Volume I
1977

MAN & ENVIRONMENT

INDIAN SOCIETY FOR PREHISTORIC AND QUATERNARY STUDIES
Ahmedabad

Price Rs. 50
$ 10

Man & Environment
is edited by Dr. V. N. Misra.
Deccan College, Poona, on behalf of
The Indian Society for Prehistoric and Quaternary Studies.

The monographs are edited by Dr. S. P. Gupta and Shri K. S. Ramachandran c/o National Museum, New Delhi.

The headquarters of the Society is located in the premises of the Physical Research Laboratory, Navarangapura, Ahmedabad.

The Chairman of the Society is Dr. R. V. Joshi, Deccan College, Poona.

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The journal is distributed by
D.K. Publishers' Distributors, 1 Ansari Rood, Daryaganj, New Delhi-110002

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Editor
V.N. Misra

Indian Society for Prehistoric and Quaternary Studies
c/o PHYSICAL RESEARCH LABORATORY, AHMEDABAD

CONTENTS

Editorial

The Indian Society for Prehistoric and Quaternary Studies (ISPQUS), of which *Man and Environment* is an organ, was founded by the members of the erstwhile Indian Prehistoric Society. During the last five years the Prehistoric Society had been regularly holding its annual conferences and seminars on specific themes. The Prehistoric Society was essentially a forum of research workers in prehistory in the universities and other research institutions. But last year two events helped to bring together the prehistorians and a large number of Quaternary scientists in organisations like the Geological Survey of India, the Central Arid Zone Research Institute and the Geology Departments of several universities. These events were the workshop on the Deserts in India, organised by the Desert Geology Division of the Geological Survey of India at Jaipur in 1975 and the workshop on the Archaeology and Palaeoclimate of Western India, organised by the Physical Research Laboratory at Ahmedabad in February 1976. At these academic gatherings it was widely felt that we need a forum broad enough to include besides prehistorians, geologists, hydrologists, geomorphologists, palaeontologists, palaeobotanists, soil scientists and others working in the field of Quaternary studies. Accordingly, it was decided to form the Indian Society for Prehistory and Quaternary Studies.

The need for a journal of the Society was felt from the very beginning. But this could not be realised due to lack of financial resources. We record here our gratitude to the Director General of Archaeological Survey of India for his generous promise of academic and financial support. Though the financial problem is far from fully resolved, many of us felt that a beginning, howsoever modest, has to be made. Despite shortage of time, we have been able to place the first issue in your hands at the time of our annual conference. It has been possible to bring out this first issue of *Man and Environment*, thanks to the energy and resourcefulness of Dr. S.P. Gupta to whom we all are beholden.

The name of the Society's journal, *Man and Environment*, was chosen after discussion with many scholars. We hope the name suitably reflects the Society's aim to promote research and dissemination of knowledge about man's biological and cultural evolution as well as about the physical and organic environments in which this evolution took place. The contents of the present issue will show that adequate coverage has been given to environmental studies. It will be our endeavour to maintain a balance between contributions on bio-cultural evolution and environmental aspects in our future issues. The journal will carry substantial research papers, technical reports, short notes on new discoveries and research findings, brief reports about current research and conferences, news about new research plans and conferences, and book reviews, etc. From the next volume we are also introducing a section on correspondence and comments on published papers from readers. We hope to enlist, from the next issue itself, the cooperation of eminent prehistorians and Quaternary scientists in other countries, to contribute brief reports on current prehistoric end Quaternary research in their respective areas. For the present the journal will appear once, at the end of every year, to coincide with the annual conference of the Society but we hope it will be possible to increase the frequency of its publication in future. The idea is to make it one of the foremost world journals of Environmental Archaeology.

I woud like to thank all the scholars who have contributed to our inaugural issue, and will appeal to them as well as other scholars and readers to extend us their fullest cooperation in future so that *Man and Environment* can become a valuable multidisciplinary forum for the community of prehistorians and Quaternary workers in India and abroad. All suggestions would be most welcome.

At the end, I feel it may most pleasant duty to acknowledge the help that I got from Shri I.C. Mittal and Shri Agam Prasad of the D.K. Publishers' Distributors and Agam Prakashan, Delhi, respectively; they took upon themselves the entire burden of seeing the journal through the press, and hand it over to us in a record period of eight weeks. A part of the burden of proof reading fell on the shoulders of Dr. (Miss) Chhaya Bhattacharya and Shri Amarendra Nath of the National Museum, New Delhi. The entire team, of course, worked under the guidance and supervision of Dr. S.P. Gupta.

—V.N. Misra

On the Problem of the Laterite Surfaces of the South Konkan

☐ Statira J. Guzder*

Beginning with Bruce Foote's discovery of the first palaeolith in a laterite gravel at Pallavaram in 1863, laterite formations and Stone Age tools have been significantly associated in the Indian Prehistoric context. In western, central and eastern India, both on the coast as well as along numerous peninsular rivers, Lower and Middle Palaeolithic artefacts have been reported to occur on the surface of primary laterites or incorporated in secondary laterite formations.

In spite of the fact that, technically, laterite** remains after 160 years of research "so poorly defined a phenomenon", (Maignien, 1966: 16), it nevertheless assumed a certain importance in early prehistoric research in the Subcontinent for two main reasons :

(i) It was classified by early geologists (e.g. Pascoe, 1964) alongwith other Pleistocene and Recent formations and was consequently of obvious relevance to prehistory :

(ii) It was believed to form only under specific environmental conditions and therefore fossil laterites were held to be important palaeoclimatic indicators (Zeuner, 1950).

It has been pointed out (Sahasrabudhe, 1973) that the majority of the Indian primary laterites are probably Tertiary formations and therefore belong to a period outside the purview of archaeology. On the other hand, numerous laterite formations are post-Tertiary and it is necessary when aiming at a complete understanding of the palaeoenvironment not to draw a line at the commencement of the Pleistocene.

The two major geographical regions of Maharashtra are, the Konkan or coastal tract and the Desh or plateau region and they present a striking contrast to each other in terms of physiography, climate and vegetation. The most conspicuous geological formation-the Deccan Trap covers the whole of the Konkan with the exception of the southern part of Ratnagiri District. Laterites are associated both with the Deccan Trap as well as the Pre-Cambrian rocks of the southern extremity.

Apart from Todd's (1932, 1939) palaeolithic discoveries around Bombay, the Konkan was once believed to have been by-passed early man. In the 1970's, however, palaeolithic artefacts were discovered in the south Konkan (Fig.1) during the course of explorations in the sub-Sayharian tract (Joshi and Bopardikar, 1972) and along the coast (Guzder, 1975). The artefact collections comprise surface finds, the ones around Mahad occurring in lateritic gravelly

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soils and the coastal examples occurring on the several laterite surfaces.

The writer's work in the south Konkan was initially concentrated on the collection of data on the problem of sub-Holocene sea level changes for which evidence was already available from Bombay (Agrawal *et al.*, 1973). Among the most conspicuous morphological features of the south Konkan are the extensive laterite surfaces (Fig.2) which occur at various elevations above the sea level and which Chatterjee (1961) was the first to suggest might be "terraces of probable marine origin" (1961:54). With the writer's discovery of artefacts in the environs of Malvan (Fig. 1) these surfaces assumed a greater significance from the point of view of (a) their possible relationship with eustatic changes of sea level and (b) their relationship with Palaeolithic cultures during the late Quaternary. The present study is a non-specialist interpretation concerining the processes of planation of the laterite surfaces based only on field observations and inferences therefrom.

The writer's field observations can be divided into five groups:

(i) Types of laterite—Three types are observed: the characteristic 3-layered structure of lithomarge, lateritic clay and crust (e.g. Mumbri and Padvel); a pisolithic laterite of varying thickness (generally 6-12m) and homogenous throughout (e.g. the Nandivede well section, Jaygad); detrital laterites comprising both a heterogenous, consolidated, re-lateritised type (e.g. Devgad coastal cliff), as well as a purely detrital laterite gravel (e.g. Kanakavli, Kasal).

(ii) Depth of profiles-in the Konkan, laterite occurs both on trap and quartzite. The depth of laterite weathering ranges from 3-6m (e.g. Mirya Bunder, Ratnagiri), but sometimes exceeds 45 m (Hatkhamba). It also occurs as remanat cappings (Fig. 3) on a number of hills (e.g. Kasal) and plateaus (e.g. Kumbhar Math).

(iii) Modes of occrrence—The early classification of the Konkan laterites into primary and secondary (Medlicott and Blanford, 1879) corresponding to high and low level occurrences does not appear to be justified.

(iv) Planation surfaces—These commonly occur at elevations of 150-200 m (around Dabhol and Khed, Guhagar and Chiplun, etc.), 60-90 m (Vijaydurg-Devgad area), 20-40 m (at Devgad), as coastal promontories ranging from 3-45 m (Malvan-Hadi) and have also been reported to extend below sea level (between Ganapatipule and Varvada, Pawade and Kumar, 1976).

The 300-600 m surface which occurs along the crest of the Western Ghats is only observed in the source region of valleys like the Savitri, where it is highly dissected and generally comprises only a thin laterite capping. An interesting feature is the 245 m surface which extends for about 30 km between Jaygad and Ratnagiri and forms a N-S divide between the drainage on the east and west of it. Many of the streams on the eastern side have deep valleys and superimposed courses with occasionally a peculier N-S oriented direction, while the rivers on the western side are short, steep and probably younger. An analogous situation occurs in the E-W transect from Kasal to Malvan.

(v) Laterite gravels—They occur not only on the coast (e.g. Vijaydurg, Bhatya Bunder), but also further inland (e.g. Padve, Kasal, Malvan) and are found at varying elevations above the sea level (e.g. Vijaydurg-9-12 m; Bhatya Bunder-25m; etc.)

In the context of our understanding and reconstructing the palaeoenvironment, it is not the genesis of the Konkan laterites but the processes which resulted in their presently observed planation which are of greater relevance. We have been able to distinguish three main groups:

(a) *An eastern or plateau zone* (Panchgani-Mahableshwar, Satara) with levels ranging from 300-600 m. These are examples of *in situ* pedogenetic processes. Here peneplanation of the Deccan Trap was followed by kaolinisation of the peneplaned surface and consequent upon this the 3-layered structure was developed. An early Tertiary (Eocene) date has been proposed for the formation of these plateau laterites. This surface was uplifted during the Tertiary and has since been subjected to sub-aerial weathering (Valeton, 1972).

(b) More than one variety of laterite was observed in the *coastal zone*. The homogenous laterite cliff at Sarjekot today stands 12 m above sea level. This may be an older *in situ* formation or it may be a secondary, re-lateritised one. It is the only example observed by the writer to have a perfectly planed surface. It is now generally accepted that marine abrasion proceeds too slowly for it to be a suitable explanation for this type of planation (Fairbridge, 1952; Machatschek, 1969). Secondly, no traces of marine deposits were found on this surface which might indicate prolonged marine activity. Finally, it is significant that palaeolithic artefacts are found on this surface, and which, typologically, may be dated to the period between 15,000 and 30,000 B.P. If there had been a high sea level during this period, and this is an increasingly controversial issue, then these artefacts would certainly have been washed away. The laterite formation immediately inland from sarjeket and extending both north and southwards is undoubtedly a dertital product. The large quartzite boulders incorporated in it point to reworking of the older, higher deposits of the central zone. The lateritic gravel overlying the 3-layered laterite profile at Bhatya Bunder, Ratnagiri has interesting implications. Recent analysis (S.N. Rajaguru, pers. comm.) of the pebbles in the gravel has disproved Fox's (1923) hypothesis that they are the product of the process of bauxitisation. The gravel appears to be a fluvial deposit. A tentative reconstruction of the sequence of events is suggested. These gravels were probably deposited during a period of high sea level when the Kajvi river, which flows immediately to the south, was flowing at a higher level. Subsequently, the gravel was stranded at its present elevation, either during a regression of the sea, or regression modified by tectonic activity. The presently observed truncated profile is the product both of sub-aerial erosion and, more recently, quarrying of the cliffside. There is, however, no way at present to date these gravels except in the local sequence.

(c) The deep, but not always uniformly thick laterite profiles of the *central zone* are of a more or less homogenous and pisolithic nature throughout. These pseudoprimary laterites probably formed during the period subsequent to Neogene tectonic activity in this region. The process of their formation was probably a combination of subaerial denudation and deposition, co-incident with the development of newer, younger (Pliocene-Pleistocene) drainage systems. Climatic conditions in the Konkan today are ideal for the formation of laterite and if it can be assumed that the monsoon pattern has not significantly changed since the end of the Tertiary then it is not necessary to evoke a different climatic regime to account for their formation. On the other hand, by virtue of their uneven distribution and thickness these laterites probably do represent redeposited and re-lateritised accumulations of material stripped off from the plateau laterites subsequent to Neogene tectonic activity. It is also possible that lateritisation and planation might have taken place at two or several different levels in this central zone, with the difference in height corresponding to the thickness of the weathered layer (Machatschek, 1969). Furthermore, the uneven pre-laterite topography and the occurrence of laterite and basalt at similar elevations (the basalt sometimes occurs even higher than the laterite) along the Lanja-Math surface and again between Khed and Chiplun, suggests that a major portion of these central zone laterites are redeposited on an older, eroded land surface. Their subsequent planation and the evidence of erosional surfaces may be explained as being the product of subaerial weathering combined with fluvial processes, which has led to their downwearing and peneplain-like appearence. These erosional forces have operated throughout the region, so that both laterite and non-laterite surfaces form these widespread peneplains. Regarding the proposed hypothesis of etchplanation as the processes responsible for the formation of the presently observed surfaces, Thomas (1968) has stated that inter-stream degradation by slope precesses and relative feebleness of stream erosion are essential to this concept. They are ascribed to the combination of intense rainfall leading to rapid run-off on slopes, so that the speed and the roughness of weathering deprive streams of adequate abrasive load in seasonally humid tropical environments. In arid landscapes, climatic dessication has led to widespread stripping of deeply weathered rock (Mabbut, 1965). In the Konkan, there is no evidence for such climatic change. On the other hand, both inter-stream degradation and feeble stream erosion are characteristic of the laterite landscape of the central zone in the south Konkan. Rainfall is high, and the porosity of the laterite combined with the relative impermeability of the underlying metamorphics, probably results in relatively rapid run-off. The abrasive load in many of the streams is also not very great. Although some of the nullahs contain quartzite boulders in their beds today, these are probably the product of colluvial by aided to deposition the gradient of the slopes from which they have been removed. These boulders are generally of subangular character and the palaeolithic artefacts associated with them show little or no trace of rolling. The concept of etchplains includes both weathered and stripped surfaces. It is possible to establish adequate intensity of weathering. The evidence of detrital laterites (e.g. as seen on the coast at Devgad) and laterite gravels (Ghare and Badve, 1976) indicates stripping processes, so that the central zone laterites might be said to belong to one of several varieties of etchplains.

Regarding their chronology, if the plateau laterites belong to a period prior to Neogene tectonic activity and if the central zone laterites represent stripped and re-lateritised material from these plateau laterites, then obviously they belong to a later period. This is partly corroborated by the discovery of plant fossils in carbonaceous shales at Devgad, Malvan, Jaygad, etc. The plant fossils themselves are of Tertiary age. The beds in which they occur are thought to be northern extensions of the Warkalli beds of the Malabar coast, the later equivalent to the Cuddalore sandstones, which are dated to the Upper Miocene. The laterites in question overlie these Tertiary deposits and can therefore be ascribed to the late Tertiary (Miocene–Pliocene) or early Pleistocene period.

In the Konkan, the formation of the primary and pseudoprimary laterites necessarily pre-dates the presently observed valley formations. The lateritic gravels on the other hand are probably co-incident with middle to late Pleistocene fluvial processes. The only geochronologically dated formations along the Konkan coast are the cemented littorals/*Karal* (Guzder, 1975), which are of mid-Holocene age. These formations post-date the alluvial fills, which in their turn post-date the planation surfaces. Therefore, these alluvial formations (detrital laterite gravels, see Fig. 3) are ascribed to the late Pleistocene fluvial processes.

Much more data is necessary before any definitive statement can be made regarding the south Konkan laterites. On the basis of the present evidence, however, it is possible to affirm that these laterite surfaces do not fall into the original divisions of primary and secondary formations, nor are the distinctions between high level and low level valid, except to differentiate between the plateau laterites and the coastal laterites and not to separate the coastal formations occurring at different elevations. Furthermore, these surfaces are not marine planation surfaces *per se* but may have been modified by sea level changes. Whether or not they are the product of later Tertiary-early Pleistocene tectonic activity, it is difficult to prove without positive evidence. The rate at which laterite forms is not well known, nor is it possible to suggest that differential rates of formation are characteristic of the different rainfall belts of the Konkan. The present hypothesis has, however, been tentatively put forward on the basis of the writer's observations.

The highly dissected laterites of the eastern plateau zone were probably subjected to stripping subsequent to Neogene tectonic activity. It has been stated (Thomas, 1974) that it is unlikely that primary laterite deposits will develop extensively unless there is a degree of stability in the denudation system of an area. The plateau laterites, therefore, probably represent remnant cappings of an earlier, more extensive, now highly eroded land surface. The stripped materials were gradually redeposited in the central zone where, over a period of 2-3 million years, they have assumed the character of homogenous, deep laterites. Together, the processes of stripping, relateritisation and base level changes (local or eustatic) are responsible for the formation of the Konkan laterites, which them selves are of different ages. One thing, however, is certain. The laterites of the central and western zone have not undergone any drastic morphological changes in the last 30,000 to 50,000 years, because the palaeolithic artefacts found on these surfaces have remained more or less intact.

ACKNOWLEDGEMENTS

The data presented in this article forms part of the writer's Ph.D. dissertation. I am particularly grateful to Dr. S.N. Rajaguru, who not only visited the south Konkan during the period of my fieldwork, but is also largely responsible for the discussions which led to the ideas of a new hypothesis on the subject of planation surfaces.

**These laterites have been termed (Rajaguru and Guzder) pseudo-primary laterites because they mainly comprise laterite washes and slope debris which have subsequently been so thoroughly relateritised as to be almost indistinguishable from true primary laterite, but without the basal lithomarge.

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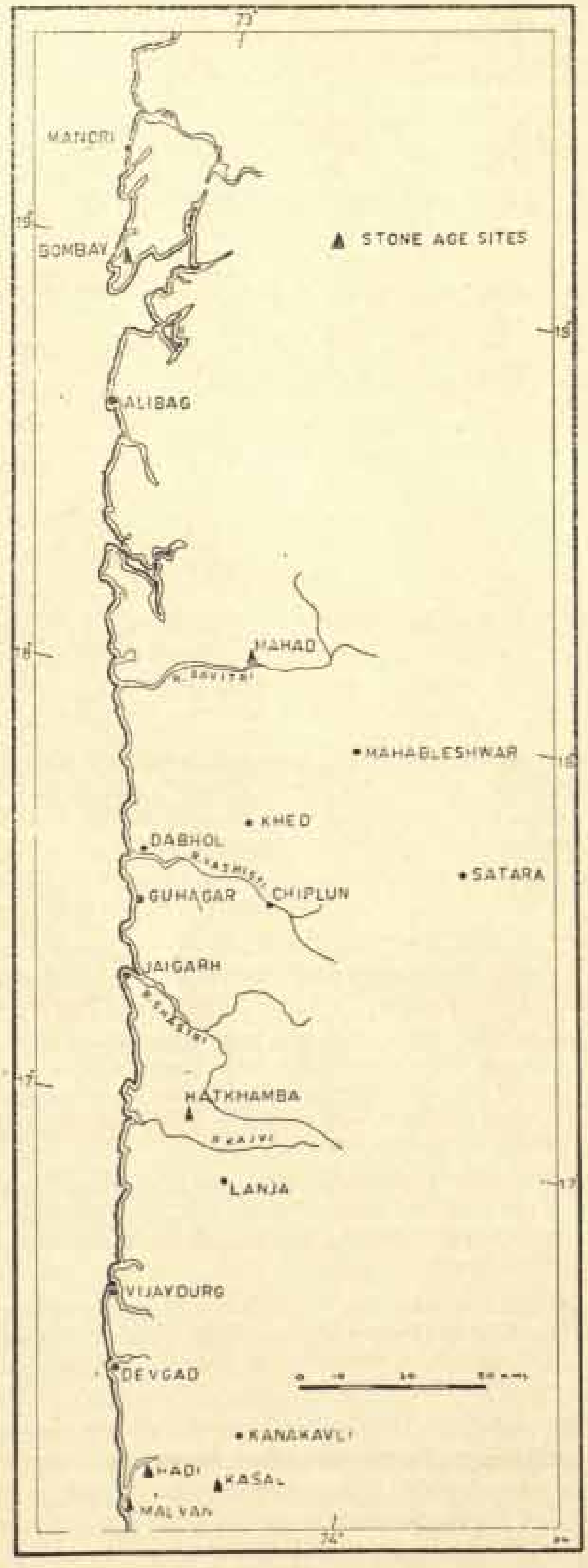

Fig. 1. Stone Age sites on Konkan

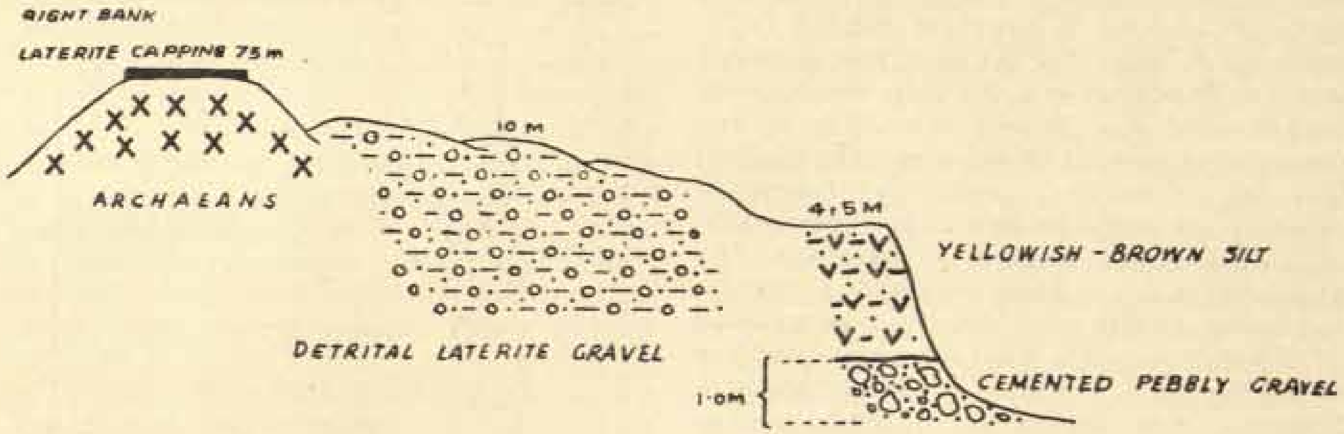

Fig. 2. Section on the Kasal River

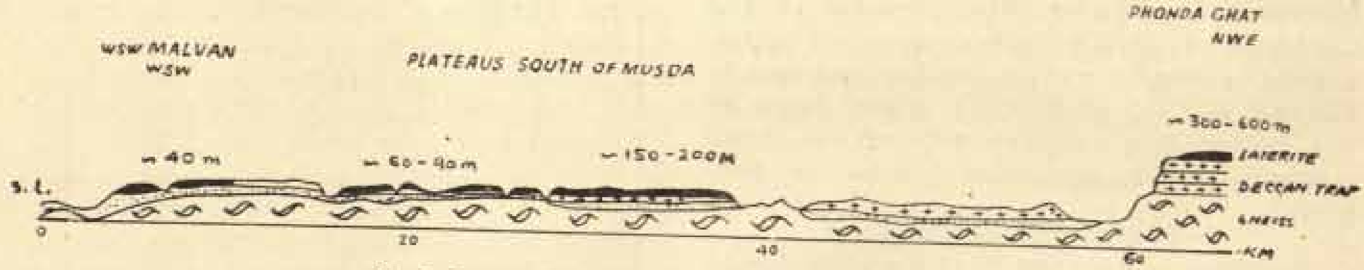

Fig. 3. Cross-profile of Laterite surfaces (After, Foote, 1867)

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Sand Dunes and Palaeoclimate in Jodhpur Distt., Western Rajasthan

□ S. Singh*

Sand dunes are the spectacular features of the Indian arid zone. About 58 per cent area of Western Rajasthan is covered with the dunes of different types and shapes. Jodhpur district forming a part of Western Rajasthan is also occupied by the stabilised and active dunes of different forms and magnitude. These dunes might have been formed and stabilised under different phases of dune building during the late Quaternary period and they could be used as the productive source for paleoclimatic reconstruction of the district. In India, very little work has been done on dunes as indicators of the past climatic fluctuations. Some studies on the origin, distribution and orientation of the sand dunes in the Central Luni basin and Bikaner district, western Rajasthan, have been done by Pandey *et al.*, (1964) and Vats *et al.*, (1976) but these studies do not provide any evidence of the past climate. However, Verstappen (1970) and Allchin and Goudie (1971) have studied the sand dunes in the Thar desert and Gujarat respectively and they have inferred that these dunes were formed, stabilised, dissected and fossilised under different climatic phases. Sand dune studies conducted in Sahara and Kalahari deserts of Africa and in East Africa (Grove and Warren, 1968; Grove, 1969; Flint and Bond, 1968) have provided evidences of past climatic changes.

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In the present article, the origin, distribution and morphology of sand dunes of different types and their significance in palaeoclimatic reconstruction in Jodhpur district, Western Rajasthan, have been discussed.

Environment

Jodhpur district occupies an area of 22,860 sq. km and lies between latitudes 25°51' to 27°40' N and longitudes 71°47' to 73°52'30" E. It can be divided into three broad physiographic units viz., sand dunes and sandy plains, extensive alluvial plains and low to high hills of different formations. The district is drained by the Luni and its major and minor tributaries which are ephemeral and intermittent in nature. The climate in the west with mean annual rainfall is arid and in the east due to mean annual rainfall of 360 mm is semi-arid. The mean maximum and minimum temperatures in the east in the months of May and January are 40.8°C and 26.5°C and 24.6°C and 27.2°C respectively while in the west they are 42.3°C and 26.8°C in May and 22.5°C and 6.7°C in January. During the month of June, the mean maximum wind velocity in the east is 20 kmph and in the west it is 24,1 kmph.

Methodology

The present studies on the sand dunes and palaeoclimate were done with the help of aerial photographs (scale 1:31,000); aerial mosaics (scale 1:25,000) and the toposheet (scale, 1:50,000). The sand dunes of different types, forms and magnitude were interpreted from aerial photographs and the dunes which were not shown on the toposheets were transferred from aerial photoes and mosaics on them. Taking into account the tone, texture, shape and size of the photographic images of the sand dunes, the stabilised and active dunes were identified and transferred on the toposheets of 1:50,000 scale. The morphometric characteristics of these dunes, like length, width and orientation, were calculated from the toposheets. Field traverses were undertaken to check the data interpreted from the aerial photographs and the data on the slopes, heights, dissections and degradation of the sand dunes were collected. The sand samples collected from the different slopes of the dunes were analysed and the size of the sand grains were determined by microscopic studies in the laboratory. The data collected from aerial photo interpretation and field surveys were finally interpreted and a map (Fig. 1) showing the distribution and orientation of stabilised and active dunes was prepared on 1:337,920 scale.

Results and discussion

There are four belts of the sand dunes in the district and they are running from southwest to northeast. One of the belts is quite extensive and occupies more or less the central part of the district. Two belts lie in the south of extensive dune belt and they run in discontinuous patches. Fourth and the smallest dune belt occurs in the extreme north-western corner of the district. These four belts constitute the stabilised and active dunes and they belong to two dune systems, old and new, respectively.

S and dunes of old system

The sand dunes of old system are obstacle, parabolic and coalesced parabolic, longitudinal and transverse. These dunes are stabilised, fossilised, degraded and well vegetated and they were formed and stabilised during different phases of dune building. These dunes have undergone two aeolian phases and one eluvial phase. The recent slight morphological changes in these dunes by fluvial activities indicate that the climate is ameliorating. The origin, morphology and distribution, and past climatic inferences from them, are discussed below.

