which we were almost immediately joined by Dr Jan van Lohuizen. It had been planned that both of them would retire in early 1984 and take up residence in Brooklands House, the property in Cambridge acquired by the Trustees on behalf of the Trust. But this was not to be, at least for Joan.

Her contribution to the Association of South Asian Archaeologists in Western Europe, and to its biennial conference, deserves a special mention. In 1970 my wife and I invited a group of scholars from several countries to Cambridge and the outcome of our meeting was to establish the Association: the first Conference was held in Cambridge in the following year. Joan van Lohuizen from the very first was an enthusiastic supporter of the idea, and remained so until the end. It was therefore natural that she should have been acclaimed as the permanent secretary of the Association, and should have fulfilled that role so faithfully. The continuity and development of the Association during its first decade owes a great deal to her.

Joan married in 1943 Jan van Lohuizen and in 1983 while in Britain they celebrated the fortieth anniversary of a most happy married life.

F.R. ALLCHIN
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New Perspectives on the Palaeolithic
of Northern Pakistan

Although the Indian subcontinent has long been recognised as an area of great importance for Palaeolithic studies, these have always been hampered by a lack of securely dated material. In the past, the river terrace deposits on or in which most palaeolithic artefacts have so far been found could not be dated directly. Instead they were correlated, often very tenuously indeed, with river terrace sequences in Europe, which were in turn correlated with glacial events in the Alps and, by inference, global Pleistocene climatic changes (see e.g. de Terra and Paterson 1939). Even in areas as well studied as Europe, the identification and dating of these climatic events was, and still is, problematic; in areas as distant from Europe as Pakistan, these objectives were virtually impossible. Now, however, with the development of a suite of radiometric and other dating techniques, the construction of an absolute chronological framework for the Pleistocene of northern Pakistan has become possible, and palaeolithic artefacts from this region can now be dated directly, providing of course that they are found in secure contexts.

In this paper, we report the progress made in this direction by fieldwork that we have conducted since 1980 on behalf of the British Archaeological Mission to Pakistan. As the Pleistocene period in the northern part of the Indian subcontinent was one of great tectonic as well as climatic change, it is useful to begin this account with a review of the geological history of this area.

The Geological Context

The Himalaya-Karakoram mountain complex is the dramatic result of the collision of the Indian subcontinent with Asia. In
general terms, India had already drifted North of the equator by about 50 million years (Myr) ago, and began to collide with Asia about 20 Myr ago. This collision was preceded by the secretion of small continental blocks, like the Lhasa block, onto the Asian continent. The complexity of this collision is indicated by recent studies in the Lhasa area by Allègre et al. (1984) and in the Nanga Parbat area of the Karakoram range by Tahirkeli and Jan (1980). Recent investigations into the rate of uplift in the Himalaya Karakoram complex have shown pronounced differences between the Great Himalaya range (uplift rate c. 1 mm/yr) and the Nanga Parbat area (c. 9 mm/yr for the period 0.5 Myr to the present (Zeitler et al. 1982) and also show that 2 Myr ago the Great Himalaya were lower than the Tibetan plateau (Wang et al. 1982). Burbank and Johnson (1983) demonstrate that the Pir Panjal range, that divides the plains of the Punjab from the Kashmir valley, has undergone uplift of 1400-1700 m during the last 400,000 yrs.

A record of the later stages of this collision is provided by the fluvial sediments that were deposited by braided rivers in the area to the South of these rising mountain ranges. These Siwalik sediments, mostly sands and overbank silts and clays, were deposited over a period of 14 Myr and were in turn folded and faulted during the period 1.6-0.4 Myr. Recent work on the magnetic polarity stratigraphy of the Siwalik series, coupled with fission-track dating of various horizons of volcanic tuffs, has established a chronological framework for these fluvial molasse deposits (G.D. Johnson et al. 1982; N.M. Johnson et al. 1982; Opdyke et al. 1979; Visser & Johnson 1978; Keller et al. 1977; Raynolds 1980). The youthfulness of many of the fold structures in the northern Punjab is particularly striking. The folding of the northern limb of the Soan syncline is thought to have occurred between 2.4 and 1.6 Myr ago (G.D. Johnson et al. 1982; Raynolds 1980); while the youngest fold structure in the Punjab, the Pabbi Hills anticline, gained surface expression only 0.6-0.4 Myr ago, with the uppermost Siwalik strata assigned a minimum age of 400,000 yr BP. One important consequence of the fact that Siwalik sediments have been folded at different times is that some of the post-Siwalik deposits in the Soan valley are likely to be older than the most recently folded Siwalik deposits of the Jhelum area. It is against this complex geological backdrop that the evidence for early man in the Punjab must be viewed.
RECENT STUDIES OF THE PALAEOLITHIC IN THE JHELUM
AND SOAN AREAS

The work reported here has focussed on two areas of particular interest with the aim of locating artefacts and archaeological sites in datable contexts, and placing these contexts in a palaeoenvironmental framework. The Jhelum and Soan areas provide a contrasting set of geological contexts and as discussed below, we can now tentatively date lower palaeolithic material in the Jhelum area to at least 400,000 yr BP, and a blade industry in the Soan valley to at least 30,000 yr ago.

1) Palaeolithic Finds in the Jhelum Area

Finds of palaeolithic artefacts were made at two sections (fig. 1): the first Northwest of Dina reported by Raynolds (1980), and the other at the Nathwala Kas part of the Jalalpur section described by N.M. Johnson et al. (1982) and Opdyke et al. (1979). Although both sections contained Upper Siwalik conglomerates, there were pronounced differences in the stratigraphy and composition of the sections.

The Upper Siwalik sequence exposed at the Dina section forms part of the eastern limb of the Mahesian fold. The uppermost 150 metres of this section are dominated by a boulder conglomerate facies composed predominantly of quartzite pebbles; the beds dip at c. 12 degrees. This ‘boulder conglomerate facies’ is strongly time-transgressive in the eastern Potwar (Raynolds 1980), and does not comprise a discrete chronological unit as suggested by de Terra and Paterson (1939) amongst others. A rolled handaxe (fig. 2) was extracted from within this conglomerate unit at just above the point where Raynolds (1980) fixed the Bruhnes-Matuyama boundary for the section, on the basis of his study of the magnetic polarity stratigraphy of the sediments. The handaxe locality is overlain by an estimated 85 m of conglomerates. An early Bruhnes age may be assigned to the conglomerates in the immediate vicinity of the handaxe, which are thus younger than 700,000 yr, but older than the onset of folding at this section. The age of the fold structures in this area of the Punjab has been estimated on the basis of the extrapolation of sedimentation
rates. Within the Upper Siwalik subgroup, these rates have been estimated to range from 25-50 cm/1000 yr (Opdyke et al. 1979; Keller et al. 1977). On the basis of Raynolds’s interpretation of the palaeomagnetic record for the Dina section, a mean sedimentation rate of 25 cm/1000 yr may be calculated for the Matuyama chron. However, given the higher sedimentation rates associated with the deposition of the conglomerate facies, a maximum rate of 40 cm/1000 yr may be applicable to the Brunhes chron.
Fig. 2 — Artefacts from Jalalpur/Chambal section.
Depending upon the sedimentation rate used, the onset of folding at the Dina section is estimated to have occurred between 500,000 and 400,000 yr BP. The upper 400 m of the Jalalpur/Chambal section are exposed along the course of the Nathwala Kas. The beds here dip strongly at angles of between 34 and 44 degrees. Lenses of conglomerates and gritstones are found at the top of this section. Fourteen artefacts, including two handaxes (fig. 2), were extracted from the uppermost conglomerate/ gritstone lens, which dips at 34 degrees and is exposed for c. 700 m transverse to the present gully channel. Whereas the artefacts were made from quartzite and chert, the conglomerate/ gritstone comprises sandstone and limestone pebbles in a matrix of buff sandstone and reddish clay clasts. This point may indicate that the raw material for these artefacts was obtained at some distance from the river channel. The palaeomagnetic record for this section is equivocal at present (Opdyke et al. 1979; N.M. Johnson et al. 1982). The Gauss-Matuyama boundary is fixed by a tuff couplet dated by fission track methods. Above this boundary, two periods of reversed magnetisation and two periods of normal magnetisation have been detected (N.M. Johnson et al. 1982). The uppermost part of the section, including the artefact-bearing horizon, is normally magnetised and may be assigned tentatively to the Brunhes chron. On the basis of considering the tectonic setting of this section, with respect to the Rohtas and Pabbi Hills anticlines, and likely sedimentation rates, a minimum age of 400,000 yr BP may be assigned to this context.

At neither of the localities discussed above is there any possibility that these artefacts were incorporated into the conglomerates at a later date. In each case, the artefacts were firmly embedded in the conglomerate matrix, and where the conglomerates showed some preferred orientation or bedding, the artefacts were aligned in the relevant plane.

2) Palaeolithic Finds and Excavation in the Soan Area

In the Soan area the sequence of Siwalik and Post-Siwalik deposits is complex and includes several erosional hiatuses. Palaeolithic artefacts are found associated either with outcrops of
Middle and Upper Siwalik quartzite conglomerates or with boulder trains derived from such outcrops. Surface spreads of pebbles frequently include artefacts of Lower, Middle and Upper Palaeolithic type. In some areas the artefacts are overlain, and occasionally also underlain, by potentially datable deposits of loess. In the area of the Soan valley to the North of Riwat several areas rich in palaeolithic artefacts have been discovered. Usually artefacts of Middle and Upper Palaeolithic type are discovered together, at surface localities, but some horizons containing only Middle Palaeolithic type flakes and cores have also been found. Much of the Upper Palaeolithic material that is being eroded out at the base of loess sections is very fresh and includes blade cores, broken blades and tiny fragments of debitage. The presence of the debitage probably indicates little post-depositional disturbance and a relatively rapid burial by loess. The age of the loess will therefore provide a *terminus ante quem* for this blade industry that should be close to its real age. Work on the thermoluminiscence dating of the loess horizons in the Riwat area is currently in progress by one of the authors (H.R.). Preliminary results suggest that the loess overlying some of these blade assemblages dates back to at least 30,000 yr BP. If older dates are confirmed, these blade industries will thus be of the same order of antiquity as the earliest found between Iran and North Africa.

Excavations at Site 55, Riwat Area

Besides attempting to locate palaeolithic artefacts in datable Pleistocene contexts, the other main objective of the fieldwork has been to find sites that are sufficiently undisturbed to repay excavation. In 1980, attention was drawn to one such locality on within the middle Soan valley c. 5 km north of Riwat, and to the East of the Grand Trunk road (see fig. 1). During that field season Rendell found a set of six conjoining pieces of struck stone that had been eroded out of the base of a loess bluff adjacent to a small outcrop of tilted gritstone. This area, and the surrounding area of $1.5 \times 2.0 \text{ km}$, were mapped in detail by the following year. In the course of that work, Dennell also found a set of over 80 fresh blades, flakes and debitage, some of which conjoined, in
a loess section near the gritstone outcrop. As the loess cover was thin enough to be removed easily, and because the outcrop protected the area behind it from material transported downslope, a small excavation was conducted in the area immediately downslope of the outcrop. This excavation was brief but revealed what appeared to be a low wall of cobbles and gritstone blocks, some possible post-holes, a stone-lined pit, and fresh blades and flakes (fig. 3). The area of excavation was increased in the spring of 1982, and again in an extended autumn season later that year, by which time an area of some 400 sq.m was exposed. The results of this excavation are still being analysed, and only a preliminary account can be given here.

The key to understanding the history of this site is the outcrop, now exposed as a sheet of gritstone dipping NNW at c.20 degrees, and largely buried on its northern side by loess. Although the age of this gritstone is unknown, it is likely to be at least Lower Pleistocene in age, and was probably tilted to its present angle during the Middle Pleistocene. The outcrop is broken up by joints and fissures and a major joint effectively splits the outcrop in two along roughly an East-West axis. The surfaces of these two parts of the outcrop differ markedly in both angle of dip and composition. The part of the outcrop initially exposed dips at c. 20 degrees and is composed of a coarse gritstone, c. 1 m thick, containing the occasional small pebble. The more northerly part of the outcrop dips at c. 15 degrees and has an upper layer entirely composed of cobbles. At the moment it is unclear whether the layer of cobbles extended over the entire upper surface of the gritstone.

After the period of tilting, and subsequent erosion, it is apparent that both surfaces of the gritstone outcrop lay exposed until well into the last glaciation. The cobbles on the surface of the gritstone were also used sporadically as a source of new material for making stone artefacts. Most of the cobbles on this surface have been flaked; this surface contains numerous abraded cores and flakes, as well as a rolled hand axe. Although the full analysis of the type and distribution of abraded material on this surface is not yet complete, the number of detached flakes seems far lower than the number of cores might suggest, indicating that flakes have been preferentially removed. In addition, the distribution of abraded flakes and cores on this surface appears
to be random, as might be expected if this surface was used intermittently over long periods of time.

During the last glaciation, loess began to cover the lower slopes of the gritstone/conglomerate sheet, as well as the open joint between it and the present outcrop of the gritstone. On the basis of current TL age determinations, this seems to have happened between 30,000 and 40,000 yr ago. Whilst this was happening, a small structure was built. This consisted of a screen, erected along the southern (upslope) edge of the gritstone/conglomerate, and indicated by three post-sockets, and a low wall some 4 m long parallel to it and between the present outcrop and the conglomerate surface. The stone-lined pit to the South of this
wall may also have been part of this structure. The main purpose of the wall may have been to divert rain water running off the outcrop, thereby keeping the space on the other side of the wall dry. This space would have been sufficient as a sleeping area for two people lying end to end, and at present the simplest interpretation of this structure is that it was a lean-to that gave some shelter from wind, and which was used for only a short period of perhaps a few days.

This structure is associated with a scatter of fresh blades and flakes, most of which were found on the uppermost part of the conglomerate sheet. As these blades and flakes were often made of a blue or white type of quartzite not found amongst the pebbles and cobbles that make up the conglomerate surface, they may have been imported from elsewhere either ready-made or as cores. A distribution map of conjoining pieces shows that they occur on either side and within the structure, suggesting either that they were used whilst the structure was in use or shortly afterwards. A significant feature of the assemblage associated with the structure is that many of the pieces are scrapers, some of which are broken. In view of the type of artefacts and their association with a stone-covered slope, it is currently thought that this site may have been used for the processing of skins. In the first place, this interpretation is consistent with the high proportion of scrapers on the site, and the absence of any evidence for prolonged occupation, such as hearths and food débris. Second, stone surfaces of the kind examined here retain heat from the sun longer than loess-covered surfaces, and could also allow air currents to circulate under the skins when being dried. However, this interpretation may change in the light of further analysis.

Whatever the activities performed on this site, they lasted for only very short periods, and eventually the entire site was buried under loess. At some stage, whilst the loess was still being deposited in the area, the site was gullied, although not to the extent of disturbing the main archaeological evidence. In historic and recent times, the topography of the loess in this area has been greatly altered by field terracing.
DISCUSSION

The palaeolithic record of Pakistan is of more than local significance for three reasons. The first is that the region has a stratigraphic record for the Pliocene and the Pleistocene that is comparable to the better-known sequences in East Africa, and thus discoveries in Pakistan could throw much light on hominid origins. Second, the location of Pakistan between the Near and Far East makes it a region of major importance for questions concerning the time when hominids first colonised Asia, and concerning the origins of modern man. Third, the loess deposits of the northern Punjab provide one of the best-preserved Upper Pleistocene landscapes outside eastern Europe. Inevitably, the development of an absolute chronological framework, and the discovery of archaeological material that can be reliably dated, will revise earlier opinions of the palaeolithic of northern Pakistan that were based on relative chronologies and surface collections of artefacts. Future fieldwork will, we hope, build on the modest beginnings reported here.

ACKNOWLEDGEMENTS

The results presented in this paper form part of the work of the Palaeolithic Environment Project of the British Archaeological Mission to Pakistan. We thank the directors of the British Mission, Drs F.R. Allchin and B. Allchin, and the Director-General of Archaeology of the Government of Pakistan, Ishtiaq Khan, for their unfailing support. We also thank M. McKean and E. Moth for their invaluable assistance in the field; Prof. L.R. Binford, Prof. N. Johnson, Dr J. Miller, Dr R. Raynolds, and Dr C. Vita-Finzi for comments and advice; and the British Academy, the Ancient India and Iran Trust, and the Universities of Sheffield and Sussex for financial support.
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BRIDGET ALLCHIN

Ethnoarchaeology in South Asia

Ethnoarchaeology has been in vogue among prehistorians of the U.S.A. and Europe for some years and more recently it has also found favour in India. As one sometimes referred to as a traditional prehistorian I felt that I ought to try to bring myself up to date and find out a little more about the way the term is used. The most satisfactory definition I have been able to find so far is that of P.J. Watson in Ethnoarchaeology (ed. C. Kramer, 1979). She says 'The theoretical basis for ethnoarchaeology is the use of analogies derived from present observations to aid interpretation of past events and processes'. If one assumes that the word 'processes' covers crafts and technology as well as economic and social processes, this would appear to me to fit the South Asian situation admirably. Furthermore, most of us would appear to have been ethnoarchaeologists, consciously or unconsciously, throughout the greater part of our working lives as archaeologists. In South Asia one can hardly avoid it. An example of what one might call spontaneous ethnoarchaeology is B.K. Thapar's now well known interpretation of the pre-Harappan ploughing pattern below the detritus of later periods at Kalibangan in north Rajasthan. Here he was able to make a very precise interpretation of the crops for which this pattern of ploughing was employed by consulting local farmers. The study of the ruins of the Pathan village in Baluchistan by Catherine Jarrige and François Audouze (1979) represents a more deliberate approach, recording material that should be of great value for the archaeologist. A more light hearted example of ethnoarchaeology applied to later periods occurred many years ago in South India when, with an Indian friend, formerly in the Indian Administrative Service, we were looking at an Asokan inscription which was incomplete. We both began speculating rather naively
on why this might be so. Our friend listened for a few minutes and then quietly put in 'It's perfectly obvious, the officer in charge must have been transferred'.

Although the South Asian Archaeological Conference is rightly regarded primarily as a forum for the presentation and discussion of recent archaeological discoveries, I feel that because so much archaeological fieldwork and research in South Asia involves ethnoarchaeology, and where it does not it would so obviously benefit from doing so, the subject deserves some special consideration in the South Asian context at this point in time. South Asia presents an outstandingly suitable context for an ethnoarchaeological approach to prehistory and indeed, if as a prehistorian I may be permitted to say so, to later archaeology. Our problem is that being constantly confronted by potential ethnographic analogies in the areas where we work, we are all too easily inclined to disregard them. We should be careful however, for soon many of them may have disappeared and this valuable material will be lost for ever. Therefore I propose to look briefly at some aspects of South Asian archaeology from this point of view, in the hope of provoking some further thought and discussion.

South Asia, with its many communities still retaining their own distinctive lifestyles alongside one another, provides a dazzling and overwhelming range of possibilities for the ethnoarchaeologist. This was brought home to me with renewed force by a recent visit to Sri Lanka. Siran Deraniyagala showed me some Late Stone Age sites he had been investigating on the coastal dunes or teris of south-eastern Sri Lanka (fig. 1). Nearby was a small traditional fishing settlement which must be very close to the lifestyle of the late Stone Age people of the same area. I was particularly delighted by this as it adds a new dimension to the picture of the late Stone Age communities of Sri Lanka that I had attempted to reconstruct many years previously on the basis of occupied caves and open sites and their relationship to the accounts of the life of the remaining Vedda hunting and cave dwelling people recorded by the Seligmans (1911), Sarasins (1908) and others. This was in my book The Stone Tipped Arrow, which I now realise was a work of ethnoarchaeology in all but name, and in an earlier paper (Allchin, B., 1959 and 1966). An example from India of the scholarly use of this kind of material — in this
case oral traditions in conjunction with archaeological and other evidence — is Murty and Sontheimer’s study of the pastoral Kurubas and other groups in the southern Deccan (Murty & Sontheimer 1980). The various categories of evidence are used to reconstruct the history and development of pastoral communities within the social and economic background of the region as a whole.

All round the coasts of Sri Lanka and India one can observe methods of inshore fishing and the subsidiary crafts involved; inland one can see traditional methods of fishing used in lakes and rivers; many of them have the stamp of antiquity. Lapidaries can be found in western India and elsewhere who work semi-precious stones by methods that can be traced back to the Mature Indus Urban culture, and from there further back to the Palaeolithic, as discussed at an earlier meeting of this Conference (Allchin, B., 1979). Observations made by local people can sometimes bring one’s archaeological work startlingly to life, as in the case of the Pathan lady visiting our excavations at Charsada in 1963 who swept back her burkha, better to examine some
curiously shaped pots, and explained that they were pickle jars (fig. 2). The shape and degree of porosity of the earthenware, she went on to tell us, was particularly well adapted to the preservation of oil-based pickles. My husband’s studies of traditional methods of making pots and their uses, made in South India many years ago, are surely in the main stream of ethnoarchaeology (Allchin, F.R., 1959 and 1978) as is Dr Judy Birmingham’s more recent study of the manufacture and use of traditional pottery types in Nepal (1975).

Various aspects of the cattle keeping culture of Karnataka, and particularly the nature of the ash mounds which proved to be the kraals of pastoral communities was worked out by us in the 1950’s. Their more detailed interpretation on the analogy of keddahs used for capturing and domesticating wild elephants in Mysore was put forward at an earlier Conference (Allchin, F.R. & B., 1974). These and our observations on the nature of Neolithic huts and other features of Neolithic hill settlements in South
India also made in the 1950's, and their relationship to certain types of huts still built and lived in by villagers of the same area today, are another case in point (Allchin, F.R., 1960). At Tekkalakota in Mysore, a Neolithic site of the early 2nd millennium BC excavated by Nagaraja Rao in the 1960's, round hut foundations with a characteristic pattern of hearths, grinding stones, etc., were found on terraces constructed on the slopes of a group of granite hills (Nagaraja Rao 1965). Their counterparts in every feature were found on the outskirts of the present village, occupied by some of the poorer members of the community. In Neolithic times they appear to have been the principal house type, and presumably that of the main bulk of the population, probably including the leading members of the community.

Most of the examples I have quoted each throw light on a particular set of techniques or practices. The question is, can such observations tell us more about the lifestyle of the communities with which they were associated in antiquity? Here one has to consider each case very carefully. The main problem is that while many communities appear to have retained their identity for periods of hundreds or in some cases thousands of years, they have throughout been constantly modifying their way of life and their relationship to other communities. Therefore all we see of their lifestyle today does not necessarily apply to the past simply because certain craft traditions, hunting and fishing methods, house styles, etc. have survived. This aspect of socially distinct communities or caste groups and their reaction to changing conditions has been dealt with at some length by the late D.D. Kosambi (1956) and I shall not go into it here, but merely point out that the example of Tekkalakota, just quoted, shows how a house pattern can survive for four thousand years, but go down in the social scale. Such surviving traits therefore are in the first instance representative only of themselves. They do not necessarily reflect wider patterns of living, nor the social and economic relations of which they are the outcome, although in certain circumstances they may contribute to a more comprehensive picture, as my recent observations of the coastal sites in Sri Lanka appear to do, and as Murty and Sontheimer's study of the Kurbas undoubtedly does.

The study of the deserted Pathan village which I referred to at the beginning also raises a number of questions of continuity
in a wider context, and in a rather different sense. It calls to mind Frank Hole's observations on nomads present and past in Luristan (1979), where he concludes that the basic house or tent plan found in nomad encampments today has remained unchanged for 8,000 years. He goes on to consider whether this means that the way of life with which it is associated is equally old. In this case there is some supporting evidence to suggest that this may be so, but it cannot be assumed automatically in other cases.

Both the Pathan village and Hole's site with ancient house plans lead one to consider several further questions with regard to actual routes taken by nomads, and more general patterns of migration. Hole is of the opinion that actual routes in Luristan must have changed, due to changing environmental patterns and political frontiers, during the 8,000 year period throughout which the pattern of dwelling of modern nomads appears to have remained constant. This seems highly probable. It also seems probable that a general pattern of pastoral nomadism, in many cases combined with trade, has been continuous in the region as a whole. The essential basis of this pattern is the seasonal migration of whole communities (or significant parts of communities, leaving some representatives at a fixed point on the annual migration route), with their animals, from one environmental region to another. In Pakistan and Afghanistan, prior to 1979, it involved seasonal movement between the mountains and the plains, and many nomad groups such as the Powandahs also acted as traders.

Early evidence of trade in turquoise and other exotic items found by the French at Mehrgarh (Jarrige, J.F., 1979) points to the possibility of migrant nomad groups acting as traders from very early times. There is no reason to suppose that the evidence so far found is that of the first communities to follow a life of seasonal nomadism, therefore the tradition is likely to be even older. The difficulty in identifying nomad camping grounds, as opposed to the easily recognized mounds of decayed mud-brick structures, littered with potsherds, that represent ancient settlements and early urban sites, makes the whole question of tracing the development of nomadic patterns of life an elusive one. The problem of identifying camp sites applies even of present day nomads, as I found in Gujarat where the Badwal, a
community of nomadic stock breeders, seem to leave virtually no trace of their presence apart from animal dung and a few rags and food scraps (Allchin, B., 1972).

The Badwal move on an East-West route from Cutch to Central India and back each year through the intensely cultivated plain of central Gujarat (fig. 3). They maintain mutually advantageous relations with the farmers of the plain, sell their surplus young stock to dealers from the cities and ghee and other products to local markets. Consequently their route has been modified from time to time as they have adapted to the advent of the railway, new villages and towns, bridges, etc. Their camping places are sometimes dictated by the local farmers’ wish to have the animals penned overnight on fields in need of manuring. The nomads of the North-West Frontier and Baluchistan have been subject to different, harder pressures of a tectonically unstable region, subject to violent erosion and massive deposition of alluvial silts etc., to the arbitrary closure of political frontiers, and for the last few years they have been involved in war. But in both
cases it is the general pattern of movement and the habit of mobility that are significant.

How far back in time do these habits and basic patterns extend? As a Palaeolithic archaeologist I find this a highly intriguing and challenging question. Already we have some indications that they may go back almost to the beginning of the recent geological period. In the early 1930's Okladnikov was of the opinion that the Mousterian cave sites of the Hissar range of northern Tadjikistan, including Teshik-Tash with its remarkable Neanderthal burial, might be summer hunting camps. He considered that their inhabitants might have spent the colder season in the sheltered lower valleys, where indeed Mousterian sites have since been found. One must consider therefore whether patterns of seasonal migration are older than pastoral nomadism as such, and perhaps even ancestral to it. In other words, the habit of travelling or transhumance may be a continuous tradition of the region, although not necessarily always involving the same communities; a tradition extending back into the Palaeolithic in Central Asia and parts of South Asia, both regions of extremes of climate, much of which are desert or near desert and consequently highly sensitive to even minor fluctuations of climatic regime. In such conditions some game animals too may have migrated annually over long distances as they do or did until very recently in other parts of the world.

The present day inhabitants of these regions are evidently conscious of the two alternative ways of life, the settled and the nomadic, and are aware of the possibility of switching from one to the other as circumstances demand. This is demonstrated by the manner in which Afghan refugees in Pakistan, artisans and shop keepers who formerly lived in towns and villages, on arrival built themselves temporary dwellings (fig. 4). These resembled the huts or tents of nomadic communities in the region which represent a long tradition going back to Neolithic times.

In the course of this brief discussion I have skated round the interesting and central question of continuity in regard to aspects of permanent settlements that lend themselves to an ethnoarchaeological approach, such as site distribution, settlement pattern, house plans and types, population density, industrial activities, and many more. They lie beyond the scope of this paper. Furthermore they have been and are being expertly dealt
Fig. 4 — Afghan refugees in Pakistan with the floor and framework of a temporary house or tent in process of construction.

with by other people. They were discussed by Lambrick in relation to Sind (Lambrick 1964). More recently aspects of these questions have been dealt with by members of the French Archaeological Mission with regard to the Kachi plain (Jarrige 1979 and 1981; Jarrige & Lechevallier 1979); by the German team at Mohenjo-daro (Jansen 1979, 1981 and 1983; Sarcina 1979); by our Italian colleagues at Shahr-i Sokhta and elsewhere (e.g. Biscione et al. 1974; Jarrige & Tosi 1981). M.K. Davalikar in a recent paper read in London discussed the ethnoarchaeology of the Chalcolithic and early Iron Age farming settlement of Inamgaon in Maharashtra (paper read in 1982). What emerges on the basis of recent and historical accounts of nomadic peoples, when set beside the archaeological record, is the long interdependence of settled and nomadic communities throughout the region. As both G. Possehl and the present writer have each independently pointed out elsewhere, both must have been essential to the structure, cohesion and functioning of a complex but closely
integrated society such as that of the Mature Indus Urban period in Pakistan and western India (Allchin, B., 1979 and 1981; Possehl 1979). The distance between the major urban sites alone is enough to demonstrate this, as Possehl has shown.

The archaeology of the Indian subcontinent as a whole, and of the Indus system in particular, shows a long overlap between sedentary village and urban settlements on the one hand, and sites representing so called Mesolithic communities on the other. As a prehistorian I tend to be particularly interested in the latter, and in the nomads whose role has tended until recently to be overlooked or played down. I feel strongly that if we are to understand the nature of early urban society in South Asia we must take into consideration its complexity and its probable composite, communal structure. This applies not only to the more arid north-western parts of the subcontinent where the question is primarily one of the relations between nomadic and settled communities, but also to the very different environmental regions of South and East India. In southern and eastern India communities at various technological and cultural levels have for long lived in a state of mutual dependence. An obvious example is that of the Kuruba shepherds described by Murty and Sontheimer and referred to earlier. Another is the cattle breeders who rear their animals in the hill and forest areas and bring the young stock to regular fairs and markets to sell to settled agriculturalists (fig. 5). Yet another is that of contemporary, or former, hunter-gatherers who until recently, and in some cases still, sell to neighbouring urban communities honey, baskets, reed or grass mats and other products of the areas in which they live. During this century such people have tended increasingly to form self-contained communities on the edge of the towns and villages with which they trade. The consistent factor throughout is that these communities were, and in many cases still are, essential to the development and continuance of the whole social and economic structure within which the urban culture has evolved.

It is the mutual interdependence of communities, rather than individuals or extended family groups, and the maintenance of group identity through time even though modified by circumstances, that has characterized the society of the subcontinent during the historical period. This appears to have been already accepted as an established tradition in Vedic times, as is shown
by the *Purusa-Sūkta* of the *Rgveda* (X.90). The increasing evidence of the predominantly indigenous roots of urban Indus culture suggests that this may be a feature of some antiquity that was already present, along with many other features still in evidence, in Mature Indus times. This in turn suggests that we should expect the total picture of the society of the urban Indus world to be a highly complex one. We should expect to find many different communities within cities, and also further communities of many kinds occupying the intervening spaces between the cities and the intensely cultivated areas of the plain associated with them. Such communities must have been to varying degrees and in different ways mutually dependent upon each other and upon the cities. But, and here I would go a stage further than Possehl does in his paper presented to the 1977 Conference, it is the cities that must have become more and more the focal points that held the whole together. This is a point of view that I was led to in the first instance by a different set of evidence — that of the stone industries of the pre-urban and urban Indus world — also presented at the 1977 Conference.
Looking at the problem from a wider ethnoarchaeological point of view I feel that the case for the complexity and multiple character of all early urban societies in the subcontinent is a strong one. The best and only model we have available for Harappan society is that of traditional Indian society as recorded in traditional literature and by travellers, historians and anthropologists of historical and modern times.

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JEAN-FRANÇOIS JARRIGE

Continuity and Change in the North Kachi Plain
(Baluchistan, Pakistan)
at the Beginning of the Second Millennium BC

Introduction

Since 1968, the work conducted by the French Archaeological Mission to Pakistan in collaboration with the Department of Archaeology of Pakistan has been regularly reported and discussed in the different volumes of South Asian Archaeology (Casal 1973; Enault & Jarrige 1973; Jarrige & Lechevallier 1979; Audouze & C. Jarrige 1979; Costantini 1981; Jarrige 1984; Costantini 1984; Meadow 1984a; Santoni 1984). This work has allowed the construction, on relatively stable foundations of a chronological framework for settlement in the Kachi plain from the early 7th millennium BC to the middle of the 1st millennium BC. Considering the symbiotic relationships between the Kachi lowland belonging to the Indus system and the upland valleys and basins of Quetta, Kalat, Loralai, and Zhob, this chronological framework has also contributed to our understanding of the general chronology of the Greater Indus (Jarrige & Lechevallier 1980; Jarrige 1984). But such work also has its limitations since the excavations at Pirak (1968-1974) and Mehrgarh (1974-present) are the only projects in Baluchistan where horizontal exposures have provided an extensive body of information suitable for reconstructing, within an interdisciplinary framework, the material culture of the local people in relation to the natural environment from about 7000 BC to 700 BC.

Early archaeological fieldwork in Baluchistan was primarily concerned with the spatial patterning of ceramic styles which were often assumed to reflect specific cultural entities or even ethnic groups. Stylistic change in ceramics was therefore thought
to be a good indicator of cultural change. Due to the non-
dynamic model used to interpret the archaeological remains of
Baluchistan, these changes were also thought to relate to strong
external influences coming from ‘more advanced’ centers and to
have often involved movements of population. For instance, the
Togau-Kili Gul Mohammad and Kechi Beg styles were attributed
to people coming from the Iranian plateau, with the Quetta ware
being brought by groups from South Turkmenia via Shahr-i
Sokhta and Mundigak. The diffusion of the Kot Dijian pottery, in
this scheme, would be indicative of the progressive integration of
large tracts of Baluchistan into the cultural system of the Indus
at a time when influences from the Northwest were becoming
weaker. The next step would be, after 2500 BC, a Harappan
colonization marked by the arrival in the area of artifacts con-
sidered to be markers of this civilization and of its control over
Baluchistan. With the 2nd millennium, influences would no
longer come from more advanced centers but, instead, the disap-
ppearance of the Harappan pottery and its replacement by cruder
handmade ceramics such as Jhukar pottery would be related to
the arrival of pastoralist invaders from Central Asia, this move-
ment opening the way to later waves of invaders, among them
the Indo-Aryans who are often identified as the Painted Gray
Ware (PGW) people of the Ganges valley in the very early 1st
millennium BC.

There is indeed little doubt that cultural interactions resulting
from contacts, exchanges, and movements of populations have played a part in the dynamics of change throughout the
western border areas of South Asia and the Indus system. But
the archaeological record from Mehrgarh, Pirak, and other sites
surveyed in this region shows that change and continuity through
pre- and protohistoric times have to be seen to a large extent as
internal processes operating within the geographical framework
of the semi-desertic Kachi plain through which very different
ecosystems (such as the marshy Indus valley and the arid intra-
montane valleys of Kalat, Quetta, and Loralai) came to be inte-
grated. This process of integration, documented by studies of
settlement patterns, subsistence techniques, craft activities, and
mortuary practices, has to be seen in the context of strategies
and responses that people had to make through the course of
time in order to maintain and increase the efficiency of their
socio-economic system in the face of a natural environment which was also undergoing change due to human exploitation.

In a semi-arid region like the North Kachi plain, the natural xerophytic vegetation is fragile and, with the coming of farmers and herders, the natural balance can be upset and a process of environmental change begun. This process can be marked by the progressive replacement of plants valuable for man and animals by antipastoral — often bitter and thorny — species, by the decreasing fertility of large tracts of land, and by salinization. Postulating such changes for the North Kachi plain, we can also expect that the archaeological record will reveal transformations through the course of pre- and protohistory both in the settlement network and in farming techniques, transformations which are linked to increasing labor investment and to intensified land use. While it is difficult to assess the role of population growth in such a process, it can be inferred from the increasing density of the settlement network that the population did indeed grow. Possible reasons for this growth include changes in birth-rate regulating mechanisms in the face of new opportunities provided by a developing agricultural technology and/or the settling down of marginal groups.

Such a picture of change for the North Kachi plain contradicts one traditional model of rural life in South Asian villages, a model characterized by a postulate of conservatism in social and economic structures deeply rooted in immutable and time-honored traditions. These villages, living at the rhythm of their two or three annual crops, were thought to have been only indirectly affected by major political events which did not upset the ancient socio-economic pattern until modern times when large scale public irrigation systems, industrialization, and sanitary campaigns speedily transformed rural life. Actually, the apparently conservative natures of rural towns and villages in Kachi and elsewhere in the Greater Indus area and South Asia are, in fact, the products of a succession of major changes in socio-economic systems through the course of pre- and protohistory. And it is on one of these transformations of the rural system — that of the first half of the 2nd millennium BC — that I intend to focus after placing it within the context of other social and economic transformations which characterize the occupation of the Kachi plain in the Neolithic and Chalcolithic periods.
The Neolithic and Chalcolithic Subsistence Patterns

The North Kachi plain, lying as it does where three environmental zones come together (hills, plains, and perennial rivers), was a region well suited to the early development of a farming economy. Although the previous stage is not yet attested in archaeological deposits from the area, we can presume that, during the late Pleistocene, hunter-gatherers could have fed themselves by collecting wild grasses and fruits in the foothills and by hunting animals on the open slopes and on the plain near watering points. Although such a way of life may have continued far into the Holocene in other parts of South Asia, by the early 7th millennium BC in the Kachi plain we know that cereal cultivation in flooded fields played an important part in the subsistence economy (Costantini 1984).

The Bolan basin provided an ideal location for this kind of incipient agriculture since the river flooded large tracts of land during the summer months, a fact attested in sections cut by the Bolan river along its present course. By bringing wild cereals from their native habitats and planting them at the end of the summer in the fertile alluvial soils, people could expect good winter crops without the considerable labor required to clear fields and set up irrigation system. At first, cereal cultivation was almost entirely limited to naked six-row barleys which, however, were ‘perhaps not completely domesticated’ (Costantini 1984: 31). Other cereals grown include much smaller amounts of wild barley, einkorn and emmer, and durum-bread wheat; the latter are significant because wild wheats are not known from this part of the Middle East today. Straw from the threshing floors was mixed with clay to form mud bricks which were used to build multi-roomed buildings and storage units. Some goats were kept by these earliest known inhabitants, but most of the meat seems to have come from wild ungulates (Meadow 1984a & b). By about 6000 BC and the end of the aceramic Neolithic, however, sheep, goat, and cattle were all being kept as domestic animals with cattle breeding having replaced hunting as the dominant form of animal exploitation. The agricultural economy had developed to the point where domesticated sphaerococcid naked barley, a form well adapted to flood irrigation, was being cultivated and rows of large compartmented storage buildings
were being built in well-defined areas of a settlement which had grown to more than 10 ha in size and whose edges were extended out on the sloping mound surface by means of impressive mud-brick terracing systems. Other parts of the site were occupied by series of circular fire-places near which were found heaps of bones and other trash. All of these elements suggest some degree of collective effort in agriculture-related activities during the Neolithic period.

This type of socio-economic pattern seems not to have changed much in the course of the 6th and 5th millennia BC even though a spectacular development of craft activities is attested at Mehrgarh. The main architectural elements of this Chalcolithic period are still the impressive complexes of compartmented buildings (now even more elaborate), but by the end of the 5th millennium, pottery known in other parts of Baluchistan as the 'Kili Ghul Mohammed' or 'Togau A' wares began to be produced on a massive scale in specialized areas and came to be spread over more than 70 ha of the site. Even allowing for several shifts of the settled area over many centuries, such a wide distribution implies the presence of a considerable population aggregated in a manner already seen on a smaller scale during the early Neolithic. Excavations of a graveyard of this period also reveals a remarkable density of burials, this also consistent with a high population concentration (Samzun & Sellier 1983 & this volume).

Later in this period and in the next, after 4000 BC, there is a marked change in settlement patterns. Whereas for earlier periods no other sites are known for the North Kachi plain (in spite of concerted efforts to locate some), with the 4th millennium we can report six medium-sized settlements in the area. At Mehrgarh itself, the settlement shifts to the South where clusters of houses with private courtyards, domestic installations, and storage jars have been exposed. This change in settlement patterns coincides with one in agriculture. Cultivation of naked (and especially sphaerococcoid) wheats, which previously had been very limited, becomes important, this attesting to a greater diversification of the economic base (Costantini 1984). A similar phenomenon is evident in the animal economy which is based less on cattle and more on sheep and goat with also an increasing amount of wild fauna being hunted, especially hemiones and wild boar (Meadow 1984a & b).
The development of a more diversified agricultural system in North Kachi coincides with a significant increase in the number of settlements all over the Greater Indus area, not only in the upland valleys of Baluchistan (e.g., Fairservis 1956, 1959; de Cardi 1965, 1983) but also in the Indus valley itself (Jarrige 1981, and especially Mughal 1982). The expansion of the settlement network continues in the first half of the 3rd millennium BC as can be seen both in Cholistan (Mughal 1982) and in the Quetta region where sites of the Sadaat II and III phases 'occur almost everywhere in the valley where fertile soil and water exist' (Fairservis 1956: 359). Starting from that 4th millennium period marked by pottery of the 'Togau C' style (also present in the Indus valley at Amri in levels of Period IA), a network of sites came to extend over most valleys of southern Baluchistan and into the lowlands of Las Bela (e.g., the site of Balakot — Dales 1979). And it is to this period that the building of the first of the *gabarbands* of highland Baluchistan probably can also be attributed. Those sometimes elaborate systems of stone embankments trap silt and permit cultivation in regions otherwise poorly endowed with water and arable ground. Even with their construction, however, cultivable land would have been limited as it would also have been in the North Kachi plain where only restricted areas can be easily exploited. Thus pressure on available land as well processes of environmental degradation probably encouraged settlement of the Indus alluvium itself, a process facilitated by an agricultural technology developed over millennia in Baluchistan. One can only presume that devastating floods, thick riparian forests, and unhealthy marshy tracts were no longer insurmountable deterrents in those areas of the Indus alluvium suitable for cultivation of winter crops.

Unfortunately, it is impossible to recover the prehistoric settlement network of the Indus valley because of the erosional and depositional history of the alluvium. The excellent survey conducted by Mughal along the dry bed of the Hakra river, however, shows the scope of what might be expected. There 174 sites of the Mature Harappan period have been identified, a marked increase from the 40 settlements of the Early Harappan period (Mughal 1982: 87). These data support the hypothesis that by the middle of the 3rd millennium BC, a network of settlements inhabited by farmers, herders, and craftsmen had
grown up over much of the Indus system and that the conditions were favorable for the emergence of very large settlements like those of Mohenjo-daro and Naru-warodharo (Flam 1981: 157) in Sind, Harappa in Punjab, Judeirjo-daro (Flam 1981: 157) and Pathani Damb (de Cardi 1983) in lower Kachi, and Ganweriwala in Cholistan (Mughal 1982: 93).

This is not to imply that the existence of a network of settlements practising a successful form of agriculture within the context of an efficient socio-economic system is sufficient to explain the development of urban civilization in the second half of the 3rd millennium BC. Other factors must have played an active part in this process, but a part not easy to recognize independently of the general intensification of economic and cultural interactions which took place throughout the Middle East in the 3rd millennium from Mesopotamia to the Kara Kum, Arabian Gulf, and Indus valley. While this period is not the principal subject of the present paper, it is important to note in this context that several objects claimed to be 'foreign' to the greater Indus valley and ascribed to 'invaders' because of their resemblances to items found in Hissar III contexts can no longer be interpreted in this fashion. Specialists now date Hissar III before 2000 BC and the objects in question are similar to others now well known from Bronze Age cultures of Bactria, Margiana, and eastern Iran. Pierre Amiet (1978) has shown that many of these items have to be seen within the context of intensive international relations, particularly in the domain of metallurgy. The discovery of many similar objects in the South necropolis of Mehrgarh (Period VIII) and at Sibri (Santoni 1984) demonstrate that international relations were also important for the North Kachi plain at the end of the 3rd millennium and that the area had become a dynamic frontier in the context of strong interregional interactions which marked the development of urban centers throughout the Middle East (Jarrige, n.d.).

In sum, many socio-economic elements which not long ago were thought to be foreign to Indus valley, in fact, existed there as early as 4000 BC. Furthermore, in the domains of agriculture, technology, craft specialization, and architecture, many of the solutions adopted by groups living within a Mature Harappan cultural framework had been elaborated in Neolithic or Chalcolithic contexts in the region. Thus the links between the early 3rd
millennium Kot-Diji and Amri complexes of the Indus valley (the Early Harappan) and the Mature Harappan which were correctly stressed by Mughal (1970) can be seen to have even earlier counterparts in the past of the region.

The Collapse of the Urban System

The continuous sequence of adaptive changes stretching from the early Neolithic of Mehrgarh to the urban phase of the Mature Harappan period appears to be broken with the abandonment of the large Indus settlements about 1800 BC. The end of the Indus civilization has long been a matter of controversy and conflicting hypotheses involving a great deal of imaginative interpretation based on scanty evidence from rather poorly controlled sources of information. It is often postulated on the basis of negative evidence, namely the desertion of sites like Mohenjo-daro and Harappa and the absence of sizable post-Harappan sites in the Indus valley, that natural catastrophes or invasions played a leading role in the collapse of the urban system. A rather commonly entertained notion is that exceptional earthquakes or floods would have upset the socio-economic base of the Harappan system which then would have been unable to resist incursions of semi-nomadic groups coming from Central Asia. The migration of these groups would sometimes be traced on maps based on the accidental discovery of certain types of artifacts — principally metal objects and seals — which could be stylistically associated with the Hissar III C complex (see Jarrige 1973 for a summary of this question). Hissar III, as we have seen above, is now dated to the end of the 3rd millennium BC making it contemporary with the Mature Harappan and not later as was previously thought. Thus most of these finds must be interpreted in the context of international exchange covering the whole of the Middle East and cannot be interpreted as reflecting the invasion of pastoralists in the mid-2nd millennium BC.

Settlement Patterns in the Early Second Millennium BC

In contrast to an apparent absence of sizable permanent settlements in the alluvial plain of the Indus and in Baluchistan
during the 2nd millennium BC, a great many sites of the ‘late post-Harappan’ tradition have been discovered in the Indian Punjab, Rajasthan, Haryana, and Gujarat. This network of sites is much denser than that of the Harappan period in the same region, this indicating a rather marked population increase in western India at a time when the Indus valley itself was apparently less densely settled than it had been before. One explanation for this situation could be that the population of the Indus valley, discouraged by (presumed) natural disasters and fleeing (presumed) invaders, fled to the territories of their ‘Harappan’ relatives living in the eastern provinces of a Harappan empire (Gupta 1982). In the course of their (presumed) migration, they would have given up features linked to an urban civilization which were no longer useful for survival under rural conditions.

In order to test this series of hypotheses, however, it is necessary to ascertain whether there was, in fact, a disruption of sedentary life in the Indus valley and a sudden drop in the agricultural productivity of that region accompanied by a shift to semi-nomadic pastoralism and evidence of warfare. I have already stated that it is impossible to determine the pre-and protohistoric settlement pattern of the Indus alluvium because of the complex history of erosion and alluviation which have almost certainly destroyed or buried many sites of the earlier periods. This power of the Indus is clearly attested by the following statistics for the years 1947 through 1957, a period when a complex system of dams and flood control systems was in operation: 3,022 villages officially ‘entirely destroyed’ and 18,907 badly damaged (Anwar 1958: 75-88). Along the Hakra channel in Cholistan in an area not subject to the ravages of the rivers, however, Mughal has recorded 50 Late Harappan (Cemetery H related) sites, some up to 14 m in height and covering up to 38 ha in area. A few of the sites show evidence of specialized craft activities (Mughal 1982: 92-3).

In the North Kachi plain, only one major Harappan site is known, although scatters of Harappan sherd have also been found at two smaller sites as well. This site of Nowsharo, which rises 12 m above the plain, was already occupied in the first half of the 3rd millennium BC. It reached its maximum extension of c. 8 ha during the Harappan period but continued to be occupied later, a fact attested by the presence of Pirak-style sherds on the
surface. The only well preserved 2nd millennium site in the area, however, is situated at Pirak some 20 km East of Mehrgarh and Nowsharo. Excavations at this site were carried out between 1968 and 1974 and a final report has been published (Jarrige, Santoni & Enault 1979). Thus Pirak will be discussed only briefly. The site rises 12 m above the surrounding plain and covers an area of c. 9 ha. Although Pirak has yielded a few Harappan artifacts (including a unicorn seal), the maximum extent of occupation can be dated from 1700 to 700 BC. To judge by its size, the elaborate nature of its architecture, and the complexity of attested economic activities, the site can hardly have been less of a ‘town’ than Nowsharo.

In discussing the 3rd millennium above, I mentioned the site of Pathani Damb which is located near Gandava in lower Kachi and which was discovered by Beatrice de Cardi. From sherds collected at the site, it is evident that Pathani Damb was occupied at least as early as 4000 BC and that it increased in size through the 4th and early 3rd millennia (based on the distribution of ‘Faiz Mohammad Grayware’ and ‘Quetta ware’), reaching its maximum extension during the Mature Harappan period to judge from the tens of hectares covered with Harappan sherds. The main mound was apparently abandoned after that time, but a few hundred meters away there is a smaller mound covering several hectares on which have been found pottery and artifacts of the 1st millennium BC together with a few sherds in the Pirak style of the 2nd millennium. A few kilometers to the North of Pathani Damb is another mound which has been almost entirely destroyed by modern cultivators. What is left of this site still stands several meters above the plain and reveals on its surface pottery typical of all the periods at Pirak.

Although no systematic surveys have been carried out in the Kachi plain, it appears that this region lying between highland Baluchistan and the Indus valley was occupied without break by sizable settlements throughout the 2nd and into the 1st millennium BC. It is also important to note continuity in the settlement pattern with that of the early 3rd millennium as characterized by Chalcolithic pottery styles from Mehrgarh. Thus, pottery in the Pirak style has been found not only along the whole western side of Kachi but also on the Quetta plateau — e.g., at Sulaimanzai (de Cardi 1983: 17) and at Ispelanji North of Kalat (personal
observation) — and in the Loralai valley at Dabar Kot (Stein 1929: pls. XIV, XV).

*The Agricultural System of the Second Millennium BC*

Turning now to agricultural productivity, the picture of decreased cereal cultivation said to accompany the presumed semi-nomadic lifestyle of the 2nd millennium is contradicted by Costantini’s analysis of the macrobotanical remains from Pirak (Costantini 1979, 1981). To sum up the background to 2nd millennium events, let us recall that the agriculture of the Harappan period was based on a system of winter crops well adapted to flood irrigation (sphaerococcoid wheat and barley) and that animal husbandry was based on cattle, sheep, and goats. Thus the agricultural system of the Harappan period can be viewed as the logical elaboration of a technology having its origin in the 7th millennium BC.

With Pirak, however, we have evidence for a spectacular transformation to that multicropping system still characteristic of a large part of South Asia today. From Pirak, Costantini has identified imprints and charred seeds not only of the winter cereals (wheat and barley), but also of such summer crops as rice, millet, and sorghum. Thick layers of decomposed rice husks have been identified, these indicating the importance of a crop which could have been grown in Kachi only with the introduction of permanent irrigation systems. In contrast, millet and sorghum are well adapted to arid conditions and their introduction to the Indus valley (and to the South Asia as a whole) meant that more marginal areas, not suited to wheat and barley cultivation, could be exploited and that, in some areas, two crops a season could be harvested. Furthermore, these new cereals provided more fodder for animals in a region where the natural vegetation must have become severely degraded by the beginning of the 2nd millennium BC. The availability of this fodder permitted the keeping of animals not suited to grazing in the Kachi region (e.g., the horse) and the specialized breeding of others (like the Bala-Nari bull bred today near Pirak and fed entirely on second-crop sorghum). Attested for the first time in South Asia at Pirak are both the horse and donkey (Meadow 1979a) which,
together with the camel (known already from the Harappan period, e.g., Meadow 1984c), provided opportunities for transport and labor complementary to those provided by cattle. The introduction of the domestic horse is especially significant since firm evidence for the existence of this animal at earlier sites in South Asia is absent, this in spite of numerous claims to the contrary (Meadow, in press).

In conclusion, as far as 2nd millennium settlement patterns and agriculture are concerned, we have evidence in Kachi for sizable settlements in the midst of a rural landscape which was irrigated and cultivated more intensely than in the 3rd millennium BC. This picture is just the opposite of that which has been presumed on the basis of negative evidence! Before discussing the extraregional implications of these changes in the agricultural economy, however, it is useful to try to relate the economic transformations to the material culture of the people living in Kachi.

The Material Culture of Pirak

Since a report on the material culture of Pirak has been published (Jarrige, Santoni & Enault 1979), I wish only to stress a few points which concern the question of continuity and change in the early 2nd millennium BC. Thus, houses with rectangular rooms and several stories of symmetrically arranged deep niches covering the walls are characteristic of all periods at Pirak (fig. 1) but are not known previously in the region although the bricks used are similar in size to those of the later periods at Mehrgarh (45×21×9 cm). In contrast to these smaller structures, where only small scale domestic activities are attested, are a large building of many rooms with storage jars and diverse material remains and craftsmen’s quarters with interconnected houses located in a single block. We can postulate that these different types of structures reflect a differentiated social organization with craftsmen, for instance, living in a specific quarter. Specialized craft areas are attested at Mehrgarh as early as the 5th millennium, but these are principally open areas and are not located within closed blocks of rooms and courtyards. As for storage facilities, those at Pirak are circular clay silos of a type
Fig. 1 — Pirak, dist. Kachi. Ruins of a house, end of the 2nd millennium BC.

Fig. 2 — Kotra, dist. Kachi. Ruins of a house deserted by a Hindu family in 1947.
still used in the region today but unknown even in the 3rd millennium BC.

Fireplaces are another important feature on any site, related as they are to food processing. At Mehrgarh from the early Neolithic to at least the end of the 4th millennium BC, the dominant type of hearth is a circular pit containing heavily burnt pebbles. These indicate that indirect transfer of heat from flame to pot was used to cook food in containers; vessels were not placed in direct contact with the fire but their contents were heated by adding hot stones. Kitchen areas at Mehrgarh have provided many examples of jars which still contain heat-cracked pebbles, and if one examines the catalog of ceramics from this or any Chalcolithic site in the region, round-bottomed coarse cooking pots are noteworthy by their absence. The shapes and flat bases of the early pottery are not particularly suitable for placement directly above a fire and, so far, no such device as a ‘firedog’ has been discovered.

Circular fire-places dug into floors like at Mehrgarh have also been found at other Greater Indus sites, for instance at Kot Diji where, however, triangular or circular cakes of terracotta seem to have replaced burnt pebbles as a source of indirect heat (Khan 1965: 22). Even as far away as Shortughai in northern Afghanistan, Francfort (n.d.) reports the presence of circular fire-places containing burnt pebbles.

With Pirak, another type of hearth becomes dominant in the Kachi plain and burnt pebbles or terracotta cakes are no longer associated with cooking. This hearth is a raised square platform carefully assembled of mud bricks with a small circular cavity in its center. This type of hearth is not an entirely new feature in the western border areas of South Asia since it can be related to earlier examples at Shahr-i Sokhta, Mundigak, and even at late 4th and early 3rd millennium Mehrgarh where there are square hearths with slightly raised edges. At Pirak, however, the hearths are more elaborate and ‘firedogs’ are found around the central cavity (Jarrige, Santoni, and Enault 1979: fig. 103, pls. X, XI). Such firedogs have not been found in earlier contexts in Baluchistan or the Indus valley, but several similar (although not identical) terracotta objects have been reported at ‘Late-Harappan’ sites in northwestern India — at Bara, Sanghol, Bhagwanpura, and Hulas (Jamal Hasan 1978-1979). Furthermore, the
same type of objects — some closely resembling those from Pirak — have been found around fireplaces at early Iron Age Sites in Fergana (Zadneprovskij 1962). Identical objects, also with a hole bored through them, have been excavated from Tillya Tepe in southern Bactria (northern Afghanistan), the earlier periods of which date to the late 2nd millennium BC (Sarianidi, personal communication). Although these objects are associated with the new type of hearth at Pirak beginning in the first half of the 2nd millennium, their precise function remains problematical. They may indeed have been used as firedogs but the wide range of sizes (including miniature examples), the variety of incised decoration, and the fact that not all are pierced by a hole through the side do not suggest a standardized function.

From the type of hearth found at Pirak, it can be assumed that pots were heated directly by the fire, a technique of cooking which should be reflected by the nature of the ceramic corpus from the site. At Mehrgarh, almost all 3rd and 4th millennium pottery was wheel-thrown. At Pirak, nearly 70% of the sherds come from coarse, unevenly shaped and unpainted vessels of ‘domestic’ character, 20% from similarly shaped but painted or slipped vessels, and only about 10% from finer, wheel-thrown pots. Like the domestic pottery still used in Kachi today, the pots in coarse ware from Pirak have rounded shapes and various kinds of lugs and handles, elements never found on 3rd millennium pottery (fig. 3). Several of these pots have blackened surfaces which are obviously the result of their regular use over a fire. In all these features the Pirak pots bear a striking resemblance to the cooking pots used by the women in villages near Mehrgarh up until a few years ago. It is worth mentioning that these modern vessels were not made locally but were imported from villages in the Bolan Pass where clay considered highly suitable for cooking pots could be found (fig. 4).

Some archaeologists have suggested that the replacement of fine wheel-thrown pottery by coarser wares after the end of the cities of the Indus indicates a general cultural ‘decline’ or the coming of invaders who brought with them less sophisticated manufacturing techniques. In fact, the pottery wheel was still known and used for making a limited number of vessels.

Therefore we must assume that the widespread utilization of coarser ceramics resulted from deliberate choice made in the
Fig. 3 — Pirak, dist. Kachi. Two cooking-pots, end of the 2nd millennium BC.

Fig. 4 — Gay village, dist. Kachi. Two modern cooking-pots.
context of the remarkable diversification of the subsistence system and reflecting, for instance, the need to cook rice, while the handles and lugs reflect new requirements for vessel handling.

The replacement of fine wheel-thrown wares by coarser hand-made forms is a phenomenon apparent throughout the western border areas of South Asia and the Greater Indus valley after 2000 BC. To judge from evidence recovered in the North Kachi plain, however, the process was more gradual than it might at first appear. At Sibri, where an amulet bearing characters like those of the Indus script has been found, coarse hand-made pottery makes up about 30% of the ceramic assemblage, the remainder of the ceramics having been formed on the fast wheel (Santoni 1984). At Nowsharo, similarly coarse pottery is found on the surface in significant quantity in areas yielding large numbers of Mature Harappan sherds; when the site is excavated it will be interesting to learn whether all these sherds belong to the same assemblage.

Another element of continuity between ceramics of the 3rd millennium Baluchistan and those of the 2nd millennium can be found in the decoration. While the geometric painted designs on pottery from Pirak may be quite different from those on Harappan pottery, they are very much in the older ‘Quetta-Amri’ tradition. In our report on Pirak we pointed out similarities which we feel are too close to be explained merely as the result of coincidence. We postulated that such traditional styles of decoration survived in regions which were at the periphery of the principal zone of Harappan influence. For instance, at Ispelanji, located in a small valley on the Quetta plateau, the surface of the mound there has yielded sherds painted with the classic 3rd millennium motifs (Mehrgarh VII, Damb Sadaat II and III), small quantities of Mature Harappan sherds, sherds still from wheel-thrown pots but bearing what seem to be ‘late Quetta’ types of motifs heralding the Pirak style, and finally sherds from coarse hand-made vessels decorated with typical 2nd millennium Pirak designs. The fact that these elements of continuity in the pottery of Baluchistan are still evident in the early Iron Age levels of Pirak is in marked contrast to the situation in Central Asia where there is a technological and stylistic break between Namazga VI ceramics and the painted hand-made pottery of the Iron Age complex of Yaz I. This last material, and especially that from
Tillya Tepe, is similar in some respects to some of the pottery from Pirak (Sarianidi 1977).

Turning from pottery to figurines — a part of the cultural assemblage which is often thought to reflect ideology — we find with Pirak a significant new element in the form of terracotta figures of riders, horses, and camels. These figurines are accompanied by human models which are much coarser and simpler than those of 3rd millennium Mehrgarh. In spite of these different elements, however, we also see continuity in the presence of figurines of humped bulls, and in the fact that there are several violin-shaped human models with the pubis indicated by dots which can be related to similar figurines occurring in earlier contexts at Sibri. Other figurines find prototypes at Mundigak. Here again, the human figurines of Pirak can be seen to continue traditions which apparently survived in regions marginal to the principal Harappan zone of influence.

As for ‘administrative devices’, seals in terracotta and in copper/bronze have been found at Pirak principally in the pre-Iron Age levels. Some of these seals have pierced backs and cruciform designs which are identical to specimens from mid-3rd millennium Mehrgarh. Other examples, more or less square with dots, have exact parallels at Shahr-i Sokhta in the burnt building of Period IV (Tosi 1983: pl. LXXIV), while metal compartmented seals are similar to specimens found at many sites in South Turkmenia and Bactria in the 2nd millennium BC. Several sealings have also been found at Pirak indicating the continued use of seals as administrative devices. It appears that square seals with inscriptions in the Indus script are objects solely linked to the Harappan system and are objects which completely disappear with that system at the beginning of the 2nd millennium at which time they are replaced by the geometrical seals which had long been known in the region.

Metallurgy at Pirak in the pre-Iron Age levels continued to be carried out using crucibles of a type found in 4th and 3rd millennium levels at Mehrgarh. Several metal artifacts (flat axes and daggers) have shapes known from Harappan sites, but others (moulded daggers and arrowheads) represent technological innovations. Among the new types of objects in copper/bronze, small convex disks with a loop fixed to the inside are similar to many specimens found in South Turkmenia (Anau III) and at sites of
the Iron Age complex of Yaz 1 (Jarrige, Santoni & Enault 1979: 398, figs. 107, 833). Another object in copper/bronze also found both at Pirak and in southern Central Asia at sites of the Yaz 1 complex deserves special mention, this being a hollow point made of a rolled sheet of metal pierced by many holes (Jarrige, Santoni & Enault 1979: fig. 107, p. XLVI). Due to the raspy surface of these conical objects, which are found at Pirak in pre-Iron and early Iron Age levels, we suggested that they could have been used as drilling rasps. Several identical specimens, however, have been discovered in the Near East and Egypt in the second half of the 2nd millennium BC where representations show people sucking up the contents of vessels through drinking tubes with strainer ends. The similarity of the Pirak specimens to the objects found in Syria and Egypt and to the strainer ends depicted on carvings and paintings leaves little doubt that those Pirak specimens must also have been fixed to the ends of drinking straws which were probably made out of reeds. In addition to the Near Eastern and Pirak evidence, V.I. Sarianidi has recently provided me with drawings of similar objects in copper/bronze found in the early Iron Age levels of Tillya Tepe in southern Bactria. The distribution of these strainers thus suggests that drinking habits were similar throughout a wide area of Asia in the second half of the 2nd millennium BC. (A paper discussing the implications of strainer ends is being prepared by Annie Caubet and myself).

The development of metallurgy as represented at Pirak did not immediately eliminate the flint industry. Sickle elements are still made in flint although they are now hafted lengthwise instead of in a slanting fashion as they were throughout the sequence at Mehrgarh. In addition, the blades themselves are denticulated, this being an element of Harappan sickle blades as well. The production of backed tools which are deeply serrated and sometimes trimmed to triangles or lunates can be linked to the earlier local tradition of manufacturing geometric microliths, a tradition which continued throughout the whole occupation of Mehrgarh (Lechevallier 1984). The sturdy aspect of the Pirak flint tools, however, is quite original (Lechevallier 1979). Even with the first occurrence of iron at Pirak at about 1200 BC, the flint industry remains active and it is not until the development of iron metallurgy on a large scale in the 1st millennium BC that
flint sickles finally disappear. A similar situation seems to have characterized at least parts of southern Central Asia. I have had the opportunity to see a collection of sturdy and deeply serrated backed blades in the Institute of Archaeology in Leningrad which are said to come from Kučuk Tepe, a site in southern Uzbekistan which is related to the early Iron Age Yaz complex. Also found at many 2nd millennium sites throughout southern Central Asia are laurel-shaped arrowheads of flint very similar to those from Pirak, 3rd millennium Mehrgarh, and elsewhere in the western border areas of South Asia.

Seashells, in particular the conch (*Turbinella pyrum*), are represented at Pirak by bangles of a type made even as early as the Chalcolithic period in the region and very well known from Harappan sites. Bone and ivory working also have a long tradition in the area, ivory having been shaped since the Neolithic. At Pirak, however, there appears a new technology for shaping bone, antler, and ivory to form the tips for projectiles, all stages in the manufacture of these points being represented at the site in special workshop areas. While these artifacts have no earlier parallels in Kachi, they are similar to examples known from 2nd millennium sites in the Ganges valley where they can be linked to an earlier 3rd millennium tradition of making socketed bone points at a time when rice cultivation was also being developed (Jarrige, Santoni & Enault 1979: 400). North of the Hindu Kush in southern Tadjikistan, four-faceted bone points with small hafting holes have been found at sites of the Vaxš culture which probably dates from as early as the first period at Pirak (Kohl 1984: 19b).

To conclude this discussion of continuity and change in material culture, it is evident that the people living in the North Kachi plain during the 2nd millennium BC were strongly affected by the major economic transformations of the time. Nevertheless, in spite of changes in many aspects of the material culture, it is possible to trace significant elements of continuity which indicate the survival of traditions dating back to the first part of the 3rd millennium and even earlier. These traditions seem to have survived on the margins of the area of principal Harappan influence and were again taken up, albeit sometimes in modified form, when that influence had waned. Cultural conservatism, however, does not exclude innovation. This is shown by the oc-
currence of many new features which can be interpreted as adaptations to the new social and economic situation of the post-Harappan period. Cultural conservatism also does not imply isolation. Many of the new features in the material culture of Pirak have parallels at contemporary sites as distant as southern Central Asia and the Ganges valley. Also at Tepe Yahya in eastern Iran, jars with applied cordons decorated with finger impressions and common wares with a plum slip, which are characteristic of Period IVA (2nd millennium BC — Lamberg-Karlovsky 1970), have counterparts at Pirak where they represent new features in the pottery sequence of Baluchistan. These and other similarities in the artifacts from many 2nd millennium sites of the western border areas of South Asia and beyond (see Jarrige, Santoni & Enault 1979) are certainly more than chance resemblances. Since they represent similar choices made by different groups living in a wide range of geographical settings, they must also reflect the underlying structure of a net of higher level cultural interactions stretched across much of the eastern Middle East and northern South Asia. Given the early 2nd millennium date of Pirak, the peoples on the western borders of the Indus valley were clearly a significant part of this network.

Possible Causes for Second Millennium BC Agricultural Change

Farmers are usually conservative people and, in semi-arid regions where scarcity is a constant threat, they are not likely to risk change so long as their agricultural system is perceived by them to be an efficient strategy for minimizing losses in an unstable environment. At the beginning of this paper, I pointed out some important transformations of the agricultural system which took place during the Neolithic and Chalcolithic periods. The transformations of the 2nd millennium, however, are qualitatively different. No longer can they be viewed as the efforts of a rural society to adjust the components of a functioning system to a changing situation in order to maintain that system within the traditional agricultural framework of winter cereal cultivation and bovid husbandry. Should the origins for these transformations of the 2nd millennium be sought in exogenous events, in colonization of the area by new peoples, by a sudden influx of
refugees bringing new crops and animals with them? Probably not, since the processes which I have briefly described are too complex to be attributed to the arrival of invaders who at the same time would have had to have introduced rice from the Ganges, sorghum from the Arabian Gulf, and camels and horses from Central Asia. It is also not likely that newcomers, whether they be a ruling élite or refugees, would have had the impetus to change an agricultural system still capable of being intensified without the introduction of new crops and, for rice, new irrigation practices.

