NORTHERN RHODESIA

The Batoka Gorge approximately 6 miles below the Falls, looking up towards the confluence of the Songwe Gorge with the Zambezi, and showing the steep trench-like character of the gorge which is preserved until a few miles above the Chimamba Rapids. This gorge and those upstream of it have been cut since the beginning of the Upper Pleistocene.

The Stone Age Cultures of Northern Rhodesia

With Particular Reference to the
Cultural and Climatic Succession
in the Upper Zambezi Valley
and its Tributaries

By

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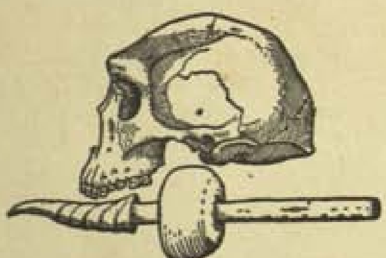
Rhodes-Livingstone Museum,
Livingstone, Northern Rhodesia

WITH A CHAPTER ON THE GEOLOGY BY
F. DIXEY, C.M.G., O.B.E., D.SC., F.G.S.
AND APPENDIXES BY H. B. S. COOKE,
L. H. WELLS AND GEOFFREY BOND



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FOREWORD

BY HIS EXCELLENCY THE GOVERNOR OF NORTHERN RHODESIA,
SIR GILBERT RENNIE, K.C.M.G., M.C.

Up to about ten years ago Northern Rhodesia featured largely as a blank on the prehistoric map of Africa. The banks of the Zambezi at the Victoria Falls had yielded a few surface collections of stone implements and an African cousin of the Neanderthal race of Europe had been found in a cave at Broken Hill, but apart from these two isolated instances almost nothing was known of the prehistory of the territory. In Northern Rhodesia as in other Central African territories that is tantamount to saying that almost nothing was known of the history of the territory before European penetration. In Europe we are accustomed to a historic past of hundreds, even thousands, of years in length, and it is difficult to realise how little was known of most parts of southern Africa even one hundred years ago; yet situated as Northern Rhodesia is astride the migration routes to Southern Africa we may expect to find rich evidence of the past in this territory.

In this book the authors have tried to show the part played by Northern Rhodesia on the prehistoric stage. A cultural sequence has been worked out based largely upon work carried out in the Upper Zambezi Valley, which holds good for a large part, if not all, of Rhodesia. The authors also compare the events and cultures found in this territory with those found in other parts of Africa, and it can be seen that the correlation is a very close one. The Northern Rhodesian evidence forms an important link between East and South Africa in unravelling the prehistory of this ancient continent.

The book contains much that is new and of interest. It provides for the first time a firm basis for future correlation work as well as a lucid though technical description of the prehistoric cultures themselves. It appears that in prehistoric times as well as during the period of Bantu immigration Northern Rhodesia was peopled by immigrants from the North-West rather than from the East.

Any scientific study of the ancient inhabitants of this country, such as this work, is of importance to us in Northern Rhodesia today, as it helps to fill in the long blank of the territory's past.

The excellent drawings and photographs add greatly to the interest and value of the book.

G. M. RENNIE.
Governor of Northern Rhodesia.
President of the Board of Trustees,
Rhodes-Livingstone Museum.

Government House,
Lusaka.
16th March, 1950.

PREFACE

"The study of man's past brings poise and perspective to our judgment of the present", said Dr. J. D. Clark in a public address given at Cape Town in April of this year. The immense period of time that has elapsed since the first peopling of Africa by Man certainly provokes the thought that all our petty politics, all our worries concerning the future of our continent, its climate, erosion and final control, are but small things in the face of the overwhelming history that Dr. Clark has brought to light.

The curious bilobate territory of Northern Rhodesia is surrounded by areas whose prehistory is more or less known. To the north lies the Belgian Congo where such workers as Colette and Cabu have worked. To the west is Portuguese Angola the field of Janmart, further studied recently by Leakey. To the south lies Southern Rhodesia which Neville Jones has made his own by his recent publication of the results of some thirty years of work in "The Prehistory of Southern Rhodesia". Of the east and the immediate north-east little is known, but further north work has been carried out by Wayland and by O'Brien in Uganda and by Leakey in Kenya, providing us with a detailed though (as always) incomplete knowledge of the equatorial regions.

A curious pattern of political boundaries has been imposed upon our continent by the chances of conquest, discovery and exploitation. Into this pattern Northern Rhodesia fits like an element of a jigsaw pattern. It can now be seen in relation to the fascinating picture of changing climates and evolving man, of changing fauna and shifting sands. These last, the Kalahari Sands, provide a true Riddle of the Sands that will take many years of work to elucidate. Evidence from Angola, from Southern Rhodesia and now from the Northern of these two sister colonies, proves that the Kalahari expanded and contracted in relation to the rhythm of climates. How often did it spread out its dry, brown, destructive tentacles over parts of our sub-continent; how often did it draw them back again in the face of pluvial reaction? That, and the chronology which the encroaching and receding sands provided, are the main theme of this fine and detailed work.

As to the future of these same sands little can be guessed, but that little is a warning to us. In French Equatorial Africa it has been shown that analogous spreads and retractions of the Sahara have occurred. Here two factors have constantly been at work; the edaphic factor at ground level consists of man and his destruction of forest, grassland and bush through the effective medium of fire, while the over-all climatic pattern follows a global plan far outside the range of man's control.

One drawback to the detailed work in Uganda and Kenya lay in the equatorial position of those areas, but in the great climatic architecture Northern Rhodesia and parts of French Equatorial Africa are mirror images, set opposite each other in relation to the Equator. The climate factors that have governed these two areas are thus ultimately much the same. The appreciation of climatic change in our summer-rainfall area thus yields more important evidence than that provided by the tropical belt. It only remains for a similar study of climates in the two winter-rainfall belts of Africa to give a clear and indisputable link with oceanic changes of level.

The clarity and taste that have been added to impersonal scientific accuracy in the drawings that illustrate this work are to be credited to the pen of Mrs. Clark. As in the text itself, we have a standard of excellence that should in future commend itself to the emulation of Members of our South African Archæological Society, whose pleasant priviledge it is to present to the world this successful and authoritative monograph.

A. J. H. GOODWIN.

The University of Cape Town,
May 15, 1950.

ACKNOWLEDGMENTS

The basic fieldwork for this monograph was undertaken during the years 1938-1940, during which time the main succession of geological and prehistoric events in the Upper Zambezi Valley was elucidated in collaboration with Dr. H. B. S. Cooke and later with Dr. F. Dixey. The conclusions arrived at during these years have since formed the groundwork for future correlation in the Rhodesias.

During 1948 and 1949 the deductions made before the war were reconsidered and further work carried out in the Upper Zambezi Valley and at a number of other sites in Northern Rhodesia, notably in the Northern and Central Provinces. This work, therefore, summarises the present extent of our knowledge of the prehistory of Northern Rhodesia and provides a basis for correlation with other areas of the African continent.

This book would, however, never have been written without the help I have received from many colleagues and I must endeavour to record here my acknowledgment of their most valued assistance. First to Dr. F. Dixey, who is responsible for the chapter on the Geology of the Upper Zambezi Valley, I must express my deep gratitude for his inestimable assistance and stimulating co-operation which leave no doubt that the geological evidence rests on the firmest possible foundation.

I am grateful to His Excellency the Governor of Northern Rhodesia, Sir Gilbert Rennie, K.C.M.G., M.C., for graciously consenting to write the foreword. The appendixes by Dr. H. B. S. Cooke on the fossil fauna, by Dr. L. H. Wells on the human remains, and by Dr. G. Bond on the Kalahari Sand have greatly added to the value of the work and I am very grateful too for their willing co-operation.

I must also acknowledge a deep debt of gratitude to my colleagues in Rhodesia—Mr. Neville Jones, Mr. R. F. H. Summers and Mrs. E. Goodall—with all of whom I have had many thought-provoking discussions, and whose kindness in making available to me for examination collections from prehistoric sites in Southern Rhodesia has placed at my disposal valuable comparative material.

My best thanks must also go to Dr. and Mrs. L. S. B. Leakey who spent some days in Livingstone in 1948 on their return from Angola and whose critical examination of a number of the type sites in the Zambezi Valley in the neighbourhood of Livingstone has helped me very greatly in arriving at my present conclusions. I am indebted also to Dr. Leakey for the mechanical analysis by Dr. W. Pulfrey of certain Kalahari Sands from the Victoria Falls.

I am most grateful also to Mr. Miles Burkitt of Cambridge University under whose stimulating tutelage I was first introduced to the science of prehistory, to Professor C. van Riet Lowe and Mr. B. D. Malan of the Archæological Survey, Johannesburg, for many valuable discussions and for placing at my disposal collections for examination.

Most of what is known of the prehistory of the Luangwa valley and of the Eastern and much of the Northern Provinces of this territory we owe to the careful collecting and observations of Mr. F. B. Macrae and Mr. D. Gordon Lancaster, and to them we must all express gratitude.

The list grows longer and longer and it is almost impossible to include everyone whose help in some form has gone towards making possible the publication of this monograph. Mention must still be made, however, of Mrs. P. M. Bolton, Mr. Martin J. Morris, Mr. N. V. J. Watt of the Information Department, Lusaka, and of Mr. A. Lyndall Brown of the Department of Surveys and Land, Livingstone, for their valuable help with photographs and maps; and of Mr. Charles Pritchard, D.F.C., who so kindly flew me down the whole length of the Batoka Gorge.

To the Council of the South African Archæological Society and to the Rhodes-Livingstone Museum Trust I must record my most sincere thanks for providing the facilities and financial assistance whereby this book is now published.

Finally to Mr. A. J. H. Goodwin, who has done so much work to see this book through the press and has given so readily of his advice and assistance while it was in preparation, and to my wife for the very excellent illustrations of the stone implements, which have so greatly enhanced the work, and for her assistance with correcting proofs, I cannot sufficiently express my gratitude.

J.D.C.