(i) Obstacle sand-dunes

Origin : These dunes were formed on the windward and/or leeward sides of the isolated and continuous chains of the hills due to the obstruction in the path of sand laden winds during the prolonged arid phase and they are known as windward and leeward obstacle dunes. The windward obstacle dunes of flat semi-cone shape were formed due to the fixed eddy, decreased wind velocity and a calm zone on the upwind of the hills. The prevailing southwest winds swept the sand over the hills and deposited it on the leeward side right from the slopes of the obstruction upto few kilometres in the direction of the upwind and the leeward obstacle dunes were formed. At certain localities, the leeward obstacle dunes had also been formed by the northeast winds which are gently upsloping towards the hill slopes. The isolated hill formed one obstacle dune but the broad hills in chains created several obstacle dunes. These dunes at present are badly dissected, well cemented and vegetated and have been separated from the hills by the gullies of 25 to 50 m depth and 50 to 100 m width. This indicates that at the time of the formation in pre-Holocene period these dunes were active and were stabilised in a prolonged humid phase of early Holocene period, around 10,000 B.P. Similar mode of the formation of these dunes in certain parts of the Great Indian desert and in other deserts of the world has been reported by several investigators (Cornish, 1914; Bosworth, 1922; Thornbury, 1954; Verstappen, 1970; Allchin and Goudie, 1971).

Distribution and morphology : These dunes occur scatteringly, mostly in the central and north eastern parts of the district. The windward obstacle dunes, against the isolated hills of rhyolite and granite, and chain of hills of sandstone formations lie near Shergarh, Fitkasni, Rasdio, Bhadura, Ratton Ka Bas, Begriya Ki Dhani, Mewasa, Rathkuriya, Ujalio and Deriya villages. The leeward obstacle dunes on the leeward sides of these hills occur near Shergarh, Barabera, Shakla Ki Dhani, Gujar Ki Dhani, Malunga, Baru, Basni and Betwa villages.

The obstacle dunes are of 10 to 40 m and 8 to 15 m heights and their sands are compact and highly calcareous. These dunes are sufficiently degraded and the lime nodules of 8 to 10 cm length and 2 to 5 cm width are exposed at crests and flanks which indicate that these dunes are well cemented and static. (Pl.Ia). The slopes of the windward sides and flanks are 2° and 10° respectively. The orientation of the windward obstacle dunes is N 40°E and of the leeward obstacle dunes is N 48°W. The grain size of these dunes varies from 0.03 to 0.25 mm and the sand grains of 0.06 to 0.12 mm are dominant. The mean diameter of these sand grains is 0.14 mm.

(ii) Parabolic and coalesced parabolic dunes

Origin : The parabolic dunes are the outcome of the erosional and depositional processes that by during the prolonged operated arid phase. The sands were removed by the erosional process and created the long scoop-shaped hollows or paraboles with flanks tapering upto several kilometres towards the gentle windward slopes. The sands were subsequently redeposited on the lee of the parabolas by depositional process, created the steep leeward slopes and the parabolic dunes came into being. A number of parabolic dunes were formed by the prevailing winds in the same path which were coalesced by the transverse ridges and the coalesced parabolic dunes were formed. Like the obstacle dunes, these dunes were active at the time of their formation but were stabilised during the humid phase. Similar process of the formation of these dunes in other deserts of the world has been reported by some investigators. Hack (1941) has stated that the parabolic dunes are not the original forms but rather forms produced by blowouts and subsequent redeposition. He, therefore, described them as "parabolic dunes of deflation". According to Cooke and Warren (1973:318) the sands are eroded by winds and the hollows are created. Initially the accumulation of the sands downwind of the hollow forms a blow-out dune, if this dune migrates downwind as the hollow is enlarged trailing dunes are left on either blank of the hollow and a parabolic dune is formed. Migration of several dunes down the same path gives the nested parabolic system. The findings of these authors on the origin of the parabolic dunes are in conformity with the findings of the present author.

Distribution and morphology : Parabolic and coalesced parabolic dunes occupy more area than the other dunes and occur in the western, north-western and south-western parts of the district. Parabolic dunes scatteringly occur near Hingola, Chincharli, Narayana Ki Dhani, Minania Ki Dhani, Uter, Kalijaran, Dholasar and Kanasar villages. The coalesced parabolic dunes in continuous chains have been found in Phalodi tehsil near Chadi, Chaku, Chimana, Kelansar, Jesalsar and Chhain villages and in Osian tehsil near Debri, Bhikamkor, Khetasar, Samrau and Bhakri villages. In Shergarh tehsil, the dunes occur in three major chains near Sai, Sointra, Timri, Suwalia, Chaba, Someshwar, Dashnio, Bhungri and Solankiyatala villages.

The parabolic dunes of 10 to 25 m heights are well stabilised and vegetated (Pl. IB). The slopes of the leeward side of these dunes are steep, varying from 14° to 16°, and of windward sides are gentle, ranging between 2° to 4°. The sands are calcareous and compact. The average orientation is N 41°E. The coalesced parabolic dunes are also well stabilised, degraded and support good density of vegetation which indicate the advanced development of soil (Pl. IIa). The coalesced parabolic dunes in Phalodi tehsil are of 18 to 30 m and 40 to 80 m heights. The number of dunes in dune chains varies from 15 to 35 and the length of these chains ranges between 0.5 to 10 km. The diameter of the sand grains on all the slopes varies from 0.03 to 0.25 mm and 60 to 70% sand grains are of 0.06 to 0.12 mm size. The average length and width of these dunes are 1288 m and 226 m respectively. The coalesced parabolic dunes in Osian Tehsil have almost similar morphological characteristics except average size of sand grains. In Osian Tehsil the average size of sand grains in dunes is 0.14 mm and in Phalodi tehsil it is 0.12 mm. The sand dunes in Shergarh tehsil occur in three major dune chains and they are well stabilised, cemented, and on their slopes the lime nodules of different shape and size are exposed along the flanks and crests. The heights of dunes of three chains in this tehsil vary from 12 to 70 m, 10 to 80 m and 15 to 85 m respectively. The lengths of these dune chains are 7 km, 9 km and 5 to 12 km respectively. The orientation varies from N 45°E to N 47°E. The slopes of the leeward, flanks and windward sides are 22° to 24°, 8° to 12° and 2° to 40° respectively. The diameter of the sand grains in these dunes also varies 0.03 to 0.25 mm and average diameter is 0.14 mm. The coalesced parabolic dunes in all the three tehsils are covered with the fresh sands of 3 to 4 thickness. The barchan dunes are superimposed in the flanks of these dunes, indicating the renewed aeolian activities.

(iii) Longitudinal and dunes

Origin : The longitudinal dunes in parallel sand ridges had originated due to the strong prevailing winds during the prolonged arid phase of pre-Holocene period. Bagnold (1954) advocated that the longtitudinal is a modification of the fundamental barchan form produced by strong cross winds transverse to the prevailing wind direction. The hypothesis propounded by Bagnold is not convincing to the author. In the opinion of the author, the transverse sand ridges coalescing the trailing arms of the parabolic dunes in the lee of the parabolas were removed by the strong prevailing winds, resulting into parallel sand ridges which further grew in length downwind by aeolian deposition. The longitudinal dunes have not resulted from the barchan dunes but they are the outcome of the parabolic dunes. In the early Holocene period the arid phase was terminated and the humid phase started which was responsible for the stabilisation of these dunes. Verstapped (1968 : 202 and 203) has also reported that the longitudinal dunes in Thar desert were originated from the parabolic dunes. The central curved parts due to funnelling effect were readily removed by the strong winds and the parallel ridges stretching in the direction of the prevailing winds were resulted. This process of the origin of the longitudinal dunes has also been recognised by several investigators in other deserts of the world (Melton, 1940; King, 1960; Smith, 1965).

Distribution and morphology : The longitudinal dunes mostly occur in north-eastern parts of Phalodi tehsil near Jambo, Ghantalia, Kelansar, Rupa Ki Dhani and Mishri Ki Dhani. In Jodhpur tehsil, they are found between Salawas and Tanaura Kalan and near Minania Ki Dhani and in Shergarh tehsil, they occur in east of Shergarh north and south of Bhungri, north of Baorli and near Jethania villages.

These dunes are also stabilised, well vegetated and show the advanced development of soil (Pl. IIB). They are 6 to 50 m and 5 to 15 m heights and their orientation varies from N 40° E to N 45°E. The slopes of the leeward, flanks and windward vary from 20° to 24°, 9° to 14° and 2° to 3°, respectively. The dunes are at a distance of 600 to 1200 m from each other. The average values of the length and width of these dunes are 3000 m and 280 m, respectively. The dune sands are mixed with lime nodules of 2 to 25 m length and they are highly calcareous and compact. The sand grains of 0.07 to 0.15 mm diameter are 70 to 90 per cent. The average diameter of these sand grains on leeward slope is 0.10 mm and on flanks and windward slope is 0.14 mm. The dunes are in eluvial phase but due to renewed aeolian activity, the crests have been reactivated and the sands are piled up on leeward sides and crests. The barchan dunes of 3 to 4 m heights are superimposed on the flanks of these dunes.

(iv) **Transverse sand dunes**

Origin : The origin of these dunes is least understood and more controversial as to how the transverse dunes could be formed at the right angle to the prevailing winds. From the interpretation of the serial photographs and field investigations, the author has concluded that these dunes were orginated due to prodigious sand cover on the ground, abundance sand supply, absence of vegetation, and persistant and widespread wind action under arid climatic conditions. The dune building winds due to the above factors created the wave-like ridges separated by the trough-like furrows at right angles to the prevailing winds and the transverse dunes came into being. These dunes were established during the humid phase which prevailed after the arid phase of pre-Holocene period. These dunes have again undergone the renewed aeolian activity which has eroded the old sands of these dunes. The loose sands of 2 to 3 m thickness are superimposed on all the slopes of these dunes. Similar mode of for mation of these dunes in central and western Nebraska has been recognised (Smith, 1965 : 564).

Distribution and morphology : The transverse dunes are distributed scatteringly and occupy a small area of the district. These dunes are found near Dhandhaniya, Dudabera, Janadesar, Karan Ki Dhani and between Moklao and Lordi villages. The low transverse dunes also occur in the south-eastern part of the district.

These dunes are of 5 to 10 m and 10 to 40 m heights and lie 500 to 1000 m apart from each other. The orientation of high dunes is N 50°W and that of low dunes is N 45°W. The slopes of the leeward, flanks and windward sides are 22°, 12° to 14° and 3° to 4° respectively. The average length and width of these dunes are 750 m and 150 m respectively. The sand grains in the dunes are of 0.03 to 0.18 mm diameter which are finer than the grains of other dunes. About 50 per cent sand grains are of 0.03 to 0.07 mm size. The average diameter of the grains is 0.11 mm. The sands are highly calcareous and compact. These dunes have undergone changes due to renewed aeolian activities which have superimposed fresh sands of 1 to 3 m thickness on the flanks, crests and leeward side of these stabilised dunes.

II. Sand Dunes of New System

The sand dunes of this system were formed during the second arid phase that set in around 3800 BP and was of less intensity than the first one. During this arid phase, the dune building activities were renewed. The old sands of the old system dunes and coarse to medium texture sediments of the vast aggraded older alluvial plains were eroded by wind and built into new system of barchan, coalesced barchan and shrub-coppice (minor obstacle) dunes. The dunes of this system, particularly the shrub-coppice dunes, are still being formed on the sandy plains with sparse vegetation. The origin, distribution and morphology of the dunes of this system are discussed below.

(i) **Barchan and coalesced barchan sand dunes**

Origin : The barchan dunes were formed by unidirectional uniform winds on the hard surfaces with scanty vegetation and limited sand supply. The prevailing winds deposited the sand on the bare surfaces and they continued to deposit the sand in the lee of the crest till the angle of repose for loose sand was reached at which point the sand moved downwind and the steep face was produced. Due to the absence of vegetation, two elongated ridges on either side of the steep face advanced downwind up to a few kilometers and the crescent-shaped barchan dune with concave leeward side and convex windward side was formed. By this process several barchan dunes in the same path were originated and grouped together and ultimately resulted into coalesced barchan dunes. The barchan dunes are still being formed on the bare surfaces mostly near the settlements. The mode of the formation of the barchan dunes has also been investigated by some other investigators (Bagnold, 1954 ; Easterbrook, 1969 ; Thornbury, 1954).

Distribution and morphology : Individual and coalesced barchan dunes are scatteringly distributed in the central, western and south-western parts of the district. They are generally found near the settlements, on the old dunes and in the river beds. Most of the dunes are concentrated near Raneri, Palusar, Dhandhaniya, Balesar, Phalodi, Belwa, Tapu, Tepu Dholasar, Kalau and Himdal Ka Gol villages.

These dunes are active, devoid of vegetation and have non-calcareous, loose and single-grained sands (Pl. IIIA). The heights of the dunes vary from 2 to 5 m, 4 to 10 m and 6 to 15 m. There are 5 to 15 dunes in the dune chains and the average spacing is 100 m in south-west and 300 m in north-west. The dune orientation varies from N 38°E to 40°E. The average length and width of these dunes are 350 m and 250 m respectively. The slopes of the leeward, flanks and windward sides are 14° to 16°, 5° to 8° and 2° to 3° respectively. The horizontal and vertical sand ripples at 12 cm apart are formed on the dune crests. The sand grain size in 0.03 to 0.25 mm and the grains of 0.18 mm size are dominant. The sand grains of 0.06 to 0.12 mm size are 25 to 50 per cent. The average size of the sand grains on three dune slopes is 0.12 mm.

(ii) Shrub-coppice (minor obstacle) sand dunes

Shrub-coppice (minor obstacle) dunes were formed on the windward and leeward sides of the minor obstacles like shrubs and grasses. The sand carried by winds was caught by shrubs like *Calligonum polygonoides, Crotolaria burhia, Leptadenia pyrotechnica, Aerva pseudotomentosa*, and *Capparis decidua* and grasses, such as *Panicum turgidum Lasiurus sindicus, Cenchrus ciliaris* and *Cenchrus biflorous* and the shrub-coppice dunes in the form of sand mounds, fence line hummocks, low longitudinal and transverse ridges were formed. This process of dune formations has not stopped, and such dunes are still being formed on the sandy surface in the district. In other deserts of the world, the small shrub-coppice dunes are known as *nebkha* and large one as *rebdon*. These dune formations have been widely reported (Chudeau, 1920 ; Bourcart, 1928 ; Melton, 1940 ; Hefley and Sidwell, 1945 ; Coque, 1962 ; Petrov, 1962).

Distribution and morphology : These dunes are widely distributed almost in all parts of the district. They occur in the sandy undulating interdune and aggraded older alluvial plains and sandy buried pediments near Utambar, Korni, Suwalia, Sai, Danwaro, Baowri, Rathkuriya, Kherisalwa, Sagaria, Hardani, Lavera Kalan, Dabri, Samrau, Baru, Pugliya, Ramrawas, Salwakhurd and Nathrau villages.

The shrub-coppice dunes are of different shapes, sizes and orientation. (Pl. III B) The dunes formed earlier are old, stabilised, degraded and their sands are compact and calcareous. But recently formed dunes are active, their sands are loose and non-calcareous. The sand mounds are of 90 cm to 1-5 m height and their length and width are almost equal. They do not have any definite orientation and lie quite close to each other. The fence line hummocks of 2 to 5m heights occur at 120 to 250 m and 250 to 500 m apart from each other. The length and width of these fence line hummocks are 300 to 2000 m and 250 to 500 m respectively. The longitudinal and transverse ridges of 2 to 4m heights are 250 to 1250 m in length and 120 to 250 m in width, and they lie 250 to 500 m apart from each other. The average orientation of the longitudinal ridges is N 35°E and of transverse ridges N 45°E. These ridges do not have slip face and the slopes of the windward and flanks are 1° to 2° and 3° to 5° respectively. The size of the sand grains varies from 0.03 to 0.25 mm. About 49% sand grains of these dunes are of 0.06 to 0.07 mm diameter and this percentage is larger than that found in other dunes.

III. Correlation Between Sand Dunes and Palaeoclimate

The origin and morphological characteristics of the dunes of old and new systems occurring on the vast aggraded older alluvial plains of the district reveal that there is a definite correlation between dune building and climatic phases of late Quaternary period. The magnitude and shape of the dunes of old system indicate that these dunes were formed under first major arid phase, probably, in early Holocene period by different dune building processes. The size, shape and mineral composition of the sand grains reveal that the dunes have been formed of the sands produced by the large scale weathering and erosion of the pre-existing hills, river beds and extensive aggraded older alluvial plains. The studies on the Pavagarh fossil dunes in Gujarat and the presence of Upper Palaeolithic tools within them at a depth of 1 to 2 m have also suggested that these dunes were formed under a major arid phase (Allchin & Goudie 1971 : 252). This major arid phase terminated probably in early Holocene period and a major humid phase started which was responsible for the stabilisation of the dunes by vegetation and formation of the layers of calcium carbonate and advanced soil development in them. The obstacle dunes were badly dissected by intense fluvial activities and the gullies of 25 to 50 m depth and 50 to 100 m width were created. The parabolic, longitudinal and transverse dunes were also modified by soil forming processes, slope wash mass movement and the irregularities developed in them at the time of formation were removed and smoothed out. The steep slopes of these dunes became gentler and the sediments washed out from the slopes by slope wash were deposited in the inter-dune plains. The presence of microliths on the Pavagarh dune in Gujarat has also indicated that the dunes of this region were stabilised under a major humid phase (Allchin and Goudie 1971 : 252). The major humid phase came to an end and an arid phase of less intensive dune building activity was set in, which caused the deterioration of vegetation and renewed the aeolian activity. These renewed aeolian activity modified the forms of the pre-existing larger old dunes. The dune crests were reactivated and the smaller and younder dunes, particularly the barchans, were superimposed on their flanks. The light to medium textured sandy aggraded older alluvial plains were also degraded by the renewed aeolian activity and led to the formation of the new system dunes of smaller size and different character, mostly the individual and coalesced barchan and shrub-coppice dunes. The dune building processes of the new dune system have not yet stopped, and the shrub-coppice dunes are still being formed on the sandy aggraded older alluvial plains of the district. Recent morphological changes, like deepening and widening of old gullies, formation of new rills and gullies, exposed lime nodules in alternate layers along the flnaks and increased slope wash in the dunes of old system indicates that the present climate of the district is ameliorating. Similarly, the morphological changes, like dissection of the longer sand ridges into shorter ones, formation of rills and gullies in the sandy aggraded older alluvial plains, slight soil development and formation of the lime cover on the sand grains in the dunes of the new system also confirm the evidences for the ameliorations in the present climate of the district.

It may be inferred from the above findings that the climate of the district has changed and two arid and one humid phases have occurred in it. In the Recent period, the climate is ameliorating. However, these findings on the correlation of sand dunes and palaeoclimate are based on the qualitative data and to get definite solution of this problem, additional data by conducting multidisciplinary researches in the fields of palynology, archaeology, pedology, ecology, geology, geomorphology and radiocarbon dating, etc., will be needed. But the evidence of the dunes will remain of paramount importance and the results from other investigations can only be meaningful

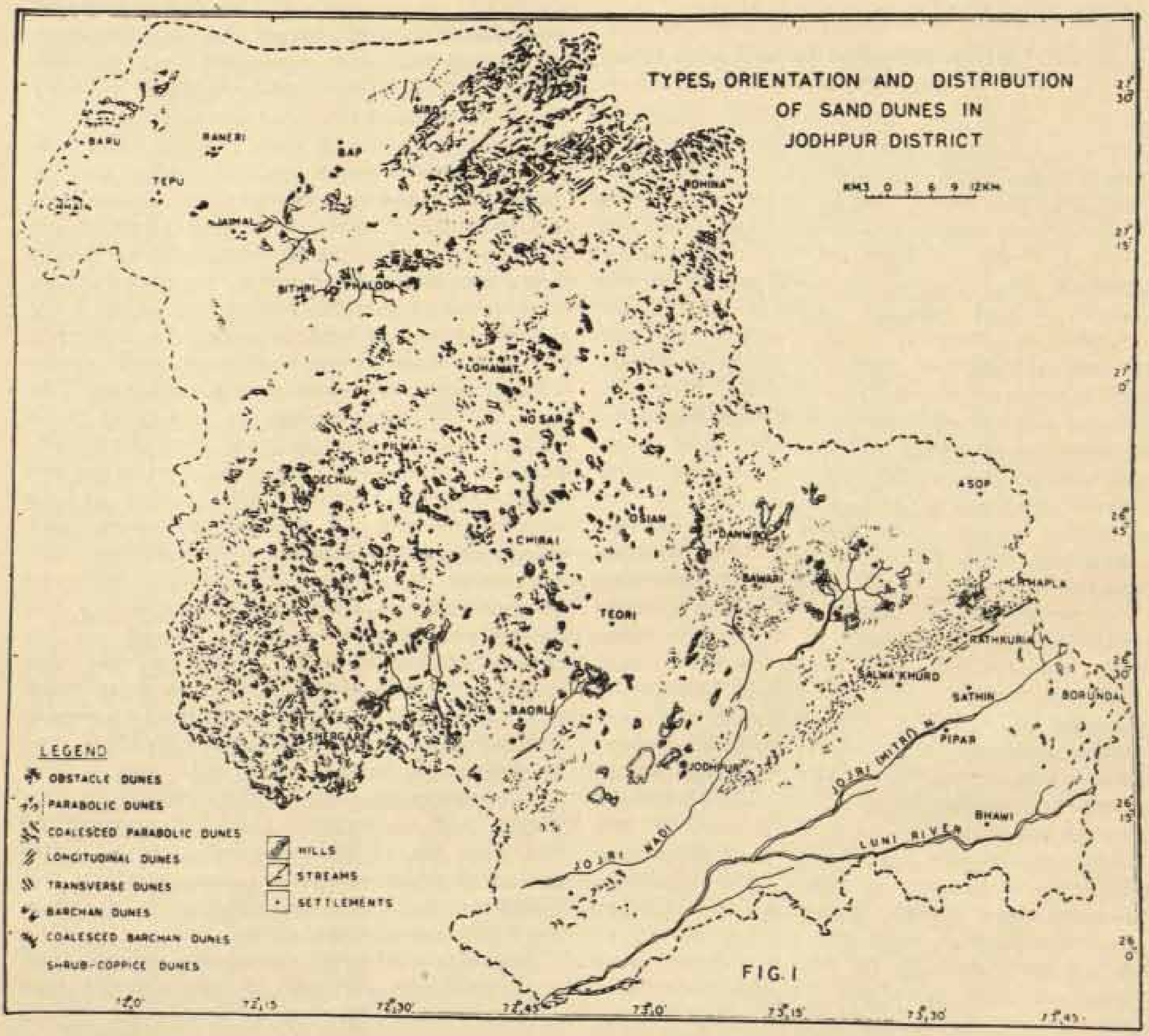

Fig. Sand dunes in Jodhpur Distt.

and fruitful if they have the relationship to the data already collected on the aeolian phenomena of the district.

Conclusions

The following conclusions from the results of this study have been drawn :

1. The major dune field lies in the north-western, central and south-western parts of the district. This dune field has two systems of dunes—old and new and they were formed under different climatic phases during the late Quaternary period.
2. The dunes of the old system occupy the major area of the dune field and they were originated under prolonged arid phase by different dune building processes. These dunes have different morphological characteristics and were stabilised under a major humid phase that prevailed after the end of the major arid phase.

3. The dunes of the new system are of smaller size and different character and were formed under the second arid phase by renewed aeolian activity. The sands for the formation of these dunes were derived from the pre-existing old dunes and sandy undulating aggraded older alluvial plains.
4. The recent morphological changes in the dunes of old and new systems indicate that the present climate of the district is ameliorating.
5. The results of this study will provide the guide lines to the investigators of related fields to provide the definite solution to the palaeoclimatic problem of the district.

Acknowledgment

The author is grateful te Dr. H.S. Mann, Director, Dr. K.A. Shankarnarayan, Head of Basic Resource Survey and to Shri Bimal Ghose, Geomorphologist for valuable suggestions and guidance in writing this article. Thanks are also due to Sarvashri P.C. Vats, Assistant Geomorphologist and D.S. Kaith, Research Assistant for the help in the analysis of the data and preparation of the map.

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Geomorphological Characteristics and Palaeoclimatic significance of Rhyolite Pediments in Jodhpur District, Western Rajasthan

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One of the least understood among the major landform units in the arid and semi-arid environments is the pediment, which is generally a gently sloping rocky or gravelly land surface, occassionally finely veneered with medium to coarse textured sediments Significant studies on the morphometric characteristics of the pediments and their evolution have already been done in many parts of the arid and semi-arid regions of the world. Appropriate summary of the information gathered is available in Tator (1952-53), Rahn (1967), Weise (1970), Young (1972) and Cooke & Warren (1973). There is a general consensus among the different authors that the slope along the pediment is gentler and gives a slight concavity to the form. It is also generally agreed that occassional sheet-wash is the dominant process in the formation and evolution of the pediments. Most authors also agree that the evolution of the hill slopes and pediments is through parallel retreat of the slope. However, no such work is available for the pediments in the arid and semi-arid regions of India.

Moreover, the studies of the pediments are likely to give some interesting clues about the climate and human activities in the past. We have in the present article attempted to discuss the geomorphological characteristics of two rhyolite pediments in Jodhpur district and Palaeoclimatic inferences drawn from them,

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Methodology

The two representative sites at Kui 1 and Kui 2 were selected for detailed study after careful interpretation of topographical sheets and aerial photographs of different scales and subsequent field checks. Actual measurements of the pediment profiles in the field were taken with the help of a dumpy level with accessories and abney's level. Slide-callipers were used to measure the size characteristics of rock fragments and sediment. The samples for analysis were taken through auguring.

Results and Discussions

From the field studies, it transpired that the ideal conditions of a pediment surface do not prevail in much of the rhyolite topography of the district. Several factors seem to be responsible for this discrepancy.

The rhyolite in the area is of Purana (Algonkian) age and is better known as the Malani volcanics. Stratified rhyolite láva is found intercalated with less common lavas of intermediate to mafic type. The formations are massive and hard, and have developed vertical and horizontal joint systems. Quartz and felspars are the dominant constituents of the rock. The typical joint systems and the easy weatherability of the felspars help in the rapid disintegration of the rock and increased production of debris. Under the low frequency and high intensity rainfall condition of the arid areas the debris cannot move enough downslope from the hill. But, instead, these tend to accumulate at the base of the hills attributing a convexity to the foot-hill slopes. The ideal condition of a rocky or thinly veneered pediment is, therefore, mostly unrealistic in the rhyolite region.

However, where the rock has become more glassy than felsic, the rates of weathering and debris production are less. It was observed in the field that the spacing of joints becomes wider as the felspathic minerals become less in comparison to the ferro-magnesians. The differences in joint spacing have been observed even in the case of a single hill because of the stratification of lavas of different chemical composition and even horizontal mixing between them. Around Mandore and Daijar the rhyolite pediments are quite extensive and rocky throughout. But the nearness of these sites to the city of Jodhpur and crossing of some arterial roads through the pedimented surface have favoured biotic interference with the result of an obliterated morphology. These sites have, therefore, been excluded from the detailed study.

The hills and pediments near Kui Jodha (between Balasar and Shergarh) approximately resemble the ideal condition of a pediment. The two representative pediment surfaces selected here for detailed investigation lie on either side of a northwest-southeast running hill complex (26°26' N, 72°27'E), and have been named Kui 1 and Kui 2. At both the sites gently sloping, debris strewn pediment surfaces were observed, but rock outcrops were very few. Drainage channels are widely spaced on the pediments, but have effective control on the direction of slope and movement of surface runoff. Detailed field measurements were taken in respect of slope, sediment size, depth of sediments and channel configuration.

Kui 1 : Geomorphological characteristics : This pediment surface, (Pl. IV a) about 155 m wide, lies on the western flank of the rhyolite hill. The distal end of the pediment terminates abruptly along the short, steep bank of a major channel flowing towards the north. The channel is the clear demarcation line between the pediment on its east bank side and deeper sandy alluvial plain on the west bank side. The source of the channel is out of the reach of the pediment studied, but the debris produced in the adjoining hill and the pediment, find their ways finally into this channel, to be transported downstream and out of the area. The channel bed is covered with sandy deposits, rhyolite fragments of various size and occasional exposed bed rock. Most of the fragments are coated with $CaCo_3$. Large rhyolite fragments coated with $CaCo_3$ and intercalated with fine sand are also found from the channel banks.

The proximal end of the pediment merges imperceptibly with a rugged rhyolite hill about 30 m high. Its slope varies from 15° to 45°. Flaking is the chief weathering process along the hill slopes, and it produces fragments of different size.

Within the study area and elsewhere in the locality the spacing of streams is wide. Hence the debris produced in the hills are transported downslope mainly through overland flow and are spread over the pediment surface. However, sheetflow is dominant on the pediment and much of the sheet flow on the pediment is directed towards the existing channels, since the direction of pediment slope is also governed by the activities along the channels.