The real question to ask is whether the traditional agrarian system, based on the Neolithic/Chalcolithic pattern, was still efficient in the context of the early 2nd millennium BC. Exploitation of arable land and grazing grounds through the course of several millennia by a growing farming population settled in an increasingly dense network of villages and towns must have generated environmental changes throughout the region. The development of large ‘urban’ complexes at the end of the 3rd millennium is the culmination of this process and must represent significantly increased pressure on the rural landscape. The spacious houses of the lower town of Mohenjo-daro suggest the existence of an urban ‘middle class’ which was supported by specialist craftsmen and by a rural agricultural population which was stimulated to grow not only food stuffs, but also such non-subsistence crops as cotton on a scale far greater than would be needed for self-sufficiency. Could the demands of the social and economic systems of these large Indus centers have led to increased environmental degradation through overgrazing, monocropping, and overwatering leading to salinization? We unfortunately lack the textual evidence of Mesopotamia which speaks of very serious ecological problems in the 3rd millennium BC. Nevertheless the example of Mesopotamia may have some validity for the Indus.

Although floods and silting have drastically changed the rural landscape of the Indus valley itself making it very difficult to identify the evidence of possible environmental degradation, it is significant that such evidence can be found throughout the intramontane valleys of Baluchistan for the period of the late 3rd millennium BC. For example, at Nindowari (Casal 1966; Jarrige 1983), the stone remains of a Kulli-Harappan settlement covers about 25 ha. The site has a monumental platform overlooking a
vast granary which contained the remains of seeds, grinding stones, hundreds of bull figurines, and two Indus unicorn seals. A complex of 52 gabarbands or huge stone walls are part of a terracing system built in order to exploit the slopes around the site, slopes which today are barren and eroded. The number of gabarbands in the valleys of Baluchistan, many of which can be attributed to the end of the 3rd millennium, is a tribute to the degree of agricultural intensification possible in the area, an intensification which could, in the long run, have had significant consequences for the fragile environment.

While overexploitation of the agrarian resources of Baluchistan is possible to envisage, a similar phenomenon in the Indus valley seems harder to accept given the restoration of natural fertility which is provided by the annual flood of the river. In fact, fertility was not the major problem with the Indus; instead the major difficulty is getting the water where one wants it when one wants it there. Before huge dams and canals were built under the British Raj in the 19th and 20th centuries, the irrigation system was entirely at the mercy of the shifting river which would regularly disrupt whole water supply system over thousands of square miles and of floods which would destroy both fields and villages. As Hughes remarked in 1876 (p. 19), 'it is clear that where the number of risks to which cultivation is liable are such that a careful cultivator has but little more chance than a careless one, all enterprise must be annihilated'. Thus in spite of its natural fertility, the Indus valley has been observed by travellers to be traditionally an area of relatively low population density with large groups living as fishermen or pastoralists. Given this situation, the Harappan peoples of the late 3rd millennium BC would have found it difficult to build up a rigid hydraulic state, and instead the great Harappan 'cities' may have been much more like overgrown villages organized in a communicating network for the purpose of exploiting a wide range of natural and human resources. The growth and survival of this network may have been stimulated by demand from outside systems the disruption of which at the beginning of the 2nd millennium BC caused the network to collapse.

In situations of crisis, individuals marginal to a system often play a key role in providing alternative solutions which, in transforming the system, in fact permit it to survive, albeit in altered
form. In the case of the Greater Indus area at the end of the 3rd millennium BC, groups living within economic systems marginal to that of the Indus valley could have provided alternatives to a Neolithic/Chalcolithic pattern which was no longer functioning efficiently. The process of change which was well underway by the time of Pirak may, in fact, have begun during the Harappan period although this is impossible presently to determine due to a general dearth of information concerning developments within Indus sites over the approximately 500 years thought to have been covered by that civilization. It is interesting in this regard to note, however, the major change in subsistence which took place at Balakot during the Harappan period. In the earlier Bala-kotian phase at this coastal site, the subsistence system was based principally upon the cultivation of winter cereals and the herding of cattle. In the Harappan period, the importance of cattle decreases in relation to that of sheep and goats and sea-foods become an integral and important part of the diet of the site’s population (Meadow 1979b). This shift indicates that coastal fishermen were contributing in a significant fashion to the food supply at a time when peoples in other areas of Baluchistan were also maximizing their exploitation of available resources.

The process of incorporation of elements provided by socio-economic systems marginal to the principal one of the Indus valley was probably stimulated by increased interregional contacts and by expansion of Indus-related settlements outside of the Indus valley proper. Sites with a material culture related to that of the Mature Harappan are found at the end of the 3rd millennium in eastern Punjab, Rajasthan, Haryana, and Gujarat. This expansion of Harappan ‘influence’ even reached the Ganges valley where contacts were established with sub-Neolithic groups of hunters, fishers, and incipient rice farmers (Sharma 1980). It is also significant that these Ganges groups with their microlithic tools are related by archaeologists to the so-called ‘Mesolithic’ groups of Central India and Gujarat, groups with whom the ‘Harappan settlers’ in Saurashtra must have established contacts in the late 3rd millennium through such sites as Lothal where rice is attested in the earlier phases (Rao 1973: 109). It is also at about 2000 BC that we have growing evidence for contacts between the Indus valley and the Arabian Gulf where Indus seals, weights, and pottery have been recovered from various sites.
(Cleuziou 1984). These last contacts can help explain the introduction of sorghum to the Indus system from regions where this African cultivar was exploited already in the 3rd millennium BC, e.g., the Oman peninsula (Cleuziou & Costantini 1982). With regard to millet, while this summer crop has not yet been found in the Indus valley in the 3rd millennium, it occurs in Harappan levels at Shortughai in eastern Bactria and in 3rd millennium sites of Central Asia (Francfort, personal communication) as well as in southeastern Iran at Dolatabad R37 near Tepe Yahya as early as the 6th millennium BC (Costantini, personal communication).

With the introduction of horse and camel into the Kachi plain, we come to a topic the detailed discussion of which is beyond the scope of this paper. We can recall, however, that the domestication of these two animals is often associated with ecological transformations on the Eurasian steppes in the course of the 3rd millennium BC. Camels, however, are already known from South Turkmenian sites and from Shahr-i Sokhta in the early 3rd millennium (Compagnoni & Tosi 1978) and the presence of two-humped camel figurines at Altyn Tepe and at Ulug Tepe indicates that the Bactrian camel was well integrated into the socioeconomic system of South Turkmenian communities in the 3rd millennium. Remains of camel have also been identified at Harappa, Mohenjo-daro, and Kalibangan and camel figurines occur from the earliest levels of Pirak. For Meadow (1984c: 136), ‘the available information, therefore, seems to indicate that camels of the bactrian type were introduced into the Greater Indus valley from the highland during the late third or early second millennium B.C.’. It is well known that, in semi-arid regions, camel pastoralists can exploit marginal and degraded lands where their animals feed successfully where others cannot.

As for the horse, I have already noted its absence from the archaeological record of the Indus valley before the 2nd millennium. The remains of equids found in earlier contexts are all hemiones according to R.H. Meadow (in press). Thus the sudden occurrence of figurines of horses and riders at Pirak in the early levels has to be seen in relation to the evidence of the increasing importance of this animal throughout the Eurasian steppes at the end of the 3rd and beginning of the 2nd millennium BC. The domestication of horses in these regions is thought to be directly
associated with the development of mounted nomadic pastoralism in the formative stages of the Andronovo and Karasuk cultures. The fact that their presence at Pirak is revealed not only by figurines of the animals themselves but also of their riders indicates the symbolic importance of the horse in the cultural system of the site’s population. Indeed, the presence of horse and camel figurines at Pirak represents a major historical event in the Greater Indus valley since it indicates that groups related to those from the Eurasian steppes and Central Asian highlands had begun to play an important role in the functioning of social and economic systems in the northwestern part of South Asia.

Conclusion

The early 2nd millennium BC, which until recently has been almost a complete blank on the archaeological map of the Greater Indus valley, was in fact a major formative period for social and economic patterns in ancient South Asia. Future research, however, will probably show that the processes of change which we have outlined for that period in the North Kachi plain had already begun during what is called the ‘Mature Harappan’ phase. The concept of a rigidly uniform ‘Harappan empire’ has blurred our understanding of the actual diversity of peoples living in the Greater Indus valley at the end of the 3rd millennium, a time when environmental and demographic problems cumulated to a degree sufficient to encourage the development of new agricultural systems, the adoption of which marks the true beginning of the agrarian pattern still found today in many parts of South Asia.

Socio-economic processes and technological change occurring in the Greater Indus valley also affected farming and non-farming economies of North and central India. Archaeological research in those areas has revealed the existence of many sites called ‘Mesolithic’ because of a lithic industry dominated by geometric microliths. The presence of so many sites in regions where Palaeolithic settlements are few has been interpreted as an indication of population growth because of the development of a more efficient hunting technology. But it now appears that many of these hunter-gatherers were, in fact, contemporaries of
the farmers of the Indus system and influenced by them. For example, at Bagor, a 'Mesolithic' camp in Rajasthan, the presence of domestic animals, ceramics, and metal arrowheads reflects some sort of contact with the Indus region (Misra 1973). Furthermore, the growing importance of domestic animals to these hunting-gathering groups through the course of the 4th and 3rd millennia suggests that it was necessary to supplement a traditional subsistence base which was becoming eroded because of a more efficient food-gathering technology which included the use of composite flint tools, metal arrowheads, and metal fish hooks.

Since it is clear that areas peripheral to the Indus system were already being influenced by that system, it is hardly surprising that the agricultural transformations at the beginning of the 2nd millennium in the Greater Indus valley also provided an opportunity for change in neighboring regions. The availability of millet and sorghum, in particular, permitted farming communities to expand onto soils which were not suited to the growth of such winter crops as wheat and barley, the staple crops of the 7th through 3rd millennia. In particular, the black cotton soils of western and central India are famous today for the growth of different forms of sorghum and millet (jowar, ragi, and bajra), forms which are also reported at several of the earliest farming settlements of these regions in the early 2nd millennium BC. Also significant is the association of rice and jowar at the site of Ahar in Rajasthan at the very beginning of the 2nd millennium (Khajale 1974).

Maurizio Tosi (1983) has argued in a convincing way that Central Asia underwent a process of socio-economic transformation at the beginning of the 2nd millennium similar to that which occurred in South Asia. Stage III of his sequence for that region 'should be characterized by the emergence of new production means geared to the exploitation of the once marginal territories, largely developing from the cultural context of the non-farmers'. It is significant that the process in Central Asia corresponds to the decline of the large 'urban' agglomerations of the Namazga V period which are replaced by smaller settlements arranged in a denser network, this marking optimization of land resources in a new farming system. I find it hard to believe that this Central Asian process occurred independently of the similar transformations evident in the North Kachi plain and several
other parts of South Asia at a time marked by the decline of the Harappan ‘cities’.

The agricultural transformations of the early 2nd millennium must also have deeply affected the social basis for life in South Asia. A multicropping system puts farmers less at the mercy of an uncertain environment and local scarcities, thus increasing their self-sufficiency within the local context. This fact may help account for the breakdown of vast interregional systems like that of the Harappan with its administrative devices and collective granaries which could function as a cushion against scarcity when people had only winter crops upon which to rely. The introduction of the horse and the camel also created new possibilities for transport and mobility, opening new routes across arid areas and permitting much more rapid communication throughout the region.

The appearance of figurines of horse and rider at Pirak demonstrates that western South Asia, at least, was within the reach of enterprising groups of horsemen who were to play leading roles in the history of India, bringing with them as they eventually did new religious and linguistic structures.

As I have tried to show here, however, the role played by these groups — including ‘Indo-Aryan’ peoples whose existence so far has only been deduced on the basis of linguistic evidence — cannot be interpreted within the framework of simplistic models which involve large scale invasions sweeping aside the older socio-economic structures. Instead, what we see is a dynamic system of multidirectional contacts and ‘influences’ extending throughout a vast area from southern Central Asia to the Ganges valley and continuing from the beginning of the 2nd millennium into the 1st millennium BC. It is clear from our work at Pirak that cultures of the Greater Indus valley played an important role in the development and spread of ways of life which included new craft and farming technologies and that this area was not merely on the receiving end of imported lifeways. It is also clear, however, that the significance of relations between sites like Pirak in the Greater Indus valley and sites in Bactria, Margiana, and Fergana requires further consideration, particularly in the light of evidence that these latter areas were in contact with steppic peoples to the North through much of the 2nd millennium (Kohl 1984: 183).
Southern Central Asia marks the southeastern limit of the spread of settlements related to the Andronovo culture, this spread being linked by several specialists not only to the advent of mounted pastoral nomadism (a topic with which we still must deal cautiously) but also with the movements of Indo-European groups (a topic with which we must deal even more cautiously!). (For a brief discussion of the relation of the Andronovo culture with the Vedic Aryans, see Kuzmina 1983). Those who postulate contacts between groups from the Eurasian steppes and those from the northwestern parts of South Asia, however, must not overlook the intermediary or filtering role played by the peoples of southern Central Asia. Given the existence of these cultures, it seems unlikely that the dream of several generations of scholars — to find a continuous line of sites from the Eurasian steppes to the Ganges valley all with ‘typical’ gray ware or ‘steppe-style’ pottery which could be used to map the movements of Indo-Aryan populations — will ever materialize. Indeed, the expectation that such a chain of evidence would exist is based on a misconception of the way that population movements actually occurred and of the role that alien groups eventually played among the 2nd millennium settled populations which, until recently, have been so poorly known.

The spread of new religious and linguistic elements through the northern part of South Asia was indeed a major historic event, although one which is still difficult to date precisely. It is not my purpose, however, to add to the already overlarge speculative literature on the Indo-Aryans. Instead, I would like to stress that the search for traces of this spread must not overshadow the search for a much more attainable understanding of local cultural systems of the 2nd millennium, and these cultural systems must be analysed within the framework of complex mechanisms of socio-economic transformations which include the emergence of new agricultural systems in the northwestern part of South Asia. Furthermore, although socio-economic transformations dominate the protohistory of 2nd millennium South Asia, these changes in agricultural technology and society took place within the framework of cultural systems which retained links to 3rd millennium and earlier traditions. I have outlined elements of continuity in the material culture of Pirak and similar elements can be traced elsewhere in the Greater Indus valley.
as well. Noting only a couple of examples, Casal (1964) has pointed out the link which exists between the Jhukar pottery of Amri IIID style and Harappan pottery of the late Mature phase at Mohenjo-daro and Amri itself. The Cemetery H ceramics of Harappa and the Cholistan sites and the Late Harappan style of eastern Punjab and Haryana reveal a mixture of pre-Harappan, Harappan, and local elements. The same situation can also be observed in Saurashtra (Possehl 1980).

Large scale archaeological projects directed toward an elucidation of social and economic systems of the 2nd and 1st millennia BC are already beginning to show that a ‘Vedic Dark Age’ never existed and that invaders never created a socio-cultural vacuum anywhere in South Asia. From Haryana and areas around Delhi almost 500 Late Harappan settlements have been reported, some of these revealing evidence for rice cultivation (Joshi et al. 1984). Previously it was believed that the appearance of gray pottery along the Ganges at the beginning of the 1st millennium marked a break in the archaeological sequence which could correspond to an invasion of Indo-Aryan groups. Now we know from several Late Harappan sites that Late Harappan and painted gray ware (PGW) ceramics can occur together. Also at Pirak we have wheel-thrown gray pottery occurring together with coarser hand-made Pirak wares at the end of the 2nd millennium. This gray ware of Pirak can be related to an earlier wheel-thrown pink ware, the change in color corresponding to changes in the firing process which are probably related to the beginning of iron smelting. It is significant that the Ganges gray ware, which is similar in many respects to that from Pirak, is decorated with white motifs very close in style to those characteristic of the ‘sub-neolithic black-and-red ware’ which begins to be produced, for example at Ahar, at about 2000 BC.

Work in Pakistan and northern India is beginning to show that the cultural synthesis which was accomplished during the 2nd millennium BC has provided many elements which continue to be found in rural South Asia today. Just before the 1947 partition of India and Pakistan, Hindus living at Kotra not far from a mound with Pirak sherds in South Kachi could recite the gāyatṛ in Vedic Sanskrit in rooms whose walls were covered with niches four stories high and arrayed in a fashion strongly reminiscent of rooms at Pirak (fig. 2).
Today in Kachi, horses, donkeys, and especially camels are still considered important domestic animals together with sheep, goats, cattle, and water buffalo; sorghum and millet (and not so long ago, rice) are grown along with wheat and barley; the crops are stored in circular silos similar to those found at Pirak; food is cooked in pots of a type found at Pirak; and raised fireplaces with a concavity in the center are still a feature of many households.

ACKNOWLEDGEMENTS

This article owes a great deal to the work carried out by Lorenzo Costantini (IsMEO, Rome) on macrobotanical remains from Pirak and Mehrgarh. His study of materials from the Kachi plain has formed the basis for a reappraisal of the 2nd millennium in the Greater Indus valley. I also thank Richard H. Meadow for his outstanding contribution to our understanding of ancient animal use in the area, for his generosity in providing new ideas, and for his improvement of the English of this article. I also acknowledge stimulating and fruitful discussions with Maurizio Tosi who has contributed to a new perception of the problem of continuity and change throughout the Middle East in the 3rd and 2nd millennia BC.

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MONIQUE LECHEVALLIER and GONZAGUE QUIVRON

Results of the Recent Excavations at the Neolithic Site of Mehrgarh, Pakistan

The discovery in 1976 in Baluchistan by the French Expedition of a Neolithic settlement with a long sequence of archaeological levels at Mehrgarh, was of fundamental importance for our understanding of the prehistoric past of the Indo-Pakistani subcontinent. Moreover, due to its location at the western fringe of the Bolan pass in the Suleiman range, the site is also geographically related to the Iranian plateau and thus offers evidence for possible relationships at an early period between Western and Central Asia on one side and South Asia on the other (fig. 1).

Fig. 1 — Bolan pass.
Dating the aceramic mound has been a primary focus in our investigations from the start. The first C14 determinations seemed too low in comparison with our chronological estimation based upon archaeological parallels with Iranian and South Turkmenian sites, just as the long and continuous archaeological sequence of Mehrgarh prevents application of the diffusionist model justifying such a late dating. Another factor which made the interpretation difficult was the possible complexity of this large site and its long sequence of deposits as seen in the cliff created by the Bolan river when it changed its course over a century ago and cut its way through the site (fig. 2).

Fig. 2 — Plan of surface levels. Periods IA, IB and IIA.
The archaeological area near the Bolan river, about 1800 m North of the Bronze Age mound of Mehrgarh, covers a vast zone, estimated at about 12 ha, including the eastern part cut away by the river. At its centre is found an aceramic settlement, called MR3 in the first reports, which corresponds to Period 1 in the Mehrgarh sequence. This settlement is surrounded by later remains with successive types of pottery first identified to the South and then to the North-West of the aceramic settlement — called MR3/4 — and belonging to Period II (Jarrige & Lechevallier 1979; Lechevallier & Quivron 1981).

In this paper, our aim is to discuss the internal chronology of the first period as well as the stratigraphical problems attached to the development of the aceramic mound and of the first pottery levels in relation to the gradual rising level of the Kachi plain (already discussed in Jarrige 1984).

Taking into consideration the size of the site, several operations were undertaken (Jarrige & Lechevallier 1980)¹:

1) a large sounding MR3-S, 15 m back from the cliff. The excavated area is 110 m² down to 3.50 m below surface, then reduced to 50 m² and further down to 25 m². Eight main building levels were found as well as 28 graves at various levels.

2) a 20 m² sounding — MR3-T — 50 m North of the first one. Ashy layers and seven building levels were recognized. Eleven burials were excavated.

In both soundings, virgin soil was found at 7 m below the surface. No pottery was present, except some coarse sherds in the top levels at the South sounding.

3) extensive surface exposures over MR3 totalling an area about 6500 m². A large number of house plans were obtained: mainly four- and six-room houses in the centre and compartmented buildings as well as large mud-brick retaining walls at the periphery. Several levels of tombs were distinguished, revealing concentrations of graves in certain areas.

In spite of the volume of field data recovered, the history of the site of MR3 was difficult to trace and some aspects remained totally unclear. Moreover, the soundings were located too far

¹ In charge of the various excavations were: M. Lechevallier (MR3-S sounding), A. Samzun (MR3-T sounding), G. Quivron and J.F. Jarrige (surface levels excavations), G. Quivron (MR3-D Bolan sounding and Bolan general section).
from each other to establish reliable stratigraphical links between their respective levels. In order to clarify these problems, we took advantage of the long cliff section along the river which has washed away the eastern part of the site. During the first seasons, ashy layers and fire-places had been observed in the cliff at 10 m below the surface of the plain and 50 m to the South of the MR3-S sounding along the cliff. Above the ashy layers, several metres of alluvial deposits were seen butting against the slope of the aceramic settlement and these sediments were in turn covered with the archaeological deposits of Period II.

In 1982, a first cleaning of the cliff was undertaken and a 15 m long section (MR3-F) which extended back about 1 m from the face of the cliff was excavated down to virgin soil. This section allowed us to see more clearly the limits of the aceramic mound, on the slopes of which were seen eroded layers that included some chaff-tempered coarse sherds. However, the section was too limited to provide a complete understanding of the stratigraphy, especially in the upper layers as it was not possible to determine precisely where in the section the first pottery layers begin their downward slope. Thus, in 1983, a new sounding (sector MR3-D Bolan on the grid plan) was undertaken along the cliff nearer the core of the mound. This 15 m long sounding was extended over a length of 30 m to the North in the upper levels. To the South of the first sounding a cleaning of the cliff was done to provide a section over 70 m long (figs. 3-4).

*Sounding MR3-D Bolan* (fig. 5)

The sounding, between 2 and 5 m wide, was brought down to a depth of 10 m below the surface, the lowest 3 metres being sterile. Eleven building levels were discerned. The plans of the buildings exposed are fragmentary due to the restricted size of the sounding. Most of the brick walls, preserved in some cases to a height of 0.80 m, are part of quadrangular buildings divided into several small units or rooms. This type of building is already

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2 Undertaken by P. Gentelle, in connection with a geographical study of the Kachi plain, and M. Lechevallier.
visible in section in the lowest layers of this sounding, almost on the natural soil. The bricks are of the type already reported for the buildings of the later Neolithic phases: more or less cigar-shaped bricks with finger marks for keying the mortar. Ashy layers were associated with fireplaces and contained burnt pebbles, mortars, pestles, flint and bone tools showing intensive domestic activities. Beads and pendants made of stone and shell have been found with uncompleted rough-outs, an evidence of craft activities. No pottery was found in any of these layers, a fact which confirms the results of sounding MR3-T, indicating that we have located the core of the preceramic settlement. However, familiarity with clay is attested not only by brick-making but also by the presence of artifacts such as shall unbaked containers and even a human figurine with a rounded base and a conical body on which a belt is applied (layer 2). This is so far the earliest example of a human figurine at Mehrgarh.

Several burials have been found. Three areas have a greater concentration of graves. The earlier group consists of pit burials dug into layer 2 and includes several child burials. In one case,
Fig. 5 — MR3-D section along the cliff above the Bolan river.
two children had been buried together. Another group of graves was dug into layers 5 and 6 and the third into layer 7. The graves belong to types already found in the aceramic deposits of the two previous soundings (MR3-T and MR3-S). All the skeletons are coloured with red ochre and lie in a flexed position with an East-West orientation, heads often facing South. The earlier graves were not found associated with the short mud-brick walls which are a common feature of the later Neolithic graves and whose purpose was to seal a funerary chamber. One grave in layer 5 which was cut right through by the section shows a pit of almost 1 m sunk into earlier ashy deposits. After the body was deposed at the bottom of the grave, the pit was filled up and the grave was sealed by a heap of earth. Cakes of red ochre were often associated with the skeletons: other grave-goods included personal ornaments in stone and shell, among which belts with big bivalve shells. There are also examples of graves in which grinding stones were included.

The sounding was extended further North over a length of 30 m through layers 9, 10 and 11 (upper layers of the aceramic mound). More graves were exposed; they are associated with the small brickwalls at the foot of which the skeletons were laid down in flexed position. Four polished stone axes were found together in between the graves, but their possible association with any of these graves is unclear.

The Cleaning of the Cliff (fig. 4)

In the southern half of the section of the MR3-D Bolan sounding one can see a long slope with four layers (1-4) which accumulated on the southern edge of the aceramic mound. These ashy layers contained a few coarse chaff-tempered sherds.

From these results which showed clearly the existence of two stratigraphical, culturally distinct units, it is obvious now that two phases have to be distinguished in Period I: an early phase IA which is aceramic, and a later one IB with the first occurrence of potsherds, but still stratigraphically older than the buildings of Period IIA.

— Phase IA is represented by the aceramic mound with 11 horizontal levels, as seen in the MR3-D section which can be
related to the North sounding MR3-T. The section shows that the aceramic settlement was first built on a small natural mound and that, little by little, it looked down upon the surrounding plain until it reached a height of 7 m. The aceramic phase was followed by a period of desertion or more probably a shifting of inhabitation of the site during which the erosion of this part of the mound seems to have been very active as shown by the damaged upper levels.

— Phase IB is represented by the sloping levels 1-4. Level 1 consists of a thick deposit of trash with ashes and burnt pebbles mixed with fallen bricks. Further to the south, this deposit is divided into several layers which become thinner and thinner as they inserted themselves between alluvial strata. It is interesting to recall the fact that some years ago we had spotted a few circular fire-places in the shape of shallow tandoori ovens at the bottom of the cliff, 10 m below the surface, which had been exposed by the summer floods of the river. Although these fire-places had been flooded and weathered for quite some time, charcoal was collected. These dates after calibration, ranged between 5500 and 5000 BC (Klein et al. 1982).

Such dates for a layer at 10 m below the surface were thought to be much too recent, as would be expected for samples collected under such conditions. In fact, the fire-place is not related to the aceramic layers as previously thought but had been laid in a layer of Period IB which slopes from the top of the southern edge of the aceramic mound, A date around 5500 BC becomes therefore less contradictory with other archaeological evidence 3.

The archaeological layers are buried under successive alluvial strata raising the level of the plain by several metres. Such a process of accumulation cannot have taken place in a short span of time and we must allow for a duration of more than a few

3 However, the datation of the sequence remains a problem since we have obtained similar dates for much older layers in the MR3-D Bolan section. This seems due to the levelling down of the surface and a subsequent episode of vegetation, which is still visible in section in the form of precipitated carbonates corresponding to fossilized roots. This could account for the fact that organic samples collected just below the surface yielded dates similar to those from samples collected 7 m below, above the natural soil.
centuries for Phase IB and the following Phase IIA whose layers are to be found above the alluvial strata 4.

The clear section obtained from the cliff along the Bolan river over a length of 200 m and the surface plan (fig. 2) now show the extension of the preserved part of the aceramic mound of Phase IA and the limits of the area occupied by the surrounding sloping levels of Phase IB: simple four-room houses at the centre (Phase IA) are surrounded by the first prototypes of the compartmented buildings in between retaining walls (Phase IB).

**MR3-S Sounding (fig. 6)**

Using these new elements, a better evaluation of the MR3-S sounding can now be attempted. When the results of the first three seasons were presented at the Berlin conference (Lechevallier & Quivron 1981), the whole sequence was thought to be aceramic and the few sherds found near and on the surface were considered intrusive. Later, we realized that the upper eroded levels to the South belonged to an early pottery phase, thus linking the aceramic period to the following Period II in which this type of primitive pottery persisted during the early Phase IIA. Moreover, as the sections of the sounding were cleaned to facilitate the drawing, a sherd was found at 2.50 m below the surface in a layer which can be equated with the thick IBI layer in the MR3-D Bolan section (figs. 5-6). This division of the earliest period into two phases now explains some important discrepancies which puzzled us when comparing the fauna and lithics of the two soundings.

R. Meadow (1981: 144) had already pointed out in the course of the excavations that there must be a diachronism between the upper levels of the two soundings. This deduction was verified and a stratigraphical readjustment had to be made: levels IA1-7 in MR3-S sounding correspond to the same lower levels in the

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4 A series of samples has been collected in 1983 on the whole height of the cliff about 70 m South of the MR3-D Bolan sounding. The analyses of the sediments are being made at the Centre d'Études Atomiques at Saclay under the care of M. Drin. The geomorphological studies should help understand the events at the origin of such deposits, events which must have been determinant for the inhabitants of the mound, including changes in farming techniques for example.
Fig. 6 — MR3-S sounding North section.
North sounding (MR3-T) and in the MR3-D Bolan section; levels IA8-11 are missing in MR3-S and on the eroded levels IA5-7 lie the Phase IB levels (Table 1).

**Table 1 — Stratigraphical correction for the MR3-S sounding.**

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In the diagram published by R. Meadow in 1982 (fig. 7), Phase IA is represented by the MR3-T North sounding and by the MR3-S South sounding levels 6-8, then numbered from top to bottom. They show a great proportion of wild animals, especially at the beginning but with a good number of domesticated goats and later of sheep. On the other hand, Phase IB starting with former level 5 in MR3-S is characterized by fewer wilder animals and a striking increase of domesticated species, especially of cattle.

In the lithic material, there is a general continuity in the two phases. However, amongst the microliths, lunates are predomi-
Fig. 7 — Fauna diagram for Periods I-III, after Meadow 1981.
nant in Phase IA, along with a few triangles and straight-backed trapezes whereas in Phase IB there are few lunates in comparison with the trapezes which have become concave-backed and very seldom straight-backed as in Phase IA. The characteristic artifact which appears in Phase IB is also present in the following Phase II A along with the coarse pottery. Also specific of Phase IB are the polished axes, although they are also present at the end of Phase IA.

Here is a brief description of the stratigraphy observed in the MR3-S sounding with its main archaeological features, starting from virgin soil (fig. 6):

— *Phase IA*: Levels 1 and 2 have mud-brick walls. The sediment is mainly clay. The artifacts and the fauna are rare. Level 3 is characterized by ashy layers. A group of nine burials had been dug from this level or the following, seven of which down into level 2. The two deepest graves are of particular interest: the adults, buried in a flexed position and covered with red ochre as is usual in the early graves at Mehrgarh, were accompanied by five young caprines, aged between three and six months (Lechevallier, Meadow & Quivron 1982). The animals lay up against each other at the feet of the deceased, according to the space available in the pit. One burial (tomb 288) (fig. 8) had no ornaments while the other (tomb 287) (fig. 9) was richly adorned with two necklaces in shell and calcite, anklets in calcite beads, a few turquoise beads around the head and a cylindrical bead in lapis lazuli at the neck.

Animals as grave-offerings are especially significant in light of the fact that domestic species, mainly goats, were present already at the beginning of village life at Mehrgarh and that a process of domestication is taking place through the whole sequence. These offerings can be interpreted as another sign of domestication as it does not seem likely that hunters could have had so many animals of about the same age at their disposal at anyone time. In addition to raising questions of a religious nature, these animal grave offerings may well be an indication of the social status of the deceased (shepherd, animal owner, etc.) within the village.

Another grave from the same level was very damaged and contained only one caprid, as did a tomb of the last level of Phase IA.
Fig. 8 — Grave 288 (MR3-S sounding).
Fig. 9 — Grave 287 (MR3-S sounding).
Other food offerings, i.e. isolated animal bones, have been found in the graves, indicating that it was not exceptional. The basket imprints in bitumen associated with many burials, could also indicate the presence of food, probably of vegetal nature. A third burial (tomb 283), apparently without food offering, showed a profusion of ornaments (fig. 10): a dentalium necklace, two mother-of-pearl and shell pendants, a belt of steatite beads with a large bivalve shell, two anklets and bone rings near the legs. Near the head a large lump of ochre and two complete bone needles were found.

At levels 4 and 5, two houses were partially excavated. Levels 6 and 7 have greatly suffered from erosion but three graves were excavated in level 6 and one in level 7.

More work has been done in 1984 in the sounding MR3-S. Its southern part has been excavated from 2 m down to 3.50 m below surface and the whole South section has been cleaned again and drawn. Twelve more burials have been exposed: three belong to Phase IA and the others to Phase IB. One tomb of Phase IA (tomb 84-12) contained the skeleton of an old woman, covered with red ochre and richly adorned with a belt and a necklace made of shell and stone beads, a mother-of-pearl pendant and a weaved head-dress in dentalium beads (fig. 11). A chisel was uncovered near the skull.

— Phase IB: These levels, already described (Lechevallier & Quivron 1981), will be mentioned only briefly. There is no break in the architecture. The same type of rectangular four-room house is present in various levels (IB1-2) but in level IB3, we found a structure with small compartments which constitutes the earliest compartment building known at Mehrgarh. Above, in level IB5, there was another compartment building. To the South, the layers IB6-10 are quite eroded; yet they provided evidence of successive retaining walls built to stabilize the loose ashy sediments of the sloping mound.

In the additional work done in 1984 in the South part of MR3-S, nine tombs of Phase IB were excavated. In one tomb (tomb 84-2), a mud-brick wall was found on one side of the skeleton, as is usual in the graves of that period. The burial was exposed very close to the section on which the pit of the grave was visible. This is the first evidence of a complete grave of Phase IB with a funerary chamber dug on one side of a 1 m deep
pit. At the time of the inhumation, after the deceased had been laid, the chamber was sealed with a mud-brick wall (fig. 12).

From the thick sloping layers covering the sides of the aceramic mound, it appears clearly that the higher part of the mound, in the centre, where the IB levels topped the IA levels, has been completely eroded, leaving a relatively flat surface, not much higher than the present mean level of the plain. This explains why the site could not be perceived as a tell and also why it has been under cultivation like the rest of the plain.

The stratigraphical data from the recent soundings along the cliffs, added to the results of the other excavation units, provide a clearer and also more coherent view of the history of the Neolithic settlement of Mehrgarh. The sedimentological studies now in progress will hopefully clarify the environmental problems.

We can sum up the two phases of Period I at Mehrgarh in the following manner:

1) Phase IA is completely aceramic; it shows a well developed village life, characterized by simple multi-room architec-
Fig. 12 — Grave 84-2 (MR3-S sounding). Top left: part of the South section showing the pit. Top right: location of the grave wall and the skeleton (excavated by Anne Fetizon) in relation to the section. Below: a representation of the way the tomb was made (reconstitution).
ture, agriculture, herding but also much hunting, especially in the early levels.

2) Phase IB continues the same tradition, but with more advanced aspects: elaborate tombs with the addition of a wall, storage facilities which imply a new emphasis on agriculture, increased proportion of domesticated animals with a shift to raising cattle and new elements such as the introduction of pottery, although in a very discrete way, and the first prototypes of compartmented buildings, both of which features were to be developed in the following Phase IIA.

Phase IB represents a long sequence as indicated in the MR3-S sounding and the surface excavation (sloping levels), to which correspond the clay deposits in the cliff which raised the level of the plain of several metres. The considerable time span obviously represented by this phase and the earlier phase IA (as suggested by the sedimentologists) is evidence for the chronology which we have already proposed: the 8th-7th millennia for the aceramic phase IA and the 6th millennium BC for the early pottery phases IB and IIA, which agrees with the available archaeological parallels (Lechevalier 1985) and the local process of domestication established by R. Meadow.

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ANAÎCK SAMZUN and PASCAL SELLIER

First Anthropological and Cultural Evidences for the Funerary Practices of the Chalcolithic Population of Mehrgarh, Pakistan

The archaeological site of Mehrgarh (Baluchistan, Pakistan), excavated since 1974 by the French Archaeological Mission, represents a cluster of overlapping sites spread over an area of more than 200 ha. It allows to establish a chronological sequence covering five millennia from the 7th to the 3rd millennium BC (Jarrige & Lechevallier 1979, 1980).

Period III of Mehrgarh

The MR2 area, the largest of the site, extends over 75 ha. littered over with artifacts and potsherds characteristic of period III of the sequence of Mehrgarh. It follows the Neolithic (periods Ia, Ib and IIa) and the early Chalcolithic (period IIb) phases of the 7th, 6th and early 5th millennia and has been tentatively dated by J.F. Jarrige from the second half of the 5th millennium (Jarrige 1981).

The pottery of this period (figs. 1-2) shows figurative black paintings (humans, caprids or birds, usually in friezes and associated with simple geometrical motives) typical of the Togau A style as defined by B. de Cardi (de Cardi 1965) or geometrical motives quite identical to those of the so-called Kili Gul Mohammad III style of the Quetta valley (Fairservis 1956). Eighty percent of the sherds bear clear marks of shaping with the help of a rotating device, probably a slow wheel, and the decorative motives adorn about twenty percent of the sherds. Moreover, the cultural assemblage of period III has to be linked to the earlier

1 Directed by J.F. Jarrige with helpful collaboration of the Archaeological Department of Pakistan.
Fig. 1 — Characteristic pottery from Mehrgarh, period III, phase 1.

phases of the site, showing an impressive continuous process since the 7th millennium (Jarrige 1981; Jarrige & Lechevallier 1979). Considering those data and the depth of the archaeological deposits in the soundings (up to 6 m in some cases) attesting a massive pottery production, it is no longer possible to think according to a diffusionist model, like J.M. Casal, that this kind of pottery could have been imported to Baluchistan from the Iranian plateau or from Turkmenia through a site like Mundigak (Casal 1961).

Within this period III, we can reveal an evolution with three successive pottery phases. Phase 1 shows pottery very close to

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2 A PhD Thesis studying MR2 cultural assemblage is to be published by A. Samzun.
Fig. 2 — Characteristic pottery from Mehrgarh, period III, phase 2.
period IIb (early Chalcolithic); ceramic ware is found in small quantities and most of it is wheel-turned but there is still some very coarse ware and some basket ware; black decorative motives, either on red background or buff surface, are very simple, geometrical and not various at all (fig. 1); the buildings MR2.F', MR2.S1C and MR2.R5J (North and East in fig. 3) belong to this period. The sherds of phase 2 (fig. 2) reveal the diminution of the basket ware, the apparition of a very scarce proto-wet ware and the increase of the decorated sherds together with a diversification of the motives: figurative (caprids or birds) often associated with geometrical ones (triangles, squares, often criss-crossed); the complex of buildings MR2.X (South in fig. 2) belongs to this period and shows a more elaborated layout than the earlier ones. The 3rd and last phase of period III (to which belongs another building, MR2.S, and a huge pottery kilns area)
is characterized by a great abundance of pottery showing both diversification and stereotyping of the figurative motives, often stylized and associated in friezes; paste and shapes are the same as those found during the previous periods except for some new flat dishes; two scarce new features are to be developed in the following period IV (site MR1): wet ware and decorated bases with stylized flowers.

From 1976 to 1981, excavations in MR2 area had led to uncover three types of remains: compartmented mud-brick buildings, probably storage units, comparable to the architectural prototypes of the earlier periods; specialized craftsmanship areas connected with the work of semi-precious stones or sea shells and with metallurgy, and a very extended pottery kilns area; few isolated burials had also been found (usually near the buildings). All these finds gave evidences of a high technological level and an elaborated social organization (Jarrige 1981).

During the last two seasons of excavation, 1982-83 and 1983-84, we could uncover three more mud-brick structures (MR2.F', MR2.R5J and MR2.S1C, see fig. 3) and, moreover, partially excavate the first genuine graveyard of this period III which had been accidentally revealed. Through a first study, the MR2 cemetery gave new evidences for the cultural, technological and social interpretation of this period but, since the first presentation (Samzun & Sellier 1983) and since the paper read in Brussels, we have added some corrections and have thoroughly completed and revised our data making allowance for the 47 more individuals excavated this last season. We shall first introduce the main funerary features of the graveyard before coping with demographical and general interpretation.

THE MR2 GRAVEYARD

The MR2 graveyard is located West of most mud-brick buildings (fig. 3) and especially very close to the S1C and the R5J structures (fig. 4), even overlapping the latter, but we shall examine further their mutual relations. During the two seasons of excavation, three main sectors have been dug in order to try to determine the extension of the cemetery: North-East near the S1C building (fig. 6), South near the R5J structure (fig. 7), and the
central sector (fig. 5) including a sounding of 14 sq.m (part of squares R2J and R2I) which was excavated as deep as to reach the virgin soil in order to give the exact pattern of the burial density.

Density and Extension

Within these three sectors, 99 individuals have been excavated so far and 26 more could be located, giving a total of 125 individuals covering an area of 144 sq.m. However, this (0.87
Fig. 5 — MR2 graveyard, central sector.
Fig. 6 — MR2 graveyard. North-East sector.
Fig. 7 — MR2 graveyard, South sector.

individual /sq.m.) is not the actual density of the burials for the whole depth could not be excavated everywhere (approximately up to 30-50 cm below surface). Only the R2J sounding can give us a clear idea of this density: scattered at various depths (within a range of 75 cm where it is yet impossible to distinguish separate levels), 24 individuals cover a surface of 14 sq.m., namely 1.7 individual/sq.m..

Among the important data for the interpretation (Nemeskéri 1962), the total area of the graveyard can be evaluated for we know some of its boundaries beyond which no skeletal finds could be uncovered in spite of the depth of the excavation. The
only unknown limit is the South-South-West one, so we can estimate the minimum extent of the cemetery as at least 800 sq.m. (fig. 4). On that basis and assuming the R2J sounding to be representative of the density of the whole, the minimum total number of the deceased would be 1360 individuals which is an underestimate, more especially as the state of preservation of the bones is very poor due to their closeness to the present surface and to the very high salinity of the soil (although some authors mostly pointed out the part played by the acidity and the limestone rates — dell’Agnola & Alciati 1974). Indeed, some of the skeletons are only partially preserved but, moreover, a certain amount must have been completely destroyed. It is also impossible to figure to what extent the graveyard depicts the actual living population of MR2 but our estimation supports the archaeological hypothesis of a large concentration of population in period III (Jarrige 1984: 26); it is nevertheless possible to examine the funerary practices of this chalcolithic population and try to detect a possible bias in the demographic data.

**Position, Orientation and Degree of Dislocation of the Skeletons**

Among the 99 uncovered individuals, the more numerous (84) are in strict anatomical connection and 15 represent what is called complete dislocation (Brézillon 1975: 9).

Some of the skeletons in anatomical connection are incomplete (especially crania of the upper ones, missing because of an eastwards slope) due mostly to their poor state of preservation (and, for few of them, to bad atmospheric conditions during the excavation) and some denote small perturbations called loose connections (Leclerc 1975: 20) or natural dislocations in anatomical order (Brézillon 1975: 9) which can be explained by the action of the gravity after rupture of the ligaments. Nevertheless, all the individuals are oriented East-West, skull eastwards, except one (child No. 71: Southwest-Northeast, skull southeastwards) and 2/3 of them (56/84) lie in left lateral decubitus, facing South;

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3 Tipping up of skulls 21, 36, 73, 78; dislocations of mandibles of 25A, 55, 70, of left foot of 39, of right forearm of 21, of cervical vertebrae of 55.
their lower limbs are usually in a compelled flexion (sometimes very compelled), at least tibia-fibula on femur but also femur on pelvis, denoting most likely a system of wedging or fastening the dead bodies; the position of the upper limbs is more variable but often leads the hands close to the face (see fig. 8, No. 48). The other 28 (33% of the connected skeletons), in rarer positions, are either in right lateral decubitus, thus facing North (9.5%), in ventral decubitus (4.5%; see fig. 8, No. 49), in dorsal decubitus (13%; see fig. 8, No. 51), or even in a very uncommon half-seated position (6%) with upright skull resting on the mandible and fore-arms and knees upwards (see fig. 9, No. 24A). In all these

![Image of burial positions](image-url)

Fig. 8 — Individuals Nos. 48 (standard position), 50 (secondary burial), 51 (dorsal decubitus) and 49 (cutting into 50 and 51; ventral decubitus).
cases, the main characteristics are respected (flexed lower limbs, hand near the face, looking southwards).

Among the 15 disconnected individuals, 9 are only represented by isolated bones and the other 6 (immatures 9 and 87B, females 4A and 40, males 19AB and 50) by heaps gathering completely disconnected bones (only No. 19AB shows few partial connections) all belonging, as far as morphology and measures can tell, to a single individual in each heap: most of the long bones of the limbs, the skull and mandible or part of them, fragments of pelvis; very few ribs and vertebrae can be noticed and all the small or short bones of the hands and the feet are
always missing as well as the patellae. That is a strong argument to suggest actual secondary burials, which relates to a genuine process of re-inhumation like what happens in an ossuary (Ubelaker 1974: 8) and not what is called *réduction de corps* ('body reduction' — Leclerc 1975: 20) which is a simple disturbance of a primary inhumation, after body tissue decomposition. The 9 isolated bones, all partial or complete crania (see fig. 5, Nos. 4B, 13, 15, 19C, 22, 23, 24B, 25B, 72), can also be related to that same practice of re-inhumation as shown by child No. 72, handled so as to put the two parietal bones nested inside one another and around the left side of the face.

*Burial Structures, Repartition and Associations*

The study of the repartition and of the associations of the skeletons is not made easy because of the scarce structures that could be observed; very few evidences of a pit underlining the graves have been noticed (No. 3, 6, 10, 16, 48, and 63) and, at times, few mud bricks are surrounding the skeletons either isolated (see, e.g., No. 1) or forming small walls sometimes difficult to relate definitely to a particular individual except for some incomplete bins (Nos. 14 and 58). We can also notice that the skull of 25% of connected skeletons is resting on one mud brick (we have called it 'pillow-brick'). Nevertheless, we are able to distinguish three types of association among the individuals.

The first one is represented by simple isolated skeletons (approximatively 2/3 of the whole) showing unquestionable individual sepultures although the high density of the burials does not always make it very clear for some of them (Nos. 56 and 62; 6 and 21) when there is no obvious pit or separating wall.

The second possibility is the association of two individuals who have been obviously buried simultaneously as shown by their closeness or direct superposition having not disturbed the degree of connection. Almost all the secondary burials are associated to another connected one they have been inhumated with, which shows quite clearly the process of re-inhumation (Nos. 65 and 72; 12 and 13; 15 and 16; 7 and 9; 87A and 87B; 50 and 51 — see fig. 8). Sometimes two disconnected individuals are together, being then an isolated fragment of cranium among a dislocated
(incomplete) skeleton (Nos. 4A and 4B; 19AB and 19C). Only one case seems to gather four individuals: the connected female 24A whose legs are just upon child 25A (fig. 9) accompanied by an adult occipital bone (24B) and the face of a child (25B) in square R2J.

The last case is quite exceptional as it is a genuine collective sepulture but which could be only partially excavated so far; six complete individuals in undisturbed strict anatomical connection are lying in an area well delimited by single-rowed mud-brick wall and should represent around the quarter of the whole collective grave (fig. 10 and fig. 5, square S1A, North). Considering their perfect connection despite some partial superpositions, it is difficult to think they are not simultaneous inhumations, unless a specific (now destroyed) protective structure would have created a kind of burial vault allowing possible successive burials.

In spite of the homogeneity of the stratigraphy we have already underlined, some underneath burials are obviously older than others (see square R2J) and we must also report that in few cases a partial relative chronology is possible since the digging of some graves has clearly cut into previous ones (No. 3 posterior to 4A-4B; 63 to 56-62; 65 to 73; 49 to 50-51 — see fig. 8).

The Grave Deposits

The grave goods, always clearly belonging to a single individual (even in the collective sepulture) are relatively scarce but give more evidences for the existence of a well developed craftsmanship with a high technological level, already well attested elsewhere in MR2 (Samzun n.d.). They are mostly ornaments besides two pottery vessels and one metal object.

A carinated pot with black geometrical criss-crossed motives on buff ware was laid on the lumbar vertebrae of male No. 1 and a small buff ware pot, with black caprids and geometrical motives both in criss-cross lines (fig. 11), was wedged between the skull and the right shoulder of female No. 91. Both wheel-turned, they are the only two examples of pottery within the whole graveyard despite a very important pottery production in period III but assume peculiar importance being characteristic of the
Fig. 10 — The collective sepulture (excavation in progress).
second phase of this period (see infra). The third exceptional find is a copper/bronze object, most likely a circular compartmented seal, but unfortunately much corroded, placed near the skull of female No. 33; so far, we had only few evidences of a high level metallurgy during period III at Mehrgarh: some fragments of copper/bronze pins (including a two-spiral headed one) and a golden cylindrical bead. That seal supports J.F. Jarrige’s hypothesis of an increase of the metallurgy already shown by the discovery of some crucibles and indirectly reflected by the decrease of the flint and bone artifacts (Jarrige 1981: 108). It could also indicate that this kind of metal seals have been produced in an earlier context than the Quetta-Namazga III one (Jarrige n.d.).

But the more frequent grave goods are the ornaments (fig. 12) worn by 37 individuals. They are essentially made with small white cylindrical beads (average length, 1 mm; diameter, 2 mm) of baked steatite forming various necklaces (some three-rowed and counting more than 300 beads), bracelets or head ornaments (with longer cylindrical beads) placed at the top of the skull,
Fig. 12 — Ornaments from MR2 graveyard. Four examples of lapis lazuli pendants (a: H. 6; b: H. 3; c: H. 1; d: H. 58); head ornament (e: H.52); necklace of child (f: H. 36); example of agate bead (g: H. 28).
most likely part of the hairdressing. Some of them also wear, alone as pendants or among the steatite beads, some beads made of semi-precious stone (17 individuals) such as lapis lazuli, cornelian, turquoise, chrysoprase and agate (plus few examples of perforated sea shells and of terracotta beads). We shall discuss further the discriminating repartition of all the grave goods among the dead but we can already notice that usually skeletons only wear one single necklace or pendant, few of them adding one or two bracelets (4 females, 1 male, and 1 child) or a head ornament (6, all females). We must also underline the elaborate technique necessary for the production of baked steatite beads, well studied for the Harappan civilization (Hedge, Karanth & Sychanthavong 1982) but obviously already known at Mehrgarh; as for the craft of semi-precious stones we have evidences from periods I and II of Mehrgarh; it shows the continuance of the traditions (Jarrige, this volume), though with some technological improvement (Samzun n.d.) such as the use of microdrills in green phtanite (found in the workshop remains of MR2 with unachieved beads), probably part a bow drill, so far only known since the 3rd millennium at Shahr-i Sokhta, Amri, Shahdad and Chanhu-daro (Jarrige 1981: 109).

Demography

The sex and age determination presents a particular importance for it allows a significant interpretation of discriminating mortuary practices evidenced by the repartition of the grave deposits and of the anatomical state of the bodies (see infra); moreover, it provides the only conclusive data on the demography of the chalcolithic population of Mehrgarh more especially as the sample of 99 excavated individuals can be regarded as fairly representative. Recently, C. Masset argued that reliable facts on paleodemography would first come from the analysis of the skeletons (Masset 1980) and not from speculations about a so-called 'demographic pression' or conjectural population densities computed from too many uncontrolled parameters (size and occupation rate of the settlements, average population density, average number of inhabitants per housing unit...) often leading
to ineffective assessments and sometimes to a high degree of confusion about data being not demographic at all (Aurenche 1981). Of course, we must be cautious, even pessimistic, for we have no hope of reconstructing the integral population structure (Bocquet-Appel & Masset 1982), but yet one could at least detect in some cases major anomalies or decisive bias showing a non natural demographic pattern related to specific burial practices (Masset 1976 a; Sellier n.d.a).

Crude Data and Methods

Anyway the present analysis is restricted to the data accessible before restoration and further examination of the bones; we thus evade the main difficulty which is the determination of the age of adults (Masset 1976b; Bocquet-Appel & Masset 1982) and limit this study to the determination of the age of children and the sex of adults.

The sexual diagnosis is based on classical morphological criteria (skull, mandible and pelvis), scored and weighed as to give a coefficient of sexualization (Acsádi & Nemeskéri 1970; Ferembach, Schwidetzky & Stloukal 1979), and also on the discriminative indexes of the pelvis, ischio-pubic (Schultz 1949) and cotylo-sciatic (Sauter & Privat 1955). Age of subadults is based on the epiphyseal union (Paturet 1951; Stewart 1979) and age of children is determined according to the teeth formation and eruption (Acsádi & Nemeskéri 1970: 104-10; Aubenque, Deruelle & Tisserand-Perrier 1958) but, the jaws being not yet X-rayed, the state of mineralization of each tooth could not always be specified (Vlček et al. 1975); besides, for very few difficult cases, we also considered the formation of the carpal bones (Paturet 1951) and wide age intervals inferred from femoral length (Stewart 1979).

The results of this analysis are given in table 1 where the reader will notice that the age intervals for the children are not the classical ones in order to compute specific estimators (Sellier n.d.b).
Table 1 — Demographic data from MR2 graveyard (99 individuals).

<table>
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<tr>
<th></th>
<th>adultes: 73 (73.7%)</th>
<th>immatures: 26 (26.3%)</th>
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<td>38%</td>
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Analysis

The demographic data confirm the conclusions after the first season of excavation (Samzun & Sellier 1983) but add some nuances and corrections. The proportion of sexually undetermined adults is still very high (34%) due to the poor state of preservation we already noticed. The apparent unbalanced sex ratio (58% females against 42% males among 48 determined adults) is in fact statistically non significant 4.

On the other hand, the mortality pattern of the children is highly anomalous. The rate of children under 14 years old, 23.2% of the total number of the dead, is absolutely inconsistent with what we can know about mortality of traditional populations (Ledermann 1969; Acsádi & Nemeskéri 1970: 238; Masset 1980: 338), more especially as we can await a rather low life expectancy at birth. In fact, the under-representation of the children does not affect all the age classes; the death rates of 5-9 years and 9-12 years children (quotient: 1.5) can be regarded as reliable (Masset 1973: 337) but the age of 5 years seems to indicate a critical level. Indeed age specific death rates between 0 and 5 years of 8% and furthermore between 0 and 1 (infantile mortality) of 3% 5 are properly unnatural (Ledermann 1969; Masset

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4 $\alpha = 25\%$ with a Chi-squared test against a theoretical balanced repartition.

5 In table 1, the three 0-2 years infants are in fact less than 1 year old.
1976a: 79-86); we would expect respectively around 40-55% and 25-30%. Thus we must allow for a huge bias in our population sample but it is clearly circumscribed, concerning only the newborns and the very young children, and can even be estimated: around 89% of the children between 0 and 5 years old are missing (Sellier n.d.b).

This is not an isolated case in the archaeological samples and hypotheses about this disappearance of the very young children have already been discussed (Acsádi & Nemeskéri 1970: 238 ff; Masset 1973, 1976a). It is clear that a worse conservation of the infants’ bones cannot be seriously considered (Masset 1976a: 80-83) and we should at least have found dental germs sifting the earth; the lesser depth of children graves, sometimes called to explain their preferential destruction (Acsádi & Nemeskéri 1970: 239), is neither a good answer for the lower graves are much more void of children than the upper ones nearer to the surface. Finally, the only consistent hypothesis is the creation of a bias by the chalcolithic people themselves who sorted out their sample, choosing not to bury newborns and very young children (under 5 years) in this graveyard (or so few). Besides, the three infants are not placed at random but all at the very north-western boundary of the cemetery (fig. 4; fig. 5, Nos. 66 and 68; fig. 6, No. 87B). This funerary practice of excluding the very young children off the older children/adults graveyard is not uncommon in archaeological examples, the former being often buried in the dwelling itself (which is not the case in MR2). In fact, this custom finds one more evidence with its exact reversed image, in the following periods of Mehrgarh, on site MR1 providing only foetuses, newborns and very young children whereas the older children/adults burials could never be found.

INTERPRETATION

Datation of the Graveyard

Both fillings of the cemetery and of the nearby R5J and S1C structures (fig. 4) are very homogeneous but slightly different; the sherds of the buildings are clearly from the first phase of

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6 Specific infant burial sites are also known at Altyndepe, Gawra and Tell es-Sawwan (Alekshin 1983: 140).
period III whereas those of the whole graveyard belong to the second phase (see supra and figs. 1-2). Moreover, if few identical steatite beads can also be found at the following periods (up to VII), some other grave deposits, doubtless associated to the skeletons, are typical: the same lapis lazuli pendants (fig. 12) are known in attested period III contexts (in MR2.X buildings, phase 2) and the two pottery vessels (individuals Nos. 1 and 91) are absolutely characteristic of phase 2 of period III (figs. 2, 11). Besides, the R2J sounding showed that the burial level was above the burnt soil corresponding to the S1C structure and we noticed also that some skeletons were leaning against walls of R5J building (fig. 7, Nos. 77, 78, 89 and 91) but never cutting into them, the whole graveyard being therefore posterior to those buildings of phase 1.

Being close to the surface, the graves could have been dug in the MR2 site at a more or less undefined date but we thus see that there are strong arguments for attributing this graveyard to period III of Mehrgarh and more precisely to its second phase.

*Discriminating Funerary Practices*

The aspirations of prehistorians towards paleo-ethnological reconstruction, with accurate field and analysis methods, and major evolutions in archaeological and ethnological research (review in Bartel 1982) led to study mortuary remains not only as common cultural features but as reflections, through symbolism, of the degree of complexity of the social structure (Binford 1971; Pader 1982). Beyond simple interpretations in strict terms of social stratification (Alekshin 1983), authors have explored the potentialities of such analyses through the study of the repartition of grave goods and of burial characteristics, and their correlations with the demographic data (Piperno 1979; Pader 1982; Forest 1983). We would like to present some first results of a similar approach about the MR2 graveyard.

Concerning the association with structures (walls, bins, 'pillow-bricks'), there is no consistent correlation with a particular class of age or sex. Nor are there any obvious differences of treatment (orientation, position) among the 84 connected individuals: 2/3 of each category are in left lateral decubitus, facing
South (standard position); nevertheless, among the rarer positions, it seems that only males are in ventral decubitus (4 cases, i.e. 22% of the connected males, including one facing North) and that females are more often in dorsal decubitus or in half-seated position (respectively 19% and 15% of the connected females) but none of these variations can be considered as significant.

The repartition of the 15 secondary burials (anatomical dislocations, see supra) is more interesting (fig. 13): 8 are adult individuals (including 2 males and 2 females, the other 4 indetermined), namely 11% of the adults, and 7 are immature (all under 14 years of age), that is 27% of them. This differential repartition is statistically significant\(^7\) and gives evidence for a peculiar treatment given to the children.

\(^7\) Chi-squared test: \(\alpha = 5\%\); if we include the subadults (14-18) in the adults, the differences between disconnection rates will be even stronger: 10.5% of the adults against 30.5% of the children.
In order to study the repartition of the grave deposits, we partially followed the proposal of V.A. Alekshin (1983: 141) in defining the burial ‘standard assemblage’ but, in order not to deal with comparison between more or less ‘wealthy’ graves and considering the rather stereotyped artifacts, we created only two other categories (more and less than the standard). Class 1 (more than the standard) includes individuals whose ornaments present at least one semi-precious stone bead or with ‘exceptional’ deposit, even if the object is not usually considered as rare or precious in itself (the two pottery vessels and the copper/bronze seal); class 2 (standard assemblage) concerns burials with one or several ornaments made of only steatite beads; and class 3 (less than the standard) has no grave good at all.

Among the 84 connected skeletons, 22.5% belong to class 1, also 22.5% to class 2 and 55% to class 3 but among the 15 disconnected none are to be found in class 1 (0%), only 1 in class 2 (7%) and the 14 others in class 3 (93%). This interesting difference in the grave goods repartition (fig. 13) according to the type of inhumation, primary (connected) or secondary (dislocated), is statistically highly significant 8.

Other variations are depending on the sex or age of the individuals (fig. 13); class 3 (no grave deposit) gathers only 25% of the adult females, but 60% of the adult males and 73% of the immatures; besides, class 2 concerns 39% of the females, 20% of the males, and 15.5% of the immatures whereas class 1 (more than the standard) counts 36% of the females, 20% of the males, and only 11.5% of the immatures (namely 3 individuals, including a probably female subadult). This discriminating repartition is statistically highly significant 9. We can also notice that the head ornament is specific of the females (6 cases, with or without semi-precious stone).

With the exclusion off the cemetery of the newborns and very young children that we already saw and with these significant differences in the repartition of the grave goods and in the variation of the burial practices, we have an image of a great codification of the funerary customs according to various criteria. The women definitely seem to have a different status.

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8 Chi-squared test: \( \alpha = 2\% \).
9 Chi-squared test: \( \alpha = 1\% \).
(probably a higher one) than men (intermediate position) and immatures; children under 14 years of age are mostly concerned with the process of re-inhumation (after first inhumation or exposure) and always (the 7 cases) in order to be associated with another individual (adult or not, connected or not). Moreover, the immatures (both dislocated or not) are preferentially lacking of grave goods as also the few disconnected adults.

**Comparisons and Conclusion**

Being a first attempt at the interpretation of MR2 funerary practices, the comparisons can only concern a rather more general level but it is not easy to connect the Mehrgarh period III graveyard to other Chalcolithic sites of the Quetta valley. Indeed, Kili Gul Mohammad or Anjira, the pottery of which (Fairservis 1956; de Cardi 1965) is very similar to that of Mehrgarh in both style and technique, did not provide evidence of any inhumations probably because of the very small extent of the excavations. In central Iran, only few flexed skeletons are known at Sialk II (Ghirshman 1938). The earlier bin collective sepultures seem to be, at the end of the 6th millennium, those of Hajji Firuz Tepe in Greater Mesopotamia (Voigt 1983: 70-94) where both connected and dislocated skeletons are gathered in rectangular mud-brick bins, located inside the rooms of the housing structures themselves. Nearer, in Afghanistan, Mundigak, where the pottery of the earlier periods has to be connected with Togau A style, presents in graveyard C from phase III 6 (probably slightly later than period III of Mehrgarh) both individual and collective sepultures (Casal 1961) but the published data are very scarce and the individual ones are said to be older than the others (Casal 1961: 44); nevertheless, important differences with MR2 must be noticed: those collective burials, in rectangular mud-brick bins, are ossuaries with total anatomical dislocations and bones often gathered by category (mostly skulls which seem over-represented). Further North, in southern Turkmenia, in the Namazga III levels of Geoksyur 1 (second half of the 4th millennium), both individual and collective burials are known (Kohl 1984: 97), the latter being mostly circular 'tholoi' with connected skeletons quite comparable with the MR2 collective burial. This double tradition
of individual and collective inhumations on the same site will be kept later, in the 3rd millennium, at Altyn-depe in the Namazga IV and V levels (Kohl 1984) and also at Shahri Sokhta (Piperno 1979) in Iranian Sistan.

Looking at Mehrgarh itself, we can establish, to a certain extent, some continuity of the funerary customs with the Neolithic period (period I, site MR3): same position of the bodies (mostly left lateral decubitus) with flexed lower limbs and hands often near the face, same orientation (East-West, skull eastwards, facing South) and some similar ornaments (perforated sea shells, turquoise beads); but the main differences are numerous: besides systematic spreading of red ochre, the grave deposits of period I (Lechevallier & Quivron 1981) are much more diversified with many possible assemblages between various ornaments, stone or clay vessels, bitumen-coated baskets, lithic or bone implements or exceptional animal offerings (Lechevallier, Meadow & Quivron 1982). Moreover, they are mostly side-walled graves, in order to form a kind of small funerary chamber which remains empty, like a burial vault, allowing important post-mortem movements, whereas the MR2 standard burials seem to be filled pits. From the skeletal data, still being studied, we can also assess a different demographic pattern in MR3; all classes of age seem to be present including newborns, infants and very young children, buried in the same graveyard than older children and adults; and furthermore, being usually among the most adorned, the children assume probably a different status than those of MR2. No collective sepulture is known on the neolithic site and the disconnected individuals are not true secondary burials but 'body reduction', namely complete skeletons, often with many partial connections, pushed aside to make room for one later primary associated burial.

Period III, Chalcolithic, of Mehrgarh finally gives the feeling of a higher specialization in all fields, architectural, technological and moreover funerary as evidenced by the rigorous codification of the burial practices, probably related to a certain degree of social complexification, with specific sectors (collective sepulture; exclusion of the newborns and very young children) and characteristic associations with grave deposits and types of inhumation (primary or not). These main data finish off the picture of the dwelling of a large concentration of population in
period III and also underline the value of the site of Mehrgarh as a whole, each period being linked to an earlier cultural and technological tradition but with its own peculiarities and internal factors of evolution.

ACKNOWLEDGEMENTS

We wish to express special thanks to Anne Fetizon, Stéphanie Thiébault and Gilles Tosello for their cheerful and skilful help on the field and to Nigel Plummer for revising the English manuscript.

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JOHN R. LUKACS

Dental Pathology and Tooth Size at Early Neolithic Mehrgarh: an Anthropological Assessment

Introduction

Anatomical variations in bones and teeth record, and often preserve, a history of the genetic-environmental interactions that occurred during the course of an organism's life span. If this osteological and odontological record is read carefully and completely the anthropologist may gain abundant and valuable insights into the health status, dietary patterns and genetic relationships of prehistoric populations. Since evidence derived from human skeletal remains is fundamentally different than archaeological evidence, anthropological studies have the potential to contribute unique insights crucial to the development of a comprehensive picture of prehistoric cultures and their biocultural adaptations.

Dental structures are particularly suitable for use in prehistoric studies because: 1) being composed of enamel and dentine, teeth are the most dense and durable structures in the human body and are often preserved in abundance even when osteological remains are poorly preserved, 2) dramatic variations in an organism's health or diet during the period of dental growth and development may affect the final structure and color of the enamel and dentine, and 3) tooth crown size and morphology are biological attributes characterized by high heritability assuring a high degree of reliability in estimating the genetic relationships between both prehistoric and living populations.

One problem in dental studies is that different classes of dental data are often complementary in nature, a single specimen may yield only one, not two types of information. For example, genetically controlled morphological variants of the tooth crown
and tooth crown dimensions can only be observed and recorded for teeth free from dental attrition. While the degree and orientation planes of dental attrition may yield valuable data regarding dietary patterns, attrition erases crown morphology and reduces overall crown dimensions. Thus, what often appear to be adequately large skeletal samples for biological studies quickly become small as they are sub-divided according to the type of dental data they can provide.

The historical development of dental anthropology in South Asia was recently reviewed by Lukacs (1984), who also summarized current research results in dental morphology and tooth crown dimensions for prehistoric and living South Asian populations. Sources on paleodontal pathology in India and Pakistan are very rare. Lukacs (1981) described dental pathologies in the Iron Age skeletal series from the Megalithic site of Mahurjhari, near Nagpur in central India, and Pal (1981) recently surveyed the incidence of specific dental diseases in several prehistoric Indian skeletal series. At present the only source of information regarding tooth size, crown morphology and dental pathology of Neolithic South Asians is from the MR3 site at Mehrgarh (fig. 1). Consequently, this report provides a first glimpse of the oral health status, dietary patterns and tooth size of these early Neolithic occupants of the North Kacchi plain of Baluchistan.