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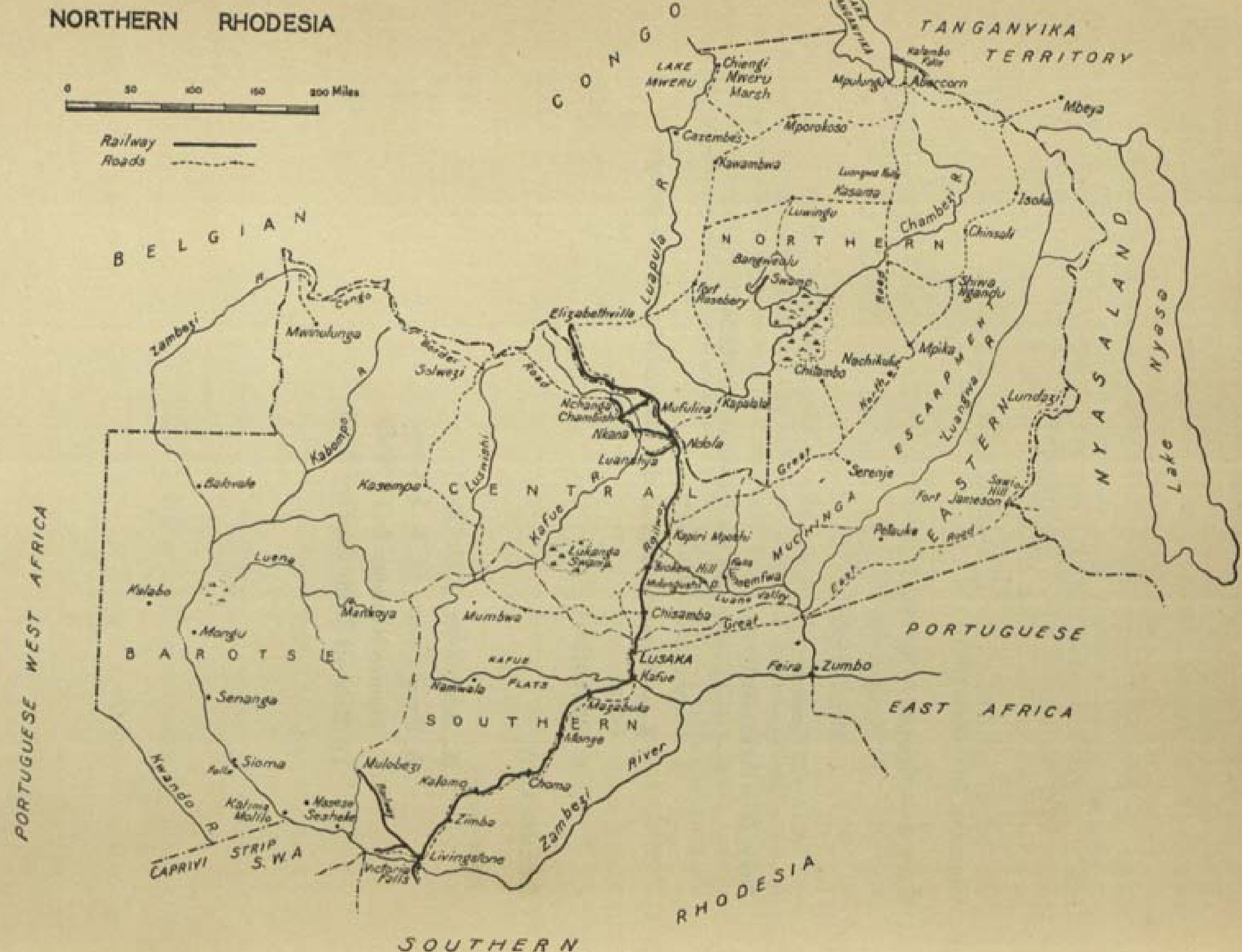
NORTHERN RHODESIA
0 50 100 150 200 Miles
Railway
Roads
BELGIAN
CONGO
TANGANYIKA TERRITORY
NYASALAND
Lake Nyasa
PORTUGUESE EAST AFRICA
SOUTHERN RHODESIA
PORTUGUESE WEST AFRICA
CAPRIVI STRIP S.W.A.
NORTHERN
CENTRAL
SOUTHERN
EASTERN
BAROTSE
MUCHINGA ESCARPMENT
LAKE MWERU
LAKE TANGANYIKA
Kalambo Falls
Chiengi
Mweru Marsh
Mpulungu
Abercorn
Mbeya
Mporokoso
Casembes
Kawambwa
Kasama
Luwingu
Chambezi R.
Isoka
Chinsali
Bangweulu
Swamp
Fort Rosebery
Shiwa Ngandu
Elizabethville
Luapula R.
Mpika
Nachikufu
Chitambo
Kapalala
Mufulira
Nchanga
Chambishi
Nkana
Ndola
Luanshya
Luangwa R.
Lundazi
Serenje
Sasare Hill
Fort Jameson
Petauke
Kapiri Mposhi
Broken Hill
Mkushi
Luano Valley
Chisamba
LUSAKA
Kafue
Feira
Zumbo
Mazabuka
Monze
Choma
Kalomo
Zimba
Livingstone
Victoria Falls
Mulobezi
Railway
Zambezi River
Kafue R.
Lukanga Swamp
Mumbwa
KAFUE FLATS
Namwala
Kasempa
Lunga
Solwezi
Border Road
Mwinilunga
Kabompo R.
Zambezi
Balovale
Luena
Mankoya
Kalabo
Mongu
Senanga
Sioma
Falls
Mamse
Sesheke
Katima Mulilo
Kwando R.
Great North Road
Great East Road

Fig. 1

GENERAL INTRODUCTION

NORTHERN RHODESIA is strategically situated in the middle of the great Central African plateau, astride the migration routes to Southern Africa. It consists largely of a plateau with a mean altitude of 4,000 to 5,000 feet (1,200-1,500m.), intersected to a depth of 1,000 feet (300m.) by three large rivers—the Zambezi and its two main tributaries, the Luangwa and the Kafue. In the north the wider and shallower Chambezi Valley (which becomes the Luapula, a tributary of the Congo, after it leaves Lake Bangweulu) drains an extensive area of the plateau.

The country is bounded on the north by the Rift Valley lakes of Tanganyika and Mweru, and by the southern highlands of the Rukwa Rift between Lakes Tanganyika and Nyasa. This Rift with its marginal highlands has acted as a deterrent to any widespread immigration of Bantu tribes from the north-east into Northern Rhodesia, and has been instrumental in deflecting the main migration stream to the east of Lake Nyasa.

The boundary on the east runs along the watershed hills between the Luangwa and the Lake Nyasa basin, but the natural boundary here is the lake itself, and indeed the tribal affinities between the inhabitants of the Eastern Province and those of Nyasaland are very close.

On the south the boundary is the Zambezi River which, although unlikely to have formed any effective barrier to sufficiently determined migrant people, nevertheless divides two ecologically distinct provinces.

In the west the boundary is divided into two parts by the Congo pedicle. To the north of this the boundary is the Luapula River, which flows through a broad, shallow valley, and, far from proving an obstacle to the passage of ethnic groups, acted as the jumping-off ground for a series of migrations from the north-west into Northern Rhodesia. With the exception of the Tonga/Ila speaking tribes in the Southern Province (whose origins can only be guessed at) and of the Ngoni and Mambwe speaking group, all the tribes that inhabit the territory today are of Congo origin, having migrated from the Lunda/Luba country between the end of the 16th and the end of the 18th centuries. The southern boundary of the Congo pedicle is formed by the Zambezi-Congo watershed, the most prominent physiographical feature in the west. South of this watershed the boundary is artificial, and wide areas of Kalahari Sand, covered by Baikiaea forest and Isoberlinia woodland, stretch for miles across the flat and featureless plateau surface. Within shallow basins of depression on the plateau are found Lake Bangweulu, with its extensive swamps, and the large swamp areas of Mweru Wantipa, Chisi and Pambashye in the north, and the Lukanga and Busango swamps in the south. The Muchinga escarpment, a notable feature ranging from 1,000 to 2,000 feet (300-600m.) in height, running down the centre of the country on a north-east line, forms the western boundary of the Luangwa Valley for the greater part of its length.

In historic and proto-historic times all southerly migration has come from the north-west; from the Katanga Plateau across the Luapula and down the Luangwa, with two subsidiary movements, one down the Zambezi river-system from its western headwater tributaries, and the other across the Rukwa Rift. There can, however, be no doubt that the main migration route through Northern Rhodesia from the north to southern Africa lay down the Luangwa and Zambezi Valleys themselves. It is in the upper part of the second of these great rivers that most research has been undertaken and very important results obtained.

Recent archæological and geological research has demonstrated that the cultural and climatic succession in the upper Zambezi Valley is applicable to most, if not all, of