Two shallow first order channels of 29.5 m and 32.5 m length respectively run through the upper part of the pediment and form a deep second order channel of 78 m length, which again joins a major channel at the pediment-alluvial margin mentioned earlier. The catchment area of this second order basin is roughly 155 m x 72 m. The whole of pediment surface is bare of vegetation excepting the presence of *Tephrosia purpurea* along the channels. It seems reasonable to conclude that *Tephrosia purpurea* is an indication of the type of plant-moisture relations existing along the channels on the pediment.

The surface of the pediment is covered with rhyolite fragments along with blown sand. Bedrock is exposed occasionally, especially in the upper slopes and along the lower reach of the channel. The stratigraphy, slope and sizes of fragments along the pediment are given in Table 1.

Table 1 : Characteristics of the rhyolite pediment at Kui 1

Unit	Declivity in degree	Size dimension of rhyolite fragments in cm			Stratigraphy	
		Length	Width	Thickness	Depth in cm	Sediment
Upper slope	8°45'— 3°45'	7.5	5.0	3.0	0-1.5	Large rhyolite fragments and sand
					1.5-66	Fine sand
					>66	Rhyolite fragments
Middle slope	3°045'— 1°025'	4.0	2.5	1.5	0-1.5	Rhyolite fragments and sand
					1.5-25	Fine sand
					>25	Rhyolite fragments
Lower slope	1°25'— 0°8'	1.5	1.0	0.5	0-1.5	Samll rhyolite fragments and sand
					1.5-15	Fine sand and few rhyolite fragments
					>15	Rhyolite fragments

The generalization of information on slope and size characteristics of the rhyolite fragments show that slope and debris size decrease along the pediment and can be conveniently grouped into three slope units. Measurements taken across the pediment, on the other hand, show that the slope generally varies from 1°45' to 0°03' in different parts along the pediment. Debris size does not vary appreciably across the pediment. The profiles taken along the pediment show a tendency of concavity and smoother surface, while those taken across it show micro-level undulations—the depressions being formed and occupied by the shallow water-flow lines during the cloud-bursts. However, since the direction and magnitude of slope are governed by the activities along the bed of the second-order channel, the micro-ridges and runnels have their slopes oriented towards that second order channel.

Kui 2 : Geomorphological characteristics : This pediment: Pl. IV b/lies on the eastern flank of the rhyolite hills. However, in contradistinction to the association features obtained at Kui 1, this pediment is flanked at its distal end by a sandy, undulating plain, beneath which rhyolite occurs as the bedrock. A major channel with large, $CaCo_3$ coated rhyolite fragments, flows northwards and demarcates the boundary between the pediment in the west and sandy plain in the east. To the east of the sandy plain is another pediment hill complex formed on rhyolite. In the south also there is a low hill with associated pediment. The only opening is towards the north. In other words, the pediments have been formed here in an intermontane, amphitheatre-like basin. The length of the pediment studied is about 170 m.

The proximal end of the pediment meets a 35 to 40 m high rhyolite hill. The rhyolite at this site, however, varies significantly from that observed at Kui 1. At Kui 2 the rhyolite is much darker in colour (dark brown to black) due to more ferro-magnesian minerals in the rock than in the earlier case and has wider spacing of joints. Therefore, the debris produced are also larger in size. One of the most interesting and yet intriguing features of weathering in desert—the desert varnish, was also noticed on the rocks. The entire hill and the adjoining pediment are varnished and the appearance of the varnished surface is shiny.

Observations also show that the varnished rocks decrease in number towards the distal end of the pediment, and $CaCo_3$ coating increases in that direction. In general, the rocks at the upper slope of the pediment are varnished on all sides except at the bottom, and have shiny lusture. In the mid-slope zone the rocks have varnishes with shiny to dull grey lustre; the underside of the rocks are faintly coated with $CaCo_3$ and give white appearance. In the lower slope the varnish is dull gray and much of the rock's surficial area is coated with $CaCo_3$. In the channel flanking the pediment almost all the rocks fragments are coated with $CaCo_3$. The reasons for this typical zonation of superficial coatings are not yet fully known, but it may be presumed that such zonation is dependent upon the availability and retention of moisture underneath the rock fragments, type of minerals present in the surrounding soil and weathered debris and their solubility, and possibly organic decompostion.

The studied area is drained by a channel (length 129.5 m) which controls the direction of flow of the surface runoff in the surrounding areas and direction of slope.

Stratigraphy, slope and size variations of the rhyolite fragments along the pediment are presented in Table 2.

The information on slope and size characteristics of the rhyolite fragments show that the slope along this pediment is gentler than in the earlier case, but the average size of the fragments is larger, because of the changed character of the rock. Concavity and smoothness of profiles are retained along the pediment as in the case of Kui 1. The profiles across the pediment show undulations with convexity of the micro-ridges.

Table 2 : Salient characteristics of the rhyolite pediment at Kui 2

Unit	*Declivity in degree*	*Size dimensions of rhyolite fragments in cm*			*Stratigraphy*	
		Length	*width*	*Thickness*	*Depth in cm*	*Sediment*
Upper slope	6°25′ — 2°0′	13.0	9.0	5.0	0-1.5	Large rhyolite fragments
					1.5-15	Fine sand
					>15	Rhyolite fragments
Middle slope	2°0′ — 1°25′	5.0	3.0	2.0	0-1.5	Large rhyolite fragments
					1.5-10	Fine sand
					>10	Rhyolite fragments
Lower slope	1°25′ 0°8′	2.5	1.5	1.5	0-1.5	Small rhyolite fragments
					1.5-27	Fine sand
					>27	Rhyolite fragments and sand

Palaeoclimatic Inferences

It is clear from the stratigraphic column at Kui 1 that all through the pediment a layer of fine sand exists in between two layers of rhyolite fragments. The thickness of the sand layer decreases towards the distal end of the pediment and it suggests an interesting geomorphic history for the area.

It may be presumed that before the accumulation of the sandy layer, the process of pedimentation was in progress and produced a gently sloping gravelly surface. This was followed by a period of intense dune building activity. As the hill acted as a huge obstacle to the sand flow, the aeolian processes brought sand across the pediment surface and piled them up along the pediment-hill junction, and thus gradually covered a significant part of the hill front and buried the previous pediment. Then came a moister period—the dune sand became compact and the weathering and erosion of the hill became accelerated. The sandy deposit has thus become covered with debris. In the meantime, subsurface weathering of the previous rocky/gravelly pediment might have also started, as water penetrates to that depth during the occasional rains. Rhyolite fragments coated with $CaCo_3$ have been below the sandy layer.

The stratigraphic record at Kui 2 also showed the presence of a layer of blown sand between two layers of rhyolite fragments. The thickness of the sand layer is not appreciable anywhere along the pediment. It may be due to the fact that aeolian activities were less intense here because of the intermontane condition. The smaller thickness of the sand layer in the mid-slope unit, compared to that in the upper or lower slope units suggests a distinct rise in the middle part of the previously pedimented surface. In all other respects, the generalized geomorphic history of this pediment is similar to the former one.

Conclusion

It may be concluded from the above study that under a given set of climatic, lithologic and other environmental conditions :

(a) The distribution of slope angles remain almost similar along the pediments;

(b) Sheet wash is dominant on the pedimented surface but activities along the widely spaced, well-defined rills during the occassional cloud-bursts have distinct impact on the direction of slope and on the direction of movement of water and debris.

(c) The slope profile along the pediment shows tendency of concavity and smoothness but the profile across it is undulating. However, a generalized concave profile can be drawn through the base of the undulations.

(d) Debris size decreases gradually towards the distal end of the pediment.

(e) Examination of stratigraphy of the pediment yields interesting palaeoclimatic history for the area.

Acknowledgement

The authors are grateful to the Director and the Head of the Division of Basic Resources Survey for the facilities provided and for valuable suggestions. The authors are also grateful to Sri D.S. Kaith, Research Assistant (Geomorphology) for his valuable help in the field and in the laboratory work.

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Some observations on the behaviour of soils and sediments under Late Quaternary environment and human settlement in Western Rajasthan

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The Quaternary in Western Rajasthan is characterised by the occurrence of alluvium and aeolian sands. Ghose *et al* (1966) and Singh *et al* (1971) have reported aggraded alluvial plain as the dominant geomorphic unit in Central Luni Basin. Subsequent surveys in Jodhpur and Bikaner districts have also shown extensive occurrence of these plains even in the present day highly arid tracts. Presence of a prior drainage system (Ghose *et al* 1975) provides yet another evidence. Indeed judging from the thickness of this alluvial blanket which at most places is 5 to 20 meters, a massive alluvial activity during the late Quaternary is indicated. However, the richness of the sediments in free alkaline earth carbonates and their partial redistribution as concretions suggests that this activity must have taken place in an overall moisture deficit conditions (Dhir, 1971). The work of the Cambridge-Baroda team (Allchin and Goudie, 1974; Hegde, 1976) shows that the onset of aridity, dis-organisation of drainage and aeolian activity started about 20,000 years B.P. Singh (1971) and Misra and Rajaguru (1975) also point to the occurrence of a major aeolian activity prior to 10,000 years B.P. They also bring out the oscillation in climate that have occurred since then though there is considerable divergence on the amplitude of the oscillations.

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Methods and Materials

Soil survey of parts of Jodhpur and Nagaur districts (26°0' to 27°10' N lat. and 72°45' to 74°20' E. long.) has shown predominance of deep, light textured alluvial plains. Within or adjacent are large patches of medium or heavy textured plains. One such strip of nearly 30 km width starts from Asop (26°47' N 73°35' E) and it runs in northely direction for over 35 km through villages Khajwana, Sankhwai, Bakhrod upto Nagaur (27°12' N 73°44' E). The other, starting from Bisalpur (26°14' N 73° 18' E) runs in north-easterly direction to the east of Pipar, Khangta and Merta upto Degana (26° 50' N 74° 20' E). The light and heavier textured categories of plains are independent, not catenary related and owe their differences to the source rock being dominantly sandstone in one and fine sedimentary rocks in the other. Both the plains are old and appear to have been exposed to common enviromental parameters at least during the end Pleistocene. In the course of the survey the surface features like relief and humockiness were recorded and samples of soil and substrata collected for detailed particle size analysis.

The determination of the effect of the last nearly a thousand years of active human settlement and usage of land on soil parameters was a difficult task. With the entire area being under cultivation or severe overgrazing, there was not even a tiny spot in its pristine form which could serve as a reference point for comparison of man-induced changes in soil fertility. This difficulty was circumvented in two ways: (1) by comparing fertility status of soils managed under traditional, exploitive and conservation oriented systems; (2) by comparing fertility status of man-induced surface features with main soil body. The soil samples were analysed for organic carbon by Walkly and Blacks; for phosphorus by Olsens' for potassium by neutral, normal ammonium acetate methods.

Results and Discussion

Characteristics and differential behaviour of two landscape categories to common Late Pleistocene Environment

Detailed particle size analysis of a few profiles representing the two categories are shown in Table 1. These show that subsoil and substrata of profiles developed from medium and fine textured alluvium of limestone and associated fine, sedimentary rocks have 17 to 30 per cent of particles smaller than 0.002 mm (clay) and 9 to 27% of particles 0.02 to 0.002 mm (silt). Particles of sizes 0.02-0.05 mm form 8 to 10 per cent. The remaining particles are evenly distributed within size limits of 0.05 to 0.2 mm except in Pipar where coarser fractions are also present. The coarse textured alluvial plains are characterised by lower values of clay and silt and appreciably larger amount of sands, particularly size fractions 0.1 to 0.2 mm and then by 0.5 to 0.1 or 0.2 to 0.5 mm. Thus the major difference between the profiles of the two categories lies in clay plus silt content.

Field surveys as well as aerial photo studies show that medium and fine textured alluvial plains are characterised by a near total absence of any deflation or deposition features due to wind activity. Only in Pipar are there occassional signs of such activity in the form of low, fine sandy rises of relict nature.

Otherwise all the plains are flat and featureless except for occasional outcrops and hills. On the other hand light textured plains have manifestations of rather intense wind activity. The landscape here is characterised by the frequent occurrence of dunes and sand accumulation against hill obstructions. The dunes are dominantly coalesced parabolic type and occur scattered as large bodies, often 10 to 30 metre high at the crest. Individual sand ridges that combine to form the dune are 0.5 to 1 km long. Such dune bodies are large, 1 to 5 sq. km in area and surface coverage by them together generally varies between 10 to 40 per cent with sandy plains in between. Geomorphologically (S. Singh, personal communication), these dunes are considered a product of old aeolian activity.

The foregoing results clearly bring out that whereas the fine and medium textured plains are devoid of any features associated with selective deflation and accummulation, the light textured plains have ample signs of such activity. In other words, the former plains had escaped destruction associated with aridity and strong wind action of the Late Pleistocene when the major part of arid zone had witnessed a breakdown of surface stability, generation of loose, fine sand and its accummulation as big bodies of dunes. The differential behaviour is attributable to the amount of silt and clay, particularly the latter. It seems that a clay content of more than 15 per cent was able to give sufficient stability against wind erosion process.

Effect of human occupation of some landscape properties:

Allchin *et al* (1971) and Misra and Rajaguru (1975) have reported occurrence of Mesolithic and Pre-Mesolithic human settlements in Western Rajasthan. Tod (1829) states on the basis of historical information that in the year 1212 A.D. when a scion of Rajputs who subsequently founded the ruling dynasty, arrived in the desert region, the area was well occupied. The eastern part in Pali was settled by a community called Paliwals. Jodhpur region was colonised by a number of tribes. Further west in drier habitats around present day Nagaur lived a community of Mohils distributed in 1440 villages. Likewise even Jaisalmer and Barmer were also colonised. This shows that ths entire Western Rajasthan had been colonised by the beginning of the present millennium. Secondly, the highly evolved use of natural resources, i.e., adapted crop species, adjustment in cropping schedule in relation to intra-annual rainfall fluctuations, mixed farming, and the recognition and maintenance of useful perennial species all speak that many a generations experience must have gone into its making. Thus, it can safely be assumed that active human interference has gone on for the past several centuries though it may have greatly increased in the last few decades.

Manifestation of this human activity is again vivid only on light textured plains in the form of induced instability of soil surface. Effects of these are brought out in this section.

The most vivid expression of this is the occurrence of fence-line and in-field hummocks. All the cultivated lands on light textured plains show well developed fence line hummocks which are 1 to 5 metre high at crest and have a base of 5 to 20 meters. Table 2 gives results of soil fertility investigation in terms of available plant nutrient in field proper and in fence-line deposition, at a large number of sites. The data show that fence-line depositions in general have appreciably higher contents of available phosphorus and potassium. Thus, it seems that field proper is losing a more productive constituent during this process of local erosion. It is not that the soil organic component is not lost. Probably, being light in weight, the same is transported far beyond the boundaries of the cultivated field. That cultivation as practised has led to the loss of soil fertility is also borne out by results of sites managed under tradition and soil conservation oriented systems (Table 3). Thus the results show that the present exploitive land use is leading towards accelerated instability and loss of soil fertility though the magnitude is not too severe to make the land unfit for reclamation.

Acknowledgement

The authors are thankful to Dr. H. S. Mann, Director and Dr. K.A. Shankarnarayan, Head of the Division of Basic Resource Survey, both of Central Arid Zone Research Institute, Jodhpur for going through and improving this presentation.

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Table 1 : Particle-size Distribution of sub-soils and substrata

Site	Size in mm									
	Depth	Less than 0.002	0.002 –0.02	0.02 –0.05	0.05 –0.1	0.1 –0.2	0.2 –0.5	0.5 –1.0	1.0 –2.0	Ca Co_3 %
Medium and fine textured alluvial plains										
Gaj Singh pura	15-40	23.8	16.7	9.2	19.8	20.1	1.8	0.3	Nil	5.1
	40-90	30.3	26.6	10.2	12.5	10.2	0.6	0.3	Nil	6.6
	90-120	23.6	16.0	9.7	20.1	13.1	1.7	0.5	Nil	15.0
Khajwan	20-45	19.1	10.1	9.5	18.0	22.9	12.7	1.8	Nil	2.3
	45-90	23.5	11.8	7.9	17.6	21.4	10.9	0.5	Nil	7.7
Pipar	15-35	16.9	10.3	9.1	20.0	19.8	7.1	8.4	0.5	7.8
	35-50	18.9	8.5	7.5	15.1	13.5	7.0	6.7	0.3	19.2
Light textured alluvial plains										
Chirai	40-100	7.6	5.4	7.6	16.0	34.0	17.4	6.3	Nil	5.4
	100-170	8.2	5.0	8.8	15.6	30.1	17.3	5.2	Nil	9.2
	170-240	10.1	6.2	11.2	14.7	29.4	15.2	3.4	Nil	8.4
	240-320	9.6	6.0	7.9	15.2	32.2	17.5	2.6	Nil	8.2
Rathkuria	30-90	8.4	5.3	8.2	18.3	39.2	13.2	3.4	Nil	3.1
	90-180	8.6	6.3	10.2	18.0	34.6	12.6	3.3	Nil	5.2
	180-210	8.6	5.2	6.6	16.0	42.4	11.3	2.7	Nil	6.6
	210-240	8.5	4.9	7.8	15:3	41.8	10.4	3.0	Nil	7.4

Table 2 : Available nutrient element content of field proper and fence line depositions of moderately eroded light textured soils.

Site	No. of samples	Mean and standard deviation of available form of nutrient elements			
			Org. C %	Av. P kg/ha	Av. K kg/ha
Field proper	42	Mean	0.15	13.00	138
		S.D.	0.04	2.80	48
Fence line deposition	46	Mean	0.10	16.7	176
		S.D.	0.06	7.6	73

Table 3 : Comparative fertility status of ideally managed and conventionally managed sites

Site	No. of samples	Mean and standard deviation value of available plant nutrient elements			
			Org. C %	Av. P kg/ha	Av. K kg/ha
Ideally managed	28	Mean	0.17	10.78	191
		S.D.	0.03	2.04	53
Conventionally managed	14	Mean	0.14	9.32	174
		S.D.	0.07	4.53	72

India and West Asia—an Alternative Approach

☐ Dilip K. Chakrabarti*

The basic purpose of this paper is to suggest a geographical frame of reference within which the historical-cultural relationship between India and West Asia through the ages may be visualised from the Indian point of view. It also tries to assess the implication of the proposed geographical hypothesis on Indian protohistoric studies by isolating a few of those areas where the issue of a west Asiatic affinity has been most active. It then passes on to an examination of the ideological roots of many of the current archaeological attempts to understand the cultural sequence in India in terms of a series of diffusionary influence from west Asia. In this sense it enters the field of diffusionist : anti-diffusionist controversy which is perhaps a meaningless controversy is many ways. One may, however, say in extenuation that in the Indian context this controversy has hardly begun and that this perhaps has to be gone through before the archaeological investigation of the cultural process of India can become rigorous and problem-oriented.

A. The hypothesis

In Indian archaeological and historical literature "west Asia" is an undefined term, but three assumptions are generally associated with its use. First, this means any geographical point beyond the northeastern political boundary of British India. This boundary took shape only in the last quarter of the 19th century, but in this sense there is nothing to distinguish conceptually between Anatolia and Afghanistan in Indian archaeology. Secondly, this denotes an area from where people and cultural innovations repeatedly spread to India along precisely defined lines of movement. Thirdly, within India herself, the area west of the Delhi-Aravalli-Cambay axis is more open to these movements of people and cultural influences; true India is not supposed to begin till the temples of Mathura. The key assumption in this context is the first one. The meaning attached to it affects the meaning of the other two. Not all scholars perhaps have expressed these assumptions, but—it may be emphasized—these happen to be the most common assumptions regarding "West Asia" in Indian history and archaeology.

An alternative assumption which is here being put forward is that the southern part of the Oxus basin, the eastern part of Iran (Khorasan, Seistan and Baluchistan), Afghanistan and the north-western part of the Indian subcontinent (roughly, the Indus system) constitute an area which has had significant political and economic interaction through the ages, and in this sense at least,

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if not in any other, this area as a whole may be visualised as a separate interaction sphere[1] which belongs neither to the Iranian heartland on the west nor to the Gangetic India on the east. Throughout documented history it was subject to influence from both directions. More often than not it was within the political orbit of either Iran or India, but it seems to have retained always an identity of its own, and when neither Iran nor India was powerful enough to make itself felt the political forces emanating from this area have determined the shape of events both in the east and the west.

A I. **Political interaction**

The nature of the political interaction is comparatively easy to point out, and at this place one may do so without the detailed documentation necessary for a full-length study. Documented history begins in this area with the Achaemenids who controlled it up to the Indus. This seems almost a natural corollary of the Achaemenid control of the Oxus, Afghanistan and eastern Iran. That Alexander who was only stepping into the shoes of the Achaemenids would be eager to possess supremacy over this area is also natural. After the break-up of Alexander's empire part of the mantle fell on the Indian Mauryas who pushed up to south Afghanistan. The rest belonged to the eastern successors of Alexander. After them the Greeks of Bactria were in power ; under Demetrius the Bactrian control extended from Khorasan to Kutch-Kathiawar. When Bactria and eastern Iran were lost to the Bactrian Greeks they ruled in central and south Afghanistan and north-western India. The Parthian homeland is Khorasan, and it was almost in the fitness of things that they came up to the Indus. They also went west and took control of the Iranian centre of power. The Scythians who were in India came originally from the Oxus. The Oxus again was the spring-board of the Kushana power which in the end became an Indian power based in Peshawar and Mathura, but having control as far as Chinese Turkestan. After the Kushana decline the Sassanids moved in from their base in Fars, which is, in fact, an echo of the earlier Achaemenid movement. The political history of this period in this area is not particularly clear. The Indian Guptas seem to have had a loose control over the Indus, but beyond that it was the Sassanids who mattered.[2] Bactria came alive under the Ephthalite Hunas for a while and among other things rocked the Indian Gupta power to its foundation. The Arabs came to Sind in the 8th century A.D. and it may be noted that they first consolidated their base in eastern Iran.[3]

In the 10th century Sabuktagin of Ghazni in southern Afghanistan made Jaipal, a Hindu king with his capital at Bhatinda in east Punjab, cede Lamghan or Jalalabad, and took control of the Peshawar area soon after. With this kind of base it was easy for his successor Mahmud to lead his famous plundering expeditions to India. The Ghoris who laid the basis of the Delhi Sultnate came from an area southeast of Herat. In the 14th century Ghiasuddin Tughlak of Delhi made an abortive attempt on Khorasan. The Mughals came from Samarkand The Hindukush was an outpost of their empire, and Kandahar was the bone of contention between them and the Iranians. They fought with the Uzbegs, occasionally successfully, for Badakhshan. For a few years they even controlled Bactria and Bokhara, although they gave them up in 1547. During the process of the Mughal break-up in the 18th century Nadir Shah from Khorasan, who seized power in Iran annexed all areas west of the Indus. After Nadir it was the Durranis of Afghanistan who succeeded to the eastern part of Nadir's empire. The demarcation of the boundary between Afghanistan and British India was not completed till the 1890s.

The basic point which is being made is that the area between the Oxus and the Indus constitutes a distinct geo-political unit of and in Indian history it is this geopolitical unit which is important as far as foreign invasions are concerned. A number of invading powers did not *originate* in this area—for instance, the Achaemenids, Alexander, the Kushanas, Sassanids, Arabs —but in each case they established control over this total area. It would not, however, be true to say that the move was always from west to east. A number of times south Afghanistan was under the Delhi control or under the control of a power based on the Indus. Also, the Mughal aspiration for the Oxus need not be forgotten, or for that matter, the aspiration of Ghiasuddin Tughlak for Khorasan. In a sense, the suggested geo-political unit is not as "foreign" to India as it is generally supposed to be because, for one thing, this includes the Indus system, and for another, the Indian powers too had their aspiration for this area.

A logical implication of this point is that the British Indian political boundary in the northwest should never be considered a significant line in India's pre-British history. The significant lines are the Indus and the Hindukush[4]. Thomas Holdich[5] pointed out that Hindustan to the mediaeval Arabs commenced at the Hindukush, and Kabul and Ghazni were "Indian" frontier towns. In 1898 Lord Roberts, then at the head of the Indian Army, questioned the defensibility of the British Indian frontier in the northwest. He called it a "haphazard" and "impossible" frontier, "one upon which no scheme for the defence of India could be safely based"[6].

A II. Economic interaction

The elements of economic interaction are less easy to define. There has been no systematic research on the trade linking these areas in various phases of history. In the present discussion emphasis will be placed on a few 19th-century sources which, though very much incomplete, may underline the nature of this trade in eariier periods also. The focus of interest is the British Indian trade with Afghanistan, the Oxus and eastern Iran. The issue of trade with eastern Turkestan via Kashmir and Ladakh may in the present context be ignored, because this particular trade-link does not seem to have been significant in Indian history till the Kushana period. The earlier contact with eastern Turkestan, if any, may have been through the Oxus basin.

A point which is not usually appreciated while dealing with the British Indian Northwestern Frontier policy in the later half of the 19th century is the amount of official interest to promote the British Indian goods in the Afghan and Central Asiatic markets. In an unpublished study of the Anglo-Afghan relations between 1869 and 1880 Suhash Chakravarty has tried to make this clear[7]. Even a marginal study of the relevant sources does not leave any doubt on this point. The official interest was markedly pronounced between 1861 and 1866. By the end of the 1860s Indian tea, indigo and cotton were formidable rivals of Russian products in the Bokhara market. As Chakravarty puts it : "The potentialities of the Oxus excited the imagination of the Indian officials. It was not merely a question of local consumption, they would argue, but that it embraced a great continental transit trade which penetrated from the shores of India, Persia and Asiatic Turkey, through Afghanistan, Balkh, Bokhara Samarkand, Kokand, Kashgar and Yarkand into Mongolia, Tibet and China proper. That the future development of the northwestern provinces of India might depend upon great routes of commerce being opened to Central Asia, to the Caspian and to China was within the bonds of reasonable expectation."

Afghanistan, of course, had the central geographical role in the north-western passage of goods from British India, but a good deal of attention was given to by-pass Afghanistan in reaching the markets of Kashgar, Yarkand and Khotan[8]. In the context of these later routes the official emphasis was on the routes emanating from Panjab and going across Kashmir and Ladakh. The prosperity of the north-western provinces of India had always considerably depended on the trans-frontier trade, and the British Indian official interest, Chakravarty draws attention to, fits in neatly with the general historical framework.

There is a good amount of discussion on the problem in various contemporary 19th-century records, but three of them are more useful than the rest in drawing up a general summary: Alexander Burnes' *Travels into Bokhara*[9] first published in 1834, *Cabool*[10], published in 1842, and R.H. Davies' *Report on the Trade and Resources of the Countries on the Northwestern Boundary of British India* in 1864. Burnes' *Bokhara* was the result of his travels in 1831-33 while *Cabool* described his journey to and experiences in, that city in 1836-38. R.H. Davies was a Secretary to the Government of Panjab, and his report was published in *British Parliamentary Papers* of the year 1864[11].

The routes of the Indian borderlands which are geographically precisely defined have been adequately dealt with by Holdich[12], but what is usually ignored is that these routes had different significance in different times. In Burnes' time the principal commercial route to Afghanistan was via the "Golairee Pass" along the Gomal, and consequently Dera Ismail Khan was a major entrepot of the Afghan traffic. Virtually all roads from inner India led to this point. The one from Delhi and beyond came via Bahawalpur and Multan while the one from Bombay crossed the desert to Bikaner and joined the first one at Bahawalpur. Some Bombay merchants, however, shipped their goods to Sonmiani from where Kandahar could be reached in "eighteen marches". In fact, the major routes were three: the first through Peshawar, the second along the Gomal from Dera Ismail Khan, and the third across the Bolan from Shikarpur in upper Sind. In between them there were other routes—for instance, one route went from Dera Ghazi Khan to Kandahar by the "Sakhi Surwar Pass", and there was another route along the Kurram—but in Burnes' time they were not generally used by the merchants.

The goods moving from Dera Ismail Khan went to Ghazni and Kabul but those bound for the Bokhara market were sent to Herat by Kandahar. When Burnes wrote the Peshawar route was not commercially significant because of the high levies charged along that route, and in fact, Peshawar found itself in a curious position of being supplied with European goods from Kabul. Peshawar used to produce a coarse cotton *loongee* which was "exported through Tartary and the whole of Afghanistan."[13] The wealthier people of Peshawar used to wear Russian nankeens and velvets, and Indian silks. Apart from indigo, cotton and sugar, Kabul's Indian imports comprised "white cloths of all kinds, calicoes and muslins; also chintses of European manufacture; shawls, brocades, Dacca muslins, Panjab turbans, spices, etc."[14]

About 500 camel-loads of Indian indigo used to reach the Bokhara market every year. Some of these were re-exported to the Yarkand market. Among the other items were Dacca muslins and Benares brocades. Kashmir shawls bound for Russia were mainly items of transit in Bokhara. "The whole of the natives of Bokhara and Toorkistan" used to wear turbans of white cloth imported from Panjab. The principal Bokharan exports to India were silk and wool. This wool was for Panjab where it was manufactured into a kind of coarse shawl.