**Dental Pathology and Bio-Cultural Adaptation**

A preliminary report on the dental anthropology of Early Neolithic occupants of Mehrgarh documented a low caries rate, megadonty, and a high incidence of maxillary incisor shoveling (Lukacs 1983a). The dental pathology of skeletal remains from Early Neolithic levels at Mehrgarh are described in greater detail below. Since the MR3 dental sample (permanent, n = 807; deciduous, n = 82) consists primarily of isolated teeth and dental elements anchored in fragmented and poorly preserved jaws, only lesions of the tooth crown are reported (Lukacs 1983c). Diseases affecting alveolar bone of the mandible and maxilla are not discussed.

Macroscopic observations of all dental crowns were made, frequently with the aid of a 10× or 20× hand lens. Presence and
Fig. 1 — Map showing location of Mehrgarh.
severity of dental caries, gross enamel hypoplasia, ante-mortem tooth loss and dental calculus was recorded. The deciduous dental sample, though small, was free from dental pathology. The permanent dental sample, however, exhibited high frequencies for certain dental diseases: gross enamel hypoplasia, $21/37 = 56.8\%$ and dental calculus, $18/37 = 48.7\%$; while other dental pathologies yielded a very low incidence: dental caries, $10/755 = 1.3\%$; ante-mortem tooth loss, $6/457 = 1.3\%$. The low rate of ante-mortem tooth loss may be directly attributable to the low caries rate and to the young age structure of the available MR3 skeletal sample. The high frequency of individuals affected by dental calculus deposits may be due to lack of dental hygiene and proper dental cleansing. However, changes in diet among the pre-conquest Maya of Guatemala have been cited as a cause of increased calculus formation (Evans 1973), and Anderson (1965) noted a high incidence of tartar in association with low caries rates among the prehistoric occupants of Tehuacán. The regular occurrence of dental caries and calculus deposits in the same specimen at Altar de Sacrificios controverts Anderson’s findings (Saul 1972). In the Mehrgarh sample there is a more direct explanation for the low caries incidence in the Early Neolithic skeletal series.

A routine descriptive analysis of dental morphology and pathology was being conducted by the author when unusual discolorations of the enamel and enamel pitting were found in a specimen from deep in MR3-T sondage (S36, Locus 16). By the conclusion of the 1983 field season seven specimens (28.0%, $n = 25$) from Early Neolithic levels (MR3) and two specimens (7.7%, $n = 13$) from Chalcolithic levels (MR2) were found to exhibit dental fluorosis.

Three symptoms of fluorine intoxication were recorded in the enamel of permanent teeth; 1) opaque ‘milky-white’ patches, 2) yellowish brown stains of varying extent and darkness (figs. 2-3) and 3) discrete and confluent pitting (figs. 4-5). In several specimens, symptoms two and three are found in the same indi-

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1 Frequency of gross enamel hypoplasia and dental calculus is reported in percentage of specimens affected, but dental caries and ante-mortem tooth loss is reported on the percentage of teeth affected.
Fig. 2 — Example of yellow-brown enamel motting in the maxillary dentition of specimen MR3T, 536, Loc. 16.

Fig. 3 — Example of yellow-brown enamel motting in the right maxillary incisor teeth of specimen MR3T, 536, Loc. 16.
Fig. 4 — Examples of discreet enamel pitting on the buccal surface of right maxillary molar teeth of specimen MR3, Homo 30.

Fig. 5 — Examples of discreet enamel pitting on the buccal surface of left mandibular molar teeth of specimen MR3, Homo 30.
individual and often in a single tooth. Molar and premolar teeth are most frequently the locus of severest staining and enamel pitting, while incisor teeth are often affected by lighter yellow stain and lack pitting. No cases of dental fluorosis were found in the deciduous teeth from Mehrgarh (MR2, n = 38; MR3, n = 82), nor were any cases of skeletal fluorosis (osteosclerosis) found at the site.

Seven of the twenty-five specimens recovered from Early Neolithic levels (MR3) at Mehrgarh exhibited yellow-brown enamel mottling and discrete and confluent enamel pitting. According to Dean's classification of dental fluorosis (Dean 1934), two of these specimens display a mild case of fluorosis, two moderate and three severe; the remaining 18 specimens appear normal (i.e., unaffected). The two specimens from Chalcolithic levels (MR2) display minimal enamel pitting and no yellow-brown stains, but most teeth in the upper and lower dental arcades exhibit opaque, milky-white patches in the enamel.

The differential expression of fluorosis in these two samples is partially explained by the fact that all specimens from MR3 exhibiting dental fluorosis are adults beyond 25 years of age, while the two specimens from MR2 are young adults. With the passage of time these opaque areas could have become stained and assumed an appearance very similar to that noted among MR3 adults.

Dean's community index of dental fluorosis (F_c) for MR3 is 0.88, undoubtedly an underestimation of the true community index (Dean 1942). It is possible that very mild and questionable grades of dental fluorosis may have gone unnoticed in this analysis due to variable lighting conditions and related problems of field analysis.

Water samples taken from the Bolan River, 100 m upstream from the MR3 site, and from an irrigation canal about 250 m North of the present village of Mehrgarh yielded fluoride concentrations of 2.0 mg/l. and 1.9 mg/l., respectively 2. This confirms

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the presence of excess natural fluoride in surface water in this area of the Kacchi plain. In addition, the author observed mottled enamel in the maxillary incisor teeth of children in the modern villages of Mehrgarh and Mithri, approximately 80 km SW of Mehrgarh on the West bank of the Nari River. The prevalence of natural fluoride in the local surface water is attributable to the mineral content of sedimentary rocks to the North and West of the Kacchi plain. Fluorite (CaF₂) mineralization covers an area of 38,000 sq.km near Koh-i-Maran and Kohi-i-Dilband (Ibrahim Shah 1977), while smaller deposits of fluorite are known to exist near Neghrani, Degari and Mach, the latter situated on the bank of the Bolan River (fig. 1).

The severity of expression of dental fluorosis in specific individuals at Mehrgarh is explained by complicating factors in addition to high fluoride content of the drinking water. First, in tropical and arid regions low fluoride levels can cause unacceptable levels of dental fluorosis (moderate, severe) because of the much greater intake of water in dry climates (Galagan & Lamson 1953). The maximum temperature for the months of May, June and July often exceeds 40° C. in Jacobabad, a town about 150 km SSE of Mehrgarh in the Kacchi Plain (Rao 1981). Secondly, the use of naturally fluoritated water in irrigating crops and food processing can significantly elevate the fluoride content of food (Leverett 1982). Third, malnutrition and decreased calcium intake particularly, may contribute to increased utilization of fluorides in amelogenesis and osteogenesis (Nanda at al. 1974; Massler & Schour 1952). The incidence of gross enamel hypoplasia in the MR3 dental sample is high (56%), and though this condition may be caused by incomplete calcium absorption, other causative agents are also known (Pindborg 1970).

A recent and authoritative survey of human paleopathology states, ‘Discolorations of teeth and their pathological implications have received little attention in the literature on paleopathology’ (Ortner & Putschar 1981). Although nine different sources of dental discoloration are enumerated in this volume, paleopathological evidence is cited for only one; betel-nut chewing. The discovery of dental fluorosis at Mehrgarh has important implications for understanding the interaction of biological and cultural aspects of human evolution.
One hypothesis to be tested with the Mehrgarh dental data was the relationship between diet and subsistence on one hand and caries and tooth crown size on the other. As a population becomes sedentary and shifts from hunting and gathering to farming subsistence patterns, one should find an increase in dental caries (Turner 1978, 1979) and decrease in tooth size (Brace 1982; Brace & Mahler 1971). The caries incidence at MR3 (Early Neolithic) is 1.3% (10/755), and was initially attributed to the fact that Early Neolithic diets were high in animal protein and incipient agriculture probably contributed low quantities of carbohydrates to the diet (Lukacs 1983a). It now appears that the high fluoride content of the Mehrgarh teeth is primarily responsible for the low caries incidence.

As dietary shifts to softer foods produced by more sophisticated food preparation techniques occurs, one predicts a decrease in tooth crown size (Brace 1962). However, controlled studies of tooth crown dimensions prior to and following fluoridation of town water supplies have documented a small though significant decrease in tooth crown dimensions (Goose & Roberts 1982; Jenkins 1970; Lovius & Goose 1969).

Given the relationship between increased fluoride intake and significant decreases in crown dimensions, the possibility exists that the total crown area reported below for the MR3 dentition does not represent the full genetic potential for crown size. If the Early Neolithic inhabitants of Mehrgarh had occupied an area with fluoride-free surface water, they may well have exhibited larger dental crown dimensions and crown areas.

High fluoride levels are widespread in surface water throughout Southern Asia and its biological effects widely documented among the living inhabitants of these regions. Paleoanthropologists working in areas where elevated fluoride intake are present today must proceed with caution in directly correlating caries rates and tooth size with strictly cultural/or dietary causal factors. For example, might the low caries rates reported by Pal (1981) for prehistoric Indian skeletal series from the Punjab (Harappan) and peninsular India be directly attributed to excess fluorides known to be present in the surface water in these regions of the sub-continent?
Tooth Size and Technology: A Comparative Assessment of Mehrgarh (MR3) Tooth Crown Dimensions

Crown dimensions of permanent and deciduous teeth of prehistoric and living people of Pakistan are very poorly known. Although dental data have recently been published for several prehistoric Pakistani skeletal series (Harappa: Dutta 1980, 1983; Mehrgarh: Lukacs 1983a; Mohenjo-daro: Sewell & Guha 1931; Timargarha and Sarai Khola: Lukacs 1983d), but some of these sources are incomplete, others inaccurate. Crown dimensions for Harappa are limited to molar teeth, but an analysis of sexual dimorphism in tooth size enhances the value of Dutta's (1980, 1983) research. Dental crown dimensions published by Sewell

![Diagram of tooth dimensions](image)

**INCISOR**

**LOWER MOLAR**

**UPPER MOLAR**

Fig. 6 — Measurement of dental crown diameters.
### Table 1 — Mehrgarh dental sample

<table>
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<th>Cultural Association</th>
<th>Approx. Antiquity</th>
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<td>4000-4000 BC</td>
<td>47 (11)</td>
</tr>
<tr>
<td>MR 2</td>
<td>Chalcolithic</td>
<td>4500-4000 BC</td>
<td>38 (5)</td>
</tr>
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<td>MR 3</td>
<td>Aceramic Neolithic</td>
<td>7000-6000 BC</td>
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<td>MR 3&lt;sup&gt;3&lt;/sup&gt;</td>
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<td>MR 3 (total)</td>
<td>82 (10)</td>
<td>807 (42)</td>
<td>889 (52)</td>
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</table>

Total dental sample: 167 (26) | 998 (57) | 1155 (81)

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2) Number of teeth studied followed by number of individuals in brackets.

3) Based on previous study (Lukacs 1983a).
Table 2 — Mean mesiodistal crown diameters of permanent teeth.

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Table 3 — Mean buccolingual crown diameters of permanent teeth from Neolithic levels at Mehrgarh (MR3), in mm.

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<td>R</td>
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<td></td>
<td>L</td>
<td>19</td>
<td>7.99</td>
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<td>0.639</td>
<td>7.1</td>
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<tr>
<td>Pm4</td>
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<td>20</td>
<td>8.38</td>
<td>0.14</td>
<td>0.602</td>
<td>7.1</td>
<td>9.5</td>
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<tr>
<td></td>
<td>L</td>
<td>19</td>
<td>8.40</td>
<td>0.13</td>
<td>0.573</td>
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<td>9.4</td>
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<td>M1</td>
<td>R</td>
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<td>0.10</td>
<td>0.457</td>
<td>10.3</td>
<td>12.3</td>
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<td>0.548</td>
<td>9.5</td>
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</tr>
<tr>
<td></td>
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<td>0.14</td>
<td>0.585</td>
<td>9.3</td>
<td>11.4</td>
</tr>
</tbody>
</table>
and Guha (1931) include measurements of teeth severely affected by dental attrition, resulting in inaccurate estimates of tooth crown size.

Except for a preliminary report on permanent tooth crown dimensions among Early Neolithic inhabitants of Mehrgarh (Lukacs 1983a), virtually nothing is known regarding variation in this trait for pre-Harappan populations of Pakistan. This section of the paper presents dental crown dimensions and indices of permanent and deciduous teeth from Early Neolithic levels (MR3) at Mehrgarh. These data are then comparatively analysed and interpreted in the context of relevant models of human dental evolution.

Maximum mesiodistal (MD) and buccolingual (BL) diameters of unworn permanent and deciduous teeth were measured (fig. 6) according to the methods described by Moorees (1957) and Wolpoff (1971). Since sex was frequently indeterminate in many adult specimens from Mehrgarh, due to incomplete preservation, measurements for males and females were pooled for statistical analysis.

Mean MD and BL crown diameters of permanent teeth are presented in Tables 2 and 3, respectively. Data for right and left sides of the dental arcade are reported separately though in nearly every instance the mean difference between antimeres is very small and statistically not significant (Table 4). Absolute crown diameters for each tooth were used to calculate three dental indices (fig. 7): CROWN AREA (MD × BL), a measure of the area of the occlusal surface of the crown and often referred to as Robustness Value; CROWN INDEX (MD/BL × 100), a measure of crown shape; and CROWN MODULE (MD + BL) / 2, an indicator of crown perimeter (Wolpoff 1971). Indical values for each specimen were statistically summarized to obtain an overall impression of tooth size and shape for the MR3 skeletal series. Mean values for each index are presented in Table 5.

The most widely used index for comparative evaluation of tooth crown size is the sum of mean crown area values for the left or right side of the dental arcade. This technique yields a

---

3 The paired samples t-test was employed to determine the significance of mean difference in crown diameter between R and L antimeres. This test was not applied to the deciduous dentition because the sample sizes are too small.
Table 4 — Mean difference in dental crown diameters between right and left antimeres of permanent teeth from Early Neolithic levels at Mehrgarh (sexes pooled).

<table>
<thead>
<tr>
<th></th>
<th>Mesiodistal</th>
<th></th>
<th>Buccolingual</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>( \bar{x} ) (R-L)</td>
<td>SE(( \bar{x} ) diff)</td>
<td>n</td>
</tr>
<tr>
<td>Maxilla</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td>(11)</td>
<td>0.018</td>
<td>0.048</td>
<td>(10)</td>
</tr>
<tr>
<td>I2</td>
<td>(8)</td>
<td>-0.063</td>
<td>0.080</td>
<td>(8)</td>
</tr>
<tr>
<td>C</td>
<td>(10)</td>
<td>0.060</td>
<td>0.034</td>
<td>(10)</td>
</tr>
<tr>
<td>P3</td>
<td>(14)</td>
<td>0.014</td>
<td>0.092</td>
<td>(14)</td>
</tr>
<tr>
<td>P4</td>
<td>(14)</td>
<td>0.036</td>
<td>0.063</td>
<td>(16)</td>
</tr>
<tr>
<td>M1</td>
<td>(15)</td>
<td>0.027</td>
<td>0.043</td>
<td>(15)</td>
</tr>
<tr>
<td>M2</td>
<td>(15)</td>
<td>0.067</td>
<td>0.090</td>
<td>(15)</td>
</tr>
<tr>
<td>M3</td>
<td>(6)</td>
<td>0.117</td>
<td>0.154</td>
<td>(5)</td>
</tr>
<tr>
<td>Mandible</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td>(8)</td>
<td>-0.063</td>
<td>0.063</td>
<td>(8)</td>
</tr>
<tr>
<td>I2</td>
<td>(10)</td>
<td>0.010</td>
<td>0.050</td>
<td>(10)</td>
</tr>
<tr>
<td>C</td>
<td>(13)</td>
<td>-0.008</td>
<td>0.063</td>
<td>(13)</td>
</tr>
<tr>
<td>P3</td>
<td>(18)</td>
<td>-0.056</td>
<td>0.047</td>
<td>(18)</td>
</tr>
<tr>
<td>P4</td>
<td>(18)</td>
<td>0.017</td>
<td>0.066</td>
<td>(18)</td>
</tr>
<tr>
<td>M1</td>
<td>(22)</td>
<td>-0.109*</td>
<td>0.050</td>
<td>(22)</td>
</tr>
<tr>
<td>M2</td>
<td>(15)</td>
<td>0.067</td>
<td>0.084</td>
<td>(15)</td>
</tr>
<tr>
<td>M3</td>
<td>(16)</td>
<td>-0.038</td>
<td>0.068</td>
<td>(16)</td>
</tr>
</tbody>
</table>

* P ≤ 0.05

single composite figure Total Crown Area (TCA) that expresses the approximate occlusal surface area of all teeth in the arch. Brace has employed this method of analysis with success in studies of tooth size in fossil man (Brace 1962, 1967, 1979) and in the comparative study of tooth size in living populations and their prehistoric antecedents (Brace 1978, 1980; Brace & Mahler 1971; Brace & Hinton 1981; Brace & Nagai 1982; Brace et al. 1984).

The mean crown area of each permanent tooth is presented in Table 5; these figures were summed to obtain TCA values of 1255.70 mm² (right) and 1259.24 mm² (left). This yields an average TCA of 1257 mm² which is the largest TCA value yet reported for prehistoric or modern populations from Southern Asia (Table 6).
Table 5 — Mean crown indices of permanent teeth from Neolithic levels at Mehrgarh (MR3).

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Side</th>
<th>(n)</th>
<th>MAXILLA</th>
<th></th>
<th></th>
<th>MANDIBLE</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I 1</td>
<td>R</td>
<td>(16)</td>
<td>66.52</td>
<td>7.51</td>
<td>120.02</td>
<td>4.39</td>
<td>8.18</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>(13)</td>
<td>64.57</td>
<td>7.46</td>
<td>119.92</td>
<td>4.86</td>
<td>8.06</td>
<td>0.47</td>
</tr>
<tr>
<td>I 2</td>
<td>R</td>
<td>(1)</td>
<td>46.73</td>
<td>4.04</td>
<td>109.86</td>
<td>8.25</td>
<td>6.84</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>(13)</td>
<td>48.24</td>
<td>3.50</td>
<td>105.10</td>
<td>7.05</td>
<td>6.95</td>
<td>0.25</td>
</tr>
<tr>
<td>C</td>
<td>R</td>
<td>(14)</td>
<td>66.23</td>
<td>6.10</td>
<td>92.86</td>
<td>5.43</td>
<td>8.14</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>(18)</td>
<td>64.66</td>
<td>5.69</td>
<td>92.28</td>
<td>4.68</td>
<td>8.03</td>
<td>0.36</td>
</tr>
<tr>
<td>Pm 3</td>
<td>R</td>
<td>(19)</td>
<td>67.69</td>
<td>5.81</td>
<td>74.18</td>
<td>4.36</td>
<td>8.32</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>(18)</td>
<td>67.03</td>
<td>7.12</td>
<td>72.96</td>
<td>3.86</td>
<td>8.28</td>
<td>0.44</td>
</tr>
<tr>
<td>Pm 4</td>
<td>R</td>
<td>(18)</td>
<td>67.26</td>
<td>5.89</td>
<td>72.94</td>
<td>4.18</td>
<td>8.30</td>
<td>0.37</td>
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<tr>
<td></td>
<td>L</td>
<td>(16)</td>
<td>66.19</td>
<td>7.25</td>
<td>72.56</td>
<td>3.38</td>
<td>8.23</td>
<td>0.45</td>
</tr>
<tr>
<td>M 1</td>
<td>R</td>
<td>(19)</td>
<td>126.69</td>
<td>11.18</td>
<td>90.83</td>
<td>3.61</td>
<td>11.26</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>(20)</td>
<td>126.20</td>
<td>10.32</td>
<td>90.79</td>
<td>3.61</td>
<td>11.24</td>
<td>0.46</td>
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<tr>
<td>M 2</td>
<td>R</td>
<td>(19)</td>
<td>116.69</td>
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<td>85.25</td>
<td>4.57</td>
<td>10.83</td>
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<tr>
<td></td>
<td>L</td>
<td>(16)</td>
<td>117.67</td>
<td>9.67</td>
<td>85.54</td>
<td>3.47</td>
<td>10.87</td>
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<tr>
<td>M 3</td>
<td>R</td>
<td>(9)</td>
<td>99.12</td>
<td>11.37</td>
<td>80.72</td>
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<td>10.00</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>(12)</td>
<td>102.40</td>
<td>17.98</td>
<td>82.61</td>
<td>4.81</td>
<td>10.13</td>
<td>0.89</td>
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</table>
CROWN AREA = MD x BL measures occlusal surface area
CROWN INDEX = \( \frac{MD}{BL} \times 100 \) measures crown shape
CROWN MODULE = \( \frac{MD + BL}{2} \) measures crown perimeter

128.1 mm² CROWN AREA 96.82 mm²
116.19 CROWN INDEX 109.57
11.35 mm² CROWN MODULE 9.85 mm

Fig. 7 — Dental crown indices.

Though the number of South Asian skeletal series for which TCA figures are presently available is small, several valuable insights can be gained from the data in Table 6: 1) Mehrgarh is closest in tooth size to the skeletal sample from Abou Ghosh, an Early Neolithic sample from Southwest Asia, 2) Iron Age (Mahurjhar) and Late Chalcolithic (Inamgaon) skeletal series from Central and West India, respectively, exhibit TCAs that are 3% smaller than the figure reported for Mehrgarh, and 3) Iron Age Pakistani skeletal series from Timargarha and Sarai Khola exhibit TCAs that are smaller by 7% and 12% respectively, than the Mehrgarh value.

Brace and Nagai (1982; 403) postulate that differences in TCA ‘in the neighborhood of 50 mm² are probably significant, and differences of 100 mm² almost certainly express meaningful biological differences between the groups being compared’. In this context the 84 mm² difference in TCA between Timargarha and Mehrgarh (MR3) is probably significant and the 150 mm² difference in TCA between Sarai Khola and Mehrgarh (MR3) is certainly indicative of adaptive biological differences.

Tooth size differences for the Pakistani skeletal samples are graphically portrayed in figure 8 for the maxillary dentition and
Fig. 8 — Tooth size differences in the Pakistani skeletal samples: maxillary dentition.
Fig. 9. — Tooth size differences in the Pakistani skeletal samples: mandibular dentition.
**Table 6** — Tooth size of prehistoric South Asians as expressed by Total Crown Area (TCA) and Molar Crown Area (MCA).

<table>
<thead>
<tr>
<th>Site</th>
<th>Cultural Association</th>
<th>TCA (mm²)</th>
<th>MCA (mm²)</th>
</tr>
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<td>Early Neolithic</td>
<td>1257</td>
<td>706</td>
</tr>
<tr>
<td>Abou Gosh¹</td>
<td>Early Neolithic</td>
<td>1240</td>
<td>685</td>
</tr>
<tr>
<td>Mahurjhari²</td>
<td>Iron Age</td>
<td>1220</td>
<td>677</td>
</tr>
<tr>
<td>Inamgaon³</td>
<td>Late Chalcolithic</td>
<td>1218</td>
<td>671</td>
</tr>
<tr>
<td>Bellan Bandi Palassa⁴</td>
<td>Mesolithic</td>
<td>1210</td>
<td>713</td>
</tr>
<tr>
<td>Timargarha⁵</td>
<td>Iron Age</td>
<td>1173</td>
<td>642</td>
</tr>
<tr>
<td>Sarai Khola⁵</td>
<td>Iron Age</td>
<td>1107</td>
<td>613</td>
</tr>
<tr>
<td>Harappa⁶</td>
<td>Bronze Age⁷</td>
<td>--</td>
<td>606</td>
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</table>


Figure 9 for the mandibular dentition. The large size of the MR3 dental sample justifies use of the descriptive term *megadont* ⁴.

The pattern of variation in tooth crown size for these prehistoric South Asians fits well with the idea of hominid dental reduction resulting from the natural selective effects of changes in diet, subsistence and technology. Skeletal series that are most complex technologically and may be chronologically late have the smallest TCAs reported in Table 6. Small TCA is also associated with subsistence patterns that are predominantly agricultural and in which hunting and collecting activities are negligible. Largest TCAs are associated with Early Neolithic skeletal series that exhibit subsistence patterns of incipient agriculturalism, but which lack metal tools and pottery. The absence of metal tools

⁴ *Megadont* is used in the general sense of large-toothed, not in the strict sense of values for Flower’s Dental Index greater than 44.0.
and pottery places limitations on the modes of food preparation and storage available to the population. This results in a relatively coarser less well prepared diet than in technologically more developed cultures (Brace & Mahler 1971). This cultural variability places different levels of stress on the masticatory apparatus and results in the pattern of tooth size variation depicted in Table 6 and figures 8 and 9. The fact that hunting and gathering comprise a greater portion of subsistence activities in incipient agricultural societies and that hunter-gatherer diets are more difficult to masticate, results in an additional selection pressure for large tooth size in the Early Neolithic samples.

Skeletal remains from Mahurjhari (800 BC) and Inamgaon (700-1600 BC) yield tooth size figures only slightly smaller than the Mehrgarh (MR3) figure, though these sites are associated with iron and copper implements, respectively, and are much later chronologically (Lukacs 1985b). Nevertheless, their large TCAs remain consistent with the natural selective theory of dental reduction outlined above because: 1) both these cultures, though chronologically late, are early farming communities for the regions in which they occur, 2) both cultures engaged in hunting and gathering to an appreciable degree to supplement their agriculture base, and 3) most of the metal implements recovered from these sites are decorative or ornamental, not utilitarian. The initial predictions of Brace and Montagu (1977: 422-24, fig. 188) that tooth size should increase as one proceeds from the Indo-Gangetic plains southward through the Indian peninsula is supported by these data. The inhabitants of Mahurjhari and Inamgaon have not enjoyed the benefits of agricultural subsistence for as long as the occupants of Harappa, Timargarha and Sarai Khola, sites located in the Indus Valley region.

The deciduous dental sample from Early Neolithic levels at Mehrgarh is small but yields valuable base-line data for the comparative study of deciduous dental crown dimensions in South Asia. The deciduous dental remains were measured and statistically analysed in the same manner as the permanent teeth.

Mean MD and BL crown diameters of deciduous teeth are presented in Table 7 together with relevant statistical data. Disparity in crown diameter between right and left antimeres is greater in the deciduous dental sample primarily because sample size for each measurement is much smaller than in the perma-
### Table 7 — Mean crown diameters of deciduous teeth from Early Neolithic levels at Mehrgarh (MR3), in mm.

<table>
<thead>
<tr>
<th></th>
<th>Mesiodistal Diameter</th>
<th></th>
<th>Buccolingual Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n)</td>
<td>X</td>
<td>SE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maxilla</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>di 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>(3)</td>
<td>7.03</td>
<td>0.32</td>
</tr>
<tr>
<td>L</td>
<td>(4)</td>
<td>7.15</td>
<td>0.23</td>
</tr>
<tr>
<td>di 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>(3)</td>
<td>5.70</td>
<td>0.10</td>
</tr>
<tr>
<td>L</td>
<td>(3)</td>
<td>5.80</td>
<td>0.20</td>
</tr>
<tr>
<td>dc</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>(4)</td>
<td>7.58</td>
<td>0.16</td>
</tr>
<tr>
<td>L</td>
<td>(4)</td>
<td>7.63</td>
<td>0.34</td>
</tr>
<tr>
<td>dm 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>(3)</td>
<td>7.20</td>
<td>0.17</td>
</tr>
<tr>
<td>L</td>
<td>(3)</td>
<td>7.70</td>
<td>0.38</td>
</tr>
<tr>
<td>dm 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>(5)</td>
<td>9.24</td>
<td>0.26</td>
</tr>
<tr>
<td>L</td>
<td>(5)</td>
<td>9.10</td>
<td>0.27</td>
</tr>
<tr>
<td><strong>Mandible</strong></td>
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<tr>
<td>di 1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>R</td>
<td>(2)</td>
<td>4.68</td>
<td>0.17</td>
</tr>
<tr>
<td>L</td>
<td>(2)</td>
<td>4.85</td>
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<td>R</td>
<td>(5)</td>
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</tr>
<tr>
<td>L</td>
<td>(3)</td>
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<td>0.13</td>
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<tr>
<td>dm 1</td>
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<td></td>
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<td></td>
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<td>R</td>
<td>(4)</td>
<td>10.60</td>
<td>0.04</td>
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<td>L</td>
<td>(3)</td>
<td>10.13</td>
<td>0.29</td>
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Table 8 — Mean crown indices for deciduous teeth from Early Neolithic levels at Mehrgarh (MR3).

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Area</th>
<th>Crown Index</th>
<th>Crown Module</th>
</tr>
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<tr>
<td></td>
<td></td>
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<td>(n)</td>
<td>X</td>
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<tr>
<td></td>
<td>Side</td>
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<td>di 1</td>
<td>R (3)</td>
<td>38.68</td>
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<td>R (3)</td>
<td>30.78</td>
<td>1.10</td>
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<td>L (3)</td>
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<td>dc</td>
<td>R (4)</td>
<td>49.09</td>
<td>3.30</td>
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<td>L (4)</td>
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<td>8.19</td>
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<td>dm 1</td>
<td>R (3)</td>
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<td>7.08</td>
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<td>L (3)</td>
<td>70.16</td>
<td>0.83</td>
</tr>
<tr>
<td>dm 2</td>
<td>R (5)</td>
<td>94.44</td>
<td>6.73</td>
</tr>
<tr>
<td></td>
<td>L (5)</td>
<td>93.33</td>
<td>9.39</td>
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Mandible

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Crown Area</th>
<th>Crown Index</th>
<th>Crown Module</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Mean</td>
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<tr>
<td></td>
<td></td>
<td>(n)</td>
<td>X</td>
</tr>
<tr>
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<td>2.77</td>
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<td></td>
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<td>R (3)</td>
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<td>4.21</td>
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<td>L (4)</td>
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<td>5.06</td>
</tr>
<tr>
<td>dm 2</td>
<td>R (4)</td>
<td>99.65</td>
<td>3.71</td>
</tr>
<tr>
<td></td>
<td>L (3)</td>
<td>94.31</td>
<td>7.57</td>
</tr>
</tbody>
</table>

A distinct dental sample. Crown indices for the MR3 deciduous teeth are presented in Table 8, and the CROWN AREA figures for MR3 are compared with data for other prehistoric and living South Asian samples in Table 9 (modified from Lukacs et al. 1983b). The total Crown Area figures for Mehrgarh (MR3; 521 mm²) are consistently greater than figures reported for prehistoric samples from Inamgaon (498 mm²) and Timargarha (474 mm²). The MR3 deciduous teeth are also larger by 8.6% than the deciduous teeth of a living sample of Gujarati Hindus. The Inamgaon deciduous TCA is only 4.4% smaller than the Mehrgarh sample, a finding that parallels the pattern of reduction found in the permanent teeth and is probably due to the same processes of natural
selection. Total crown area for the Timargarha deciduous dental sample is 9.0% smaller than the Mehrgarh sample and also coincides with the pattern of dental size differences in the permanent teeth. Unfortunately no appreciable deciduous dental sample was recovered for the Sarai Khola site. These tooth size differences are graphically presented in figure 10.

![Bar chart](image)

**Fig. 10** — Total crown area of deciduous teeth of prehistoric and living South Asians (sexes pooled, in mm²).

Larsen (1983) recently reported evidence of deciduous tooth size reduction accompanying the subsistence change from hunting and gathering to agriculture among prehistoric inhabitants of the Southeast coast of North America. In Larsen’s sample the percentage reduction in crown area for maxillary and mandibular dc, dm 1 and dm 2 ranges from 1.5% to 6.8%, and averages 4.28%. One tooth (maxillary dc) however, showed a 6.5% larger crown area in the agricultural sample.
<table>
<thead>
<tr>
<th></th>
<th>Prehistoric Samples</th>
<th>Timargarha</th>
<th>Living Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mehrgarh</td>
<td>Inamgaon</td>
<td>Gujarati Hindus</td>
</tr>
<tr>
<td></td>
<td><strong>x</strong> (n) SD</td>
<td><strong>x</strong> (n) SD</td>
<td><strong>x</strong> (n) SD</td>
</tr>
<tr>
<td>Maxilla</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i1</td>
<td>39.50 (4) 2.51</td>
<td>36.13 (19) 3.89</td>
<td>34.21 (4) 3.39</td>
</tr>
<tr>
<td>i2</td>
<td>29.46 (3) 3.65</td>
<td>27.99 (20) 3.64</td>
<td>26.45 (6) 3.66</td>
</tr>
<tr>
<td>c</td>
<td>49.07 (4) 8.19</td>
<td>40.26 (27) 5.45</td>
<td>40.06 (9) 5.37</td>
</tr>
<tr>
<td>m1</td>
<td>70.16 (3) 7.83</td>
<td>67.68 (32) 5.89</td>
<td>68.95 (8) 7.41</td>
</tr>
<tr>
<td>m2</td>
<td>93.33 (5) 9.39</td>
<td>95.13 (32) 11.00</td>
<td>87.86 (8) 5.74</td>
</tr>
<tr>
<td>Maxillary crown area</td>
<td>281.52</td>
<td>267.19 [5.09%]</td>
<td>257.53 [8.52%]</td>
</tr>
<tr>
<td>Mandible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i1</td>
<td>20.85 (2) 0.38</td>
<td>17.74 (20) 1.90</td>
<td>14.88 (4) 2.67</td>
</tr>
<tr>
<td>i2</td>
<td>23.44 (2) 0.58</td>
<td>21.81 (22) 2.62</td>
<td>20.61 (6) 3.20</td>
</tr>
<tr>
<td>c</td>
<td>36.39 (3) 2.95</td>
<td>31.62 (22) 3.83</td>
<td>32.51 (9) 3.62</td>
</tr>
<tr>
<td>m1</td>
<td>64.22 (4) 5.06</td>
<td>62.21 (36) 6.37</td>
<td>58.10 (13) 5.95</td>
</tr>
<tr>
<td>m2</td>
<td>94.31 (3) 7.57</td>
<td>97.34 (36) 10.16</td>
<td>90.44 (13) 7.36</td>
</tr>
<tr>
<td>Mandibular crown area</td>
<td>239.21</td>
<td>230.72 [3.55%]</td>
<td>216.54 [9.48%]</td>
</tr>
<tr>
<td>Total Crown Area</td>
<td>520.73</td>
<td>497.91 [4.83%]</td>
<td>474.07 [8.96%]</td>
</tr>
</tbody>
</table>
The Mehrgarh deciduous teeth exhibit crown areas that are consistently greater, by 1.7% to 18.4%, than the Timargarha crown areas. When the Timargarha and Mehrgarh samples are compared the average amount of crown size reduction for maxillary and mandibular dc, dm 1 and dm 2 is 8.38%; twice the average decrease reported by Larsen (1983). Explanations for the greater crown size differences in the South Asian comparison include a greater temporal and cultural hiatus separating the Timargarha and Mehrgarh samples. Though the number of specimens is small, the deciduous dental sample from Neolithic levels at Mehrgarh (MR3) can be characterized as megadont, caries-free and lacking evidence of fluorosis and gross enamel hypoplasia.

Conclusions

The dental data presented here for Neolithic inhabitants of Mehrgarh permit new and valuable insights into the biological adaptations and evolution of prehistoric South Asians.

In particular this research has documented:

1) dental fluorosis in permanent teeth of skeletal remains from MR2 and MR3 in association with a low prevalence of dental caries,

2) high frequencies of gross enamel hypoplasia and calculus formation in the MR3 permanent teeth,

3) the largest Tooth Crown Areas yet reported for permanent and deciduous dental samples (MR3) from prehistoric contexts in South Asia, justifying use of the term megadont, and

4) a healthy deciduous dental sample (MR3) that is caries-free, lacks evidence of fluorosis and gross enamel hypoplasia.

Further studies on dental samples from chalcolithic levels at Mehrgarh and other prehistoric sites in Pakistan and southern Asia will enable us to better interpret the results reported here for early Neolithic Mehrgarh.
ACKNOWLEDGMENTS

I am indebted to Jean-François Jarrige for the invitation to study the valuable human skeletal remains from Mehrgarh and to the Department of Archaeology, Government of Pakistan for its continued cooperation in my paleoanthropological research.

This research was funded by a grant from the National Geographic Society (Washington D.C.) and an award from the Fulbright Kommission (Bonn, West Germany).

It was through occasional and lively discussions with Sardar Ghaus Bakhah Raisani, landlord of Mehrgarh, I learned of the presence of fluorides in the local ground water.

SUMMARY

Pathological lesions and crown dimensions of human dental remains from early Neolithic levels at Mehrgarh (MR3) are described and interpreted from an anthropological perspective. The discovery of dental fluorosis in the Mehrgarh skeletal series is of major significance since this condition has never been reported in the paleopathology literature. The incidence of dental caries is correspondingly low (1.3%), but the incidence of specimens exhibiting gross enamel hypoplasia (56.8%) and dental calculus (48.7%) is high. The infrequent occurrence of individuals with ante-mortem tooth loss is low (1.3%) because of the low caries rate and the young age structure of the skeletal sample.

In tooth crown size the Mehrgarh dentition is megadont, despite the fact that fluorides contribute to significant reductions in tooth crown dimensions. The Total Crown Area of the Mehrgarh permanent teeth is 1257 mm², and of the deciduous teeth 521 mm². These are the largest TCAs yet reported for prehistoric South Asians and indicate that the ceramic Neolithic occupants of Mehrgarh consumed a coarse diet that selected for large dental structures. Morphological variants of the tooth crown are presently under analysis for the Mehrgarh skeletal series and promise to yield valuable information regarding their genetic relationships with other Asian populations.

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KAREN HØJGAARD

SEM (Scanning Electron Microscopic) Examination of Teeth from the Third Millennium BC Excavated in Wadi Jizzi and Hafit

In the paper I read two years ago at the meeting held in Cambridge I tried to introduce you to the use of dental anthropology in connection with the Arabian Gulf (Højgaard 1980a; 1980b; 1981; 1982; 1983; 1984).

I mentioned the lack of information about ancient teeth from both sides of the Gulf, but in the meantime progress has taken place, so that comparative statistical studies will soon be possible (Lukacs 1977; 1978; 1981; 1983a; 1983b; Basu & Pal 1980).

Two years ago I also mentioned the difference between the teeth from two nearby places in Oman: Wadi Jizzi/Suq and Hafit, excavated by Karen Frifelt, Moesgård (Frifelt 1975a; 1975b; 1976; 1979). There is only a distance of about 30 km between these two places.

The teeth from Wadi Jizzi are from grave 1134, an Umm an-Nar type grave, dated mid-3rd millennium BC.

The teeth from Hafit are from graves 1303A to 1317D, dated first half of the 3rd millennium BC till well beyond the middle of the millennium. Despite the small, fractured and disintegrated material from both places it was subjectively obvious that the two tribes had been differently nourished.

The Wadi Jizzi people had no caries but small fractures along the border of the masticating surfaces; the same pattern as seen in the Umm an-Narians whose diet mostly consisted of fish, dugongs, green turtles and antelopes, while the Hafit people inside the country showed many carious lesions and no small fractures. Three individuals represented by twelve reasonably unbroken teeth had ten cases of incipient caries and one case of more progressive caries. The same pattern as the Bahrainis (at
the Dilmun time Bahrain was famous for its fine sweet dates), a
dental status characteristic for sedentary people engaged in agri-
culture and animal husbandry.

Consequently, I suggested that the Hafit people must have
lived in an oasis, if we judge from their teeth. However, with
such small sample sizes in bad condition, I was looking for more
proof. Eventually, I came across a method which might answer
further questions concerning different diets and thus different
ways of life.

Microwear of the enamel could be the way, so scanning
electron microscopic (SEM) examinations of some molars from
both places were performed.

It is a rather new procedure but already many admirable
experiments have been performed (Covert & Kay 1981; Dahlberg
1962; Monar 1972; Peters 1982; Shkurkin et al. 1975; Teaford &
Walker 1982; Walker 1976; 1978; 1981) trying to throw light on
the pattern of striations caused by different diets.

P.O. Pedersen (Pedersen & Scott 1951) was also one of the
first to take replicas (impressions) of the tooth surfaces so that
no harm was done to the teeth. If you use the teeth directly in
the microscope chamber you have to coat them with gold.
Furthermore, replicas have the advantage that you can send
them wherever you want for investigation leaving the teeth in the
museum showcase or on the shelves in the anthropological lab-
oration.

In one of these studies, F.E. Grine (Grine 1981) from South
Africa, has examined trophic differences between gracile and
robust australopithecines. I mention his work for two reasons —
it is a good one about hominids, I think, and contains an im-
mense reference list, 505 numbers.

Also K. Gordon's study of microwear on chimpanzee molars
(Gordon 1982) is very informative and instructive.

In these studies it is, however, chiefly the occlusal or masti-
cating surface which has been investigated. This is very difficult
to do on ancient teeth as this surface is worn down at an early
age. Many other considerations such as jaw movements and the
manner of chewing, shearing, crush-grinding and puncture-
crushing may play a role here.

I therefore chose to look at the facial surfaces instead (fig.
1). The lingual surfaces were excluded due to disturbances
caused by the tongue.
Fig. 1 — SEM (scanning electron microscopy) of the facial surface of tooth (left second lower molar) from Hafit 3rd millennium BC, showing the microwear. (× 200) (Mean length of the striae: 0.21 mm).

When you are chewing the food ball always slides over the facial surfaces of the teeth scratching them. In the microscope you can examine the whole area and take your micrographs at a right angle in places not spoiled for instance by bruxchit (calcite) or post mortem damage.

The part of the surfaces investigated has been the one third situated nearest to the occlusal surface still avoiding parts worn by the antagonist.

P.-F. Puech (Puech 1977a; 1977b; 1980; Puech et al. 1980) has studied the facial surfaces for several years. He has made some baselines worked out on the facial surfaces of ancient teeth from Musée de l’Homme in Paris; teeth from individuals whose diet was known with certainty. He has plotted the striae in a star diagram. This is an instructive and easy method, I think.

You do this by help of tracing paper, a protractor and an electronic calculator.
It shows that carnivores have many vertical striae, a long diagram, while herbivores mostly have horizontal striation, a broad short diagram.

According to this the Wadi Jizzi people should have a long diagram and the Hafit people a broad short one if my opinion was correct.

For the examined molars, equally worn down and therefore presumably from individuals of the same age, the diagrams turned out as expected (fig. 2).

![Diagram of Wadi Jizzi and Hafit](image)

**WADI JIZZI**

**HAFIT**

Fig. 2 — Star diagrams showing the calculated difference between the striations of the facial surfaces of molars from Wadi Jizzi and Hafit 3rd millennium BC. The figure for Wadi Jizzi corresponds to carnivorous people while the figure for Hafit corresponds to herbivorous people according to P.-F. Puech.

This, I think, together with the macroscopic dental status confirms the theory concerning agriculture or horticulture in Hafit in the 3rd millennium BC.
ACKNOWLEDGMENTS

I am indebted to Karen Frifelt, M.A., Moesgård, for invaluable help and permission to study the skeletal remains from Oman and to the Carlsberg Foundation for its generous grant to meet the expenses involved in attending the conference.

In addition, I want to express my gratitude to the photographers Ulla Schiøtz and Karen Severin for their skillful help.

REFERENCES


MICHAEL JANSEN

Mohenjo-daro HR-A, House I, a Temple?
•Analysis of an Architectural Structure

Foreword

Since I presented my report to the Conference on South Asian Archaeology in Brussels, further articles on the redocumentation of Mohenjo-daro by the Aachen University Research Project (ARP) have been published in which we outlined our recently developed approach to the analysis of the architectural structures there (Jansen 1984 a-c).

In these articles I also dealt in extenso with the history of the excavations according to information collected from the field-books in Mohenjo-daro and which might add some new data to recent attempts (e.g. Possehl 1982: 405-16).

All these data need not be repeated here though they are the basis for our present and future analyses of architecture one of which we present in this contribution.

But a few remarks regarding the concept in general may be added. It was the first time in the history of archaeology that an already excavated site (Mohenjo-daro was excavated 60 years ago) was studied again in great detail. This project, financed by the Deutsche Forschungsgemeinschaft, Bonn, was planned as an architectural redocumentation of all structures excavated in Mohenjo-daro, a site which is not only still the most prominent representative of the Harappan Civilization but also the most endangered by natural and human destruction.

Besides the practical aspect of obtaining proper plans and elevations of the remains, the ARP was basically interested in the question how far architectural remains can serve as an independent source of information on habitation and cultural behaviour.
Apart from very general and speculative approaches in the field of protohistoric South Asian Archaeology, no real architectural analysis and interpretation had been carried out to date due to the fact that the most basic data required for an interpretation were non-existent and that no adequate analytical method had been developed. Recent attempts (Fentress 1976; Sarcina 1979) clearly showed the difficulty of developing such methods solely on the basis of published plans, descriptions and photos. Attempts for the Late Early Dynastic Period of the Diyala Region (Henrickson 1981) seem to be more successful but also partly lack the direct architectural rechecking (Jansen 1984c: 41).

As far as Mohenjo-daro is concerned, the necessary data — most of them unpublished — were still available and waiting to be collected. In the course of the 60-year interval between excavation and redocumentation many of the former primary sources — the structures themselves — had been altered so considerably that the secondary sources compiled by the excavators, such as plans, photographs, etc. are often our sole primary sources today. These sources only create one problem: the amount of different data is so enormous that their interpretation on a quantitative-qualitative level is only possible with most rationalized methods like computerization.

Today the computerization of most of the data is complete, the first Print from HR area will be published within 1985, an exchange of software for those interested is planned. With this programme can not only any object be studied in relation to its find location but also the full assemblage per registered unit. The fieldbook number also enables us to trace most of the objects on one of the several hundred original photographs of the Sind Volumes. Important questions regarding e.g. the artifactual context of seals or figurines for their better understanding or their architectural locations may be answered soon.

For the architectural analysis and interpretation new tools had to be developed to allow comparative studies. As the Mohenjo-daro architecture does not reveal much decorative variety, stylistic-ornamental or even structural-technological approaches could not be applied. Therefore the structures themselves, their size, access systems, size and proportion of rooms, position of rooms, axial orientation etc. had to serve for an analytical approach.
The final aim is to use these 'tools' for a cultural interpretation based on available archaeological evidence.

It soon becomes clear that it is not possible to arrive at a cultural understanding of such a complex entity either by interpreting the relevance of single objects or of single structures. An analysis of any single unit must remain descriptive as long as additional information from independent sources is not available. Therefore the analysis of House I, HR-A presented here has also to remain descriptive for the time being; likewise my analysis of House VIII, HR-A (Jansen 1984c: 45). The final analysis will be based on a comparative study of all sources available and their socio-cultural interpretation.

Recent Development of Research at Mohenjo-daro

When we started the architectural documentation in 1979 nobody could foresee the enormous scientific potential awaiting us. Beyond the predictable output of the documentation like ground plans, elevations, prospections and their structural analyses, the unexpected rediscovery of the fieldbooks already mentioned, photographs, and of one large and several smaller unpublished excavated sites as well as the realization that the entire archaeological surface represents a huge potential information system soon brought us to the limits of our working capacity. For five years we concentrated almost exclusively on the documentation and methods of recording it.

By spring 1984 the architectural documentation in Mohenjo-daro was complete, copies had been made of all the photographs published in the Sind Volumes, and almost all the fieldbook entries are now stored in the computer.

This analysis of the archaeological surface has become a separate research programme in cooperation with our Italian colleagues under the directorship of M. Tosi, IsMEO, Rome.

First results of this programme, which has also turned out to be extremely fruitful, were published in a joint publication, the Interim Reports I, Aachen 1984; further results appear in this volume. One highlight of this joint research venture was the use of low altitude photogrammetry from a hot-air balloon in winter

With our redocumentation of the excavated remains and the survey of the archaeological surface, two major methodological steps towards a non-destructive research approach to Mohenjodaro have been taken. While the development of these research methods has to be seen against the particular background of the present ban on excavations on the site, it is also more generally applicable to other sites with similar archaeological conditions (Tosi et al. 1984).

With the 1984 field season the results of our two parallel projects, the redocumentation of excavated remains and the surface survey of non-excavated areas, could be correlated and led us to realize that in ‘archaeological pockets’ (undisturbed parts within the excavated areas such as drains, old trenches, lower parts of houses etc.) precious primary source material like charcoal, botanic-zoological remains etc. is still in situ. Here the drains are of particular interest as not only do they connect contemporary house units, but the composition of the sediment preserved in them offers valuable information on their function, and of course also on the nutrition quality and general diet of the inhabitants. An analysis of organic sediment material will, we hope, furnish proper dating data for whole quarters connected to the drain system.

Finally the sedimentologist may even be able to throw light on the final silting up — the death of the town. Only a few additional data are needed to enable us to incorporate the excavators’ enormous data collection of 38,000 registrations into our modern technological concepts.

In a recent publication (Jansen 1984c), the author described the new concept of a qualitative-quantitative analysis of house-forms with the example of House VIII in the northern part of HR-A area. Similar analyses are currently under print in Pakistan (First International Conference on Pakistan Archaeology, ed. F. Durrani) and in the Netherlands (Felicitration volume B. de Cardi, ed. E. During-Caspers); therefore the full concept of this analysis will not be repeated here. The summarized concept may be shown in the following abbreviated form:
formal analysis

- horizontal-vertical chronological analysis
- analysis of access system (formal)
- evaluation of rooms according to degree of accessibility differentiated in:
  - rooms connected to the public
  - transit rooms (more than one entrance)
  - terminal rooms
  - size-proportion diagram

functional analysis

- analysis of access system (functional)
- replacement of artifacts into the architectural context
- correlation of room types with artefact distribution patterns.

Based on the findings of these analyses a house typology and 'residential behaviour' may be interpreted showing which houses served which purposes and differentiating functional spaces within the house units.

Analysis of House I, HR-A

The southern part of HR-A (fig. 1) belongs to the earliest excavated parts of this area which was cleared in 1925-26 by H. Hargreaves whose initials (HR) gave the site its name (Jansen 1984c).

On 17.10.1925 a 10 feet wide trial trench was sunk from a north-southern depression (later First Street) to the East, touching the later House I right in the middle. This trench was labelled in west-eastern direction with letters A to K in 20 feet units. The squares I, J of this trench and the squares 38W 17-20, 22-25 and 38X 2-5 and 7-10 cover this very large building.

H. Hargreaves wrote about House I:

The southern block consists of House I, a group of buildings mostly of the Intermediate Period, but partly reconstructed at a later date, which is bounded on the north by South Lane, on the west by Deadman Lane, and on the east by
Fig. 1 — Plan of HR Area.
only partially excavated structures while its southern limits are yet undetermined. The most striking feature of this complex of structures is the great difference of level between the northern and southern portions [footnote: The level of the northern court was raised by filling in the interior with sundried brick and mud. Simultaneously the two flights of steps from the lower court appear to have been constructed and also Chambers 23, 24 and 25, the exterior walls of which on the court side were evidently intended to be concealed beneath the crude brick filling. The interior floor of these chambers was several feet lower than the court level.][Marshall 1931: 176].

Wheeler also gave a valuable comment on House I:

Amongst other buildings attention may be drawn again to the HR area, and more especially to the so called House A 1, [...] The significance of the plan is not
brought out by the published record, which amalgamates walls of very different periods and is in several respects incomplete. The numerous additions apart, the nucleus of the plan is a high, oblong structure 52×40 feet with walls over 4 feet thick and a partial filling of mud brick. It was approached from the south by two symmetrically disposed stairs parallel with the frontage, access to which was provided in turn by a monumental double gateway between two irregular blocks of buildings. In the minor sector or court of this gateway is a ring of brickwork, 4 feet in internal diameter of a kind which has been conjectured to represent enclosures round (sacred?) trees (Wheeler 1968: 52).

House I is indeed an extraordinary structure within its architectural context, covering as it does a total of 675 sqm. While 36% of this area is covered by walls, 436 sqm remain for the actual use of the building which is constructed on two levels, the southern one at 52 m a.m.s.l. and the northern one at 54 m a.m.s.l., joined by the double staircase described above.

*Horizontal-Vertical Chronological Analysis*

What is called ‘House I’ is actually a cluster of different structures which at first glance seem quite confusing. Marshall himself distinguishes at least three major structural phases, namely Early Period I (*ibid.*: 177, footnote), represented in room 14 by a wall at a depth of 22 feet below surface (c. 46 m a.m.s.l.) (figs. 3-4), Intermediate and Late.

The photo of room 14 shows not only this wall at a considerable depth but also the other enclosing walls of the room going down as far as this level and perhaps even lower. About 1.8 m higher up (c. 47.80 m) there is a clear horizontal break indicating a new habitation level, which for the first time shows the triple entrance from the South marked by two strong piers c. 1.00 m wide. The original floor level indicated by the thresholds and the horizontal recesses in the walls must have been raised at least 88 cm (48.68 m) judging by the partly blocked up entrances. No traces can be seen in the eastern wall either of new paving or of ceiling beams. The walls standing today — as can be seen by comparing the two photos — are recent restorations and of no use for further studies. A fourth phase may be indicated by the entrance height of rooms 15, 16 at 52.00 m which corresponds to our figures for the habitation level of the southern part of House I.
Figs. 3-4 — Comparative photos of room HR-A, I from West. Original 1925 (fig. 3); the same, 1982 (fig. 4).
Otherwise little is reported about the internal chronology. There are only the following entries recorded:

Rooms 8 and 9 were originally one chamber, the cross walls belonging to a subsequent reconstruction, and Rooms 1 and 2 were similarly originally connected[...]. Ascending the flights of steps from courtyard 10, another large courtyard, no. 18 is reached, the centre of which had a filling of sun dried bricks.¹

The existing masonry remains inside this court are principally later additions but the chambers 23-26² are original structures of the Intermediate Period. A drain on the south of this courtyard runs southward, then eastward under the western flight of steps, and by the north wall of courtyard 10, and south again at the base of the eastern steps (ibid.: 171).

What seems to be obvious is that by incorporating older walls (at least in the southern part) a large new building was constructed consisting of three major blocks (figs. 5-6) built independently without any direct structural connection.

The triangular arrangement of these blocks is so far unique within the architectural context of Mohenjo-daro. The space between these blocks functions as a T-shaped traffic route. While the 'monumental double gateway' leads from the South between blocks A and B into courtyard 10, the double staircase leads at right angles up to courtyard 18 (fig. 7).

None of the three blocks has direct access to another. Courtyard 10 with the ring structure lies at the very centre of the complex enclosed by a part of the outer wall of each block. These three blocks form the structural skeleton of House I.

Originally, the basic layout of each block was different but, as Marshall noted, this concept was altered in later times when most probably the original function was abandoned.

Block A measuring 13 m East-West and 12 m North-South (156 sqm) had originally another two-room structure (rooms 4, 5) in its centre with a walkway round it. The entrance to block A seems to have been from Deadman Lane but was blocked up

¹ This sundried brick filling is a good example for construction reasons other than flooding. It makes no sense at all to explain such platforms functionally as flood protections. Without discussing further the phenomenon of platforms I may just point out that such elevations are mostly to be found in the North of specific structures like House VIII HR A, Great Bath, etc.
² Chamber 26 does not belong to the original structure.
Fig. 5 — Generalized concept of blocks, House I.

Fig. 6 — Isometric view of House I (present day remains).
later on when the circumambulatory was also given up. Through the further addition of several smaller walls the original function was subsequently changed completely.

Block B (8.6 m East-West, 10.8 m North-South, 92.88 sqm) can be recognized as having originally been a two-room unit of a type well known in Mohenjo-daro architecture. What is extraordinary in this case is the triple entrance to the northern room. The separation of the southern room into two smaller units (rooms 15, 16) is of later date but did not significantly alter the major concept.
Block C (12.0 × 13.0 = 156 sqm) is of the same size and proportion as block A. It consists mainly of a courtyard to which rooms 23-25 are attached in the North-East corner. Whether its western wall alone belongs to the earlier concept is difficult to say as this part no longer stands. The whole western part (rooms 19-22) is a later addition to the basic concept of three blocks as is the eastern addition (room 26).

Remarkable is the approx. 4° shift of the whole northern part of the complex towards North-Northeast. According to our observations this shift in orientation marks a later construction phase. This would mean that the southern part (blocks A, B) was constructed on older buildings following the older orientation pattern (figs. 3-4) while the later northern part (block C and adjacent additions) was based on a 'new' orientation with a deviation of 4°. The drain connecting courtyards 18 and 10 clearly shows the contemporaneity of the whole concept. That new buildings were erected by joining bits and pieces of existing ones may be typical for the late urban phase of Mohenjo-daro. It might also indicate that a change of function demanded a new architectural concept which could not be served by a single existing unit, thus necessitating the amalgamation of several smaller houses into one large new structure.

Analysis of Access System (Formal)

According to the layout of House I the main entrance seems to have been from South (rooms 12, 13 as described by Wheeler), though no street leading to this entrance could be found, which seems to start from a large open space South of House I, probably a courtyard, the southern walls of which were not traced by the excavators.

Only block A had obviously direct access to Deadman Lane while block C had a smaller entrance from South Lane probably belonging to the latest phase of the building. Block B shows a separate entrance East of the main entrance from South.

The reconstructed original layout (fig. 8) shows separate access systems which may be of two distinct types, circular or linear, for each of the three blocks. While in circular orientation systems the visitor reaches his point of entry again after some
Fig. 8 — Reconstructed original lay-out. 1 = rooms directly connected to the public; 2 = transit rooms; 3 = terminal rooms.

Fig. 9 — Idealized access system of House I showing western circular movements and eastern linear ones.
time simply by walking ahead, in linear orientation systems he has to go back the same way he came in order to reach his point of entry.

While block A has a circular orientation with the central rooms 4, 5 in the middle, block B has a linear orientation marked by three entrances to a second room. Block C is indifferent in its layout but here also a circular movement may be suggested by the double staircase as access from South. Even the western addition to block C indicates in its original layout a circular orientation with central room 19 in the middle, while the eastern part of courtyard 18 shows an angular variation of a linear access system. Idealized, the access system of House I could be depicted as is shown in figure 9.

The circular orientation systems are to be found in the western part of House I, the linear systems in the eastern part. Only the two systems in the northern block C are directly linked up with the central access system while the southern systems seem to have been somehow independent.

Most of the later alterations to House I were carried out in the western part where the circular orientation systems were blocked up by several new walls in order to create additional rooms (fig. 10).

It may be worth mentioning that a similar blocking up of a circular orientation can be observed in the Great Bath (Jansen et al. 1983). While the central access to House I seems to have remained unchanged, the entrance room to block B was subdivided into rooms 15 and 16 thus separating the easternmost entrance to room 14 from the two others.

The number of paved rooms was increased from originally one to three in the final stage.

_**Evaluation of Rooms**_

Beginning again with the 'original' layout (fig. 8), the entrance (category 1) to block A is not separated from the transit corridor (category 2) as is the case in other houses (Jansen 1984c). From the transit corridor there is access to another transit room (no. 5) from which the terminal room 4 is entered.
Fig. 10 — Reconstructed final lay-out. 1 = rooms directly connected to the public; 2 = transit rooms; 3 = terminal rooms.

The paving in this room might be part of the original construction.

A similar situation is to be found in block B where rooms 15 and 16 serve as a very large entrance opening directly onto room 14 which could be understood as a terminal room. While room 14 here marks the architectural climax reached via a straight south-northern orientation, the circular concept of block C is slightly less straightforward.

The concept of terminal rooms is repeated in block C and its extensions. In the western additions there is a dual system of small entrances leading to a terminal room, both of the same size and proportion but one oriented towards North and the other
to the South. Here a circumambulation of a central structure similar to that in block A can be observed.

The eastern addition shows a complicated access system terminating in room 23.

In the original layout covering 436 sqm of habitational space not more than 60 sqm or 14% consists of terminal rooms while all the others are transit rooms. This contrasts markedly with the final layout (fig. 10) where 37% of the habitational space becomes terminal rooms, an obvious change not only in general layout but also in function. By giving up the circumambulatory concept many small rooms could be built, many of them terminal.

_Size-Proportion Diagrams_ (fig. 11)

The final structural analysis is that of the size and proportion of each room. To begin with the ‘original’ layout again, the pattern shows a form not previously encountered in dwelling-houses (Jansen 1984c). Most of the rooms (40%) are concentrated in the size range between 5 and 10 sqm, 39% of all rooms show a proportion between 0.6 and 0.8. The terminal rooms range in proportion from 0.45 to 0.7 with two concentrations in area around 5 sqm and 10-12 sqm. Only one room, no. 14, does not fit the general pattern.

Easily identifiable are the long corridors in the proportion between 0.1 and 0.2, while the large courtyards are mainly in the proportional sector larger than 0.6.

The diagram of the final layout shows the increase in the number of smaller rooms between 4 and 12 sqm. Three distinct groups of terminal rooms can be distinguished which mainly correspond with those of diagram I.

The isolated room 14 was the only one extended subsequently by room 9 to form the small third group. Again most of the rooms (38%) are between 5 and 10 sqm. The comparative list (Table 1) shows an increase in the category 0-5 sqm by 11% while the number of large rooms between 10-20 sqm decreases by 5% as does the group larger than 30 sqm. Besides the formal analysis of the architecture the finds registered in the fieldbooks for
Fig. 11 — Size-proportion diagram: original lay-out (left) and final lay-out (right).

† square metres $a \times b$; $-$ proportion $a/b$ of each room indicated by room number; and evaluation $\Theta = 1$, $\bullet = 2$; $\circ = 3$. 
this structure will have to be analysed before a final conclusion can be drawn.

**Table 1 - Comparative list of room sizes and room proportions.**

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An Attempt towards the Replacement of Artifacts into Their Architectural Context

Not very many entries in Marshall's monograph concern artifacts found in House I. One spectacular find however, a head of a human figure, was made in room 14 (HR 910, 6.7 feet).

The head, 6.9 inches in height and of the white limestone found in the neighbouring hills, is of a bearded figure, and, save for light damage to the nose, lip and
right ear, is well preserved. The hair elaborately but conventionally treated is indicated on the top of the head by chevrons, but on the large chignon by horizontal parallel lines (Marshall 1931: 177).

This head, which Marshall continues to describe in detail, is one of the only very few stone heads (see Ardeleanu 1984) ever found in Mohenjo-daro and which are unique so far for the whole Harappan civilization.

Another stone figure, unfortunately broken into three parts (HR 163, 193, 226), was discovered in the northern part of House I. As the broken parts were scattered over several square meters in the surface rubble, this damage may be modern. The location of the trunk close to the retaining wall between courtyards 10 and 18 may be an indication of the original position of the figure. As Ardeleanu and others could show, these stone figures belong to a series which can be compared with sculptures traced up to Shahr-i-Sokhta and Mundigak. They possibly represent a newly introduced cult which gained favour in Mohenjo-daro as these figures are only found in late architectural contexts there.

The other objects found in House I as published by Marshall are:

— Seal no. 30 (ibid.: 177) (Courtyard 10, superficial debris);
— numerous small objects of faience and alabaster at the base of the Northern wall' (courtyard 10);
— HR 960, an ivory ornament (room 14);
— HR 980, three fragments of decorated pottery (room 14);
— Seal no. 482 (room 14);
— Seal no. 430 (room 4);
— Seal no. 53 (room 5);
— HR 1123, alabaster mace head (?) (room 5);
— Seal no. 426 (room 3);
— HR 1442, shallow cup (room 8);
— Seal nos. 6, 13, 446, 541, and 558, fragment of a vessel with two pictographs in courtyard 18;
— T.C. seal no. 431 (room 21);
— 3 pieces, seal no. 236 and HR 432, a miniature vase (room 23).

These objects described by Marshall represent less than 4% of the objects recorded in the fieldbook. Between December 1925 and March 1926 more than 500 objects were registered in the 20
Fig. 12 — House I and overlying 20' square system of Hargreaves 1925.

ft grid registration system, over a 100 more were registered from the trench previously dug \(^3\) (fig. 12).

As fig. 15 shows, the habitational level of the structure in the northern part is represented by a high concentration of artifacts at a level of c. 54 m a.m.s.l. while the lower, southern part is represented by a concentration at about 52 m.

\(^3\) As H. Hargreaves used the 20 ft grid orientation system in HR-A (1925-26), these objects cannot be identified according to rooms but only by grid square. Therefore a more specific analysis of room types (Category I-III) is not possible here. Fortunately c. 50% of all data registered for the whole site are identifiable by rooms (Mackay's orientation system). It will be instructive to discover which room category the seals are mostly to be found in and which artifactual context they have. Similar analyses are important for figurines etc.
Grid Analysis of Artefact Types and Concentrations in View of Their Architectural Contexts

House I is covered by the two 20 ft units I and J of Hargreaves 1925 trial trench and by the squares 38 W 17-20, 22-25 and 38 X 2-5 and 7-10.

Square 38 W 17 (fig. 12, App. 1, 2)

In this square a total of 71 finds are reported. Out of these 71 objects 33 or 46% were concentrated between —1.35 to —1.40 m below surface (b.s.) (s. = 55.30 m a.m.s.l.) giving an absolute depth of c. 54 m a.m.s.l.

Another high concentration of 23 objects (32%) was found at —0.91 m (b.s.) or c. 54.40 m a.m.s.l. which might represent a later habitation period. Of these 23 objects one (HR 710) is a grinding stone, two are complete miniature vases and the rest are pottery sherds of which 17 (HR 517) are painted fragments. The grinding stone and the high concentration of pottery remains might indicate a change in use of this part of the building in later times, a change which is emphasized by a fragment of a huge stone stand for some big jar (HR 519) found at —1.07 m b.s.

The objects found at the main habitation level at c. 54 m consist almost totally of personal ornaments and miniature pottery. 55% could not be identified any further as they are so neutrally termed in the fieldbook; they consist of ivory, faience, copper and stone.

One seal (HR 1365) is reported from here. Also worth mentioning is a carved conch shell object (HR 1366) and the head of a terracotta (t.c.) human figure (HR 1398).

Square 38 W 18 (fig. 12, App. 1, 2)

Here a total of 30 objects have been recorded of which 27 were concentrated between —1.37 and —1.63 m (54.13-53.87 m a.m.s.l.) thus reflecting the habitation level of the original building. There is a rather high concentration of animal figurines at —1.63 b.s. (HR 1433, 1432). As they are fragmentary it cannot be

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4 Excluding the objects reported by Hargreaves from trench unit K.
said whether they each belong to different figures or all to one or two figures. A fragment of a female figurine (HR 1431) is also reported. Eleven objects classified as personal ornaments (beads, bangles) were found. Besides four ceramic pieces 8 non-identifiable objects, again of the usual materials such as copper, faience, shell and stone are mentioned.

Square 38 W 19 (fig. 12, App. 1, 2)

The absolute surface height of square 38 W 19 has been reconstructed as 53.20 m a.m.s.l. 46 objects are reported in the fieldbooks going down to —4.88 (48.32 m). This is the square mostly covering room 14 where a deep dig was carried out. From the lowest level only one object (HR 2609, ‘one bead of chalcedony’) is reported.

The main habitation horizon according to the evidence of entrances etc. was in the lower, southern part at c. 52 m a.m.s.l. which would be represented by the concentration of 13 objects at —1.07 (52.13). They consist of a female figurine (HR 2686), several beads, one seal (HR 2674, ‘without animal’), one t.c. urn (HR 2684), one carved conch shell (HR 2682), and some minor objects. The famous stone head HR 910 — also found in room 14 — is registered under 38 W 25 at —2.01 m and not under 38 W 19. Square 38 W 25 shares the very South-West corner of room 14 \(^5\) where obviously HR 910 was found.