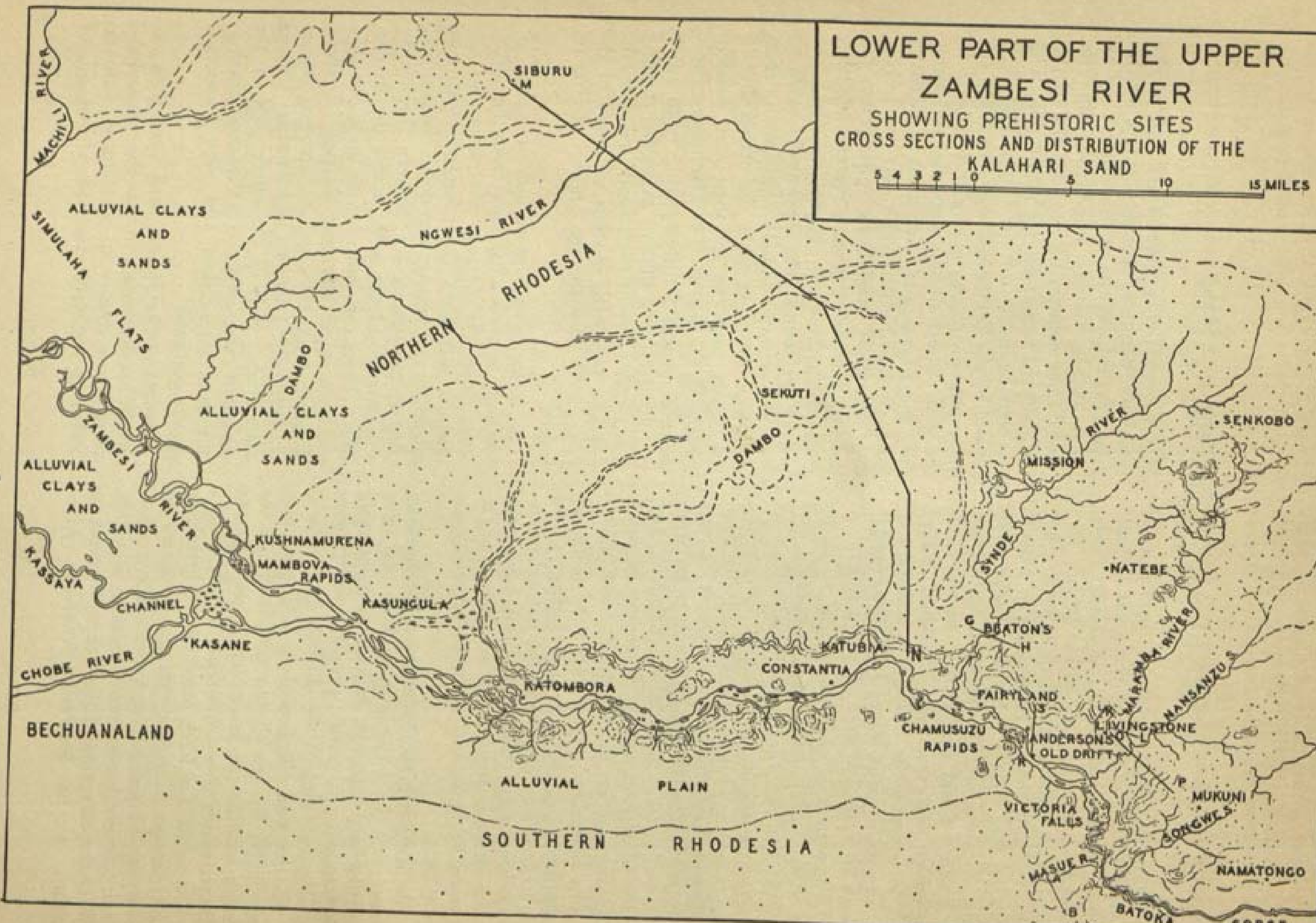
LOWER PART OF THE UPPER
ZAMBESI RIVER
SHOWING PREHISTORIC SITES
CROSS SECTIONS AND DISTRIBUTION OF THE
KALAHARI SAND
5 4 3 2 1 0 5 10 15 MILES
MACHILI RIVER
SIBURU
M
ALLUVIAL CLAYS
AND
SANDS
SIMULAHA
FLATS
NGWESI RIVER
NORTHERN
RHODESIA
DAMBO
ALLUVIAL CLAYS
AND
SANDS
ZAMBESI
RIVER
ALLUVIAL
CLAYS
AND
SANDS
KASSAYA
CHANNEL
KUSHNAMURENA
MAMBOVA
RAPIDS
KASUNGULA
KASANE
CHOBE RIVER
BECHUANALAND
SEKUTI
DAMBO
MISSION
RIVER
SENKOBO
SINDE
NATEBE
G
BEATON'S
H
KATUBIA
N
CONSTANTIA
KATOMBORA
FAIRYLAND
MARAMBA RIVER
NAMSANZU
LIVINGSTONE
CHAMUSUZU
RAPIDS
ANDERSONS
OLD DRIFT
ALLUVIAL
PLAIN
VICTORIA
FALLS
P
MUKUNI
SONGWE
SOUTHERN
RHODESIA
MASUE R.
NAMATONGO
B
BATOKA
GORGE

FIG. 2

Rhodesia, even though the actual composition of the geological deposits may vary from locality to locality. The preliminary survey carried out in 1938 evolved a tentative correlation for this area, since when the work of Dixey, Bond, Jones and others, including the present writer, has modified this early succession-table and built up a firm basis for future correlation work in the two Rhodesias. The Upper Zambezi Valley between the end of the Sesheke Plain above the Mambova Rapids, and the Batoka Gorge shows most clearly and completely this cultural and climatic sequence, and the area also forms an important link for correlating more certainly the evidence from South and East Africa.

The succession is most complete in the valley of the Zambezi itself. This is, therefore, described and considered in detail, but where valuable corroborative evidence is provided by the tributary rivers or by other areas (for example, the Luangwa Valley) this is used to elaborate the evidence from the Zambezi Valley itself, or to fill in any gaps there may be in the evidence from this main area.

For nearly half a century now the Zambezi Valley in the neighbourhood of the Victoria Falls has been noted for the large assemblages of stone implements found in the gravels along the former river banks, both above and below the present line of falls. Ever since A. J. C. Molyneux (1905, p. 40) and Colonel Fielden (1905, p. 77) drew the attention of the scientific world to this fact, and recognised that the implements were of primitive forms resembling those of Palæolithic cultures in Western Europe, this immediate area has yielded implements in considerable numbers to both geologists and archæologists.

Colonel Fielden's account of his finds in "Nature" was followed by a fuller report by G. W. Lamplugh (1906, p. 159) of the collections he made in the Zambezi and Maramba valleys during his survey of the Victoria Falls and the Batoka Gorge. Also in the same year Professor H. Balfour (1906, p. 170) published a description of a *coup de poing* found by him in a shallow gravel-pit about a quarter of a mile (400m.) above the Falls on the northern bank.

Both Lamplugh and Fielden were of the opinion that the gravels containing the implements were true Zambezi gravels, and that their occurrence on the top of the flat basalt plateau down-stream from the present gorge could, in the words of Lamplugh, be accounted for by the fact "that the river probably flowed at its highest level over the present sites when the implements were deposited and that the upper part of the gorge has since been excavated". Doubts as to the truth of this statement were raised by T. Codrington (1909, p. 390) in his paper "Notes on the neighbourhood of the Victoria Falls", in which he gives it as his opinion that the gravels and early Palæolithic forms of implements were brought down from the north and deposited by such tributary rivers as the Maramba and the Sinde, while only small flake tools were made on the place where they are found today. He states as his thesis: "The supposition, that implements or artificially-worked stones have been found embedded in a deposit which can be considered a gravel of the Zambezi within the area which came under my notice, appears baseless, nor is there any ground for supposing that those found on both sides of the gorge on the rocky surface of the old Zambezi Valley, 400 feet (120m.) above the present level of the river, were there when the Zambezi was flowing at that level before the gorge was eroded."

Opinion as to the origin of the implement-bearing gravels was, therefore, divided when, in 1929, A. L. Armstrong and Neville Jones (1936, p. 331) made collections of implements from a number of localities on the basalt plateau below the Falls. They were able to identify only one deposit of gravel which they considered had accumulated since the beginning of the Pleistocene; but, although only this one river deposit was recognised it was realised that others must have existed, and the writers state as one of their conclusions "there is reason to believe that since Pre-Chellean times two arid and two pluvial periods have supervened". Of the implements recovered from the gravels Armstrong says "stratigraphy is, of course, absent and in attempting to define a sequence of cultures the implements can only be classified by their typological characters".

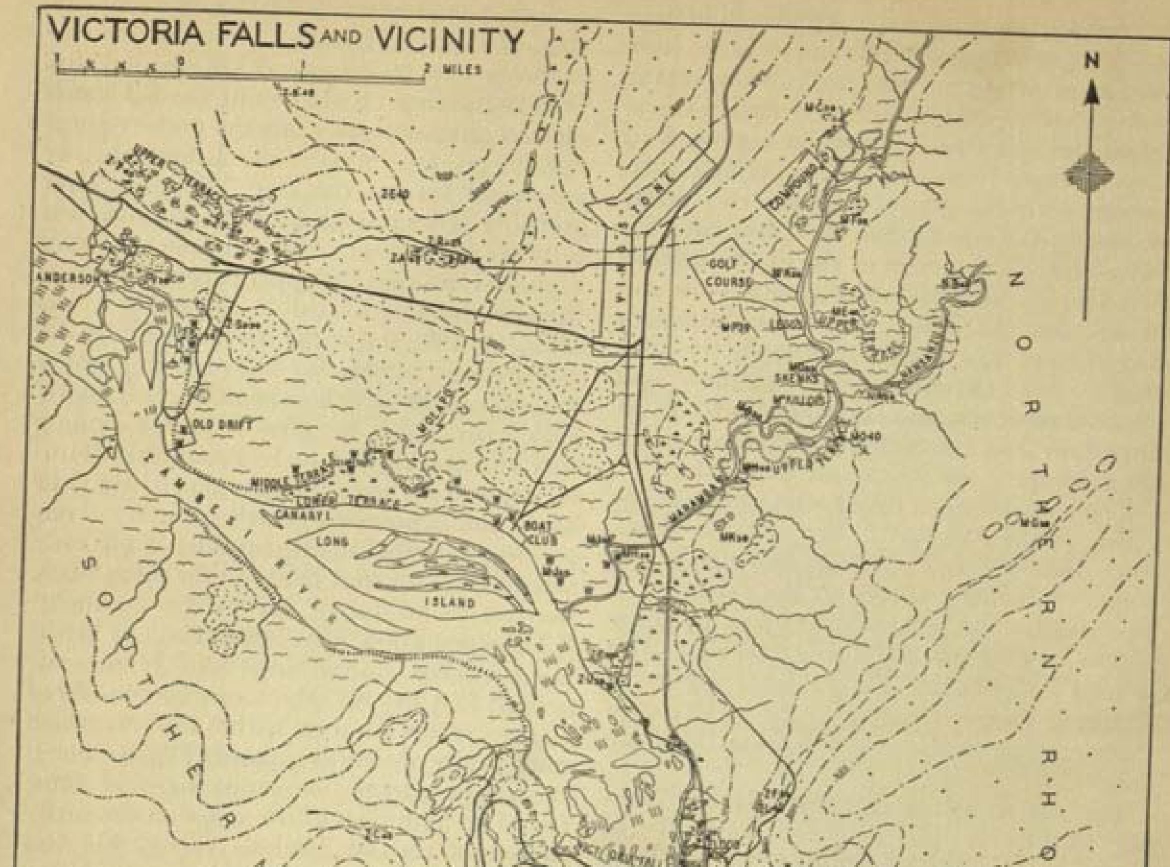
VICTORIA FALLS AND VICINITY
2 MILES
N
ANDERSON'S
UPPER TERRACE
GOLF COURSE
OLD DRIFT
MIDDLE TERRACE
LOWER TERRACE
ZAMBESI RIVER
LONG
ISLAND
BOAT CLUB
SOUTHERN RHODESIA
NORTHERN RHODESIA
MASUE R.
BATOKA GORGE
INDEX
DAMBO
ALLUVIUM
GRAVELS
KALAHARI SANDS 2
KALAHARI SANDS 1
KARROO BASALT
SHINGLE ON OLD RIVER BED
PRINCIPAL WILTON SITES
OTHER SITES & EXCAVATIONS
CONTOURS
RAILWAY
PRINCIPAL ROADS
J.D.C. 1940

FIG. 3

On this basis the writers were able to recognise seven different cultures, which they related to seven former lips of the Falls, giving their opinion that since Pre-Chellean times, the river had gradually cut its way back from six other lines of falls until the seventh or existing line was reached. The work of Armstrong and Jones, therefore, marks the first attempt at correlation of the archæological remains with the past climatic phases and, together with the geological evidence provided by Maufe (1929, p. 57) finally proved beyond a doubt that the gravel and contained implements were deposited by the Zambezi before the erosion of the upper seven gorges.