It is also possible to deduce something about the organization of this trade from Burnes. The principal carriers were the Afghan Lohanis occupying "the country eastward from Ghazni to the Indus"[15]. The principal financial operators seem to have been the merchants of Shikarpur, a place where Burnes could gather intelligence of the designs of Persia on Kandahar and Herat. Shikarpur's commerce extended over "all Asia, China and Turkey excepted...This does not result from any superiority in its home manufactures, but from its extensive money transactions which establish a commercial connexion between it and many remote marts...In every direction commercial roads conduct the trade to Shikarpoor... Beginning from the west, every place of note from Astracan to Calcutta seems to have a Shikarpooree stationed in it...In all these places bills may be negotiated at most of them there is a direct trade either from Shikarpoor or one of its agencies"[16]. Burnes also refers to the existence of Hindu traders in Bokhara.

Davies' report is more specific and detailed, but does not alter the basic pattern described by Burnes. Davies devotes a good deal of attention to the routes, products and the trading people of this whole area. For instance, the "Babis" in the south of Kandahara and the "Sayyads" were merchahts, and so were the Babis" of Baluchistan. Madder, apparently a plant whose roots contained dyeing material and which came from Afghanistan to India, was cultivated in Ghazni and Kandahar and took three years to mature. Between Herat and Kabul lay the mountainous country of the Hazaras, which was occasionally crossed by the caravans in summer, but owing to its difficulties those by Maimana and Kandahar were commonly used. The Hazaras had no money, sheep being "the prime standard of barter with the traders who came among them from Afghanistan and Tartary". Davies' report is, in fact, an indispensable manual for those interested in the trade of this region.

On the Afghan Lohanis or *Provindahs* Davies is quite elaborate. They possessed large numbers of camels. Some were merchants while others were nearly carriers or retail agents. They had 5 subdivisions who descended to the plains and returned to the hills in the following order: the Nasirs with their four sub-groups, coming down successively (the Ghawainal, the Gosfandwal, the Nasirs with small means and the Nasirs with large stock), Niazi Mithi, Kharothi, Dutani and Mian Khel. It was estimated that 5000 Nasirs used to come down to India with 16000 camels. The Niazi Mithi had 600 men and 3000 camels. The Kharothi had 1800 men with 6000 camels. The Dutani possessed 600 men and 4000 camels, and the Mian Khel had 1400 men and 6000 camels. According to Burnes the custom-house books for 1836 showed that 5140 camel-loads of merchandise passed along the Gomal route that years, and this did not include the camels carrying the tents and baggage of the people, which were calculated to be 24000 in number. Davies offers a graphic description of the operational procedures of the *Povindahs* of his period, and it is worth quoting him in detail on this point.

"In the summer, living in tents, they pasture their flocks and herds on the plateaux of Ghuzni and Kilat-i-Ghilzi, and pay to the ruling chiefs a tribute, which is assessed in proportion to the number of camels, cattle, sheep, and goats owned by individuals. About October, the Kafilas commence moving towards the plains. Some are also engaged in the salt trade between Ghuzni and the British mines at Bahadur Khel. The Kharotis, again, ply between Kandahar and Herat; others towards Bukhara and Kabul. Leaving their families in tents, at the foot of the hills, the largest kafilas proceed to Mooltan, whence parties branch off by the way of Bhawalpur to Rajputana, through Sirsa and Delhi to Benares and Calcutta, and to Lahore and Amritsar. Some of these traders have houses at Mooltan, and reside there until, in the spring, the passes are reopened. Both there and at Kurrachee goods are disposed of through commissioned agents. Others proceed to the eastern markets of Hindustan, thus obtaining higher prices. On returning about April they will sometimes find, at Jhung or Chuniot, investments of cotton piece-goods purchased during their absence by agents, and these they take on to Afghanistan. Others again, return with their camels laden from Benares and Delhi".

The *Report on the External Land Trade of the Province of Sind and of British Baluchistan for the Year 1900-1901*[17] mentions the following items of import: horses, ponies and mules, cattle, sheep and goats, European cotton piece goods, assafoetida, fruits of different sorts, wheat, gram, and pulse, hides and skins, *ghi*, mustard and rapeseed, raw wool, woollen piece goods and silver. The place of origin of such item is not mentioned, but horses, ponies and mules came from Herat, Seistan, Kalat and Kandahar. The items of export were apparel, European cotton twist and yarn, cotton piece goods, wheat, rice and other spring and rain crops, iron and raw wool, refined sugar, foreign tea and piece goods. The report for the year 1882-83 mentions similar items of import from, and export to, Kandahar, Kabul, Pishin, Herat, Girishk, Kalat and Las Bela.[18]

Khorasan and Seistan in eastern Iran are specifically mentioned in these reports. Davies mentions that in his period Shikarpur used to get turquoise from Nishapur through Herat, and Indian indigo went that way in the return traffic. But the indigo trade with northeast Iran had diminished considerably by then, because an alternate, and then more important, route of indigo to the Persian market was via Yezd. The Yezd route obviously went through Iranian Baluchistan. It also appears that the wool from Kirman used to come regularly to the Amritsar market[19]. In 1861-62, 1000 maunds of Kirmani wool reached Amritsar[20]. Obviously, southeast Iran was within a close trading network. It is also very natural because Iranian Baluchistan, as far as the communication routes are concerned, looks more to the east than to the west.[21]

It should be clear, even on the basis of this preliminary discussion, that the trade relationship between the Indus system and the areas like Bokhara, Afghanistan, northeast and southeast Iran was in no way a marginal one. It is a clear case of reciprocal and intimate economic relationship. Even a superficial study of the exchanged items makes this abundantly clear. It is not—and possibly never was—a trade in basically non-essential luxury items. Davies clearly recognized this point. While writing on the Afghan trade passing through Baluchistan to the Indus valley he commented that commercially these areas might be regarded as one region, inhabited by cognate tribes.

There also does not seem to be any point in asserting that this economic relationship was essentially a matter of the 19th century. Historical evidence of this trade is abundant and offers the scope of a detailed study. If in the present context attention has been drawn only to some 19th century sources, that is only because these comparatively recent documents leave little doubt on the nature of this relationship. Burnes pointed out that Babar while campaigning in the *Derajat* (i.e., Dera Ismail Khan—Dera Ghazi Khan area) plundered some merchants of white cloth, aromatic drugs, sugar and horses. Burnes adds that thes are "the selfsame articles in which the trade is now carried on".[22] One may also bring out this element of continuity by a reference to the Achaemenid interest in opening up the Indus and virtually the same interest displayed by the British Indian government till Sind fell to Charles Napier in the 1840s. Little is known of the Achaemenid interest except Herodotus' (IV.44) reference to the fact that a Greek, Scylax of Caryanda, was sent by Darius to explore the Indus. The motivating interest could have been only commercial because an exploration of the navigational (and thus commercial) opportunities of the Indus was something which no far-flung power having interest or possession in this area could ignore. One has to turn only to Burnes' account of his voyage up the Indus to realize this.

The present discussion may also have succeeded in emphasizing the overwhelmingly caravan character of this trade. The Indus region, particularly the delta, surely possessed maritime coastal relationship with the areas up to the Persian Gulf on the one hand[23] and the Gujarat coast on the other. But at no point of history would it be wise to overemphasize the maritime character of the Sind trade at the expense of its overland ties.[24]

B. Implications in Indian protohistoric studies

There is a considerable scope of elaborating the political and economic data cited earlier. The 19th-century trading pattern can be traced back in time till one reaches prehistory. The political events can be analysed in detail within the broader framework of geography. The interplay of trade,politics and geography between the Oxus and the Indus deserves to be studied in its own right, something which has not been attempted since Holdich's pioneering but necessarily limited efforts in this direction. But however inadequate the present discussion may be, this should lead back to the point made in the beginning: the southern part of the Oxus basin, eastern Iran, Afghanistan and the Indus system constitute a political and economic interaction sphere which apparently possessed a distinct identity of its own till the recent changes in the regional geopolitics. If accepted, this hypothesis should have a number of significant implications in the study of Indian history and archaeology. The focus of the ensuing discussion is Indian "protohistory", rather an unsatisfactory term[25] generally taken to denote the period between the first subcontinental village settlements in Baluchistan and the beginning of the early historic civilization in the Gangetic valley, roughly 400-600 B.C.

B I. "Western" artifact types in the northwest

Perhaps the most obvious of these implications is that the "western" artifact types found in the Indus system and the associated areas in the northwest, which have been usually interpreted as archaeological evidence of different population movements may more satisfactorily be explained as nothing more than what they apparently are: isolated objects finding their way in through trade or some other medium of contact, not necessarily any population movement of historic magnitude. The archaeological instances one has in mind are copper-bronze objects like the shaft-hole axe from the late level of Mohenjodaro, the Rajanpur sword, the trunnion celt from Kurram, etc. These *are* isolated objects, though one scholar[26] has recently gone to the extent of illustrating these and similar specimens as "new types of weapons and tools dating from the period just before, during and soon ofter the Aryan invasions". These are undoubtedly non-Indian artifact types, but two points may be noted: first, these types have a wide currency in Iran and beyond, too wide in fact to be pinned down, there is virtually nothing in the contexts of their occurrence in the northwest to suggest that they were mutually related or belonged to the same period. They might or might not have been so, but the point is that there is no evidence either way.

Secondly, even when the date are coherent and do suggest a specific cultural contact with Afghanistan, eastern Iran and the Oxus there is no need to interpret it as anything more than a primary spread within the total area. A notable case in point is the distribution of the "Quetta" ware and certain distinctive terracotta female figurines in north and central Pakistani Baluchistan and some greater Indus valley sites[27]. There is little doubt that the point of origin of these traits was south Turkmenia during Namazga III period and that the Indus and Baluchistan contexts of their occurrence make sense together, suggesting for them a specific south Turkmenian contact. Again, this has been interpreted as evidence of a tribal movement from south Turkmenia to the west of the Indus during this period[28]. In view of the present hypothesis this type of contact is only to be expected in the archaeological record of this area and does not *necessarily* mean any basic cultural change.

B II. Delhi-Aravalli-Cambay line of Indian geography

One may, in fact, go one step further and hypothesize that any new significant cultural innovation in any one area between the Oxus and the Indus is likely to spread rapidly to the rest of this total area. From the Indian point of view, the primary zone of such spread will be the Indus and the areas to its west. But one may also visualize a secondary spread up to the Delhi-Aravalli Cambay line—up to the Indo-Gangetic divide on the one hand, and the coastal and Peninsular Gujarat on the other. The importance of this line in Indian geography was emphasized by O.H.K. Spate[29], followed up latter by B. Subbarao[30]. From the Indus one could move to these areas in a number of easy ways. The shortest way is to follow the line of the Hakra-Ghaggar and arrive near Delhi. As the archaeological evidence from the pre-Harappan-Harappan settlements to the mediaeval forts along this line indicates, this route must have been active throughout Indian history. The second route, of course, was up the Indus and then across Sutlej. At the other end, Kutch-Kathiawar and the coastal Gujarat could be reached by the straight overland route from lower Sind to Gujarat[31]. From Gujarat one may also cross the desert to Bikaner and join the Ghaggar-Hakra route to Sind or the *Derajat*. From Sind itself there could be another route across the desert to west Rajasthan (Hyderabad-Barmer-Jaisalmer). The antiquity of the two last-mentioned routes is not clear. They are surely mediaeval, but one cannot suggest an earlier antiquity for them on the basis of the existing evidence. There is, however, no such doubt about the antiquity of the Ghaggar-Hakra and Sind-Kutch routes which go back to the pre-Harappan-Harappan times. The Rajasthan desert as a barrier to human and cultural movement has occasionally been overemphasized in Indian history. It surely provided some barrier but the ease with which cultural and other influences fom Sind could reach the "divide" and Gujarat suggests that the Rajasthan desert was not as great a geographical barrier as it is supposed to be.

B III. Geography and any suggested diffusion from the west to inner India

The third premise is that the proof of any suggested diffusion from the west to inner India should first be found in the Indus system and then either in the "divide" or in Gujarat. It is in these areas that the trait was likely to have been absorbed before being transmitted to the east, if it was so transmitted at all. One is not aware of any single move coming from the west in Indian history, which goes against this assumption. Whether any influence emanating from the Indus system could spread further east depended basically on its strength. In early historic period the Kushanas who had a capital at Mathura on the eastern fringe of the "divide" could make themselves felt politically, culturally and economically in inner India, but the same perhaps cannot be said of the earlier Saka-Parthians and Indo-Greeks. The Harappan move, for instance, ended in the "divide" and Gujarat. Nadir Shah sacked Delhi in the "divide" but he did so only with a consolidated base west of the Indus. The Achaemenid influence travelled as far east as south Bihar, but there is no point in forgetting that the Achaemenids once controlled the Indus system. Examples may be multiplied, but the basic point which emerges is that any political, economic and cultural influence could travel from the west to inner India only in three stages. In the first stage the influence should be well-defined in the suggested interaction sphere which included the Indus system. In the next stage there should be a reasonable evidence of its spread up to the "divide" and Gujarat. It was only in the third stage that this influence could move into the Gangetic or Peninsular India. Any hypothesis which suggests a diffusion, cultural or otherwise, from the west to inner India but does not systematically define its evidence in terms of these three stages is *prima facie* suspect.

B IV. Origin of the central Indian and Deccanese chalcolithic tradition

Virtually none of the current diffusionary hypotheses in the protohistoric archaeology of inner India takes note of this geographical frame of reference. One may refer in this context to the generally accepted idea of origin of the central Indian and Deccanese chalcolithic tradition represented at such sites like Ahar, Navdatoli, Kayatha, Nevasa, Chandoli, Daimabad, Inamgaon, etc. The discovery of, and initiation of extensive horizontal excavations at these sites, are among H.D. Sankalia's monumental contributions to Indian protohistoric studies, and it is with him that the idea is associated. He first set it forth in 1963[32]. It would be worthwhile to discuss his theory in some detail because by and large this is typical of all current diffusionary explanation in Indian archaeology.

The basic items considered in the central Indian and Deccanese chalcolithic contexts were some ceramic shapes and designs, one copper-bronze tool type, the occurrence of lentil and linseed, and incised decorations on terracotta beads and spindle-whorls. The ceramic shapes which were cited are channel-spouted vessels, dish-on-stands, footed cups or goblets, zoomorphic vessels, three-legged bowls and a grey pottery, either spouted or with a hollow base. The cited ceramic designs are stylized dancing human figures and antelopes with elongated legs. The incised decorations on beads and spindle whorls are mostly geometric, although there is an incised stag on one specimen. The copper-bronze tool type is antennae-hilted sword or dagger with raised mid-rib, two specimens of which were cited. In addition, some general ceramic shapes, like white-slipped concave-sided bowls, globular vessels with long neck and corrugated body, straight-sided large bowls, etc., were taken into consideration. Analogies for these shapes and designs were sought among a wide range of sites in Iran and elsewhere in West Asia. The most frequently cited sites were Sialk, Giyan and Hissar in Iran. Sankalia's basic conclusions were that "amongst the large mass of pottery, certain types or shapes and designs can be compared with similar shapes and designs of excavated pottery from Iran in particular and Western Asia, as far as Crete, in general", and that a *prima facie* case existed for a fresh approach to the "Indo-Iranian problem."

In some of his subsequent publications Sankalia[33] widened the range of his analogies. Theriomorphic vessels from the Deccan were compared to those from Nuzi in Mesopotamia. The ancestry of the central Indian channel-spouted vessels was looked for in sites like Kara Tepe and Ismailabad near Tehran, and a reference was made to Catal Huyuk VI-A and Hissar III to explain some Deccanese terracottas having some religious significance. The basic cultural conclusion was put forward in 1973 :

"...With its distinctive pottery forms such as goblets, channel-spouted bowls, and some of the painted designs, *which distantly recall those of Western Asia and Iran* (italics ours), there is no alternative but to regard this manifestation as a kind of colonization, a mixing of a foreign-oriented people with the indigenes, leading to the development of the characteristic second millennium B.C. cultures of central India. The story seems to be similar in western Maharashtra. Here the evidence is a little more positive and varied. Besides the vertically spouted pots which *vaguely* (italics ours) recall those of Western Asia, we have theriomorphic bulls from Nevasa and Chandoli, and the mother goddess figures from Nevasa and Inamgaon. And there is the custom of burying the dead under the floor in the living house; children in two or more urns, and adults in a pit, oriented north-south. The theriomorphic bulls show close parallels with those from Sialk and Nuzi, and particularly at Catal Huyuk. The study of six adult skeletons shows mixed anatomical features, partly indigenous like those of the Gonds and Bhils, and partly Mediterranean"[34].

There can be certain basic objections to this hypothesis. First, this hypothesis of a population movement from Iran and elsewhere to Peninsular India does not conform to the geographical framework suggested earlier in the present paper on the basis of documented political and economic records. Second, almost all the suggested analogies are too general to be of any use in a valid and meaningful archaeological comparison. For instance, one fails to understand how an archaeological study of cross-cultural relationship in widely separate geographical areas can be based on vague similarities in items like simple geometric, virtually ageless, terracotta types, painted stylized human and animal figures, etc. Third, some of the analogies cited are positively misleading. To take only one example, there is no conceivable similarity between the Sialk "tea-pots" and Navdatoli channel spouts, not even in any vague identity of form. Besides, the Navdatoli bowls are considerably earlier. Fourth, the suggested West Asiatic analogies do not belong to any single cultural assemblage or even different assemblages of any specific period. One has only to remember that Catal Huyuk VI-A and Sialk Necropole B, two of the many horizons cited, belong to the sixth millennium B.C. and the first half of the first millennium B.C., respectively. Finally, it should be pointed out that not a single demonstrably West Asiatic type fossil occurs in the cited Indian assemblages. For instance, one may wonder why there is not a single sherd of typical Nuzi Ware in this Indian context if Nuzi has really anything to do with the origin of this context. Moreover, the basic character of these Indian assemblages is very different from that of their supposedly parent (in Sankalia's hypothesis they are parent sites) West Asiatic sites, a difference which should be obvious to anybody who studies these assemblages without primarily looking for similarities.

B V. Suggested Scythian migration to south India

Attention may also be drawn in this context to the hypothesis of a pastoral Scythian migration to the south of India in the late centuries B.C. and early centuries A.D. The Scythians along with the Druids have long been parts of Indian archaeology[35], but one may perhaps justifiably wonder if any major movement of nomads can be suggested across the face of India primarily on the basis of archaeological analogies which have ranged from the Caucasus to Susa (two widely separate areas), particularly when this movement has not apparently left any visible archaeological trace between Taxila on the one hand and Berar on the other. Lawrence Leshnik, the originator of this hypothesis, adds, "...were it left to Archaeology alone, the role of the Sakas in India would still remain unsuspected".[36] One always thought that the basic evidence of the Scythians or Sakas in India came from archaeology—inscriptions, coins and different art objects showing Saka influence. Morever, F.R. Allchin (in personal discussion) points out that the absence of any Iranian linguistic influences in south India strongly goes against Leshnik's hypothesis.

C. Ideological roots of diffusionism in Indian archaeology

The archaeological theories which have been discussed above are only a few among many such theories current in Indian archaeology. There is really no point in denying that Indian archaeology is primarily dominated by diffusionist thinking. As far as West Asia is concerned this may reflect in one sense attempts to link archaeologically less explored India with West Asia where the archaeological sequence and chronology are much more secure and documented. The historical roots of this diffusionism, however, lie deeper and are intimately associated with a few fundamental assumptions of Indian historical studies.

One of these relates to the coming of the Aryans or Indo-Iranian language-speakers to India. In much of the Indological literature the Aryans enjoy far more than a mere linguistic status. They possess cultural and racial connotations as well. The cultural overtone is apparent when virtually all cultural elements of India are neatly grouped into Aryan and pre-Aryan[37]. The racial implication has not merely manifested itself in the fervour with which the Aryan idea was accepted by the Indian nationalists[38] but also in the generally accepted idea of a dichotomy between the Aryans and pre-Aryan inhabitants of India. In some Indological literature the Aryans possess the attributes of a "superior race"[39]; they culturally interact with the autochthones no doubt, but they also colonise their land, push them into the background and generally try to impose what has been called an Aryan way of life.

The other assumptions relate to Indian racial and linguistic history. Though there are differences of nomenclature between the various systems of racial classification proposed, they all agree that despite subsequent intermixture the history of Indian population is essentially a series of racial migrations from outside the country[40]. What is also significant is that each of the proposed major racial stocks has been given a specific linguistic association[41]. For instance, the proto-Australoids are supposed to have brought in the Austric language family and the Mediterraneans are said to be responsible for the introduction of the Dravidian language group. Learned attempts have been made to assess the individual contributions made by these and other language groups to the formation of Indian culture and to determine when and from where they migrated to India[12]. The relationship of these historical, racial and linguistic models with the current predominantly diffusionist approach in Indian archaeology is obvious[13].

D. Conclusion

The basic argument of the present paper is simple. Limited, but hopefully adequate, data have been cited in favour of the assumption that the area between the Oxus and the Indus forms a political and economic interaction sphere. It has been emphasized that it is this area which is directly relevant to the study of Indian history and archaeology, and as the Indus system happens to be one of its component elements, this area is as much "Indian" as "West Asiatic." Viewed from this point of view, the archaeological data from the Indus system and the area to its west, up to the British Indian border, which have been interpreted as different types of diffusion from a vague and undefined West Asia are no more than the indications of mutual contact between the geographical components of this interaction sphere. The area up to the Indus is obviously within the primary zone of this contact. It is possible to postulate a secondary zone up to the Delhi-Aravalli-Cambay line which could be approached from the Indus in a number of ways, the Rajasthan desert hardly acting as an effective barrier. Whether any diffusionary movement went further east into inner India depended basically on its strength, but any suggestion of a major western movement, cultural or otherwise, to inner India should show that it was first based on the Indus, gradually moving toward the Indo-Gangetic divide and Gujarat. The current idea of a West Asiatic origin of the central Indian and Deccanese chalcolithic tradition does not provide any such evidence. The archaeological basis of this idea is also far from satisfactory. The same may be said about the idea of a movement of Scythian nomads to the south. It should, however, be added that the movement of isolated artifact types is not in issue. But when a major diffusionary move is implied, that should fit in with the suggested geographical frame of reference.

The idea that the region between the Oxus and the Indus has in the past been always interconnected politically and economically (and by implication, culturally) is rooted in Holdich. Among the archaeologists A.H. Dani has put some specific emphasis on this[14]. The importance of the Delhi Aravalli-Cambay line was pointed out by Spate and Subbarao. The basic directions of pre-European movements in Indian history were studied by F.J. Richards in 1933.[15]

what the paper has tried to do is to elaborate the idea of Holdich and demonstrate the real significance of this approach in the study of Indian protohistory. By and large, this makes possible to visualise the protohistoric cultural growth in inner India in its own term, without any reference to the supposed multiple waves of people and cultural innovations pouring in from the west.

Acknowledgement

The present paper owes a lot to the trenchant criticism of Dr. F.R. Allchin on its earlier version.

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3. According to one source the boundary of the king of Sind in the 8th cent. A.D., who had his capital at Alore "extended in an easterly direction to Kashmir and Kanoge, to the west to Mukran and the sea side...to the

south to Surat and Diu Bunder, to north to Kandahar, Sejistan, the Sooliman mountains, Karmania and Keekanan" (*Selections from the Records of the Bombay Government*, no. 19, N. Series, p.8, Bombay 1855). The record is obviously Tufat-ul-Kiram in Lambrick, *op. cit.*, p. 136 where Keekanan is identified with Loralai (the other identifications are clear enough). Whatever may be the value of this testimony, the general geographical limit suggested in India remarkably conforms to the distribution of the Indus civilization. This also shows how there was no difficulty in visualising a political unit comprising Sind, Kandahar, Seistan, etc.

4. W.K. Fraser-Tytler, *Afghanistan* (London, 1958: Oxford University Press), p.14 calls the Hindukush "the true northwest frontier of India".

5. T. Holdich, *The Gates of India* (London, 1910: MacMillan and Co. Ltd.), p.226.

6. Cited in R.L. Greaves, *Persia and the Defence of India. 1884-1892* (London, 1959: University of London Press), p. 197. It is also interesting to know that one of the alternatives of the British Forward Policy in relation to Afghanistan in 1875-79 was "outer line with the Oxus for ultimate boundary and Balkh, Maimana, Herat for its main outposts...". Fraser-Tytler, *op. cit.*, 143. For a brief history of the frontier in the 19th century, A. Lamb, *Asian Frontiers* (London, 1968; Pall Mall Press), pp. 79-93.

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12. *op. cit.*

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17. Published by the Government in 1901, Karachi.

18. *Report on the External and Internal Landtrade of the Province of Sind for Year 1882-83*, Karachi, 1883 (Government).

19. *Punjab trade Reports 1875-76*, p. 31 : "Kerman wool is one of the most important imports by the routes across the the Suleiman range". It was cheaper than Kashmir wool.

20. Statement exhibiting the moral and material progress and conditions of India during the year 1872-73, *British Parliamentary Papers*, vol. XLIX, 1874.

21. C.C. Lamberg-Karlovsky and J. Humphries, The cairn burials of southeastern Iran, *East and West*, 18 (1968), p. 275: "...one must note that the few routes of communication which do exist, all point to India. To the West, the Iranian plateau is separated from Baluchistan by relatively more difficult natural barriers than the long valleys directed toward the east". This point is almost obious to anybody who has had some experience of that area.

22. *Cabool*, pp. 78-79.

23. It might be useful to cite some data on the trade relationship between Sind and the Persian Gulf. For instance, a report by Lieutenant Colonel Lewis Pelly, the British Political Resident in the Persian Gulf, to the Secretary to Government, Political Department, Bombay, dated Bushire, 23rd April, 1870 (*British Parliamentary Papers*, vol. LI, 1871) contains the following informations on the imports from Persian Gulf to Sind from 1861-62 to 1868-69, and 1847-48 to 1854-55 : living animals, brimstone, coconut, cotton goods, drugs and medicines, dyeing and colouring materials, fruites and vegetables, pulse, oil, precious stones and pearls, provisions and oilmen's stores, seeds, shells, silk, manufactures of silk, spices, wood and timber, wool and woollen goods and other miscellaneous articles. The exports from Sind to the Persian Gulf during this period were: cotton goods, drugs and medicines, dyeing and colouring materials, grain and pulse, hides and skins, liquors, metals, oils, seeds, silk piece goods, spices, sugar and other sachharine matter, micellaneous objects. Also, *Statements Exhibiting Trade of Sind for the Year 1859-60*, Bombay 1861; *Statements Exhibiting the External Trade of Sind for the Year 1858-58*, Bombay, 1859. Pelly's evidence is corroborated by these reports.

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As early as 1936 Arthur Keith pointed out that "...all, or nearly all, who have sought to explain the differentiation of the population of India into racial types have sought the solution of the problem outside the Peninsula. They have never attempted to ascertain how far India has bred her own races. They have proceeded on the assumption that evolution has taken place long ago and far away, but not in the great anthropological paradise of India... No doubt India has been invaded over and over again; certain racial types are of extraneous origin. But one would venture the opinion that 85 per cent of the blood in India is native to soil. At least it is urgently necessary that our eyes should be more directly focussed on the possibility of India being an evolutionary field—both now and in former times" (review of B.S. Guha, "Racial Affinities of the Peoples of India" in *Man*, 36 (1936), pp.28-30). In 1967 D.K. Sen categorically demonstrated the unreliability of the methods and assumptions behind the racial classification of the skeletal remains excavated in various archaeological sites of India up to the early 1960s. The basic plea was to discard the old typological method of racial analysis and to subject the data to statistical methods of population studies. This is a seminal paper on the racial studies on ancient skeletons in the Indian context (D.K. Sen, Ancient races of India and Pakistan—a study of methods, *Ancient India*, nos. 20-21, 1967, pp. 178-205).