Another concentration of finds was reported about one meter deeper (—2.03 b.s., 51.17 m) where another t.c. female figurine (HR 1437) is recorded. All other objects found here could be classified as belonging to the ‘prestige group’. The next lower level (—2.29 b.s., 50.91 m) shows the same pattern but instead of a human figurine a t.c. animal figurine (HR 1085) is registered. Otherwise the rather high concentration (22\%) of shell products in this square is remarkable \(^6\).

\(^5\) This example shows the difficulty of correlating room and square units which could have been avoided by pointing orientation systems.

\(^6\) Here it should be mentioned that in the circular brick structure in courtyard 10 one conch shell (HR 214, peg, I-J exterior South, 2.4 m b.s.) was found (cf. Ardeleanu 1984).
Square 38 W 20 (fig. 12, App. 1, 2)

In this square no direct correlation with the architectural structural level could be built up. With a reconstructed height of 53.50 m for the surface the third registration of —1.63 (51.87) would be closest to the indicated architectural level of c. 52.00 m. This level only gives us 7 painted potsherds.

On —0.61 m b.s. (52.89 m) 13 objects are reported out of which 12 were identified as personal ornaments.

In the lower levels another concentration is to be observed at —2.13 (51.37 m). Again, personal ornaments and miniature pottery predominate. Stray finds go down to —5.49 (48.01 m), clearly showing that the deep dig extended as far as this square. The lowest registration is '2 fragments of alabaster pottery' at 5.49 m b.s. (HR 1813).

Worth mentioning are two seals found close together, HR 2582 (—2.44) and HR 1400 (—2.84), with no animal depicted on the latter. One fragment of a female figurine HR 1588 (—2.13) and two of animals (HR 1482, —3.05, a bird; HR 2608, —4.88) are reported here. Only one registration (HR 962, —1.98) might indicate functions other than 'prestige'.

Square 38 W 22

Only 11 objects were reported from this square. The hypothetical habitation level of 54.00 m is represented by only 2 t.c. containers found —1.52 b.s. Another six registrations were made for —3.66 b.s. (51.84 m) consisting of two fragments of t.c. animal figurines (HR 897), 2 t.c. beads, one t.c. lid and a miniature vase.

Square 38 W 23

33 objects entered under this square are divided into two finding levels: 1) —0.91 m b.s. (54.09 m), 2) —1.22 m b.s. (53.78 m).

7 HR 962, '2 fragments of flint polisher 1:6 6/8'.
22 objects (67%) fall within the category of 'personal ornaments' and thus belong to the 'prestige' class.

Square 38 W 24

Only one object is mentioned under this square which almost completely covers courtyard 10. (For further finds see registrations in pegs. I-J ext. South: —8 ft. HR 201 to HR 214 + HR 217).

Square 38 W 25

In this square 22% of the objects recorded (49) could not be indentified. The major habitation level is clearly to be seen at —1.47 m (52.03 m) with 16 registrations. A second concentration with 19 objects is recorded at —2.13 m (51.37 m). Two figurines are registered, one, the famous stone head HR 910 which was found in the South-West corner of room 14 at —2.01 m and another, a t.c. animal figurine HR 1710 at —1.47 m.

Again, personal ornaments are highly represented as well as miniature pottery.

Square 38 X 2

The reconstructed surface level in this square is 55.30 m and the first registration of objects marked at —1.22 m (54.08 m), thus compatible with the general level of the northern part of House I at 54.00 m.

29 beads, 27 made of 'white paste', the familiar micro-beads (Hegde et al. 1982: 239-44) were found here. One chertstone (HR 711) is unique for House I.

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8 What is important to note here is that the open spaces, the courtyards, do not show evidence of multifunctional activities as could be observed in House VIII (Jansen 1984c). In House I they seem to have served primarily as access routes.
Square 38 X 3

The first concentration of objects at —0.76 m b.s. (54.04 m) coincides here with the habitation level of House I. Out of 16 objects 3 could not be specified. Of the rest one seal (HR 1575) must be mentioned and three stone weights (HR 376) which might point towards a different function. Another seal (HR 350) was found 15 cm deeper. The six objects found at this level —91 cm (53.89 m) probably also belong to the habitation level here. One head of a female figurine was also found in this square.

Square 38 X 4

Square 38 X 4 almost fully covers the north-eastern part of block A with a reconstructed surface level of 53.30 m. The uppermost find level of —1.22 m (52.08 m) represents the habitation level with 9 objects. One of them (HR 857) is a t.c. animal (hen), 5 are parts of personal ornaments. A deeper level at —1.96 m (51.34 m) could indicate a second, earlier habitation period.

Square 38 X 5

Square 38 X 5 covers the south-eastern part of block A. The reconstructed surface is 53.20 m and the habitation level might be indicated by the objects found at —1.07 m (52.13 m). 12 out of 22 objects noted are containers or parts of containers, 7 of them miniature pots. Only 4 beads are reported. 16 cm higher one of two seals found in this square is reported under HR 1574. The other seal (HR 1121) was found at 51.35 m. Neither seal depicts an animal. Two fragments of t.c. animal figurines were found at 51.68 m and 51.22 m.

Square 38 X 7

Square 38 X 7 covers the north-western corner of House I. With a reconstructed height of 55.50 m the main habitation level might be represented by —1.37 m to —1.60 m with 26 objects
from a total of 43. 17 objects are again ‘personal ornaments'; one human figure (HR 1596) was also found. Miniature pottery is represented by 9 pieces while 2 objects can be identified as ‘tools' (one flint implement HR 1578, one t.c. cone HR 1579).

Square 38 X 8

The square 38 X 8 covers the south-western part of block C with a reconstructed surface height of 55.00 m a.m.s.l.

A first concentration of 23 objects is reported at −0.91 m, a second of 14 at −1.07. Both are concentrated with a deviation of ± 8 cm, around 54.01 m, which marks the habitation level of this part according to architectural indicators. The objects include one figure of a bull (HR 642), and the already common pattern of miniature vases, beads, bangles and painted pottery. Another concentration is reported at −1.22 (14 objects) and −1.32 (8 objects), with an average depth of +53.73 m a.m.s.l. and a deviation of ± 5 cm. One limestone weight (HR 773) and five t.c. cones (HR 1196) are worth mentioning here as they might suggest a different function than the previous one.

Square 38 X 9

This square covers most of the lower southern part of block A. Its reconstructed surface is reported at 53.50 m. It is impossible here to identify exact habitation levels in the architecture through concentrations of objects, as there is a break between 54 m in the northern part and 52 m in the South.

The lowest concentration at −1.52 (51.98) with 9 objects may mark the habitation level of block A. Another t.c. animal figurines is reported here (HR 916). Otherwise it is exclusively miniature pottery, one with a pictographic impression of an elephant (HR 909). But also in the upper strata no change of the assemblage can be observed. At −0.91 m (52.59) another concentration of 10 objects is reported, which can be classified as ‘prestige objects'. Besides one t.c. figurine of a bird (HR 869) and one t.c. animal (HR 875), three ‘black stone bangles' have been found (HR

**Square 38 X 10**

This square covers the south-western corner of House I and has a reconstructed height of 53.50 m a.m.s.l. Three distinct groups are reported. The first at —0.91 m (11 objects), a second at —1.22 m (19 objects) and a third at —1.52 (15 objects). The final group (51.98 m) would correspond with the reconstructed habitation level of 52.00 m. A very high concentration of 8 t.c. animals (HR 2476) in fragmentary condition is worth mentioning here, as well as one t.c. female figurine (HR 2478). The next concentration at 52.28 m (—1.22 m) is only 0.3 m higher and might conceivably belong to the same habitation level. This group consists mainly of beads. In the upper level (—0.91 m) one seal (HR 629), several beads and personal ornaments are reported. Here, as in square 38 X 9, no basic change in the material culture can be observed.

**Conclusion**

From every point of view, House I is an extraordinary structure (fig. 13).

The horizontal-vertical analysis revealed that a new building had been constructed over various older buildings, partly resting on older walls. This structure had from the beginning a northern elevated part accessible from the South via a double staircase. Later on, the very clear layout was complicated by many additions and partly abandoned.

When all is considered, it is surprising that this large building did not have any well though a drain and several platforms, especially of the later phase, are reported. The ring structure in courtyard 10 was not a well, but a shell (*Xancus pyrum*) was found in it. The nearest water supply was 40 m away in block 2. This is puzzling as a water supply was common in all the larger houses, at least in the HR area.
Fig.13 — Isometric view (idealized).

But obviously the whole southern part of HR A and also block 4 along First Street lacks any kind of water supply. One reason for the absence of wells may be that in the late Harappan phase new wells could no longer be sunk due to the technical problems of digging down at least 12 to 14 metres cutting through older structures. We therefore could conclude that the wells normally in use were older wells which had been rebuilt again and again, thus explaining their peculiar positions in walls etc. as arising from the necessity for the older wells to be integrated in the new groundplans of the later houses.
The layout of House I in its original concept shows an extraordinary pattern of circular access systems in the western and linear access systems in the eastern part with a central circular system interconnecting them. Additionally the whole House I is separated into a northern raised part and into a southern lower one connected by a double staircase. In both the northern and the southern part, the circular access system is in the western and the linear one in the eastern part.

At the foot of the separation wall a huge quantity of miniature pottery and alabaster objects are reported to have been found (fig. 14). One figure was uncovered here. The whole access system clearly points towards functions which differed very much from those of dwelling houses already analysed such as House 8, HR A, House B II, III, IV in Moneer area. Very few rooms are terminal rooms, the whole architectural concept is based on transit rooms.

All these facts are evidence of a public use. This interpretation is given added weight by the fact that most of the objects found in this context belong to the groups 'figurines', 'personal ornaments', and 'containers', whereby most of the 'containers' are miniature pots. Almost no tools or indicators for production were reported.

The figurines, animal as well as human, were distributed evenly over the whole area of House I. They were found together with personal ornaments, beads, bangles, etc.
Fig. 15 — Diagram showing the total distribution of objects per square differentiated to depth.
Top right number: sub-square number of individual square 38 X 17, 18, 19, etc.
Top left number: reconstructed height of surface in metres above mean seal-level (a.m.s.l.)
The vertical axis indicates metres a.m.s.l., the horizontal axis indicates the number of objects (nbs.)
Concentrations of objects and height number may indicate a habitation level.
All in all, a total of 12 seals have been found out of which seven bear both an animal and an inscription (fig. 16). All the animals depicted are of one type — the unicorn. Would it be possible that these unicorn seals are connected with rituals performed here?

Seals, figurines, miniature pottery, stone sculptures, an extraordinary groundplan — what is their common denominator?

We are definitely still on the speculative side when we agree with Wheeler that House I must have served religious purposes. On the other hand, much more supporting data could be collected since Wheeler formulated his hypothesis.

House I was constructed as a new concept in the Late Urban Phase and the stone sculptures (cf. Ardeleanu 1984) may have
made their appearance about the same time. As these sculptures obviously show connections to Mundigak and Shahr-i Sokhta and are found only in late Harappan contexts at Mohenjo-daro, they might be related to a new cult introduced here in the late Harappan period. Dominant architectural features are the northern raised platform also to be observed in the Great Bath and e.g. in House I, HR A and circumambulatoriories as well as the distinction between eastern linear access systems and western circular ones.

Besides personal ornaments, human and animal figurines might have served a similar purpose as votive offerings.

As all seals with animals show the unicorn, this animal might also be connected with the cult in this apparently sacred building. In this case seals might have been amulets which were donated in a similar way to the figurines. To prove such a hypothesis much more research has to be done as we pointed out earlier. But we feel confident now that with the new data available and with the combined efforts of the different experts involved our operation in Mohenjo-daro will be rewarded by a much more sensitively researched understanding of the complex phenomenon 'Harappan Civilization'.

ACKNOWLEDGEMENTS

We are deeply thankful to all our friends in the Archaeological Department of Pakistan who supported us all the years in our research.

Special thanks are due to M. Ishtiaq Khan, Director General, for all his kind cooperation and help.

Without the help of all our colleagues this painstaking research would have never been successful.

REFERENCES


Appendix 1 shows the fieldbook entries for House I arranged according to horizontal units (e.g., 38 W 17, column 5) which correspond to a 20×20 ft square. The objects within each square are further sorted according to their increasing relative depth in cm (column 6). Reading the Table horizontally, the different columns correspond to the following: 1. Computer serial number; 2. Fieldbook number for HR Area (HR); 3. Key to museum in which the objects were to be found in 1940; 4. Date of excavation; 5. Horizontal orientation system (20×20 ft grid); 6. Relative depth (below surface) in cm; 7. Original text of fieldbook.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Date</th>
<th>Unit</th>
<th>Depth (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>456</td>
<td>Faience min. vase of light blue colour &amp; 3 faience beads</td>
<td>05.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>736</td>
<td>Cylindrical T.C. vessel, ht: 4 3/4&quot;, pierced with holes</td>
<td>19.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>739</td>
<td>Frag. of an animal figurine, length 3 3/4&quot;</td>
<td>19.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>464</td>
<td>T.C. bead</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>548</td>
<td>Copper bead</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>549</td>
<td>Min. T.C. vase, ht: 1 3/4&quot;</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>460</td>
<td>Min. T.C. vase, ht: 1 5/8&quot;</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>461</td>
<td>Frag. of a T.C. dish</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>462</td>
<td>Black T.C. ball</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>463</td>
<td>Frag. of a T.C. object</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
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<tr>
<td>457</td>
<td>17 frags. of painted pottery (17 pieces)</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
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<tr>
<td>457</td>
<td>Grinding-stone, length 10&quot;</td>
<td>09.01.26</td>
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<td>0</td>
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<tr>
<td>457</td>
<td>1 huge stone stand of some big jar (frag.)</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>457</td>
<td>Faience potsherd, 2 disc beads, 2 pieces of copper</td>
<td>09.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>1354</td>
<td>Min: faience ball</td>
<td>02.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>1355</td>
<td>2 T.C. beads L; 2 7/8&quot; each; 1 frag: of a bone obj: + 1 faience obj:</td>
<td>02.01.26</td>
<td>38 W 17</td>
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<tr>
<td>1356</td>
<td>Frag: of an alabaster obj:</td>
<td>02.01.26</td>
<td>38 W 17</td>
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<tr>
<td>1357</td>
<td>Min: T.C. vase ht: 2 3/4&quot; (damaged)</td>
<td>02.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>1361</td>
<td>Frag: of carved ivory obj: L; 2 1/8&quot;; 1 stone disc with a hole in the centre dia: 4/8&quot;; 3 faience beads; 1 disc bead + 1 frag: of corroded copper</td>
<td>02.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>1362</td>
<td>2 T.C. beads A, L; 2 1/2&quot;; B, L: 1 5/8&quot;</td>
<td>02.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>1363</td>
<td>A frag: of alabaster pottery</td>
<td>02.01.26</td>
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<td>0</td>
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<tr>
<td>1364</td>
<td>Rect: piece of smoked ivory</td>
<td>02.01.26</td>
<td>38 W 17</td>
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<tr>
<td>1539</td>
<td>White disc bead, 1 frag, glazed ware, 1 frag of a disc of bone</td>
<td>02.01.26</td>
<td>38 W 17</td>
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</tr>
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<td>1539</td>
<td>Pictographic seal with the usual animal 1&quot; sq:</td>
<td>02.01.26</td>
<td>38 W 17</td>
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<tr>
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<td>Carved conch shell obj:</td>
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<tr>
<td>1426</td>
<td>T.C. ring dia: 1 3/8&quot;</td>
<td>02.01.26</td>
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<tr>
<td>1427</td>
<td>3 long T.C. beads</td>
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<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>1428</td>
<td>1 T.C. bead; 1 frag: of ivory nose ornament; 2 frags: of copper + 1 disc bead</td>
<td>02.01.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>1459</td>
<td>T.C. obj: ht: 2&quot; dia: 1 2/8&quot;</td>
<td>03.01.26</td>
<td>38 W 17</td>
<td>0</td>
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<tr>
<td>1460</td>
<td>5 frags: of a copper obj:</td>
<td>12.03.26</td>
<td>38 W 17</td>
<td>0</td>
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<tr>
<td>1461</td>
<td>T.C. beads dia: 1 1/8&quot;</td>
<td>24.03.26</td>
<td>38 W 17</td>
<td>0</td>
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<tr>
<td>1462</td>
<td>T.C. fig: (head of a human figure)</td>
<td>03.01.26</td>
<td>38 W 17</td>
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<tr>
<td>1442</td>
<td>Frag: of carved ivory L; 1 3/8&quot;</td>
<td>05.01.26</td>
<td>38 W 17</td>
<td>0</td>
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<tr>
<td>1443</td>
<td>1 frag: of a faience potsherd</td>
<td>05.01.26</td>
<td>38 W 17</td>
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<tr>
<td>2192</td>
<td>Min: T.C. pot with pointed bottom, having 3 holes near the brim ht: 2 1/2&quot;</td>
<td>13.02.26</td>
<td>38 W 17</td>
<td>0</td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Quantity</td>
<td>Date</td>
<td>W</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------</td>
<td>----------</td>
<td>---------</td>
<td>-----</td>
</tr>
<tr>
<td>609</td>
<td>579 T.C. toy-cart-wheel</td>
<td>2</td>
<td>12.01.26</td>
<td>38</td>
</tr>
<tr>
<td>610</td>
<td>560 copper ring</td>
<td>1</td>
<td>12.01.26</td>
<td>38</td>
</tr>
<tr>
<td>2066</td>
<td>1957 frag: of corroded copper</td>
<td>1</td>
<td>11.02.26</td>
<td>38</td>
</tr>
<tr>
<td>1447</td>
<td>1385 1 faience object: 1, another 1/2&quot;, 3 frags: copper obj: 1 T.C. bead; 1 faience bead; 1 T.C. bead + 1 frag: conch shell ring + 1 white paste bead</td>
<td>0.02.26</td>
<td>38</td>
<td>W/18</td>
</tr>
<tr>
<td>1448</td>
<td>1386 1 T.C. lid dia: 2 1/2&quot;</td>
<td>M</td>
<td>0.02.26</td>
<td>38</td>
</tr>
<tr>
<td>1450</td>
<td>1387 a painted potsherd</td>
<td>M</td>
<td>0.02.26</td>
<td>38</td>
</tr>
<tr>
<td>1451</td>
<td>1388 1 frag: of a T.C. black coloured dish</td>
<td>M</td>
<td>0.02.26</td>
<td>38</td>
</tr>
<tr>
<td>1452</td>
<td>1389 7 frag: of a stone bangle</td>
<td>7</td>
<td>0.02.26</td>
<td>38</td>
</tr>
<tr>
<td>1453</td>
<td>1390 2 frags: of conch shell bangles + 1 copper bead</td>
<td>0.02.26</td>
<td>38</td>
<td>W/18</td>
</tr>
<tr>
<td>1497</td>
<td>1430 3 frags: of copper; 1 frag: carnelian bead; 1 white paste bead + 1 T.C. bead</td>
<td>0.03.26</td>
<td>38</td>
<td>W/18</td>
</tr>
<tr>
<td>1498</td>
<td>1431 1 frag: T.C. female fig:</td>
<td>M</td>
<td>0.03.26</td>
<td>38</td>
</tr>
<tr>
<td>1499</td>
<td>1432 2 frags: T.C. animal fig:</td>
<td>M</td>
<td>0.03.26</td>
<td>38</td>
</tr>
<tr>
<td>1500</td>
<td>1433 2 frags: T.C. bird fig:</td>
<td>ML2</td>
<td>0.03.26</td>
<td>38</td>
</tr>
<tr>
<td>1501</td>
<td>1434 1 min: T.C. vase ht: 1 6/8&quot;</td>
<td>0.03.26</td>
<td>38</td>
<td>W/18</td>
</tr>
<tr>
<td>1502</td>
<td>1435 1 frag: of conch shell obj:</td>
<td>0.03.26</td>
<td>38</td>
<td>W/18</td>
</tr>
<tr>
<td>2827</td>
<td>2677 1 stone + 2 faience beads</td>
<td>M</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2824</td>
<td>2674 1 pictographic seal without animal fig:</td>
<td>M</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2825</td>
<td>2675 1 copper + 1 faience bead</td>
<td>M</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2829</td>
<td>2679 1 copper bead + 2 frags:</td>
<td>M</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2830</td>
<td>2680 1 piece of carved ivory</td>
<td>M</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2832</td>
<td>2682 1 carved conch shell</td>
<td>M</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2833</td>
<td>2683 1 white paste + 1 stone bead</td>
<td>M</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2834</td>
<td>2684 1 T.C. urn</td>
<td>1</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2835</td>
<td>2685 1 painted T.C. bowl (damaged)</td>
<td>M</td>
<td>20.03.26</td>
<td>38</td>
</tr>
<tr>
<td>2836</td>
<td>2686 1 frag: T.C. fig: of a female</td>
<td>0.03.26</td>
<td>38</td>
<td>W/19</td>
</tr>
<tr>
<td>1503</td>
<td>1436 9 complete bangle dia: 3 3/8&quot;</td>
<td>0.03.26</td>
<td>38</td>
<td>W/19</td>
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<tr>
<td>1504</td>
<td>1437 1 frag: T.C. fig: of a female (body)</td>
<td>0.03.26</td>
<td>38</td>
<td>W/19</td>
</tr>
<tr>
<td>1505</td>
<td>1438 21 min: T.C. vase ht: 2&quot;</td>
<td>M</td>
<td>0.03.26</td>
<td>38</td>
</tr>
<tr>
<td>1506</td>
<td>1439 2 black coloured T.C. potsherds</td>
<td>M</td>
<td>0.03.26</td>
<td>38</td>
</tr>
<tr>
<td>1507</td>
<td>1440 1 faience bead; 1 frag: corroded copper; 1 conch shell disc dia: 1&quot;</td>
<td>0.03.26</td>
<td>38</td>
<td>W/19</td>
</tr>
<tr>
<td>1128</td>
<td>1084 5 faience beads + 1 copper bead</td>
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<td>W/19</td>
</tr>
<tr>
<td>1129</td>
<td>1085 229 frags: of a fig: of an animal</td>
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<td>W/19</td>
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<tr>
<td>1228</td>
<td>1178 2 frag: of chalcedony</td>
<td>29.01.26</td>
<td>38</td>
<td>W/19</td>
</tr>
<tr>
<td>1382</td>
<td>1325 274 1 complete conch shell bangle &amp; 4 frags (unfinished)</td>
<td>26</td>
<td>02.02.26</td>
<td>38</td>
</tr>
<tr>
<td>1383</td>
<td>23 274 1 conch shell disc dia: 13/16&quot;</td>
<td>26</td>
<td>02.02.26</td>
<td>38</td>
</tr>
<tr>
<td>1384</td>
<td>1326 274 frag: of a conch shell bangle</td>
<td>26</td>
<td>02.02.26</td>
<td>38</td>
</tr>
<tr>
<td>1385</td>
<td>1327 325 1 faience obj: (probably an ear obj:)</td>
<td>26</td>
<td>02.02.26</td>
<td>38</td>
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<tr>
<td>1292</td>
<td>1239 325 1 T.C. tumbler (damaged) ht: 5&quot;</td>
<td>30.01.26</td>
<td>38</td>
<td>W/19</td>
</tr>
<tr>
<td>1293</td>
<td>1240 154 3 frag: of copper</td>
<td>30.01.26</td>
<td>38</td>
<td>W/19</td>
</tr>
<tr>
<td>1548</td>
<td>1480 488 1 bead of chalcedony</td>
<td>30.01.26</td>
<td>38</td>
<td>W/19</td>
</tr>
<tr>
<td>2755</td>
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<td>W/19</td>
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<td>Item</td>
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<td></td>
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</tr>
<tr>
<td>61</td>
<td>4 disc beads, 1 copper bead, 2 black stone discs, 1 frag. faience bangle</td>
<td></td>
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<tr>
<td>61</td>
<td>3 frags. of a T.C. ribbed vase</td>
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<td></td>
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</tr>
<tr>
<td>61</td>
<td>4 disc beads</td>
<td></td>
<td></td>
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<tr>
<td>122</td>
<td>1 frag. T.C. bangle</td>
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<tr>
<td>122</td>
<td>1 faience bead</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>122</td>
<td>1 frag. conch shell bangle, unfinished</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>163</td>
<td>7 frags. of painted pottery</td>
<td></td>
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<tr>
<td>198</td>
<td>2 fragments of flint polisher 1: 6 6/8&quot;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>666</td>
<td>2 fragments of painted T.C. pottery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>213</td>
<td>1 frag. T.C. fig: of a female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>213</td>
<td>1 frag. of a conch shell bangle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>213</td>
<td>2 T.C. lids dia: 1 1/2&quot; each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>213</td>
<td>1 T.C. bead (damaged) dia: 1&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>244</td>
<td>1 pictographic seal with the usual animal sq: 1 2/8&quot; (damaged)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>284</td>
<td>1 small sq: seal with only 1 pictograph on it + no animal</td>
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<td>305</td>
<td>1 conch shell disc with a hole in the centre, dia: 1&quot;</td>
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<td>1 frag. T.C. fig: of a bird</td>
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<td>frags: of alabaster pottery</td>
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<td>1307</td>
<td>38 frag: of copper obj: + 2 faience beads</td>
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<td>152</td>
<td>1 T.C. oval shaped vase with holes at the bottom</td>
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<td>2 frag: of a T.C. perforated pot</td>
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<td>2 T.C. beads</td>
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<td>1 T.C. vase, ht: 2 2/8&quot;</td>
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<td>1 T.C. lid dia: 1&quot;</td>
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<td>366</td>
<td>2 T.C. fragments figurines of animals</td>
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<tr>
<td>345</td>
<td>9 beads &amp; 3 frags. of copper</td>
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<td>346</td>
<td>2 frags. of alabaster mace head</td>
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<td>1 frag. of a T.C. dish</td>
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<td>1 frag. of a T.C. brim of a jar</td>
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<td>1 piece of faience of light blue colour</td>
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<td>2 black stone, foursided objects</td>
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<td>1 conch shell disc with a hole in centre</td>
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<td>1 T.C. bead</td>
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<td>6 white paste disc beads, 1 faience bead, 1 black stone unfinished bead, 1 faience long beads, 2 copper frags., 1 frag. of conch shell object, 1 lapis lazuli bead</td>
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<td>1 min: alabaster lid dia: 1 1/2&quot;</td>
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</table>

- 0 1 frag: of carved ivory
- 46 2 faience beads of black colour; 1 cylin: white paste bead + 3 white paste disc beads
- 107 a T.C. lid, dia: 1 3/8"
- 107 1 frag: of glass stone bangle
- 107 2 frag: of painted pottery
- 107 1 frag: of copper
- 107 1 frag: of conch shell
- 147 1 frag: of T.C. fig: of an animal
- 147 1 T.C. bead
- 147 5 frags: of T.C. beads
- 147 1 frag: of copper; 3 faience beads; 1 frag: of conch shell bangle + 1 faience bead
- 147 3 min: T.C. lids, dia: 1" each
- 201 frag: of a sculpture (head of a bearded fig: with interesting treatment of hair: ht: 6 3/4")
- 201 1 faience obj: like a chessman ht: 6/8" + 1 faience bead
- 213 4 fragments of ivory obj:
- 213 1 ivory obj: (complete)
- 213 1 T.C. pot ht: 4 1/2"
- 213 2 fragments of T.C. vase ht: 6"
- 213 2 fragments of horn
- 213 3 fragments of a painted lid of a T.C. jar (in black, white, red)
- 213 6 painted pot-sherds

- 122 1 frag. of a T.C. dish
- 122 a min: T.C. vase, ht: 2"
- 122 1 white paste bead, 1: 7/8"
- 122 1 T.C. rattle
- 122 27 white paste beads
- 122 3 T.C. lids
- 122 3 T.C. min: vases
- 122 1 frag: of T.C. pottery
- 137 1 chertstone weight, ht: 3/4" & 1 faience bead
- 152 a painted potsherd
- 163 1 faience bead
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</table>

<p>| 76  | 2 frags. of a copper bangle                                                  |        |          |
| 76  | 3 stone weights, 2 round &amp; 1 flat                                          |        |          |
| 76  | 1 rectangular piece of conch shell                                         |        |          |
| 76  | 1 frag. of an abalaster object                                              |        |          |
| 76  | 2 T.C. beads                                                                |        |          |
| 76  | 1 T.C. bangle (complete), dia. 2 1/2&quot;                                      |        |          |
| 76  | 1 copper nail L: 5 1/8&quot;                                                    |        |          |
| 76  | 2 T.C. lids dia: 1 1/2&quot; + 1&quot; respect:                                       |        |          |
| 76  | 1 T.C. vase ht: 1 1/2&quot; (B) lid                                              |        |          |
| 76  | 1 frag. of a conch shell bangle                                            |        |          |
| 76  | 1 frag. of a pictographic seal with the usual animal                        |        |          |
| 91  | 1 fragment of a pictographic amulet seal                                    |        |          |
| 91  | 1 black stone object                                                        |        |          |
| 91  | 1 frag. of carved conch shell                                              |        |          |
| 91  | 2 frags. of copper                                                          |        |          |
| 91  | 1 T.C. figurine of a female (head only)                                     |        |          |
| 168 | 1 T.C. pot ht: 4 1/2&quot;                                                     |        |          |
| 168 | 1 T.C. vase ht: 6 1/2&quot;                                                    |        |          |
| 931 | a T.C. vase (damaged) ht: 1&quot;                                                |        |          |
| 122 | 1 frag. of a T.C. bangle                                                   |        |          |
| 122 | 1 frag. of a faience bead (1: 1 2/8&quot;)                                     |        |          |
| 122 | 1 frag. of stone                                                           |        |          |
| 122 | 1 T.C. min: vase, ht: 2 1/2&quot;                                               |        |          |
| 122 | 1 T.C. fig: (fray:), hen                                                   |        |          |
| 122 | 1 bead of cornelian, 1 bead of stone (emerald green colour) + 1 piece of   |        |          |
| 122 | metallic ore?                                                               |        |          |
| 122 | 1 T.C. painted obj: (damaged) ht: 2&quot;                                       |        |          |
| 163 | 1 T.C. bead                                                                |        |          |
| 163 | 1 T.C. urn ht: 4 1/2&quot;                                                      |        |          |
| 163 | 1 T.C. obj: like a clay lamp found inside the urn no. 1234                 |        |          |
| 170 | 1 min: T.C. vase ht: 1 5/9&quot; (damaged)                                      |        |          |
| 196 | 2 min. T.C. lids, 1 frag of shell, 3 frags of corroded copper, 1 part of   |        |          |
| 198 | T.C. bead                                                                  |        |          |
| 198 | frag. of T.C. dish (black)                                                  |        |          |</p>
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<td>1 carved conch shell</td>
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<td>1 min. T.C. vase, ht: 1 6/8&quot;</td>
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<td>1 frag. T.C. dish</td>
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<td>1 pictographic rectang: shaped seal without any animal on it</td>
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<td>3 frags of an ivory rod (dice?)</td>
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<td>1 disc, 1 frag of shell, 1 T.C. long bead, 2 1/2 paste disc beads</td>
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<td>1 frag decorated pottery, black on red, length 5 1/2&quot;</td>
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<td>1 min. disc or lid, fine red ware, dia: 2 3/4&quot;, damaged</td>
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<td>1 min. vase of elegant shape, broken, ht: 4 3/4&quot;, fine ware</td>
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<td>2 frags of shell, length 4&quot;</td>
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<td>1 chert scraper, length 2 3/8&quot;</td>
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<td>1 min. T.C. lid, dia: 3&quot;, fine ware, broken</td>
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<td>fragmentary fig: of an animal</td>
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152 1 frag: conch shell, l: 5 1/2"
152 a T.C. lid, dia: 1 1/2"
152 fragmentary fig: of an animal
152 fragmentary faience object l: 1 2/8, lattice
152 a faience bead
152 a T.C. rattle
152 frag(s): of a large earth: pot
183 1 frag: of a pictogr: seal without animal
198 1 frag: fig: of an animal

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<th>Item Code</th>
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Note: The above table includes various fragments and objects found, each with a specific description.
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<th>No.</th>
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<th>Details</th>
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<tbody>
<tr>
<td>719</td>
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<td>26 19.01.26 38 X/9 1 min. T.C. lid, dia: 1 3/8&quot;</td>
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<td>21.01.26 38 X/9 76 fragments of corroded copper</td>
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<td>643</td>
<td>16.01.26 38 X/9 1 frag black stone bangle</td>
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<td>M 23.01.26 38 X/9 1 T.C. vase, ht: 2 6/8&quot;</td>
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<td>873</td>
<td>23.01.26 38 X/9 T.C. complete bangle</td>
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<td>22 19.01.26 38 X/9 1 T.C. toy-cart wheel, dia: 2 3/4&quot;</td>
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<td>2 25.01.26 38 X/9 2 T.C. vases - complete ht: 6 1/2&quot; each</td>
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<td>21 25.01.26 38 X/9 1 T.C. vase ht: 5 1/2&quot; with a pictogr: impression (elephant)</td>
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<td>M 25.01.26 38 X/9 1 T.C. vase ht: 4&quot; (damaged)</td>
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<td>24 25.01.26 38 X/9 1 T.C. lid dia: 2 6/8&quot;</td>
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<td>14.01.26 38 X/10 1 pictographic seal</td>
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<td>13 23.01.26 38 X/10 fragments of a vase</td>
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Appendix 2

It has been attempted in this appendix to provide a horizontal-vertical classification of the artifacts for each separate unit. The number of the square (e.g., 38 W 17) as well as its reconstructed absolute height(s) is given in the top left-hand corner. The horizontal axis of the diagram is divided into:

- figurines
- personal ornaments
- seals
- containers
- tools
- others.

These divisions are provisional and can be altered if necessary. The next sub-division produces further sub-groups, which can themselves be further sub-divided into 0 = complete, 10 = broken, 11 = unfinished.

The vertical axis of the diagram shows in the first column the relative heights (rel.) below the surface, and the second column shows the absolute heights (abs.) calculated on the basis of the reconstructed surface.

All objects found at one particular depth have been added together, and the sum can be seen in the column marked 'total', whereby the number of objects is not identical with the fieldbook numbers in Appendix 1 because the fieldbook numbers sometimes include a number of differing objects, which are taken into consideration in fig. 15.

Furthermore, a selective analysis has been carried out in squares 38 W 17, 18, 19 by which minor registrations have not been included.
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| M. Jansen |

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*The total number of the seals is 12 if the previous trend of 1924 is included (see tab...
On the Type, Distribution and Extent of Craft Industries at Moenjo-daro

This paper is aimed to outline a first picture of the craft industries performed within the urban context of Moenjo-daro at the light of its surface evidence. We shall briefly summarize the observations gathered after the first two campaigns of the Surface Evaluation Program (SEP) initiated in January 1982 and carried out by the joint RWTH-IsMEO Project to the present\(^1\). The scientific background of the Program, its basic methodological postulates and the monitoring of the surface evidence as a primary source of archaeological information have already been described in a preliminary report (Bondioli et al. 1984). Here all the data on the Craft Activity Areas (hereafter AA)\(^2\) identified up to March 1984 across the Moenjo-daro surface have been combined on a general distribution map (fig. 1) and tabulated on a distribution chart of Archaeological Indicators of Craft Activity (Tab. 1).

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\(^1\) The entire mounded region of the Moenjo-daro compound (49 a.s.l.) is included in the 1:2000 photogrammetrical restitution of the aerial imagery, recording 1m contour lines, produced by H. Wanzke as part of the RWTH-DFG documentation project (Wanzke 1983). The base grid is on 100m squares numbered according to 4 digit coordinates that allow to detail each square meter across the area. Thus position 2820/1395 will indicate a point located 2.820 km to the East of x point of origin and 1.395 km to the North of y point of origin. To facilitate location of points to readers mostly accustomed to the earlier terminology, Tab. 1 is specifying locations according to the traditional system based on the initials of the field supervisors.

\(^2\) Approximately 40 ha of Moenjo-daro are liable for surface evaluation (Bondioli et al. 1984: fig. 20). Of those we reckon to have observed at various degrees of care some 10 ha.
### Table 1: Archaeological Indicators for Craft Activities

<table>
<thead>
<tr>
<th>Category</th>
<th>Surface Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broken Pottery</td>
<td>Ceramics</td>
</tr>
<tr>
<td>Fragments</td>
<td>Red Clays</td>
</tr>
<tr>
<td>Deliberate Modifications</td>
<td>Striations</td>
</tr>
<tr>
<td>Tools and Technological Surfaces</td>
<td>Holes</td>
</tr>
<tr>
<td>Carved Surfaces</td>
<td>Engravings</td>
</tr>
<tr>
<td>Organic Remains</td>
<td>Wood Charcoal</td>
</tr>
<tr>
<td>Faunal Remains</td>
<td>Bone Debris</td>
</tr>
<tr>
<td>Plant Remains</td>
<td>Seeds</td>
</tr>
</tbody>
</table>

### Class of Indicators

<table>
<thead>
<tr>
<th>Indicator Type</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beads</td>
<td>Shell</td>
</tr>
<tr>
<td>Stones</td>
<td>Flint</td>
</tr>
<tr>
<td>Bone</td>
<td>Antler</td>
</tr>
<tr>
<td>Wood</td>
<td>Bark</td>
</tr>
</tbody>
</table>

### Craft Industries & Processes

<table>
<thead>
<tr>
<th>Process Type</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaving</td>
<td>Flax</td>
</tr>
<tr>
<td>Spinning</td>
<td>Wool</td>
</tr>
<tr>
<td>Pottery Making</td>
<td>Clay</td>
</tr>
<tr>
<td>Metalworking</td>
<td>Copper</td>
</tr>
</tbody>
</table>

### Distribution of ACA in Activity Areas

<table>
<thead>
<tr>
<th>Area</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class of Objects</td>
<td>Beads</td>
<td>Stones</td>
<td>Bone</td>
<td>Wood</td>
<td>Metal</td>
<td>Clay</td>
<td>Flax</td>
<td>Wool</td>
<td>Cloth</td>
</tr>
</tbody>
</table>
In the present paper we shall confine ourselves to describe the Y axis of Tab. 1, i.e. the evidence relative to the detected craft industries, in order to establish the actual stand of each manufacture from the archaeological record, from both a locational and a processual viewpoint, as well as to determine to which extent the large spectrum of commodities consumed by the Moenjo-daro population was actually produced within the city. Such an attempt will complement from a different perspective the information presented in our first report (Bondioli et al. 1984). More detailed reconstruction of each manufacturing process will require specific studies, involving ethnographical comparison and simulation work such as those presented for the Harappan Culture by J.M. Kenoyer (1984), Halim and Vidale (1984), Hegde et al. (1982), developing a much finer scale of analytical definition. In general, a project such as the Moenjo-daro SEP is meaningful only if data are presented at different levels of elaboration.

It has already been stressed the strongly discontinuous character of craft indicators across the archaeological record (Bondioli et al. 1984: 19-21). This discontinuity results from a wide range of different factors as origin, composition, post-depositional behaviour and, ultimately, resistance to decay and erosion. Such a multi-dimensional variability calls for a rather elastic system of categories where to organize the emerging picture of the transformational activities performed. We shall take into account those craft industries more substantially represented at Moenjo-daro, defining with this term, rather loosely, 'groups' or 'families' of closely related production cycles. For the industries whose archaeological record is more consistent, exhaustive and detailed, it will become possible to articulate the discussion to include production categories such as processes and operation or 'stages' (Tosi 1984: 24), as the basic organizational units of a manufacturing sequence (Vidale 1983: 110).

In not a too distant future we expect to place a major emphasis in evaluating, among the detected transformational sequences of manufacture, degrees of segmentation and cooccurrence, representing forms of spatial distribution relevant to an explanation of the organizational structure of craft and compatible with an archaeological record. \textit{Segmentation} is here described as the spatial dislocation of one or more manufacturing
cycles, while *cooccurrence* is determined when different manufacturing cycles are spatially integrated in the available data, i.e. within a single activity area.

Tab. 1 contrasts the 39 categories of craft indicators as classified by Tosi (1984: 25) so far detected across the surface of Moenjo-daro against the total of 37 classes of commodities representing the artifacts found in the city from 1921, and grouped according to presumed production cycles or craft industries. Those are portioned in pyrotechnological industries, heavily emphasized in the surface record of any site for the higher resistance of slags to all factors of weathering, and extractive ones representing rather indiscriminately all manufactures that do not involve any other physical transformation of matter than its reduction. It is a controversial issue whether certain extractive manufactures did involve a significant degree of thermical transformation, such as flint knapping, colouration of chalcedony through heating, or, for example, the production of steatite seals vitrified after baking treatment. The proposed ubicac of such manufacturing procedures in the frame of extractive industries is based on the confined role those stages play in the entire cycle. Even after this rather gross grouping, not less than 14 out of 37 classes of industries, i.e. 37.83%, remain unrepresented through the surface record. Although at the present stage of investigation this result is still largely a product of limited analysis, it is largely evident that the archaeological record will fail to document a large percentage of manufacturing sectors, unless more innovative methods of detection and evaluation are introduced aside a steady growth in investments.

*Brick Baking*

Once we consider the importance of brick baking as a known character of distinction of the Indus Civilization from the early days of Harappan archaeology is remarkable how elusive its evidence has remained so far. No installation monitored to this purpose has been detected at Moenjo-daro or on the surface of its peripheral mounds, while the extension of brick production remains everywhere massive in front of us. Quite expectedly kilns or baking pits were located in direct proximity to clay
sources, which in the Indus floodplain is no specification of any place. We may assume that baking areas would have been at some distance from the center, but the few radial prospectings we have carried out so far have failed to detect any area of extensive burning. According to Marshall (1931: 266, 268) the main constraint in brick-baking areas dislocation would have been proximity to the large amounts of wood needed in firing. On the other hands, traditional brick-making techniques recorded across south-western Asia and particularly in Iran are based on very poor wood fuel, such as desert shrubs, burning with a long, intensely hot flame for an average of 72 hours (Wulff 1976: 117). In most types permanent structures of kilns would consist of a small fireplace, while the stacking of unfired bricks itself would build up the superstructure. As a result even recent brick-baking areas abandoned at outskirts of towns become rapidly invisible. The lack of evidence at Moenjo-daro might then be the result of such a specialized technology that could produce large masses of standard bricks in spite of the insignificance of the wood burnt, leaving very little in terms of fuel or clay waste.

Pottery Making

A series of kilns and areas characterized by the presence of pottery-making wasters had been detected by the early excavators in various areas of the town. Some kilns in HR and VS areas (Marshall 1931: 193, pl. LIa; 225-226, pl. LVIIIb) had to be referred to small, isolated productive units, while the larger complex of installations and dumps of DK-G north (part of which corresponds to our AA 32) would represent the result of the transformation of a residential area into an industrial compound (Mackay 1938: 6). Beside the discovery of at least 6 kilns this interpretation was supported by the presence of a large amount of ceramic refuse, as well as by the poor quality of the structures in which the kilns were found; such a context, according to the

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3 More recently analytical investigations on the destructive effects of salt have proposed that baking temperatures for bricks would have been over 700 (Ludwig 1983: 156).
excavator, should be related to the decline of the urban organization. According to Mackay, such a decline was clearly demonstrated by the discovery of a kiln in the middle of the great DK-G road (ibid.: 6, 33, pl. Xd); some other areas of the town indirectly revealed the presence of pottery-making activities in decayed residential contexts, as in the case of L area, where, like in DK-G (Mackay 1983: 57), brick-robbing pits had been re-filled with kiln wasters (Marshall 1931: 174).

Description of this kind of evidence in the published reports is always very summary; details on the technological features of the kilns are missing, and only rarely we find specific functional interpretations. The kilns are, in general, up-draught structures, having a lower firing chamber separated from the upper one by a perforated grate supported by a pillar. The firing chamber is round or oval in plan; maximum dimensions of the kilns range from $2.20 \times 1.60$ to $1.60 \times 1$ m. Usually sunk into the ground, the firing chamber is outlined by a single row of vitrified bricks.

In a single case a kiln was found to contain some artefacts that could be identified as the product to be fired, i.e. a group of ‘half baked betel-leaf-shaped clay plaques’ (Marshall 1931: 193, pl. L1a). In another context, the identity of the product was suggested by a nearby dump of pottery misproducts (Marshall 1931: 102, pl. LV16). All the observed situations apparently belonged to the upper levels of the ruins.

Wasters from pyrotechnological transformational activities are a very common feature on the site’s surfaces. The green-blackish slags of vitrified earthen lumps, almost ubiquitous across the Moenjodaro compound, present a striking morphological and dimensional variability. On every section of the site the densities vary from a few specimens to clusters forming almost compact pavements. Slags represent almost exclusively ceramic production, and pottery-making is the preponderant manufacture. As industrial activities, those are of particular relevance for the SEP not only because of the qualitative and quantitative amount of retrieved evidence, but also for the dual value of pottery as a commodity and as a chronological indicator.

On the basis of the observed characters slag assemblages have been recognized as pertaining to three main classes of con-
centrations: nodule floors\(^4\), pottery-firing dumps, stoneware-firing waste spreads. Dumps associated to pottery-making are identified by occurrence of individual or packed overfired potsherds and vitrified kiln linings. Since 1983 pottery and such manufacturing installations had been selected as the object of a separate research project, aimed to evaluate the manufacturing processes. Recovered in connection with dismantled infrastructures, pottery types may rescue their chronological significance, thanks to the safe contexts of cooccurrence otherwise randomized by salt erosion on exposed surfaces.

Assuming that clusters of kiln wasters annexing vitrified potsherds could pinpoint firing installations closer to ground level, we proceeded to the exploration of specimen areas, covering the main geomorphological configurations of the site: plateau hummocks, depressions etc. In each case surface was stripped and cleaned to evaluate degrees of disturbance of the original archaeological deposition through a stratigraphical recording of horizontal topsoil variability. Surface distribution were mapped and graphically classified according to an operational typology to overfired remains. A grid based on 250 cm squares was laid over the areas of wasters occurrence. Finer soil fractions were then removed by vacuum cleaner, and immediately sieved in order to

\(^4\) The so called ‘terracotta nodules’ formations are rather uniform spreading of hand-modelled, sub-spherical lumps of overfired greenish clay, which appear actually to be the most substantially represented indicators over wide sections of the town’s surface (fig. 1). They are concentrated in 4 main areas: South of AA 27, for an extension of about 2000 sq.m, South of AA 31 and 35, with about 6000 sq.m, South of AA 27, with 3000 sq.m, Southwest of the Citadel mound, with about 3000 sq.m. Such surface formations account so for about 13000 sq.m, an estimate to be increased adding to the mentioned sites part of the much-disturbed slopes of L area and other minor clusters. No final explanation of the functional meaning of such an important indicator is to date available. The first observations would point to some kind of connection with ceramic firing processes, but this hypothesis calls for specific studies. At Kalibangan (Lal 1984: 60) the excavators noted extensive employment of such overfired nodules in masonry, mainly as standardized components for building foundation with insulating and draining purposes. At Moenjo-daro layers of overfired nodules are commonly encountered as thick substructions carefully laid under brick floors or ‘bathing platforms’. Some localized spreads of overfired nodules might therefore result from eroded structures, having so no connection with industrial activities.
Fig. 1 — General distribution map of craft activity areas across the Moenjo-daro compound.
evaluate surface variability by weighing the different components of the sediment.

Observations of this kind were carried out in three separate areas, respectively located on a plateau area south of DK-B,C (2820/1395), Southeast of AA 27 (2870/1030), and on a low relief within the major concentration of AA 32 North of the excavated DK-G complex (2550/1845). In the two first cases sub-surface observation confirmed the actual presence of a kiln. In the site south of DK-B,C the wasters' concentration, covering an area of about 6 sq.m, turned out to mark the location of a kiln with a sub-triangular ground plan, measuring $1.40 \times 1.50$ m (figs. 2, 3).

Fig. 2 — Moenjo-daro: sub-surface stripping on the concentration of overfired remains South of DK B.C.

The chamber, eroded in its topmost part, is bound by a row of almost complete re-utilized bricks. Inside the chamber, on the wall facing the stoke hole, two recesses with evident signs of overfiring indicate the possible presence of two vertical flues.
Fig. 3 — Moenjo-daro: Plan of the kiln in the site South of DK B.C after surface stripping, showing the outline of the chamber and the internal variability of the filling.

The kiln’s morphology reminds of the infrastructure unearthed at Harappa (Vats 1940: 470-71), but the position of the possible posterior flues would represent a feature so far unrecorded. The inner core of the chamber’s filling is formed by a layer of ashes, embedding drops of vitrified clay produced by melting plaster (fig. 6). Just in front of the stock-hole, in a quite excentric position for a kiln’s load, we found a group of vessels in advanced state of decay, due to the proximity of the pottery to the topsoil. It should
Fig. 4 — Moenjo-daro: the kiln Southeast of AA 27 before surface stripping.

Fig. 5 — Moenjo-daro: plan of the kiln in the site Southeast of AA 27 after surface cleaning. Dotted surfaces mark the remains of the firing chamber.
Fig. 6 — Melted clay drops.

Fig. 7 — Moenjo-daro: concentration of slags and other vitrified remains on the top of a low hummock in AA 32.
be stressed that the product to be fired could be found in direct contact with the fuel only in a single-chamber structure, and also in this case it would be expected in the interior of the chamber and not close to the entrance. It is so possible that these vessels represent some firing refuse thrown into the kiln after its abandonment.

In the site Southeast of AA 27 (figs. 4, 5) wasters were concentrated in an area of about 3 sq.m, and the structure in situ was partly visible before surface cleaning. The kiln presented a circular ground-plan, comparable with the already mentioned infrastructures discovered in the early excavations, with the kiln unearthed at Balakot by G. Dales (1974: 10, fig. 7) as well as with a kiln from Lothal (Rao 1979: 83, 118, figs. 11, 12; pls. XXXVIb, XLCl a, b). The kiln, measuring 2.00×1.70 m, has a stock-hole 70 cm long. From the back of the lower chamber departs a tongue-wall about 90 cm long. Sub-surface inspection suggested that it had been eroded down to the floor of the firing chamber, of which were visible irregular patches of vitrified compact clay. Certain details, such as the double linings of the posterior part of the kiln, would suggest subsequent restorations of the firing chamber and the possible presence of more superimposed floors. Like in the preceding case, the kiln was probably sunk into the ground, or supported by a filling, as shown by the weakness of the walls (10-15 cm), statically unconceivable for an aereal structure of this size. No evidence is available about the nature of the product to be fired, with the possible exception of a scanty presence of overfired sherds.

In AA 32 another concentration of slags and other vitrified remains on the top of a small, low hummock (fig. 7) turned out to be simply the product of the selective action of erosive processes, leaving the largest blocks on a restricted portion of the relief, and scattering the lighter fraction along the gradient.

In all the sampled areas vitrified wasters remained the most abundant indicators also after surface stripping. Cleaning revealed the presence of a wide range of artefactual types, almost totally composed of perishable clay elements which, generally, may be related to specific segments of the transformational sequences only according to their locational setting.

The identified classes of indicators are listed in Table 2 according to Tosi’s categories (1984: 36-37). Tools for forming are
Table 2 — Identified classes of craft indicators related to pottery manufacture at Moenjo-daro.

<table>
<thead>
<tr>
<th>Stage of Manufacture</th>
<th>Kilns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>burnishers (argillite pebbles)</td>
</tr>
<tr>
<td>C</td>
<td>Ac</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

so far almost completely missing; this may be due either to non-representation of perishable products in wood, leather and cloth, or to actual patterns of dislocation of forming process.

Following results of the first campaign we have been able to develop a preliminary typology of overfired ceramic slags based on their morphological features. In Table 3 this typology is organized according to progressive stages of vitrification. The different types are then referred to their expected and/or observed position inside the kiln. The three vitrification stages are empirically determined on the base of formal characteristics of slags approximately corresponding to those considered by Tite et al. (1982a, b) in their ceramic analysis.

As previously stated, only two of the sampled areas actually corresponded to kilns in situ; in the third case, the cluster of misproducts covered a formation of ceramics only a small part of which was overfired, whose features — incoherence, preva-
Table 3 - Morphological classification of ceramic remains according to the assumed stages of relative vitrification of clay, locational attribution within the infrastructure and structural origin.

<table>
<thead>
<tr>
<th>Structural Components of Kiln</th>
<th>Vitrification Stages</th>
<th>Locational Attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bricks</td>
<td>OB</td>
<td>all parts</td>
</tr>
<tr>
<td></td>
<td>PV</td>
<td>all parts</td>
</tr>
<tr>
<td></td>
<td>PM</td>
<td>inner side of walls</td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>under mid grate</td>
</tr>
<tr>
<td>Clay Linings</td>
<td>CC</td>
<td>proximity of flues and chimneys</td>
</tr>
<tr>
<td></td>
<td>MC</td>
<td>over mid grate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>against walls</td>
</tr>
<tr>
<td>Unidentified Parts</td>
<td></td>
<td>rear surfaces exposed to heat</td>
</tr>
</tbody>
</table>

OB: overfired bricks (see fig. 8); PV: plain vitrified surfaces (fig. 9); ST: stalactite-like formations (fig. 10); CC: chaff-tempered clay linings (fig. 11); MC: melted chaff-tempered clay linings; BM: bubbled melted surfaces (fig. 12); FS: fracture surfaces (fig. 13); DM: drop-covered surfaces (fig. 14); WM: wrinkled melted surfaces (fig. 15); CM: coarse vitrified surfaces; VD: vitrified clay drops (fig. 6).
Figs. 8-15. — Variability of the surface features of structural components of kilns according to the scheme presented in Table 3. Fig. 8: overfired bricks (cf. tab. 3, OB); fig. 9: plain vitrified surface (tab. 3, PV); fig. 10: stalactite-like formations (tab. 3, ST); fig. 11: chaff-tempered clay linings (tab. 3, CC); fig. 12: bubbled melted surface (tab. 3, BM); fig. 13: fracture surface (tab. 3, FS); fig. 14: drop-covered surface (tab. 3, DM); fig. 15: wrinkled surface (tab. 3, WM).
Fig. 16 — Hypothetical model for the formation dynamics of a surface cluster of overfired ceramic wasters not produced by an infrastructure in situ.  
A. Incipient erosion of a dumped kiln block (1). The block is progressively cracked by thermal dilation combined with salt efflorescence.  
B. Progressive erosion lowers the surface level, exposing blocks (2) and (3) and scattering along the slope the crumbled remains of block (1).  
C. The crumbled slags are captured into an erosion gully.  
D. In horizontal projection, the output of the erosion process resembles the clusters that, in primary contexts, mark the position of kilns in situ. Sub-surface evaluation, in this case, would reveal that such a distribution is more apparent than real: weighing the slag fraction embedded in the sub-surface loose sediment, one would recover a substantial amount of non-concentrated particles, revealing the more randomized distribution of the dispersed refuse.
lence of ceramics over the clayish matrix — could be referred to
dumps produced by ceramic manufacture. While in the infra-
structures the concentrations were determined by the erosive at-
tack of the topmost parts, in the dumps concentrations were
produced by hydraulic-gravitational selection combined with pro-
gressive crumbling of the exposed remains. Fig. 16 sketches in a
graphical model the dynamics of formation of slags' surface clus-
ters analogous to the one observed in AA 32. If the simple identi-
fication of a surface cluster does not support the recovery of a
kiln, the study of the inner variability of the cluster's com-
ponents may provide more precise information. Melting drops,
for instance, when found densely packed in well defined concen-
trations (like in the case of the kiln in AA 40 — Bondioli et al.
1984: fig. 6) would appear to indicate erosion of a firing chamber
and, consequently, the location of a kiln still in situ (the firing
chamber, being sunk into the ground, was a much less precarious
element than the upper one, which had to be restored and, some-
times, reconstructed after every firing, and was anyhow more
affected by collapse and dispersion dynamics).

At this very preliminary stage the observed situations are
still too restricted to allow any generalization on the nature of
the Moenjo-daro ceramic production. The first data would con-
firm the presence of both isolated kilns and larger specialized
areas. Considering how imprecise is still our control of the chron-
ological meaning of Harappan pottery types, it is hardly pos-
sible to speculate on the possible cooccurrence of two forms of
labour organization.

Stoneware-Making

The material which, for sake of simplicity, is defined 'stone-
ware' was described in the excavation reports of Moenjo-daro
and Harappa (Marshall 1931: 530, 686; Vats 1940: 449) as being a
sophisticated ceramic distinguished by outstanding compositional
and textural characteristics (Halim & Vidale 1984). Stoneware
production appears to have been strictly confined to a single type
of commodity, namely a kind of ceramic ring (figs. 17, 19), most
probably to be worn as a bangle, whose gray-blackish or pinkish
shadows often present diffused whitish mottlings, suggesting so
Fig. 17 — Moenjo-daro: fragment of stoneware bracelet with incised micro-inscription.

Fig. 18 — Moenjo-daro: fragment of stone-ware bracelet with incised micro-inscription with three signs.

Fig. 19 — Moenjo-daro: unbroken stoneware bracelet.
a conscious attempt to imitate some features of veined metamorphic rocks. Such a sophisticated compositional standard, the vitreous texture of the material, the absence of macroscopic inclusions or air bubbles, point all to extremely elaborated, painstaking processes of tempering and refining of clay materials, probably involving long-term investments of labour-force for decanting and re-mixing stages (like in the case of the later, classic Chinese stoneware). This sphere of the manufacturing cycle, however, due to a complete lack of archaeological evidence, remains
in the realm of probability. Like in the case of the more common pottery-making industry, our observation range is strictly limited to the massive documentation of products and misproducts resulting from the firing process (Halim & Vidale 1984: 64-65). After the 1982-84 campaigns it was possible to ascertain that stoneware bangles were fired inside small specialized saggers, endowed with a distinctive chaff-tempered outer coating with insulating purposes (ibid.: figs. 65-68). The saggers containing the bangles were superimposed to each other to form cylindrical columns, granting the product a uniform reducing atmosphere throughout the firing process which could be controlled in the most effective way (fig. 20). Somehow the recurrent use of minute inscriptions, ranging from 1 to 5 characters, minutely carved on the bangles before firing (figs. 17-18; Franke 1984; pls. 8-11), as well as the marking with other signs on the saggers’ lid (Halim & Vidale 1984: fig. 76) suggest particular controlled formalization to the production of this personal ornament.

The bangles’ firing saggers were recovered in partial association with remnants of larger specialized coated containers, apparently exhibiting similar nature. The recovery of some complete specimens and their careful technological examination lead us to realize that these larger saggers were the central element of very complex firing assemblages composed by more than 50 separate ceramic elements (fig. 21), taking into account the mouth closure assemblage, the saggar itself and the network of terracotta rings forming the basal support system (Halim & Vidale 1984: 87-88). All these elements were recovered within collapsed kiln-firing contexts (Bondioli et al. 1984: fig. 6), indicating the function of the containers’ system. This complex device, before the insertion in the kiln’s chamber, received sealings with unicorn-stamp seal impressions (fig. 22). Administrative control on kiln-firing processes might be explained hypothesizing an outstanding importance of the processed material. The recovery in 1984 of a kiln slag in one of the DK B,C dumps (Vidale, n.d.), in which is clearly visible a small saggar enclosing two superimposed stoneware bangles could indicate that the coated containers of the first type were sealed inside the larger vessels (fig. 23). These might have so worked as a further device to insulate the bangles during firing. This explanation would account for the spatial cooccurrence of the two types of coated vessels in kiln-firing context.
Fig. 22 — Moenjo-daro: sealing with unicorn-stamp seal impression on the mouth of an overfired coated carinated jar.

Fig. 23 — Moenjo-daro, DK-B.C dumps: overfired slag embedding a sub-cylindrical coated saggar containing two superimposed stoneware bracelets still retaining their original setting.
Stoneware bangles' production or, more precisely, firing, although more substantially represented in the southeastern corner of the 'lower town', would recur in other sections of the compound as well (fig. 1). This pattern would appear more scattered if the hypothesis of a direct functional connection between the two indicators will turn out correct. The importance of such an industry within the town's craft system would be demonstrated by the relative size of the surface concentrations of mis-products, whose total amount accounts now for 500 sq.m c., closely following the extension of chalcedony manufacturing areas (Bondioli et al. 1984: fig. 19).

**Metalworking and Related Industries**

Together with brickworking, metallurgy is the most conspicuous absence across Moenjo-daro. Oddly enough, once we consider how representative of the Indus Civilization those classes of artefacts have become for archaeology. Indeed these critical absences cast a shadow of doubt on the liability of our entire program, for what concerns its ultimate representation of the industrial organization of the great Sindhi center. Particular efforts have been made to search for both within and around the mounded region of the site presently enclosed by the Unesco canal. While the search for bricks' kilns have been unsuccessful and we lack any consistent explanation for it, after careful scrutiny of the surface we have recovered a little evidence of metalworking. It is very far from what we expected, considering two aspects of the problem: first, the diffuse use of metal at any level of Harappan world; second, the size of metalworking activity areas known from earlier and contemporary complexes in eastern Iran and Oman (Dales 1974; Weisgerber 1983). The high resistance of copper slags to any form of weathering transforms the waste dumps of the protohistoric workshops in the most impressive deflation pavements: gapless floors of hard shining rocks that have become true landmarks in desertic Sistan (Dales 1972: fig. 4). We expected something of this size and configuration also at Moenjo-daro which after all was at least eight times the size of Hissar in the late fourth millennium BC. Evidently our assumptions were wrong, but to some extent we may con-
struct a fairly consistent explanation. Three were the major areas of copper occurrence the Harappans could get their supply from, all three extensively exploited in second and third millennium BC: the Chagai massive of northwestern Baluchistan, the ophiolitic belt of northern Oman and the Ganshwar area in norther Rajasthan. While directly in control of this latter source (Agrawala 1984), the Harappans were in relation with both the others as evidenced by the occurrence of their pottery and their artefacts (Dales, personal communication; Cleuziou 1984). As ascertained by Weisgerber in Oman (1981; 1983), copper in this period was largely extracted from the ore in very close proximity to the mining areas and it travelled towards the urban centers partly as ingots and partly in form of semi-refined lumps technically known as Matte. Further refining would have taken place in the workshops within the consumption areas, at the other extreme location, suggesting alloying already at this very preparatory stage. As a result the quantity of smelting waste, the most remarkable of the by-products in the archaeological record, dropped consistently in all the centres of consumption. Copper would have been introduced at Moenjo-daro either as refined metal, in ingots, bars, rods, or as Matte thus requiring various stages of refinement and alloying in crucibles and/or small furnaces. A little amount of small light slags very poor in copper content would have been produced aside prills’ spreads. This description closely corresponds to the small surface clusters of indicators so far recovered at Moenjo-daro.

An example of such clusters is provided by the Activity Area occurring in our list with number 19. The site was identified on the surface of an isolated hillock (fig. 24) about 10 m long on the East-West axis and 1.5 m high, aligned with the row of possible workshops detected on the southern flank of HR East, perhaps along the edge of a single great mudbrick substructure (Bondioli et al. 1984: 30). Here, scattered on an area of 4-5 sq.m c., we detected a small cluster of bronze smelting wasters, including some fragments of the furnace’s walls, a bronze slag, some prills and a single perforated cylinder of copper.

A recent survey by the authors among the collections from the Bronze Age excavations of Failaka in the Kuwait National Museum and on the surface of the site itself has produced a substantial reconsideration of major metalworking activities
Fig. 24 — Cluster of bronze smelting wasters on the southern flank of HR East.

carried out on the island during the first half of the second millennium BC, a cultural context in close contact with the Indus Valley and its culture. While slags are rather scarce and concentrated along the northern edge of the site, thousands of rods, small bars and shapeless masses of melted copper bear witness of intense metalworking. Round and square-sectioned rods, 0.3 to 0.8 cm in diameter, were standard units by which refined copper was transported and a great number of tool types were produced from. At the same time, such rods and rod-like fragments form a very frequent class of metal finds in the Moenjo-daro inventory (e.g. Mackay 1938: pl. CXXIV 1-23, 26; CXXX 1-7, 16-17; CXXXI
1-11). The likely assumption is that metal was worked at Moenjodaro, but, as in the small Failaka compound, it was introduced mostly in a refined state, to be manufactured for a greater extent by cold hammering of rods and bars. The amount of waste product would have been irrelevant and we should rather look for indirect sources of evidence to evaluate occurrence of such transformational activities.

Equally indirect is the type of evidence we expect for the cycles of more precious metals like silver, gold and electrum, whose popularity is well known from the Harappan jewellery hoards. Silver-lead ore smelting has possibly been recognized in AA 38, a surface concentration about 20-25 sq.m large, characterized by the cooccurrence of a wide range of indicators relative to quite different manufacturing cycles. In particular, it may be observed that the possible silver-lead smelting traces — a metal slag and a small crucible identical to the one nowadays used by the goldsmiths of Dokhri — were found together with a handful of glassy slags, steatite debitage and bone micro-splinters, an association possibly connected with faience glazing (Sher & Vidale, n.d.; Vidale 1985a).

Faience-Making

The archaeological literature recognizes in the Harappan production two basic types of faience: the first variety is a ceramic with a siliceous body, mainly composed of ground quartz (Marshall 1931: 686-87) and a second one whose body was composed of steatite paste (ibid.: 576-77, 687). In both the cases, the manufacturing sequence probably included processes of grinding and refining the raw material, a forming process by shaping, moulding or extruding, finally followed by glazing and firing (with a possible intervention, furthermore, of a preliminary firing after forming). Given the nature of the material to be ground, bond and reformed into the faience core, it is possible that faience production could have depended on the debitage left by other cycles transforming silica oxides like, for example, rock crystal or chalcedony, or in the second case, on the debitage produced by steatite manufacturing units. In this perspective, supply of raw material for faience-making should be looked for
in and around the network of workshops contemporarily active in the town.

The possible evidence of faience-making we have been able to identify at Moenjo-daro is still rather doubtful, represented by the association of vitreous shapeless slags, steatite debitage with sawing marks and bone remains we have described for AA 38 (Bondioli et al. 1984: 30). In the same site, such remains were found together with ceramic walls or linings bearing analogous vitreous encrustations, suggesting the presence of specialized crucible-like containers and/or small firing infrastructures. In the cases we could observe, such surface evidence was always characterized by very small-sized clusters, never exceeding 3-4 sq.m. This circumstance could indicate small, light pyrotechnological installations easy to dismantle, whose identification across the surface of the site requires highly accurate standards of actual ground inspection.

Steatite Working

Debitage left by small steatite-working units has been identified, to date, in different parts of the town. In a separate report (Bondioli et al. 1984: 30) we have mentioned Kenoyer's discovery of a concentration of steatite wasters within the borders of the DK-G North old trenches, in the site labelled AA 14 (fig. 25). This

![Fig. 25 — Moenjo-daro, AA 14: steatite debitage from a possible disc-shaped beads manufacture.](image-url)
is the only one area in which we could probably observe the residual evidence of the manufacturing sequence of the thin disk-shaped white beads sometimes known in the literature as 'wafer beads' (Mackay 1937: 13; 1943: 205). The blanks would be represented by tiny unfired platelets with irregular contour, bearing a central hole, exactly corresponding to analogous indicators from Chanhu-daro (Mackay 1943: 212). The plates were recovered in association with parallelepiped-shaped blocklets with bi-polar perforation. Size of the AA was evaluated around 25-30 sq.m, but such a value is biased by the surrounding context of excavated structures. To the list of steatite-working surface occurrences we may add the wasters recovered by Kenoyer on the very top of the western dump of Moneer excavations. Although in secondary context, the evidence is substantial enough to indicate that these transformational activities were performed in the nearby excavated houses. The extension of the survey along the western slopes of the compound, furthermore, allowed us to point out a series of small units sharing the outcropping of steatite debitage. These AA are lying approximately in a row, at the foot of the slope, for a length of about 100 m; they are, as a rule, very small, averaging 10-15 sq.m. AA 9 presents indicators suggesting the separation of the stone from its calcareous gangue, and, possibly, its heating or baking; other concentrations were mainly composed by debitage with sawing marks, which, in one case (AA 47: figs. 26-28) could be arranged into a preliminary reconstruction of a bead-making sequence. The recovered parallelepiped-shaped blocklets were analogous to the ones found in the mentioned AA 14. As it has been stated in discussing faience-glazing, the cooccurrence of vitreous slags and steatite debitage has so been detected in this part of the site.