In 1938, after examining the Victoria Falls area, the writer considered that several distinct deposits could be recognised which would make it possible to amplify many of the conclusions arrived at by Armstrong and Jones, particularly in their correlation of the archæological evidence with the rate of retrocession of the Zambezi through the gorge, and began, therefore, to conduct excavations. At the end of 1938 a preliminary account of the geology and archæology of a limited area on the north bank was written in collaboration with H. B. S. Cooke (1939, p. 287) to accompany the latter's description of new fossil elephant remains discovered by the present writer in an excavation adjacent to the Silent Pool. (See map, Fig. 4.) Since this preliminary report was written work over a much wider area has necessitated some modification of the geological sequence, while important new archæological evidence has come to light, extending considerably our knowledge of the various cultures and, in two specific cases, requiring a reconsideration of the incomplete earlier evidence.

The present work embodies, therefore, the results and conclusions arrived at after some five years' fieldwork, which was carried out partly between 1938-1940, when work was concentrated on the alluvial deposits, and then in 1948 and 1949 when work was confined largely to the deposits of the sand scarps and it was possible to check the earlier results obtained from the valley. During this time a large collection of artifacts was made and the Quaternary deposits were mapped wherever possible.

The immediate aim of the survey was to provide a solution to the two main problems which necessarily arise in any study of the Upper Zambezi Valley. The first is the correlation and interpretation of the Pleistocene and Recent deposits and climatic conditions with the archæological remains; the second is the rate of retrocession of the Zambezi through the Batoka Gorge, and the position down-stream of the falls during any particular climatic period.

In the past twenty years much detailed work has been undertaken in both East and South Africa which has greatly increased our knowledge of the climatic conditions and Stone Age cultures of these two parts of the Continent during Pleistocene and Recent times. The work of Goodwin and van Riet Lowe (1929), of Cooke (1941), Malan (Malan and Goodwin, 1939; Malan 1942 *a* and *b*) and others in South Africa, and of Leakey (1931, 1936), Nilsson (1945), Wayland (1934) and O'Brien (1939) in East Africa has enabled the sequence of events and prehistoric cultures to be elucidated in some detail in each area; but correlation work between these areas themselves still remains more a matter of probability than of certainty. The Zambezi Survey, as will be shown, now provides an important link in the chain of evidence joining the events and cultures of East and South Africa.

In spite of a number of difficulties encountered during the course of the investigation much valuable archæological evidence was obtained. In the first place, in the Zambezi Valley very few exposures of the deposits have been laid bare as they have by diggers in the Vaal and other South African rivers, and we therefore had to open up sections ourselves at various points along the river. It is only occasionally, therefore, that such extensive exposures as those in the Conduit and Storm Drain at the Eastern Cataract and Silent Pool at the Victoria Falls themselves can be seen. Excavation was conducted, except where circumstances dictated otherwise, by opening up an exploratory trench 15 by 3 feet (5 x 1m.), which was divided into sections and excavated in 6″ (15cm.) layers until bed-rock was

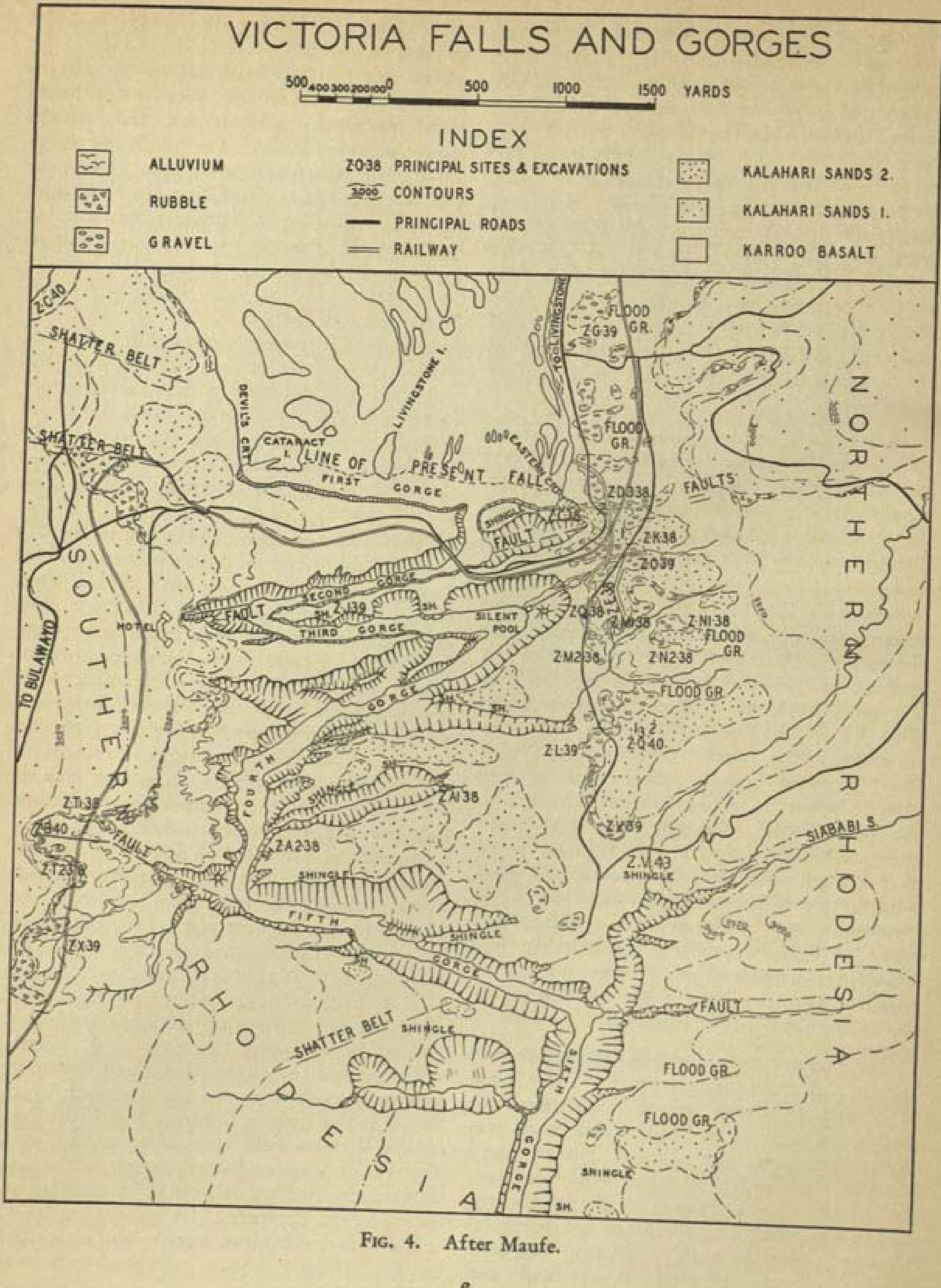

FIG. 4. After Maufe.

reached. All material was put through a riddle and every artificially fractured stone kept for examination before it was finally retained or discarded.

A second difficulty was the comparative scarcity of roads or even meagre tracks except in the immediate neighbourhood of Livingstone, and the total impracticability of a bicycle on the boulder-strewn basalt country that had to be traversed. This fact necessitated walking, often considerable distances, to the various sites, particularly below the fifth gorge where a detour of some miles had to be made on foot over weathered basalt boulders in order to skirt the Songwe and other gorges and reach the gravels on the further side. These gorges run back into the plateau towards the escarpment hills, and crossing them near their confluence with the Zambezi gorge is impossible. In spite of these difficulties, however, the wide distribution of the gravels and other deposits was established, and the difficulties themselves were considerably lessened when, at the end of 1948, a road was cut to the Songwe Gorge, thus materially assisting in the examination of the lower gorges.

EXTENT OF THE SURVEY

The Survey covers the lower part of the Upper Zambezi Valley, that is to say, from the river's exit from the Sesheke Plain at the Mambova Rapids, to the Victoria Falls and the upper part of the Batoka Gorge. (See Map, Fig. 2.) The sequence of deposits and their contents holds good for the whole of this area examined. Evidence accompanied by specimens from Barotseland shows that it is also universal over most of that area, but here deep deposits of Kalahari Sands obscure for the most part the underlying stratigraphy.

The investigations were concentrated mainly in the valley of the Zambezi itself and it was here that the richest deposits were found. In some areas the shallowness of the deposits rendered the evidence inconclusive, but corroboration was in most instances forthcoming from tributaries, as, for example, the Maramba, Masue, Songwe, Sinde and Kalomo Rivers, where implement-bearing deposits of some depth are to be found.