Even in the field of Indian archaeology the Aryan hypothesis has not gone entirely unchallenged. In 1968 the present author critically reviewed the theories put forward till then and pointed out their mutual contradictions and methodological inconsistencies. For example, it was considered very unlikely that the Painted Grey Ware culture of the "divide" and upper Ganges valley which had rice, pig and buffalo as its dominant subsistence traits should have anything "West Asiatic" or "Aryan" about it. A survey of the relevant linguistic literature revealed that the idea of Aryan migration to India in two waves, which was accepted by some Indian archaeologists, was discredited in linguistics itself as early as 1926 (Dilip K Chakrabrti, The Aryan hypothesis in Indian archaeology, *Indian Studies: Past and Present*, 9, 1968, pp. 343-353). In 1969 in her Presidential address to Section I of the 31st session of the Indian History Congress Romila Thapar took up the issue and went to the extent of suggesting that the Aryan hypothesis could be a red herring drawn across the path of Indian historical research. In 1970 B.K. Thapar surveyed the problem and found no archaeological evidence which could be equated to the Aryans in India (B.K. Thapar, The Aryans: a reappraisal of the problem, in L. Chandra *et al* (eds), *India's Contribution to World Thought and Culture*, (Vivekananda Kendra, Madras), 1970, pp.847-164).

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Excavations at Sarutaru : A Neolithic site in Assam

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Prehistoric studies in North-eastern India began over a century ago with the discovery of ground stone celts by Sir John Lubbock in the Brahmaputra valley in Assam in 1867. As far as the neolithic phase is concerned, Assam received the earnest attention of many workers whose results were published earlier. But the picture of pre-neolithic prehistory is a blank except for the discovery of a few palaeolithic tools from Garo hills in Meghalaya. The neolithic studies in this region were largely confined to the collection of stone celts from the surface or the collection from the house-holds of the simple societies who preserve them for the supposedly magico-medicinal properties resident in them. Worman (1949) and Dani (1960) attempted typological classification of the stone axes to demonstrate their affinity with and their possible introduction from South China and South-east Asia. The excavation at Daojali Hading in North Cachar Hills in Assam (Sharma, 1967) brought to light the neolithic phase with celts and potsherds, associated together in a stratified deposit.

In this paper an attempt is made to enumerate the results of the excavations of a neolithic site at Sarutaru in Kamrup district, Assam, which was carried out by the writer during 1967-73 under the auspices of the Department of Anthropology, Dibrugarh University.

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The site

Sarutaru is a hamlet situated at 25 km. south-east of Gauhati, and the neolithic site lies on the top of a small hillock about 125 metres high from the foot-hill. Geologically, this area is a part of the Shillong plateau, or, rather it is situated on the periphery where the plateau merges with the plains of the Brahmaputra valley on the north. The area around the site is dotted with hillocks, more or less of the same dimension relieved by the rich alluvial plains. Flanking on the northern side is the river Digaru, a tributory of the Brahmaputra which is a perennial source of water in the region. The hillock is dome-shaped and flat at the apex. It is formed by brown soil with murram which was derived from the decomposition of the parent rock due to prolonged precipitation and the consequent growth of dense tropical rain forest. The area comes under the high rainfall zone receiving about 300 mm annually. Just as its physiographic position, it is situated in between the highest (Shillong: 404 mm) and the lowest rainfall (Gauhati: 172 mm) areas.

Ethnographic present

Two main groups of aboriginal societies

inhabit this area : the Khasis and the Mikirs. The Khasis belong to Mongoloid stock and speak a language of the Mon-Khmer linguistic group. Linguistically, they are akin to Cambodians who speak a language of the same family. The Khasis are distinguished by their matriarchal system. Marriage is matriarcal. Inheritance and succession to office also indicate matriarchal characteristic. Among the Khasis the system of agriculture is comparatively elaborate and carefully adjusted to the productive power of the soil. In the flat valleys, rice is grown in terraced and well irrigated fields. With this exception, however, the rest of their crops, like unirrigated rice, potatoes, millets and chillies are grown on hillocks by *zhumming* (cultivation). In addition, they supplement their subsistence by hunting and fishing. The Khasi people are known for their excellence in the use of bow and arrow. They do not use plough even to this day; instead, they use an iron implement as hoe, a perfect replica of shouldered stone celt of the prehistoric period. Another living tradition of this society is the erection of monoliths or mehirs in memory of the deceased. They usually cremate the dead and then gather uncalcined bones and put them in stone cairns or what the Khasis call *mawshieng* (bone-stone).

The Mikirs also belong to Mongoloid stock who speak a dialect of Tibeto-burman linguistic group. Their main habitation is the Mikir Hills though at present they are scattered over a wider area in the north-east. Mikirs inhabit at Sarutaru and in the neighbourhood, at present. They live in pile welding type of houses built of bamboo and thatch that are situated generally at the foot-hills. By nature they are migratory in character and the pace of their migration depends upon the *Jhum* cycle. This explains as to their distribution over a wider area outside their main habitat, unlike the other simple societies who live in a compact territory. In the process of migration from place to place they were subjected to acculturation. In the Mikir Hills proper these people do not erect memorial stones in the name of the deceased but the Mikirs at Sarutaru and in the neighbourhood do erect memorial stones as they appear to have adopted this tradition of the Khasis. The Mikirs practice *jhumming* on hillocks and raise such crops as potatoes, chillies, maize, cotton, yama and castor but in the flat alluvial land they practise wet paddy cultivation. They use iron implements for their agricultural activities.

Excavations

A few ground stone celts were encountered during the construction of a farmhouse on the hillock at Sarutaru on the report of which it was decided to excavate the site to establish their stratigraphic position. Three trenches, measuring three metre square each, were laid and dug to a depth of 65 cm. where the virgin soil was met with. The excavations revealed the cultural horizon at a depth of 20 cm. from the surface which continued upto a depth of 56 cm. Thereafter it was sterile. The cultural layer was composed of brown to blackish soil and it was covered on the top by humus. The cultural contents recovered from the excavations include ground stone celts and pot-sherds. The stratigraphy and the archaeological evidence from the three trenches are similar without any marked difference.

Stone Industry (Fig. 1)

Nine ground stone celts were recovered from the excavations. These are made on slate of grey to black colour and sandstone of cream to buff colour. The artifacts are stained on the surface with brownish tinge since they lie embedded in the brownish soil. These are manufactured in two stages: chipping and grinding. Celts made on slate are generally flat and require less of chipping. In such cases the stone celts are ground at the working edge only as a result of which the effort in fashioning the tool was minimal. Since the slate material occurs naturally as flat nodules it must have attracted the attention of the neolithic folk. In the case of sandstone material chipping clearly preceded grinding. The tools that were obtained by chipping and grinding retain the flake scars on the surfaces in spite of the subsequent grinding all over the body. The stone tools can be classified into two following types:

(A) Shouldered celts ... 7
(B) Round-butted axes ... 2

The shouldered celts are made on flat and thin nodules of slate, as a result; both the faces are smooth and the sections thin. The straight and broad cutting edge is sharp due to bifacial grinding, about a centimetre from the edge. The tenon at the butt is formed by two curved shoulders on either side. The shoulders were obtained by making two grooves on either side, first by chipping and then by grinding, possibly with a harder rounded pebble that was no more than a centimetre long. In one specimen one of the shoulders is finished, almost to the right angle. The edge on one shouldered celt is blunt due to utilization which leaves identation marks.

The round-butted axe is ground all over and yet retains a few flake-scars due to chipping. It has a median cutting edge which is sharp and broad. The sides gently taper to make the butt-end rounded and the cross-section biconvex.

Pottery [Fig. 2]

Numerous potsherds were recovered from the excavations and, significantly in association with stone axes. No complete shape is available. Pottery is hand-made. It is made of clay mixed with quartz particles which show up on the surface. On the whole, the ware is unrefined and not well baked. Three ceramic types, on the basis of colour, are recognised: brown, buff and grey. The brown ware dominates over others and the grey ware occurs in small numbers. On the exterior, the ceramic is sometimes decorated with cord impressions or basket impressions. The decoration is in the form of either parallel or criss-cross lines. The decoration is impressed on the pot with paddle which is wrapped in cord or matting. But the sherds belonging to the neck or rim portion are plain without any sort of decoration. This is evidently due to the fact that the portion from the shoulder to the base was decorated and the rest of the vessel is left plain.

Synthesis

For a better understanding of the varying cultural developments, within amacro-geographical area, like north-eastern India, it is necessary to stress the climatic and physiographic peculiarities. To achieve this objective we may invoke the concept of regions of attraction, relative isolation and isolation (Subbarao, 1958). Sarutaru, the neolithic site in Kamrup district, Assam, is appropriately a region of relative isolation which is situated in between the Brahmaputra valley and the Shillong plateau.

Excavations at Sarutaru revealed a single horizon yielding ground stone celts of two types : shouldered celt and round butted axe. Dani mentions the use of a metal wire in obtaining the tenon and the body implying thereby that this type was innovated by those people who had a prior-knowledge of metal. But the shouldered celts were certainly in use in the 'Lungshanaid period of China who had no knowledge of any metals. Further, the central Highlanders of New Guinea make use of flake tools for sawing out stone axes (White & Thomas, 1972). It therefore follows that the making of shouldered celt does not imply knowledge of metallurgy. These stone celts, after hafting in a wooden or bamboo handle by setting the edge horizontally or at right angle could be used for *zhumming* or 'slash and burn' agriculture, a practice still prevalent in this region. The pottery, crude and hade-made, is simple and lack lustre. The technological competence as reflected in their stone and pottery industries was suitable to an economy characterized by limited food production in the hilly regions and possibly in the intervening patches of alluvial plains. Hence the stone axe culture under study is termed as 'neolithic'.

The shouldered hoe and round-butted axe types along with others had a wider distribution in the rest of eastern India as well as in eastern Asia. The ceramic tradition of Sarutaru is closely similar to that of Daojali Hading in North Cachar Hills, Assam, more emphatically in the execution of exterior decoration. But it has no similarities with the neolithic cultures of other parts of India unless one trait or the other is taken out in isolation to establish relationship between the cultures of widely separated regions without regard for ecological factors.

The earliest evidence of the manufacture of shouldered celts and cord impressioned ware comes from the Lungshanoid farming culture of China which was developed prior to Shang period in the beginning of Second millennium, B. C. from where it is believed to have spread gradually into South China and beyond, into South-East Asia (Clarke, 1969). But on the contrary a similar archaeological evidence from an undisputed stratigraphic context at Spirit Cave in north-west Thailand (Highham, 1972) gives a much earlier date. The shouldered hoes and corded pottery occur in the context of hunting and farming economy and a C-14 date of 6000 B.C. was assigned to the same stratum. It is further claimed on the basis of the excavation at Non Nok Tha in north-east Thailand that here the cattle domestication, rice farming and later the bronze technology were all present earlier than in any other part of south-east Asia or China examined archaeologically. The above two kinds of evidence with conflicting chronological inferences makes any attempts at tracing the origin of the neolithic culture of Sarutaru or that of north-eastern India a difficult task and all such inferences drawn in the past would merit revision.

In this context it is necessary to refer to another of our recent excavations of a low mound at Marakdole which is situated at a distance of one kilometre from the neolithic site of Sarutaru to derive a relative date for the later. The excavations reveal a single cultural stratum of one metre thickness from which were recovered wheel turned pottery of fine kaolin clay. Exterior decoration include among others, cord impressions on some of the vessels from shoulder to the base. Among the terracotta objects mention must be made of a flat and triangular form which resembles stone axe. Finally, the occurrence of a shouldered celt along with pottery is very interesting. The fine kaolin ceramic ware with typical forms and decorations had a wide distribution in the nuclear area of the Brahmaputra valley. At Ambari in Gauhati this pottery occurs in Period I which is assigned to a time bracket of 7th century A.D. to 12th century A.D. with a proviso that its beginnings may be pushed back to the early centuries of the Christian era and so the Marakdola site can be assigned to the same time span. It is reasonably certain that the bearers of the culture at Marakdola were culturally different from the neolithic Sarutaru. We can postulate their contemporaneity in the light of the following model of a single state or phase of interaction in a restricted territorial environment (Clarke, 1968).

Phase I *Symbiosis* Intrusion of people (or potters) from the Brahmaputra valley, a region of attraction, bearing kaolin pottery into a region of relative isolation where the neolithic peasants inhabit. Learning of technique of decoration by cord impression from the neolithic people. Borrowing stone celts either for their functional or symbolic value. Occasional clay modelling of stone celts.

Accepting the contemporaneity of neolithic phase of Sarutaru with that of Ambari culture at Marakdola we shall provisionally attribute a date about the beginning of the Christian era for the Neolithic Sarutaru. This date is evidently not applicable to other areas in north-eastern India when we realise that the neolithic culture had a differential distribution in time and space.

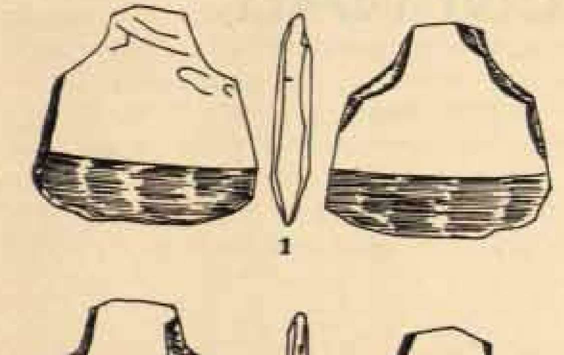

Fig. 1. Polished stone axes

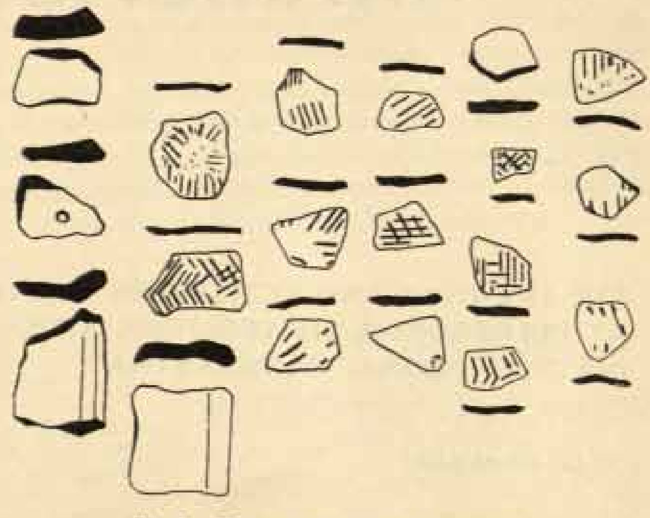

Fig. 2. Pottery with incised designs

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INAMGAON SEMINAR

THE LIFEWAYS AND SETTLEMENT PATTERN AT INAMGAON, A CHALCOLITHIC SITE, DISTRICT POONA, MAHARASTRA

□H.D. Sankalia*

Any archaeological excavation, vertical or horizontal, will throw up objects which will give some idea of the life of the people to whom they belong. But a fuller picture can only be had, if all *the* objects—useful or otherwise—are gathered contextually and their relation discussed at the *end of the day*.

The settlement pattern, that is, the way, method or plan, according to which the site being excavated was inhabited, can again be understood only if the ground plans of a number of houses are exposed. It is essential that these must be contiguous, that is, the trenches, squares, and cuttings must be all in one defined area and not scattered all over the mound.

At Inamgaon, situated on the right bank of the Ghod river, a tributary of the Bhima, Taluka Sirur, District Poona, at a distance of some 85 km. from Poona, our objectives were definite, right from the outset. We did not want a timetable of cultures. This was fairly well known. Hence the suggestion that we should have one long trench across the mound, in Wheelerian fashion, was not adopted. Instead, as at Navdatoli, right from the beginning, one end of the eastern mound, INM-II, upto Md. I was selected. The area selected was divided into a grid.

All my colleagues were instructed beforehand in a special lecture at the Deccan College, how we were to dig, and how we were to proceed day by day. Instead of a general pottery yard, which serves only a chronological purpose, separate pottery yards for each house excavated, were suggested. While exposing a ground plan, the excavators were advised to note (it they could), how bones were found—in one corner of a would be house, or spread all over—be, cause this small detail, if carefully observed while excavating, might tell us whether the occupant of the house, observed sanitary principles and kept the remains of the animal butchered, or the meat eaten by the family, in one corner, or threw it all over, or in a refuge pit.

The same specific instructions were given for collecting pots and potsherds. These, if collected housewise, might help tell us the number of pots and pans each family had, so that we might infer about the size of the family.

From these detailed collections, we might also know the social organization—differences between the families occupying one definite area in the mound.

With the help of the small but very experienced team consisting of Dr. Z.D. Ansari, Dr. M.K. Dhavalikar, Shri Y.S. Rasar, and Shri C.G. Padwal and expert assistance from Dr. S.N. Rajaguru, Dr. R.V. Joshi, Shri

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M.D. Kajale, Dr. G.G. Majumdar and Dr.G.L. Badam, we are able to tell you *something* about the bio-archaeology of Inamgaon.

Our provisional conclusions are placed before you. We shall feel thankful to you for your suggestions. I may mention, that there is nothing particularly novel about the plan and method we have followed at Inamgaon. These come by experience and working on the finds. The idea of housewise collection of pottery nay, in fact all finds, came when I was working on the thousands of blades from Navdatoli, as far back as 1964. Even now I feel that had we followed the methods we adopted at Inamgaon, a much better picture of the life of Navdatoli would have been available than its houses and beautiful pottery.

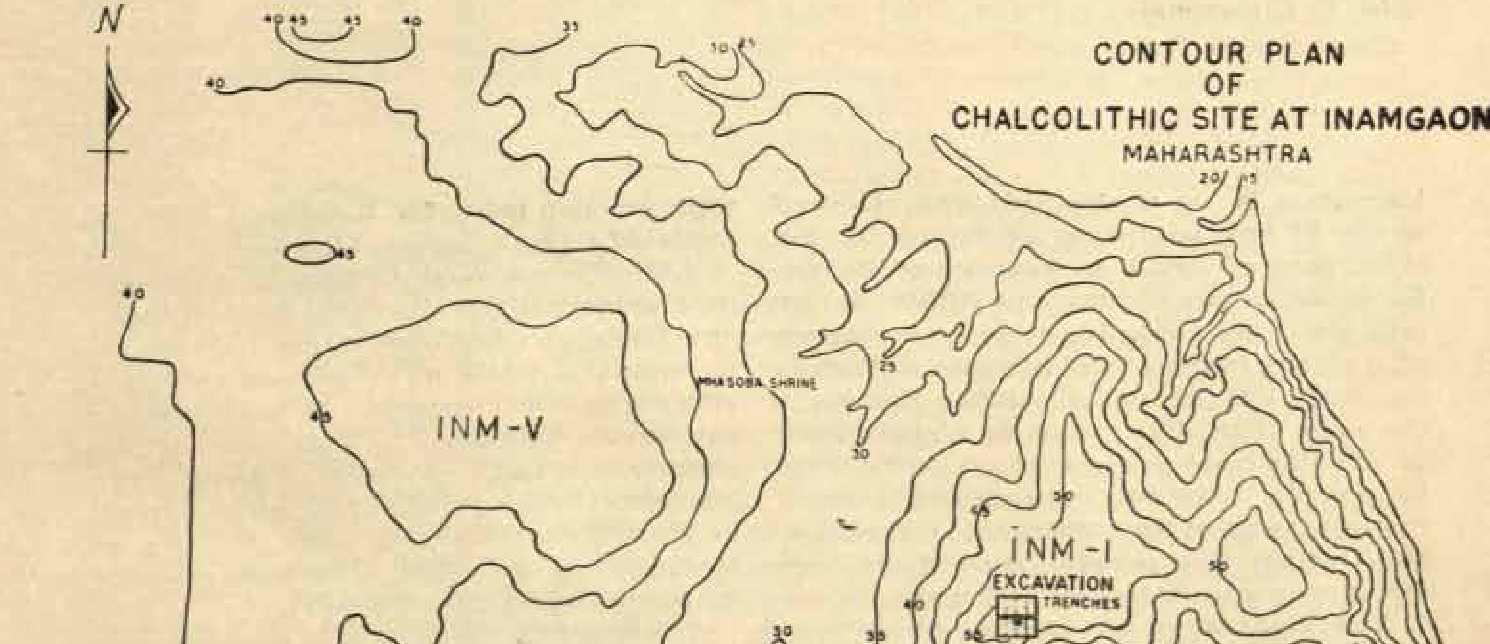

Fig. 1.

INAMGAON : THE PATTERN OF SETTLEMENT

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Inamgaon is a chalcolithic site located about 85 km southeast of Poona, on the right bank of Ghod, a tributary of Bhima. Six seasons' work at the site (1969-75) has brought to light valuable evidence in respect of the early farmers of Maharashtra (Sankalia, Ansari & Dhavalikar, 1975). Since it is the only chalcolithic site in Maharashtra which has been excavated on sufficiently large scale, it has become possible to study many aspects of the chalcolithic cultures of the Deccan. The present paper deals with the settlement pattern of Inamgaon.

The study of ancient settlement patterns has not so far been carried out in India, but it occupies an important place in the Western world, more particularly in American archaeology. The concept of settlement pattern is borrowed from Geography and its application in Archaeology is quite recent and Jevery A. Sablati (1974:149). An excellent definition of the term has been given by Gordon R. Willey who define it as "the way in which man disposed himself over the landscape on which he lived. It refers to dwellings, to their arrangement, and to the nature and disposition of other buildings pertaining to community life. These settlements reflect the natural environment, the level of technology on which the builders operated, and various institutions of social interaction and control which the culture maintained. Because settlement patterns are, to a large extent, directly shaped by widely held culture needs, they offer a strategic starting point for functional interpretation of archaeological cultures."

Although we must confess at the outset that no chalcolithic site in the Deccan, including Inamgaon, has been excavated on such an extensive scale as to provide thorough information in respect of protohistoric settlement patterns in this part of the country, we think we have evidence from Inamgaon which is helpful, to some extent, in visualizing how the early farmers of Maharashtra disposed themselves over the landscape on which they lived.

The first and the foremost question that we must address to ourselves is why Inamgaon is located where it is, or, in other words, why was the site selected for habitation by the chalcolithic people. This question becomes significant when we take into consideration that, next to Daimabad, Inamgaon is the largest known chalcolithic site in Maharashtra. And what is more, even the earliest settlement at the sitet, hat of the Malwa Culture—which flourished from *circa* 1600-1400 B.C.—is considerably extensive. The size of the habitation increases during the Early Jorwe period, but it again shrinks in the Late Jorwe period. It is important to note that whereas almost all the chalcolithic sites in the Tapi and the Pravara-Godavari valleys were deserted around 1000 B.C., the habitation at Inamgaon continued till *circa* 700 B.C. The duration of three cultural periods is as follows:

Period I—Malwa (*circa* 1600—1400 B.C.)

Period II—Early Jorwe (*circa* 1400-1000 B.C.)
Period III—Late Jorwe (*circa* 1000-700 B.C.)

Environment

The ancient site is located in a meander of the Ghod, a tributary of Bhima. Across the site, on the left bank of the river, we see an outcrop of the columer basalt which has caused the meander, and, consequently, a large pool of water has been formed. This was the perennial source of water to the chalcolithic people of Inamgaon as it is now. Geologically, the region around Inamgaon forms part of the Deccan trap, and is characterised by stcny uplands and rugged valleys, but the boundaries slope into more open plains towards the river. The uplands have, in some cases, tracts of black cotton soil which is very productive even with a very scanty rainfall. The area along the river, up to its confluence with Bhima, 15 km downstream, has a fair share of rich black cotton soil, but for which the soil cover is very thin. Consequently, the region is very sparsely wooded and the vegetation cover is Xerophytic *acacia, caparis,* tamarind, etc. It was more wooded some fifty years ago, but in recent times serious depletion of vegetal cover has taken place as a result of felling trees and clearing land for agriculture and overgrazing which, in its turn, has affected the fauna. The region is now semi-arid because of scanty rainfall which averages 40 cm, but because of the construction of a dam some 20 km upstream at Chinchani the picture is changed. The principal crops today are *jowar*, (*Sorghum vulgare*), Bajra (*Penicillaria spicata*), wheat, *kulith* (*Dolichos biflorus*) etc. Rice is also grown in small plots.

Pattern of settlement

In the course of six seasons' work at Inamgaon we have laid bare about 60 houses of different periods. Of these, the majority (39) belong to period III and the rest to periods II and I. The earliest settlers at the site first selected a spot quite close to the river, just on the right bank as the location of mound INM II shows (Fig. 1) Nevertheless, the Malwa occupation, which was semi-circular in shape (INM I-IV), was quite extensive, for the remains of this period have been found in all the localities except at INM V. There, however, does not appear to be any planning in the Malwa settlement: the houses, though spacious, were situated close to each other in a haphazard manner and even dwelling pits were dug by the side of mud houses. The pit houses, however, disappear in the succeeding Period II. The Early Jorwe (Period II) houses were large rectanguler structures and there appears to be some modicum of planning of the settlement during this period (Fig. 2). The houses were situated about a metre and half from each other, the intervening space forming a sort of road or lane. The Early Jorwe settlement was very extensive; it was spread over the entire site save INM II which was occupied only during Period I. The alignment of the houses suggests that it was a linear settlement. All the mounds (INM I-IV) are situated in a semi-circular fashion. INM V, however, is situated 150 m west of the main habitational area (Fig. 1).

The houses of Periods I and II were rectangular on plan; they had walls made of split bamboo which were plastered with mud and cowdunq. The roof above was probably conical. But the house plan undergoes a drastic change in Period III when small round huts were built. The late Jorwe habitation was a nucleated settlement with clusters of round houses and the entire habitation from above would have looked like a veritable beehive (Fig. 3). The huts were tightly spaced units, almost nestling with each other and the open space in between the two huts was hardly a metre. Considering the fact that in a traditional Indian house the most important part is not the house but the courtyard where most of the family's life was lived, it is surprising that only a few Late Jorwe houses have a courtyard. It, therefore, seems highly likely that each cluster of huts had a common court-yard which was used for private as well as community purposes.

An important feature of the settlement was a huge diversionary embankment (240 m long and 2.25 m wide) which was constructed during the Early Jorwe period. It was built near INM V in a north-south direction. The wall was constructed of rubble set in mud mortar at the base whereas the upper part was probably earthen. Its height may have been 3 m. A channel (4 m wide and 3.50 m deep) was dug almost parallel to it. Our recent investigations show that this was actually a storage tank dug by the people.* The flood water could be stored in it and was utilised for irrigating fields nearby, the excess water being drained through the stream on the south.

Community pattern

The evidence from excavations shows that the houses of craftsmen like, the potter, the goldsmith, the ivory-carver, etc., were situated on the western periphery of the principal area of habitation (INM I). This was the case during the three periods of occupation. The craftsmen's quarter was located on the left of the entrance to the settlement. It is interesting to note that the same pattern prevails even today in the villages in Maharashtra. A noteworthy feature of these houses is that most of them have pit-silos in them for storing grain. The pit silos first appear in Period I and continue in the succeeding periods. An average pit is a metre deep and has a diametre of 1.5 m. The pit silos were used for storing coarse grain, like barely and *kulith* (*Dolichos biflorus*), wheat, as is the case today, is not stored in pits because it cannot stand the heat underground. The craftsmen may have been paid in the form of grain—and that too coarse grain-like barley and *kulith*—for their services to the community. This reminds us of the *Baluta* system which was in vogue in Maharashtra till recently. Under this system the craftsmen, like the potter, the cobbler, the blacksmith and others were paid at the time of harvest once a year for their services. Traditionally, there were 12 such *balutedars*.

*For discussion, see S. N. Rajaguru's article on "Geoarchaeology of Inamgaon" in this issue

In the central part of the main habitation area, a few houses of the Early Jorwe period were exposed. They were rather well made and were in a better state of preservation. House No. 38 belonging to the middle phase of Period II was the most complete one of its kind; it had successively repaired floors and there was also arrangement for draining out rain water. In the same area, but in an earlier level, was another house which, though considerably disturbed, yielded a mother goddess in a clay box, a goddess without head and a bull all deposited in the southwest corner of the house in a hole (Dhavalikar, 1976). All these objects are of unbaked clay and were obviously made for occasional use. Even the Late Jorwe houses in this area were in a better state of preservation. A round house, having a diametre of 4.30 m is the largest structure of Period III.

The Early and the Late Jorwe house in this area usually had a set of four flat stones which served as supports to a huge four legged storage jar. Some houses had two sets of such stones. Sometime the legs of the jar were plastered with mud to the ground. Some of the larger houses of the Malwa and the Early Jorwe period had a circular mud platform for supporting a storage bin. This would suggest that the people living in the central part of the main settlement area (INM I) were better off than those living on the periphery.

Burials

The dead were buried inside the house and very rarely in the courtyard. Usually, the adults were buried in an extended position whereas the children were accommodated in two coarse, handmade red/grey ware urns, placed horizontally mouth-to-mouth in a pit. The pit for both adults and children was dug into the house floor and very rarely in the courtyard of the house. This was probably done because the people desired to have the departed soul within the precincts of their residence. In the case of adults the portion below the ankle was deliberately chopped off because the people probably did not want the dead to go away. This can be explained as the fear of the dead who usually was supposed to turn into a ghost, for the very idea underlying the burial in a pit below the house floor or a cairn was motivated by the fear of the deceased ghost soul, and those who were living always tried to control the actions of the ghosts of the dead.