If, on the one hand, the identification of these small units in different sites of the compound (DK-G North, Moneer, DK-A West) speaks in favour of a decentered pattern of distribution, on the other one the concentration of sites identified along the western slopes, characterized by a relative degree of technologi- cal interdependence, would appear to conform, at least partly, to a selective strategy.
Fig. 26 — Moenjo-daro, AA 46: concentration of steatite debitage on the site's surface.

Fig. 27 — Moenjo-daro, AA 46: stick-like, square-sectioned elements in steatite relative to a bead-making manufacturing sequence.

Semiprecious Stone-Working

With this term we define a complex of manufacturing cycles holding a primary place in the Moenjo-daro craft production. ‘Semiprecious Stones’ are, rather generically, a wide, heteroge-
neous group of minerals and rocks employed, through the adoption of specific technological sequences, to produce an equally wide range of products. The most represented group of stones falls under the definition of silicium oxides, i.e., the minerals of the quartz series in their opaque (banded chert, jasper, plasma, heliotrope), translucent (mainly chalcedony in its numerous inner varieties, among which dominate different types of agate) and transparent (rock crystal, amethyst) varieties (Vidale 1985b). Next come different silicates, comprehending serpentine and the rare lapis lazuli. All across the compound, distribution of steatite-processing appears to be clearly independent of the other stone-working areas, underlining the autonomous character of this industry. In particular, chalcedony and steatite-working would appear mutually exclusive: in the case of AA 40, out of more than 3000 lithics, not a single steatite piece was recovered.

Other stones which are rather frequently found within the surface concentrations we are discussing are sedimentary (limestone) or metamorphic rocks (marble, breccia and others). Lithic debitage on the surface of Moenjo-daro lacks the immediate self-evidence which characterizes other classes of indicators. Although a certain percentage of semiprecious stones debitage may occur in different, large sections of the site, after a careful inspection at 20-30 cm of distance from the ground we have been able to single out some anomalous concentrations. The identifi-
cation of more units is doubtless dependent on the extension of the observation according to such standards of accuracy. The areas to date identified have normally a size corresponding to the space of 1 or 2 rooms of a residential house; altogether they account for a total of almost 2000 sq.m, characterizing so semiprecious stone-working as the most important non-pyrotechnological industry of the town. This statement is somehow biased by the strong incidence of a single area, i.e. AA 40, the largest semiprecious stone-working unit so far discovered, accounting alone for 1200 sq.m. It must be stressed, anyhow, that such an areal could easily turn out to be simply the result of relatively modest heaps of flake debitage scattered and washed along the mound’s slopes; comparison with the modern stone-working units of Cambay show that small quantities of processed material may generate striking amounts of wasted flakes.

In the attempt to briefly outline the nature of these surface assemblages, we shall make reference to the anomalous AA 40, object of the most intensive surface collection effort of the Project, as a descriptive model. AA 40, also called Moneer Southeast Area, stands out from among the other sites not only for its outstanding dimensions, but also for the relative completeness of the archaeological record (Bondioli et al. 1984: 24; Vidale 1985a). As a feature of these assemblages we have mentioned a relative degree of heterogeneity in the processed raw materials, matched by a correspondent variability in the produced commodities. In the case of the Moneer Southeast Area, the picture is further complicated by the occurrence, within the processed stone debitage, of a substantial amount of chert items, namely wasters produced by the manufacture of polyhedral cores, discarded and/or broken bladelets, unfinished and finished, utilized chert drill-heads, as well as a wide range of other specialized tools such as different types of blades, end-scrapers, hammerstones. The technological relationships of these classes of indicators with the more isolable semiprecious stone-working cycles is a future research topic strictly depending upon development of wear-trace analyses.

As the quartz series predominates, from the quantitative viewpoint, over the other materials, bead-making sequences at Moneer Southeast Area prevail over the other cycles. Small agate and chalcedony beads were manufactured starting from supplies
of small lumps and geoids (Vidale 1985a: fig. 32). The manufacturing sequence conforms to the schedule reconstructed by Mackay at Chanhu-daro (1937) and recently re-encountered in the study of the eastern Iranian workshops of third millennium BC (Bulgarelli and Tosi 1977: fig. 6). The lumps were turned into square rough-outs by a chipping technique sometimes simplified by exploiting the presence of macrocrystalline inner formations determining diaclastic planes. By combining series of chipping-breaking operations the lapidaries of Moneer Southeast Area were able to produce parallelepiped-shaped blocklets ready for further processing. Defective blocklets are a rather common find in the record from AA 40, probably representing the witness of a critical point of the manufacturing sequence. The blocklets were subsequently shaped into beadblanks by rubbing them onto broken, re-utilized sandstone or quartzite blocks (fig. 29). The sharp edges and corners of the blocklets, the rubbing of small bead blanks with rounded sections left on the surface of the blocks or grinding-stones some characteristic radiants of streakings. Examination of the polished, rejected or unfinished blocklets reveals that this operation, involving excentric pressures on banded stones whose veins determined differential resistance de-

Fig. 29 — Moenjo-daro: re-utilized quartzite grinding stones with bead-smoothing grooves.
grees to friction, could frequently produce breaking or flaking. The bipolar perforation of the blanks was accomplished by bow-drills bearing the phtanite heads (fig. 30) already known from Chanhu-daro (Mackay 1943: pl. LXXVIb, 8), Mehrgarh (Jarige 1981: 109), Mundigak (Jarige & Tosi 1981: 135), Shahr-i Sokhta (Piperno 1973; Tosi 1973: figs. 2-5; Piperno 1976: figs. 2-4; Piperno 1981; Gwinnet & Gorelik 1981: 23), and Shahdad (Salvatori & Vidale 1982: 8-9, fig. 3). Still rather doubtful is the dichotomous cooccurrence of phtanite and chert drills which, at Shahr-i Sokhta and Hissar were employed with lapis lazuli and turquoise beads. Perforation, due to the inner disomogeneity of the banded stone and/or excentricity of the drilling pressure, resulted sometimes in splitting or exploding the blank. The impression one gets in examining the whole sequence is one of relative efficiency, being the fruit of an intimate knowledge of the idiosyncratic behaviour of the different varieties on record to minimize the waste. If we think, furthermore, that together with the mentioned chalcedony group we find quite different stones, such as serpentine, which splits according to large inner diaclastic planes, or lapis lazuli, whose single perforated roughout demonstrates the presence of the grooving-and-splitting technique identified at Shahr-i Sokhta (Tosi & Piperno 1973), the range of technological constraints imposed by the materials onto the transformational sequences becomes larger and larger. Besides
bead-making, the assemblage from AA 40 comprehends broken squared rough-outs of banded chert for cube-shaped weights making, as well as some unfinished items documenting the manufacture of small objects generically rubricated as gaming pieces. The resulting pattern of production is so rather complex and diversified. If the various cycles were contemporaneously performed by the same unit, it had to master a correspondingly wide, composite knowhow.

**Shell-Working**

In the frame of the 1983 field season J.M. Kenoyer was invited at Moenjo-daro to carry on a complete survey of the shell industries, in the Museum collection as well as on the surface of the site. His results are extensively published in other reports (Kenoyer 1984), one in the present volume. Some workshops for the production of shell inlay elements have been encountered during the old excavations, together with some possible deposits of unfinished items or waste cores to be reprocessed (Kenoyer 1984: 106). On the surface of the site Kenoyer was able to detect some major concentration of shell-working indicators although his data seem to reveal an overall pattern of scattered localizations. As a matter of fact, a limited amount of shell-working manufacturing wasters commonly occurs in most of the areas presenting remains of other industries (Bondioli et al. 1984: 32-34). In the case of the Moneer Southeast Area, for instance, shell manufacturing wasters accounted for less than 1% of the total amount of indicators, suggesting that this craft was partly carried out together with semiprecious stone-working, but in an irrelevant rate. Kenoyer reports a single, significant divergence from this scattered distribution of shell working indicators: an important discovery was made on the surface of a low peripheral mound East of the main compound, presenting a heavy concentration of fragments produced by chipping tips of *Turbinella pyrum*. According to the author (Kenoyer 1984: 107) this operation was necessary to remove part of the body of the animal, in order to clean the shell for further processing. Etnographic comparison with modern Bengal ultimately suggested the existence at Moenjo-daro of a clear-cut form of segregation of a well de-
fined group of craftsmen possibly because of the highly polluting character of the performed activities.

Concluding Remarks

At such an initial stage, our preliminary survey of craft activities at Moenjo-daro could have only provided a most uneven picture. While hardly any conclusion could be drawn from the random observations assembled so far, it is anyway worthwhile to point out a few aspects of relevance that might direct future lines of investigations.

First of all we should consider the ratio of consumed versus produced goods. Moenjo-daro was a great urban center, drawing agricultural surplus from a wide alluvial region of northern Sind, and we expected that as a center it would have functioned by concentrating a number of specialized activities, craft production being one of them. Quite evidently, at least in the final period of its existence, best represented in the actual surface record, this assumption meets with a rather bizarre factual evidence: the many production units within the city were primarily in small fancy articles of ornaments and leisure. Although some of these manufactures did incorporate quite sophisticated technologies, as silica glazing, cupellation or stoneware production in closed containers, we are left at the end with none of the great industrial activities that stood behind the wealth of artifacts unearthed by the early excavators. Only a small percentage of the produced goods was manufactured in the city's center, although even this restricted production might represent the whole of the ornaments known. Moenjo-daro, or, more precisely, its innermost core, was engaged in a limited sector of the industrial production it used; certainly, in none of the heavy infrastructural-demanding ones. No metal smelting, no metallurgical workshops, and very little pottery making, even considering the relatively impressive ceramic dumps in DK-G North (AA 32) and HR South (AA 35).

The second consideration developed is corollary to the first one: the average size of each possible production unit ranges around 25-30 sq.m, and c. 60% of the detected units are smaller than 100 sq.m. As noticed supra even the larger manufacturing
area of Moneer Southeast (AA 40) might represent a peculiar case of slope runoff fanning, so that the actual size of the point of origin may be considerably below the 1200 sq.m of the total surface spread.

Often smaller surface concentrations are aligned one after the other, apparently deriving from rows of units reminiscent in pattern of the traditional urban market areas of Asia or Medieval Europe. The image we might have pieced together could be that of an oriental bazaar, a quarter combining small manufactures and distribution units in shop-like arrangements. In such a context of spatially segregated allocation for distinctive services, we may also expect that a number of smaller, lower-ranking craft units did not hold rights for permanent occupation of a given space, but moved from place to place within the allocated town’s region.

These loose activities might be identified in scattered small patches of wasters, with little sedimentary deposition and no permanent installations. The presence of such a shifting component could in particular explain certain distributions of shell-working indicators observed across the compound. The most impressive shell-working concentrations recorded by Kenoyer (1984: 105-6) are related to inlay-working and might represent different kinds of manufacturing activities using shells as a mean of decoration. On the contrary, shell bangles’ manufacture, represented almost exclusively by Turbinella pyrum debitage, are encountered as loose concentrations. It is here suggested that these two types of occurrence derived from different organizations of labour. While bangles could have been clearly produced in small units for a retail demand, inlays were part of a complex use-reuse of various shell species including wasters of other cycles carried out only in true workshops.

In general, the evident alignments of activity areas in HR East or DK-A would indicate a monitored allocation of space of craft activity by the city’s authorities. If the analogy with the oriental market organization holds, we are getting only half of the picture, since all heavy industrial infrastructures would have been located at some distance from the center around its suburban belt (Bondioli et al. 1984: 15; Woolley 1976: 81-86, for Ur; Nicholas 1981, for Malyan). Unfortunately, the flat, low-lying surroundings of Moenjo-daro remain a very poor ground of obser-
vation, quite unreliable for surface investigation. Kenoyer's discovery of the mentioned shell-working unit outside the main mounded compound in Winter 1983 suggested that suburban locations at closer inspection might provide evidence of bulk industries (Kenoyer 1984: 107).

A recent short but successful survey by G.M. Sher and M. Vidale (n.d.) on the actual surface of Chanhu-daro, refreshing our knowledge of one of the most important Harappan centers to date extensively investigated, might suggest a different configuration of craft activities. Although this .5 ha site, at about 130 km SSE of Moenjo-daro, might have represented a kind of regional or districtual center, the proportion of its space which, according to Mackay's data (1943), was allocated to craft activities, is exceedingly higher than at Moenjo-daro, definitely ranging over 50% of the total amount. All the manufactures presently identified on the surface of Moenjo-daro have been recognized in the excavated materials or in the present surface of the site, with the only exception of stoneware bangles production, an artefact whose occurrence was apparently limited to the major urban centers of the Harappan Civilization. Chanhu-daro suggests strongly decentralized spreading of craft production across different levels of settlement hierarchy. The slightly larger site of Lothal (c. 6 ha) in Saurashtra proved an extensive involvement in different craft industries (Rao 1973: 80-108). Specific resources were often manufactured locally across the whole vast constellation of Harappan settlement systems, from the case of the Meretrix sp. bangles at Balakot (Dales & Kenoyer 1977), to lapis lazuli beads at Shortugai (Francfort 1984), to the chalcedony ones at Lothal (Rao 1973: 102-3). The size of these peripheral activity areas leaves no doubt on their effective orientation towards larger inner markets, as in the case of the Nageshwar factories in Saurashtra, where thousands of wasted columellae of Turbinella pyrum were stored in large heaps (K. Bhan, personal communication).

Future investigations will have to be monitored towards a combinatory analysis of settlement hierarchy to the surface distribution of craft indicators to evaluate quantitatively the rank/size order of sites and industrial allocation patterns (Johnson 1983; Tosi 1984: 49). As much as production, consumption of ornaments and other manufactured commodities seem to have
been rather widespread. Hoards of fancy jewellery have turned out in such minor centers as Allahdino in lower Sind (Fairservis 1982).

In every case, it remains that the average size of production units appears to be quite restricted, something the kind of a room and a courtyard. As analytically determined in our previous report (Bondioli et al. 1984: 32-34; figs. 20-22), size is neither related to specialization of manufacture nor to the degree of cooccurrence of cycles. Some of the smallest areas so far detected (AA 9, 38, 45-48) are related to such complex pyrotechnological productions such as steatite-faience glazing or silver-lead working. Technological features of interdependence seem to be very frequent among these types of industries. We are still very far from determining reliable lists of 'professions' partitioning the craft industries as a whole. The general impression is that intersection, juxtaposition and even combination of different manufacturing cycles was quite frequent: although this might be the case of compacting and crowding factor in the town's center. When occurring at Mohenjo-daro around 2000 BC craft industries had an at least 2000 years old tradition behind them, considering the strict spatial definition of craft activities at Mehrgarh in Period III (Jarrige 1983; Samzun 1984). We should not forget that the determinant factor of craft organization in Moenjo-daro, beyond any economical consideration, would have been the long selective process shaping the social relationships and articulating the craftsmen among themselves with the rest of the population.
REFERENCES


SERGE CLEUZIOU and BURKHARD VOGT

Tomb A at Hili North (United Arab Emirates) and Its Material Connections to Southeast Iran and the Greater Indus Valley

When in the thirties Sir Aurel Stein (1931, 1937) and N.C. Majumdar (1934) published their reports on reconnaissances in Sind and the Indo-Iranian borderlands, the possibility of cultural relations between that area and southeastern Arabia was certainly not a topic for archaeological research. The first attempt to trace such relations was made by the Danish team in the Gulf (Thorvildsen 1962) who tried to date and explain the unexpected discoveries at Umm an-Nar by comparing them to the material of Stein's prospections (still the only one available at that time) or B. de Cardi's work in Baluchistan. Reference was made to the Kulli style of pottery, according to a unique depiction of a humped bull on the shoulder of a small black-on-red jar at Umm an-Nar. Soundings by B. de Cardi at Bampur (1969), re-analysis of the Damin material (Tosi 1970) and excavations of the Harvard expedition at Tepe Yahya combined with the fieldwork of the Danish expedition in the Oman Peninsula slightly yielded more informations about contacts between both sides of the Strait of Hormuz. B. de Cardi already pointed out the occurrence of black-on-grey and incised grey wares in both areas while Lamberg-Karlovsky and Tosi, in a classical paper, included the Peninsula in the protohistory of the eastern Iranian plateau (1973). The sequences of Bampur, Tepe Yahya and even Shahr-i Sokhta were used in various attempts to date the material issuing from the first prospections in the Sultanate of Oman (Humphries et al. 1974, 1975; Tosi 1974, 1976) and to establish a cultural sequence for this region. The pitfalls were obvious, among them the restricted size of the soundings of Bampur, the problems in the preliminary sequence at Tepe Yahya and more general questions about the chronology of the Iranian plateau.
In 1975, K. Frifelt drew the attention further East by quoting a few similarities between the material of grave 1059 at Hili and the Indus valley itself (Frifelt 1975a: 368). During the last five years, more and more contributions have emphasized this aspect, each one bringing a new piece of evidence to an increasing set of data (among others Cleuziou 1981, 1984, forth. c; Ratnagar 1981; Weisgerber 1984). The exceptional discovery of a sherd inscribed with Harappan signs at the Ras al-Junayz (Tosi, paper read at this conference) came in time to strengthen the interest for the question. The aim of this paper is not to add one more review to an already long list, but to stress the relevance and significance of a well defined assemblage from the Oman Peninsula: Tomb A at Hili North.

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Tomb A at Hili North, the al-Ain oasis, the Emirate of Abu Dhabi, was excavated by the Mission archéologique française en Abou Dhabi collaborating with the Department of Antiquities and Tourism, al-Ain, during three campaigns between 1982 and 1984. The first results have been published elsewhere (Cleuziou & Vogt 1983; Vogt forth.a) and suffice it to recall that the monument belongs to a category of round collective burials known as the ‘Umm an-Nar type burials’ in the Oman Peninsula (Frifelt 1975 a, b) among which it ranges as one of the largest with 10.70 m in diameter. The facing of large ashlars and the monolithic doorstone recall tomb 1059 excavated by K. Frifelt (1970) at Hili. The upper part was widely destroyed but a subterranean part, dug 1.40 m into the ground, was found in rather good condition. Main differences lay in the plan of the interior, made of four parallel chambers instead of the cross pattern usually recog-

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1 The site of Hili North lays 2 Km North of the site of Hili. Presently, two graves have been excavated, named A and B. It should not be confused with Hili, located East of the village of Hili, where are located settlement 1060 and tomb 1059 excavated by the Danish team, settlement Hili 8 and tomb M excavated by the French team, and several graves (B-K) excavated by the Department of Antiquities and Tourism. Grave 1059 is now numbered as Hili A and settlement 1060 as Hili 1. See map in Cleuziou & Vogt 1983: fig. 1.
nized, but the general idea of a monument divided in two halves is kept (figs. 1-2). Despite further disturbances, two of the four chambers yielded layers of bones among which we were able to distinguish between material in situ in the lower chamber (fig. 3) and material fallen from the upper floor. Attribution of the grave goods to the upper or the lower floor could be elaborated but at this early stage of our study, no interpretation can be selected, although a chronological difference cannot be ruled out.

In a previous communication (Cleuziou & Vogt 1983), we advocated a date in the last three centuries of the third millennium BC, an occupation of 200-300 years being the maximum timespan. The domestic ware associated to the upper floor and found in the foundation trench (Cleuziou & Vogt 1983: fig. 9, no. 2) is identical to the material of phases IIIf and IIg at Hili 8, an assemblage which clearly postdates Akkadian period in terms of Mesopotamian chronology (2250-2000 BC; see Cleuziou forth.a:
Fig. 2 — General view of tomb A at Hili North.

table 1; and for argumentation outside the Oman Peninsula, Cleuziou forth.b). Eventually, the absence of Wadi Suq related material excludes a termination later than 2000 BC. This very end of the 3rd millennium BC is obviously a very sensitive period, with the extension of the Indus civilization westwards (Baluchistan) and northwards (Shortugai in Bactria), the end of the urban centres on the Iranian plateau and the appearance of the so-called 'Bactrian elements' as far South as Shahdad and Tepe Yahya. We shall therefore not use eastern Iranian or Indus-like material as indicators of the date of the assemblage of tomb A, but on the contrary consider their occurrence in a well dated context and its cultural meaning.

Goods deposited in tomb A include pottery, stone vessels, metal objects and personal ornaments like beads and pendants. Metal objects can be neglected in this study: they include two ‘razors’, a needle and several rings, all made of copper. It cannot be decided whether this scarcity is the result of plundering or of
rarity of the deposits. We should just recall here the finding of copper objects, tools and weapons, in several Umm an-Nar type burials such as Umm an-Nar itself (Thorvildsen 1962: fig. 18, 19), Hili (Bibby 1966: fig. 13) and Maysar (Weisgerber 1981: fig. 34).
SOFT STONE VESSELS

The bulk of soft stone vessels found in tomb A at Hili North belongs to an already well known type termed as série récente by Miroshedji (1973). These c. 80 items include mainly hemispherical bowls with a frieze of dot-in-double circles just under the rim, often accompanied by a horizontal groove on the rim and sometimes by a horizontal line under the frieze of circles. To the same série récente belong rectangular compartmented boxes with rectangular lids and cylindrical beakers with concave sides, both decorated with an all-over pattern of dot-in-double circles. Such vessels are common in Umm an-Nar type burials and their absence in some monuments, at Umm an-Nar itself or in tomb M at Hili (see Vogt forth.b) is probably a matter of chronology. Weisgerber (1981: 212) is probably right in considering that such vessels were made in the Oman Peninsula, the presence of unfinished vases at Maysar being an argument among others. If one looks at the distribution of these items within the Peninsula, Maysar 1 and the contemporaneous settlement of Bilad al-Ma‘adin are the only places where they appear in a significant quantity among a domestic context. Hili 8 only yielded seven sherds of such vessels, all from phases IIa and IIg (Cleuziou 1978-79: fig. 41). We are therefore not reluctant to consider that chlorite vessels in the Oman Peninsula were primarily made for funerary purpose during the last quarter of the 3rd millennium BC, if not a shorter time-span towards the end of this period.

Anticipating an archaeometrical demonstration still to be done, we consider that these items were also exported, bearing in mind that this does not imply that the Oman Peninsula was the sole origin. These objects appear in various contexts in the Gulf.

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2 Chlorite is abundant as a natural resource in the Oman Peninsula, and was widely used in protohistoric times. The region is supposed to be the origin of the two Arabian groups evidenced by Kohl et al. (1979) in their archaeometrical study of chlorite vessels.

3 The chlorite vessels published by Frifelt (1975a: fig. 17 d-e) originate from tomb 1059 at Hili. Another fifty fragments are mentioned from the Danish excavations at Hili and at Umm an-Nar by al-Tikrīti (1982: 192) without further precision. The chlorite vessels published by Frifelt (1976: fig. 4) from the stone tower at Bat are typical items of the Wadi Suq period (early 2nd millennium BC).
area, mainly in the burial mounds at Bahrain (Ibrahim 1982: fig. 45; Mughal 1983: figs. 24, 25). Other finding places include Tarut, where they are considered as Omani imports (Zarins 1978: pl. 72, nos. 103, 235, 300, 336), Susa (Miroschedji 1973: fig. 8, nos. 8-10; fig. 9, nos. 2, 3) and later graves in the Royal Cemetery at Ur (Woolley 1934: pl. 245, no. 53). A bowl from Tello was dedicated by Ur Baba, son of the merchant Shesh-Shesh to an unknown prince of Lagash (Miroschedji 1973: fig. 116) and is now dated of the third dynasty of Ur by D. Potts (forth.). In Southeast Iran, an hemispherical bowl is known from Tepe Yahya IV A (Lamberg-Karloffsky 1973: fig. 5 F). The only occurrence in the Indus area is an unpublished bowl on display in the Mohenjo-daro Museum 4.

A few vessels from tomb A at Hili North are very different from this main bulk in texture, colour, shape and decoration (or absence of decoration). Without a petrological examination, their provenience cannot be assumed with certainty, but from a stylistic point of view, some of them are attested in quite a large area. We shall focus here on the two most outstanding ones.

m.90 (fig. 4, no. 2) is a bell-shaped beaker with a slightly protruding base. Parallels are found at Tarut where they are rare (Zarins 1978: pl. 64, no. 33), Ur (Wolley 1934: pl. 245, no. 51), Tepe Yahya IV B_i (Khol 1979: fig. 18) and Shahdad (Hakemi 1972: pl. IX B, E). The only other example in the Oman Peninsula is a rim-sherd from an Umm an-Nar tomb in the Wadi Suq (Frifelt 1975a: fig. 18e).

m.225 (fig. 4, no. 5) is a small flask with a circular neck, bearing a dotted circle on each side. The shape is unique in the Oman Peninsula, as well as the technique. The interior, c. 2.5 cm in diameter, was clearly drilled whereas soft-stone vessels in the area are usually carved and chiselled. For this reason, we would like to consider it as an imported object. Close parallels are documented at Susa (Miroschedji 1973: fig. 11, nos. 1-6) but are mainly found eastwards: Tepe Yahya (Lamberg-Karloffsky 1970: pl. 24 E), Shahdad (Amiet 1976: fig. 8) and Bactria (Amiet 1977: figs. 7, 8) This object stands as the most clear link between the

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4 Seen by S. Cleuziou during a visit in November 1977.
Fig. 4 — Hili North, tomb A: selected chlorite vessels.
assemblage of tomb A at Hili North and the material known as 'Bactrian' all over the Indo-Iranian borderland at the very end of the 3rd millennium BC (Santoni, paper read at this conference).

Beads

Compared to older burials of Umm an-Nar type in the al-Ain area (Vogt forth.b), the number and the variety of beads and personal ornaments from tomb A at Hili North is rather limited. Material includes carnelian, shell, fritte, agate and, to a lesser extent, silver.

Of special interest are two etched carnelian beads, a still current technique in the lapidary workshops of the Indian subcontinent. This technique of etching with an alkaline paste is generally considered to have been exclusively acquainted by the Harappan civilization and was recently reviewed by Reade (1979).

Bead m.100 (fig. 5, no. 1) is oval with a lozenge-like section

Fig. 5 — Hili North, tomb A: selected beads (1 and 2, etched carnelian; 3 and 4, silver).
and a white-on-red design. The ornamentation consists of two pairs of concentric circles touching each other and enclosed by a kind of oval frame. Identical beads were found in later graves at the Ur cemetery (Wolley 1934: pl. 134) and in Harappan levels II/III at Lothal (Reade 1979: 19). They are referenced as type D8 by Reade who tentatively advocates a date between 2300 and 2150.

m.146 (fig. 5, no. 2) is a black-on-white etched carnelian, said to be produced by heating the material (Reade 1979: 5). It is oval, flat in section, with two etched concentric ovals at the periphery and four loops determining a cross inside the inner oval. An identical counterpart in white-on-red etched carnelian is reported from the later graves at Ur (Woolley 1934: pl. 134) and more distant parallels are published from Chanhu-daro (Mackay 1943: pl. 79, no. 15).

A single etched carnelian bead found at Umm an-Nar is attributed by Reade to his type B 1 (1979: 11), a rather meaningless class of objects. A barrel-shaped bead originating from tomb B at Hili, bearing a dotted honeycomb design somewhat comparable to Reade's type B 8 is displayed in the al Ain Museum.

Carnelian beads of various shades and shapes predominate among the material from tomb A at Hili North, and were obviously a praised item. Carnelian is usually reputed to come from India, but some minor sources in the Arabic Peninsula or on the Iranian coast near Bushir are also reported (Whitehouse 1975). It would probably be hazardous to assume an Indian origin for all the carnelian beads found in the Oman Peninsula, but the probability is high for part of them, including of course the etched ones.

**Pottery**

Potteries are by far the most abundant items found in grave A at Hili North. 384 complete profiles could be recognized, and c. 200 others are represented by rim-sherds, a rather similar number to that recovered from grave 1059 at Hili by the Danish team. In a previous paper (Cleuziou & Vogt 1983) we broadly divided this amount in two groups: domestic ware, which also appears in the contemporary settlements, and various classes of fine to medium ware which seem restricted to funerary contexts.
To make an example, domestic ware which occurs for more than 25% of the complete vessels in tomb A at Hili North represents 95% of the sherds collected at Hili 8 in phases IIf and IIg.

**Domestic Ware**

Domestic ware was clearly a local product made for everyday purpose and would not be expected to be found on the other side of the Strait of Hormuz. The only similar object reported so far comes from an early IV A level at Tepe Yahya where D. Potts (forth.) considers it as a clear importation from the Oman Peninsula. Unfortunately, the sherd reported (Potts forth.: fig. 1, no. 8), already published by Lamberg-Karlovsky (1970: fig. 16 D) may belong to phases IId to IIg at Hili 8, too long a time-span to be of some interest in that paper.

**Various Classes of Funerary Ware**

Here again, we shall keep a rather crude division, a more precise classification being presently worked out by S. Méry with the help of petrological and physico-chemical analysis (for preliminary results, see Méry forth.). These wares broadly fall within five groups:

1) Sandy buff ware with red slip, almost similar to domestic ware, used for the 'suspension vessels'.

2, 3) two groups of fine ware, red to buff, with black painted decoration.

4) Black-on-grey painted ware.

5) incised grey ware.

Other varieties occur for one or two pots each time and may be neglected for our purpose. We should bear in mind however that some pending questions are likely to be solved through further archaeometrical research.

**Suspension Vessels**

Suspension vessels with appliqué ridge and four lugs on the shoulder, ring base and everted neck, black-painted decoration representing a net all over the body and hatching on the ridge represent c. 9% of the complete vessels in tomb A. They range in
height from 7.5 cm to 16.5 cm, with an average around 11.5 cm. One can broadly distinguish between a globular type with a narrow meshed net and an elongated type with a wider meshed net, although all variants do exist. These vessels are a typical item of the late 3rd millennium funerary assemblages in the Oman Peninsula and are never reported from elsewhere.

**Black-on-Red Fine Wares**

The main category of black-on-red fine ware is well represented in practically all Umm an-Nar type burials throughout the whole Umm an-Nar horizon, a very long time-span covering period II at Hili 8 (c. 2700-2000 BC) which is not to be confused with the occupation at Umm an-Nar itself (see al-Takriti 1982). The typological evolution of shapes and decoration is hardly discernible although some decorative patterns seem to be restricted to the earlier phases (IIa-IIId) at Hili 8 (see Cleuziou forth.a: figs. 15, 16, 20). These patterns are not present among the assemblage of tomb A at Hili North. Another interesting fact is that such pottery, present in significative quantities in the earlier settlement assemblages of period II, slightly diminishes and is only represented by a few isolated sherds in phases IIIf/g contemporaneous with tomb A at Hili 8.

Shapes are restricted to two main types: globular vases with short neck and everted rim (fig. 6, no. 1), sometimes with a slightly protruding base, and barrel-shaped vessels with cylindrical to slightly conical body, short neck and everted rim (fig. 6, no. 2). These shapes appear in the early Umm an-Nar tomb at Hili M and persist until the end of the Umm an-Nar period. Only the upper part of the vessels is painted, with simple geometric patterns like wavy lines, horizontal lines, friezes of strokes on the shoulder and multiple chevrons on the upper part of the body.

No proper comparison can be drawn on the Iranian side of the Gulf. A few similar sherds were recovered from city I at

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5 The comparison with a single ED I vessel at Tell Agrab (Frifelt 1970), several times emphasized and commented upon, seems no longer valid due to the amount of such objects in the Oman Peninsula and their exclusive presence in late 3rd millennium contexts.
Fig. 6 — Hili North, tomb A: fine red ware of the first group.
Qala’at al Bahrain (Bibby 1983) and similar vases were found during the excavations of some grave-mounds of unusual type at Hamad Town in the Northwest part of Bahrain.

The second group of black-on-red painted ware appears to be restricted to the end of the 3rd millennium BC, and never appears on contemporary settlements. The colour of the paste is almost the same as that of the previous class, ranging from red to buff, but the texture clearly differs (Méry forth.). The range of shapes and decorative elements is much wider. The shapes of the main class of black-on-red ware also occur, but are often more accentuated (for instance shoulder carination, protruding base). Basic ornaments are combined with more complex patterns like hatched trapezes with concave sides, cross-hatched triangles, etc. The painting is commonly confined to the upper half of the vessel, but quite frequently the decoration goes beyond the maximum diameter of the vessel. The most outstanding features are the occurrence of bottle-necked vessels and floral as well as zoomorphic elements.

Most of the bottle-necked shapes have a squat-bellied body. Others display an elegantly curved body with a more or less accentuated shoulder. The neck is usually short, the rim simply rounded or slightly thickened and everted. Bottoms may be simple flat bases, concave or slightly convex bases, rounded and pointed bases.

Decorative patterns include geometric, floral, zoomorphic designs and their combination. The geometric designs are hatched or cross-hatched trapezes with concave sides, hatched ‘arcades’ and cross-hatched triangles. They cover the shoulder zones forming multipetalled flowers and multiradiant stars (fig. 7, nos. 1, 6). Other occurrences in the Oman Peninsula all belong to the late 3rd millennium context like grave 1059 at Hili (Frifelt 1975a: fig. 15c) or Umm an-Nar type graves in the Wadi Suq (Frifelt 1975a: fig. 18f). Trapezes, hatched or cross-hatched, are a widespread design in the Indus area, for instance at Chan-

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* Thanks to the Department of Antiquities of Bahrain and its Director, Sheikha Haya al-Khalifa, the material from these very interesting excavations which may be dated towards the end of the 3rd millennium BC was presented to the attendants of the conference ‘Bahrain through the Ages’ in December 1983.
Fig. 7 — Hili North, tomb A: black-on-grey ware.
hu-daro (Mackay 1943: pl. XXX, nos. 2-4, 6), Mohenjo-daro (Mackay 1937: pl. XX, no. 34) or Kalibangan (Manchanda 1972: opp. p. 343). They often appear in combination with floral or zoomorphic elements.

Also well represented are bands of dotted squares just below the main decorative pattern, usually around or just below the maximum diameter of the vessel. The squares usually vary in shape from proper squares to dotted fish-scale and loop designs. This element occasionally appears in combination with other designs in the main decoration (fig. 7, nos. 4, 8). It is very common among the repertoire of Indus valley painted pottery.

Floral designs include stylized palm trees and isolated hatched palm leaves (fig. 6, nos. 5, 7, 8). All are strongly abstracted, forming palm groves or regular composition on the shoulder of the vessels. They are sometimes integrated parts of floral and zoomorphic compositions.

Hatched palm trees and palm leaves have already been reported from grave 1059 at Hili (Frifelt 1975a: fig. 15d, e), Bat (Frifelt 1975a: fig. 31c) and Amlah 1 (de Cardi et al.: fig. 17, no. 28). This decoration seems restricted to our second class of funerary ware in the Oman Peninsula. It is a very common design in Harappan pottery, for instance from Harappa (Vats 1975: pl. 67, nos. 4-6), Lothal (Rao 1973: fig. 25) or Chanhu-daro (Mackay 1943: pl. XXXV, no. 4; pl. XXXIII, no. 8), etc. No proper parallel can be traced in Eastern Iran. However, stylized palm leaves forming arches associated to a 'feathered' branch on the shoulder of v. 163 (fig. 7, no. 2) find a close analogy, while on a rather different vessel, among A. Stein's discoveries at Khurab (Stein 1937: pl. XXXIII, no. 6). This is by far the closest one in southeastern Iran.

Among the floral designs, pipal leaves (fig. 7, no. 3) and creeping plants (fig. 7, no. 5) are rather exceptional. Pipal is certainly not a tree which would have grown in the Oman Peninsula, while it is a typical feature in the Indus area. Parallels are abundant at Harappa (Vats 1975: pl. LXIX), Mohenjo-daro (Manchanda 1972: 361), Chanhu-daro (Mackay 1943: pl. XXXI, nos. 2, 3, 5), Ghazi Shah (Majumdar 1934: pl. XXXIV, nos. 1, 16, 20). At Mundigak, hatched pipal leaves appear for the first time in period III and persist through period IV (numerous occurrences in Casal 1961). Three pipal leaves on the lower part of an open dish
are published from Bampur V₂ (de Cardi 1970: fig. 38, no. 369). Two of these black-on-red vessels deserve special attention according to the quality of their decoration.

The first one (fig. 7, no. 5) is a bottle-necked jar with a unique depiction of a goat among vegetal features. These include stylized palm tree, an abstracted climbing plant and isolated palm leaves as filling elements. Animal representations on black-on-red fine ware are extremely rare in the Oman Peninsula² contrary to zoomorphic representations on black-on-grey ware (see below) and the depiction of the goat is completely different from representations on black-on-red ware. The body is elongated, the front part clearly sagging. Special attention is paid to the execution of the head with accentuated snout and nose. The ears are leaf-shaped and left blank, the horns are bent backwards in the upper part.

Here again, it is very difficult to trace any close parallel from the other side of the Strait of Hormuz⁸. Representations of animals among a rich and dense vegetation are certainly a very common motif of Harappan painted ware, but caprids are rare in such a context where birds, deers, humped bulls and fishes are more usual. If one looks at the style of the animal itself, a good similarity can be found with a black-on-grey sherd from Bampur V₁ (de Cardi 1970: fig. 32, no. 6; fig. 35, no. 348).

More illustrative of these parallels is certainly vase 222 (fig. 7, no. 8), a small bottle-necked vessel with rounded bottom. The decoration consists of a palm tree accompanied by four dotted circles, a bird and a panel of geometric elements. The latter includes from bottom to top a hatched zone, a band of dotted loops (which recalls bands of dotted squares) and three dotted circles. Such a pattern is commonly interpreted as a 'comb design' in Harappan pottery (Manchanda 1972: 359). The bird is obviously a peacock with hatched body and tail. There is hardly

² The only other representations are a humped bull (Thorvildsen 1962: fig. 23, down) and an ibex (al Tikriti 1982: pl. 133) from Umm an-Nar, raised felines (al-Tikriti 1982: fig. 73) from tomb B at Hili and friezes of caprid heads on a black-on-red jar at Hili M.

⁸ According to a personal communication of S. Salvatori, an almost similar vessel was found at Shahdad.
any need to stress its resemblance with painted pottery of the Indus area where the peacock is probably the most favourite animal depiction on ceramics (to quote among many others, Marshall 1976: pl. XXXII, nos. 2, 8, 9, from Mohenjo-daro; Casal 1964: fig. 74, no. 316a, from Amri IIIA). Its association with the other designs leaves no doubt about a direct inspiration from the Indus valley area. On the contrary, the shape of the vessel itself has no proper parallel among Harappan assemblages.

From all these comparisons, it seems clear that, although no precise parallel can be drawn, references are more to the Indus civilization area itself than to closer sites in Southeast Iran. We would therefore tend to consider that they indicate direct contacts with the Harappan world rather than relations through Indo-Iran borderlands.

The situation is completely different with the two following classes of pottery: black-on-grey and incised grey ware. Both are recognized since a long time as a typical item linking southeastern Iran to the Oman Peninsula, but never appear in the Indus area itself. Again, they are limited in Oman to the funerary context, their presence on settlement sites being limited to a handful. The systematic collection and publication of any sherd from this obviously significant material probably yielded to an overemphasis of its importance, both in Oman and Southeast Iran. To our knowledge, a proper tabulation of all the known sherds has never been made but would be very informative. In tomb A at Hili North, each class represents a dozen of vessels, that is less than 3% of the complete vessels. Grey ware vessels seem to count for a dozen or two at Umm an-Nar (al-Tikriti 1982: pls. 135, 136), and the inventory of tombs 1059 and B at Hili would not add more than 200 sherds (including body sherds, al-Tikriti 1982: pls. 78-89). At Bampur, black-on-grey ware of the type related to the Oman Peninsula appears in IV, (de Cardi 1970: fig. 28, nos. 264, 269) and is ‘fairly plentiful’ in phase IV, (de Cardi 1970: 297), that is five sherds out of 37 published. It continues through period V (19 sherds out of 109) and is still present in period VI (9 sherds out of 106)⁹. As to incised grey

⁹ Countings are after de Cardi’s catalogue, pp. 335-59. We ignore the statistical reliability of these countings. De Cardi herself hesitates to decide if the sherds
ware, only 21 sherds were recovered at Bampur (During Caspers 1970: 325) from phases IV, (3 sherds), V (6 sherds) and VI (5 sherds), 7 sherds being out of context.

Black-on-Grey Ware

The most frequent type from tomb A at Hili North is a globular miniature vessel with a short neck, simple everted rim and flat to slightly concave base (fig. 8, nos. 3, 4). The shoulder is decorated by a band of short vertical or oblique lines between two horizontal ones. This shape is present at Bampur, where the best parallel known is a brown-on-red vessel from period VI (de Cardi 1970: fig. 39, no. 392).

Three vessels (fig. 8, nos. 5, 6) are cylindrical beakers with flat base and everted rim. One of them is decorated with two superimposed friezes of running caprids, a well known design at Bampur. The other bears a frieze of diagonal squeezy lines above a band of hatched leaves, possibly pipal. Such beakers are absent at Bampur, although they find parallels in streak-burnished grey ware during period V (de Cardi 1970: fig. 34, nos. 343, 344) and VI (de Cardi 1970: fig. 43, nos. 462, 463).

Two small globular jars with short everted neck and flat protruding base are decorated with a wavy appliqué cordon between two horizontal ones (fig. 8, no. 8). These vessels are too badly preserved to distinguish the painted decoration, but their attribution to black-on-grey ware is beyond doubt. A similar vessel with geometric decoration was found in cairn 1 at Umm an-Nar (Thorvildsen 1962: fig. 21, top right) and similar vessels may also bear running caprids (al-Tikriti 1982: pls. 82, 84). These vessels have no proper parallels outside the Oman Peninsula, although they may recall larger jars with appliqué cordons rather frequent in Southeast Iran, where such a decoration mostly appears on large bowls (e.g. Stein 1937: pl. XXXIII, no. 6, from Khurab; pl. XXXI, no. 14, from Bampur; de Cardi 1970: fig. 23, published as period VI belong to that period or if they should be considered as V (De Cardi 1970: 318). We ourselves wonder why no. 258 on fig. 25 (period IV) which is described as 'unique according to the form' (p. 341) was not included in the same series.
no. 191, from Bampur IV; fig. 40, no. 402, from Bampur VI). These are however very different objects.

Vase 82 (fig. 8, no. 2) is a black-on-grey ware bowl on a ring base decorated with a band of running caprids and M-motifs. This is the only complete vessel of that type found in the Oman Peninsula but al-Tikriti (1982: fig. 83) reports similar sherds from tomb B at Hili. Parallels can be traced with Gwargusht (de Cardi 1970: fig. 15, left), Khurab (Lamberg-Karlovsky & Schmand-Besserat 1977: fig. 7, nos. 13-15, 23), and Bampur IV, (de Cardi 1970: fig. 28, no. 269), IV, (ibid.: fig. 29, nos. 296, 297, 300) and V
(ibid.: fig. 36, no. 81). However, these comparisons always involve grey-ware bowls with painted friezes of stylized caprid heads, and not complete depiction of the animals like at Hili.

Tomb A at Hili North yielded a single ‘canister jar’, probably the most famous type of black-on-grey ware among archaeologists (Tosi 1974: fig. 10) but its decoration is very different from the other jars of this type, both in Oman and Southeast Iran. It bears two concentric rows of simple chevrons on the shoulder. Below the carination, two intersecting wavy lines delineate lenticular designs filled with a single dot. This band is separated by two horizontal lines from a frieze of running caprids, possibly oryxes (fig. 8, no. 1). The animals are extremely schematic and no comparison can be drawn, from neither the Oman Peninsula nor Southeast Iran. To some extent, the oryxes recall the animals which ornament the southern door of grave 1059 at Hili (Frifelt 1968: fig. 1) although their ‘running’ attitude is very different.

Incised Grey Ware

Thirteen complete vessels of incised grey ware and fragments of several others were recovered from tomb A at Hili North. The most characteristic is a slightly conical beaker with gently flaring walls, everted rim and flat or slightly rounded bottom (fig. 9, nos. 3, 4). The decoration alternates the usual ‘sagging lintel’ motif with cross-hatched filling and panels divided in four hatched triangles by two diagonal lines. These vessels differ in some way from the classical ‘hut-pots’ usually referred to, for instance at Umm an-Nar (Thorvildsen 1962: fig. 20, top left) or Hili 1059 (Bibby 1966: fig. 12, top left) which are more similar to vase 255 from tomb A at Hili North (fig. 9, no. 1). In southeastern Iran, a vessel from Katukan (Stein 1937: pl. XXXII, no. 12) is rather close to the most common type at Hili North.

Two conical beakers with flat bottom and everted rim deserve special attention, as they are unique in their decoration. One of them (fig. 9, no. 5, already published in Cleuziou & Vogt 1983: fig. 5, no. 1) is decorated with three triangles filled with impressed circles and grain-like designs, the latter recalling a unique incomplete vessel from Hili 1059 (Frifelt 1970: fig. 3c). The other (fig. 9, no. 2) bears a band of stylized vegetals above a
band of oblique lenticular motives, or stylized leaves. It is unparalleled and to our knowledge it represents the first mention of a vegetal design applied to an incised grey-ware vessel.

To summarize our evidence, black-on-grey as well as incised grey ware display clear similarities on both sides of the Oman Sea, together with internal variations which are still difficult to
interpret according to the finding context. As already mentioned, the Bampur sequence is rather weak with, for instance, only fourteen stratified sherds of incised grey ware. Black-on-grey and incised grey ware are indeed indicators of relations between Southeast Iran and the Oman Peninsula, but what do they precisely indicate?

The possibility of a trade of these items between one side of the Strait and the other, sometimes advocated, cannot be ruled out nor confirmed in the absence of archaeometrical studies. The fact that some shapes appear here and not there is not significant in itself, as the geographical distribution of this too small number of items would only account for the current state of the research. The only apparent difference may be related to the absence of these two classes of pottery among the settlement assemblages of the Oman Peninsula, and the fact that grey ware is unknown in earlier periods in the Oman Peninsula while it clearly derives from a long tradition at Bampur and in Southeast Iran. But even this needs further confirmation.

One may also look for chronology. During-Caspers (1970) considers for instance that incised grey ware could be a substitute for chlorite vessels of the ‘intercultural style’ or ‘série ancienne’, with which similarities are obvious, noticeably the motif of the ‘sagging lintel’. This raises serious questions and particularly the fact that the sample of tomb A is clearly linked with chlorite vessels of the ‘série récente’, that is long time after the date commonly accepted for the ‘intercultural style’. The assumption of contemporaneity clearly underlies the idea of substitute and if we accept the idea, we have to admit a duration of incised grey ware over several centuries 9 and we may try to interpret chronologically the differences among various assemblages of incised grey ware 10. It is certainly possible to define groups according to shape, decoration, thickness of the paste and

9 D. J. Potts (forth.) has recently advocated a later date for the ‘intercultural style’, down to the Akkadian period. Even that would lead to accept four centuries. It should also be mentioned that as far as it is known, the style of chlorite vessels from the Indo-Iran borderlands in late 3rd millennium BC, as known from Bampur (During-Caspers 1970: fig. 44a) and several other sites seems rather different from the ‘intercultural style’.
type of incision...B. de Cardi for instance (de Cardi 1976: 119) already noticed the absence at Amlah 1a of the 'herringbone infill' present at Hili 1059 (Bibby 1966: fig. 12, bottom right), Umm an-Nar (Thorvildsen 1962: fig. 20, left), Bampur (During Caspers 1970: fig. 46, no. 3) or Shahr-i Sokhta (Tosi 1983: pl. LXIII, figs. 28, 29), a motif also absent from tomb A at Hili North. But here again, the small amount of material and the scarcity of reliable stratigraphic data would quickly turn any attempt to find typological differences into a hopeless game.

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The material of tomb A and the cultural relations on both sides of the Oman Sea have to be studied within a broader frame: the whole chronology of eastern Iran and Baluchistan at the end of the 3rd millennium BC. Although problems are still obvious, and waiting for a more precise dating of Tepe Yahya IV A or Shahr-i Sokhta IVb, several points can be developed.

In a previous paper, Cleuziou (1981) pointed out several similarities between Oman Peninsula in the early 2nd millennium BC and the Indus area. This included the presence of Harappan-like or Harappan pottery sherds during period III at Hili 8, concentric rows at the bottom of pedestal cups in the same levels and the occurrence of cubic stone weights at Shima'al in early 2nd millennium collective burial. Since this paper, new evidence came to light at Maysar (Weisgerber 1984) but also at Hili 8. Rim-shehrs of Harappan-like jars with dark grey slip inside were found at Hili 8, period IIb (Cleuziou forth.a: fig. 24, no. 2). According to Kenoyer (pers. comm.), similar Harappan jars are present at Balakot where they are considered as containers for exportation. The ware of these sherds is similar to that of the sherd engraved with Harappan writing at Ras al-Junayz (Tosi, paper read at this conference). Although the foreign origin of such potteries in the Oman Peninsula remains to be demonstrated on an archaeometrical basis, their presence on many sites (Hili 8, Maysar, Ras al-Junayz, Ras Ghanada) seems very significant of the contacts between southeastern Arabia and the Harappan world. Also significant is the presence at Hili 8, both in periods IIa and III, of cord-impressed sherds, also found at Maysar (Weisgerber 1984: fig. 24). Cord impressions are common in the Indus
basin, but also on the western fringes of the Harappan world, at Shortugai (Francfort & Pottier 1978: fig. 22) and in the Gerdan Reg (Dales 1972: fig. 9).

It is now clear that the Harappan influence (whatever precisely this means) in the Oman Peninsula started earlier than 2000 BC, encompassing certainly the last century of the 3rd millennium and maybe slightly earlier. Tomb A - Hili North is in that respect a very important assemblage. But all the elements listed in this paper should not be interpreted in the same way.

Luxury items like the etched carnelian beads only indicate that the Oman Peninsula took part in the international trade of that time. The inventory of Reade (1979) may give the impression of a remote area, with just one atypical bead, but this seems clearly due to the lack of information at that time. To the same international trade can be related the indication of tin-alloying at Hili (Cleuziou & Berthoud 1982). Without any doubt, these are just isolated scraps left by the flourishing exchange system of that period. The presence of ‘série récente’ chlorite vessels outside Oman partly reflects the region’s own contribution to that system, together with the long established exportation of copper.

The occurrence of black-on-grey and incised grey ware is to be related to North/South relations on both sides of the Strait of Hormuz. These contacts are not new and are reflected also by a long parallel tradition in black-on-red ware. This is true for instance of a globular jar in black-on-red ware (fig. 10) found in grave M at Hili, dated c. 2500 BC, which bears a decoration of friezes of stylized caprid heads, a design already common in early periods at Bampur. These relations are still difficult to explain and need further study. We fully ignore what was the degree of cultural integration between the two areas and its evolution through time.

Considering contacts with the Harappan world itself, or at least its western fringes, our second group of black-on-red ware is the most significant. We have already noticed that the parallels for its decoration point towards the Indus area itself rather than to Southeast Iran. Beyond the decorative pattern, a technical aspect may be significant. Some vessels of this class present string-cut bases, a feature always absent in the late 3rd millennium domestic ware in the Oman Peninsula, but very frequent in early 2nd millennium (Wadi Suq) ware. String-cut bases are also
a recurrent feature in Gerdan Reg sites or at Mehrgarh (Jarrige, pers. comm.) and this should be added to a set of technical items, like finger-nail or cord impressions widely distributed on the western fringe of the Harappan world at the end of the 3rd millennium BC. In this respect, tomb A at Hili North appears as a significant testimony of the Harappan influence over the Lower Gulf area during the same period (see also Cleuziou forth.b).

Eventually, the square chlorite flask also ties tomb A at Hili North with another archaeological problem of the Indo-Iran borderlands. We have already noticed its 'Bactrian' aspect, in relation with the appearance of so-called 'Bactrian elements' at Tepe Yahya IV A, Khurab or Shahdad. The interpretation of these elements is certainly still unclear, and much is expected from the study of sites like Mehrgarh VIII or Sibri to understand their relationship to the Indus valley where such elements can be detected together with Harappan influences on a local culture. Oman Peninsula took part in this important process which ante-
dates the 'collapse of the urban system' in Middle Asia, and
the assemblage of tomb A at Hili North indicates a rather safe
chronological mark: the 21st or at the earliest the late 22nd
century BC.

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MAURO CUCARZI

A Methodology for Geophysical Prospecting in Archaeology
An Example: Mohenjo-daro

Introduction *

Geophysical methods have been employed for more than twenty years to provide support in archaeological investigations and archaeologists are making increasing use of them for a new strategy in the excavations as well as for economic reasons, in order to obtain a greater amount of information on the chosen area to be studied.

It should be stressed, however, that geophysical investigations cannot provide an alternative to digging, at least for the time being. Nevertheless, where environmental conditions are favourable, they can be regarded as a rapid, economic, reliable method of obtaining information about the configuration of an archaeological site, its approximate stratigraphy, the location of archaeological remains and the identification of some of them, such as walls and roads, wells, canals and moats, kilns, graveyards, etc. (Ellis 1982).

This kind of information can be very useful for the archaeologist, especially in the dig-planning stage, since it can be decisive as regards choice of the point where to start the excavation. It can also be very useful during the dig, by providing quite detailed indications on the areas adjacent to the site itself (Carandini 1981).

The more closely the geophysicist and archaeologist collaborate before the start of operations to unify the various prob-

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*I would like to dedicate this modest paper to the memory of Professor Antonio Marussi, Director of the Istituto di Geodesia e Geofisica, University of Trieste, who guided, encouraged and helped me from the very outset of my work in this field.
lems into one problem complex, the more useful will be the information collected for resolving this.

The Geophysical Approach

Before going into details of the geophysical methodology, it will be useful to clarify some concepts which crop up frequently in this paper.

Since 'archaeological remains' are the subject of the investigations, this is something that must be defined from the point of view of the geophysical survey, since the remains represent the 'event' that must be measured in some way.

I would define 'archaeological remains' as a morphological alteration of the soil caused directly or indirectly by the presence of men in a given area in past time.

The 'event' has to be fixed in time and space, time being that of Man, while space is that part of the earth's crust (lithosphere) immediately below the surface of the soil which englobes most of human activities. I propose to call this the 'Zone of Anthropic Interference'.

Not only is this zone characterized by signs of the presence of man, it is distinguished geologically by the physical properties of the rocks and by the spatial and temporal geological limits, by the mobility of groundwaters and by a constant horizontal and vertical movement of moisture and salts (Ogilvy et al. 1980).

Now if the 'archaeological remains event' is viewed as a modification of the soil morphology, evaluation of the geomorphological difference between the archaeological remains and the surrounding ground, by measurement of given physical characteristics, is tantamount to likening the 'event' to a geophysical anomaly.

Advanced measuring instruments, used today, with their sensors, are capable of detecting even very small differences in the physical properties of the soil; these are generally represented by numerical values which, as regards the geophysical investigations, are the data that have to be interpreted.

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1 Eidt 1984 refers to this area by the term 'Anthrosols'.
2 Experience acquired to date suggests that the study should concern the differences in the intensity of the earth's magnetic field, magnetic susceptibility, electrical resistivity, and the propagation of elastic, sound and electromagnetic waves. Instruments that use induced polarisation, radar waves and acoustical waves are also at a very advanced stage of development.
Interpretation of the Data

Interpretation of data means finding an explanation for them and the aim is to elaborate a conceptual model in relation to which the acquired data will adapt intelligibly along with others that are better known (Hanson 1958). Hence the term ‘model’ has to be understood not as a uniquely determined class of logic structures, but as a mediator between theory and experience, where its most valuable feature is the fact that it is used in a purely provisional manner (Bellone 1973).

Within the context of this flexibility it is as well to make an operational distinction among the various stages of model building, namely:

1. *Hypothetical model*, for starting the investigations
2. *Working model*, for interpretation of data
3. *Resulting model*, for representing the conclusions.

The first stage in any scientific investigation is to define the problem. In the case of geophysical prospecting for archaeological purposes, the problem has various aspects, but schematically it can be assumed that it concerns the identification of specific archaeological areas, e.g. limits, burial areas, particular monumental areas, etc.

*Hypothetical Model*

The geophysical investigation starts with the collection of information in the natural-geological and historical-archaeological environments, a surface survey being made, where possible. On the basis of the initial informations collected, a working hypothesis is framed as to the possibility of distinguishing the archaeological remains from the surrounding ground by measuring the contrast between certain identified physical characteristics.

To this end, an initial set of soil samples is collected and various kinds of archaeological remains (pottery, structures, etc.) at various depths and in different areas are systematically sampled. The samples are then analysed on site or in the laboratory, depending on the level of organization of the geophysical team. By reference to the results of these analyses, combined with the
preceding information, the survey method is selected: magnetic, geoelectric, electromagnetic, thermal, seismic, acoustic, etc.

At this stage there is sufficient information available to set up the 'Hypothetical Model'.

With this model in mind, a selection is made of the areas where the investigations are to start, and the sequence of methodologies is established. Systematic field measurements can then begin and the results can be plotted in the most appropriate manner.

**Working Model**

It is then possible to frame interpretative hypotheses and to build a 'Working Model' on the basis of the Hypothetical one and the data collected in the field.

At this point a dialectic relationship is established between the data and the researcher who must check logically whether the data adapt to known data in the Working Model.

Mathematical methods are also employed at this stage, and it is essential to use a computer, as it is throughout the whole of the investigation. This permits rapid representation of the hypotheses and of data treatment and processing, so it is a great help for building models and for mathematical control thereof.

The process of framing hypotheses and inferring proceeds until the 'Resulting Model' is built, assumptions and questions being formulated continuously while seeking solutions which are not combinations of previous ones. When the operator has decided that the Working Model is adequately refined, he runs checks to verify this.

Where geophysical-archaeological investigations are concerned, it is usual for these checks to be made on very limited areas which, at the maximum, can be a trial trench measuring 1×1 m or 1×2 m or which anyway do not exceed 2 or 3 sq.m in size. Where conditions so require, trial trenches can be replaced by borings, though these provide less information.

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3 With the compact microcomputer now on the market it is possible to run the calculations and to perform the modelling and checking directly in the field.
In any case, examination of these or stratigraphic samples and comparison of the findings with the results of the Working Model and field data will reveal some degree of deviation. This must be evaluated to decide whether it lies within an acceptable range, which will depend on a great amount of parameters linked not least to instrument sensitivity but which will also be bound up conceptually with the size of such errors as may have been committed during the measurements as well as in the generalization process. This situation can be expressed in mathematical terms by appropriate statistical analysis.

A further series of hypotheses and inferring will enable the researcher to arrive at the ‘Resulting Model’.

To recapitulate, therefore, the whole process of interpretation takes the form of an iterative cycle designed to specify and refine the Working Model until it provides an acceptable approximation of real conditions.

The final stage is to perform a series of checks and controls on the ‘Resulting Model’.

Depending on conditions, these may be:

1. **Direct checks**: intensive excavations, trial trenches or borings.

2. **Indirect checks**: instrument cross-checks.

The more thorough the checks and controls, the better the model will represent the real situation (Popper 1968)⁴.

**Field Example**

The procedure briefly described above has been applied successfully many times. Permit me, therefore, to present an example of geophysical investigations run at Mohenjo-daro, one of the most extensive proto-historic sites of the Indus Civil-

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⁴ In the specific case of geophysical-archaeological investigations, the mistaking of particular natural situations for man-made structures can be a very dangerous source of error. When direct checks cannot be made, analogical comparisons and considerations of a geometric nature may be the only way of discriminating between the two situations. These criteria, however, are not always sufficient to provide a reliable interpretation, so experience indicates that direct checks should be made, if at all possible, albeit of a limited nature.
sation, located in the Sind Province of Pakistan, 500 km from Karachi and 25 km from Larkana, the nearest town.

The site lies about a kilometer from the Indus River, and between 1921 and 1965 there were many digs by various scholars (Jansen 1983). Since 1964 Mohenjo-daro is under protection of UNESCO which has drawn up a protection programme and is implementing it (UNESCO 1964).

Owing to the particular environmental conditions at the site, no excavations are permitted, since any structures brought to light would deteriorate rapidly because of salt action.

In 1982 Prof. Maurizio Tosi of the Istituto Universitario Orientale, Naples and the Institute of Middle and Far Eastern Studies (IsMEO), Rome, submitted to the Pakistan Department of Archaeology a programme for a Project to help protect Mohenjo-daro; this provides for a series of multidisciplinary investigations which also include geophysical prospecting.

Since 1979 the University of Aachen (Germany) has been documenting the excavated areas under the direction of Dr Michael Jansen, architect, and in 1983 an agreement was reached with IsMEO which enables the two groups to operate jointly, to the great advantage of scientific advancement.

The main aim of the geophysical research was to investigate the configuration of Mohenjo-daro, in its complex, and, moreover, to identify possible special areas as indicators of craft activities (Pracchia, Tosi & Vidale 1985) or to locate particular architectural structures (wells, moats, town walls, etc.). Knowledge of the horizontal limits was needed to evaluate the real extent of the site in order to plan future conservation measures. Identification of the vertical limits, instead, was required to locate the deepest points and so, presumably, the oldest levels of Mohenjo-daro, thus permitting the preparation of a future plan of action in this regard.

It was felt that identification of particular buried architectural areas or structures (kilns, roads, houses, etc.) would permit a very useful tie-in with the data collected by surface examination conducted by numerous specialists, in the field (Tosi 1982, Jansen 1983, Urban 1983).

Reference was made to publications and research papers on hydrological, geological, historical, geographical and archaeological aspects (Snelgrove 1967, Panhwar 1969, Gazetteer of Sind
1907, Flam 1981, Lambrick 1964, Mughal 1970, Mackay 1938, Marshall 1931). The information acquired indicated that a geophysical investigation could provide good results because the geological setting is the Indus river System flood plain, with clay and sand deposits, while most of the archaeological remains consist of brick and in some cases mud-brick structures.

Numerous drillings made by NEDECO and WAPDA had indicated that burnt brick and pottery fragments occur to depths of twenty metres and that the last layers of brick rest on a thin bed of clay which overlies sand (Nabi Khan 1973; Unesco 1964).

The site was visited in March 1982 and samples of soils and of archaeological remains were collected for laboratory analysis. The results revealed marked differences between the intensity of magnetization of the burnt bricks and the surrounding ground, consisting mainly of clays and/or sands.

It was also considered that there should be a difference in electrical conductivity between the archaeological structures and the ground in which these are found, though it was evident that this parameter might be influenced in various ways.

For these reasons, it was decided to perform the geophysical investigations by measurements of the intensity of magnetic field and of electrical resistivity. The decision to leave seismic and gravity surveys to a later stage was taken because the former method is not applicable theoretically, since the clay lies above the sand, while as regards gravity measurements, the density difference between the brick and the surrounding ground did not seem to be such as to provide clearly interpretable results, even using very sensitive instruments such as the Lacoste-Romberg microgravity meters.

A Hypothetical Model was built, therefore, which represented Mohenjo-daro as a complex of constructions, generally of brick with a certain number of overlays of burnt-brick, mud-brick, clay, pottery fragments, and vitrified nodules, the thickness of the layers being quite variable, with the deepest on a bed of clay underlaid by sand.

This model was built on the assumption that the magnetic survey could identify the brick/clay or brick/sand interface because of their different intensity of magnetization, thus permitting the horizontal limits of the site to be determined, while the electrical soundings, instead, could identify the brick/sand inter-
face owing to their different electrical conductivity thus enabling the depth to be ascertained.

In order to test this model, several areas were chosen for investigation. The selection criterion was of operating in the lowest areas (h = 50 m a.s.l.); both to minimize the influence of the topographic effect on the measurements and because it seemed that the way the structures merged with the ground could be followed better.

The geophysical investigations were thus concentrated in the depressions.

The first selected area was the depression to the South of the HR area, because there was no elements that could upset the magnetic prospecting (absence of power lines) and because a clear-cut distinction could be seen between the area of the depression and the built-up zone. At the same time, the German Team was conducting photogrammetric surveys with a hot-air balloon, while the Italian Team was carrying out surface examinations of this area. It appeared very likely, therefore, that there would be a large amount of information available on the area that would be useful for checking and monitoring the geophysical data collected.

It was decided to perform the magnetic prospecting first, in order to obtain an initial idea on the size and distribution of magnetic anomalies in the depression and then to make the geoelectrical soundings afterwards.

**Prospecting**

Magnetic prospecting was performed in Zones A and B of HR South and D South along profiles 1 to 14 run random across the depression (fig. 1). The data have been plotted on an isoanomaly contour map, while the profiles have been plotted as diagrams with a system of H,m coordinates.

Resistivity profiles were run along the same profiles using a Wenner array and an electrode separation of 1-3 m, measurements being taken every two metres. These data have been plotted as diagrams with an Ohm/m,m coordinate system (Cucarzi 1984).
Fig. 1 — Map of the southern part of Mohenjo-daro with areas and profiles where magnetic measurements have been collected, thick line indicates the elevation of 49 m a.s.l.
The following points emerge from perusal of the magnetic isoanomalies contour map, the geomagnetic diagrams and the Resistivity profiles diagrams plotted with the data collected on the geophysical sections:

1. There is a long, deep magnetic anomaly running East-West occupying the whole length L of the study Area. This has an average intensity of 280 nT and a width of 12 m.

2) Geomagnetic cross-sections 1 to 14 indicate the presence of a magnetic anomaly of very similar shape, while the profiles resistivity data do not appear to provide indications that can be clearly interpreted.

On the basis of the Hypothetical Model and the above points, a Working Model was built which interprets the depression as a contact zone between an area constructed of baked brick and an area of clay or mud-brick. In fact, it has been possible to build a Geophysical Model which, taking account of the magnetic susceptibility derived from laboratory measurements, and the topographic effect caused by the relief present in the Study Area, can be represented by a situation and a corresponding anomaly as shown in fig. 2.

Fig. 3 illustrates the anomaly produced by the Model and those due to the data collected along the fourteen N-S cross-sections.

As stated earlier, one of the key stages in the methodology is that of establishing whether the deviation between observed data and those calculated by the proposed Model is acceptable, i.e. whether it comes within a range of values due to instrumental error and to the generalization process.

The statistical analysis of the magnetic data of the model and those collected on the cross-sections was performed in the field with a program of General Statistics processed for a top-desk computer Hewlett-Packard HP 85. All the values ranging from the minimum to the maximum of the magnetic anomaly of the cross-sections were selected, plus three values to the North of the minimum and three to the South of the maximum. In this

5 For calculating the model on an HP 85 top-desk computer, use was made of the known step-model formula (Grant & West 1965) and that of Gupta & Fitzpatrick 1971 for the topographic effect.
Fig. 2 — Magnetic model of a cross section N/S across HR South depression with the shape of magnetic anomalies computed with the values of magnetic susceptibility taken from soil samples.
Fig. 3 — Part of the magnetic anomalies observed in all cross sections (14) compared with those computed from magnetic model proposed.

way, 18-metres lengths on fourteen different sections of the depression were considered. The results of this analysis are summarized in the Table.