Maps of limited areas of the Zambezi in the vicinity of Livingstone (See Figs. 2, 3) and of the Victoria Falls (See Fig. 4) show the position of the Quaternary deposits and of the more important prehistoric sites. A general map of Northern Rhodesia (See Fig. 1) shows sites and other places mentioned in the text which it was not possible to indicate on the maps of more limited extent.

A.—*The Zambezi*

Work was concentrated mainly on that area of the river within easy distance of Livingstone, that is, for a distance of 7 miles (11km.) below and 15 miles (24km.) above the Victoria Falls. On the north bank, however, the deposits were examined for a distance of 55 miles (88km.) up the river to the Mambova Rapids and, on the south bank, to the confluence of the Chobe River. The right bank of the Chobe itself was examined at several points up to the pontoon crossing at Ngoma, and the Zambezi was examined again on the right bank from Katima Molilo to the Sioma Falls, and on the left bank from New Sesheke to Lusu village, about 26 miles (42km.) up river.

Below the Victoria Falls the gravels were traced for some 11 miles (17·5km.) to below the junction of the Songwe Gorge; a tour of the country lying to the north-east of this was made and several tributary rivers examined, the Zambezi gorge being reached again at a point about 18 miles (29km.) below the Falls. On the southern bank examination was carried out as far as a point four miles (6·4km.) below the confluence of the Masue River. In 1949 an aerial survey was carried out of the whole length of the Zambezi gorge, from its commencement at the Victoria Falls to its end, 60 miles (96km.)

down river, where the Matetsi joins the Zambezi.

The country north of the river from Katombora to the Machili was also examined. This tour extended up the Machili to Mulanga and Mulobesi where a number of sites were visited, and down the railway line to Bombwe, Siburu, Ngwesi, Sinde and Livingstone. The country north of Livingstone was examined as far as Kalomo on the Miocene Plateau.

B.—The Maramba

The deposits laid down by this river proved of considerable importance for, whereas the same sequence of events noted in the Zambezi Valley can be seen here, yet the deposits are often of considerable depth and contain valuable archæological material. The Maramba was surveyed for a distance of 15 miles (24km.) upstream, and its tributary, the Nansanzu, was also examined at a number of points. That part of the valley in the neighbourhood of Livingstone was found to yield the finest assemblage of tools of the Hope Fountain Culture yet recovered. In the gravels laid down during the second half of the Second Pluvial handaxes and cleavers are numerous, but after the decline of this period the main centre of habitation appears to have moved to the parent river, for, in spite of the thickness of the deposits, very few Middle and Late Stone Age tools have been found.

C.—The Masue

The deposits in this river were examined from its confluence with the Zambezi to the Victoria Falls-Bulawayo road bridge, and again on the farm Jafuta, in its middle course, where large assemblages of Middle Stone Age material are to be found.

D.—Other Tributaries

Amongst the other tributaries on the northern bank of the Zambezi, in the valleys of which Stone Age material occurs, must be mentioned the Machili, Mulobesi, Ngwesi, Sinde, Songwe and Kalomo rivers. The supplementary evidence they provide will be discussed in dealing with the stratigraphy.

PART I

GEOLOGY

The Geology of the Upper Zambezi Valley

By F. Dixey, C.M.G., O.B.E., D.Sc., F.G.S.

I INTRODUCTION.
II PHYSIOGRAPHY.
III GEOLOGY.

I—INTRODUCTION

The geology and physiography of the Victoria Falls and the surrounding country have been described by A. J. C. Molyneux (1903), G. W. Lamplugh (1907) and H. B. Maufe (1929 and 1936). Maufe (1938) described new sections in the Kalahari beds in railway cuttings south of the Victoria Falls. H. B. S. Cooke and J. D. Clark (1939) described new fossil elephant remains from the Older Gravels at the Falls and gave a brief account of the geology of this area. Finally, the writer (Dixey, 1941) gave reasons for regarding the Upper Zambezi Valley as representing the end-Tertiary peneplain rather than the Miocene peneplain, from which it followed that the chalcedony (silicified limestone) of the Victoria Falls area was of end-Tertiary or early Pleistocene age rather than Miocene.

The following pages present a more detailed account of the physiography and the later geology of that part of the Upper Zambezi Valley covered by Mr. J. D. Clark's archæological survey.

II—PHYSIOGRAPHY

Above the Victoria Falls the Zambezi flows for some hundreds of miles through an area of very subdued relief which in earlier accounts has been referred to as part of the great interior plateau of Africa. This statement is true in a general way, but later observations have shown that in this region the plateau surface is a composite one, in which may be distinguished two erosion surfaces of different ages, namely, the Miocene and the end-Tertiary.

At the Falls the Zambezi plunges headlong into a narrow precipitous gorge 400 feet deep (120m.), which for several miles follows a remarkably zigzag course; the gorge maintains its trench-like character for a total of 60 miles (96km.) after which, while still in the Karroo basalts, it rather suddenly expands into a more open valley.

Below the Falls the plateau surface has suffered intense dissection in the vicinity of the main river and its tributaries, so that a great wedge of exceedingly broken country has been produced, expanding eastwards on both sides of the river from its apex at the Falls (Lamplugh, 1907).

Above and below the Falls, at distances varying from one to several miles from the river, there extends along both sides of the valley a minor scarp, 50 to 150 feet (15 to 45m.) or more in height, due to the eroded edge of the Kalahari sands, which formerly extended right across the valley (Plate 29).

The main plateau of Northern Rhodesia and adjacent countries is due to a vast peneplain that was in course of formation throughout the later Cretaceous and the early and middle Tertiary, and it is generally believed to have been disturbed by continental uplift in the mid-Tertiary or Miocene

For bibliographical references see pp. 132-134.

(Veatch, 1935); it is well preserved, for example, on the higher uplands bordering the Middle Zambezi Valley, namely, the high-veld of Southern Rhodesia and the Choma-Lusaka ridge of Northern Rhodesia, as well as on the high plateau extending along the Zambezi-Congo watershed.

But, following the Miocene uplift, there was initiated a new cycle, which in the Congo basin gave rise to a new peneplain of considerable extent, and broad valley-floor extensions of this peneplain continued up the tributary valleys of the Congo towards the Zambezi-Congo watershed; this younger cycle was brought to a close by renewed uplift, which took place in the end-Tertiary or early post-Tertiary (*ibid.*).

A cycle closely analogous with the end-Tertiary cycle of the Congo basin has greatly modified the Miocene peneplain of Northern Rhodesia (*ibid.*). For example, the Zambezi Valley and the Kafue tributary valley, coming down from the Zambesi-Congo watershed, gradually sink beneath the level of the Miocene peneplain and assume the characters of great " valley-floor peneplains " 50 miles (80km.) or more in width. Along the railway route between Livingstone and Lusaka they lie respectively 1,200 and 900 feet (360 and 270m.) below the older surfaces, and they are both accordant with a great, dissected, terrace-like feature running along the north flank of the Middle Zambezi Valley. Moreover, the Kafue, like the Upper Zambezi, descends to the level of the Middle Zambezi by way of a deep gorge incised into the broad valley-plain. Finally, the manner in which the Kafue escapes from its broad late-mature basin, by way of the wide gap cut through the Choma-Lusaka Miocene ridge, is convincing evidence of the magnitude and slow development of the younger cycle (see p. 12). I have described these features more fully elsewhere, but sufficient has perhaps been given to show that the Upper Zambezi and the Kafue valleys belong to the same cycle of erosion and that this cycle represents the end-Tertiary cycle of the Congo Basin and adjacent territories.

Along the railway the end-Tertiary surface rises very gradually north-eastwards and gives place imperceptibly to the Miocene surface; but in an easterly direction the upper escarpment of the Middle Zambezi Valley gradually develops. It is shown as a minor feature in Lamplugh's north-south section 45 miles (72km.) east of the Victoria Falls, and becomes more pronounced still farther east. Across this escarpment the Zambezi tributaries have developed mature end-Tertiary valleys, now rejuvenated by headward erosion from the tributary gorges.

A careful examination of Lamplugh's map and sections indicates that the end-Tertiary cycle extends similarly a considerable distance south of the Zambezi and again fingers out amongst residuals of an older surface. These two surfaces appear to represent those described by Maufe (1930 and 1935) as the " high-veld " and the " middle-veld " of Southern Rhodesia. The former is identified with the mid-Tertiary peneplain, and thus corresponds to the Choma-Lusaka upland on the opposite side of the valley, while the " middle-veld " represents the surrounding lower end-Tertiary surface.

Accordingly, on both sides of the Zambezi a surface representing the end-Tertiary peneplain of the Congo Basin has been extensively developed at the expense of the mid-Tertiary or Miocene peneplain, and in general the depth of this younger surface beneath the older one increased with proximity to the main river-valleys.

This question of the age of the Upper Zambezi Valley is of importance in relation to the age of the deposits resting on its floor; for example, in view of the above considerations, the silicified limestone (chalcedony) of the Victoria Falls area cannot be of Miocene age, as has been suggested by various writers, but must be referred to the end-Tertiary or shortly afterwards.

Both the mid-Tertiary and the end-Tertiary surfaces are now undergoing erosion in the modern or post-Tertiary cycle which assumes two widely-contrasting forms, depending on the extent to which the entrenchment of streams consequent upon the Pliocene uplift has progressed. For example, on the Middle Zambezi, the limit of such entrenchment is marked by the Victoria Falls; above the Falls, the erosion of the modern cycle, protected by the resistant base-level provided by the basalt valley-floor, is scarcely distinguishable from that of the end-Tertiary, of which, indeed, it is a direct continuation, although the effect of climatic changes and some very gentle warping has to be taken into account.