Adults as well as children were buried in a north-south direction with the head towards north and the legs towards south. In the burial pit we usually come across two vessels, a carinated bowl and a spouted jar, both of the painted Jorwe fabric. They must have obviously contained food and water, respectively, for the dead. More than two vessels have also been found in some of the burials, but in a few cases no vessels of any kind were found. This may be betoken of the economic conditions of the family. But the most interesting and unique is the four legged urn burial which was found in the largest, five roomed, house unearthed so far. It belongs to the end of the Early Jorwe and the beginning of the Late Jorwe and can therefore be dated to *circa* 1000 B.C. (Pl.VIIA). The urn is made of unbaked clay and has four short legs. It contained the skeleton of a male, about 35 year old, placed in a sitting posture. But the portion of his legs below the ankles was not chopped off as usual and he therefore appears to be a most important person in the settlement, probably the ruling chief or priest. Inside the urn were a spouted jar and a bowl, the former was painted with a boat design which is significant in the light of current Hindu belief that the departed soul has to cross waters in a ferry on way to heaven.

Granary

A unique structure was encountered close to the craftsmen's quarter but not far from the elite area which is located in the central part of the habitation (Fig. 2 : H. No. 50-51). It is a squarish structure (10.5x9.15 m) partitioned into two rooms by a reed screen which, however, appears to have been removed to make room for storage bins. The structure had low mud walls, not more than 30 cm in height, over which was the mud plastered bamboo screen, the impressions of which have been traced. The structure contained a number of pit silos (6) and round mud platforms (7) for storage bins of various sizes, all disposed in very orderly fashion for storing different kinds of grains; such mud platforms are even today seen in the houses in Inamgaon which are used as supports for storage bins. In some cases the sides and the bottom of the pits were lined with lime whereas in case of others the bottom was full of sand. No remains of grains, however, were found in the pits. The structure is open on north and partly on east where only post-holes are to be seen.

In the southern half of the structure there were two large fire pits, one (2.18 × .77 m and 42 cm deep) near the southern edge and the other (1.30 m × 72 cm and 35 cm deep) near the eastern periphery where there was no wall. Both of them had in the centre of the base a large, flat round clay lump possibly for keeping the receptacle which, however, was missing. But a similar fire pit unearthed in the Malwa levels had the broken base of a huge storage jar well embeded in the centre of the pit. The sides and the bottom of both the pits were completely burned hard indicating their long use. The existence of such large fire pits inside a structure suggests that they were probably connected with the religious ideas of the people (Dhavalikar, 1976).

The number of pit silos and the mud platforms for storage bins indicates that the structure could have been a granary. With the identification of the structure as a sanctuary for fire worship the existence of so many of pit silos and platforms for bins can be explained easily. The people must have paid tribute and made offerings in the form of grain which was stored in the silos and bins. This, in its turn, is betoken of organized religion with a priest-chief. It may not be out of place here to state that there is convincing evidence in archaeological record which demonstrates the transition from temple to palace because "the increasing wealth in the temples offered vastly greater inducements to military activity." (Adams, 1972 : 361)

House of the ruling chief

Just to the north of the granary and almost adjoining it was found a large house consisting of five rooms of which one was a kitchen and the other, a store room (Fig. 2; H. No. 52-56). The house had a well plastered floor and it covered an area of 25×10 m. In the court-yard of the house was found a symbolic burial consisting of one full and the other half four legged, unbacked urns which contained a Jorwe Ware painted jar covered with a lid. n the same area was found a similar four legged urn containing a human skeleton which belonged to the end of Early Jorwe and the beginning of the Late Jorwe. Hence the former can be identified as a symbolic burial since it did not contain any mortal remains. The elaborate burial and the multi-roomed house can be identified as that of the ruling chief since all other houses so far discovered are single room units. Moreover, its proximity to the granary also indicates that he collected the taxes from the members of the community in the form of grain and stored it in the granary by the side of his house (Dhavalikar, 1975).

In conclusion, we can say that Inamgaon offers a classic example where the people flourished even in the adverse circumstances. The site is not situated in fertile alluvial tract as is the case with Daimabad or Prakash : the chalcolithic farmers, there-

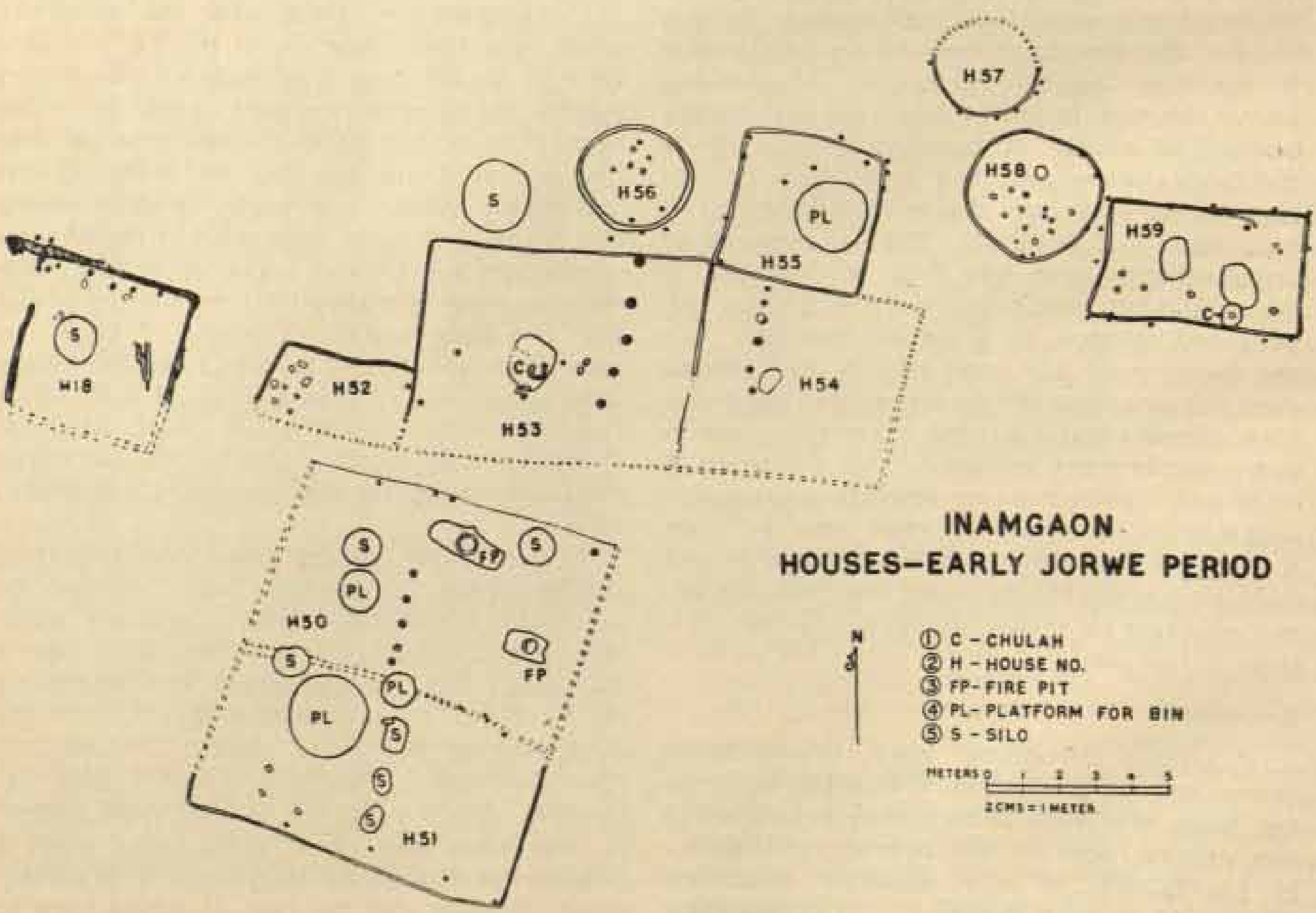

Fig. 2.

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fore, may have cultivated the black soil (Dhavalikar, 1974). This, coupled with the facility of artificial irrigation, must have made adequate food production possible. The availability of native copper at Rashin in the neighbourhood may also have been an important factor in the selection of the site. Raw material for stone tools was available in plenty. But we do not know whether Inamgaon was a contre of cattle trade as the adjoining village of Kashti is today. All these factors would have led to the prosperity of Inamgaon.

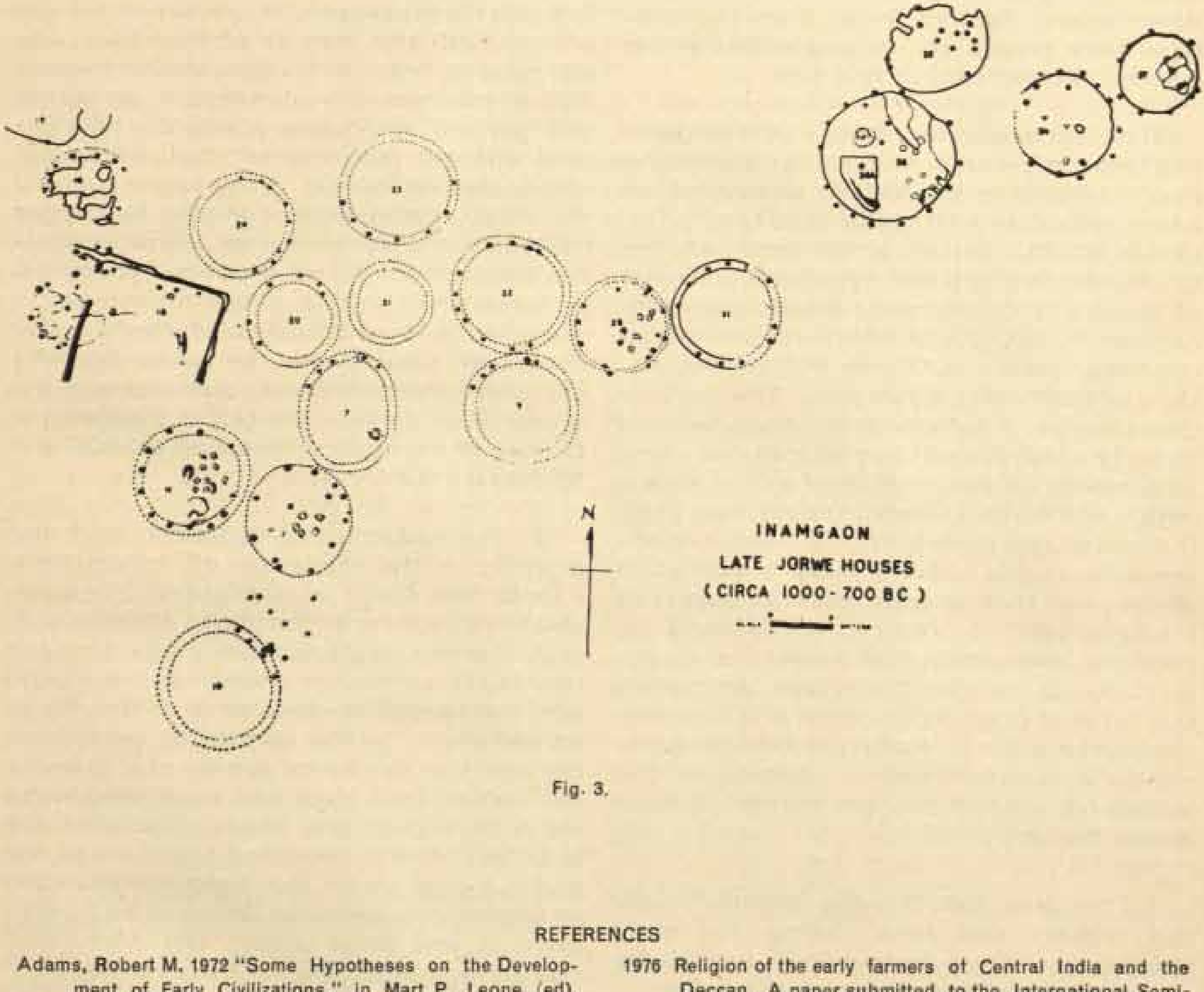

Fig. 3.

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GEOARCHAEOLOGY OF INAMGAON

During archaeological investigation, a study of any site within its own ecosystem throws considerable light on man-land relationships in the past. Our geo-archaeological studies around a chalcolithic settlement of Inamgaon have shown that the material prosperity of this site cannot be explained solely by the general law of environmental determinism. Factors other than the ecology have played an important part in the cultural development of this site.

The chalcolithic habitation of Inamgaon has taken place on a low (14 m above the river bed) terrace-like surface developed on a late Pleistocene fill of the river Ghod. The extent of alluvium on either bank of the Ghod is limited (0.5 km) by rolling plateaux of basalts of Createaceous-Eocene age. The climate is semi-arid with mean annual rainfall of about 400 mm and the vegetation is thorn and scrub type. The present Ghod carries floods with a water depth of 10 to 12 m for 3 to 4 days almost every year as a result of intensive rains in the source region of Western Ghats. During long (8 to 9 months) dry period of the year it is the pools developed in the present gravelly bed of the river that provide assured supply of drinking water. In order to understand the possible changes in the modern environment during the late Quaternary we carried out detailed geomorphological and palaeontological studies in the Ghod valley in general and around Inamgaon in particular. The salient features of the geomorphic history are as follows :

1. The Ghod was flowing slightly below the present bed level during the early Quaternary. The depositional record for this period is almost absent in the valley.

2. The late Pleistocene (*circa*. 40,000—*circa*. 10,000 yrs. B.P.) is well represented by the fluvial deposits ranging in thickness from 10 to 20 m. The mineral characters, such as dominance of montmorillonite in the calcreted, oxidized and brownish sediments and a few pollen grains of *Eugenia Acacia* and abundance of Holoptelea (Mittre and Gupta: 1976) from them indicate that the climate was essentially semi-arid in the major part of the valley. The field characters such as bedding and interfingering of colluvial deposits with the alluvia strongly suggests accelerated fluvial activity in the entire length and breadth of the valley possibly due to recurrent intensive storm rains during the monsoon months. It is during this general alluviation phase the herbivorous animals like elephant, bull, horse and hippopotamus existed in the lower parts of the valley. Occurrence of Middle and Upper Palaeolithic tools made on cryptocrystalline silica in the fluvial deposits proves the presence of early food gathering cultures in the area. A few C^{14} dates of fresh water molluscan shells from the fluvial deposits and the palaeontological characters of the animal fossils place the Upper Palaeolithic Culture of Inamgaon in between 20,000 and 10,000 yrs B.P.

3. The reduction in sediment load and possibly in the frequency of storm rains caused the Ghod to straighten its course and to rejuvenate in the Early Holocene. It is during this degradational stage that the river cut down to the present bed level and left the terrace surface of the late Pleistocene alluvia to the pedogenic processes. During this period of geomorphic stability the vertisol type black soil developed in the major portion of the valley. The black soil is at least 4 to 5 thousand years old as the soil is buried under the habitational debris of Chalcolithic period at Chandoli and Inamgaon in the Ghod valley. The Mesolithic culture existed during the Early Holocene.

4. The Ghod had an entrenched course more or less like that of today at a time when the Malwa people settled in the Ghod valley by about 3,604 yrs B.P. The perennial pools in the gravelly bed of the Ghod and

the lightly forested open valley plains with black soil cover provided ideal environment for early food-producers in this area. Owing to the entrenched nature of the course there was no major flood danger to the Malwa settlement.

5. Sometime between 1200-1000 B. C. the Ghod seemed to have acquired an aggradational tendency. This is indicated by the dark-brown, faintly laminated silty deposits occurring up to about 12 to 14 m above the modern bed level of the Ghod at Inamgaon. These deposits have yielded a few Jorwe potsherds and have formed an inset terrace cut into earlier late Pleistocene surface. One of the arms of the braided course of the Ghod was flowing 30m south-west and had shifted more towards the Early Jorwe settlement in the western corner of the mound. Owing to the shift in the course and due to the shallowness of the banks the settlement was threatened by the recurring monsoon floods. The Early Jorwe people, therefore, constructed a stone embankment or a guide bund in northwest-southeast direction for a distance of about 300 m and dug a diversionary channel, 100m long, 5m wide and 2.5 m deep, on a flat divide separating rill system of the inner bend of the meander loop of the Ghod. The embankment and the channel not only protected the settlement from the recurring annual floods but also served as a water storing system with a capacity of about 54,000 CFT. There is a strong possibility of the use of stored water for irrigating nearby fields to produce winter crops like wheat, barley, lentil, peas, etc. It is possibly the first evidence of irrigation system of Early Jorwe times, so far discovered in India.

6. The Ghod acquired its present entrenched form sometimes in the post-Chalcolithic period and developed low floodplains varying in height from 3 to 5 m above the modern bed level. The reasons for Early Jorwe aggradational phase in the Ghod are not yet clear. Biological evidence obtained from the excavations at Inamgaon does not suggest any change in the semi-arid climate. It is then possible to have a change in the flood regime due to excessive supply of finer sediment load due to excessive soil stripping on the slopes of the valley. The soil denudation might have been due to men's interference with vegetation in the form of cultivation, livestock grazing and forest clearance during chalcolithic times. The higher floods during Early Jorwe times, therefore, indicate a temporary disturbance in the quasi-equilibrium conditions of the Ghod. Once the disturbance was absorbed the Ghod returned to its normal rejuvenated form.

Thus the ecological setting of Inamgaon characterized by high variability of rainfall and consequent threats of droughts, availability of only narrow (less than 0.5 km) alluvial strips for cultivation and absence of any known nearby source of economically important raw material such as copper, was not congenial for the existence of rich chalcolithic culture for about 900 years. On the other hand Chalcolithic sites like Chandoli (R. Ghod), Songaon (R. Nira-Karha) and Nevasa (R. Pravara) are situated in more congenial eco-zones. The rainfall at these sites is assured and the alluvial flats, with higher agriculture potential, are rather wide (about 1.5 km). In spite of these advantageous environments these sites remained poor self-sufficient villages which could not develop to the level of Inamgaon in respect of the habitational area as also the material equipment.

It is, therefore, necessary to probe deeper into the problem of man's cultural development during chalcolithic times in western Maharashtra by considering factors other than environment, such as social, economical and political organizations.

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PLANT ECONOMY AT INAMGAON

The botanical remains excavated from three successive cultural periods (Malwa, Early Jorwe, and Late Jorwe respectively) of Chalcolithic Inamgaon include carbonised of cultivated and wild plants along with a piece of uncarbonised floor material.

Cultivated assemblage comprises wheat barley, rice, lentil, horse-gram, hyacinth bean (wal), grass pea, pea, moong/urd. Wild seeds include those of wild-date, ber, Jamun *(Syzigium cumini* Linn.) and Beheda (*Terminalia belerica* Roxb.) A few unidentifiable fruits and a seed of water plant are also noteworthy. On microscopic examination the uncarbonised floor material has revealed the presence of epidermis, cortex and fibres. Its detailed identification and factors responsible for such an interesting preservation are under investigation.

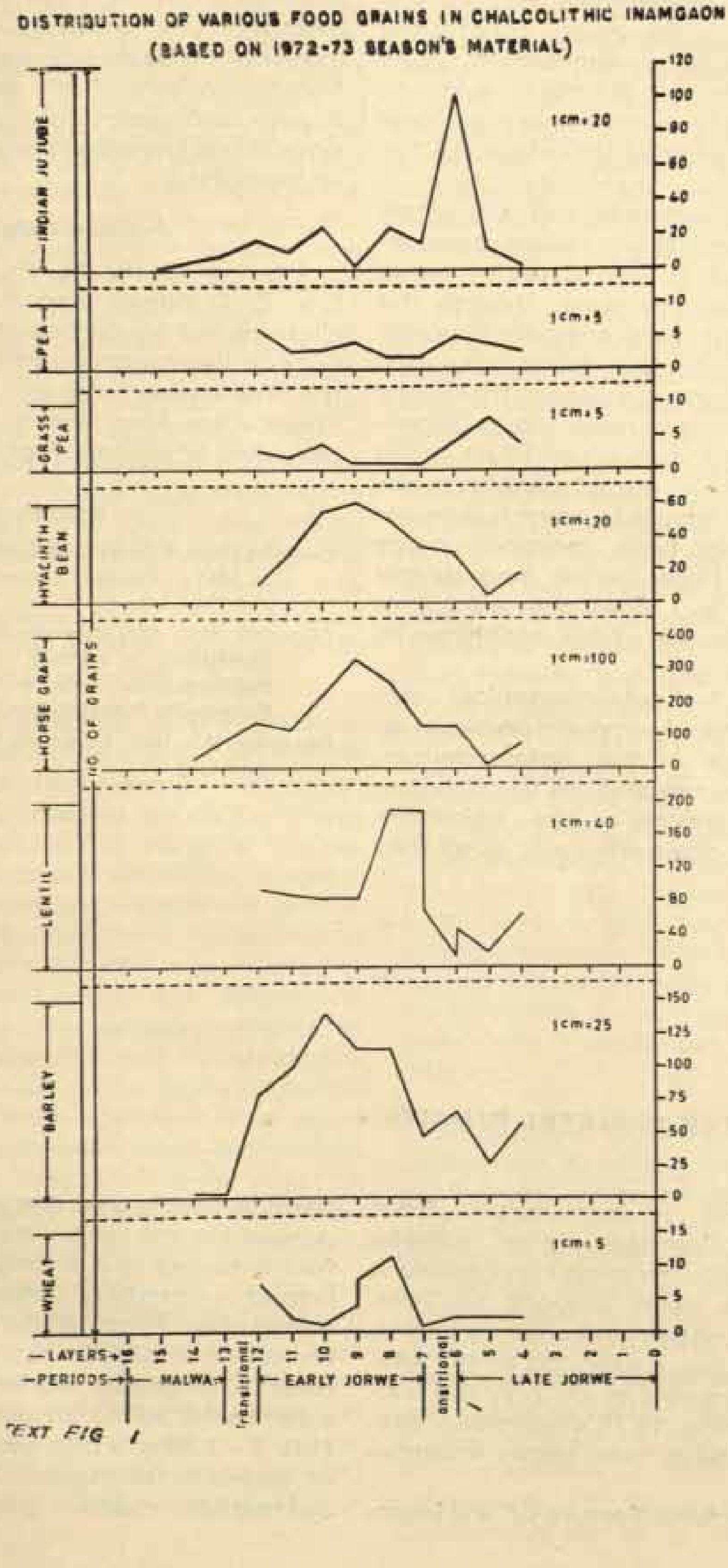
The grain assemblage has been subjected to rigorous statistical analysis for knowing the frequency of diffrent grains in various trenches, layers and houses of the three cultural periods. Variation existing in a few species of grains has been analysed in terms of histograms. (on pp. 55 and 60)

All the grains exhibit maximum concentration in period II thereby indicating richness of agricultural activity in early Jorwe culture. It is also corroborated cultural findings such as pottery, beads, etc. All the type of grains except ber are represented in period III in reduced quantities. The frequency of ber increases considerably in period III. This is probably due to the decline of agricultural activities in the Late Jorwe period (Fig. 1). Cultural antiquities collected from this period also suggest general deterioration in Late Jorwe culture (Dhavaikar, 1974)

It is interesting to see that maximum plant economy has been represented in out house area of the excavated mounds. Out of a total fifty-nine house, only nine have yielded plant remains. Amongst these nine houses, two are from Malwa, four from Early Jorwe and three from Late Jorwe periods. House numbers fifty one to fifty six have yielded maximum grains and probably belong to a rich member of Chalcolithic community (Fig. 2). The material evidence gathered from these houses suggests that it was a habitational area of rich sector of the community (Dhavalikar, 1976).

The meagre quantity of moong/urd and grass pea indicates that these might not have been cultivated on large scale. Wheat is represented by a single grain in Malwa period while it appears in appreciable quantity in Early Jorwe period and continues upto Late Jorwe cultural layers with the exception of 5th one. Barley is a dominant crop right from Malwa to the Late Jorwe period. It seems that barley cultivation was preferred to wheat since the frequency of barley is 21 times that of wheat. Rice appeared for the first time in 5th layer of trenches C6 and D4. Its presence need not necessarily indicate rice cultivation around the site. The Chalcolithic people might have brought it to the site from upstream regions of Ghod river where greater rainfall (more than 750 mm) and topographic conditions favourable for its natural growth and cultivation are found. The occurrence of wild grains of Beheda (*Terminalia belerica* Roxb.) and Jamun (*syzigium cumini* Linn) characteristic of moist deciduous forests of upstream region is also suggestive of intercultural communications of Chalcolithic people of Inamgaon with Ambegaon, Junnar, Hiwre-Kushire, etc. The above mentioned wild plants are not the naturalised members of the thorn and scrub surface flora of present day semi-arid Inamgaon.

Cultivation of two cereals (wheat, barley) and four pulses (horse-gram, hyacinth bean, lentil, pea) in Chalcolithic times suggests that the farmers had made use of available water resources very intelligently. Even at present, when modern agricultural technologies are available, the Inamgaon farmers do not cultivate so many grains. Thus there exists a difference in the past and present crop pattern which needs to be explained


DISTRIBUTION OF VARIOUS FOOD GRAINS IN CHALCOLITHIC INAMGAON
(BASED ON 1972-73 SEASON'S MATERIAL)
INDIAN JUJUBE
1cm=20
PEA
1cm=5
GRASS PEA
1cm=5
HYACINTH BEAN
1cm=20
HORSE GRAM
1cm=100
NO OF GRAINS
LENTIL
1cm=40
BARLEY
1cm=25
WHEAT
1cm=5
LAYERS
16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
PERIODS
MALWA
Transitional
EARLY JORWE
Transitional
LATE JORWE

TEXT FIG 1

in terms of proper perspectives of man-land relationship which in turn constitutes the ecosystem. In this connection, it is worthwhile to refer to a unique evidence of a guide bund and a diversionary channel of the Early Jorwe period (Dhavalikar, 1975). It is quite likely that Chalcolithic farmers might have taken advantage of the water stored in this channel and raised successfully the crops, such as wheat, barley, lentil, pea, hyacinth bean, etc. even though the chalcolithic climate was essentially semi-arid as at present. Our reconnaissance survey around Inamgaon suggest that there were no highly attractive ecological incentives for successful cultivation of all these crops. It would not be out of place to guess that the Chalcolithic people were intelligent enough to cultivate both monsoon crops (hyacinth bean, horse-gram) and winter crops (wheat, barley, lentil, pea, etc.). Probably they were aware of the technique of rotation of crops also.

In conclusion, the palaeobotanical evidence at Chalcolithic Inamgaon presents an incomplete picture of the palaeoenvironment of the lower reaches of Ghod valley. The qualitative aspects of the palaeoenvironment and its fluctuations (if at all they have occurred) in three cultural phases at Inamgaon are complex and difficult to unravel on the basis of the seed remains alone. Substantial help from palynologists, pedo logists and geomorphologists may help in unravelling the palaeoenvironmental history of Inamgoan.

Acknowledgements

I am greateful to Prof. H. D. Sankalia, Drs. Z. D. Ansari and M. K. Dhavalikar for allowing me to participate in their excavations at Inamgaon and for entrusting to me the interesting material for investigation. Thanks are also due to Prof. S.B. Deo for providing laboratory facilities.

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INAMGAON—HUMAN SKELETAL REMAINS

During the course of excavations from 1968 to 1975 at Inamgaon rich material evidence for an early farming community in Maharashtra has been brought to light. Besides houses, pottery and charred grains, 70 burials have been exposed at the site. However, in the present study only the burials recovered during 1975 excavation season (see Table 1) have been taken into consideration.

The most important feature of the Inamgaon burials is that one skeleton of the Late Jorwe period, with its feet intact, was found buried in a sitting posture in a four-legged urn made of unbaked clay. The total complex of features exhibited in this burial are without parallel in the Indian sub-continent. This unique burial (Inm-59) is of an adult male, 30 to 35 years old. Its stature (162.7—3.62cm) falls well within the range of variation for stature among both Chalcolithic and modern populations of Maharashtra. The cranial index (77.8) falls within the mesocranial category. Its cranial capacity was estimated at 1,336.7 cc. Lukacs and Badam, 1975; Lukacs and Badam, in Press) The morpho-metric characters of the skull include the sphenoid shape of the cranium, well developed parietal bones, slight concavity of the nasal bones, prominence of glabellar region, poor development of the supra-orbital ridges, sub-rectangular form of the orbits, parabolic shape of the dental arch, robust mandible, sturdy construction of the symphysial region, etc. The medium stature, low mesocranial value, narrow forehead, bizygomatic width, absence of aveolar prognathism, medium cranial capacity and the general form of the skull compare very well with other series reported from Nevasa, Piklihal, Langhnaj, Brahmagiri (Neolithic), Harappa, Bagor, etc. In terms of the racial affinities, the Inamgaon specimen conforms to the type generally referred to as "Mediterranean".