<table>
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<th>stand. err.</th>
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<tr>
<td>18</td>
<td>14</td>
<td>20.25</td>
<td>6.5-8.4</td>
<td>2.11%-2.90%</td>
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</table>
The standard deviation spread is 5 nT and that of the standard error is 2 nT, indicating that most of the error is instrumental error. 6

The Geophysical Model is thus sufficiently reliable to represent the situation in the southern depression of HR which is characterized by a line marking the transition from a burnt-brick phase on the North side to one of clay or mud-brick on the South.

The archaeological interpretation of this could be that to the South of the interface there is a stretch of clay or mud-brick which, considering the regularity of form and comparing the situation with other known Indus Civilization Sites (Khan 1959, Rao 1979, Thapar 1973, Mackay 1976, Vats 1940, Wheeler 1947), may well be a platform bounding the South side of a Mohenjodaro constructional phase.

The first checks were made by a series of 18 mm diameter stratigraphic borings to a depth of 3 m; these tend to bear out the interpretation.

A further series of checks was made by Vertical Electrical Soundings (VES) performed with an ABEM Terrameter SAS300 instrument. The data were processed with a program for the top-desk computer HP 85, capable of distinguishing up to nine different soil horizons, down to depths of at least 300 m (where environmental conditions so permit). The VES run at numerous points in the depression, all indicating that there are no baked-clay structure levels in the part occupied by the presumed platform.

From the geophysical point of view the processed model is consistent with all data collected and the model fits in very well with the information received so far regarding the geology and the archaeology. There are still few uncertain points, regarding the archaeological aspect, because direct checks reached a depth of only 3 m on the ‘platform’.

Below this, the only information available is that provided indirectly by the resistivity measurements.

Two holes were drilled at points P1 and P2 using a rig generally utilized by the local inhabitants for constructing pump

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6 In fact, though the error given by the manufacturer is 2 nT, it was ascertained to be actually at least 4 nT.
boreholes to tap groundwaters for domestic purposes. Both holes reached depths of 19 m without encountering any signs of human activity involving burnt-brick structures.

In fact, after 17 m of a succession of more or less fine clays, the sand bed was reached and this continued down to at least 19 m.

It is considered, therefore, that a sufficient number of data have been collected, checked and verified to be reasonably certain that the magnetic anomalies are caused by the presence of a clay or mud-brick platform which extends from coordinates 2285/1000 and 2850/1098 for a length of 600 m over a width of 5 m (fig. 4).

Regression analysis performed on the maximum and minimum coordinates of the anomaly present in the fourteen cross-sections shows that from point 2285/1000 to point 2560/1055 these lie on one line, while from 2560/1055 to 2850/1098 they lie on another with an angular difference of 7°, 2560/1055 being the point of divergence.

In fact, when these data are subjected to linear regression, it is evident that an analysis of the residuals is too far removed from the standard, while the data approximate better to a second-order polynomial, but the best fit is that given by two lines diverging by 7° at coordinate 2560/1055 7.

There could be many reasons for this fact, which are unknown at present, but one interpretation could be that postulated by Michael Jansen that the axes of the urban layout followed a different orientation in different constructional periods (Jansen 1983).

It still remains to be ascertained whether this structure is a defensive moat (from which the clay was taken to build the town) or whether it is a canal or something else, and whether it was built entirely by man or — as appears more likely — whether it was formed by modifying a bank of an ancient natural channel of the River Indus.

7 This situation has been obtained with magnetic readings collected on 14 cross sections in HR South depression and represents the latest one instead of those indicated in Cucarzi 1984.
Fig. 4 — The line represents the horizontal trend of clay (or mudbrick) platform probably connected with a constructional phase of Mohenjo-daro.
Studies on the stratigraphic samples taken during the drilling and on the hydrogeology of the area may well provide satisfactory answers to these unresolved questions.

ACKNOWLEDGEMENTS

I am especially grateful to Prof. Maurizio Tosi for many suggestions about the archaeological problems. I am also thankful to Patrizia Zolese, archaeologist, for assistance and advice during the course of this work.

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JONATHAN MARK KENOYER

Shell Working at Moenjo-daro, Pakistan

INTRODUCTION

For many years, archaeologists studying the Indus Civilization have concentrated on the major features of pottery, architecture and the enigmatic Indus script, giving only passing attention to the numerous varieties of 'minor' artifacts. Among the most common of these 'minor' artifacts are fragments of marine shell ornaments, utensils and manufacturing wasters. The deemphasis of shell artifacts is entirely unjustifiable in view of the fact that after terracotta and stone, shell is one of the most durable materials found in the archaeological context and it was used to produce a variety of utilitarian and ornamental objects.

Some shell species have isolated or limited distributions along specific coastal regions and by determining the ancient source areas for these species, we can gain a new perspective on the trade networks within the Indus Valley, as well as between the Indus Civilization and other contemporaneous societies. A detailed study of the shell industry also allows us to better understand the exploitation of marine resources by coastal populations and the development of specialized technologies and cultural styles.

A large number of shell artifacts were recovered during the early excavations from 1925 to 1938, but these artifacts are now spread out in numerous museums and reserve collections throughout both India and Pakistan. In 1980-81 I was able to make a detailed study of most of these collections by the kind permission and encouragement of the Department of Archaeology, Government of Pakistan, the Archaeological Survey of India and the different Museum Institutions. Funding for this research was provided by a Fulbright-Hays (DDRA) Grant and the final results
are presented in my doctoral dissertation from the University of California, Berkeley (Kenoyer 1983). During the final stages of my research, in 1983, I was fortunate to be invited by the directors of the IsMEO/RWTH Joint Moenjo-daro Project, Dr M. Tosi and Dr M. Jansen, to study and help in the collection of shell artifacts in the surface survey of the site. This additional research was supported by a Research Grant from the Smithsonian Institute, Foreign Currency Program.

By combining the data collected from the earlier excavations and the important new data recovered from the recent surface survey, it has been possible to gain a new understanding of the outstanding technological developments of the Harappan shell industry and its socio-economic role at a large urban center such as Moenjo-daro.

**Species of Mollusca Used as Raw Materials**

Although many different species of marine and fresh water mollusca have been recovered from Moenjo-daro, the shells of only a few of these were actually used as a raw material for the manufacture of different objects such as bangles, inlay, ladles, figurines, etc. (Natural shells that have simply been perforated for use as ornaments are not included in this present discussion). All of the species used as raw materials are still found in the Arabian Sea and come from different areas of what used to be the coastal regions of the Indus Civilization, which extend from Sutkagen-dor on the Makran coast, to Lothal on the Gulf of Khambhat (Cambay).

List of Species

**GASTROPODA:**  
*Turbinella pyrum*, Linnaeus  
*Chicoreus ramosus*, Linnaeus  
*Lambis truncata sebae*, Röding  
*Fasciolaria trapezium*, Linnaeus

Each species is adapted to a specific habitat area in the coastal environment and although the descriptive section provided below may seem somewhat detailed for archaeological pur-
Fig. 1 — Major sites of the Indus Civilization.
poses, an intimate knowledge of the basic physical characteristics, habitat and distribution of the major species is important. This information can aid in our understanding of the archaeological occurrences of these different species, and also to better understand how the protohistoric coastal populations exploited their marine resources.

GASTROPODA

Turbinella pyrum was the species most commonly used as a raw material at Moenjo-daro. In its natural form, the shell is ovate with a well balanced spire and a smooth globose body whorl that has no external protuberances (fig. 2). Underneath the protective exterior covering or periostracum the white shell is extremely hard and sturdy. Its structure is quite massive, with thick walls spiraling around a solid columella, joined together by thick, reinforced sutures. This columella can be distinguished

Fig. 2 — Parts of the gastropod Turbinella pyrum.
from that of other large gastropods by the presence of 3 or 4 prominent ridges, to which the major muscles are attached.

Average adult specimens can reach 150 to 200 mm in length and 100 to 150 mm in breadth. Because of its ovate shape and well joined sutures, this shell provides a unique structure that is suitable for the manufacture of several circular bangles from a single shell.

Being a gregarious species, it tends to form colonies on sandy bottoms or in sandy areas between coral reefs or rocky areas. Occasionally specimens are washed up on the reefs, but they generally live in the shallow littoral zone, to depths of 20 m (Mahadevan & Nagappannayar 1974: 118-119). Shells living in close proximity to the coral reefs are often preyed upon by shell boring organisms such as the Cliona sponge, but Hornell (1915: 7) found that shells coming from regularly fished localities, have fewer bore holes. At Moenjo-daro, the low percentage of shells bearing these bore holes may therefore suggest that they were collected regularly from beds in deeper water, or away from the reefs.

Turbinella pyrum has a fairly restricted distribution, occurring only in the protected bays of the Indian subcontinent. This limited distribution makes it possible to trace the movement of the shells from their source areas to distant inland markets. At present there are major concentrations of T. pyrum at the southern tip of India, in the Gulf of Mannar, all around Sri Lanka and as far North on the eastern coast as the mouth of the Godavari River. These source areas, however, were not exploited during the Indus period. On the western coast of the sub-continent it is not so common, but in the Gulf of Kutch and along the coast of Sindh and Baluchistan, West of Karachi, large populations are to be found. Harappan shell collectors probably used these source areas to supply inland manufacturing centers (fig. 3). The westernmost occurrence of this species is reported from Pasni, on the Makran coast (Khan & Dastagir 1971: 56-57), but it is not found in the Arabian/Persian Gulf itself (hereafter referred to as the Gulf).

In studying the various coastal changes that have occurred over the last 5000 years in western India and Pakistan, we see that the most drastic changes have taken place in delta regions or rocky coasts, where the species does not normally live.
Snead's study of the Makran coast indicates that there has been some tectonic uplift, about 2 m along the Karachi coast and increasing westerly to as much as 30 m near Ras Jiwani near the Iranian border (Snead 1967: 564-565). Some of the uplifted marine banks may have emerged as late as the 17th or 18th century AD while others were probably uplifted during the 3rd or 2nd millennia BC (ibid.). Even if specific dates are not yet available for these local tectonic movements, it is evident that for the past 5000 years or more, the Makran coast has been tectonically active, with increasing instability towards the West. Unstable con-
ditions on the coast result in drastic changes in coastal marine habitats, a situation that is not suitable for the development of major concentrations of the species of gastropoda used in the Indus shell industry. The absence of sub-fossil examples of *T. pyrum* and the other large gastropods in the uplifted beaches may indicate that, as is the case today, there were no major concentrations of these species here or in the gulf. In the east, however, the coast has been more stable and there has been relatively little silting. In view of these factors, we can assume that there has been little change in the marine habitats of this region during the last 5000 years, and that the *Turbinella pyrum* beds found West of Karachi were probably located in the same general areas during the 3rd millennium BC. In Kutch and Saurashtra, recent changes have been primarily due to silting and not because of tectonic activity. On the basis of preliminary dating of inland coral and shell concentrations, Gupta suggests that the sea level along the Saurashtra coast at about 6000 BC was from 2 to 6 m higher than the present day mean sea level (Gupta 1977a). Major silting has however completely changed the ecology of the Little and Greater Rann of Kutch. On the basis of an average silt rate of 2 mm per annum, Gupta has calculated that as late as 2000 years ago, the Little Rann of Kutch was about 4 m deep and was inundated throughout the year (Gupta 1977b). This silt factor may have destroyed many shell beds further inside the Gulf of Kutch, but it has not affected the shell beds on the southern shore and nearer the mouth of the Gulf. In view of these studies, it is probable that the distributions of shell beds as we see them today is very similar to the distribution during the 3rd millennium BC.

Another commonly used species was *Chicoreus ramosus*, a large shell characterised by an inflated body whorl, covered with sets of 3 long curving varices or spines and numerous smaller tubercules (fig. 4c). Adult specimens range in size from 70 mm to 250 mm in length and 60 mm to 200 mm in width, including the varices. Although generally larger than the *T. pyrum*, it has much thinner body walls and a hollow, spiraling columella. The sutures, however, are quite solidly joined making it possible to produce several circlets from each shell, providing all the exterior spines are first removed.
The most common habitat for this species is on rocky areas or coral reefs. It is equipped with a decalcifying acid that is used to perforate the shells of oysters in order to consume the inner organism. Ironically, due to its thin periostracum, various other boring organisms attack the calcareous shell, perforating it with numerous interlacing burrows.

Even though this species has a wide distribution throughout the Indo-Pacific region, its actual distribution along the coasts of the subcontinent is somewhat limited. It is quite common in South Indian waters and also along the southern shore of the Gulf of Kutch, becoming less common further West along the Sindh and Makran coasts. One modern source is noted in the Gulf of Oman around Fahal Island near Muscat (Bosch & Bosch 1982: 89), but is either extinct or extremely rare in the Gulf. Smythe (1982: 59) (fig. 3) suggests that this is only a recent development based on the fact that she has seen well preserved specimens purported to have come from inside the Gulf itself.

*Lambis truncata sebae* was the most massive shell used at Moenjo-daro, ranging in size from 200 mm to 300 mm in length.
and 130 mm to 200 mm in width, including the digitations (Abbott 1961: 156) (fig. 4b). One of the characteristic features of this genus are 6 or 7 digitations extending from the outer lip. In sebae these are not very distinct due to the massive build up of porcellaneous, enamel layers on the outer lip and over part of the spire.

The spire itself is well balanced and has a series of small tubercules along the shoulder ridge near the sutures. This form of spire differentiates it from the subspecies Lambis truncata truncata, Humphery, which has a flattened, truncated spire. As in most gastropods, the columella is solid and spiraling, but it is not as massive as would be expected for a shell of this size. In fact, except for the heavy accumulations on the outer lip, the remainder of the shell is quite thin, and the sutures are relatively weak.

This species is also gregarious, and large numbers are found on sandy or coral rubble bottoms, especially on the seaward side of the reefs (Abbott 1961: 155). Occasionally, specimens can be found washed up on the reef, and in South Indian waters they are common in shallow weedy bottoms. Like the C. ramosus, they have a thin periostracum that is soon perforated by burrowing organisms. Consequently, most specimens are covered with calcareous algae and honeycombed by numerous burrows (Abbott 1961: 155).

There has been some confusion regarding the distribution of this subspecies, due to the occurrence of the flat-spired subspecies truncata in an intervening geographical region. Sebae is basically found throughout the Pacific region and then again along the western coasts of the Indian subcontinent from Kutch to the Makran. It is also reported from the Gulf, the Gulf of Oman and the Red Sea (fig. 3). Truncata on the other hand is found from South Indian waters across the Indian Ocean to Zanzibar and the east coast of Africa (Abbott 1961: 156).

Fasciolaria trapezium is similar in form to the T. pyrum, but slightly more elongate, reaching 200 mm in length and 150 mm in width (fig. 4a). A series of short nodes or tubercules is located on the shoulder of the spiraling whorls and the spire is well balanced. Although the columella is solid, spiraling and massive, it can be distinguished from that of the T. pyrum, by the presence
of two or three low columellar ridges or folds. Traces of the thick periostracum are often fused in the center of the columella and in the spiraling sutures, resulting in a less homogeneous columella and weak sutures.

Occurring in habitats similar to the T. pyrum, these two species are often found together on sandy bottoms (Hornell 1951: 27). In some regions, however, F. trapezium occurs around rocky areas or reefs, where it is exposed to the predations of burrowing organisms. Most specimens found at Moenjo-daro are badly damaged by their interlacing burrows.

Unlike the T. pyrum, this species has a widespread distribution, and is common throughout the Indo-Pacific region. Along the coasts of the Indian subcontinent, it is found from South India to Kutch, with occasional specimens reported from the Sindh and Makran coasts. Like the C. ramosus it is found in the Gulf of Oman around Fahal Island and off the coast from Muscat (Bosch & Bosch 1982: 107), but it is quite rare or possibly extinct in the Gulf itself (Smythe 1982).

Keeping in mind the variable distributions and habitats of these species, we can see that a wide range of marine ecosystems were being exploited by the Indus peoples in their collection of food and suitable raw materials. Bivalves and smaller gastropods were undoubtedly being gathered from beaches, protected lagoons and estuaries simply by digging in the sand at low tide, but the larger gastropods could only be obtained from less accessible areas. Some species (Chicoreus ramosus, Lambis truncata sebae) were probably being collected from reef and rocky areas by wading and submerging at low tide; while others (Turbinella pyrum, Fasciolaria trapezium) were obtained by making shallow dives, probably from reed or wooden boats. The fishing seasons for the intertidal species could have extended throughout most of the year, but the use of boats and diving was probably limited by seasonal weather conditions, such as the monsoons. Present day weather conditions do not appear to have changed drastically since the 4th and 3rd millennia BC so the ancient shell fishing season probably followed the same pattern as the modern shell fisheries in Kutch and South India. These fisheries begin around April and continue through June, until the
onset of the monsoon storms, after which they continue from October to the beginning of January.

The collection of shells is relatively simple once they have been located, but the sea is not a gentle playground and it contains numerous other creatures that must be respected and avoided. Sharks do not pose a grave problem to divers, since collection areas are in relatively shallow water and large sharks do not normally haunt these regions.

However, several species of poisonous fish and snakes inhabit the coral reefs, along with moray eels, and when the wind blows them inshore, there are the extremely poisonous *Pysallia* (Portugese Man-o-War) and the *Chrysaora* 'jelly-fish' (Hornell 1914: 20).

Very little research has been done at the coastal sites of the Indus Civilization, regarding subsistence patterns and social organization (see Meadow 1979), but it is probable that the collection of shells was a part of the subsistence strategy of those coastal populations specializing in the exploitation of marine resources, and was not done by the groups who actually manufactured the shell objects. It is not improbable that at the coastal sites of Balakot, Allahdino, Nageshwar, or Lothal, for example, there may have been a close relationship between shell collectors and shell workers, but at larger inland centers they were undoubtedly quite removed from one another, both physically and socially.

**MOENJO-DARO SHELL INDUSTRY**

Moving now to a discussion of the shell industry as it is represented at the major urban center of Moenjo-daro, we are confronted with a vast array of shell objects made by various technological processes and from several different species. This extremely specialized industry developed out of the early Neolithic and Chalcolithic periods where the use of shell was limited to the manufacture of simple ornaments by perforating natural shells and occasionally making shaped pendants or bangles. During the urban period however, shell as a raw material came to be used intensively for the production of more than just beads and
bangles, but rather, to produce a vast range of decorative, ornamental, utilitarian and possibly ritual objects.

I have been able to study over 2800 artifacts that have been recovered from excavations and surface collections at the site during the past 60 years. Because of the different contexts from which these artifacts come, it is first necessary to explain the nature of the samples to be discussed below. Most of the artifacts come from the early excavations made by Marshall and Mackay during the 1920’s and 1930’s, and have been recorded in the original field registers. In comparing the records of the field registers with the corresponding artifacts that I was able to locate, I found numerous discrepancies in terms of the description and identification of these objects. Because of their unreliable descriptions, I have not used the sample recorded from the field registers in the present discussion. Unfortunately, these ‘unreliable’ registers are also the only source for determining the provenience from which the artifacts were recovered. With reference to most areas of the site, HR, VS and DK, all shell artifacts can be assumed to belong to the Indus Period occupation, but in DM and SD areas on the Stupa Mound, some of the levels are related to the Buddhist Period occupation. It has not been possible at this point to determine if some of the levels recorded in the registers relate to the Buddhist occupation (AD 150-500, Marshall 1931: 122), or the Indus Period occupation. Eventually we hope to be able to sort some of these problems out through the reanalysis of the architecture, but until then, I have decided to exclude the tabulation of all shells from DM area and include all the artifacts from SD area.

Although there are definitely Indus Period objects in the DM sample and possibly some Buddhist Period artifacts in the SD sample, I think that any possible skewing of artifact frequencies, particularly of bangle measurements, will be balanced out by this arrangement. I have not been able to examine any of the shell artifacts recovered from Wheeler’s excavations, but artifacts from Dales' excavation have been studied and are included along with the other artifacts from excavated contexts. Due to restraints in time and finances, it has not been possible to complete the distributional analysis of the different types of artifacts within the site, and consequently all excavated artifacts have been grouped together. This shortcoming can fortunately be bal-
anced by the inclusion of a detailed surface analysis conducted in 1981-83 in cooperation with the IsMEO/RWTH Joint Project at Moenjo-daro. This surface collection has been studied separately in order to compare the types of artifact patterning with those from excavated contexts. Although the earlier excavators have discussed the artifact types at the site in terms of Early, Intermediate and Late periods, the lack of stratigraphic correlations have made it necessary to lump all shell artifacts together and regard them as representing the full range of variation during the Mature Indus Period. In the past, all discussions of Harappan or Indus culture have used Moenjo-daro as the type site, and all artifacts comparable to Moenjo-daro types were considered as being 'true' Indus Period artifacts. The object of the following descriptive section is not meant to provide another set of such types, but rather to illustrate the different stylistic and technological traditions within this large urban center. By using this sample as a reference point, we can more reliably isolate regional variation at other urban and rural sites.

Although the site of Moenjo-daro is far inland, a wide range of marine mollusca are represented in the total sample. As in the Early Indus Period, some of the smaller, colorful gastropods were used as beads or pendants, by simply perforating them (fig. 14.10). All of the species used for making these simple ornaments at Moenjo-daro were also commonly used during the earlier period at other sites in the lower Indus plain (i.e. Oliva, Polinices tumidus, Cypraea, etc.). Their presence at the site may represent the continuation of earlier traditions, or the presence of rural people who still wore the older forms of ornaments. Most of these species are common along the entire coast except for delta regions, but some species, i.e. Pinctada and Engina mendicaria may have been brought from further West along the Makran coast or from the Gulf of Oman. The main focus of my study has been the artifacts manufactured from larger gastropods, and these comprise a vast array of objects made by various technological processes. In order to facilitate the study of these numerous artifacts I have grouped them into eight general categories on the basis of important morphological variables relating to stylistic, technological and possible functional features.

1) Finished Ornaments
2) Unfinished Ornaments and Manufacturing Waste
3) Finished Utensils  
4) Unfinished Utensils and Manufacturing Waste  
5) Finished Inlay  
6) Unfinished Inlay and Manufacturing Waste  
7) Other Special Objects  
8) Unfinished Objects and Manufacturing Waste.

**Ornaments**

The most common shell ornament at Moenjo-daro is represented by shell bangle fragments (35.1%; Table 4), which were produced almost exclusively from *T. pyrum*. On the basis of a detailed analysis of manufacturing wasters and partly finished artifacts, it has been possible to reconstruct the major manufacturing stages and the types of tools used.

First, the shell was prepared for sawing by hollowing out the interior and breaking the thick columella (fig. 5a-f). A stone or metal hammer was used to perforate the apex and then a metal pick (or hammer and punch) was used to break the internal septa. Numerous copper/bronze chisels or punches have been recovered from the excavations, and some of these could have been used for shell manufacture (Marshall 1931, vol. 1: 501; vol. 3: pl. CXXXVII 8, 12, pl. CXXXV 11-16). Once the shell had been hollowed out in this manner, it was sawn at a diagonal to avoid the aperture and remove the irregular anterior portion (fig. 5g-i). The remaining hollow spire was then sawn into rough circlets of the desired width (fig. 5j-k). These circlets were ground on the interior using a cylindrical piece of sandstone or some other type of abrasive tool, while the exterior was probably ground on a flat sandstone slab (fig. 5m, n).

Most of the finished bangles have an incised design carved into the shell at the point where the suture joins the whorls together (fig. 5o). The motif is generally in the form of a chevron, 'V', which very neatly transforms the natural irregularity of the shell circlet into an attractive design (fig. 10.1, 2, 3). During the surface survey, one unique bangle fragment was discovered with a single Indus script character inscribed over the more common chevron motif (fig. 10.1). This is the only example of script occurring on a shell bangle, and could indicate a specific socio-ritual use of this specific bangle.
The most common bangle form has a faceted or peaked exterior face, forming a rough triangular section (fig. 10.3, 7). On extremely worn examples the exterior is slightly rounded, resulting in a plano-convex section. Wide bangles are generally treated in the same manner, but due to the width, the faces tend to be slightly concave (fig. 10.9, 10). No grooved bangles have been discovered from any of the excavated areas of the site, but 10 fragments have been recorded that apparently came from surface contexts (no register number is recorded). These grooved bangles have anywhere from one to three parallel grooves (fig. 10.11) and can probably be assigned to the Buddhist Period occupation, as this design is quite common during the later historical periods (Kenoyer 1983: chap. IV).

A comparison of bangle widths shows a wide range of style, from thin to extremely wide bangles: 2 mm to 44 mm (Table 1). During the Indus period the variation in width is definitely a stylistic feature and can no longer be attributed to a difference in manufacturing traditions, because we now have evidence in the form of unfinished bangles and manufacturing waste indicating the production of wide bangles using a copper/bronze saw. One result of this use of a metal saw is the less distinct division between thin and wide bangles, which were more clearly differentiated in the earlier periods. However, we still see a rough bi-modal (or even tri-modal) distribution (Table 1), but it is difficult to determine where to divide these for stylistic classification. The thin bangles can be tentatively divided into two sub-categories, those having widths of 2 to 8 mm, and those from 8 to 18 mm wide. The wide bangles are much more varied, ranging from 20 to 44 mm in width, but there are concentrations between 20 to 25 mm, and 32 to 35 mm. Analysis of the bangles in relation to their spatial distribution at the site would provide an additional variable that might determine if certain types of bangles were being worn/discarded in specific parts of the city, but until this study has been completed, we must work with these less defined groupings.

Getting back to the manufacture of these ornaments, the incised design could have been made using a chert blade or a more specialized copper/bronze file, and a study of the striae suggests that both types of tools were used. Sawing, on the other
Fig. 5 — Bangle manufacture with *Turbinella pyrum.*
hand, was not done with stone tools, as has been suggested by scholars in the past, but by a highly specialized form of copper/bronze saw. A detailed study of sawing wasters indicates that the saw had a long convex edge that was extremely thin; approximately 0.4 to 0.6 mm (Kenoyer 1983, Appendix III: 9). Usually, this saw was only needed to cut through the thickness of the shell body wall, about 5 to 7 mm, but the maximum recorded depth to which the saw could cut is between 20 and 30 mm. The section of the saw edge is generally slightly rounded, and the cutting striae indicate that the saw was bi-directionally denticulate, cutting equally well with each thrust as it was moved back and forth. The maximum distance between each cutting stria is approximately 0.5 mm indicating the efficient cutting ability of the saw. There is no evidence in the configurations of the cutting striae to suggest that any form of abrasive was used in the sawing process.

Several convex saws have been recovered from the earlier excavations, but none of them fit the requirements indicated by the shell wasters (Marshall 1931, vol. 2: 500-501; vol. 3: pl. CXXXVII 6, 7, pl.CXXXVIII 4, 8). The only ethnographic example of a similar saw is the large crescent saw used by modern shell cutters in West Bengal and Bangladesh (Kenoyer 1983: chap. IV, fig. 4.1, 2).

In addition to _T. pyrum_, two other species, _Pugilina bucephalala_ and _Chicoreus ramosus_ were also occasionally used for manufacturing bangles (fig. 10.5). It is usually difficult to determine the species of a shell from a small bangle fragment, but if the shell suture is present one can distinguish bangles made from _T. pyrum_ (thick, heavy), from those made from _C. ramosus_ (thin, twisted). Out of 658 bangle fragments from the total sample (excluding DM Area), only 24 (3.6%) were made from _C. ramosus_.

Other ornaments made from shell include various sizes of rings, beads, perforated discs, pendants, buttons, etc. (figs. 11.5-18; 14.3-10). Again, it is often impossible to determine which species of shell an object was made from unless it portrays characteristic structural features of the original shell. On the basis of this type of evidence, it appears that rings were generally made from the spire portion of the _T. pyrum_, and perforated cylinders from the columella; while the remaining beads, pendants, etc. could have been manufactured from any of the larger
Table 1 — Moenjo-daro: shell bangle widths.

### Excavated Sample

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N = 460

### Surface Sample

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N = 176
gastropods. These objects were produced by various processes of chipping, sawing, grinding and drilling. Many of the circular pieces (fig. 11.27) were made using a tubular drill, which was probably made of copper/bronze.

The thickness of the tube edge was approximately 0.9 mm, but the diameter varied according to the size of the disc being produced (Kenoyer 1983, Appendix III: 9). Smaller perforations were undoubtedly made by tiny chert drills using a standard bow drill. Replicative experiments by the author using chert drills, have shown that a piece of shell 3 mm thick can be perforated in about one minute.

Utensils

The most important type of ‘utensil’ found at Moenjodaro is the distinctive shell ladle or spoon, made from *Chicoreus ramosus* (figs. 6; 13.1). It is interesting that no other shell was ever used to make this type of ladle, even though an unproportionate amount of labour was required to produce it. Before the body of the shell could be cut, all of the exterior spires and varices had to be first sawn or chipped off (fig. 6a-b). Then, a diagonal cut was made from the top of the main whorl extending around both sides of the shell and eventually reaching the narrow anterior end of the shell (fig. 6c-d). A handle was formed by making two parallel, longitudinal cuts extending from the anterior tip towards the main body whorl (fig. 6e). In this manner, a rough ladle was detached from the body of the shell, and by repeating the process on the remaining half of the shell, a second, but smaller ladle could also be produced (fig. 6d, e). These rough forms were then ground smooth and polished, but due to the irregular nature of the exterior surface, traces of the natural shell are usually visible on the exterior of the finished ladle (fig. 6f). Another apparent defect in the ladles are the numerous holes left by burrowing organisms.

Some of these holes actually perforate the body of the shell and were presumably stopped up with some sort of plaster to make the ladle functional. However, it is not quite certain what this function was. Fragments of finished and even complete ladles have been found throughout the site and it is evident that
Fig. 6 — Ladle manufacture with *Chicoreus ramosus.*
they were used in habitation areas, either for domestic or ritual purposes. A considerable amount of time and energy was required to produce these objects and it is unlikely that they were easily obtained or used by the average individual for domestic purposes. The discovery of identical clay replicas suggests that these ladles had a specific socio-ritual function for dispensing food or liquids (Marshall 1931: 471, pl. CXXXIII 12).

**Inlay**

Due to the small size of most inlay pieces, it is often impossible to determine the species of shell used to make a particular piece, but a study of the shell wasters indicates that all of the large gastropods were used in the production of inlay. Waste fragments of *T. pyrum* left from bangle manufacture were recycled to make various flat geometric designs. *Chicoreus ramosus* fragments were also reused, but it is interesting that on the evidence from the types of manufacturing waste recovered throughout the site, *F. trapezium* appears to have been used solely for the manufacture of inlay (fig. 7). Numerous examples of this shell have been found where only the thick body whorl was removed by chipping or sawing, leaving the columella and spire as waste. The large pieces of body whorl were sawn, chiselled, drilled and ground to produce various geometric shapes (figs. 11.19-35; 14.6-9). Another species, *Lambis truncata sebae*, was used primarily for making exceptionally large, solid plaques (figs. 8; 12.11). The outer lip was sawn into thin sheets or planks, that could then be cut into the desired designs. Saw marks on many of the inlay wasters, especially those cut from the *Lambis*, appear to have been sawn by a saw having a fairly flat cutting edge. This saw was also bi-directionally denticulated, but the saw cuts are slightly thicker, indicating that the saw edge was about 0.7 mm thick (Appendix 3: 9).

Very few of the other types of shell fragments at the site show evidence of burning, but quite a large number of burnt inlay pieces have been recorded. Possibly these pieces were set into wooden furniture or paraphernalia that were later discarded or accidentally burned. It is interesting that many of the larger inlay plaques are made from *Lambis*, a species that was also
used in Mesopotamia to provide inlay pieces for furniture, gaming boards etc. Shell inlay was also used on statuary to accentuate features or decorations and one of the seated limestone figures from Moenjo-daro still has an almond-shaped piece of shell as an eye (Marshall 1931: 566, pl. XCVIII). On most inlay pieces, the edges have been intentionally bevelled to facilitate setting, which was evidently done using a form of gypsum plaster (Marshall 1931, vol. I: 566). Some pieces also have traces of red, and occasionally black pigment around the edges or inside the incised designs. Unfortunately, no examples of inlaid wooden objects have been recovered from Moenjo-daro, but ceramic motifs can provide us with some idea of the exquisite geometric and floral designs made from the white shell, outlined in red and black.

Special Objects

This group includes all of those shell objects not covered by the above categories, and only a few of the major types are discussed below, because it is not in the scope of this paper to present a detailed discussion of all the different varieties. The craftsmen at Moenjo-daro were extremely skilled at working shell and they used specific portions of the different species to produce a wide range of objects that were often made in terracotta as well as other materials.

Most objects in this group are solid, heavy pieces made from the thickest portions of various shells. The massive columella of T. pyrum was used to produce a wide range of these objects (fig. 12.1, 2). Numerous pointed cones have been found that are similar to the more common terracotta cones (Marshall 1931: 476), but unfortunately the examples in shell do not shed any more light on possible uses for this simple object. The columella was also used to make various sizes of solid and perforated cylinders. Many of the solid cylinders appear to be rough-outs for making smaller objects, such as spheres, 'gaming pieces' or 'wavey rings' (fig. 12.3-6, 7-10). Some of the large perforated cylinders are smoothed from wear on the exterior as well as the interior of the hole, suggesting their use as an ornament. Other examples, however, are only smoothed on the exterior, but not inside the hole.
Fig. 7 — Inlay manufactures with Facioidea trapezium.
Fig. 8 — Inlay manufacture with *Lambis truncata sebae.*
Table 2. Moenjo-daro: Special Objects

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<td>columella</td>
</tr>
<tr>
<td>‘Cap’</td>
<td>T. pyrum</td>
<td>body whorl and spire</td>
</tr>
<tr>
<td></td>
<td>F. trapezium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. ramosus</td>
<td></td>
</tr>
<tr>
<td>Toy Cart Frame</td>
<td>L. truncata sebae</td>
<td>outer lip</td>
</tr>
<tr>
<td>Animal Figurines,</td>
<td>L. truncata sebae</td>
<td>outer lip</td>
</tr>
<tr>
<td>Bull, Tortoise,</td>
<td>L. truncata sebae</td>
<td>outer lip</td>
</tr>
<tr>
<td>Garial, Bird,</td>
<td>L. truncata sebae</td>
<td>outer lip</td>
</tr>
<tr>
<td>Shake, Frog</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Libation’ Vessel</td>
<td>T. pyrum</td>
<td>entire shell</td>
</tr>
</tbody>
</table>

These may have been used as components in segmented or composite rods as has also been suggested for the ‘wavey rings’ by Mackay (Marshall 1931: 475). After considerable detailed examination of these artifacts, I would agree with Mackay’s interpretation, primarily on the basis of the lack of wear on the interior and the ends of the ‘wavey rings’ and the presence of a high polish on the exterior. The only major problem is that we have found no evidence of a paste of mastic used to join the rings on a central rod, but this discussion must await further research and exploration.

Another intriguing object is the shell ‘cap’. These objects were comprised of two or three convex pieces that theoretically joined together to form a low, flat-topped dome. The exteriors are incised with single or parallel grooves (fig. 12.16) that were
often filled with red coloring. So far, however, no matched sets have been recovered and their function is still a mystery. They were made from three different species. *T. pyrum*, *F. trapezium* and *C. ramosus*.

Although the columella of the *T. pyrum* is massive, it is not quite as large as the outer lip of *Lambis truncata sebae*, and most figurines and toys were made from this shell. Generally, the thick digitations on the edge of the outer lip were sawn off to make the head of bull figurines.

These figurines were made in two parts, the head and the hump (fig. 14.1,2), but up till now no other body parts have been discovered. It is possible that these fragments were joined onto the composite rods as a carved standard or possibly set into the pommel of a tool/weapon. Other types of figurines include tortoises? (fig. 12.14), gharials, birds (fig. 14.3), snakes? (fig. 14.4) and frogs (fig. 14.5). The carving on all of these objects is so exceptional that one can only assume that Mackay was speaking in a different context when he suggests that the shell workers of Moenjo-daro were not so ‘adept’ as the Sumerians (Marshall 1931: 568).

One other group of special objects deserves special mention, particularly because its significance has been overlooked in the earlier reports. These are called ‘shell receptacles’ by Mackay and he mentions that ‘In Sumer similarly smoothed shells were used as drinking cups or for libations or ablutions’ (Marshall 1931: 569). It should be noted however that the receptacles from Mesopotamia are almost all made from *Lambis truncata sebae* whereas those at Moenjo-daro are almost exclusively made from *Turbinella pyrum* (only one possible example is from *C. ramosus*). To manufacture these vessels, the interior of the shell was hollowed out by chipping away the columella and internal septa from the opening of the orifice, leaving the apex intact. This difficult process was often even further extended by the careful smoothing of the interior chipped edges, while the exteriors were always smoothed and incised with single or parallel grooves. These grooves were then filled with red coloring. I have called these ‘libation vessels’ because of their special manufacture and shape, which is suited to holding and pouring some form of liquid (fig. 15.4, 5, 6). There are no evidences of burning at the edges, so we can rule out the possibility of their use as lamps. In
South India similar, unincised, but hollowed out shells are used by traditional mothers, to milk-feed infants. More elaborate and carefully manufactured vessels are made in the shell manufacturing centers in Bengal for special ritual libations, but some of the simpler styles are identical to those found at Moenjo-daro.

Our past understanding of the shell industry at Moenjo-daro was based primarily on the data presented by Marshall and Mackay in the original excavation reports (1931 and 1938). Mackay's technological interests led him to study many of the craft activities represented at Moenjo-daro, but shell working was evidently not one of his main interests. In the first report, only ten different species of mollusca were identified (Marshall 1931: 664-60; whereas now, over 33 species have been recorded from the site. The technological aspects of the shell industry were also dealt with quite briefly; a short reference was made regarding the possible similarity of the bangle manufacturing industry to the modern industry in Bengal, and a general discussion was provided on the possible different manufacturing techniques used to cut and shape inlay pieces (1931: 56-570). Mackay (1938: 568) notes that

in the manufacture of shell inlay, however, the people of Moenjo Daro were not so adept as the Sumerians. In India, we do not find the wonderful figurines carved in this material that we find in Sumer. Possibly the people of Moenjo Daro used wood as their chief medium of expression.

He also points out that the major species used at the site was *Fasciolaria trapezium*. A reexamination of the shell artifacts indicates that although *F. Trapezium* was indeed important in the manufacture of inlay, it was by no means the major species used at the site, this position is held by *Turbinella pyrum*. Fortunately, the generalizations and interpretations made by the earlier excavators were based on excavated shell artifacts that were recorded by provenience and preserved for future study. It has been possible to relocate most of the shell objects recorded in the field registers, but the descriptions are often brief and occasionally incorrect, indicating that the recording was done without making a detailed examination of each object. This lack of interest can be understood in view of the large quantities of artifacts that were being processed, but cannot be ignored when assessing the reliability of the artifact descriptions in the regis-
ters. Generally speaking, the excavation reports do not go into
detail describing the contexts in which shell artifacts were found. 
Without this information, it is difficult to understand the 
processes involved in the final deposition of the artifacts and any 
conclusions based on the published reports, must necessarily 
remain generalized and conjectural.

Nonetheless, certain areas of the site appear to have been 
used specifically for the manufacture of shell objects, and these 
can be recognized by the presence of raw materials, unfinished 
pieces, manufacturing waste, finished objects and occasionally 
even tools (fig. 9).
In ‘L’ area, South of the stupa mound, a large quantity of unworked and partially worked *F. trapezium* was discovered in the partitioned apartments South of the ‘Pillared Hall’. Marshall suggests that shell workers came and occupied these quarters after the original function of the building had ceased, and assign this occupation to the ‘latter end of the Late Period’ (1931: 165). He mentions that in some areas the ‘late’ floor was still used by the artisans, while in other areas they had built up mud floorings. In one of the adjacent chambers (Chamber 6) a large sandstone grinding stone was found, which Marshall interpreted as being a possible leather-worker’s whetstone. On the basis of its association with shell fragments and inlay manufacturing waste, it is more likely to have been used as a grinding stone or whetstone by the shell workers. One further point of interest that has come out in the restudy of the shell fragments from this area, is that there is a conspicuous lack of shell bangles and bangle manufacturing waste. From the entire ‘L’ area excavations, only three shell bangle fragments are recorded in the registers, and there are very few examples of *T. pyrum* wasters. Most shell fragments belong to *F. trapezium*, with a few examples of *Lambis* sp. and *C. ramosus*. Almost all of the shell wasters from this area are definitely related to inlay manufacture, or the manufacture of discs and beads.

Another possible workshop for inlay is in the ‘HR’ area (Section B, Block 2, House IX, Room 85), where quantities of inlay and waste pieces were found, together with a copper chisel (Marshall 1931: 195). The room in which these artifacts were found, was supposedly built in the ‘Intermediate’ period and then rebuilt again in the ‘Late’ period. Not far from this building, another area was located that may have been used for processing ‘oyster’ shells to make lime/gypsum plaster (Block 2, House X, Rooms 134, 135) (Marshall 1931: 197).

The presence of a wide range of waste fragments from different stages in bangle manufacture, indicates that bangle manufacturing was definitely being carried out somewhere in or near the site. One possible manufacturing area was located in ‘VS’ area (Block 2, House XIII), where numerous broken shell fragments and 41 shell cores were found. After examining many of these cores or rather columellae, it was evident that they were all from *Turbinella pyrum*, and sawn from the shell in the
process of bangle manufacture. This collection of columellae could indicate a primary context where the shells were actually sawn, or it could represent a storage area or workshop where they were being reprocessed to make cylinders, cones, beads, etc. If we had more details regarding the stratigraphy of this area it might have been possible to interpret this cache more specifically. In ‘HR’ area (Section A, Block 2, East of House III) we encounter a similar situation, where a large pot was found containing 15 complete, but unfinished shell bangles. From ethnographic examples in the shell working community in Bengal, we know that merchants often provide workmen with unfinished bangles, to be processed at home and then returned after they have been ground and carved. The cache of unfinished bangles could have been passing through a similar chain, when it was lost or abandoned.

Burials are another important context where shell artifacts have been recorded. Though no major cemetery has been found at Moenjo-daro, some so called ‘fractional burials’ are reported from different habitational areas of the site. In one of these, a skull was found ‘in a potsherd’ and a shell ‘spoon’ was recorded among the other cultural debris in the same strata (Marshall 1931, vol. 1: 82, pl. XLIId). Another reported association is of shell bangle fragments with a skull and finger joint that were found in a subterranean chamber (Ch. 3, Building XXI, Block 4, VS Area; ibid.: 87). This feature has been classified as a «Post Cremation Burial » on the basis of ashes and charcoal occurring with the bones and other objects (T/C figurine fragments, chert scraper, etc.). Only one other occurrence is reported, but this is again in a questionable context and does not indicate any intentional association. In one room (House X, Room 174, Hr Area; ibid.: 184, pl. XLVI) a large number of skeletons were discovered lying on top of each other as if they had all been dumped there, and on the left wrist of one of these unfortunate individuals (sex not determined) a complete shell bangle was discovered. None of the other individuals had any shell ornaments, but some had copper rings as well as bangles.

The presence of shell with burials was a common practice during the Neolithic and even the later periods at Mehrgarh, but it does not occur with the same frequency or quantity during the Indus Period. More evidence is seen in the burials at Harappa,
Kalibangan and Lothal, but even at these sites there is no pattern indicating the specific inclusion of shell ornaments as burial offerings (Kenoyer 1983: 188, passim). These few examples are the only clues provided in the excavation reports regarding the role of shell working at Moenjodaro. The only way to acquire new data would be to prepare a map of the overall distribution of the different artifact types on the basis of my reanalysis of the shell artifacts collected by the early excavators.

**Surface Survey, 1982-83**

One important objective of the surface survey carried out by the IsMEO/RWTH Joint Project was to sample the unexcavated surfaces of the site to try and locate possible shell manufacturing areas. Another objective was to examine the previously excavated sections and dump areas in order to better understand the contexts from which shell artifacts were recovered and also to determine what types of artifacts were discarded in the dumps.

Over 700 shell artifacts were recovered from the exposed surface areas of the site, coming from three basically different contexts, 1) in association with excavated structures, 2) in dump areas, and 3) on unexcavated eroded surfaces.

Only a few artifacts were recovered from the previously excavated areas and these are comprised of fragments of finished ornaments, utensils, etc. The dumps however, yielded a large quantity of wasters as well as semi-finished objects. In the L Area dump (fig. 9) there were 53 wasters of *F. trapezium*, variously sawn or chipped and all resulting from inlay manufacture. Only one fragment of *T. pyrum* waste was found in this same area, and this appears to have been a waster from inlay manufacture rather than from bangle manufacture. Only four finished bangle fragments were recovered from the dump, bringing the number of shell bangles from L Area to a total of seven. The evidence of inlay wasters from the dump areas would lend support to the interpretation that this was an inlay manufacturing area, but unfortunately it does not throw any more light on the problems of chronology or rare occurrence of shell bangles. Similar concentrations of *F. trapezium* fragments were found in the dumps associated with SD Area and the excavation of the so
called 'Granary'. Other dumps from VS Area, HR Area and DK Area were also examined but they do not provide any conclusive evidence for specific types of manufacturing activities because of the small sample size and the varieties of artifact types.

In the unexcavated areas within the main site we found only two important concentrations of manufacturing waste, one in a recently exposed room eroding out of the ridge to the North of L Area, and the other eroding from the northern face of the southern East-West ridge located to the East of HR Area (fig. 9). The concentration in L Area consists of inlay waste fragments (8) and unfinished inlay pieces (2). Due to time constraints, this area was not fully sampled, but will hopefully provide an interesting area for study in the following season. It appears that the shell fragments are part of a deposit enclosed by three walls, and as such may indicate a primary manufacturing area where inlay and small ornaments were being processed.

In HR East, the concentration consists of numerous manufacturing wasters from bangle, ladle and also inlay production. The fragments were found eroding from the side of the ridge and lying on the silty aeolian and fluvial deposits at the base of the slope. These fragments could possibly indicate the presence of an ancient dump area, from a nearby workshop, or the secondary deposition of such an area.

The most interesting discovery relating to shell manufacture was on a low mound, several hundred meters Northeast of the Moneer Area. Although it has not yet been properly mapped, the eroding structures appear to be oriented in the cardinal directions and the associated pottery and artifacts are all of the mature Harappan period. This mound is isolated from the main site by a recent river flood channel and is cut in two by an old road leading to Dokri village. The eastern portion of this mound was covered with large quantities of tiny chipped fragments of T. pyrum. This type of fragment is produced during the preliminary chipping stages of bangle manufacture, when the apex is perforated and the internal septa are broken. The hollowed out shell would then be sawn into rough circlets. Only a few fragments of these subsequent stages of manufacture were found during the sampling of this area, suggesting that this location may have been used only for the preliminary preparation of the shell for sawing.
In addition to the location of these important manufacturing indicators, other shell artifacts were recovered that were used by bead drillers as backing for a bow drill (fig 13.3). These pieces were made from broken fragments of ladles or sawn wasters that fit easily in the palm of the hand. By placing the concave side against the back of the drill, steady pressure could be applied during the drilling process. Numerous shallow depressions in the concave portion of these pieces indicate that the back of the drill shaft was probably tipped by a stone or copper/bronze point. It is possible that the shell pieces were being used by craftsmen who were drilling shell beads but they may also have been used in drilling other types of beads or ornaments. Further surface analysis in the areas where these objects were found may help in our understanding of these other important craft activities at Moenjo-daro.

Due to the relatively small and diverse samples of shell artifacts found during the 1982-83 surface survey in specific localities, it is difficult to get more than a general impression of the relationship between manufacturing waste and finished objects. Nonetheless, this sample is very useful for comparative purposes and illustrates the important information that can be collected through surface collection. In the following section I have listed the tabulations and frequencies from the surface survey separately in order to show how they relate to the corresponding excavated sample.

Table 3. General Grouping of Shell Artifacts

<table>
<thead>
<tr>
<th></th>
<th>EXCAVATED</th>
<th>SURFACE SURVEY</th>
<th>TOTAL SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>Finished Objects</td>
<td>1354</td>
<td>63.8</td>
<td>294</td>
</tr>
<tr>
<td>Unfinished and Waste</td>
<td>729</td>
<td>34.4</td>
<td>369</td>
</tr>
<tr>
<td>Not Determinable</td>
<td>39</td>
<td>1.8</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>2122</td>
<td>100.0</td>
<td>673</td>
</tr>
</tbody>
</table>
In the excavated sample we see a predominance of finished pieces over manufacturing wasters, suggesting a bias towards the collection of finished artifacts by the early excavators. This bias has been substantiated by the examination of the old dump areas. The sample from the surface survey, on the other hand shows a more balanced distribution between finished and waste, but again we must remember that many of the waste pieces in this sample came from the earlier excavations. Looking at the total combined sample we get a more reliable distribution, showing a definite predominance of finished artifacts over manufacturing waste. This pattern probably reflects the fact that much of the manufacturing waste was recycled to make smaller and smaller objects, such as beads and inlay. In Table 4 below, we notice another feature that can be attributed to two different factors; breakage and production. The high percentage of bangle fragments probably reflects the fact that a single bangle, especially the thin ones, can result in numerous tiny fragments, whereas bead and tiny inlay pieces would tend to be more completely preserved. With this in mind, the high frequency of inlay suggests that it may have been equally common with ornaments. On the other hand, the fact that a single shell could produce several bangles, beads, inlay and special objects is definitely reflected in their higher frequency, while only one or two ladles could be made from each shell.

**Table 4. Finished Shell Objects**

<table>
<thead>
<tr>
<th></th>
<th>EXCAVATED</th>
<th>SURFACE SURVEY</th>
<th>TOTAL SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>ORNAMENTS, Bangles</td>
<td>422</td>
<td>31.6</td>
<td>150</td>
</tr>
<tr>
<td>Other Ornaments</td>
<td>144</td>
<td>10.4</td>
<td>33</td>
</tr>
<tr>
<td>UTENSILS, Ladles</td>
<td>177</td>
<td>13.7</td>
<td>44</td>
</tr>
<tr>
<td>INLAY</td>
<td>423</td>
<td>31.7</td>
<td>33</td>
</tr>
<tr>
<td>SPECIAL OBJECTS</td>
<td>168</td>
<td>12.6</td>
<td>34</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1334</td>
<td>100.0</td>
<td>294</td>
</tr>
</tbody>
</table>
Table 5. Bangle Manufacture

<table>
<thead>
<tr>
<th></th>
<th>EXCAVATED</th>
<th>SURFACE SURVEY</th>
<th>TOTAL SAMPLE</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>Finished</td>
<td>422</td>
<td>54.7</td>
<td>150</td>
</tr>
<tr>
<td>Unfinished</td>
<td>44</td>
<td>5.7</td>
<td>28</td>
</tr>
<tr>
<td>Man. Waste</td>
<td>305</td>
<td>39.6</td>
<td>212</td>
</tr>
<tr>
<td>Not Deter.</td>
<td>0</td>
<td>.0</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>771</td>
<td>100.0</td>
<td>395</td>
</tr>
</tbody>
</table>

Table 6. Other Ornaments, Inlay and Special Objects

<table>
<thead>
<tr>
<th></th>
<th>EXCAVATED</th>
<th>SURFACE SURVEY</th>
<th>TOTAL SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>Finished</td>
<td>755</td>
<td>66.1</td>
<td>100</td>
</tr>
<tr>
<td>Unfinished and Waste</td>
<td>(16)</td>
<td>(7.1)</td>
<td>103</td>
</tr>
<tr>
<td>Not Deter.</td>
<td>39</td>
<td>3.4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>1142</td>
<td>100.0</td>
<td>224</td>
</tr>
</tbody>
</table>

Table 7. Ladle Manufacture

<table>
<thead>
<tr>
<th></th>
<th>EXCAVATED</th>
<th>SURFACE SURVEY</th>
<th>TOTAL SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>Finished</td>
<td>177</td>
<td>66.1</td>
<td>44</td>
</tr>
<tr>
<td>Unfinished</td>
<td>24</td>
<td>11.5</td>
<td>5</td>
</tr>
<tr>
<td>Man. Waste</td>
<td>8</td>
<td>3.8</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>209</td>
<td>100.0</td>
<td>54</td>
</tr>
</tbody>
</table>
The most informative quantitative data is seen in the comparisons within each general category. Looking first at bangle manufacture (Table 5), we see about 50% waste to 50% finished bangles. This balance is not reflected in the category of Other Objects, where there is only 34% waste to 62% finished objects (Table 6). The differences between these two groups can be explained by the fact that much of the bangle manufacturing waste was used to produce other objects. This explanation however, does not apply to the Ladle category (Table 7). Here we note a sharp decrease in waste (15%), and the breakage factor for large ladles cannot be the reason for this disproportionate amount of finished artifacts. Although it is possible that the ladle manufacturing areas of the site have been missed, the repetition of this pattern at other large urban sites such as Harappa and Lothal suggests that many of the ladles were being manufactured outside of the site, and brought in as semi-finished or finished objects (Kenoyer 1983: 199, 208, passim). This hypothesis is further supported by the discovery of a major bangle and ladle manufacturing center at the site of Nageshwar on the Gulf of Kutch (Bhan & Kenoyer 1983).

**Summary**

On the basis of these preliminary observations it is evident that Moenjo-daro definitely had workshops that specialized in the production of shell objects such as bangles, beads, inlay, utensils and other decorative objects. The excavated materials and the collections from the surface survey have provided us with a fairly comprehensive set of data representing all of the basic manufacturing stages of the various types of objects, and it is evident that large quantities of bangles, inlay and other special objects were being made at the site. The raw shells, however, were most certainly transported to the site, and three major source areas can be defined on the basis of modern distributions of shell species. The Karachi coast, which supplied *Turbinella pyrum*; the Gulf of Kutch which supplied this species as well as *Chicoreus ramosus*; and the Gulf of Oman which is the probable source for *Fasciolaria trapezium* and *Lambis truncata sebae*. Although these last two species are occasionally found in the Gulf
of Kutch and even possibly along the Karachi coast, the fact that they were not utilized at the ancient Indus sites in Kathiawar or along the western coast suggest that these areas were not supplying the interior urban centers with these species (see Kenoyer 1983: 253 for discussion). The recent discovery of a Harappan potsherd with graffiti in the Harappan script from the site at Ra’s Al-Junayz in Oman (Tosi 1982) may indicate that this area had close contacts with the Harappan sites across the Gulf, and raw shells may have been one of the important commodities in this trade/exchange. The raw shells were probably brought to the site along riverine trade routes or possibly overland, and from Moenjo-daro it is likely that many shells were traded further into the interior. In terms of finished shell objects however, the quantity of shell wasters discovered from the site do not indicate a large scale industry manufacturing products for trade purposes. The size of the work areas discovered so far at the site suggest that the industry was gauged for local markets either within the city itself or at the most for nearby communities that had close contacts with the urban center.

The manufacturing areas in certain rural areas of Bengal, that produce goods only for the local market are very similar to those seen at Moenjo-daro. On the other hand, manufacturing centers that produce semi-finished products and finished products for local and long-distance trade are much larger, and have extremely high percentages of waste to finished goods. The preliminary study of the shell artifacts at Nageshwar serves to illustrate this difference quite well. Located just near a major habitat area for both Turbinella pyrum and Chicoreus ramosus, the site contains extremely large quantities of shell wasters from bangle and ladle manufacture. In one dump area, of about one square meter, there were literally hundreds of columellae from Turbinella pyrum, many more than have been found from the entire site of Moenjo-daro. We have not yet discovered any such concentrations of wasters at Moenjo-daro, but before arriving at any conclusions, we must carefully consider the fact that a lot of the shell waste at the site was being reprocessed into ornaments, or inlay, and many of the fragments may have been burned to produce lime. As mentioned above, Marshall does report one room in HR Area (Section B, Block 2, House X, Room 135) where he found a large concentration of ‘oyster’ shells that may have
been used for making gypsum plaster. However, even with these factors considered, shell manufacturing at the site does not appear to be in the form of a large scale industry, producing trade items that would comprise a major asset in the overall economy of the site. On the other hand, it was most certainly an important industry and this is demonstrated by the distances from which raw shells were obtained and the presence of shell artifacts throughout the entire site. As we continue to study the different crafts and small industries at the site of Moenjodaro we will be able to better interpret the role of various objects, such as shell, in the socio-economic and possibly the socio-religious spheres of this complex culture.

BIBLIOGRAPHY


Fig. 10 — Moenjo-daro bangle fragments, 1982-83.

1. Incised and engraved with script, *Turbinella pyrum* (MD/83/150).
2. Incised and repaired, *T. pyrum* (HRE/83/554)
3. Incised, interior not finished, *T. pyrum* (Channel/82/107)
4. Incised, heavily worn, *T. pyrum* (MD/83/170)
5. Incised, heavily worn, *Chicoreus ramosus* (MN/83/416)
6. Incised, multiple slashes, *T. pyrum* (MN/83/403)
8. Incised, multiple slashes, *T. pyrum* (DK/83/439)
10. Wide, heavily worn, *T. pyrum* (E/83/105)
12. Repaired, heavily worn, *T. pyrum* (HRE/83/298)
1. Reworked bangle fragment, _T. pyrum_ (MN/83/475)
2. Reworked bangle fragment, _T. pyrum_ (HRE/83/432)
3. Reworked bangle fragment, _T. pyrum_ (E/83/122)
4. Reworked bangle fragment, _T. pyrum_ (MD/83/159)
5. Reworked bangle fragment/bead blank, _T. pyrum_ (MD/83/539)
6. Reworked bangle fragment/bead blank, _T. pyrum_ (MD/83/540)
7. Bead blank, species? (MN/83/549)
8. Bead blank, species? (HRS/83/544)
9. Unfinished bead, species? (HRS/83/547)
10. Finished bead, species? (DKG/83/524)
11. Drilled inlay, species? (MD/83/487)
12. Partly drilled fragment, species? (LN/83/418)
13. Bead, species? (MN/83/419)
15. Bead, species? (HRE/83/349)
16. Bead, species? (NE, Mound/83/490)
17. Pendant, _Cypreaa turdus_ (DK/83/525)
18. Pendant, _Nerita_, sp. (HRE/83/413)
19. Inlay blank, species? (HRE/83/264)
20. Finished inlay, species? (MN/83/71)
21. Inlay waster, species? (L/83/46)
22. Fretted inlay, species? (MN/83/49)
23. Fretted inlay, species? (HRN/83/50)
24. Triangular inlay, species? (MN/83/531)
25. Triangular inlay, species? (MN/83/417)
26. Unfinished ground disc, species? (MN/83/121)
27. Tubular drill waster, species? (DK/83/45)
28. Inlay, concentric incised circles, species? (DK/83/53)
29. Inlay, concentric incised circles, species? (M/83/535)
30. Inlay, with incised design, species? (DK/83/220)
31. Inlay/ disc, species? (MD/83/201)
32. Unfinished inlay, species? (SD/83/330)
33. Finished inlay, species? (VS/83/358)
34. Triangular inlay, species? (DK/83/304)
35. Triangular inlay, species? (MN/83/315)
36. Sawn body whorl, _T. pyrum_ (L/83/445)
37. Sawn apex fragment, _T. pyrum_ (MN/83/190)
38. Sawn and ground apex fragment, _T. pyrum_ (DK/83/523).
Fig. 11 — Shell artifacts, Moenjo-daro, 1982-83.
1. Sawn columella, *T. pyrum* (MD/83/196)
2. Sawn and ground columella, *T. pyrum* (MR/83/412)
4. Unfinished ‘wavey ring’, *T. pyrum* (DK/83/546)
5. Finished ‘wavey ring’, *T. pyrum* (HRS/83/110)
6. Finished ring, *T. pyrum* (MD/83/203)
7. Finished ‘wavey ring’, *T. pyrum* (MD/83/191)
10. Finished ‘wavey ring’, *T. pyrum* (HRE/83/252)
12. Sawn and ground columella, *T. pyrum* (SD/83/324)
15. Carved lid, *Lambis truncata sebae* (MN/83/414)
Fig. 12 — Shell artifacts, Moenjo-daro, 1982-83.
Fig. 13 — Moenjo-daro shell artifacts, 1982-83.

1. Ladle, heavily worn, *Chicoreus ramosus* (E/83/99)
2. Inlay rough-out, sawn and chipped, *T. pyrum* (E/83/97)
Fig. 14 — Moenjo-daro; shell artifacts.

1. Composite bull figurine, hump, *Lambis truncata sebae* (L 781)
2. Composite bull figurine, head, *Lambis truncata sebae* (DK 5923, MN 913)
3. Bird figurine, flat inlay?, species? (no., MM 937)
4. Snake or tortoise head, *Turbinella pyrum* (SD 3307)
5. Frog figurine, *Lambis truncata sebae* (DK 95)
6. Inlay, zig-zag design, species? (HR 4625, MM 912)
7. Inlay, stepped cross, species? (DK 8317, MM 905)
8. Inlay, fretted design, species? (HR 4517, MM 907)
9. Inlay, rosette, species? (no., MM 906)
Fig. 15 — Moenjo-daro; shell artifacts.

1. Special object, half ring, Turbinella pyrum (HR 3898)
2. Special object, half ring, Turbinella pyrum (SD 566)
3. Special object, half ring, unfinished, Turbinella pyrum (E 2208)
4. 'Libation vessel', Turbinella pyrum (HR 3517)
5. 'Libation vessel', Turbinella pyrum (DK 8538)
6. 'Libation vessel', Turbinella pyrum (HR 5726).
PAUL RISSMAN

The Oriyo Test Excavation and the End of the Harappan Tradition in Gujarat

Investigation of the Harappan tradition in Gujarat has provided a large array of material for the study of Harappan culture as a whole. One example of this connection is the impact on our ideas of Harappan urban organization provided by the excavations at Lothal (Rao 1973, 1979) and Surkotada (Joshi 1972). Additionally, work at the Saurashtraian sites of Rangpur (Rao 1963), Rojdi (IAR 1958-59: 19-21), and Somnath (Nanavati et al. 1971), as well as Lothal, has done much to define dimensions of change in the material culture of the Indus Civilization, over both space and time. Categories of ceramic fabrics such as Black-and-Red Ware and Micaceous Red Ware, and vessel forms including stud-handle bowls and club rim storage jars, are common at Mature and Late Harappan sites in Gujarat although they are not found with any frequency in the Indus Valley itself (Possehl 1980: 41); this is indicative of the degree of regionalism found in the lands Southeast of the Indus Basin. Diachronic transformations are also in evidence. The Rangpur excavation in particular has revealed changes in form and frequency of both regional and more classically Indus types through time. Rangpur's cultural sequence stretches from the Mature Harappan to the end of the Indus tradition in Gujarat, when ceramic assemblages in the region become marked by significant proportions of Lustrous Red Ware. The evolution of the ceramic corpus which accompanies Harappan culture change in Gujarat has been extensively examined (Rao 1963; Misra 1965); however, other aspects of this process, for example economic data, are poorly known.

The Gujarat Prehistoric Project, a joint effort of the Gujarat State Department of Archaeology and the American Institute of Indian Studies, was formed in 1981 to address the gaps in our
knowledge of Harappan culture change in Gujarat, and to concentrate specifically on the economic factors contributing to culture change. The first part of this project was designed to investigate a site representing the latest manifestation of Harappan culture in Gujarat, dating to the Rangpur III or Lustrous Red Ware phase in S.R. Rao’s terminology.

A site named Oriyo Timbo (coordinates 21° 54’ N, 71° 32’ E), located near Chiroda village in Bhavnagar District, Saurashtra, was selected for excavation in the winter of 1981-82 because of its manageable size, profusion of Lustrous Red Ware on the surface, and its place within an area already systematically surveyed. The results from the brief work at Oriyo have led to the creation of some hypotheses relevant to the end of the Harappan tradition in this region, and can serve to guide future research toward explaining Late Harappan settlement changes and the disappearance of Harappan settlements after the Rangpur III phase. This paper will describe data that have helped to reconstruct the subsistence economy of the site, and will offer some ideas as to how the Harappan sequence in Gujarat might be better understood through a more complete grasp of economic factors.

Oriyo Timbo is a low, flat mound approximately 250×175 m in size. The mound was sampled in the center, where occupation was thought to be the thickest, and at the eastern and western ends, where artifactual material in relatively high concentrations was seen eroding from the edges of the site. The central and eastern operations revealed strata in varying degrees of disturbance. The western operation, however, produced an undisturbed Rangpur III layer containing some small architectural features, along with two other disturbed Rangpur III strata, and a series of pits infilled during Rangpur III times. Because of a very low frequency of intrusive historic and modern ceramics in the disturbed levels, and the presence of nearly identical frequencies of artifact types among all of the Rangpur III layers, it is assumed that all of the 0.7 meters of Harappan occupation in the western operation at Oriyo are derived from the same Rangpur III component, and thus the operation may be viewed as one unit for analytical purposes. Stratified beneath the Rangpur III habitation was an assemblage consisting primarily of unretouched microblades. Since the relationship of this lithic assemblage to
the Harappan occupation is doubtful, it will not be considered further in this paper.

The architectural features at Oriyo were found to be extremely ephemeral. Three hearths of two different types were discovered. One was a bowl-shaped oven with plastered sides dug into the ground surface. There were two examples of this. The other type of hearth was a U-shaped chula of mud built upon the ground surface itself. No other architectural traces were uncovered. The texture of the undisturbed stratum resembled rammed earth, and initially it was suspected that this stratum might represent flooring. But the 20 cm thickness of the layer, its lack of definable edges over 110 sq.m of exposure, the absence of features on its surface, and the presence of artifacts all through its matrix made it unlikely that this could have been related to any structure. Similarly, many holes were defined and inspected, but the irregularity of their placement and shape discouraged any notion of the presence of post-holes. Nor were any fragments of daub recovered that might have indicated the remains of mud walling. Poor preservation at the site cannot be blamed for the lack of architecture, for in addition to the rather fragile hearths mentioned above, several hoofprints of cattle were found to be associated with the undisturbed layer. Thus there is no evidence at Oriyo for any shelter more substantial than a tent.

The architectural data suggest that permanence of habitation was probably not an important characteristic of the Oriyo subsistence economy. One should not simply assume, however, that Oriyo represents occupation by groups of nomadic pastoralists. Artifactual layers over one half meter in total thickness spread across four hectares, an abundance of pottery including a small but persistent proportion of large storage jars (1-6% of all sherds for each context), and the recovery of quern and muller fragments suggest something more than an occasional, casual visit. It should be emphasized that between nomadic pastoralism and sedentary agriculture there is a vast range of subsistence choices. The botanical and faunal remains from Oriyo should help to clarify this point.