That the post-Pliocene erosion should be so slight is not surprising, in view of the low gradients already developed and the brevity of post-Pliocene time, compared with that required for the erosion of the end-Tertiary surface—namely, part of the Miocene and the whole of the Pliocene. Veatch (1935), on the basis of recent radio-active measurements of geological time, quotes 700,000 years as the time possibly required for the later period as against 10,000,000 years for the earlier. Yet during this same lapse of time (namely, the post-Pliocene) the erosion accomplished by the Middle Zambezi and its tributaries has been immense, and the recession of the Falls along the uppermost four gorges, aided by faults, shatter-belts and open joints in the basalt (Lamplugh, 1907) has been surprisingly rapid. For the distance between the Songwe River, six miles (10km.) below the Falls, to the Third Gorge, was almost certainly carved out during the Third Pluvial,* when the Younger Gravels were being deposited, thus leaving the old river-bed south of the Fourth Gorge exposed to the deposition of wind-distributed Kalahari Sand II, in and below which unrolled tools of the Rhodesian Magosian are found (Cooke and Clark, 1939). Hence the whole of these six miles (10km.) of gorge has been cut since sometime in the later Pleistocene, during a period of perhaps 300,000 years, or about 1·25 inches per year. It should be noted, too, that, although no appreciable recession of the lip of the Falls as a whole was observed during the 22 years from 1906 to 1928, erosion was none the less seen to be in progress at the Western Cataract, where a short longitudinal gorge may be forming comparable with the Boiling Pot Gorge.

But with increasing distance from the Falls the gorge, throughout its total length of 60 miles (100km.), as well as its tributaries, has been undergoing erosion during a correspondingly greater part of post-Tertiary time; accordingly, the gorge becomes increasingly wider and deeper, with sides of decreasing slope, until it attains a maximum depth of fully 800 feet (240m.). Moreover, stages in the erosion of the gorge are marked by numerous flats usually overlain by siliceous and calcareous surface deposits, such as those in the Lower Matetsi Valley at heights of 100 and 500 feet (30 and 150m.) above the river (Lamplugh, 1907, p. 204).

While the implementiferous succession of the Zambezi just above the Falls is sometimes crowded within deposits only a few feet thick, corresponding deposits in the older part of the gorge probably extend over a vertical range of several hundred feet, consequently the examination of these down-stream flats and terraces may be expected to yield results of considerable value.

It is of interest to consider to what extent the Middle Zambezi Valley has been determined by warping complementary to the Southern Rhodesia north-east south-west axis, as suggested by Maufe (1927, p. 32).

It should in the first place be noted that the Choma-Lusaka ridge shows a striking parallelism with this axis and with the Middle Zambezi Valley. Maufe has recorded an

* The term "pluvial" has been used to designate a climate of long extent, consistently wetter (though allowing for minor fluctuations within the whole) than the climate pertaining today in south Central Africa. Similarly the term "Interpluvial" has been used to denote a major phase when the climate was drier than is the case today. It is understood that the stratigraphic division of the Pleistocene in Africa (excluding the North African littoral) as proposed by the First Pan-African Congress on Prehistory (1947) has now been approved by the appropriate sub-commission of the International Geological Congress (1949). (See Man, Vol. XLIX 72.)

The divisions used in the present work should, most probably, be correlated as follows:

First Pluvial deposits = Kageran.
Second Pluvial deposits: First part = Kamasian.
Second part = Kanjeran.
Third Pluvial deposits = Gamblian.
First Post-pluvial Wet Phase deposits = Makalian.
Second Post-pluvial Wet Phase deposits = Nakuran.

inward or synclinal dip of the mid-Tertiary peneplain on the one side, but there is no general dip of this character on the other side; east of Choma, for example, the surface has an inclination of less than two feet to the mile (1/2,600), and this is probably original. The structures are none the less clearly related.

It should be noted, too, that these structures are but part of a far larger pattern as developed throughout Northern Rhodesia. For example, the Luangwa Valley is directly in line with the Middle Zambezi Valley, while the Choma-Lusaka ridge is similarly in line with the high watershed ridge separating the Luangwa Valley from the parallel Chambezi Valley, which in turn is in line with the Middle Kafue Valley.

But consideration of the geology of these valleys and of the remnants of older peneplains on certain of the ridges indicates that the pattern had its beginning in pre-Miocene times (Dixey, F. 1944(*a*)). It is, therefore, of interest that W. D. Johnston, as quoted by Maufe (1935), has suggested that the warping that produced the Southern Rhodesia watershed is older than the peneplain developed on that watershed. It is also evident that, prior to the Miocene uplift, the Zambezi was flowing across the line of what is now the Choma-Lusaka ridge, while its tributary, the Kafue, was flowing similarly across another part of it; and that, as the uplift proceeded, they both maintained their courses and ultimately developed deep, late, mature valleys across the ridge in the end-Tertiary cyle. But the Zambezi Valley, none the less, still shows a marked constriction at Livingstone, where it passes between the end of this ridge and the end of the opposite subsidiary watershed, which extends from Bulawayo to Victoria Falls and is largely followed by the railway.

Additional movements of later date (probably associated with the end-Tertiary uplift) have also taken place in the Zambezi Valley, both above and below Livingstone. Du Toit (1933, p. 14) has described a north-east south-west depression running at right angles across the courses of the Okavango, Linyanti and Upper Zambezi rivers, which he has termed the Okavango-Linyanti depression. He states (loc. cit.) that the Zambezi, dropping into the hollow from the north by the Katima Molilo rapids, has developed a winding channel across the wide flood-plain before escaping through the higher ground on the south at Katombora.*

Du Toit regards the depression as complementary to the axis of upwarping that extends in a south-westerly direction across Southern Rhodesia into the Kalahari, which he has termed the Kalahari-Rhodesia axis. He considers that these features are part of a roughly parallel system of warping, traceable over the southern part of the continent, which developed in Tertiary and later times as an effect or an accompaniment of the Rift Zone movements of East Africa.

From the account now given of the Upper Zambezi Valley it is clear that the Okavango-Linyanti depression is of post-Tertiary age, since it cuts across the end-Tertiary Zambezi Valley plain; but, on the other hand, the Southern Rhodesia axis was in place throughout the later Tertiary, and possibly before, since it was a factor in the development of the end-Tertiary surface in its vicinity. The same remark applies to the parallel watersheds north of the Zambezi. It is therefore possible that the Kalahari end of

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* The extension north-eastwards of the Okavango-Linyanti Depression is clearly seen on the vegetation and soil map (1949) compiled by the Ecological Survey of Northern Rhodesia. In the report for North-Western Rhodesia C. G. Trapnell states: "Extending north-east from the Sesheke Plain, across the Machili Basin, and south-west from the Kafue Flats across the Nanzila Basin, are two imperfectly mapped clay plains, believed to lie on Karroo beds, which are characterised by mopane trees. These areas have the appearance of former flood plains of the Zambezi and Kafue drainages formed in basins eroded out of the borders of the Kalahari Sand in a past epoch when flooding of these rivers was more extensive than at present."

(Trapnell, C. G., and Clothier, J. N. 1937. The soils, vegetation and agricultural systems of North-Western Rhodesia. Government Printer, Lusaka. p. 4.)

the axis is somewhat younger than the Southern Rhodesia end, or that along the latter the movement was renewed along an older line. Such renewed movement appears to have occurred locally in Northern Rhodesia, since all the larger post-Tertiary swampy depressions of this country lie within main watersheds that date from the Miocene uplift or possibly even earlier.

The gradient of the Zambezi in the Katima Molilo-Katombora section is clearly very low, but between the depression, at about 3,100 feet (1,000m.) (du Toit, 1933, p. 15), and Livingstone, there is a fall of 200 feet (60m.) in about 50 miles (80km.), or about four feet per mile; over the whole stretch of about 430 miles (700km.) from Balovale to Livingstone the average gradient is only about 1·5 feet per mile (1/3,500).

Yet from Lamplugh's map (1907) and section, between Livingstone and a point 45 miles (72km.) down-stream the slope of the floor of the valley, above the shoulders of the gorge, is as much as 18 feet per mile (1/300). This section of the valley lies in a prolongation of the flat watershed, separating the Okavango-Linyati depression from the similar Makarikari depression; its relatively steep slope would thus appear to be connected with the post-Tertiary movements that formed these depressions. Its presence has probably been a factor in the rapid cutting back of the Falls in this section of the valley.

III—Geology

1. The Geological Succession.
2. Siliceous and Calcareous Surface Deposits.
3. Rock Barriers; Warping; Terraces.
4. Changes of Climate.
5. Correlation with other Areas.

1.—The Geological Succession

The following succession of deposits, reading from below upwards, is recognised in the Upper Zambezi Valley:

11. Wind - blown Sands, with calc-tufa.	Recent.	
10. Sandy Calcareous Aluvium.		
9. Kalahari Sand II.	Upper.	Pleistocene.
8. The Younger Gravels and Sands.		
7. Kalahari Sand I.	Middle.	
6. The Older Gravels and Sands.		
5. The Pipe-Sandstone.	Lower.	
4. The Chalcedony (silicified limestone)		
3. The High - Level Gravels.	Lower Pleistocene and Pliocene	
2. Basalt.	Karroo.	
1. Sandstone.		

2—*Karroo Basalt*

The even surface of erosion of the Victoria Falls area is underlain by basalts of Karroo age, and it is in these basalts that the Falls themselves and the down-stream gorges have been cut. Lamplugh (1907) showed that these gorges were developed along belts of weakness in the basalt resulting from close jointing, shatter-belts, and opened joints filled by breccia or vein calcite. Maufe (1929, p. 57) has shown that two of the gorges, at least, were developed along shatter-belts which were also lines of faulting, and he demonstrated that the transverse gorges marked former positions of the Falls, recognising eight or nine such sites including the present one.

In the vicinity of the gorges the basalts occur in two strikingly different forms (Maufe, 1929); the one is a fine-grained dark-bluish rock, which forms the bare cliffs with vertical jointing on the walls of the gorges, while the second is purplish-red-amygdaloid, an example of which crops out on the path from Victoria Falls Hotel to the Falls. On the walls of the gorges the amygdaloids form continuous bands free from regular jointing, and from the second gorge down-stream they break the verticality of the walls. Six layers of the dark, fine-grained variety of basalt have been recognised, and these alternate with amygdaloid. The basalts lie horizontally or with very gentle dips.

The basalt outcrop tapers to a point about 70 miles (110km.) east of Victoria Falls, where the Zambezi flows from the basalt on to the underlying sandstones; east of the Falls a narrow outcrop of these sandstones intervenes between the basalt and the gneiss on both sides of the valley. Sandstones, possibly of Karroo age, occur also beneath the alluvium of the Zambezi flats above the Machili confluence, and similarly in the Machili Valley near Mulanga Police Post.