Pathological conditions of the dentition which plagued the burial (INM 59) include antemortem tooth loss, severe caries formation and heavy calculus deposits. These conditions are probably attributable to masticatory stress imposed on dental structures by a diet composed primarily of grains. The pathological conditions observed in this specimen are largely age related in their mode of occurrenes. The calcareous fine deposition on the alveolar margins of the gum area suggests a long standing condition of the spongy gums. Decalcification of the vertebrae is also marked. It is acentuated more by temporal decay. Such absorption sugests an illness of some duration requiring recumbancy in bed for a long time before death.

Another individual (INM 68) unlike the specimen from burial No. 59 was entered in the more traditional extended burial posture. The gracile anatomical details of mandibular morphology and the dental eruption pattern indicate that this specimen represents a young female, and the estemated age at the time of death is between 18 and 20 years.

Another individual (INM 67) shows a peculiar lesion of osteoperiostitis. Its bones show signs of chronic periosteal changes which are commonly found in syphilitic disease. Such bony changes may in some cases be caused by pulmonary osteodystrophy, or by an occupational stress of smoke and dust giving the person that morbidity ultimately leading to death.

In general, the craniometric data for the Inamgaon specimens are slightly at variance with those reported for the skeletal series from Chandoli and Nevasa where the predominant cranial form is dolichocranial in contrast to the mesocranial values for the Inamgaon meterial. Values for cranial height reported at Inamgaon are also low in contrast to the Nevasa series. If we examine skeletal series beyond the Deccan for comparison, the Inamgaon specimens show closest affinities with Neolithic specimens from Piklihal. The Imagaon cranium (INM-59) approaches the values for cranial length—breadth index exhibited by the series from Brahmagiri (a megalithic site in peninsular India) and Harappa. In contrast to the Navasa mandibles, the specimens from Inamgaon (INM-59, INM-67 INM-68, etc.) are smaller in every dimension except symphysial height and ascending ramus minimum breath. In dental morphology, similarities between Inamagaon and Nevasa are exhibited in maxillary hypocone development and mandibular cusp and groove patterns.

A detailed analysis of the Inamgaon specimens, therefore, throws considerable light on the range of phenotypic variation and the nature of dental pathology of Chalcolithic populations in western India. The individuals exhibit a slightly novel phenotypic pattern in contrast to that previously reported for prehistoric populations of the Deccan plateau. Since the new features are within the expected range of variation for a given population, the present specimens are considered as part of the indigenous population of Western India during the Chalcolithic period.

TABLE 1—Burials yielding Human Skeletal Remains at Inamgaon (Locus INM-1)*

	Burial No.	Age	Sex	Trench	Sealed by Layer
End of EARLY JORWE (Period IIa)	61	Child	?	C^7	6
	68	18-20	F	C^3-D^3	6
Beginning of LATE JORWE (Period IIb)	58	Child	?	D^7	5
	59	30-35	M	D^4	5
LATE JORWE (Period IIb)	63	Child	?	D^8	4
	67	Child	?	E^4	2
End of LATE JORWE (Period IIb)	64	Child	?	E^4	1

* Only burials recovered during 1975 excavation season are included here.

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FAUNAL REMAINS FROM CHALCOLITHIC INAMGAON

A large number of faunal remains from the three successive cultural periods (Malwa, Early Jorwe and Late Jorwe respectively) of Inamgaon have been discovered during the course of excavations. The fauna includes both wild and domesticated forms. The domestic animals recovered are :

Canis familiaris Linn. 1758 (domestic dog)
Elephas maximus Linn. 1758 (Indian elephant)
Equus caballus Linn. 1758 (domestic horse)
Sus scrofa cristatus Wagner 1939 (pig)
Bos indicus Linn 1758 (Indian humped cattle)
Ovis orientalis vignei Blyth 1841 (domestic sheep)
Capra hircus aegagrus Erxl. 1777 (domestic goat)

The wild species are :

Rhinoceros unicornis Linn. 1758 (one-horned rhinoceros)
Antilope cervicapra Linn. 1758 (black buck)
Boselaphus tragocamelus Pallas 1766 (nilgai)
Tetracarus quadriconnis Blainville 1816 (four-horned antelope)
Bubalus bubalis Linn. 1758 (wild buffalo)
Axis axis Erxl. 1777 (chital)
Cervus unicolor Kerr. 1792 (sambar)
Cervus duvauceli Cuvier 1823 (barasingha)

The present study is based on the work carried out in 1974-75 field season. The faunal material collected from earlier field seasons has been analysed by Dr. A. T. Clason of the Biologisch—Archaeologisch Institute, Groningon, which is being published as a monograph, (Clason, in press).

Preservation of bones

Of the several hundred bones collected, the preservation in many cases is reasonable but often the bones are soft and break easily on handling, for instance, some teeth break into many small fragments making it imposible to determine as to how many teeth they represented and to which species they belonged. The epiphyses of long bones, vertebrae, phalanges, astragalii, etc. are generally completely preserved. Jaws of animals are not uncommon. Rest of the material was generally fragmentary but in some cases not beyond reconstruction. Some bones were fractured showing cutting marks, some had been in contact with fire. Most bones are covered with a thin crust of grey material that is often difficult to remove.

Discussion of the species

Cattle are the most predominant species followed by sheep/goat, deer and pigs. Horses, dogs, elephants and rhinoceroses come next in that order. In addition, there are numerous fowl (mostly water fowls) and rodent bones. Rodents are burrowing animals and it is possible that they buried themselves at a later date among the prehistoric remains. Fowls are fewer in number because their bones are easy to chew.

The cattle finds from Inamgaon belong to *Bos indicus*, the humped variety. The spina dorsalis of the thoracic vertebrae, broaden dorsally, and have a cleft due to the developed hump. There is also a flattening of the medial condyle of the trochlea of humerus. The skeletal material is generally represented in the form of skull fragments, jaws, long bones and horn cores.

Nilgai (*Boselaphus tragocamelus*) is represented by a few bones of metatarsals, astragalii and horncores.

The four-horned antelope (*Tetracerus quadricornis*) is represented by two posterior horncores, with more , or less round cross-section. They are slightly curved and massive.

Osteologically, it is difficult to separate sheep from goat especially when the bones are badly damaged. The most frequently collected bones of sheep/goat are the mandibles and isolated teeth. Other parts recovered include long bones, scapulae, humerii, raddii and ulna, pelvis, femur, tibia, metetarsals and phalanges. It is not possible to say anything about the ratio in which these small ruminants were slaughtered or the numbers in which they were kept. Mandibles and maxillae collected and the unfused epiphysis of the long bones give us an insight into the slaughtering age, which range from 3 months to 2 years. It seems that the inhabitants of Inamgaon preferred these animals at very young age.

A large number of horncores of black buck (*Antilope cervicapra*) were collected. There is a possibility of some of these horncores having been used as rituals.

The deer family is represented by *Axis axis* (spotted deer or chital), *Cervus unicolor* (sambar) and *Cervus duvauceli* (swamp deer). The bones of this group collected are mainly antlers and antler fragments. Small number of mandibles, humerii, radii, phalanges, etc. have also been collected. Antler was also used as raw material for the manufacture of objects like borers and points.

Domestic dog (*Canis familiaris*) is represented by mandibles and long bones.

Indian elephant (*Elephas maximus*) is represented by phalanges, limb bones and tusk portions. The tusk portions have been used for making ivory beads.

The domestic horse (*Equus caballus*) is represented by teeth, astragali, jaws and long bones.

Amongst the bones of pig (*Sus scrofa cristatus*) collected are jaws, isolated teeth, astragali and vertabrae.

Conclusion

The presence of the above faunal assemblage at Inamgaon indicates a relatively open vegetation covered with grass and bushes and dry thorn scrub forests during the Chalcolithic period (1600 B.C. to 700 B.C.). There were probably some swamps but no dense forests.

It is difficult, on the basis of the limited material studied, to draw any far reaching conclusions about possible change in the composition of the domesticated animals in different periods. Whether they bear any evidence of local domestication is also difficult to say. The general faunal account suggests that cattle were the most important domesticated and also the most numerous slaughtered animals. Sheep/goat came in the second and deer in the third place. In some of the long bones, cutting or chopping marks are found suggesting that these animals were slaughtered for food. The presence of both wild and domesticated animals shows that the inhabitants practised both hunting and stock-raising.

The abundance of the cultural material and the utilization of the rich fauna in different ways shows that the inhabitants were self-sufficient in their economy. The presence of microliths and stone balls collected uniformly from Malwa to Late Jorwe period suggests their use for hunting by the inhabitants. The bones must have been fractured with stone hammers.

The nature of charring on most of the bones indicates that these were cooked in open fire. A big hearth in Trench C 3, Layer 7, (Early Jorwe) found might have been a community roasting centre for animals.

A detailed study of the faunal remains from some houses of Early Jorwe period indicates that the inhabitants preferred to eat flesh of the vertebrae, limb bones, girdles, jaws, etc., as these bones are more commonly found. This also hints that people preferred high value meat. A house in Early Jorwe (Trench C 3, Layer 7, House No. 52) yielded the maximum number of bones weighing roughly 6 kg. Further study on these lines can throw light on the number of inhabitants of that particular house, the number of animals slaughtered and also the socioeconomic conditions of the people living in that house.

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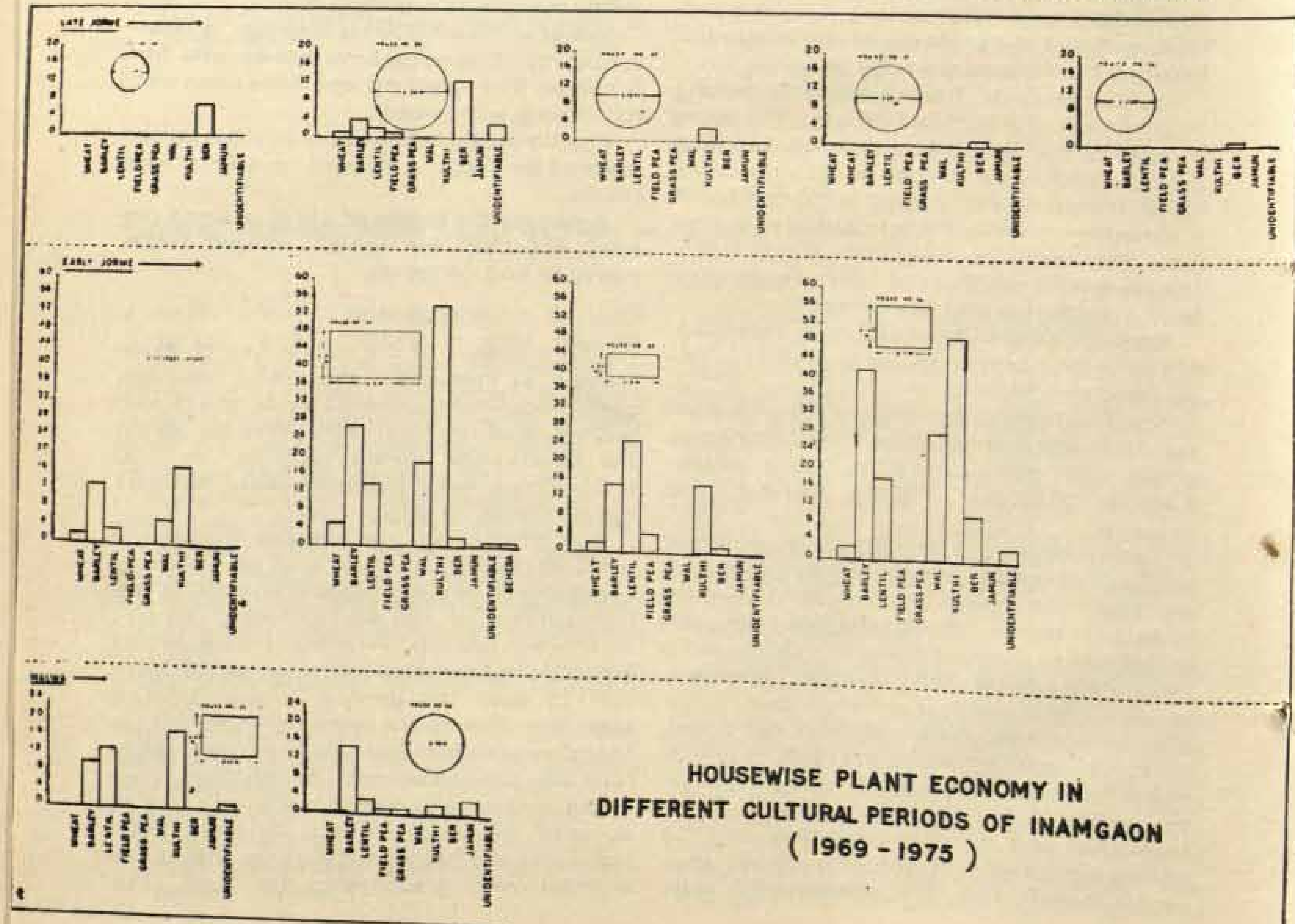

HOUSEWISE PLANT ECONOMY IN DIFFERENT CULTURAL PERIODS OF INAMGAON (1969 - 1975)

NOTES AND NEWS

MICROLITHIC INDUSTRY OF MAIHAR, DISTRICT SANTA (Madhya Pradesh)

Maihar is situated at a distance of 66 km from Rewa in a south-westerly direction on the Rewa-Jabalpur Road in Satna district of Madhya Pradesh. It is one of the sub-divisional headquarters of the district, and a railway station on the Allahabad-Jabalpur branch of the Central Railway. The general feature of the tract presents a rugged, stony and forest-clad physiography. South and west of Maihar are scarps of Vindhyan sandstone. The isolated Maihar (Sharda) outcrop is wall-like steep and is about over 100 m. above the valley floor. The region lies below the ghats and is a part of the Baghelkhand plateau, with a gentle slope towards the north-east. Much of it is covered with typical Baghelkhand and Bundelkhand flora. The chief trees are dhawa (*Anogeissus latifolia*) sej (*Lagerstraemia-parvlifolia*) tendu (*Diespyros melanoxylon*) haldu (*Adina-cordifolia*) saj (*Terminalia tomentosa*) bamboo (*Dendrocalamus strictus*). Bushes of Khalr (*Acacia kateehu*) and Ber (*Zizyphus Jujuba*) are also very common. The rainfall in the region is between 100 and 120 cm per annum and occurs for the most part during July-September. The wild life in the region is now sparse but is known to have been plentiful until a few decades ago. Foxes, jackals and pigs are ubiquitous. The common antelope (*Antelope cervicapra*) is often seen moving in the area. Panthers are still found in good numbers in the adjoining forest-clad hilly region.

Recently, one of the authors of this note visited the site and collected a few palaeoliths from the banks of Lilzi, a perennial tributary of the Tons. Subsequently, the area between the Lilzi in the east, the temple outcrop in the west, and a nullah, almost dry, apparently joining Lilzi below the teak plantation, on the left side of Maihar-Sharda Devi Road, was extensively explored by the writers. The nullah has sections exposed at a number of points with a maximum thickness of about 10 metres. At the base is a shallow formation which is capped by a poorly cemented gravel bed, composed of almost round and angular stone blocks, and about 1 m thick. This gravel yielded Lower Palaeolithic tools. The gravel bed is overlaid by a 2.5 m thick silt deposit with shale fragments. This deposit is followed by another unit of silt about 3.5 m thick and light-brown in colour, at the bottom of which was noticed a kankar bed. The topmost deposit is composed of brick red silt.

The Mesolithic site of Maihar is situated on the left bank of the nullah joining the rivulet Lilzi in front of the recent teak plantation. Microliths in the form of cores, flakes and finished tools were found scattered over a considerable area. As the artefacts were found in different stages of manufacture, the site may be designated as a factory site. The microliths are collected from the topmost deposit, i.e. the formation with brick red colour. The top of this deposit also contains fragments of shale and quartzite, probably hill-wash coming from the eastern slope of the Bhaner chains. Some stone pieces with battered edge suggest their use by microlithic man. Microliths are distributed all through the silt deposit showing that this deposit was under formation when Mesolithic man was on the scene.

The stone industry collected consists of 516 artefacts. Its typological composition is as given below.

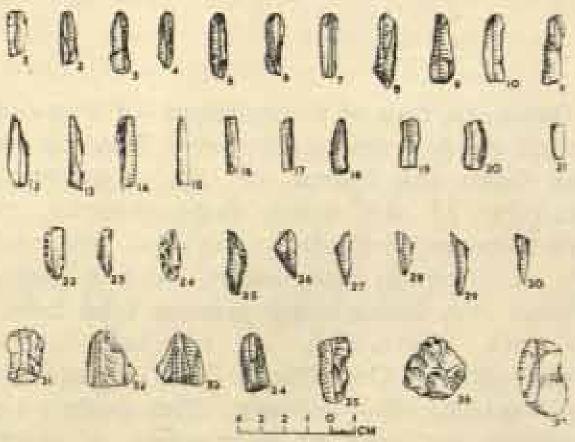

Fig. 1

Waste		*Finished tools*	
Cores	72	Retouched blades	49
Flakes	265	Blunted back blades	23
Core rejv. flakes	13	Triangles	10
Unretouched blades	60	Lunates	5
		Scraper-cum-Point	1
		Miscellaneous	5
Total	410	Total	106

The finished tools constitute only 25% of the total assemblage; the rest consist of cores, flakes, core rejuvenation flakes and unretouched blades. This composition of the assembloge clearly shows the place to be a factory site.

Thin, parrallel-sided blades were detatched either from one or both ends of the core. The cores were first dressed by removing the cortex, and striking platform was prepared on one or both ends. The blades were then converted into different tools. Scrapers are made on cores and flakes. Most of the tools are symetrical in form with careful retouching.

Maihar microlithic asseblage comprises parallel-sided blades, blunted back blades, triangle, lunates, scrapers, a point and a notch (Fig. 1). The blades are thin and parallel-sided. Retouch has been executed on one or both lateral sides from ventral or dorsal surfaces.

The length of the blades ranges from 3.6 to 1.4 cm and the width from 1.2 cm to 0.2 cm. The average length and breadth are 2.27 cm and 0.8 cm respectively. The blunted back blades have one lateral side steeply blunted while the other is minutely retouched from ventral or dorsal surfaces. The length of the blunted back blades varies from 3.00 cm to 1.2 cm with an average of 2.2 cm. The width of blunted back blades ranges from 1.3 cm to 0.4 cm with an average of 0.8 cm.

Lunate (5). The lunates of symmetrical and asymmetrical varieties range from 2.7 cm to 2.1 cm in length and 0·9 to 0.6 in width, the average length and width being 2.4 cm and 0.8 cm, respectively.

Triangle (10). All the triangles are of scalene variety. Their length varies from 2.5 cm to 1.4 cm and the width from 0.9 cm to 0.5 cm an averge length & width being 2.2 cm & 0.6 cm, respectively.

The assemblage is made on chert, chalcedony, jasper, agate and quartz. Of the total of 516 specimens, chert accounts for 388, chalcedony 88 and others 40 odd pieces, constituting 75%, 17% and 8%, respectively. The percentage of different raw materials in relation to finished tools is as follows:

Chert 54%, chalcedony 41.5%, others 5.5%. The proportion of finished tools in chalcedony is higher because this material gives a better conchoidal fracture than chert and is less wasteful.

A study of the microlithic assemblage of Maihar leads to following observations:

1. It is primarily a blade-dominated industry, the parallel-sided and blunted-back blades constituting about 68% of the

finished tools. The other tools, like lunates and triangles, are also fashioned on blades.

2. Geometric microliths in the assemblage are represented by triangles. In this connection, it may be pointed out that the excavations in the open-air-mesolithic settlement at Lekhahia in Mirzapur district (Sharma, 1964-1965, pp. 76-78) clearly demonstrate the priority of triangle over trapeze in point of time. While triangle appears at Lekhahia in layer (6) and (15) trapeze and pottery have been obtained only from subsequent layers. The layers (6) and (5) at Lekhahia, it may be recalled, represent the IInd stage of the Mesolithic cultures of the Vindhyas—the stage of geometric microliths (triangle alone) without pottery. The excavations at Rangpur (Rao, 1962 & 1963, p. 15), Bagor (Misra, 1973, pp. 92-110) and Sarai Nahar Rai (Sharma, 1973, pp. 129-44; 1975, pp. 1-20) also reveal the chronological priority of the geometric tools over pottery. Of these sites, Sari Nahar Rai has also yielded triangle alone, thus supporting the evidence of Lekhahia indirectly. The Mesolithic site of Maihar is also devoid of pottery,. Thus it may be linked with the IInd stage of Mesolithic cultures of the Vindhyas and that of Sarai Nahar Rai in the Ganga Valley.

3. No core or flake exhibiting the employment of crested ridge technique has been found at Maihar. As this technique is associated with the Neolithic and Chalcolithic short blade industry in India, its absence at Maihar is significant from the chronological point of view. There is no evidence to date the site in any precise terms. However, as geometric microlithic industries without pottery are dated by C^{14} at Adamgarh and Bagor to *circa* 4500—5500 B.C., the Maihar industry may have a comparable antiquity.

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A COPPER HOARD FROM NANDLALPURA, DISTRICT JAIPUR, RAJASTHAN

Nandlalpura is a village in Tahsil Chaksu, District Jaipur, Rajasthan. On 8th June, 1973 famine relief workers digging for earth by the ride of Rachcha tract found a hoard of six bar-celts. The hoard was deposited in the sub-Treasury office at Chaksu. It was a sheer chance that during my exploration tour in this area I came to know of this hoard on 11th Oct., 1973. I brought this back to the notice of the Director of Archaeology and Museums Department, Rajastnan and as a result the hoard was acquired by the Department under the Rajasthan Treasure Trove Rules. Subsequently, a team led by Shri. R. C. Agrawal Director of Archaealogy and Museums, Rajasthan, visited the site of discovery and collected a few postsherds fromits disturbed surface and irregular cuttings. Though the celts can not be put in a stratigraphical context, the presence of O.C.P. sherds at the site is significant in view of the presence of OCP sites in the area.

The average size of Nandlalpura bar-celts is 27.0×7.2×2.1 cm. This size falls in between the size of the plain and shouldered axes and bar-celts found in the copper hoards complex. Both the ends of these celts are sharp. Similar objects have not been found at any site in Rajasthan. Whether the celts are made of copper or branze can only be determined after chemical analysis.

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FIRST RECORD OF A FOSSIL HEXAPROTODON FROM THE GHOD VALLEY, MAHARASHTRA

A fairly well-preserved part of the left mandibular ramus of adult hippopotamus, *Hexaprotodon palaeindicus* (Falconer and Cautley, 1836) containing M2 and M3 (Pl. viii A & B) has been discovered from the valley of the river Ghod, about 5 km North-East of Inamgaon (19° 35' N:74° 30'E), 70 km east of Poona (Fig. 1 on p. 45). The specimen was found in a gravel bed, about 2 m above the base on the left bank of the river (Fig.2). The gravel bed is of Late Pleistocene age, the associated fresh water molluscan shells have been dated to about 20,000 years B.P. by C^{14} method (Agrawal and Kusumgar, 1975). The specimen, numbered DC/INM-1, has been deposited in the Department of Archaeology of the Institute.

Description

The specimen is a fairly preserved part of the left mandibular ramus of *Hexaprotodon palaeindicus* with M2 and M3. The teeth are hypsodont. Enamel is worn out and the crown has a number of cracks, possibly due to sub-aerial drying.

M2 is developed into four, full, almost equidimensional, cusps, arranged in a squarish fashion, two on the lingual and two on the buccal side. It has also a small accessory cusp placed posteriorly on the buccal side and touching the secord left (buccal) cusp of M3. The intervening enamel of the cusps

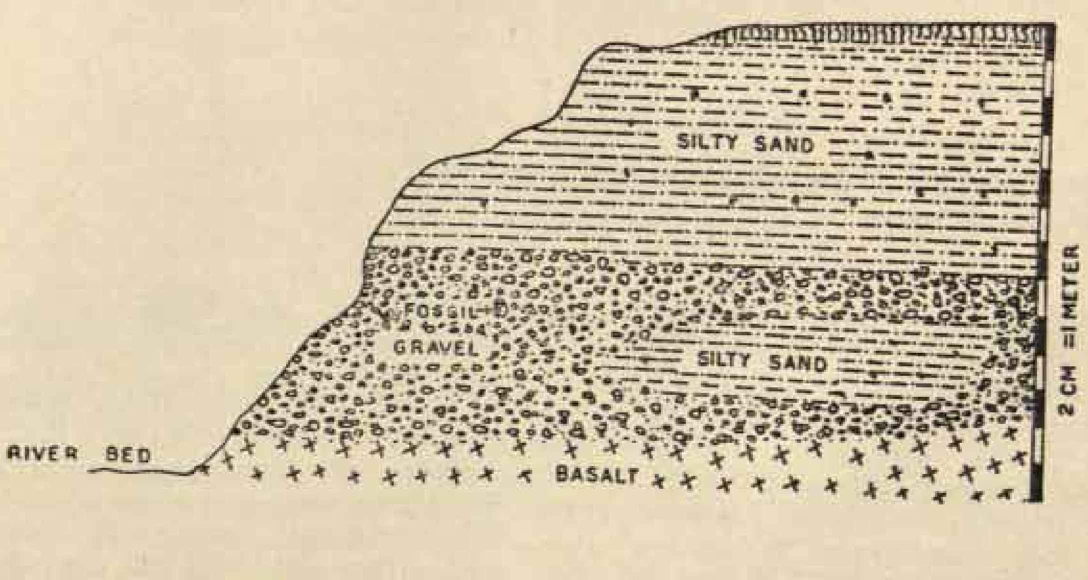

FIG. 2 SECTION EXPOSED ON THE LEFT BANK OF THE GHOD

has fused resulting in the formation of a single median cavity. This tooth has a bifurcated root.

M3 has a trefoil structure and a bifurcated root. Its posterior most cusp does not show any effect of wear. Consequently, no cavity is formed in this cusp. The anterior two cusps are placed side by side, one on the lingual and the other on the buccal side. The enamel of the cups has not fused and the median cavities of these two cusps are irregular.

From the nature of the cusp development and the dimensions of the teeth, the part of the mandible appears to belong to a somewhat adult individual.

TABLE-1

Measurements (in mm)*

	M2	M3
Anteroposterior diameter (Length)	33.5	33.0
Transverse diameter (width)	42.5	38.0

*Only maximum measurements have heen taken.

Palaeoenvironmental conditions

The restricted distribution of *Hexadrotodon* in the Pleistocene seems to have been the result of environmental factors. In North India, the genus is represented from Middle Pliocene up to Lower Pleistocene, but in the central part of India, it ranges from Middle to Late Pleistocene. It is unlikely that the rarity of the remains of the genus from elsewhere is due merely to collecting chances.

The present discovery of *Hexadrotodon* has a considerable bearing on the palaeoenvironmental conditions of the Ghod valley during the Late Pleistocene. The sedimentary characters of the Late Pleistocene formations indicate that they were deposited either as a braid bar or point bar with a series of water pools in them. This is evidenced by the occurrence of lenticular bands of silt and clay (indicating periodic flooding of the river) in the pebble gravel. Such pools, probably with tall grass cover, might have provided a habitat for water-loving animals such as *Hexaprotodon*. The overbank flooding as frequent in the later part of sedimentation, and consequently the general water level in the area went up at least by 3 or 4 m ; this is suggested by the occurrence of sands, gravels and silt layers at that level around Inamgaon. The rise in general water table would increase soil moisture, which in effect would result in better vegetation in the form of tall grass cover.

It appears certain that *Hexaprotodon* was more selective as to habitat than were a number of its contemporaries. Though the animal inhabited swampy plain areas where sluggish water predominates, the presence or the remains of the contemporary animals (*Canis, Equus, Bos, Bubalus, Cervus, Elephas,* etc.) indicates a tropical semi-arid climate in the region with plateaux and lowlands covered by dense grass (of about 1 m. height) and stunted trees. It is to be emphasised, however, that in this valley which is essentially flanked by basaltic rolling plateaux, there was no opportunity for the development of vast flood plains suitable for the formation of extensive swamps and marshes during the whole of the Late Pleistocene.

Favourable conditions for the existence of *Hexaprotodon* were more probable in the central Indian plains with dense tall grass cover and sluggish waters. This view is supported by the presence of more than one species of the genus from that region (Narmada and Godavari valleys) as against only one species from the Siwalik of North India (where the slopes were steep and movement of water fast) and the single species in the Ghod Valley.