Botanical evidence from Oriyo consists of seed remains recovered by a flotation method devised by Gail E. Wagner (Wagner 1983). Wagner’s analysis indicates the presence of *ragi* or finger millet (*Eleusine cf. coracana*) as a cultivated grain in the
undisturbed layer as well as in one of the disturbed layers of the Rangpur III occupation. In addition, seeds and grain impressions of foxtail millet (Setaria spp.) were recovered from the same strata. One species of cultivated Setaria is known in Gujarat today (Setaria italica) while three species occur in the wild. The Oriyo Setaria remains could not be identified as to species, but the possibility exists that they were cultivated along with the ragi. From the character of the botanical remains and the evidence of quern and muller fragments it seems clear that agricultural activities formed one component of the Oriyo subsistence system. Ragi, Setaria, and other grains in the millet family are well-suited to the soil and climate of much of Gujarat. Black cotton soil, which is found in most of Saurashtra as well as the vicinity of Oriyo, has moisture-retaining properties which allow dry farming even with the scanty rainfall which characterizes the region. Dry farming of millets provides an important source of calories with relatively little labour input compared to irrigated crops, and it is not surprising that this form of cultivation is widespread in Gujarat today, as it presumably was in Late Harappan times.

Another major component of the subsistence economy at Oriyo, revealed through analysis of the faunal remains, consisted of cattle herding, sheep and goat herding, and possibly the rearing of pigs. Five hundred sixty-eight bones from the Rangpur III occupation were identified either as cattle (Bos indicus?), perhaps mixed with some buffalo (Bubalus bubalis), sheep (Ovis aries), goat (Capra hircus), or domestic pig (Sus scrofa). The category sheep/goat/gazelle/antelope was also utilized. Sheep and goat were distinguished using Boessneck, Müller & Teichert (1964). The only Sus lower third molar in the Oriyo faunal assemblage was determined to have come from a domestic animal by reference to measurements published by Clutton-Brock (1965) and Hole, Flannery & Neely (1969: 309). Although no evidence of Bubalus was present in an examination of horn cores, lower third molars, and mandibular coronoid processes classed as Bos, the possibility exists that some bones identified as cattle are those of water buffalo.

In attempting to assess the relative importance of species at Oriyo both total fragment counts and the method of minimum number of individuals (Chaplin 1971) have been used. In terms of
total fragments, the percentage of cattle varied between 87% and 89% for all three layers of the western operation. Sheep/goat/gazelle/antelope accounted for about 10% of all fragments in each layer. Pig made up only 1% of the fragment count. Of the nine bones that could be identified as sheep or goat, goat accounted for six.

These ratios are broadly echoed by the minimum number of individuals for the entire Rangpur III component. Based on a sample of 32 bones, the percentages of cattle to sheep/goat/gazelle/antelope to pig are 78:16:6.

While these measures can only approximate the true proportions of species at the site, they nevertheless seem to indicate an overwhelming importance for cattle in the pastoral system.

Some hint of hunting activities at Oriyo may be supported by the recovery of a charred hare mandible from a refuse pit and an occasional find of a cervid. There is a general paucity of hunted species, however, which leads to the belief that sheep and goat comprise the bulk of the remains classified as sheep/goat/gazelle/antelope.

Other details of the pastoral economy are indicated by an examination of the age at death of the herd animals. This was accomplished by gathering data on epiphyseal fusion of cattle long bones, and epiphyseal fusion as well as tooth wear for the probable sheep/goat remains (Silver 1970). For the cattle it was recorded that of the bones which normally fuse at the age of two to two and one half years or earlier, less than 1% were recovered in an unfused state. Many animals died between the ages of two and one half and four years, but even among the bones which fuse at the age of three and one half to four years over 60% had fused, indicating that more than half the cattle at the site probably survived into adulthood. These data are similar for the sheep/goat remains. Among the sheep/goat, killing seldom took place before the first birthday had passed, and again seemingly half the animals survived into full maturity. The advanced age of the herd animals suggests that pastoral production for meat consumption was not significant in this economy and that secondary products such as milk, ghee, wool and hair were more important in the Oriyo pastoral strategy.

A synthesis of the architectural, botanical, and faunal data yields a picture of a mixed farming and herding economy utiliz-
ing a semi-permanent occupational cycle. This constitutes an extremely flexible and opportunistic kind of economy, one that fits well within the unpredictable monsoonal pattern of Western India. In good years bountiful grain harvests may be reaped with relatively little labour input. In case of drought, the herd represents a mobile productive resource which can be transferred to areas of greater rainfall. Such a strategy would enable the migrants to preserve the well-being of their herds while trading dairy products and dung to the local populace in exchange for grain.

Modern parallels to the type of subsistence system implied by the Oriyo data are most often found in mountainous areas of the world, but also characterize some lowland regions where a short supply of cultivable land or a severe climate limit the opportunities for grain production (Vincze 1980). In India, semi-nomadic pastoralists are found in the Himalayan foothills, in Central and Southern India scattered around the Deccan Plateau, and in Western India in Rajasthan, North Gujarat, Kutch and Saurashtra (Bose 1975: 6). Where details of the subsistence economy are known, as in the Anupgarh-Pugal tract of Western Rajasthan, it appears that villagers own widely varying amounts of land, own varying numbers of animals, and spend varying amounts of time on their nomadic round, conditioned by herd size and composition and by yearly climatic factors (Bose 1975: 3). If the Oriyo inhabitants corresponded in the seasonal pattern evidenced generally by Western Indian mixed farming groups, the period from July to October would see the herds away from the settlement exploiting the rainy season pasture and avoiding cultivated fields (Desai 1954), while some segment of the population remained in the village to guard the growing crops. October and November would find the herds in the village, grazing stubble in newly harvested fields as people concentrated on stores of grain. Finally, the period from December to July would see variations in mobility depending on supplies of water, pasture, and stored grain within the confines of a village and its neighborhood. Large-scale political and economic factors such as extent of raiding and access to markets may also contribute to differing spans of mobility. Additional variations within the village itself would stem from individual differences in herd size, labour pool, social position and ties with other social groups,
which would cause each family to adopt a slightly modified strategy.

This model may derive some archaeological support from studies of tooth eruption sequences in Oriyo sheep/goat mandibles (cattle mandibles were generally recovered without teeth). If the ages at which teeth erupt in modern sheep and goats can be extended to encompass archaeological animals, it should be possible to estimate the age at death of a young sheep or goat within about four months. If an assumption is then made regarding the lambing season of the ancient animals, the season in which the animal was slaughtered can be determined (Ewbank et al. 1964). The chart of eruption sequences of the Oriyo sheep/goat mandibles (Table 1) illustrates two clusters of eruption phases: one as the second molar erupts, and one as the third molar erupts. According to Silver (1970) and Ewbank et al. (1964), this should represent one group slaughtered at 8-12 months of age and another group slaughtered at 19-23 months of age. The clustering of sheep and goats slaughtered just prior to their first and second birthdays hints at a marked seasonality of herd exploitation at the site. This evidence fits nicely with the mixed farming model but is far from conclusive. At present in Saurashtra unimproved breeds of sheep and goat have a lambing season with the highest birth frequencies during late October and November but trailing into February. Another major period of birthing comes in June and July. Thus with only this information the specific seasons when small livestock were slaughtered at Oriyo cannot be fixed. Future research on the Oriyo material will include thin-section studies of a larger sample of teeth. The thin-section method attempts to distinguish microscopic seasonal variations in tooth formation (Gordon 1982) and has promise in resolving the issue of seasonality at Oriyo.

The question raised earlier regarding the insights into Harappan culture change that might stem from a prior knowledge of economic conditions can now be addressed. Specifically I wish to raise the issue of settlement dynamics.

Settlement in Gujarat during the Mature Harappan, or Rangpur IIA phase in S.R. Rao's system, was characterized by a cluster of sites in the Kutch region but very few known sites elsewhere in the state. In the initial phase of the Late Harappan, however, site counts jump dramatically. There are 18 known
Table 1 — Oriyo 1981-82: eruption sequence of sheep/goat mandibles (n = 12).

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sites in Gujarat from the Mature Harappan/Rangpur IIA phase but over 120 sites\(^1\) recorded for the next phase, Late Harappan/Rangpur IIB-C (Possehl 1980: 89-119). Possehl (in press) has equated this increase with the introduction of millet agriculture into Gujarat, and the opening of large tracts of land to a new productive technology. The final phase of the Harappan tradition, the Rangpur III phase to which Oriyo is assigned, sees a reversal of this trend. Site counts drop, from 120 to 32. In addition, in the only area for which there are published data, site size decreased from Rangpur IIB-C to Rangpur III times. Survey results from the Ghelo and Kalubhar Valleys (Possehl 1980: 65) indicate that mean site size fell from 5.3 ha to 3.1 ha. After Rangpur III a further decline in settlement renders the remains of human occupation in Gujarat so ephemeral that no material culture complex can even be defined until Early Historic times, perhaps 700 years later than the end of Rangpur III. Evidently the strong increase in settlement of Rangpur IIB-C times was without lasting impact.

The reduction in settlement count and size is consistent with a model of nomadization, in which an increasing segment of the population engages in ever longer periods of nomadic activity across time, rendering their habitation sites less and less visible to the archaeologist. It was shown that the Oriyo data probably indicate a flexible economy combining cultivation with pastoral production. Such an economy would allow its participants to easily respond to changing external and internal factors by adjusting planting and herding strategies, and varying the emphases upon them. Therefore a trend toward nomadism would imply only incremental alterations instead of any abrupt shift in subsistence strategy. The flexibility of the Oriyo subsistence economy, if it can be generalized and extended to other sites in Gujarat during Rangpur III times, may thus provide an important basis for the changes in settlement in evidence during Rangpur III and afterward.

Among the variables that influence population mobility along a regional dimension we might include changes in political

\(^1\) Site counts are accurate as of 1980. Several new Harappan sites have been discovered since but the pattern of fluctuation between phases remains unchanged. Cf. Bhan 1983.
stability and economic opportunities, as well as short-term environmental change induced by human land use or climatic fluctuation. These factors acquire additional relevance in a Late Harappan context, due to the impact of a highly developed organization, the Indus Civilization, which has diminished in complexity over the time period in question. Perhaps it is the relationship between these large-scale institutions and processes, and the small-scale responses of a flexible mixed economy, that may help us to explain some of the cultural changes that occurred within the Harappan tradition in Gujarat.

REFERENCES


GIORGIO STACUL

A Harappan Post-Urban Outpost in the Swāt Valley

In the previous conferences of this Association I have reported on the earliest open settlements discovered in the Swāt Valley, Pakistan. I refer to Loebanr III, Bīr-kōṭ-ghuṇḍai, as well as to some other sites, the earliest occupation of which occurred during the 4th Period in the Ghālīgai sequence, dated between 18th and 15th centuries BC (Stacul 1979, 1981).

During the most recent expeditions of the Italian Archaeological Mission of IsMEO in Pakistan, further excavations have been carried out at the foot of the hill which rises above the modern village of Barikot ¹.

At Bīr-kōṭ-ghuṇḍai, as well as at Loebanr III, the cultural complex features two subsequent patterns of settlement. The earlier one with pit-dwellings and the later one with rectangular stone-walled structures at ground level (Stacul 1980a, b).

Only a few differences divide the industries of these phases. A large part of the stone implements are made from siltite pebbles and consist of hatchets and sickles, sometimes with bifacial covering retouch, including crescentic sickles notched at the opposite ends (fig. 1), which recall a type very common in the Neolithic of Northern China (Andersson 1943: pl. 163; Watson 1970: 24, pl. 7d). The polished stone tools consist mostly of axes. The pottery comprises grey-burnished, mostly hand-made ware (55%), gritty-brown ware (25%) and red wheel-turned ware (18%). Small human (fig. 2) as well as animal terracotta figurines have been also recovered. Copper implements are represented by pins

¹ The Mission was lead by Dr Domenico Faccenna; the excavations at Bīr-kōṭ-ghuṇḍai were directed by the present author.
and fish-hooks. Ornaments consist of lapis-lazuli, jade, shell, coral and ‘faience’ beads.

Iconography

Linear and geometrical motifs as well as floral and faunal subjects are represented on the black-on-red painted pottery of Bîr-kot-ghunţai.

A floral, very common subject, is the ṣṭpal ‘tree’ (three leaves springing from a stem). A ‘tree’ close to a three-pointed object occurs on a rectangular-shaped potsherd (fig. 3). On other sherds a sequence of ‘trees’ is set on horizontal lines (probably all round the body of the vase).

The faunal representations mostly consist of birds. In addition to the peacock (Stacul 1981: fig. 4), there also occur a duck (fig. 4), a pair of birds’ heads like multi-rayed sun-motifs (fig. 5), and a sequence of birds between astral symbols (fig. 6). The careful finishing of some details (fig. 7) suggests a keen observation of nature.
Figs. 3-5 — Black-on-red painted potsherds: 3. Inv. no. BKG 643, length 8 cm; 4. Inv. no. BKG 652, length 7 cm; 5. Inv. no. BKG 373, length 6 cm.
Figs. 6-8  Black-on-red painted potsherds: 6. Inv. no. BKG 647, length 12 cm; 7. Inv. no. BKG 653, length 10 cm; 8. Inv. no. BKG 645, diam. 6 cm.
It may be noted that the multi-rayed heads represented in pair, as well as birds and astral symbols depicted in panels, occur on burial jars of Cemetery H at Harappa (Vats 1940: pl. LXVI, no. 82; pl. LXII).

The domestic animals first include cattle. On a round-shaped potsherd the back part of a bull with a tail shaped like a lanceolate leaf, probably a *ptpal* leaf, is depicted (fig. 8).

Of special interest is the representation of an equid, maybe a horse, which is attacked by a bird of prey or by a fabulous animal (fig. 9). This scene could symbolize the struggle between
two opposite forces, but another possible meaning may also be suggested: the ritual ‘sacrifice’ of the horse, compared with the ‘sacrifice’ of the bull performed by a lion or an eagle, which appears on some Mesopotamian representations (Goff 1963: 63, fig. 260; Parrot 1960: fig. 161c, 168d; Parpola 1981: 22). The representation of the bull which is attacked by predators, also occurs on seals of Bronze Age in Margiana (Sarianidi 1981: 230-2).

The particular importance ascribed to the horse since the earliest Vedic times, has been stressed in the Ṛgveda in connection with the horse as sacrificial animal, superior to bull, cow, sheep and goat (RV I 162, 163).

As regards the singular composition from Bṛ-kōṭ-ghuṇḍai, it cannot be inferred with certainty that the equid represents a horse (Equus caballus) rather than a hemionus (Equus hemionus), nor can it be stated that originally the sanscrit word aśva stood for the Equus caballus proper only. In any case it seems likely that when equids were represented on pots or modelled with clay (Jarrige & Santoni 1979: 24, 25), new ideologies — probably a ‘Rigvedic’ pattern of belief — had spread to the western area of the Subcontinent.

Lastly I notice an incomplete figure which represents the upper part of a three-pointed object between a pair of horns (fig. 10).
According to some scholars, during the Early and Mature Harappan Culture, the horns represented an attribute of power and probably the emblem of a deity (Marshall 1931: 54, 55; Allchin 1982b: 163). The early Harappan complex of Lewan, in the Bannu district, includes painted potsherds representing buffalo as well as bovine horns with sprouting plants emerging between (Allchin 1982b: fig. 6.32). At Mundigak IV 1 a *pipal* leaf is set between the horns (Casal 1961: fig. 65, nos. 179-182). Parpola suggests a prototype of this subject, represented on a Proto-Elamite seal from Susa (Parpola, in this volume). In the subsequent Harappan post-urban period, the *pipal* leaf was to change into an arrow, as at Bara in eastern Panjab (Gordon 1958: fig. 10, no. 6), or was replaced by a trident, as on some figures from Harappa Cemetery H (Vats 1940: pl. LXII, nos. 1b and 11).

Before concluding this description, I would like to remark a curious detail. Several painted potsherds from Bīr-kōṭ-ghungdai are almost square (e.g. figs. 3, 5), while one is circular in shape (fig. 8). The occurrence of these ‘panels’ or ‘medallions’ is probably not casual. Such evidence suggests that some sherds may have been intentionally reduced to regular-shaped pieces, while others may have been selected according to their painted patterns after the breaking of the jars. These pieces may also have been preserved not merely because of their beautiful decorations, but very probably because of their religious meaning.

*The Harappan Outpost*

I recall that already during the 3rd millennium, the Swāt Valley represented an outpost of a Southern culture, namely an Early Harappan culture, as it is shown at Ghālīgai by Period II complex, which features fine wheel-turned and painted pottery (Stacul 1969). Such event very probably represented an intrusion in the neolithic background of the north-western regions of the Subcontinent. This sort of ‘colonization’ could be explained by economical reasons, such as the exploitation of the forests, which are very rich in valuable wood, including *Cedrus deodara*. As it is known, wooden structures made of *C. deodara* have been recovered in some buildings of Harappa. According to some general typological affinities, a possible link in the surrounding
regions might be represented by the ‘Kotdijian’ complex discovered at Hatial near Taxila (Allchin 1982a). The intrusive nature of this culture is evidenced by the subsequent spreading in the same valley of Period III complex, dated to the very beginning of the 2nd millennium, which seems to be the expression of a wide-extended Northern neolithic background.

A further different picture is given by Period IV, represented in various sites of the Swat Valley including Bir-kōt-ghunḍai. During this times the neolithic pattern of settlement, consisting of pit-dwellings, was replaced by stone-walled structures at ground level. This change appears to be firstly the result of a population growth, which in turn seems to be closely connected with a highly developed agriculture as well as with short- and long-range trade.

Crops, identified by Dr L. Costantini, include wheat, barley, rice, oats, ray, lentils, peas and grapes. The faunal remains belong to the main domestic animals. According to Dr B. Compagnoni, the horse (Equus caballus) is also evidenced at Bir-kōt-ghunḍai.

During this time Bir-kōt-ghunḍai was probably the most important site of the Swat Valley. Such evidence is suggested not only because it is the largest settlement of Period IV as yet discovered in this area, but also because it displayed some ‘luxury’ wares which could be connected with a more stratified community in comparison to other sites.

This evidence may support the hypothesis that around the middle of the 2nd millennium Bir-kōt-ghunḍai represented a trading outpost which firstly connected the Swat Valley with the Southern plain countries. An outpost should have been located here, owing to the geographical setting, which easily leads to the major routes which may connect the surrounding regions. Furthermore, Bir-kōt-ghunḍai would represent a trading outpost, rather than a military one, considering some particular goods recovered here, which seem to evidence different long-distance trades.

At this point a question arises: could the painted wheel-turned pottery be an imported good, as the ‘faience’ ware likely was?
It seems significant that at Bīr-kōṭ-ghunḍai the wheel-turned pottery includes some grey burnished vases, i.e. a ware which represents a particular fashion of all the sites of the Swāt Valley. It may also be noted that some red wheel-made pots appear to be clearly derived from shapes on grey ware which occurred in Swāt since the beginning of this cultural period. Lastly, analysis made on red-painted as well as on grey-burnished wares shows that the respective mineral components are identical.

On the ground of these evidence, we may cautiously infer that the painted pottery of Bīr-kōṭ-ghunḍai was made in the Swāt Valley and that the potter’s wheel was in use at Bīr-kōṭ-ghunḍai itself rather than far from this country.

It my also be remarked that the painted decoration does not seem to represent a mere imitation from the well-known patterns which occurred in the western plain countries of the Subcontinent. The careful naturalistic treatment of various compositions, which does not stand comparison with the schematic stylizations on the Harappan urban and post-urban pottery, suggests a particular and partly independent evolution.

Conclusions

At the present state one may conclude that around the middle of the 2nd millennium, Bīr-kōṭ-ghunḍai represented the northern outpost of a trading route which introduced here some ‘luxury’ wares as well as some iconographic patterns connected with a Harappan post-urban culture. Some links with Mundigak IV may suggest the original geographical extent or some source of this stylistic fashion.

At present we cannot state whether the peoples which introduced here the above-mentioned painted iconography may be connected with the Aryans of early Vedic times. We cannot state whether this culture represented a primary settlement of the Indo-Aryan expansion into the Subcontinent, or a secondary one (Allchin 1982b: 303-5), due to the peoples that, around the 18th

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2 The analyses were directed by Prof. S. Mariani of the Istituto di Chimica Applicata, University of Trieste.
century BC, introduced the grey-burnished ware as well as some North-Iranian vase shapes. In the same way it is still not clear whether the grey-burnished and the red-painted wares are to be connected with ethnical immigrations extended to the Northern hilly areas, or merely testify a new ceramic style.

In other words: who run the outpost of Bīr-kōṭ-ghunḍai? Local peoples who independently promoted the great cultural change which took place around the middle of the 2nd millennium? Newcomers? Or, more likely, a people who represented a fusion of different ethnical and cultural components?

As regards the subsequent times, the cultural sequence shows that the Harappan post-urban outpost of Bīr-kōṭ-ghunḍai represented a very short-lived event in the Swāt area. During the 14th century a new culture spread over the valley as well as in the surrounding regions, including the Potwar plateau and the Peshawar plain countries. The potter's wheel as well as some 'luxury' goods completely disappeared. The new culture represented stability, uniformity, as well as a relative isolation of the north-western regions in comparison to the previous period (Tusa 1979).

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F. RAYMOND ALLCHIN

The Interpretation of a Seal from Chanhu-daro and Its Significance for the Religion of the Indus Civilization

The seal which is the subject of this note was discovered during Mackay's excavations at Chanhu-daro in 1935-36, in the lower, or earlier, period of Harappan occupation, in square 8/E at locus 113 (fig. 1). It was given the register number 3148 and subsequently published in the excavation report (Mackay 1943: 49, 292, pl. 51, no. 13). A somewhat clearer print, apparently of the same negative, was published in the Illustrated London News (Nov. 1936, fig. 3). The Chanhu-daro excavations were the first American Expedition to India, and the Government of India agreed to a division of the finds, one part remaining in Delhi and the other going to the Boston Museum of Fine Arts. Enquiries in both Delhi and Boston have so far failed to reveal the whereabouts of the seal, and until its whereabouts can be ascertained we have to rely on the photograph for our knowledge of it. A sketchy drawing, apparently copied from the photograph, appeared in Mode's Indische Frühkulturen (1944), and another print from the same source was published by Gordon (1958).

Mackay described the subject of the seal thus: the bison on no. 13 is trampling a human figure lying prostrate on the ground. This figure wears a peculiar form of head-dress, which can just be made out at the right; one arm and one leg are raised as if to fend off the animal (Mackay 1943: 147). Mode at first read the seal as one of a group showing a sportif character, linked with bull sports and probably also with a bull cult, and here representing an enraged beast trampling a figure lying beneath him with hands raised to defend himself (Mode 1944: 60). In 1959 however he published a significant new view, seeing the scene as one of bestial intercourse, and drawing comparison with that
part of the Aśvamedha rite in which the royal consort lay with the already sacrificed horse (Mode 1959: 69). Gordon (1958) does not refer to the subject of the seal in his text, but the caption to the plate describes the scene as a bull trampling a man. However, he too held another, unpublished view. I recall him on one occasion, probably shortly before the appearance of his book, taking me on one side, safely beyond the reach of female ears, and confiding his idea that the seal depicted a scene of bestial sexual intercourse. I do not know whether it was coincidence that both Gordon and Mode reached this conclusion at approximately the same time, or whether one made the discovery and shared it with the other.

To rediscover and to attempt to understand the meaning of the scenes depicted on the Indus seals is no simple task. At the outset it calls for a systematic understanding of the methods employed by the Harappan craftsmen and artists and of the conventions whose unannounced acceptance lies behind their work. It is only in the light of such an understanding that we can hope to succeed in our task. A considerable part of our knowledge of the Indus civilization, particularly relating to its religious ideas, comes from the small repertoire of sealings and seals, copper tablets, and other objects bearing subjects in outline or relief. A study of these scenes makes it clear that there was an accepted iconography which was widely diffused in space and which endured for a considerable period of time. The iconography includes several species of plants or animals, as well as mythical animals and composite animals, human beings or human formed gods, and scenes involving several of these components together. The recurrence of such themes enables us to observe their distribution. For example several of the same themes recur at Mohenjo-daro in both the lower levels and in the upper, suggesting that they were current throughout a considerable period of time. Again the same theme may have been found at more than one site: for example, the kneeling tree spirit approached by a tiger occurs at Mohenjo-daro, Harappa and Kalibangan; and other scenes are found at Mohenjo-daro, Harappa and Chanhu-daro. Thus one is left in no doubt that the subjects were in common currency throughout the major settlements of the Indus civilization, in just the same way as the common script indicates a common means of communication.
The Indus artists employed a number of conventions in their representational art. In some respects these are strikingly anticipatory of the art of India during the early Buddhist period. In their work they employed recognizable schemata to represent different things. Thus, among trees the *pipal* is easily identified by its leaves, and once identified can even be suspected in some cases where the leaf forms are not clearly visible; another tree appears to be a deodar; and a third tree lacks any recognizable features and may be intended to represent an unidentified, generic ‘tree’. Among beasts there are four types of bovid. The *Bos indicus* is clearly recognized by its hump and dewlap, and by the conventionalised form of its horns; the gaur or Indian bison is also identifiable by its horns; and so is the buffalo. Both the latter appear to be representations of wild species. The fourth is the so-called ‘unicorn’ which appears, as Grigson has suggested
(Grigson 1984: 166-9), to be a mythical beast, undoubtedly a bovine but not representing any actual species.

We may thus propose as a working hypothesis that the seals depict a common symbol system which was recognizable to their users, and which in all probability related to a common body of mythical or religious beliefs.

I

We now turn to the Chanhu-daro seal. The subject is unique in that it does not occur elsewhere in the Indus repertoire. Apart from the inscription, which we shall not discuss, there are two principal characters, the bovine and the recumbent figure. The bovine is recognizable as a bison bull. That it is a bison or gaur (*Bos gaurus*) can be inferred from the form of the body and more particularly from the form of the horns. Commonly the bison is represented on the Harappan seals as standing with lowered head before a low basin or trough. As such it may be inferred to be a wild animal, as such troughs appear almost exclusively with wild animals. Among all the Indus bison figures this one is unique in that it is shown with the forepart of its body raised and with its forelegs in what at first sight appears to be a running position. In the light of what follows there can be no question that the artist intended to show the beast rearing in order to mount a cow, and that the forelegs are intended to represent the characteristic striking out of the legs in this situation. The bull has another unusual feature in that its abdomen is divided into two sections by three vertical lines in relief. Most often in the Indus depiction of the bison there is only one such line running from the shoulder, and occasionally there is a second marking the hind quarter. Another unusual feature is that there appears to be a monstrous and distorted genital organ. This, as far as I can recall, was Colonel Gordon's reading; but further inspection suggests that it is incorrect. The bull's penis is clearly visible to the left in the anatomically correct place. To its right there is an incised area in shade beyond which is a further, more prominent raised band which I shall discuss below. I understood Colonel Gordon to take these three elements together and read them as the grossly exaggerated and distorted phallus of the bull. But this seems most improbable. As we remarked above the bull's
penis is clearly represented, with considerable naturalism and is quite unmistakable. What however distinguishes it from those of the great majority of the bulls and bison bulls of the Harappan seals is that in this case the organ is evidently intended to be shown as in a state of sexual excitement.

The recumbent figure is much less clear and it is very difficult to interpret, not least in the absence of the actual seal for examination, or of better photographs in varied lights. The clearest feature is what Mackay described as a peculiar head-dress. It can be identified with confidence as a plant sprout. Such sprouts are fairly common features of Harappan iconography: they occur on the heads of several of the seated ‘yogi’ icons (Mackay 1938: nos. 222 and 235) and on the cylinder seal of a standing horned deity published by De Clercq, which even though its find spot is unknown must be regarded as an item of Harappan iconography (De Clercq 1888: pl. III 26; Corbiau 1936: 100-3; Chakrabarti 1978: 101-2). The sprout occurs on the head of a kneeling figure worshipping a spirit in a pīpal tree (Mackay 1938: no. 430). In several of these instances we are inclined to feel that these sprouts are intended to represent those of the pīpal tree. A somewhat different but clearly related motif is the ear of corn which emerges from the head of a figure scratched on a triangular terracotta cake from Kalibangan (IAR 1963-64: pl. 22b); while a seal from Kalibangan shows a ‘Tiger Mother’ with what appears to be a Deodar sprout emerging from her head. Thus the motif of the plant sprout emerging from the head of a figure is by no means uncommon in the Indus art. What is not clear however in each of the cases we have cited is whether the figures are males or females, nor whether they are human or divine. When there are clues they seem to favour females in several cases; and the accompanying ‘stars’ beside the head in one instance probably indicate that at least one is divine (Parpola 1984: 187).

Different from these examples, but clearly related to them, is the figure on a sealing from Harappa noticed by Marshall (1931: I, 52). Here a female is shown with legs spread out in a crouching position (Sanskrit, utānapād), with a plant, probably a pīpal sprout, emerging from her womb. Marshall is surely right in referring to her as the ‘Earth Goddess’. We may thus conclude that here too the plant sprout is associated with a divine being
who is female. This piece is particularly significant in view of the interpretation we shall be putting upon the Chanhu-daro seal and the parallels we shall be finding in Vedic sources.

It is when we begin to consider the recumbent figure itself that the problems begin. There is little doubt that the area to the left of (i.e. 'below') the sprout denotes the head, but its actual form is unclear. At first I took it to be in profile, with a hair knot at the back of the head, and a curious bird-like beak projecting towards the top of the seal, presumably representing the nose. Such a schema can find comparisons in several Indus seals (e.g. Marshall 1931: no. 357), and on the reverse of the Kalibangan triangular terracotta cake referred to above. But there is also another possible explanation, that the beak-like feature may be intended to represent a second eye. In this reading the face would be shown more or less frontally and the two eyes would be treated similarly to those of a terracotta figure from Chanhu-daro (Mackay 1943: pl. 53, no. 11). It is as if the artist of the seal had been asked to make an altogether new form of which he had no experience, and produced this rather strange attempt at a frontal representation of the face. From this point the lower edge of the seal is chipped and this adds to our difficulties. The next feature is the diagonally raised arm, or arms, shown with something which may be intended as a bangle near the elbow, and ending in a curiously stylised hand. My own feeling is that a pair of arms is intended and that the position is one of worship rather than of warding off an adversary. The form of the arms and hands recalls those on several other seals, for example, on the Kalibangan 'Tiger Mother' seal referred to above.

Immediately below the recumbent figure's arms we encounter a major problem: here there is another tubular object rising from the body: at first (following Gordon) I had taken it to be part of the greatly exaggerated penis of the bull, but more mature observation suggests otherwise, and a number of other possible interpretations suggest themselves. One would be Mackay's reading of the object as a raised leg, raised either to ward off the beast (as Mackay believed) or to reveal an opened female genital organ. This reading seems unlikely for two reasons: that the raised 'leg' would be disproportionately small by comparison with the other 'extended' leg; and that in any case the artist
appears to have shown two legs extended on the ground, one above the other. A second possible interpretation of the tubular feature would be in terms of the recumbent figure being male and ithyphallic. This, too, is most improbable, since the raised tubular object, whatever else it may be, has no recognizable schema which would indicate its being a human phallus, in striking contrast to the skilfully naturalistic representation of the bull’s organ nearby. What then can this problematic tubular feature represent? My own reading is as follows: The part of the seal we are considering shows a number of separate features: on the left is indisputably the clearly delineated bull’s phallus; on the right is the still unidentified tubular object which extends between the body of the bull and that of the recumbent figure; at its base there is a diamond-shaped opening, deeply cut at a point which corresponds to the meeting of the recumbent figure’s legs. This I take to be a representation of the female organ, opened in readiness to admit the bull’s penis. The tubular object can now at last be identified: it links the opened womb of the recumbent figure with that part of the bull’s abdomen where we should expect to find the navel. Hence it must be intended to represent an umbilical chord.

If our interpretation be accepted the conclusion is sufficiently striking. The recumbent figure is a female, adorned with a sprouting plant and simultaneously indicating both recent parturition and her readiness to accept sexual fecundation from her own offspring/mate. This interpretation would suggest that the scene depicts some sort of Creation myth, and would markedly diverge from the interpretation offered by Mode (1959) and more recently supported by Parpola.

Among points of difference are that the bull is here very much alive, in contrast to the sacrificed horse; and that the āśvamedha interpretation offers no explanation for the plant sprout, nor the umbilical chord. Although there can be little doubt that the artist’s intention was to represent the recumbent figure in human form, it must be admitted that he has made a pretty poor job of it and the resulting figure looks more chthonic than human. Having reached these conclusions by a study of the seal in relation to other Indus seals or iconographic materials, I now wish to consider comparable materials in the Samhitās of the Rgveda and Atharvaveda.
II

The Vedas offer a distinct view of certain aspects of Creation and a coherent, if mysterious, symbolic language through which related subjects are approached. One special feature is the way in which certain concepts and words stand in formal relationships to one another. As is well known, Heaven and Earth form a pair, often addressed together, sometimes with a dvandva compound dyāvaprthīvī (RV I 160; I 185; VI 70, etc.). Together they form the two world-halves or bowls (rodast, camā) of the Vedic universe. Heaven, dyu, dyaus, is masculine and constitutes a primal Male element: Earth, bhūmi, prthīvī, is feminine and represents a primal Female equivalent. It follows that there are often references to the fatherhood of Heaven and the motherhood of Earth: for example, ‘Heaven is my father,... Earth is my great mother’ (RV I 164, 33, and also RV I 89.4, I 185, 10-11, etc.). From this pair of sexually opposite elements a number of related ideas are derived (table 1).

Table 1

<table>
<thead>
<tr>
<th>MALE</th>
<th>HEAVEN (Dyaus)</th>
<th>FATHER</th>
<th>BULL, STALLION</th>
<th>PARJANYA</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMALE</td>
<td>EARTH (Bhūmi)</td>
<td>NATURE (Prthīvī)</td>
<td>MOTHER</td>
<td>COW</td>
</tr>
</tbody>
</table>

Thus the Sun is also masculine, so too are Fire, Lightning and Soma. So too is Parjanya whose Vedic aspect as a storm or rain god is probably not more significant than that as a father. Each of these extensions may be referred to as representative of the Male, and thus as the Bull (vṛṣa, etc.). They may also be referred to as other male animals, as a bison bull, or a buffalo bull, or a stallion. There are similar extensions on the side of the Female: particularly Earth is referred to as a cow. Earth is described at length in the Prthīvī Sākta (AV XII 1.1-63): among many other epithets she is described as Mother (mātā), goddess
(devī), cow (dhenu), who bears all things in her womb (viśvagarbhā) (v. 43), mother of plants (mātā osadhīnām) (v. 17), Aditi (mother) of people (janānām aditi) (v. 61), and wish-granting cow (kāma duḥghā) (v. 61).

The context of the passages which refer to Heaven and Earth in this way is invariably one of Creation. This becomes clear from the following example: Heaven is my father, here is the navel that gave me birth; here is my connection (or umbilical chord), Earth is my great Mother; the womb for me was between the two bowls stretched apart; the father placed the embryo in the daughter (RV I 164, 33). The special role of Parjanya is often stressed and he may be expressly paired with Aditi, as in AV XII 1, 42, where Aditi is referred to as Parjanya paṇti, the consort of Parjanya. In the same hymn (v. 12) the poet states, Earth (bhūmi) is my mother, I am a son of Prthvī; Parjanya is my father, may he fill us with plenty. In such contexts there are frequent references on the Male side to seed (retas), rain, milk or honey; and on the Female to the womb or embryo (garbhā), and to the ‘link’ or umbilical chord (bandhu).

It is particularly in the hymns addressed to Parjanya (there are three in the Rgveda) that these various features come together. The principal hymn is RV V 83: here in verse 1, Parjanya is described as the bellowing bull, flowing with luscious drops, who places his seed in plants as an embryo. In the following verse he is the god bursting with seed like a bull, thundering as he slays evil doers with his enormous deadly weapon. In the fourth verse the plants shoot up and sap surges up in every stem when Parjanya quickens Earth (Prthvī); and in the fifth verse Earth bows low at his bidding, and flowers don various shapes and colours. In the sixth verse, Parjanya is a stallion (vrśno aśva), as well as a heavenly Father (asuraḥ pītā). In the second hymn (RV VII 101) Parjanya is again hailed as the god who causes plants to grow, and as the bull who places seed in all plants. This hymn has a curious feature, that it treats Parjanya as part male and part female. The third short hymn (RV VII 102) again speaks of Parjanya as the embryo of plants, kine, horses and women.

The western scholar who first drew attention to the significance of this complex of ideas in the Rgveda was Bergaigne, and since his views were formulated long before the discovery of the Chanhu-daro seal, and indeed of the Indus civilization itself, they
are all the more striking in the present context. Therefore I shall quote Bergaigne extensively in what follows. On the broad context of the myths in question he writes (1878, 1969: 14):

The idea therefore of heaven is one of those which might be expected to underlie the mythical male, particularly the myth of the bull or even the horse, when the object of these zoomorphic representations has not received any other designation. A suggestion of such a representation has been conveyed for heaven by the imagined identity of rain with the sperm of a male animal which has fecundated the earth, herself regarded as female; the identification of the bull finds its confirmation in the bellowing of thunder.

If at this point we pause to compare the Chanhu-daro seal with the Rigvedic myth we cannot but be struck by their close similarities. We must not fail to remark however that the Chanhu-daro seal depicts a bison bull, while there is no specific reference to the bison in connection with Parjanya. Parjanya is specifically likened to a bull (vrṣa, vrṣabhā). The bison, gaura, hence Bos gaurus, is referred to several times in the Rgveda, but the indication is that it is a wild animal (then as now), and it is more often compared to Indra or the Aśvins, both being likened to a thirsty bison, yearning to drink Soma. Another difference is the absence on the seal of any indication of the rain or storm aspects which are associated with Parjanya. But admitting these differences we can find most of the other features of the Vedic myth in the seal. There is one feature in particular which is so strange and unexpected that its presence in the myth would greatly strengthen the comparison we are making: that is the implication of the umbilical chord and the apparently dual nature of the Bull/recumbent figure relationship, as simultaneously mates and parents.

Applying the Rgveda myth to the seal we may infer that the recumbent figure is Female, representing Earth as mother, about to be fecundated by the Male, represented by Heaven, or the Bull as father, and more specifically by Parjanya. The umbilical chord suggests that the bull is at one and the same time the mate and the son or calf of the female. Bergaigne had already recognized the ambiguous character or the Male-Female relationship involved in the Creation myths in the Rgveda.

Commenting on the relations between the Male and Female gods in the Rgveda, Bergaigne remarks (1971: II 44-45):
We know the bull who ‘has built’ heaven and earth, IV.56.1, that the being, whatever he may be, who begotten them, IV.56.3, may be the same as has been elsewhere called their son. There are reasons therefore to think that in I.160.2-4, the father and the son of the two worlds are one and the same being. We shall see later on that Indra has ‘begotten from his own body his father and mother’ X.54.3. There is a mention in X.32.3 of a son who ‘knows the birth of his parents’. The poet no doubt understands this second expression in the sense that the son was present at the birth of his parents, since the poet has given this as a marvel of marvels. This paradox is similar to the one according to which the son is the father of this parents.

When we look more closely at the hymn to Parjanya (RV VII 101) we find a similar state of affairs indicated there. Once again we quote Bergaigne (1973: III 26):

The father is often regarded as a hermaphrodite. Neither is this trait lacking in the myth of Parjanya. In VII.101.1 the breast from which flows a sweet liquor which is drawn by the ‘three speeches’ is evidently of this god, of this bull, whose calf, according to the second hemistich of the same verse is the foetus of the plants. This interpretation has been placed beyond all doubt by v. 3 of the same hymn. Indeed we find here the mother mentioned at the same time as the father, but it is definitely of the father that we have it stated: ‘sometimes he is sterile (start, f.), sometimes he begets children’. The proof of it is in the second pāda where masculine pronouns have been used: ‘he does with his body whatever he wishes to do’, and in the third, that is to say, in the very pāda in which the mother is mentioned: ‘the mother receives the milk of the father’. The father’s milk of course is what in other texts has been naturally called the seminal fluid. But there remains this fact all the same that the father, Parjanya, has been identified in this particular passages with a female, however bizarre might be this identification which has been introduced exactly in the description of his relations with the mother.

This conception does not, moreover, occur only in an isolated manner in the Vedic mythology. We know that heaven and earth, father and mother of all things, have been often regarded as two females. Now the mother of this particular passage appears to represent the earth whom Parjanya sprinkles with his seminal fluid (v. 83.4). As to Parjanya, we can say, properly speaking, that he represents heaven.

The language of these passages is obscure and we may wonder whether even Bergaigne fully grasped their meaning. There would appear to be more than one possible way of understanding the words ‘the bull created the calf’ (v. 1) or ‘the mother receives the milk of the father; with it the father increases and prospers and the son thrives’ (v. 3). However, there are further passages which add clarification or at least support. The enigmatic Asyavāmasya Sākta contains many verses which appear to relate
to the same broad group of Creation myths (RV I 164). Here there are several recurrent symbols, of Heaven and Earth, Bull and Cow, and of the calf. Bergaigne read verse 33 (which we quoted above) as linking Heaven with father and with the navel, and Earth with mother and the umbilical chord. In verses 7-9 the beautiful bird, the Sun, becomes another symbol for the Male, and by impregnating the cow produces a calf. Another related reference comes from RV I 160, where Heaven and Earth are addressed as two females, while the Sun assumes the role of the Male. As the son of these parents he daily milks the milk that is his seed from the dappled milk cow and the bull with good seed (v. 3). The same theme also appears in the Atharvaveda. For example, in VII 6, a hymn to Aditi we read, ‘Aditi is heaven, Aditi is atmosphere, Aditi is mother, Aditi is father, Aditi is son,... Aditi is both the begetter and the begotten’. In such passages there appears to be a special use of the words bandhu, link hence (according to Bergaigne) umbilical chord, and nābhi, navel. On the use of the word navel as the equivalent of father Bergaigne cites RV I 105.9, ‘there are in the high heaven seven rays; it is there that my navel extends; Tṛta Aptya knows this and proclaims the relationship’ (Bergaigne 1969: I 35). He goes on to note that in this case it is heaven itself who is the father referred to, and to draw the highly suggestive analogy with later Indian mythology of Brahmā issuing from the lotus which itself issued from the navel of Viṣṇu. It is indeed the iconographic type of Viṣṇu Anantaśāyī which suggests itself as the parallel for the umbilical chord rising from the god to the creature.

The theme of the complexity of the relations of the prime movers in the process of Creation occurs in other myths of the Rgveda. Both Agni and Soma may be regarded as aspects of the Male, for whom the same word, bull, is often used, and who become involved in similarly incestuous or androgynous situations (Bergaigne 1971: II 98-113). It is striking how in the Vedic Creation cycle the concepts of the male and female, and of the bull and the cow, appear to have a somewhat shadowy existence as a second order of meaning, forming a common substratum underlying the outward signification of the various deities named. The themes of divine incest and androgyny likewise seem to be a part of the substratum. In terms of the Chanhu-daro seal it is not difficult to conceive a meaning for the problematic term
tanānapāt, son of himself, implying that the bull is at one and the same time the father and the son.

I think I have said enough to establish the case, that in the Chanhu-daro seal we have a representation of Heaven, the Bull, who is at once the consort and father of Earth; and of Earth who is at the same time the consort of the Bull, Heaven, and the mother of the Bull, her calf; and that these themes can be understood by reference to the Creation myths found in the Ṛgveda and Atharvaveda. It would be fascinating, but beyond the scope of this paper, to trace these themes through into the mythology of later periods of Indian thought. There is unquestionably prolific and rich material to use, both from textual and from modern ethnographic sources.

But for our understanding of the Indus civilization and its religion the discussion appears to be pregnant with suggestive meaning. We are led to wonder whether the omnipresent ‘bull’, whether unicorn, bison or zebu, may not be the symbolic representation of the Heaven Father, just as the deity with the plant sprout emerging from head or genitals may not be the Earth Mother. How well the Vedic epithets Earth Mother (Mātā bhūmi), mother of plants (Mātā oṣēdhīnaṁ), Aditi uttānapad (Aditi with the extended legs) and Aditi of the people (Aditi janānāmi), seem to fit the Indus representations! How suggestive that Sāyaṇa commenting on the word uttānapad should have linked it with vegetation and the whole creation of upward-germinating plants!

In conclusion I want to touch briefly on the significance of my interpretation of this seal in its wider context. Mircea Eliade has shown convincingly that the maleness of heaven and the femaleness of earth are very widely distributed but by no means universal myths; and that from them there arises a whole cluster of creation myths centring around the heavenly marriage and the relations of the pair to their offspring, Creation. In the course of these myths the ideas of androgyne, and of the apparently incestuous relations which are involved, appear as not uncommon concomitants (Eliade 1958: chs. II, III, VII-IX; and Eliade 1960: ch. VII, particularly 172-4). This very wide distribution seems to us to lend support to the correctness of our reading. It does however lead us to be on guard against any over simple attempt to attribute the myths in question to any one group (for instance,
to the Indo-Iranians or Indo-Europeans). Clearly these creation myths were, along with early agriculture and accompanying fertility rites, to be found from a very early date among agricultural societies.

This should warn us against any premature attempt to see in the Chanhu-daro seal evidence of the presence of Indo-Aryan speaking people; and equally against any over simple attempt to derive these ideas in the Rgveda from an Indus source. But having said so much, it must still be admitted that the correspondences in the present case appear to be so profound, and so harmonious, that they must have involved some kind of fairly direct culture contact. Several times in recent years we have expressed our view that Indo-Aryan speaking people must have arrived in the Indus Valley during the lifetime of the mature Indus civilization, and that there must have been a period of cultural synthesis between the two very different elements. It is still not possible to say when the first Indo-Aryans arrived, nor over how long a period they continued to move into the Indus region from their earlier homelands in Central Asia, but the model of this period of cultural interaction provides in our view the most plausible indication of the medium within which the sort of cultural synthesis suggested by the Chanhu-daro seal and the Rigvedic myths could have taken place. It is our expectation and belief that further enquiries along these lines, investigating the same underlying hypothesis, may reveal further evidence to test its validity.

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ASKO PARPOLA

The Harappan 'Priest-King's' Robe and the Vedic Tārpya Garment: Their Interrelation and Symbolism (Astral and Procreative)

1. Scope of the Paper

At the Seventh International Conference of the Association of South Asian Archaeologists in Western Europe, held at Brussels in July 1983, I read a short paper 'On the garment of the Harappan 'priest-king''. Its gist was the following.

On the basis of the Near Eastern parallels adduced by Ernest Mackay (1931: I, 356 f.; cf. Wheeler 1968: 87) and A. Leo Oppenheim (1949), the 'trefoil' patterns decorating the robe of the 'priest-king' statue from Mohenjo-daro (fig. 1) are likely to have had an astral significance, and to present appliqué work, i.e. decorations (made of precious material like gold) sewn in the garments of gods or divine kings. A garment matching this description, called tārpya, is found in the Vedic ritual, where it is the garment of the divine king Varuṇa; and Varuṇa's garment appears to represent the night sky, decorated with star-jewels. The ornaments of the tārpya garment are said to symbolize the sacrificial fireplaces (dhiṣṇya). The stars, on the other hand, are in both the epic and the Vedic texts said to be fireplaces (dhiṣṇya) of pious sacrificers of yore, who in the heavenly world are shining on their hearths. This evidence appears to confirm the hypotheses made on the basis of the Mesopotamian parallels, and at the same time give proof for a remarkable continuity in Indian religion from the Harappan to the Vedic times.

While preparing this paper for publication in 1984 I wished to document it fully. In the process I could penetrate further into the symbolism of the trefoil pattern and the tārpya garment. This development considerably enlarged the scope of the investi-
1. The Harappan ‘Priest-King’s’ Robe

gation, which now came to comprise the fire cult related to the dhisiya hearths and its astral connections. Finally even the linga cult and its origins in the Harappan religion came within the range of this study. At the moment of writing, the nearly finished report comprises about 150 pages. Obviously it exceeds the limits of a conference paper. Entitled ‘The Sky Garment’, the full study will be published shortly as a separate monograph. The following outline aims at summarizing the main theses of this forthcoming book, to which the interested reader is referred for details and documentation.

2. The Starting Point: Astral Symbolism of the Trefoils

The present study continues my earlier paper read at the sixth session of this conference at Cambridge in 1981 (Parpola 1984). Both stem from the wish to check the main results of previous work on the Indus script: the fish pictograms were interpreted to represent deities through their astral symbols, based on the homonymy between the Proto-Dravidian words mtin ‘fish’ and mtn ‘star’ (Parpola 1975). The Harappan ‘priest-king’s’ robe seemed worth of closer scrutiny, because it had long been suspected to convey stellar symbolism: its trefoil decorations are similar to trefoils on Near Eastern ‘bulls of heaven’ (fig. 2) and on the cow representing the mother goddess Hathor as Lady of Heaven in Egypt.

3. The Deity Represented by the ‘Priest-King’ Statue

An internal analysis of the ‘priest-king’ statue (fig. 1) and its comparison with Harappan parallels (including those of fig. 3) suggests that it had represented a seated deity with a changeable, elaborate headdress (cf. also During Caspers 1976). It is likely that this deity was the buffalo-horned ‘Proto-Siva’, which Hiltzebeitel (1978) rightly has identified as ‘Proto-Mahisha’.

In Accadian glyptics of the ‘contest theme’, the water-buffalo is substituted for the earlier bull. Because this shift clearly was due to Harappan influence, and because the Harappan iconography of ‘Proto-Siva’ (especially his ‘yogic posture’) was strongly
influenced by earlier Proto-Elamite art, the water buffalo probably shared the symbolism of the bull in the dualistic ‘contest’ scenes of the Proto-Elamite seals and vases. Since the bull and the lion alternately win and loose in Proto-Elamite art (fig. 4), they are likely to depict night and day and other contrasting and alternating forces of nature, like water and fire, darkness and light, death and life. This is confirmed by special epithets: the bull-god is connected with streams of water, the sickle of moon, and the sitting posture (opposed to the standing posture associated with the lion, which is linked with the sun through its golden colour, hair and arrows) (Parpola 1984).

The hair-style of the ‘priest-king’ differs from that of some other statues, whose ‘double-bun’ at the back of the hair links them with the warriors of the Kalibangan cylinder seal (ibid.).
4. The ‘Sky Garment’ in Mesopotamia

The statues of Mesopotamian gods and (divine) kings wore ‘sky garments’ richly decorated with golden ornaments (fig. 5). Some of the ornaments are expressly called ‘stars’ in cuneiform texts dealing with the manufacture and repair of these dresses. In the texts, the ‘sky garment’ stood not only for the star-spangled night sky but also for the dark rain-clouds covering the sky (Oppenheim 1949).
5. The 'Sky Garment' of Varuṇa

Both of these meanings, star-decorated night and rainclouds, are included in the symbolism of the dress worn according to the earliest Indian texts by the divine king par excellence, Varuṇa (whose principal multiforms include Yama and Prajāpati in the Veda, and later Brahmā, Śiva and Mahiṣa). Varuṇa is the god of waters (including the cosmic ocean, the night sky), of death, and of creation; moreover, Varuṇa (Yama) is associated with the buffalo, and thus in all respects matches well the buffalo-horned 'Proto-Śiva'.
6. The tārpya Garment of the Vedic Ritual

In the Vedic ritual, Varuṇa's dress is represented by the tārpya garment, the various uses of which I have examined in detail. It is put on and off especially in royal rituals — including the king's unction, called 'Varuṇa's sacrifice' — and in death rites, which transport the deceased to the realm of Varuṇa/Yama in the highest heavens. I have studied the manufacture of the tārpya garment as far as this is possible — for the meaning was no more quite clear even to the ancient ritualists. Nevertheless, there is general agreement that the tārpya garment was sewn with appliqué work, like the Mesopotamian 'sky garments'.
7. The Decorations of the tārpya Garment: Symbols of Fireplaces and Stars

The images sewn into the tārpya garment are related to the sacrifice, and are (in Āpastamba-Śrautasūtra 22.16.3) particularized to represent dhīṣṇyas. In Vedic texts, this word primarily denotes a ‘fireplace’, more particularly the ‘fireplace of seven priests’, while in later literature it also means ‘star’. The two meanings are linked by the Vedic idea that the stars are pious sacrificers of yore, standing in the sky upon their sacrificial fires (cf. Mahābhārata 3.43.26 ff. with e.g. Maitrāyaṇī Saṃhitā 1.8.6). Chief among these heavenly sacrificers are the Seven sages of Ursa major, the ancestors of the brahmanical clans.

8. The tārpya Garment as Embryonic Covers: Bath and Rebirth

Both the tārpya garment and the fireplaces (with whose images the tārpya garment was decorated) are in the Vedic texts over and over again said to symbolize the womb and embryonic covers. Varuṇa himself is identified with the womb. During a sacrificial ritual, the performer was, from his initiation to the final bath, symbolically in the womb. When the rite was finished, he was reborn out of it, and in the final bath — expressly connected with Varuṇa — this ‘newborn’ discarded the garment he had been using during the sacrifice, including the tārpya garment. Leaving that old (usually black) garment in the waters, out of which he emerged, the performer put on new clothes. Those discarded clothes symbolized ‘Varuṇa’s noose’, the bond of death, out of which he was released. This is compared to the ‘rebirth’ of a snake that sloughs its old skin, and in the Rgveda to the sun’s change of its black garment of the night for the white of the day.

9. The tārpya Garment and the Heavenly Cow

In Mesopotamia, the trefoil pattern decorated the backs of ‘heavenly bulls’ (fig. 2). In the Near East, hairwhorls of animals were represented as stars, and so were hairpits on the chest of anthropomorphic deities. In the Veda, the hairpits of the creator
god are equated with the stars, and so are the meshes of the woven garment of consecration — identified with the skin of the cow.

The tārpya garment decorated with the image of dhiṣṇyas is thrown over the 1000th cow in the three-day sacrifice of Garga. By means of that 1000th cow, the sacrificer reaches the heaven, which is said to be as far from the earth as 1000 cows put one on the top of the other. The tārpya garment with its dhiṣṇya decorations thus comes to correspond to the vault of heavens, and the stars and rainclouds are, here again, specified to be the main attributes of the sky.

The tārpya garment is, through its connection with the three-day sacrifice, as well as with the ‘three-layered’ sacrifice, where it is to be given in triplicate, connected with the number three.

10. Trefoil Decoration in Bactria: The Dāsas as Mediators of Harappan Traditions to the Veda.

That the dhiṣṇya decorations could have been trefoils even in India is suggested by the combination of trefoils and bulls in an alabaster mosaic from the ‘palace’ of Dashly-3 in northern Afghanistan c. 1500 BC. This bronze-age Bactrian culture is post-Harappan, but has clearly inherited the trefoil motif from the Harappans (Sarianidi 1978; 1979).

The fortified cult place of Dashly-3, with sacred fires in the centre, has been preserved in their ‘pagan’ religion by the local Kafirs of Nuristan to the present day: such cultic forts are associated with the worship of the ancestors and with the goddess Dhiṣanā (Jettmar 1981).

The Kafir languages are the only post-Vedic Indo-Aryan languages, which have preserved alive the name of the goddess Dhiṣanā, who in the Veda is associated with the dhiṣṇya fireplaces. Moreover, the chief deity of the Kafir pantheon is Imra, i.e. Yama-rāja, ‘king Yama’. There are other reasons, too, to assume that the bearers of the Bactrian and other Hissar III related cultures were Dāsas, Aryan-language speakers who had come to Northeastern Iran and Northwestern India before the Rgvedic Aryans, and who worshipped Asuras, especially Varuṇa/Yama (cf. Parpola 1983).
11. The Red Trefoil and the Traditional Indian Fireplace

In the Indus civilization, the trefoil pattern is always associated with red (cf. Mackay 1938: I, 227 f.), the colour of fire. This is an important point supporting the comparison of the trefoils of the ‘priest-king’s’ robe with the dhiṣṇyas, which are circular or square fireplaces. The combination of three circles into a trefoil is not in disagreement with this interpretation, for the most common form of fireplace in the Indian subcontinent consists of three stones arranged into a triangle, so as to support a cooking vessel. Such a fireplace has been found in Late Harappan Chanhu-daro (Mackay 1943: 24 f., pl. XVII f).

Moreover, the sacred fires of the śrauta ritual are three in number, and form a triangle: they represent the womb from which the pious sacrificer is to be reborn to the world of heaven at his death: at the funeral the body was placed in their middle and was covered with the tarpya garment and sacrificial implements.

12. The Trefoil in Mesopotamia: Constellation of Taurus?

The trefoil pattern is much older in Mesopotamia than in the Indus valley, and there the context (‘bulls of heaven’) suggests an astral meaning. In the archaic Sumerian script, ‘constellation’ is written with a pictogram consisting of three star-images, in classical Sumerian times arranged into a triangle. This suggested that the trefoil and the pictogram could have denoted a particular three-starred asterism — in Mesopotamia perhaps the ‘Jaw of the Heavenly Bull (Taurus).

If the Harappan trefoil, too, denoted a particular asterism, it might be possible to identify it: perhaps the original Dravidian name would even better than the somewhat obscure Sanskrit word dhiṣṇya combine the two meanings that seem to be involved: ‘fireplace’ and ‘star’.

13. The ‘Three Stars’ of the Indus Script

Written in the Indus script, ‘three stars’ would have been expressed by means of the combination ‘3 + fish’ = Dravidian
Fig. 6 — A triangular terracotta amulet from Mohenjo-daro (UPM-602), with a ship, an alligator and an Indus inscription. Length 4.6 cm. (After Dales 1968: 39. Courtesy of G.F. Dales and the University Museum, University of Pennsylvania).
mum-mín, at one time ‘three fishes’ and ‘three stars’. The combination occurs many times in the Indus inscriptions, and the Dravidian compound is attested in Old Tamil as the name of the asterism Mrgaśīrṣa. But this constellation has not been recorded as sacred to Varuṇa in the Vedic texts, while one Harappan amulet from Mohenjo-daro (fig. 6) where the combination ‘3 + fish’ occurs, suggests its association with Varuṇa: the other sides contain the images of an alligator and a ship, both of which are associated specifically with Varuṇa, the god of waters. The early Indian nakṣatra calendar comprises several groups of three stars, and the Tamil lexicographer might easily have mixed them, especially as Old Tamil star names were at his time being replaced by Indo-Aryan names.

14. Suggested Eye Symbolism of the Trefoil

Also the compound ‘eye + eye’, following ‘3 + fish’ on this amulet (fig. 6), points to Varuṇa: it can be read in Dravidian as kaṇ-kāṇi, which in Tamil means ‘overseer’. This reminds of many epithets of Varuṇa mentioning his eyes and his supervision as the just ruler. Since the ‘eye’ pictogram is identical with the dot-in-a-circle in Harappan fish-eyes and in the patterns of the ‘priest-king’s’ robe, it is suggested that the trefoil may also have symbolized ‘three eyes’.

The red colour of the trefoils would then mean anger. Three red eyes are indeed the standard iconographic attribute of the demoniac form of Śiva, Bhairava, depicted as an enraged buffalo (fig. 7). The very same form is shared by Yama, the god of death (fig. 8). The buffalo is associated with Varuṇa, too, and seems to have been his original animal. In the Vedic horse sacrifice, the chief victim (the horse) belongs to Varuṇa; it appears that the Aryans have in this sacrifice replaced the original buffalo (Sanskrit māhiṣa) with the horse, for the horse is associated with waters (Varuṇa’s realm), which better suits the water buffalo, and because the mate of the horse, the queen, is called māhiṣī, literally, ‘water buffalo cow’.

The Harappan necklaces with red trefoils carved in their beads (fig. 9) could be predecessors of the later rosaries of ‘Rudra’s tears’ as well as of later ‘asterism-necklaces’.
15. **Apabharaṇṭ, the Asterism of Yama**

We were, then, looking for the star par excellence of Varuṇa. Among the three-starred asterisms there is one that all sources ascribe to Yama: it is the last constellation of the calendrical cycle, called in Sanskrit *apa-bharaṇṭ*. It is associated by name and function with the final *ava-bhrṛtha* bath that ‘carries away’ sin and effects rebirth, sacred to Varuṇa.

The Apabharaṇṭ asterism, forming a triangle in the sky, is traditionally represented by the image of ‘vulva/womb’ in North India (Brahmanical and Śvetāmbara Jaina traditions) but in South India (Digambara Jaina and Tamil traditions) by the image of ‘fireplace consisting of three cooking-stones’. These symbols
Fig. 8 — Buffalo-formed Yama, the god of death, with three eyes. A Lamaistic statue. (After Grünwedel 1900: 168, fig. 142).

are not ascribed to any other asterism (cf. Kirfel 1920: 138 f., 280-2).

16. The Dravidian Linguistic Background

Both meanings associated with the Apabharaṇī asterism are merged in the word used in this connection in the Digambara tradition, cullī. This is the most common word for ‘fireplace, hearth’ in Indo-Aryan (Turner 1966: no. 4879) as well as in Dravidian languages (Burrow and Emeneau 1984: no. 2857), and there can be little doubt of its Dravidian etymology. In Dravidian, there is a homonym meaning ‘pregnancy’ (ibid.: no. 2733). This
Dravidian pun explains the importance given to the 'womb' symbolism of the fireplace in India.

17. Sacrifice of the Heavenly Bull

In Mesopotamia, the trefoil may have been primarily associated with the asterism of the 'heavenly bull' (cf. § 12). In early Neolithic times the conjunction of the Taurus with the sun at the vernal equinox may have marked the beginning of the year. It was probably in connection with the new-year festival that the bull sacrifice, widely attested in ancient Near East and Eastern Mediterranean, was performed.

This bull-slaughter has a counterpart in India in the royal rituals of horse sacrifice (originally: water-buffalo sacrifice, see § 14) and the almost identical human sacrifice. These Vedic rituals are descended from the same Harappan prototype as the Hindu sacrifices of men and buffaloes to the goddess of war, Durgā (Parpola 1983; 1984).

18. Sacrifice of Man in the Cult of the Goddess and in the Veda

Not only pious fire-worshippers but also brave warriors and victims of human sacrifices are in India believed to attain heaven on their death, and to be seen in the sky as stars. Interestingly, heads of human victims or warriors have been used as cooking-stones in the Hindu rituals to the Goddess.

In the Vedic ritual, the severed head of the victim symbolized the sun, while the headless trunk stood for the moon (or
night-sun). The heated pravargya pot, called ‘Great Hero’ (mahā-vītra) and ‘the head of Makha (i.e. warrior? cf. Dravidian makan ‘son, warrior’)’ is placed on a throne and called ‘emperor’: on a Harappan seal, there is a throne with the human head of a warrior (recognized from its ‘double-bun’ hairstyle) in front of a deity inside a sacred fig tree.

In the Vedic cult, the dying victim represented the sacrificing king and his divine counterpart, king Varuṇa: Varuṇa was the primeval victim, the slaughtered cosmic man or the slaughtered Sky-buffalo, the thundercloud. The victim was at his death to fertilize the queen, the impersonator of Goddess Earth. The victim-impregnator was identified with the sacrificial stake, which represented at once the deadly weapon (thunderbolt) and the phallus. The sacrificial stake was the means of attaining heaven, and the phallus likewise represents the gate through which a man in the form of his own seed transcends the existence.

19. Trefoil and bilva Leaves in the Cult of linga and yoni

In the Indus civilization, cultic phalli were placed in a stone stand representing the vulva or womb. They seem to have been worshipped with water mixed with trefoiled leaves of the bilva tree, as in later Hinduism: the trefoils carved on one such Harappan yoni-stone (fig. 10) can most naturally be interpreted to represent bilva leaves. In the Veda, bilva is identified with jyotis ‘light, star, semen’; and the Dravidian original of the word bilva is homonymous with the word meaning both ‘star, planet Venus’ and ‘semen’. Bilva, therefore, seems to stand for Śiva’s ‘seed’, which he is said to have emitted in the form of planet Venus (the ‘star’ par excellence).

20. Linga Cult and the Seven Fireplaces of Kalibangan

The womb symbolism of the fireplace in the Veda gives a natural explanation to the fiery red colour of the Harappan yoni-stone decorated with trefoils (fig. 10). At the same time this womb symbolism of the fireplace suggests that the stone stelae
of the seven cultic fireplaces in the citadel of Kalibangan (cf. Lal 1984) are phalli. The names and legends connected with the dhis-nya hearths — represented by the decorations of the tarpya garment — associate them with the Seven sages, who occupy a central position in the Indian tradition as the ancestors of all priestly clans. They are identified with the seven stars of Ursa major, which the Avestan tradition calls 'seven lingas (phalli)' — an association matching the Indian myths which associate the Seven sages with the origin of the cult of Siva's fiery linga.
21. Conclusion

Thus the 'priest-king' statue from Mohenjo-daro and more particularly its trefoil-embroidered 'sky-garment' has yielded important clues for understanding the Harappan religion. The discovery of the 'priest-king' statue was a really lucky event, for otherwise it would have been impossible to deduce all these reconstructions let alone project them to Harappan times. Now this small stone bust anchors into the 3rd millennium a web of ideas, symbols and words. This gives new evidence for the Harappan and Dravidian (and partly even Mesopotamian) origin of many conceptions and cultic practices that are central in later Indian religions. Moreover, we can now better appreciate the role of the Dāsas as the mediators of Harappan traditions — which really appear to be closest to those of Śākta Tantra — and can more confidently identify them with the bearers of the Hissar III related bronze age culture in Northeastern Iran, Bactria and Northwestern India.

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The Problem of the Khadga (Rhinoceros unicornis) in the Light of Archaeological Finds and Art

The rhinoceros, in Sanskrit literature most commonly called khadga, is the second largest land mammal in India and the fourth largest in the world, the other three being the African and Indian elephants and the African square-lipped or 'white' rhinoceros. Though it is therefore too large and impressive for being overlooked, it never became a vehicle of any god in the Indian pantheon — unlike most of the other mammals including less spectacular species like rat or goat. Even mammals which could only be seen in certain parts of Northern India, as for example the camel were employed as vahanas of several local gods. The present paper makes an attempt to show why the rhinoceros, despite of its impressive size and power, played an inferior role in the history of Indian animals in art and lore.

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1 In Khmer art, it became a vahana of god Agni. See Stönner 1925; Moens 1948; Bhattacharya 1961: 139 ff.; van Lohuizen-de Leeuw 1955: esp. fn. 91-95. Prof. J.E. van Lohuizen-de Leeuw directed our attention to the existence of the rhinoceros in Khmer art when discussing with us the subject in 1982. The present article is only concerned with the Indian subcontinent (India, Pakistan, Bangladesh). All the photographs illustrating this article are by the author.

2 We are indebted to V.S. Srivastava, Government Central Museum, Jaipur, for this information.

3 Ettinghausen (1950) considered the rhinoceros factor in the development of the unicorn motif. He calls the summary of his book ‘The karkadann as a scientific and artistic problem’ (pp. 143 ff.). Thus, the problem of the rhinoceros (karkadann) in the Islamic world has already been dealt with and will therefore be excluded from the present context.
The oldest Indian representations of the rhinoceros ⁴ were made around 2000 BC in Harappa and Mohenjo-daro and several other places. The most naturalistic renderings are those on the well known seals (Marshall 1931: pl. CXI, nos. 341-7; Mackay 1938a: pl. LXXXV, nos. 131-40; pl. LXXX, no. 309; pl. XCIX, nos. 651 and 684; Vats 1940: pl. XCI, nos. 252-3) measuring about 3.5 × 3.5 cm or something less. The artists especially emphasized the tubercles on the animal’s skin, which mostly looks like being clad in a coat of mail. For this reason, the Indian species of the rhinoceros is called *Panzernashorn* in German, a word which indicates the armour-like plates (*Panzer*) on the body of the animal. The distribution of these plates and of the bumps deserves special attention because in many cases the artists did not know, how to distribute them. Two examples from one and the same site may therefore differ considerably from each other. One rhinoceros seal from Mohenjo-daro has the armour-like plate (with its large pimpels) in the middle part of the body and on the shoulders as well as the hind quarters ⁵, whereas another example from Mohenjo-daro is devoid of this armour in its middle part ⁶. A dish-like manger in front of the rhinoceros in the last seal seems to indicate that it had been kept in captivity; however, we do not know for which purpose ⁷. Most probably it served as food. That rhinoceros meat had been eaten is further suggested by the remains of rhinoceroses excavated between 1944 and 1963 at Langhnaj in Northern Gujarat, where two scapulae, one humerus, one talus, and a molar tooth have been found. 'A unique discovery was that a rhinoceros shoulder blade had

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⁴ We are only concerned with the rhinoceros and not with the unicorn (representations of this motif are found in the art of the Indus valley civilization). The legend of Ṛṣyaśṛṅga (Lüders 1897-1901) will also not be taken into consideration.