3—*The High-Level Gravels*

In the Kasai-Lunda region of the Congo Angola border pebble-deposits, two to three metres thick or even more, rest on the mid-Tertiary peneplain (as beneath the chalcedony of Mont Bunza), and other extensive pebble-deposits form the " Plateau Gravels " underlying the " Plateau Sands " (Kalahari sands) of the end-Tertiary surface. The pebble deposits of each of these two surfaces are regarded as residual from the formerly widespread Lubilash sediments, which still underlie large parts of the surfaces (Veatch, 1935). Also, at Lusaka, a thin spread of ancient waterworn pebbles, associated with more or less surface rubble, rests on the schists of Ridgeway, a flat remnant with low side-slopes standing about 50 feet (15m.) above the surrounding peneplain; the pebbles extend down the slopes and over the lower surface. These two surfaces are ascribed tentatively to the mid-Tertiary and the end-Tertiary respectively. Search for stone implements in these deposits has given negative results. Fifty miles further east, on the Great East Road near Chinyunyu, other comparable high-level gravels ascribed to the end-Tertiary have given similar negative results.

Thus ancient gravels form thin discontinuous deposits occurring on the end-Tertiary plateau surface, and extend also down the gentle upper slopes of valleys in this surface. Along the valleys the gravels form terraces, vaguely defined above but more clearly defined below.

Along the Lower Luangwa Valley and the Lower Lunsemfwa Valley occur thick sheets of coarse pebbles, which, in the Lunsemfwa Valley, are locally as much as 200 feet (60m.) thick; these deposits rest on a surface lying below that referred to the end-Tertiary. The age of these gravels is uncertain; certain of them have clearly been re-sorted in the post-Tertiary, and to that extent they may represent the First Pluvial deposits.

The Chinyunyu gravels referred to lie 40 to 60 miles (65-100km.) east of Lusaka on the Great East Road, where thin pebble deposits extend far up the slopes of shallow late-mature valleys draining both to the Zambezi and the Luano, and then spread out over the plateau surface rising gently above the valleys. This plateau surface, at about 3,500 feet (100m.) appears to represent the fringes of the end-Tertiary cycle on the mid-Tertiary peneplain. At the upper levels implements are only doubtfully present, whereas they do come in again at the lower levels.

These high-level gravels are clearly analogous with the older gravels of the Vaal River basin. The Vaal River and its tributaries have eroded their valleys to a depth of 400 feet (120m.) into a peneplain surface of wide extent eroded below the level of the great Tertiary peneplain represented on the neighbouring Kaap plateau, as well as in the Transvaal and the Orange Free State. (Söhnge, Visser and van Riet Lowe, 1937.) On this lower surface, at distances of 20 miles (32km.) or more from the Vaal, lie thin deposits of gravel, the deposition of which was continued in successive stages down the sides of the valleys as terraces, which become increasingly well-defined as the river is approached. Above Vereeniging the earliest implements occur in the 100 foot (31m.) terrace, while below this barrier Pre-Chelles-Acheul pebble tools occur up to the 200 foot (62m.) level. In the terrace lying at about 60 feet (18m.) above the present flood-plain of the Vaal at Vereeniging has been found a prolific site of the earliest stage of the Chelles-Acheul culture (Stellenbosch I). These lowest gravels are accordingly assigned to the very end of the Lower Pleistocene, or beginning of the Middle Pleistocene, and the upper part of the gravels to the Lower Pleistocene proper. (Breuil, van Riet Lowe, and du Toit, 1948.) The surface on which the uppermost gravels rest is thus comparable with the end-Tertiary peneplain of Northern Rhodesia and the Belgian Congo. The high-level gravels usually comprise a poorly stratified river wash, but in some cases they show no clear evidence of river deposition (op. cit.), they are sometimes rather angular and comparatively little rolled, and they are overlain by fine, red eolian sands (op. cit.).

Similarly, in the vicinity of the Kasai and neighbouring rivèrs of the southern Congo Basin, the "plateau gravels" of the end-Tertiary peneplain give place to the terrace gravels at the lower levels; the earliest implements are seen only in the lower terraces. All these gravels are overlain by "plateau sands", correlated with the Kalahari sands (Veatch, 1935).

Hence certain of the high-level gravels of the Upper Zambezi Valley region have their counterparts in neighbouring countries, and the gravels have accumulated on the surface of the end-Tertiary peneplain, as a result probably of both eluvial and river action, as in the Vaal River area (Söhnge, Visser and van Riet Lowe, 1937) and in the region of the Zambezi-Congo watershed (Veatch, 1935).

In the Victoria Falls area and thence to the high plateau at Kalomo it is doubtful if any gravels so far recorded are as old as the end-Tertiary, since practically all the non-implementiferous and presumably oldest gravels of this area (such as the eastern Ngwezi gravels) have yielded pebbles or fragments of either the basal chalcedony or the pipe-sandstone. There are additional non-implementiferous gravels several miles west of Mapanza on the Namwala road, which, on physiographical grounds, appear to be of comparable age. The uppermost of the Older Gravels (such as those of Kalomo, 4,150 feet—1,265m.) occur as vaguely-defined terraces, spreading out into thin discontinuous sheets on adjacent parts of the gently-sloping plateau surface. West of Kalomo, on the Great North Road, even these uppermost gravels are implementiferous.

Again, in shallow road and railway borrow-pits and cuttings near Kabuyu (3,928 feet—1,252m.), 30 miles (48km.) north of Livingstone on the Great North Road, there occur additional high-level gravels that yield pebbles and fragments showing evidence of human handiwork. All these high-level gravels at Kalomo and Kabuyu now referred to are ferruginized, but the Kalomo ferruginized gravels are overlain by unconsolidated gravels yielding rostroid tools. Again, beneath the Kalahari sand of the Kafue Valley occur other ancient gravels, containing chalcedony and pipe-sandstone, that are also implementiferous. The tools recovered from all these ancient gravels indicate a cultural stage comparable with that of the Older Gravels of the Victoria Falls area.

4—*Chalcedony* (*Silicified Limestone*)

The most detailed account of the chalcedony is Maufe's description (1938) of the deposit as exposed in railway cuttings less than a mile south of Victoria Falls Station, at Dale's Kop, situated a mile and a half north-north-west of the station, and as rubble spread out over the basalt at the foot of the slopes of Kalahari sand (op. cit.). But the chalcedony occurs also under somewhat similar conditions on the opposite side of the Zambezi in the vicinity of Livingstone, and for some miles up the valley along the foot of the sand scarp. It occurs also as rubble in the bed of the Njoka River 140 miles (225km.) above Livingstone.

A rock referred to by Lamplugh (1907) as "silcrete" crops out from beneath the Kalahari sand on the end-Tertiary basalt plateau above the gorge as far as the gorge extends, namely, nearly 60 miles (95km.) eastwards of the Victoria Falls. He observed the "silcrete" (which includes the pipe-sandstone as well as the Chalcedony) in his traverses over the plateau on both sides of the gorge, and on the plateau above the lower Matetsi Valley he recorded a deposit of "silici-calcrete" 15 feet (4·5m.) thick (Lamplugh, 1907, p. 213). A fossiliferous bed of Kalahari chalcedony occurs also in the Bubi District of Southern Rhodesia, nearly 200 miles to the east-south-east of the Falls (Maufe, 1938, p. 123).

The chalcedony also occurs 5 to 6 miles (8 to 10km.) north-north-west of Livingstone (2,977 feet—900m.) on the track running to Kaunza and Sinde at an elevation of about 3,250 feet (990m.). It is about two feet thick (50cm.), rests on basalt, and is overlain by ferruginized pipe-sandstone and Kalahari sands. A similar sequence occurs at Natebe Railway-siding (3,349 feet—1,020m.) 9 miles (14·5km.) north-east of Livingstone.

Near Kalomo, 80 miles (130km.) from Livingstone, the chalcedony occurs on the gentle western shoulder of the Upper Kalomo Valley, almost at the level of the Miocene plateau. Here, at about 4,150 feet (1,265m.) it is exposed as a surface rubble in shallow road and railway borrow-pits, where it occurs in association with a reddish-brown quartzite (pipe-sandstone) and pebbly ferricrete.

The chalcedony appears again on the Kafue end-Tertiary valley-plain at a level not much above that of the Zambezi Valley plain, namely, 3,300 to 3,400 feet (1,005 to 1,035m.); here, 10 to 20 miles (16 to 32km.) east and south-east of Namwala, and 150 miles (240km.) north-north-east of Livingstone, well-sections show the chalcedony resting on sandstones (probably Karroo) and overlain by Kalahari sands; as at Kalomo, it is associated with a red-brown quartzite and with later gravels.

Maufe has shown that the chaldecony has been formed as the result of metasomatic replacement of an original slightly sandy limestone. This replacement was not uniform, and the unreplaced calcareous material was later removed by solution. The hard flinty rock so formed was the source of material most frequently used for making the stone implements so far recovered in the district. Consequent upon its origin the chalcedony is full of irregular cavities, the presence of which led to the production of imperfect artifacts; examples of these are numerous. Unlike the comparable deposits from Southern Rhodesia and elsewhere, the chalcedony has not yet yielded any fossils.

The chalcedony usually rests directly on the Karroo Basalt, but at Dale's Kop (now Queen Elizabeth Kopjie), where it is five to six feet thick (1·5 to 1·8m.), about a foot (30cm.) of silicified pink sandstone underlies it; about the same thickness of a similar sandstone succeeds the chalcedony. Above this lie weathered blocks of ferruginous sandstone derived from the pipe-sandstone. The silicified sandstone consists of larger well-rounded grains of quartz set amongst smaller grains, and in addition to the siliceous cement there are numerous fine siliceous veins running parallel with the bedding.

Maufe (1938, pp. 211-214) has suggested a correlation of the chalcedony and associated Kalahari beds of the Victoria Falls area with Passarge's succession in the Kalahari.