The presence of Middle and Upper Palaeolithic tools in the same geological formation which yielded the hippo and the associated fauna (horse, buffalo, cattle, deer etc.) provides additional evidence for the palaeoecology of the area. This is one of the richest palaeontological sites in the Deccan, thereby suggesting that the biotic factors might have played an important part in attracting the Palaeolithic man to this area. However, until primary palaeolithic sites are discovered and excavated in the area, we will not know the exact role played by man in the exploitations of contemporary fauna.

Discussion

The genus *Hexaprotodon* is reported from the Siwalik of the Punjab (*H. sivalensis*, Falconer and Cautley, 1836), Narmada deposits of Central India (*H. namadicus*, Falconer and Cautley, 1836 and *H. palaeindicus*, Falconer and Cautley, 1836), Irawady System of Burma (*H. Iravaticus* Falconer, and Cautley, 1847) and Ratnapura Series of (*H. sinhaieyus*, Deraniyagala, 1951). The distribution of Hippopotamidae in Asia is given in Table 1.

All the above mentioned species are large in size excepting *H. iravaticus*. In all the species the braincase is small and sagittal crest well developed. In *H. palaeindicus* and *H. sinhaleyus*, the skull is short and wide while in the rest it is elongate. In *H. palaeindicus* the mandibular symphysis is short (symphysial index 259.39), whereas in *H. sinhaleyus* it is unusually short (symphysial index 276.92). In the rest, the mandibular symphysis is elongated being most elongate is in *H. iravaticus* (symphysial index 128.12) and somewhat less elongated in *H. sivalensis* (symphysial index 193.21) and *H. namadicus* (symphysial index 218.25). In *H. palaeindicus* and *H. iravaticus* the jaws are almost square whereas in the rest they are narrow. All the species are characterised by the presence of six incisors of sub-equal size; the incisor sockets being almost in a straight line excepting in *H. sinhaleyus* in which case they are arranged in an inverted "V". The second incisor is most reduced in *H. palaeindicus* (index 11) while it is least reduced in *H. namadicus* (index 4) and *H. iravaticus* (index 4.2). The intermediate size of second incisor is represented by *H. sivale-*

TABLE 1

DISTRIBUTION OF HIPPOPOTAMIDAE IN ASIA

Age	India	Ceylon	Burma	Java
Recent				
Late Pleistocene	*H. Palaeindicus* Ghod Valley and Godavari Basin)	*H. Sinhaleyus* (Ratnapur Series)		
Middle Pleistocene (Cromerian)	*H. Palaeindicus* *H. Namadicus* (Narmada)	*H. Sinhaleyus* (Ratnapur Series)		*Hexaprotodon Sp.* (Trinil Beds)
Early Pleistocene (Villafranchian)	*H. Sivalensis* (Pinjor Siwaliks)		*H. Iravaticus* (Upper Iravadi)	*Hexaprotonodon Sp.* (Djetis Beds)
Upper Pliocene (Astian)	*H. Sivalensis* (Tatrot Siwaliks)			*Hexaprotodon Sp.* (Kaliglagah and Tjidgulang)
Middle Pliocene (Pontian)	*H. Sivalensis* (Dhok Pathan Siwaliks)			

nsis and *H. sinhaleyus*, with an index of 7 and 8 respectively. In *H. sivalensis* and *H. iravaticus*. all the alveoli of the incisors are in the same horizontal plane whereas in the rest the alveoli of second incisors are elevated above the horizontal plane of the alveoli of the first and third incisors; in *H. namadicus*, however, it is not markedly so. In *H. sinhaleyus*, *H. iravaticus* and *H. sivalensis* the third incisor is the largest of the three while in *H. palaeindicus* the largest incisor is either first or third. In the case of *H. namadicus*, first and third incisors are not much different from each other. It can be seen from the foregoing that though smaller in size, *H. iravaticus* is somewhat similar to *H. sivalensis* while *H. sinhaleyus* seems to be related to *H. palaeindicus*.

There appears to be a great deal of confusion with regard to the validity of *Hexaprotodon* as a genus. Togther with *Tetraprotodon*, it was treated as a sub-genus of *Hippopotamus* by Falconer and Cautley (1836). Owen (1845) raised *Hexaprotodon* to a generic status, distinguishing it as having six-equal incisors. Lydekker (1882), considered that there was no justification for separating *Hexaprotodon* and *Tetraprotodon* from *Hippopotamus*. Matthew (1929, p. 556) gave the following key covering the known genera.

" (a) Three sub-equal incisors on each side of jaw (sub-generic) *Hexaprotodon*.

(b) Two sub-equal incisors on each side of jaw (invalid) *Tetraprotodon*.

(c) One large and one small incisor on each side-*Hippopotamus*"

Sahni and Khan (1961) described a so-called abnormal lower dentition of *Hexaprotodon sivalensis* (with five instead of usual six incisors) from the Pinjor Formation (Lower Pleistocene) of the Upper Siwaliks. As suggested by Prasad and Satsangi (1964) this condition may well be an intermediate stage in the evolution of the Recent *Hippopotamus amphbius* of Africa, which has four incisors from the normal *Hexaprotodon sivalensis* with six incisors, by gradual loss of 2nd incisor.

Acknowledgements

We gratefully acknowledge the encouragement and help rendered by Prof. H.D. Sankalia, S. B. Deo, and R. V. Joshi of Deccan College, Poona. We are indebted to Dr. S.N. Rajaguru (Deccan College, Poona) and Dr. C. B. Cox (King's College, London) for critically going through the manuscript and offering valuable suggestions.

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—G.L. Badam and M.D. Kajalj,
Deccan College, Poona

AN INDUS VALLEY STAMP SEAL FROM NIPPUR, IRAQ

In the course of the thirteenth season of excavations carried out by the Oriental Institute of the University of Chicago, in 1975 at Nippur, in Iraq, a white stone stamp seal (Pl. VIIIC) was discovered. The seal with a humped bull and and inscription is square in plan, and has a loop for suspension on the back. The seal was found in area WC, Trench 1 in very salty debris above a floor in a Kassite house dating perhaps to the 14th century B.C. Further work is needed to date the house more precisely. Because of the salt in the soil, the seal was very brittle, and it cracked from top to bottom along one of the horns of the bull. The field number of the object is 13N 506 and the object is now in the Iraq Museum, Baghdad.

—McGuire Gibson,
Oriental Institute, University of Chicago

AN ANTHROPOMORPH IN THE BROOKLYN MUSEUM, NEW YORK

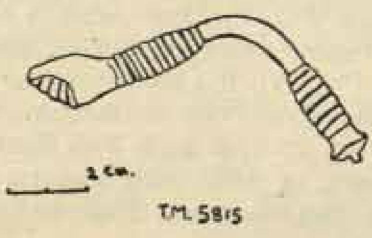
The Brooklyn Museum number of the object is L 70,27. Its height is 9.5 inches and the width 11.75 inches. It is listed as a bronze object, though it is not known to have been analysed. It has been lent to the Museum by Mr. Robin B. Martin. The date of accession to the Museum is December 15, 1970. The provenance is unknown, but in the Museum records it is assigned to the Indus Valley which is obviously wrong since it belongs to the Copper Hoards of the Ganga Yamuna Valley. It was exhibited at the Metropolitan Museum, New York, between November 6, 1969 and January 4, 1970 (Catalogue: "The Guennol Collection of Mr and Mrs Alastair B. Martin", page 12, figure 109). Its condition is very good, except heavy dirt encrustation.

Mr Robert Moes, Curator of the Oriental Art section of the Museum, showed me the anthropomorph and very kindly supplied a photograph (Pl. VIIID) and the Museum records on the object.

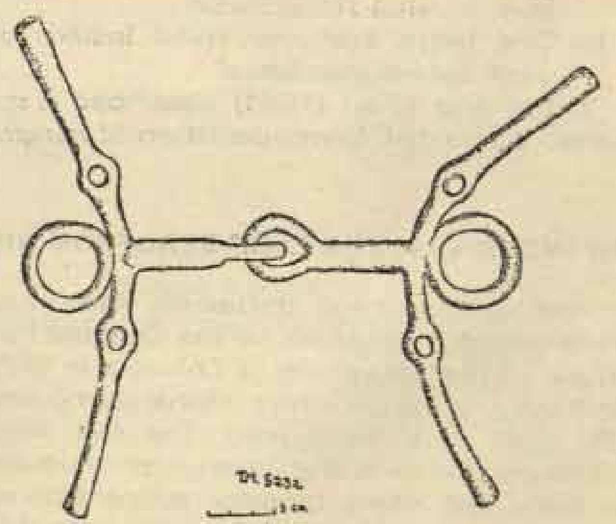
—Dilip K. Chakrabarti,
University of Calcutta

SOME UNPUBLISHED OBJECTS FROM HISSAR AND SIALK IN THE TEHRAN MUSEUM

The objects concerned are Tehran Museum numbers 5232 (Hissar), and 6025-6029 and 5815 (Sialk). Nothing is known of their stratigraphic contexts and their only interest possibly lies in the fact that they do not quite conform to the published material from these two sites. The purpose of this note is to draw attention of the scholars in Iranian archaeology with brief observations on their obvious parallels.



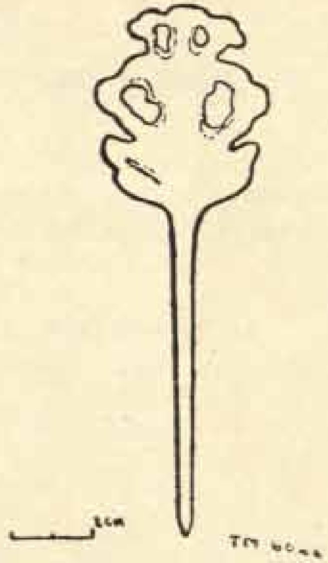
T.M. 5232. Hissar. Horse's cheek-piece of bronze measuring about 22·5 cm across and about 19 cm sidewise. The illustration number 132 in Moorey[1] provides a general

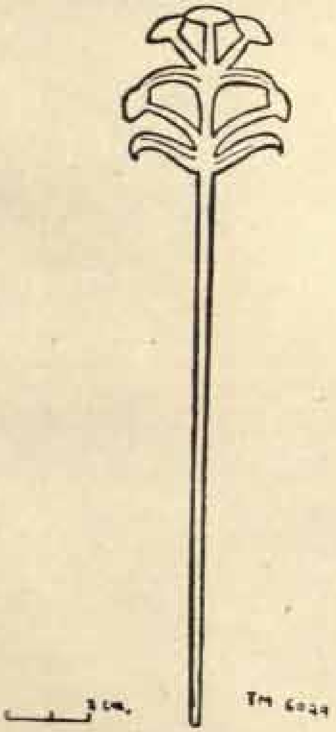


parallel. An early first millennium B.C. date seems to be preferred by Moorey for this type. There is an almost identical specimen among the Achaemenid finds in the Persepolis Museum, though in this case the straps are marked by closely yet prickly points.

T.M. 5815. Sialk. Fibula of bronze, about 8 cm from end to end. This seems to be paralleled by Stronach's Triangular Fibulae of Type III, 4[2]. A similar specimen occurs in the Perso-Achamenid level in Susa.[3]

T.M. 6029 and 6026. Sialk. Bronze pins, 18 cm and 13.5 cm long respectively. Both belong to the same general type, though the head of T.M. 6026 is far more flatly shaped than that of T.M. 6029. The other specimens, T.M. 6025, 6027 and 6028, exactly resemble T.M. 6029 and are not illustrated here. Cholpin[4] has illustrated two





broadly similar pins from Sumbar in south-west Turkmenia. A general Shah Tepe-Tuareng Tepe analogy of the Sumbar material is unmistakable.

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3. *Memories de la Mission Archeologique en Iran*, 36 (1954) Pl. 19, no. 4.
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—Parveen Moghadam and
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A

Stabilized, fossilized and a vegetated obstacle sand-dune formed on the windward side of the major obstacle. See p. 9

B

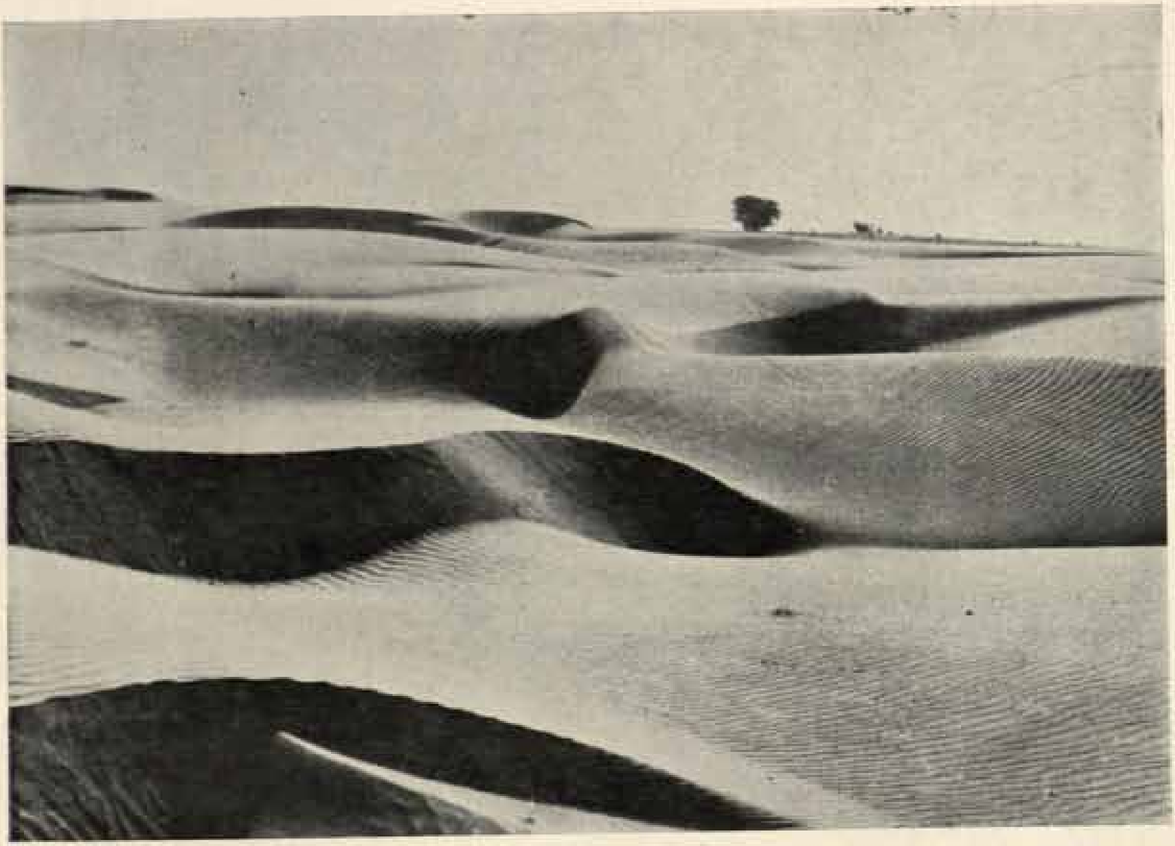
Well stabilized and vegetated parabolic sand-dune with steep leeward slope. The thick fresh sands are superimposed on the crest and leeward slope due to renewed aeolian activity. The big khejri tree is standing at the base of the leeward slope. See p. 9

A

Stabilized, degraded and well-vegetated coalesced parabolic sand-dunes with steep leeward and gentle windward slopes. See p. 10

B

Stabilized, fossilized and well-vegetated longitudinal sand-dune. The foreground is dominated by under-shrubs and shrubs. See p. 10



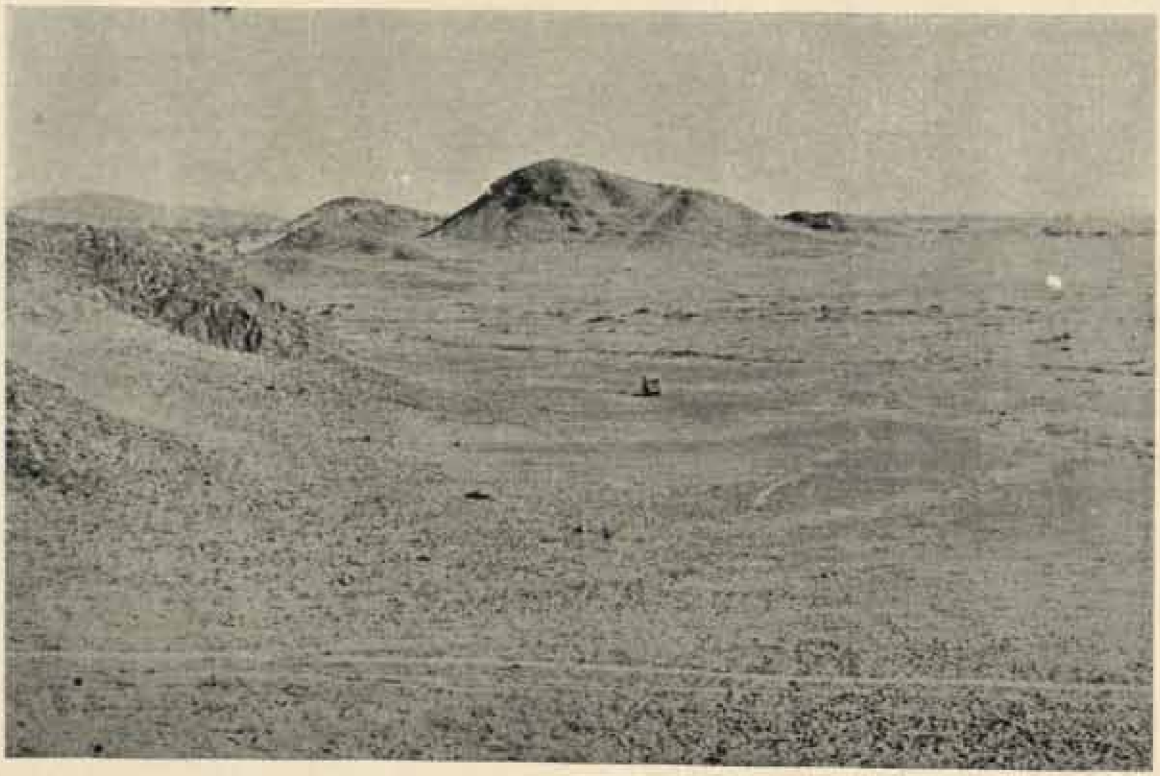
A

Active, crescent-shaped and coalesced barchan sand-dunes without vegetation cover. See p. 12

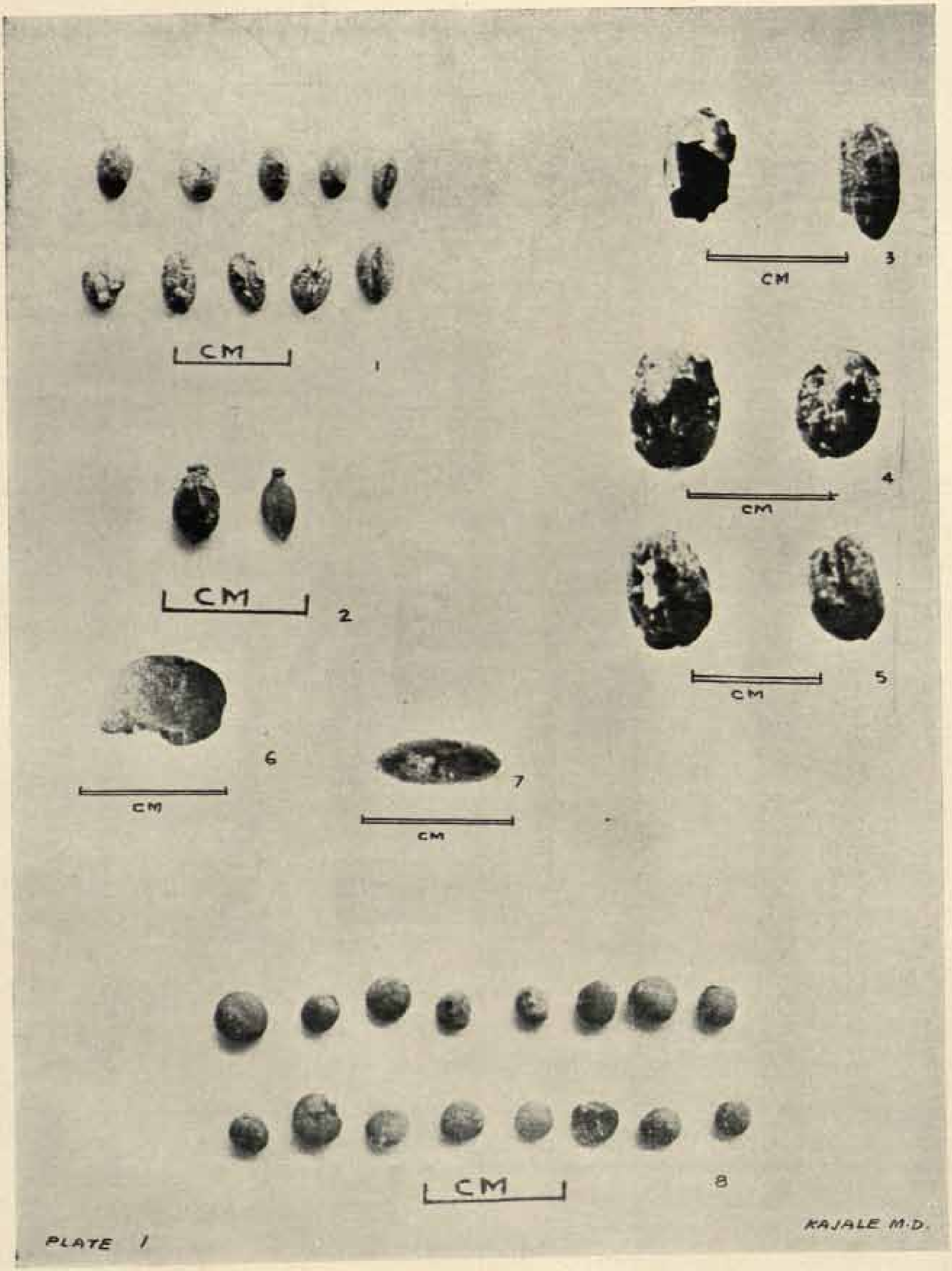
B

Shrub-coppice sand-dunes of different shapes, sizes and orientation, formed against bushes and shrubs on the sandy aggraded older alluvial plains. See p. 12

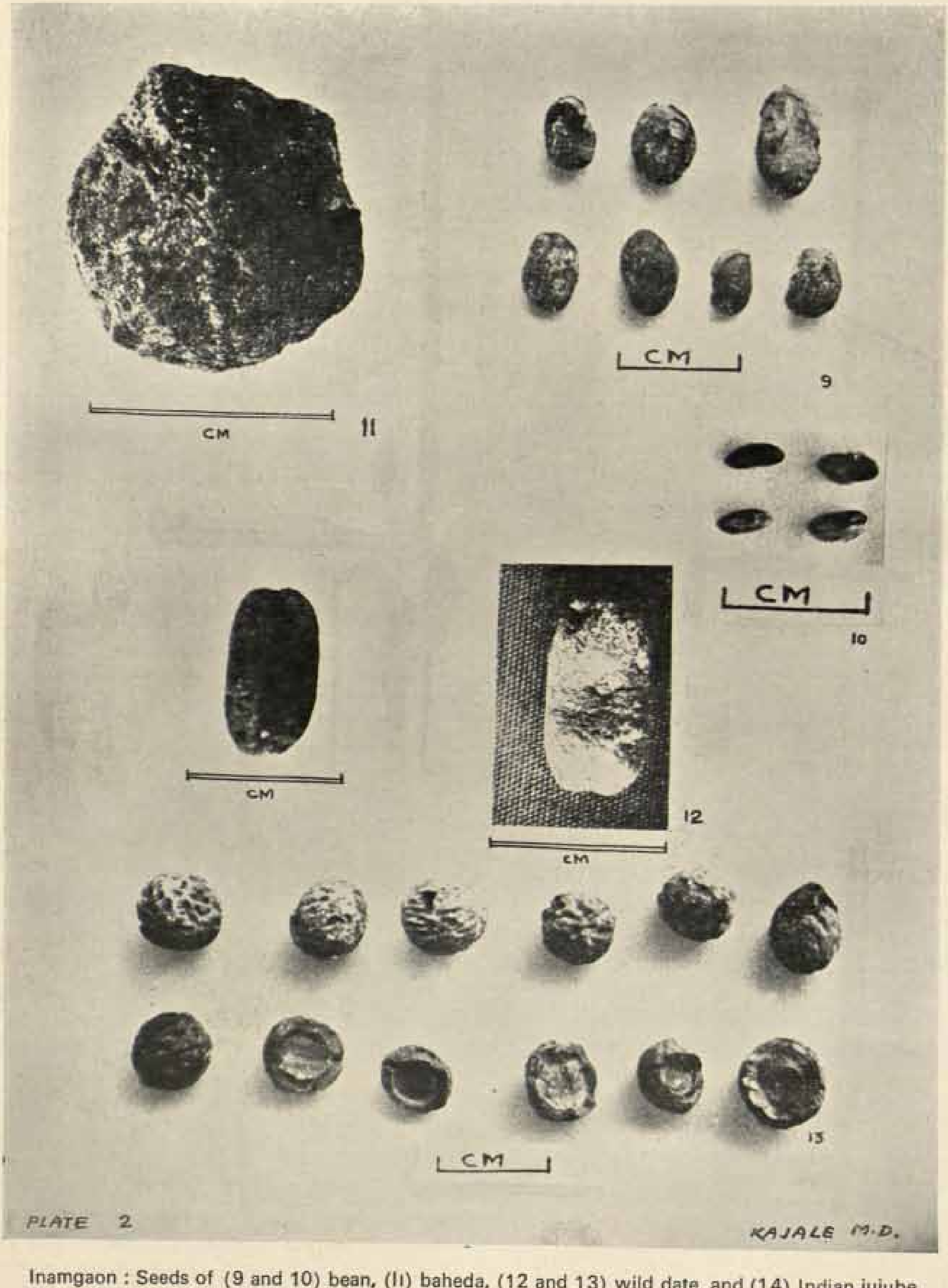
A
Rhyolite pediment (foreground) at Kui 1. Rhyolite hill is in the background. See p. 17



B
Rhyolite pediment (right foreground) at Kui 2. Rhyolite hills are at left foreground and in the background. See p. 18



Inamgaon : Grains of (1 and 2) barley, (3) rice, (4 and 5) wheat, (6 and 7) horse-gram, and (8) lentil. See p. 54

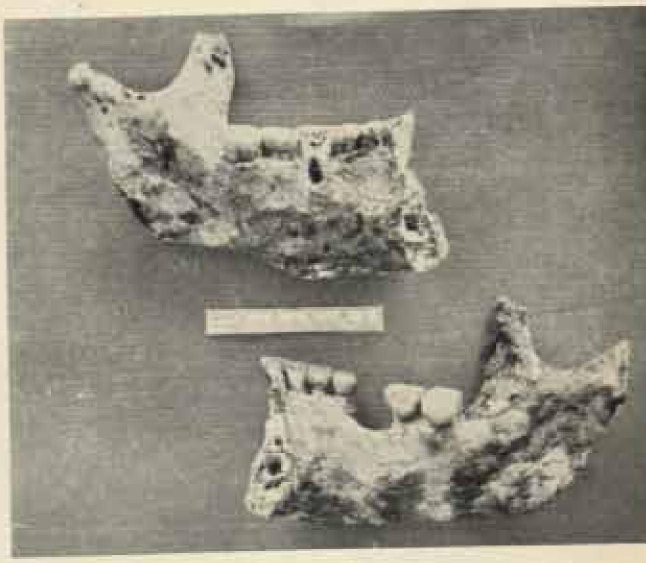


Inamgaon : Seeds of (9 and 10) bean, (II) baheda, (12 and 13) wild date, and (14) Indian jujube.
See p. 54

PLATE VII

A

B



C

D

A. Inamgaon : Burial in a four legged urn. See p. 49

B. Inamgaon : Skull before cleaning (INM-59). See p. 57

C. Inamgaon : Mandible of a skull (INM-68). See p. 57

D. Inamgaon : Mandible of a skull (INM-59) Medial view. See p. 57

A

B

C

D

A. Part of left mandible of Hippopotamus from Ghod Valley. See p. 64

B. View of the crown of the above teeth. See p. 64

C. A Harappan seal found at Nippur, Mesopotamia. See p. 67

D. An anthropomorphic figure of the Copper Hoards group in the Brooklyn Museum, USA. See p. 68

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