⁵ Mackay 1938a: pl. XCIX, no. 561 (= Mackay 1938b: fig. 36 = Mode 1944: 53, fig. 95 = Wheeler 1950: pl. IV(b), upper right = Wheeler 1953: pl. XXIII, upper right = Sivaramamurti 1977: col. pl. 14). Most of these reproductions show the imprints of the seals and not the seals themselves.


⁷ This manger has been discussed at length by Mode 1959: 54-6.
been used as an anvil for the manufacture of microliths' (Clutton-Brock 1965: 1).

The rhinoceros has not only been depicted on square seals, it also appears on amulets\(^8\) and copper tablets\(^9\). In one square seal which has often been discussed and published in connection with the representation of a seated figure in its centre\(^10\), the rhinoceros appears among other animals, like tiger, elephant and buffalo. It also occurs along with other animals (elephant and crocodile) on a cylinder seal which was found at Tell Asmar (Frankfort 1934: pl. I a-b)\(^11\) or even together with human figures in several rectangular sealings (Marshall 1931: pl. CXVI 10, 11, 13). Much less naturalistic in appearance, when compared to the representations mentioned so far, are the clay models of the rhinoceros (Marshall 1931: pl. XCII 8-13; Mackay 1938a: pls. LXXVII 22, LXXIX 2-3; Mackay 1943: pl. LVI 8; Vats 1940: pl. LXXXIX 75-74) (figs. 1 and 2), where the horn has sometimes not been given its correct position (cf. fig. 2). The armour-plates were applied after the body of the figure had been modelled. The characteristic tubercles thus became small holes. These figures resemble toys in their comparatively simple execution and small size but we cannot be sure that they were actually used as toys. If we assume that animals like the rhinoceros played an important part in the life and religion of the Indus valley people, there is also the possibility that they had been worshipped in one way or another.

The terracotta rhinoceroses are no doubt primitive in execution when compared with the smaller steatite models\(^12\) or the

\(8\) Mackay 1938a: pl. XC, no. 13b; pl. CI, no. 1b, 14a; pl. CIII, no. 13.

\(9\) Mackay 1938a: pl. XCIII, no. 7; Marshall 1931: pl. CXII, no. 7.


\(11\) For a drawing of the seal imprint cf. Mode 1944: fig. 127 or Ettinghausen 1950: 83, fig. 2.

\(12\) Vats 1940: pl. LXXIX 74; Catalogue 1959: no. 51. Both examples are very similar although, according to the last mentioned catalogue, they stem from different places.
seals which are also made of steatite. However, we find the same
difference when comparing Indian coins and stone sculptures of
the last two millennia with clay models of gods and goddesses
which are not without charm, but as a rule crudely executed.

Fig. 1 — Clay model of a rhinoceros, c. 2000 BC. Courtesy, National Museum,
New Delhi.

Thus the small clay figures of Gaurī sold in the streets of
Jaipur for the Gangore (Ganagaura) festival (Sharma 1978: 19-20)
are only intended for short use during worship. We find different
types of clay figures intended for temporary use in all parts of
India up to the present day. Some of the clay-rhinoceroses may
have served a similar purpose. Leaving such speculations aside,
we should mention another terracotta example of considerable
quality found at Lothal (Rao 1962: fig. 51). Only the head of the
animal has been found, but from its size we may assume that the
total height of this model was larger than the average size of
most of the other clay rhinoceroses. A rhinoceros of equally
remarkable size but, unlike the Lothal example, made of bronze has been discovered at Daimabad, Ahmednagar District in Maharashtra. The animal stands on four wheels and is finely executed. It measures 19 cm in height and 25 cm in length. It has already

Fig. 2 — Clay model of a rhinoceros, c. 2000 BC. Courtesy, National Museum, New Delhi.

been noticed that in this model the mouth is slightly too long, thus resembling the snout of a boar (Dhavalikar 1978: 207, fig. 7; Schroeder 1981: 59).

Literary evidence throws additional light on the problem. H. Lüders (1973) could prove that the oldest word used for rhinoceros was parasvat. It occurs in Rgveda X 86,18: ‘Вrśākapī found a killed parasvat, a butcher’s knife, a butcher’s bank, a new cooking pot and a cart loaded with fire-wood’. This passage already indicates that rhinoceros meat was edible. H. Lüders also quotes a verse in the Atharvaveda (VI 72,2.3) according to which the parasvat is known for the immense size of its penis (Lüders
1973: 518). The genitals of a rhino are in fact quite large and it may be for this reason that the parasvat is mentioned together with Kāma, god of love, in the Kāthakasāṃhitā V 7,11 and Taittirīyasāṃhitā 5,5, 21,1. Apart from that the parasvat has also been connected with Isāna, for whom it should be sacrificed, following H. Lüders who quotes Vājasaneyāsāṃhitā 24,28 and Maitrāyaṇi- sāṃhitā 3,14,10.

The most common word for rhinoceros was khaḍga which does not seem to be of Sanskrit origin (Mayrhofer 1953: 299). It appears in the Vājasaneyāsāṃhitā (24,39) (ed. Weber 1972: 746) and Maitrāyaṇi- sāṃhitā (III 14,21) (ed. von Schroeder 1881: 177) where it is connected with the Vaiśvadevas. In one instance, the khaḍga is mentioned along with the parasvat: ‘parasvati me samṛddhiḥ khaḍge ma ārtih’, ‘in the parasvat my failure, in the khaḍga my misfortune’ (Baudhāyana-Śrutasūtra 2,5) (ed. Caland 1904: 38). From other, partly later texts the interest in the meat and skin of the rhinoceros becomes evident. We learn from the Saṅkhāyana-Śrutasūtra (14,33,20) (ed. Hillebrandt 1888: 167): ‘The sacrificial fee is a horse-chariot, coated with rhinoceros-hide, covered with tiger fell, with a quiver boar-hide, with a bow-case of panther-hide, drawn by brown horses’ (transl. Caland 1953: 395). The Jaimintya-Brāhmaṇa (II 103) mentions a combatant who stands in a chariot, clad in a coat of mail made of rhinoceros-hide. This coat of mail is called khaḍga-kavaca in the text (ed. Caland 1970: 156). Even up to the end of the 16th century, rhinoceros-hide served a similar purpose 13. Shields made of rhinoceros-hide, some preserved in the Maharaja Sawai Man Singh II Museum of Jaipur, were in use in Rajasthan up to the 18th century. The skin of the rhinoceros was also used for making vessels which were employed in sacrifices.

Reference to such vessels is made in the Viṣṇusmṛti. According to the translation of J. Jolly, they were made of rhinoceros horn. The original text however, does not mention the horn as such. We may assume that J. Jolly had been mislead by the occasional custom to use rhinoceros horns as drinking cups (in

13 The war elephants of Akbar were covered with rhinoceros-hide, see Father A. Monserrati’s Account translated and edited by Rev. H. Hosten 1912: 212-3.
Europe on account of the popular belief that the rhinoceros horn indicated a poisoned drink). It would, however, appear that this custom was unknown in India. The history of the rhinoceros in Europe has already been dealt with extensively 14.


Several ancient authors also mention the rhinoceros while enumerating five or seven ‘edible animals with five claws’, e.g. Gautama, Manu and Āpastamba 16. Vasiṣṭa mentions edible animals in a similar context. He nevertheless adds (XIV 47): ‘But regarding the rhinoceros and the wild boar they make conflicting statements’ (transl. Bühler 1969, II: 74). Curiously enough, Bauḍhāyana mentions the same five animals as Manu, but regarding the rhinoceros he makes a contradictory remark: ‘The porcupine, iguano, hare, hedgehog, and rhinoceros are to be eaten, with the exception of the rhinoceros’ (ed. Hultsch 1922: I 5,12.5, p. 23).

14 The latest contribution to the subject is probably Heikamp 1980.
15 According to a synopsis of parallel passages on p. 546, a similar verse occurs also in the Gautama-Dharmasūtra XV 15, the Āpastamba-Dharmasūtra II 17, 1-3, and in the Yājñavalkyasmṛti I 257.
Not only the manes but also Rāvaṇa was amongst those who enjoyed rhinoceros meat. This is related by Hanumān while describing the banquet hall of the demon king 17.

The horn of the rhinoceros which became so important in China, as well as in Europe, has been mentioned but rarely. In the Mahābhārata (8,6,37, Crit.Ed.) we read: 'With golden and earthen jars filled to the brim with water and sanctified with mantras, with tusks of elephants and horns of rhinoceroses and mighty bulls... Karna... was invested with the command' (transl. Roy n.d., VII: 23). The word khaḍga occurs frequently in the epics and purāṇas, but in almost all cases it denotes a sword. When the ancient authors started to confuse both meanings of the word, they employed another word for the animal, namely gaṇḍa 18. Kālidāsa still used the word khaḍga, when he described Rāma's feats in Raghuvaṁśa 9,62 (ed. Narayan Ram Acharya 1948: 239): 'Souvent il allégeait les têtes des rhinoceros en les dépouillant de leurs cornes à l'aide de ses flèches acérées; comme il avait pour tâche de sévir contre l'orgueil, il ne supportait point que la corne de ses ennemis se dressât en l'air; il ne leur laissait que la vie' (transl. Renou 1928: 101; cf. also transl. Nandargikar 1971: 285). From Kālidāsa, i.e. from the Gupta age onwards, it apparently took a few centuries until the animal reappeared in various texts such as the Kālikāpurāṇa (ed. Sāstrī 1972: 492, v. 67,4a).

Unfortunately, all these textual references to the rhinoceros can hardly explain its representations in archaeological finds and in art objects. From the Indus valley finds we can merely assume that the rhinoceros had been a sacrificial animal and that traces of its cult possibly penetrated into vedic texts after the Aryans were settled in India for some time. The oldest mention of the rhinoceros occurs in the 10th and latest book of the Ṛgveda. The


18 According to Mayrhofer 1953: 318, this word does not seem to be of Indo-Aryan origin.
assumption of a borrowing from pre-Aryan tradition is supported by the fact that the words parasvat, khaḍga and gaṇḍa are not of Indo-Aryan origin. It would hardly be advisable to speculate about the role of the rhinoceros in the cult or religion of the Indus valley civilization since we cannot even read the inscriptions on the seals. The archaeological finds from historical periods, which are dated stratigraphically or through their inscriptions, are limited in number.

In 1951, 21 soapstone discs were accidentally discovered in the Mahalla of Murtaziganj near Patna (Shere 1951). These stone discs have tentatively been dated into the 1st century BC. One of these discs measures 5.1 cm in diameter and shows a rhinoceros in the company of an elephant, a horse, two peacocks, and a few stags (Shere 1951: 184, pl. VII 3; cf. Gupta 1965: 346-7, pl. LV bottom left). The use of the stone discs is still a mystery.

A seal from Bhita (Uttar Pradesh) showing a rhinoceros is preserved in the Allahabad Museum. It is also made of soapstone and has been dated into the 3rd century BC. It measures 6.6 × 6.3 cm. 'The animal, in what seems to be a flying gallop, moves to the right. The bulky body is divided into two globular parts, each enclosed by a ridged border. The small tail hangs close to the back and a horn is visible at the end of the snout' (Chandra 1970: 36; no. 3, pl. II).

Chronologically, the first known stone relief showing a rhinoceros is a half medallion at the lower part of the northernmost vedikā pillar of Stūpa no. 2 at Sanchi (Marshall & Foucher 1940: pl. 78, 24a). The rhinoceros, rather clumsily executed if compared to other reliefs of the same vedikā, stands facing left in front of a huge lotus bud. The armour-like plates are not indicated. Were it not for the horn at the snout, the identification of this animal would be difficult.

Will Buddhist sources help us to explain the presence of the rhinoceros on a Buddhist monument? As is well known, only a few sculptured panels on the vedikā of Stūpa no. 2 at Sanchi can be linked directly with Buddhist tradition.

King Asoka forbade the slaughter of rhinoceroses whereas Chandragupta Maurya had enjoyed seeing them fighting in his
arenas. In his 5th pillar edict, Aśoka proclaims: ‘(When I had been) anointed 26 years, the following animals were declared by me inviolable, viz. parrots, mainas, ..., the rhinoceros, white doves, domestic doves, (and) all the quadrupeds which are neither useful nor edible’ (Hultzsch 1925: 12; also cf. Bhandarkar 1969: 309). This edict could of course not prevent the gradual extinction of the Indian rhinoceros which is today confined to Assam and parts of Nepal. Aśoka’s word for rhinoceros is pallasata which is derived from Sanskrit parasvat. The animal is also mentioned in the Sudhābhojana Jātaka (535) and the Vidhurapanṭidita Jātaka (545) (ed. Fausboll 1891: 406; 1896: 277). A magic jewel through which the whole world can be seen is described in the latter Jātaka: ‘See on the slopes of the mountains troops of various deer, lions, tigers, boars, bears, wolves, and hyenas; rhinoceroses, gayals, buffaloes, ..., all kinds of hosts, created in the jewel’ (transl. Francis 1957, VI: 135). The rhinoceros appears in the Sudhābhojana Jātaka together with many other animals (transl. Francis 1957, V: 216). Apart from the inclusion of the rhinoceros in such lists, the animal became immortalized by a text which was named after the rhinoceros: the Khaggavisāṇasutta (Pali khagga is the equivalent of Sanskrit khaḍga). The line ‘eko care khaggavisāṇa-kappo’ — ‘live, as lives th’ rhinoceros, alone!’ (Sutta-Nipāta, Vagga 1, Sutta 3: ed. & transl. Chalmers 1932: 10-21) is repeated at the end of all except one verse. Though there are also several references to the rhinoceros in Buddhist texts, we do not get any substantial information.

An ancient representation of a rhinoceros made of ivory comes from Bagram and is datable to the 1st century AD (Hackin

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20 Further animal lists including the rhinoceros can be mentioned easily. For another Buddhist list, see e.g. Lalita-Vistara (ed. Vaidya 1958: 222, 1.8; transl. Foucaux 1884: 262. For a Jainist list, see e.g. the Praṇavādyakaraṇāṇī, Suttāgame Ed., vol. I, p. 1200, l. 27. For a Brahmanical list, see e.g. Harivaṃśa, Crit. Ed., 31,84c (=khaḍgamukha’; transl. Langlois 1835: 489.

21 Also cf. Edgerton 1953, II: 202b-203a. s.v. ‘khaḍga’. Prof. K. Bruhn directed our attention to a parallel expression in a canonical Jain text: Aupapātika Sūtra (Leumann 1883: § 27).
1954: 202, no. 150 u.5, fig. 186). Here the rhinoceros stands within an oval-shaped medallion facing left. The back of the animal seems to be covered by a blanket with a rhombic pattern. Were it not for the small horn on the snout of the animal, the correct identification would again be a difficult task.

The archaeological excavations at Chandraketugarh (near Calcutta), carried out between 1956-57, brought to light a large number of terracottas. Among the finds is a fragment of a terracotta plaque showing a rhinoceros (Das Gupta 1959: fig. 19). It dates from the Kushana period as it has been found along with other terracottas which can be assigned to that period. Though this plaque has been found in an area where rhinoceroses must have lived in great number, we cannot connect it with any inscription from that part of India. In the 7th century we hear from three Eastern Indian Kings, viz. Khaḍgodyama, his son Jata-khaḍga, and the latter’s son Devakhaḍga. Whether the word khaḍga occurring in the copper-plate grants of these kings has to be translated by ‘rhinoceros’ or by ‘sword’ cannot be decided. We are used to associate Bengal mainly with the tiger, but down to the 18th century, North Bengal and Assam were so rich in rhinoceroses that a French map of India describes that area as ‘Contrée de Rhinoceros’. Late medieval temples in Bengal, approximately from the same period as the French map, are decorated with terracotta panels showing rhinoceros hunts (Haque

22 Almost the same rendering of the back of the rhinoceros is found in an Indian miniature painting of the 18th century. See Kühnel & Ettinghausen 1933: no. 22 (= Kühnel 1937: no. 19).
24 Majumdar 1971: 86 ff., ‘Date of the Khaḍga Kings’. Also compare Kṛṣṇopaniṣad 20, ‘khaḍgarūpo maheśvarah’, where the translation ‘sword’ for khaḍga as suggested by the commentary does not seem to be quite certain. See ed. Jacob 1891: 10.
25 Since this map is not catalogued in Cole 1976, we supply the full details: ‘Presqu’Isle des Indes Orientales en deçà du Gange, Comprenant l’Indostan ou Empire du Mogol, différens Royaumes ou Etats; les vastes Possessions des Anglais (d’après leurs propres Cartes) et les autres Etablissements Européens avec les Grandes Routes; par M. Brion de la Tour Ingr. Geog. du Roi. A Paris..., 1781’. Size: 76.5 × 53 cm (height precedes width).
1975: pls. XLI 7, XLII 12) 26. It would thus hardly be surprising if in a Bengali inscription yet to be discovered the word *khadga* would clearly refer to a rhinoceros.

The rhinoceros appears, along with an inscription mentioning the word *khadga*, in a gold coin from the reign of Kumāragupta I (415-c.455). The inscription reads: ‘Bhartā khadgatrātā Kumāragupto jayatyanīsam’ (Altekar 1957: pl. XXII, no. 36). This coin, commonly called the Rhinoceros-Slayer Type of Kumāragupta was unknown before the discovery of the Bayana Hoard in 1946 (Altekar 1954). In it, Kumāragupta is shown riding a horse and attacking a rhinoceros with a sword. The rhinoceros turns its head towards the rider and opens its mouth. The circular spots on the skin of the rhinoceros are distributed all over the body. The correct translation of the inscription is controversial: *khadga* can again be translated by ‘rhinoceros’ as well as by ‘sword’ since both objects appear on the coin (Nagar 1949; Chimmulgund 1955; Sohoni 1956; Prakash 1963; Sircar 1966) 27.

The first polychrome representation of a rhinoceros is connected with Jaina art. It is a painting on a wooden manuscript cover (*patīřī*) which dates from the 13th century or earlier. It is preserved in Jaisalmer (Rajasthan). Remarkable are the long ears of the animal and the subdivisions on its skin. Like the example from Sanchi, it stands facing left, in front of a Lotus, in a medallion (Nawab 1959: col. pl. Y = fig. 35; Khandalawala & Doshi 1975: pl. 268A). In the iconography of the Jainas the rhinoceros is the *cīhna* (cognizance) of the 11th Jina, Śreyāmsa. The first text that mentions the rhinoceros as a *cīhna* belonging to the 11th Tīrthankara is the *Tiloyapanṇatti* by Yativrṣabhā (ed. Upadhyā & Jain 1956: IV 604-05) 28. This text has been dated to the 6th-8th

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26 The animal in fig. 12 of Haque 1975 has not been identified but the rendering of its skin ‘having markings resembling wooly-knots all over its body’ (*ibid.*: 125) suggests that the artists wanted to represent a rhinoceros. This device is already found at Paharpur, cf. Das Gupta 1961: 31.

27 For further reproductions see Altekar 1957: pl. XIII, nos 3-6; Altekar 1954: pl. XXX, nos. 5-8; Sivaramamurti 1977: col. pl. 47.

28 Another Digambara text which mentions the *cīhna*s is the *Pratiṣṭhāsarod-dhāra*, dated samvat 1285. I am grateful to Prof. K. Bruhn who kindly supplied information on the history of the *cīhna*. 
centuries (A.N. Upadhye) but it contains interpolations (U.P. Shah). Astonishingly, the earliest representations of the cihnas in art are much older than the earliest available references in Jaina literature. The first cihnas appear in Rajgir at the time of Candragupta II (around 400 AD). Though there are only few examples from that early period, we can be fairly sure that all the Tirthan-karas got their cihnas approximately at the same time. Representations of Śreyāmsa (Śreyāmsa = Jina image with rhinoceros cihna) seem to be rare. At least three images of this Jina, made of white marble, are preserved in a Jaina temple at Sanganer (Rajasthan). They may date from the 14th century or even later. All the three Jinas are seated and devoid of any attendant-figures. The rhinoceros is represented clearly within a rectangular field on the pedestal of each sculpture. It resembles the representation of the rhinoceros in the above mentioned paṭṭ (fig. 3). The earliest known Śreyāmsa image is possibly a piece in the Sarnath Museum (post-Gupta period?) (Sahni 1972: 328, no. G. 62). A published Śreyāmsa image in the Nagpur Museum may date from the 11th century (Bhattacharya 1974: pl. XVI).

Fig. 3 — Rhinoceros cihna on the pedestal of a Śreyāmsa-image in Sanganer (Rajasthan), c. 14th century.
It is surprising that literary evidence for the cihnás of the various Indras in the Jaina pantheon is already found in the Aupapātikasūtra of the Śvetāmbara canon (Leumann 1883: § 37; also Kirfel 1920: 302-3; Ramachandran 1934: 120-1). These cihnás appear on the crowns (mukutās) of the Indras, and amongst them we find the rhinoceros (khagga). There are, however, no representations in art ²⁹.

The Jaina author Hemacandra gives four names for the rhinoceros, viz. khaḍgī, vadhhrinasaḥ, khaḍgo and gaṇḍako (ed. & transl. Boehltingk & Rieu 1847: 1287, p. 242), whereas Dhanapāla, another Jaina author, mentions in his Pāiyalaccht Nāmamāḷa only two of these names, viz. gaṇḍāo and khaggo (ed. Bühler 1879: 49, v. 265c) ³⁰.

The first dated representation of a rhinoceros is, as most of the examples given in the sequel, a miniature painting. It is a small painting (3 cm in height) which forms part of an illustrated manuscript of the Āranyakaparvan, the 3rd book of the Mahābhārata (Khandalavala & Chandra 1974: fig. 42). Its colophon dates the manuscript into AD 1516. In the illustration, the rhinoceros — shown with a large head and long ears — tries to escape from the arrows of a hunter, who is identified by an inscription above the animal as a hunting Pāṇḍava. The skin of the rhinoceros has been pierced by five arrows: the armour-plated skin of the game was not impenetrable to the arrows of a hunter. The authors of the monograph in which this rhinoceros is reproduced do not mention any specific stanza(s) illustrated by the painting. According to the folio number, the scene most probably illustrates III 46.7-8: ‘With his arrows he laid low ruru deer and black gazelles and other sacrificial forest game...’ (transl. & ed. Buiten 1975: 314). The black gazelles are in fact represented in an adjoining illustration. Although the rhinoceros is not mentioned as such, it has been depicted by the artist. Similarly, a rhinoceros appears

³⁰ Another edition of this text was published in the ‘Pūjyaśrī Kaśyārāma Jaina Gramhamāḷa: Prathama Puṣpa’, ed. by B.D. Doshi with a Hindi commentary. Dr Nalini Balbir kindly drew my attention to these editions. For the etymology of the word gaṇḍa, cf. Kohl 1954: esp. 370.
on a folio of a now widely dispersed illustrated set of Books X-XI of the *Bhāgavata purāṇa*, which plays an important part in miniature paintings from the 16th century onwards. Probably the manuscript has been painted only a few decades later than the *Āraṇyakaparvan*. It has been called ‘Palam Bhāgavata’ by some authors (Khandalavala & Mittal 1974). The folio here referred to shows Kṛṣṇa in a chariot shooting arrows at various animals amongst which a rhinoceros stands out as the largest (Hutchins 1980: col. pl. 15). The other flying animals are tigers, hares, snakes, boars, deers and a fox-like quadruped. The rhinoceros is again not mentioned in the respective passages of the *Bhāgavata-purāṇa*. We are not surprised to see the rhinoceros also on a folio of an illustrated Jaina text, the *Mahāpurāṇa* of the Digambaras (Khandalavala & Chandra 1969: col.pl. 19b). The manuscript is dated 1540. The rhinoceros is shown roaming in a forest along with many other animals.

By the end of the 16th century the rhinoceros becomes a common element in Mughal paintings. In the Vienna *Hamza Nāma* it is the vehicle of the villains. Thus several rhinoceroses have to be slain by the various heroes of the story (Glück 1925: pl. 28 = Egger 1974: col. pl. 34; Glück 1925: pl.46 = Egger 1974: col. pl. 56). The Vienna *Hamza Nāma* has possibly been illustrated between 1562 and 1577 (Beach 1981: 58 ff.). Since Bābur mentions the rhinoceros several times in his memoirs, it appears in the *Bābur Nāma* manuscripts either as game pursued by Bābur himself, or quite alone 31.

Apart from the *Hamza Nāma* and *Bābur Nāma* it appears for almost three centuries (end of 16th to end of 18th century) on paintings illustrating different mythological, historical, narrative, and scientific texts. Three major groups of illustrations containing a rhinoceros can be established.

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31 See Smart 1977. This is the most comprehensive work on the subject. It supplies the exact references to the English translation of the text. There are at least 10 folios showing rhinoceroses (one or more than one). The following examples have been listed by Smart: A37 right; A37 left (Sotheby’s Sale Catalogue, 7 March 1921, lot 15); B43 right (Suleiman 1970: col. pl. 46); B49 right (ibid.: col. pl. 52); B52 (ibid.: col. pl. 56); C48 right (Ettinghausen 1950: pl. 32 = Smart 1977: pl. 47); C55 (Tyulayev 1960: pl. 36 = Soustiel 1973: ill. p. 60); D56 right; D62 right (Ali 1973: col. fig. 3).
I. The rhinoceros among peaceful animals.
II. The hunted rhinoceros.
III. The rhinoceros as the most prominent part of the illustration (‘portrait’).

Most of the paintings to which we have referred so far can be assigned to one of these three groups. The groups may be subdivided as follows —

I.1. Laila and Majnun.
   a. Majnun alone surrounded by his animals.
   b. Laila visiting Majnun in the middle of his animals (fig. 4).
2. ‘The animal world’.
3. ‘Emaciated animals’.

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32 Ettinghausen 1950: 49, ‘The subject was popular for Nizami illustrations in Persia as well as in seventeenth- and eighteenth-century India, and since the Indian artist delighted in giving a large and varied number of animals, it is reasonable to inquire whether or not the rhinoceros might be found in the peaceful company around the poet. So far only two examples [sic!] of this type have turned up’.


36 Sotheby & Co., 25-26 November 1968, Bibliotheca Philippiaca, N.S., pt. 4, lot 378, p. 120 ( = Christie’s 16 October 1980, lot 59, p. 34, colour). The two rhinoceroses of this miniature appear again, in a completely different setting, in a painting where angels offer food to a holy man. Compare Dublin, Chester Beatty Library, Ms 63 (27).
Fig. 4 — Lailā and Majnūn surrounded by animals amongst which a couple of rhinoceroses can be seen. Mughal miniature painting, end of 17th century. Courtesy, National Museum, New Delhi.
4. ‘King Solomon’s court’ 37.
5. ‘The lion’s court’ (Anwār-i-Suhailī) 38.
6. ‘Noah’s ark’ 39.
7. ‘Plato charming the wild beasts with his music’ (Khamseh) 40.
8. ‘Animal studies’ 41.

In most of these paintings, the rhinoceros is shown as entering the picture ‘from the border’.

II. 1. Rhinoceros hunt 42.
   2. A type of composition composed of several hunting scenes, of which at least one shows a rhinoceros hunt 43.

III.1. A rhinoceros illustrating a particular passage of a certain text (mostly Qazwīnī) 44.
   2. Paintings of a rhinoceros which cannot be related to any text (‘portrait’) (fig. 5) 45.

37 Welch & Beach 1965: 59, no. 6 (= Welch & Welch 1982: 189, no. 63).
38 Welch 1963: no. 10, dated 1596/97.
40 Martin 1968: pl. 181; Norah Titley (Titley 1977: 143, no. 323(34)) mentions an illustration of the same subject by the same artist, but she does not say whether the painting is identical with the one reproduced by F.R. Martin.
41 See our fn. 22 for the exact references to a painting illustrating this subject.
42 1) Khandalavala & Chandra 1965: col. pl. H — perhaps the most dramatic of all illustrations of this subject; 2) Montgomery & Lee 1960: col. pl. 36 ( = Welch & Beach 1965: 72, no. 27 = Beach 1974: pl. LXVII, fig. 71 = Beach 1978: fig. 2, p. 22); 3) Beach 1974: fig. 73; 4) Sotheby’s 7 December 1977, lot 43, p. 15.
44 Qazwīnī: Ettinghausen 1950: pl. 14, bottom, dated 1789. Titley 1977 refers to several examples, viz. 234 (84), dated 1685/86; 235(128); 236(91); 237(71); 239(248), dated 1790; 240(129); 241(229); 244(66). Gharāyeb al-Kaynāt: Hotel Drouot, Importants Manuscrits Persans..., 10 March 1976, no. 42, dated 17-11-1753.
45 1) Miniature showing a rhinoceros in the collection of the Maharaja Sawai Man Singh II Museum, Jaipur, cf. Das 1983: 2. We could not see the original painting when visiting the Museum, but Shri Asok Das has kindly given us a black-and-white photograph of this miniature. A nāgarī inscription in the
Fig. 5 — Drawing of two rhinoceroses facing each other, late 18th or early 19th century. Collection: Kumar Sangram Singh, Jaipur. Courtesy, Kumar Sangram Singh.

In the course of time, the rhinoceros has virtually been 'pushed aside', i.e. relegated to the extreme margins of the paintings \(^{46}\), before it disappeared completely from the Indian miniatures. The majority of the miniature paintings showing a rhinoceros have in fact been executed in the first half of the 17th century. Among those later examples which cannot be placed into any of the three major groups mentioned above is the representation of a rhinoceros in a large-size map of the world which has been painted in East Rajasthan at the end of the 18th century: here, the rhinoceros does not appear on the Indian continent — but in Africa (Ethiopia) \(^{47}\). The rendering of this rhinoceros is nevertheless unmistakably Indian as the artist made no attempt to paint an African rhinoceros (which he could have done easily by adding a second horn on the snout).

painting indicates that the rhinoceros came from Patna: 2) Soustiel 1973: no. 59, p. 59, colour; 3) Devkar 1957: pl. XXII 7; 4) our fig. 5, Collection of Kumar Sangram Singh of Nawalgarh. We are much indebted to Kumar S. Singh for being allowed to work in his collection. The reproduced area measures 6 × 15.2 cm (height precedes width). The miniature was painted in the late 18th century.

\(^{46}\) Kheiri 1921: fig. 45, upper margin; furthermore Nouveau Drouot, Salle no. 8, Collection Jean Pozzi, 5 December 1970, no. 77, lower margin.

\(^{47}\) Brisch 1979: no. 3, fig. 27. Since the rhinoceros is hardly recognizable in the reproduction (the map measures 260 × 261 cm) the reader is referred to a photograph showing the portion with the rhino: Negativ Nr. Pl 2245, Abbildungs- sammlung Nr. 8504. A colour slide of the entire map is available at the counter of the Museum.
Fig. 6 — Wall-painting showing a rhinoceros in Bijolia (Rajasthan), dated AD 1701.

The rhinoceros is not confined to miniature paintings. It appears in wall-paintings as well, and here it is perhaps even more prominent. The oldest dated wall-painting with a rhinoceros was executed in 1701 (fig. 6). It can be seen in the Mardana Mahal of the palace at Bijolia (Rajasthan). The most impressive wall-paintings with rhinoceros hunts in great number and on a large scale are found in the Chattar Mahal within the palace of Kota (Rajasthan) dated 1701. Other rhinoceros representations may be seen in the wall-paintings of the Jhala ki Haveli, Badla Mahal, and Bade Devtaji ki Haveli (all Kota), Badal Mahal, Bundi, in the Rang Sala of Samod (Rajasthan), in a wall-painting.

48 Beach 1974: pl. LXX, fig. 74. The inscription mentioning the date samvat 1758 has escaped Beach’s attention, hence his dating ‘ca. 1750’. Our researches on the wall-paintings of Bundi and Kota have been made possible through the Stiftung Volkswagenwerk to which we feel much indebted.
at the 'Sisodia Rāṇī kā Bagh' near Jaipur (Rajasthan), and at various other localities.

The representation of the rhinoceros after 1600 was in no way restricted to paintings. The animal occurs in Mughal animal carpets of the 17th century (Ettinghausen 1950: pl. 21) and in white marble reliefs like those of the Baḍā Mahal at Kota (fig. 7) 49. The rhinoceros of the Haravati area of Rajasthan (Bundi, Kota, Jhalawar) is still remembered in the words khaṅgī and khaṅgā, most probably derivatives from khaḍga 50. It must be noted that the rhinoceros does not appear in the wall-paintings of Toda Raisingh, or Indergarh, while it is shown frequently in the wall-paintings and painted wooden doors of Kota. This difference

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49 For the room in which this panel is situated, cf. Gaekwad 1980, ill. p. 75 (lower panel).

is of some importance since all these sites employed painters who were trained to work in the Bundikalam. It may prove that the artists painted only those animals which could actually be seen in the respective locality.

The European travellers in India had their own peculiar approach to the animal because they were influenced by European mythology. William Finch (1608-11 in India) assumes that the rhinoceros horn had been used for 'bucklers and divers sorts of drinking cups'. Finch further remarks: 'There are of these hornes, all the Indians affirme, some rare of great price, no jewell comparable, some esteeming them the right unicornes horne' (ed. Foster 1968: 176). Tavernier (around 1665) mentions a rhinoceros hunt: 'As soon as it was killed they cut off the horn, which the king also presented to the ambassador' (trans. Ball 1889, II: 319-20). In spite of these observations, carved rhinoceros horns are seen in India but rarely. Indian rhinoceros horn was exported to China, where the Chinese craftsmen produced some of the most outstanding examples of carved rhinoceros horns. But, as mentioned already, it never played such an important role in India as in Europe, where in one case 220 carved horns can be found in a single collection (Henchy n.d.: 15). Religious sects which made use of the rhinoceros horn had only limited influence. Tavernier describes a tamed rhinoceros: '...I saw a rhinoceros eating stalks of... millet, which a small boy of nine or ten years presented to him. On my approaching he gave me some stalks of millet, and immediately the rhinoceros came to me, opening his mouth four or five times; I placed some in it, and when he had eaten them he continued to open his mouth so that I might give him more' (transl. Ball 1889, I: 114-5). Bishop Heber also refers to tamed rhinoceroses: 'These (rhinoceroses) at Luck-

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52 Dr G. Bhattacharya (Berlin) has drawn our attention to a carved bowl made 'of rhinoceros forehead', as the caption on a postcard explains. This bowl is preserved in the State Chandradharni Museum of Darbhanga and has, besides other figures, carvings of the 'ten incarnations'. Apart from the postcard available from the Museum, this piece seems to be unpublished. For a Nepalese bowl made of rhinoceros horn, see Glasenapp 1928: pl. 35.

53 Briggs 1982 mentions on p. 7 ear-rings made of rhinoceros horn.
now are gentle and quiet animals, except that one (of five or six mentioned by Heber previously) of them has a feud with horses. They seem to propagate in captivity without reluctance, and I should conceive might be available to carry burthens as well as the elephant, except that, as their pace is still slower than his, their use could only be applicable to very great weights, and very gentle travelling. These have sometimes had howdahs on them, and were once fastened in a carriage, but only as an experiment which was never followed up. 'In passing through the city (= Baroda) I saw... a rhinoceros... which is so tame as to be ridden by a mohout, quite as patiently as an elephant' (Heber 1828, II: 58-9; III: 5). The observations of the two last-mentioned travellers are well illustrated in an Indian woodcut of 1861 showing a rhinoceros in the company of its groom. The rhino with its tiny little horn looks very tame (Bamisidhar 1861: frontispiece). Travellers' records of this kind (and the woodcut of 1861) could not prevent the majority of European travellers, writers, and artists from drawing a frightening picture of the rhinoceros. An engraving after a drawing by William Daniell shows a rhinoceros with a head more akin to the African species: the horn is too long if compared to any representation made by an Indian artist (Counter 1835: engr. facing p. 4). The animal looks even more dangerous in a coloured illustration in a handbook on mammals, where it approaches the observer with a gaping mouth (Brehm 1891: col.pl. between pp. 99-100). Its skin, so we read, 'is so hard and thick as to be generally impervious to a musket ball' (Counter 1835: 5), though in most of the paintings with hunting scenes mentioned before it is pierced either by arrows or by spears. Finally, the rhinoceros was viewed as a weird and misshapen creature: 'The rhinoceros is of a savage disposition and seems to exist merely to gratify a voracious appetite' (Counter 1835: 6), 'An ugly, small-eyed, piggish, horned-looking-beast reared itself up out of the wallow in a sitting posture, only exposing its head and shoulders, and blinked at me stupidly for a few seconds in an undecided manner, as if debating in its own mind what manner of animal I was' (Pollock & Thom 1900: 173). 'They ( = the rhinoceroses) are a poor show and of little use...' (Finn 1929: 187). Marco Polo observes: 'C'est une très vilaine bête à voir, et dégoûtante' (Polo 1955, quoted by Soustiel 1973: 60). Another traveller describes a rhinoceros fight in Baroda: 'les deux villains
animaux sont mis en liberté et parcourent la place d’un trot disgracieux et en poussant des rugissements. Leur vue parait être très mauvaise...’ (Rousselet 1875, quoted by Soustiel 1973: 61) 54. That this traveller was no objective observer but gave rein to his imagination becomes clear from his woodcut where the rhinoceroses have two horns instead of one.

It would appear from what has been said that the place of the rhinoceros in ancient Indian civilization is not very clear. It did play an important part in the Indus valley civilization, but hardly in the society of the Indo-Aryans. Here, rhinoceros meat was eaten and it was also served to the manes. However, later on eating of rhinoceros meat was prohibited. The animal became the vehicle of god Agni in far off Cambodia but it was not included in the host of vāhanas etc. peculiar to Hindu mythology and iconography. The Jainas employed the animal in two cilna-series but this incorporation was hardly reflected in Jaina art. The most noteworthy record of the rhinoceros is found in the field of coinage: the Rhinoceros-Slayer Type of Kumāragupta. Again the animal occupied no important position in either traditional or ornate poetry. It was rediscovered as it were in a comparatively late period by Indian miniature painters. The European approach to the Indian rhinoceros was quite emotional. Since the Europeans considered the rhinoceros as useful and ugly, it becomes questionable whether the Indian approach to the animal was similar before the arrival of the Europeans in India in the 16th century. This would help to explain, why the rhinoceros could not attain the position of a vāhana: an ugly animal does hardly fit a god. It can nevertheless be hoped that here and there future research will throw additional light on the role played by the rhinoceros in ancient India.

54 For the English edition, see Rousselet 1882: 106-7. For a reproduction of the wood-cut, see also Schlagintweit 1880: 1, 229.
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ELISABETH C.L. DURING CASPERS

A Possible Harappan Contact with the Aegean World

In a paper recently published in the Annali of the Istituto Universitario Orientale, Naples (During Caspers 1982), I drew attention to a sizeable group of what were loosely termed ‘sealing amulets’ from the old excavations at Harappa, Moenjo-daro and Chanhu-daro. This particular Indus material showing what appears to be definite non-Indus characteristics hints at probable small-scale, though ill-defined integration of Sumerians, and, as in Mesopotamia, of their Sumero-Indian descendants within the multi-ethnic Harappan society (During Caspers 1982: 340). It also seems safe to assume that, as in Mesopotamia, the initial impetus for the Sumerians’ appearance on the Indian scene was stimulated by purely mercantile interests (ibidem).

The majority of these ‘sealing amulets’ have been so rubbed and handled that they show heavy wear marks, indicating that their primary use was as amulets not as seals used in trade. These amulets are not the pendant type; they have no hole or boss for attachment. Most are damaged by rubbing and in cases so badly that it is difficult to make out their subjects. Perhaps they were wrapped inside the clothing in some way, just as today amulets or charms are often stitched into a rough envelope of cloth. Some pottery ‘sealing amulets’ are semi-polished, as if constantly held in the fingers (During Caspers 1982: 349).

A considerable number are cylinder-seal impressions which appear on one or more sides of warped longish pieces of clay or faience, or clay or faience roundish mould-pressed pieces or on rather squarish straight-sided or triangular pieces of clay or faience, sometimes made in a mould. They have tenuous links with the Near East in that their themes seem to be of the narrative kind reminiscent of Near Eastern cylinder seal impressions.
The Indus Valley stamp seals proper are of a more distinctly emblematic or heraldic type.

I have also suggested that the prism-shaped ‘sealing amulets’ show the greatest deviation from the original Mesopotamian concept of the cylinder seal (During Caspers 1982: 349). According to the old excavation reports these prism-shaped ‘sealing amulets’ were either made in a mould or stamped directly. They have a curious distribution pattern: 13 were discovered in Moenjodaro¹, only one at Harappa² and none at all at Chanhu-daro or, to my knowledge, elsewhere in a Harappan context.

Lack of time prevents a discussion of the various themes represented on these prisms and it may suffice to say that this is apparently the only group which appears to combine easily recognizable Indian iconographic elements with those pictorial representations and motifs and devices known from the Near East, from Egypt and probably also from the Arabian Gulf region.

As in the other groups of ‘sealing amulets’, the Indus script again appears to have been part of the depiction because the characters have been placed on one line with the pictorial elements, either at the end of the scene(s) or in front of them. We can only guess the reason for this different position of the Indus signs. It may be explained as a mere lack of space, although it would seem to have limited easy understanding of the written word. However the script and representations in these scenes may have formed a much more subtle and integrated unity than we can at present perceive.

Elements familiar from the proper seal patterns are, besides the script signs, a man seated in a tree with a cat-like animal, most likely a tiger looking back over its shoulder (Marshall 1931; Mackay 1938: note 1); a row of animals in file, most commonly a rhinoceros, an elephant and a bull and above a gharial or fish-eating crocodile (ibidem) (fig. 1); a ‘unicorn’, a short-horned bull and a tiger with or without their customary standard or manger (ibidem); horned figures or deities, spirally-horned ram-like animals and multiple-headed beasts (ibidem) (figs. 1-2).

¹ Marshall 1931: pls. CXVI 5, 8, 14, 25, CXVIII 9, 10, 12; Mackay 1938: pls. LXXXII 1, 2, XC 13, XCI 14, 20, XCI 11, 12, CI 3, 7, 12.
² Vats 1940: pl. XCV 386.
Fig. 1 — Prism-shaped ‘sealing amulet’ from Moenjo-daro. (After Marshall 1931: pl. CXVIII 10).

Fig. 2 — Prism-shaped ‘sealing amulet’ from Moenjo-daro. (After Marshall 1931: pl. LXXXII 1 + 2).
More reminiscent of Near Eastern iconography and not encountered on the square stamp seals are the goat-like animals reaching up to a tree to nibble at the branches (fig. 1), or a picture of a tree with beneath it a small truncated pyramid-like object and two goat-like creatures standing on either side with their front legs placed on top of the pyramid (*ibidem*) (fig. 3).

Less easily traceable, although found once on a square stamp seal from Moenjo-daro, are two scenes in which a buffalo with lowered head attacks a man, who has placed one foot on the animal's head, while holding a horn with one hand and being about to spear the buffalo's shoulders with his other (Mackay
Fig. 4 — Prism-shaped ‘sealing amulet’ from Moenjo-daro. (After Mackay 1938: pl. XCI 20 + XCI 11).

1938: pls. XCI 20, XCI 11) (fig. 4). Among the remainder is a prism-shaped ‘Sealing amulet’ which shows two recognizable ‘footprints’ on one side of the prism (Mackay 1928: pls. XCI 4, XCI 12) (figs. 5-6). These ‘footprints’ will shortly receive further attention below because of their particular interest to our discussion.

Two triangular prisms from the HR Area of Moenjo-daro are equally of importance (Marshall 1931: pls. CXVI 5, CXVI 8, CXVIII 9). One is made of pottery (fig. 7) and one of faience (fig. 8). They show the same script along two of their sides and as described by Marshall an identical scene along their third side. Both are rather broken and the mould or original cylinder seal has been badly applied, but the scene consisting of a procession of four human beings is fairly clear. The figure heading the procession is not properly decipherable, because it is broken. The second holds
a fragmentary pole or standard with what resembles a striated pennant or a hanging flag at the top. The third figure holds what appears to be a plinth on a pole surmounted by a standing bovine figure, which is usually referred to as a ‘unicorn’ and the fourth person carries the bowl and pole sections of what seems to represent a ‘sacred brazier’, the well-known emblem which is invariably associated with the ‘unicorn’ on the stamp seals.

The points which will be discussed more fully are:

1) The prismatic shape of the last category of amuletic imprints; 2) the device of the row of standard bearers on the two prisms from the HR Area of Moenjo-daro; 3) the depiction of the two ‘footprints’ on the three-sided pottery prism from the DK Area of Moenjo-daro.
The employment of the prismatic shape is not inherent to the Harappan seal industry and despite the tenuous affiliation of some of the motifs seen on these triple-decorated 'seal amulets' to Near Eastern glyptic portrayals, prisms with three decorated faces do not constitute an indigenous component of Near Eastern seal industry. The prism as a means of producing imprints was employed at an early stage, as attested by the so-called proto-urban prism-shaped seals from, for instance, Susa and elsewhere, e.g. in Luristan. However, these prisms show only one decorative pattern, engraved on the proper sealing surface.

The discovery of two triangular stone prisms, perforated lengthwise, with a triple decorative device, one coming from Maysar-1 in Oman (Weisgerber 1980a: 105-6, fig. 77; 1980b: 85-6, fig. 15) (fig. 9) and the other one from one of the Al-Hajjar graves (Grave 1?) on Bahrain (Weisberger 1981: 218-9, fig. 54; During
Caspers 1983: 661-70, pls. 1-11) comes as a surprise, because so far only round stamp seals have been found in the Arabian littoral. The occurrence of these three-sided stone prisms, on which Weisgerber has recently reported, is of singular importance because of their possible indigenous character and their likely place of origin. I have proposed (During Caspers 1983) that the triangular seal from Oman be regarded as an indigenous achievement of the Oman culture in the 3rd millennium BC, whereas the Bahrain prism appears to combine local scenery in the form of two caprids or gazelle-like animals with Indus Valley devices, albeit possibly of local manufacture. The prism from Al-Hajjar
Fig. 9 — Triangular stone prism seal with a triple device from Maysar-I in Oman. (After Weisgerber 1980b: fig. 15).

consists of a number of Indus characters on one of the two remaining sides and a short-horned bull with lowered head on the third side. This is, in principle, an Indus motif, although its execution and style of carving betrays a local taste and an indigenous manufacture. This fact is strengthened by the presence of a scorpion placed in front of the bull. It may be recalled that scorpions are not clearly evidenced in the seal repertoire of the Indus Culture, but are frequently portrayed in the glyptic art of the Dilmun Culture of Bahrain, the coastal areas of northeastern Arabia and the island of Failaka. The encasing of the device within a frame as we see here can be regarded as a non-Harappan practice which can be better explained as a local artifice. As the prism seal with a decoration on all three sides is neither Indian nor Near Eastern in origin, the source of inspiration of the Moenjo-daro and Arabian Gulf prisms remains to be investigated. At the same time we have to investigate the possible
origin of the standard bearers on the two Moenjo-daro 'sealing amulets' and to suggest a possible connection for the two 'footprints' on one of the other prism-shaped amulets from Moenjo-daro.

Early Mesopotamian-Egyptian contacts during the Early Dynastic or Proto-dynastic period in Egypt and the late Uruk IV, Jamdat Nasr (= Uruk III) and the ensuing Early Dynastic I periods in Mesopotamia, i.e. between c. 3100-2700 BC, are well-known and need no further comment. Among the well-accepted items of Mesopotamian influence in Egypt are high-hulled ships, interlacing serpents, serpent-necked panthers (fig. 10), humans
dominating animals, animal processions (fig. 11), headdresses and long robes, and cylinder seals.

However, Sir Flinders Petrie published a small number of four-sided prism-shaped stamp seals with geometric patterns on all four surfaces, which betray a non-Egyptian source of inspiration (Petrie 1925: pl. IV, 4th-5th row) (fig. 12). They date to the VI Dynasty, c. 2300-2200 BC and since four-sided square prisms are a well-established feature in Early Minoan times, these atypical Egyptian examples may perhaps be a result of an Early Minoan-Egyptian contact.

An example of Egyptian influence in Mesopotamian art is a scene frequently portrayed on the well-known Egyptian slate
palettes of a file of standard bearers, each person carrying a pole or standard with a flag or a piece of drapery hanging from the top, the latter crowned by a cult image of an animal (‘Narmer-Palette’, I Dynasty — fig. 10). The Mesopotamian depictions of this scene, adapted to the Sumerian taste, occur in Mesopotamia from Uruk III (Jamdat Nasr) to the Early Dynastic I period, i.e. 3100-2700 BC.

Before returning to the standard bearers of Moenjo-daro, I should like to point to the relative frequency of ‘footprints’ in the Dilmun glyptic art, both on the so-called early type of stamp seals, which, so far, are only known from Bahrain (e.g. Bibby 1958: pl. XXVII; Ibrahim 1982: fig. 49.6, pl. 60.6) as well as on the ‘classic’ ‘Persian Gulf’ stamps, discovered at both the islands of Bahrain and Failaka (Bibby 1958: pl. XXVI; Kunit 1966: fig. 4; Kjaerum 1983: nos. 73, 172, 178, 242, 260). It also needs stressing that ‘footprints’ from Susa (Amiet 1961: pl. 14.235), Tell Brak in northern Syria (Mallowan 1947: pls. XVIII 1, XX 14) and at Tepe Yahya IVB in southeastern Iran (Lamberg-Karlovsky 1971: 87-95, fig. 2C) occur exclusively on late 4th-early 3rd millennium BC stamp seals. A date round 3000-2800 BC for the Near and Middle Eastern ‘footprint’ in general and for the device of two ‘footprints’: one foot pointing up, one down, as also occurs on the Moenjo-daro example, does as yet not meet the general consensus of Indian archaeologists, because there is only general agreement on an early 3rd millennium BC date for the Early Harappa (Kot
Diji) period. Scholars in Indian archaeology still adhere to the second half of the 3rd millennium-early 2nd millennium BC dates for the Mature and Late Harappan periods respectively, as evidenced at Moenjo-daro. However, recent fieldwork at Moenjo-daro by M. Jansen seems to imply that 'Mohenjo-daro was not constructed in homogeneous horizontal units, but that it grew at different rates, resulting in variable horizontal and vertical distribution of contemporaneous structures' (Urban & Jansen 1983: 26). At the same time it has been suggested that a three-dimensional relocation of artifacts be procured within the related structures. The Forschungsprojekt at Moenjo-daro by the Hochschule, at Aachen, hopes to achieve this by means of a specially developed computer programme 'which will integrate the architectural documentation with the artifact data obtained from the original field registers' (Urban & Jansen 1983: 27), rendering superfluous Marshall's and Mackay's placing of the 'sealing amulets' in early and late levels. Yet, as long as there are no firm suggestions to update the Moenjo-daro material the generally accepted feeling that the opening chapter of Moenjo-daro should be placed around 2500 BC remains unchallenged. It remains, therefore, highly hypothetical whether any art history or stylistic parallels are to be found between the Indus and the Moenjo-daro material with that outside the Indus Valley cultural sphere. This chronological restriction applies also to the two prism-shaped 'sealing amulets' from Moenjo-daro portraying the standard bearers. An Early Dynastic I date, c. 2800 BC for the transmission of this device from Mesopotamia or another intermediary cultural region to the Harappan Culture, would fall comfortably in Brunswig's proposed formative stage of the Indus Civilization; it would, nevertheless, present a problem for its occurrence on material which is generally ascribed to the Mature or Late Harappan stage.

Returning to the prism-shaped seals from the Gulf area, it becomes apparent that both of them show a tenuous, though ill-defined link with the Harappan culture area. It would seem that neither of the two was cut in the Indus region itself so that we have to view them as either derivatives of an earlier copy or as being manufactured in one of the Arabian Gulf seal carving centres and representing a truly local product. Although the device of the short-horned bull with lowered head, and the Indus
script on two of the three sides of the Al-Hajjar prism are an Indus convention, the addition of the scorpion and the caprids are more at home in the Gulf region itself and may, therefore, find their origin in these local surroundings. The characters of the Indus script, though belonging to the Indus repertoire, are not amongst those most commonly used. These combined observations may lead us to conclude, that the carver, making use of indigenous, locally known iconographic devices, also had such an expert knowledge of the Indus literacy that he was aware of and familiar with the less frequently occurring signs and was apparently at home with their linguistic potentialities. In other words, it would appear impossible that these signs were blindly copied from an earlier prototype.

Previously I suggested with considerable reserve that the occurrence of the prism as a seal shape in the Arabian Gulf, has to be viewed against the presence of the prismatic ‘sealing amulets’ at Moenjo-daro. Although future fieldwork might prove the validity of an interrelationship between the Oman-Bahrain stone prisms and the faience and pottery prism-shaped ‘sealing amulets’ of the Indus Valley, it still does not answer the question of what source instigated the production of this unique shape in these areas.

Nothing is known as yet about the foreign affairs of the Indus Civilization, but it seems inconceivable that its only contacts by sea were with the Arabian Gulf. We know from the Mesopotamian cuneiform records that Meluḫḫa ships were distinctive enough to warrant a special reference. We also know that these Meluḫḫa ships had a seagoing capacity and it seems only natural that the Meluḫḫan sailors had learnt how to contend with the monsoon winds in the Arabian Sea and with the shamil and other winds in the Arabian Gulf.

Although the Harappan ports along the Makran coast were located away from the reach of the rough monsoon weather, in the rest of the Harappan waters there would have been no sailing in June, July and August. In the Gulf sailing is possible at all times of the year. There is nothing against assuming that the Meluḫḫan sailors were capable of utilizing either the forerunners or the tail ends of the Southwest monsoon for their eastward journeys towards India in May and September. Consequently may we not venture the hypothesis that the Meluḫḫan ships,
Fig. 13 — Prism-shaped stamp seal with a triple device from Kalochorio, Crete. Early Minoan. (After Evans 1921: fig. 37).

Fig. 14 — Prism-shaped stamp seal with a triple device from Karnak. (After Evans 1921: fig. 38B).

Fig. 15 — Prism-shaped stamp seals with a triple device. Early Minoan II-Middle Minoan I, from Crete. (After Boardman 1970: pl. 3-5).
despite the fact that they presumably only possessed square rigs, were already capable of sailing across the Arabian Sea and along the coasts of the Arabian peninsula? Would be stretching our imagination too far to assume that the Meluḫḫans had already gained sufficient knowledge to utilize the weather conditions prevailing in these waters for sailing their ships both ways? From this supposition emanates the question whether we then should visualize the Indus Culture as not only having dotted the Makran coast with seaports, but also as having spread its influence along the eastern shores of Oman and possibly even further southwards following the coastal area of Eastern Arabia. The presence of what may be a Harappan site at Ra's al-Junayz in eastern Arabia, on which Professor Tosi has reported at the 1982 Meeting of the Seminar for Arabian Studies in Oxford, lends credence to this supposition.

Fig. 16 — Four-sided steatite stamp seal from Moenjo-daro. (By courtesy of the Dept. of Archaeology, Pakistan. Photo by J.C.M.H. Moloney).
If future fieldwork should reveal Harappan or Harappan-influenced remains in eastern Arabia or beyond, a direct contact between the Indus Civilization and Egypt during the Early Dynastic period and the ensuing Old Kingdom, i.e. *grosso modo* in the 3rd millennium BC may turn out to be a reality. This could, in turn, provide an answer to the presence of the trian
gularly shaped clay and faience ‘sealing amulets’ at Moenjo-daro in the Indus Valley and for the occurrence of locally cut prism-shaped stamp seals in Oman and Bahrain; for the three-faced prism was regularly employed for stamp seals in Early Minoan Crete during the 3rd millennium BC (Evans 1921: 68-9, figs. 37, 38B; Boardman 1970: 29, pls. 3-5) (figs. 13-15). Of additional relevance in this context might be the occasional occurrence at Moenjo-daro of four-sided steatite and pottery prisms, drilled lengthwise. The most famous of them has its main face engraved with a ‘unicorn’ and Indus script, and the end surfaces bear the schematic representation of a bull-eared, horned and tailed upright figure, legs ending in hooves (fig. 16). By dint of their shape these four-sided prisms definitely recall the square prisms from Early Minoan Crete where they occur alongside the recently mentioned three-sided prism seals (Boardman 1970: 34, pl. 26).

For the moment I do not wish to venture any more suggestions; these will be treated elsewhere. I have merely tried to indicate that we should not underestimate the potentialities of 3rd millennium communications in South Asia.

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In the 2nd millennium BC we observe a peculiar change in Babylonian iconography, instead of the anthropomorphic picture of the deity we see a collection of different symbolic representations which serve as emblems: the discs of moon, sun and the star Venus represent astral gods; pedestals or shrines, often with crowns of bovine horns, sometimes with utensils on top like a spade, a knife, writing utensils, or a corn-ear or a flash, and some of them protected by a kneeling animal or monster, stand for several deities like Anu, Enlil, Ea, Marduk, Adad, etc. Another group of symbols are looking like a pillar or a club with different heads or capitals — lion-heads, an eagle, a lamp, a lion; or these animals and utensils like eagle, serpent, scorpion, lamp, plough, etc. are themselves symbols of deities (fig. 1).

The boundary stones of Kassite Babylonia and the Neo-Babylonian period (14th to 7th century) sometimes are adorned with about twenty of these emblems; the identification of the gods is still problematical in many places (Seidl 1968). In Assur (Andreas 1977; Frankfort 1970: fig. 149) were excavated two pedestals ('Symbol-Sockel') with the relief of king Tukulti-Ninurta I (1244-1208 BC) kneeling before just such a pedestal on which is visible the emblem of god Nusku (the writing tablet and stylus) or god Shamash (the wheel of the sun fixed on top of a high column).

The impression of the royal seal of king Shaushatar of Mitanni (Moortgat 1967: pl. J 5, fig. 288) (about 1450 BC), who ruled in Northern Syria, is crowded with monsters and demons, but in the top row is erected a column with the winged sun disc guarded by two lions and eagles and venerated by the king. The excavations in Kamid el Loz in Lebanon (Catalogue 1983: figs. 30, 37) recently discovered a small temple of this period, in front of
which were the traces of two columns which most probably once carried the emblems of the deity of this temple. In Tell Halaf on the border of Syria and Turkey, the top of such a column from the 9th century BC was well preserved; a huge figure of a bird with inlaid eyes was standing on the capital. This column had been erected in the court in front of the temple to protect it from evil influences, the bird was not the associated animal of the god of this temple, of Teshup, who always is mounted on a bull; the bird here was an apotropaic emblem protecting the building and its precinct. Also some of the emblems on the Kassite reliefs may be such apotropaic figures which became identified with the temple of the god itself.
During the same period, mid-2nd millennium BC, we can observe a second way used by Mesopotamian artists to emphasize the supernatural power of deities, they mounted them on animals. The use of riding animals by gods can be traced even to earlier periods, but now it is more prominent. Especially in Hittite Anatolia we meet this iconographic form. In the rock sanctuary of Yazilikaya the weather-god is standing on two mountain-deities, the sun-goddess and her son on lions, two other goddesses on a double-headed eagle. Additional mounts of weather-god and sun-goddess are two bulls, the symbols of heaven (fig. 2).

![Fig. 2 — Rock relief of Yazilikaya, Anatolia.](image)

Another relief preserves the scene of the Hittite king giving offerings to the statue of the bull — i.e. the animal mount of the weather-god — standing on a pedestal. The mount thus became the emblem of the deity in the cella of the temple (Frankfort 1970: figs. 261, 267).

In 1230 BC king Tukulti-Ninurta I of Assyria took away the statue of god Marduk from the temple in Babylon and transferred it to his capital Assur. But the Babylonians though being victorious over the Assyrians several times, only brought back the statue after one hundred years in 1133 BC (Cassin 1966: 90); it seems they were not much touched by the absence of the statue in this time of emblem-worship.

The Neo-Assyrian kings adorated their gods in three ways, on the Malatya rock relief seven deities are represented as anthropomorphic figures mounted on their associated animals; on
Fig. 3. — Urartian bronze.
the stela of Asarhaddon from Zincirli twelve deities are incised as tiny figures — some of them anthropomorphic on animal mounts, the others emblems; and on the palace reliefs from Ninive Sanherib and Assurbanipal pay homage to God before an empty chariot¹ or an empty throne: here the Assyrians were strictly aniconic.

The mixture of both ways of representation developed in the same period to a new form, the joined figure of a god on his animal mount wearing his emblem round his shoulders or upon his head (Vanden Berghe & De Meyer 1983: figs. 7, 37, 38; Porada 1962: fig. 60) (fig. 3). By this combination of the two types of iconography we get the important picture of the winged ring with the bust of the god inside — his body and animal mount were omitted, the emblematic character of this effigy was more important than the anthropomorphic. This new emblem is documented in the art of Urartu and Assyria from the early 9th century BC on and was further developed by the Achaemenid Persians since 520 BC (Eisfeld 1964; Pering 1933; Wildung 1977) (fig. 4). The Urartians and Assyrians seem to have used this picture to represent their most important heavenly deity, the weather-gods Haldi or Assur. Most art historians used to identify the Achaemenid representation with god Ahura Mazda, especially because Dareios always emphasizes his respect to this god

¹ See Calmeyer 1974: 49-77; Moortgat 1967: fig. 288 (the lion hunt of Assurbanipal); Frankfort 1970: fig. 230 (stele of Asarhaddon).
in his inscriptions. Certainly the king addresses the winged deity on the Bisutun relief and the tomb relief of Naqsh-e Rostam. There was a long discussion about this picture in the last years (Shahbazi 1974 & 1980)², because some Zoroastrian scholars denied the possibility that a deity could be depicted in their religion, Zoroastrianism being aniconic as Herodotus tells us. But I think I could demonstrate now that this winged ring with the bust is far removed from being an anthropomorphic representation of a god, it is an emblem, a symbol, used especially to express the different nature of gods as compared with man. So we are not compelled to interpret this winged disc as \textit{xvarenah} or something else, it is a symbol of Ahura Mazda, but not a picture of this deity and not an image for adoration³. Achaemenid religion remained aniconic as can be demonstrated by the empty chariot on the Apadana reliefs in Persepolis and the veneration of God in the symbolic form of sacred fire.

It is very tempting to explain the predilection for these representations of deities in the Near East during the 2nd millennium with the arrival of Indo-European peoples in this area, the Kassites and Mitanni preserving Indo-Aryan traditions, the Hittites speaking an Indo-European language. It seems obvious that these newcomers developed a hitherto unknown type of worship into which they incorporated those Mesopotamian forms of art which fitted most easily to their quite uniconic belief. When other Indo-European tribes invaded this realm a century later and founded the Persian empire, they seem to have accepted this tradition.

There is a great similarity between the relief of king Dareios I (522-486 BC) on his tomb at Naqsh-e Rostam and two stelae of king Nabonid of Babylon (555-539 BC) (Frankfort 1970: fig. 433; Pritchard 1975: fig. 68). On these pictures the king stands alone and isolated inside a big empty space, only confronted by the small emblems of the astral deities. Quite probably Babylonian artists were responsible for the creation of this Persian relief.

² His opinion was accepted by P. Calmeyer in \textit{Archäologische Mitteilungen aus Iran}, n.s., 11, 1978, pp. 73-85 and others, but disapproved by Le Coq (lecture given in Hamburg, 1984).

³ The discussion about idolatry during the Byzantine iconoclasm made a clear distinction between images to be worshipped and pictures of a holy being illustrating some events or ideas but not meant to be adored.
We do not know much about the most ancient sacred places of the Persian religion — there were some temples with fire altars like that excavated recently at Nush-e Jan near Median Ecbatana (Stronach 1969, 1973 & 1978). But more important must have been the open-air places on top of mountains or near sacred lakes or rivers, about which we get information by Herodotus and the Avestan hymns (Erdmann 1941: 11; Schippmann 1971: 466-9). Possibly these places were already equipped with an altar for the sacred fire; maybe also a pillar with an emblem was erected in the vicinity like those we observed in the Syrian sanctuaries.
Such pillars became the beautiful adornment of early Greek sanctuaries. Ionian cities from the eastern parts of the Greek area had pillars not less than 14 m high (fig. 5), crowned by a sphinx, erected in the sanctuaries of Larisa on Hermos (c. 620 BC), Aegina (600 BC), Delphi and Delos (570 BC). These pillars preceded in many places the erection of temple buildings by years, and we may suppose that many pillars made of wood have perished without traces (Schefold 1967). The emblem of the sphinx is in no way connected with the deity of the precinct, it is a sign of danger to warn strangers not to enter the holy place without ritual precautions.

The most ancient monuments of Indian art, the Mauryan pillars, most of which were erected by order of king Asoka (273-232 BC) (fig. 6), seem to continue an ancient Indian tradition of Vedic times — the Rgveda already mentions the yūpa-pillar — but only the 3rd century emperors made these pillars of stone;

Fig. 6 — Pillar of Sarnath.
up to then they were made of wood. The animal sculptures standing on top of these columns are most probably emblems of the four cardinal points of the world — lion, horse, elephant, and bull — and there is no direct connection between these emblems and the nature of the sacred places they adorns most of which are Buddhist or Hindu. Only in later times the pillars were crowned by the associated animal of the deity, so the pillar erected by Heliodoros in Besnagar about 150 BC bore the figure of bird Garuḍa, the vahana of Viṣṇu. Today pillars of similar form can be seen at the entrance of many temples in Nepal and Orissa.

The unfamiliarity of Indian religion with iconic worship is demonstrated by the early Buddhist monuments, especially the Sanchi reliefs, avoiding the picture of the Buddha and replacing it by symbols like footprints, an empty throne, etc. or by emblems like the stūpa, the pipal tree, etc. Images of gods to be placed in the cella of a Hindu temple for worship are not known before Kushan times, i.e. 2nd century AD, and up to now the cult image in the temple of Shiva is still an emblem, the liṅga, not an anthropomorphic statue. The overwhelming abundance in Hindu temples of representations of the whole pantheon is limited to the outside decoration of the buildings — these are illustrating pictures not images. So up to modern times in India the aniconic character of Indo-European religion is preserved.

By the comparison of the finds from Babylonia, Syria, Anatolia, Persia, Greece and India I think we can deduce the existence of an Indo-European custom of erecting wooden pillars with the sculpture of a bird or other animals near sacred places outside villages. In later times these pillars were replaced by stone columns ⁴.

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⁴ We may also compare the Germanic wooden pillar, the Irminsul, in West-German Saxonia, which was destroyed by Charlemagne.
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