The chalcedony has hitherto been regarded as of Miocene age; but its relations to the end-Tertiary surface and to the succeeding beds show that the original limestone must have been laid down in the late Tertiary or the early Pleistocene, and that the silicification took place shortly afterwards. Maufe (op. cit. p. 217) has shown that the silicification of the chalcedony certainly took place before the deposition of the carstone rubble bed (derived from pipe-sandstone) of the railway cuttings, since this bed contains small pieces of the chalcedony. Furthermore, the cementation of the pipe-sandstone by silica was a separate process and later in time than the silicification of the limestone, since small sub-angular pebbles of chalcedony occur within the pipe-sandstone.

Additional silicified beds occur below the Falls within the zone of dissected country lying below the level of the end-Tertiary basalt plateau (see p. 24).

5—*The Pipe-Sandstone*

The pipe-sandstone was originally described by Maufe (loc. cit.) from the railway cuttings already referred to south of Victoria Falls Station, where it rests on the chalcedony and is followed by red sands and the carstone rubble-bed. In these sections the pipe-sandstone is described as a coarse-grained, white to pale-pink, feebly cemented rock, consisting of large (0·75 to 1·5mm.) rounded quartz grains scattered abundantly, but without order, amongst smaller (mostly 0·125 to 0·5mm.) grains set in a dull white cement. This cement is regarded as an opal one in process of transformation to some form of chalcedony distinct from that of the underlying bed. Quarter-inch sub-angular pebbles of quartz and of chalcedony are scattered through the sandstone.

In 1943 fossils were found for the first time in the pipe-sandstone, near a railway cutting south of Victoria Falls station. They comprised *Limnea* sp., *Cypris* sp., *Planorbis* sp. and *Chara* sp. which unfortunately did not afford definite information as to the age. (Dixey, 1944(*b*).)

A characteristic feature of the rock is the presence of numerous hollow pipes, on the average ⅜" (1cm.) in diameter. The pipes turn into a horizontal position when followed downwards, and thus give the rock a roughly horizontal structure. They are interpreted as caused by the growth of reeds; if so, they indicate semi-arid conditions rather than thoroughly arid. The pipes characterize the rock far beyond the limits of the Victoria Falls area, and agents other than reeds have possibly contributed to their formation.

In the cuttings the thickness of the bed varies from nothing in the southern cutting to 12 feet (3·6m.) in the northern cutting, where, however, the base is not exposed. The pipe-sandstone is overlain by a highly variable thickness of red pebbly sand, with a maximum thickness of 6 feet (1·8m.). The sand consists of the stained and broken-down upper part of the pipe-sandstone; none the less, it resembles the Kalahari sand in colour, consistency and lack of bedding, but is distinguished from it by the presence of the small pebbles already referred to.

The red pebbly sand is succeeded by a carstone rubble bed, which consists mainly of lumps of a hard rock made up of sand grains cemented by iron hydroxides. In section this bed follows a wavy line and locally thickens downwards into pockets in the red sand. Maufe interpreted it as a sheet of land-rubble which accumulated on a weathered surface of the pipe-sandstone, and the silicification of the sandstone is considered to have been completed before the accumulation of the rubble.

From consideration of the carstone rubble-bed in relation to numerous exposures in the Livingstone area, I suggest that the principal elements of the bed are derived from the disintegration of an upper ferruginized horizon of the pipe-sandstone itself. They are indistinguishable in the hand-specimen from the common ferruginous phase of the pipe-sandstone, and in some cases the characteristic dull white cement of this rock can still be detected. Even in those cases in which ferruginization has been carried to an extreme stage, small patches occur showing a transition to the less ferruginous phases.

Maufe recognised the presence in the rubble of chalcedony flakes showing human workmanship, and on archæological grounds the rubble is now correlated with the Ferricrete horizon of the Livingstone area (op. cit. p. 121 et seq.). The overlying Kalahari sand is thus a redeposited sand.

In the Livingstone area, where it forms a persistent but thin bed above the chalcedony, the pipe-sandstone shows all the phases of silicification, iron-staining, and disintegration to sand revealed in the cuttings; but it appears in addition as a hard pale-grey quartzite (as along the Maramba River) or as a hard ferruginous sandstone, or as the broken-down sandy representatives of these rocks.

The fresh pink or reddish quartzitic form seen beside the railway two miles (3·2km.) south of Victoria Falls Station is well represented on the northern side of the river, as is also the basal calcareous facies recorded by Maufe (1941, p. xcv) from 1¼ miles (2km.) north-west of the station.

For example, the basal calcareous facies is strikingly exposed in the bed of the Maramba River opposite Legg's Farm, near the eastern end of the Livingstone Golf Course. Here it was laid down in a small hollow in the basalt surface, and the normal quartzitic facies is present in the stream banks about 200 yards (180m.) up-stream at a level just above that of the calcareous bed, as well as about 30 yards (27m.) down-stream of it (Plate 22.1).

The limestone is typically compact in texture and pale-grey in colour, and the deposit is about six feet (1·8m.) thick. It contains numerous masses and nodules of dark-grey to black flint-like concretions and, while most parts of it are more or less sandy, near the base and top of the deposit it contains an increasing proportion of well-rounded sand-grains and graduates into quartzite. This deposit was originally described (Dixey, 1941, p. 40) as representing the basal chalcedony, but Maufe (Proc., 1941) has drawn attention to its similarity to the basal calcareous facies of the pipe-sandstone of the Falls Area.

In the vicinity of Livingstone the pipe-sandstone frequently appears in the form of a hard pale-grey quartzite, breaking down on weathering to a white chalky-looking sandstone, more or less friable, and the characteristic pipe structure becomes more and more pronounced as weathering increases. This form of the rock gives rise to a terrace-like feature on both sides of the Maramba River near the Livingstone Municipal Compound (where it rests on much-weathered basalt) and is seen also on the floors of shallow valleys and in well-shafts near the Kalambo and Makunka sidings on the Zambezi Sawmills Railway (Fig. 13), and between Sinde Mission and Senkobo, where again it rests on basalt. In places, as along the Maramba River and elsewhere, the quartzite passes into or contains nodules of an extremely hard, mottled, light and dark grey to black flint-like rock. These nodules sometimes give the weathered mass a conglomeratic appearance.

Locally (e.g., near the cuttings two miles (3·2km.) south of Victoria Falls Station and in an exposure near Makunka siding) the fresh quartzite is pink to dull red in colour. On weathering it breaks down into sandstone and sands showing varying degrees of iron-staining and leaching as already described. But at greater distances from Livingstone (e.g., at Natebe, Kalomo, and in the Kafue Valley near Namwala) the fresh quartzite, not merely locally but generally, is of a reddish colour, as it is also on the Victoria Falls-Bulawayo Road in the vicinity of the Gwaai River. The reddish quartzites are usually translucent and sometimes of relatively fine grain. At Kalomo, Natebe and Namwala, the reddish quartzite occurs in association with the chalcedony, and in the two latter localities it is overlain by Kalahari sand (see p. 40). In all these localities the pipe-sandstone does not appear to exceed two or three feet (60 or 90cm.) in thickness.

The upper part of the pipe-sandstone (or the whole of it if only two to three feet thick) frequently takes the form of a brown or dark-brown to chocolate-coloured ferruginous quartzite, which often retains the characteristic pipe structure and the siliceous cement around the grains. The ferruginization clearly took place subsequently to the silicification. The ferruginous rock is very durable, and in many places provides the only remaining evidence of the presence of pipe-sandstone. Nodules of it frequently occur in the Older Gravels, and these sometimes show signs of artificial fracture. When the ferruginized rock is 12 inches (30cm.) or more in thickness it tends to be more or less massive, with relatively few pipes at intervals of several inches, and divided into rough blocks by irregular joints a foot or two (30 to 60cm.) apart. Overlying this is a friable phase of finer texture with close-set vertical pipes. Such a section appears to correspond to the horizon of ferricrete formation in a deep soil profile.

These ferruginized forms of the pipe-sandstone are exposed at many places on both sides of the Zambezi near Victoria Falls, as on the path to Fifth Gorge, at 1¼ miles (2km.) north-west of Victoria Falls Station, in railway cuttings south of the station, at the Maramba Quarry, and about five miles (8km.) east of Kalambo Halt on the Sawmills Railway.

In some cases (as on the Kaunza track five miles (8km.) north-north-west of Livingstone, at Natebe Station, and on the Great North Road near Senkobo) the outcrop assumes a coarse rubbly or finer pisolitic form in which the rounded elements of the pipe-sandstone are more or less heavily coated by iron-oxides and cemented into a hard ferricrete. Sometimes (as near Kabuyu) these outcrops are overlain by, or otherwise associated with, water-worn gravels or a surface-rubble of quartz fragments, etc., which are also heavily ferricreted, thus indicating a second stage of ferruginization of the pipe-sandstone.

The pipe-sandstone exposed along the Maramba Valley, already referred to, was clearly described by Lamplugh (1907, p. 199) under the name of "silcrete" or "chalcedonic quartzite". He recorded it also from the Masue Valley, four to five miles (6·5 to 8km.) south of the Falls, where it was "generally associated with a hard ferruginous sand-rock". . . . (op.cit.)

> "The greatest thickness of this surface-rock that came under my observation was in the sharp south-eastern rim of the Matetsi Valley, some 500 feet above the alluvial flat at Tsheza's, five miles from the mouth of the Matetsi. Here the beds cropped out at the margin of a high sand-covered upland in a bold krantz, which showed 8 to 10 feet of chalcedonic quartzite with 10 to 15 feet of partly siliceous, partly calcareous, brecciated or conglomeratic material below, resting on much-weathered spheroidal basalt. The position of this bed in relation to the valley appeared to denote its considerable antiquity."

It may be concluded that this Matetsi Valley occurrence with its calcareous basal facies and its relation to the Kalahari sands does actually represent the pipe-sandstone, particularly in view of Lamplugh's acquaintance with sections in the Livingstone area now referred to this deposit. This conclusion is not necessarily affected by his further comment that thinner patches of similar chalcedonic rock occurred on the stepped slopes along the opposite side of the valley at all elevations. These observations are of importance in that they show that the Matetsi and the Zambezi in its vicinity had eroded widely-opened valleys to a depth of some hundreds of feet below the level of the end-Tertiary surface before the pipe-sandstone and the Kalahari sands were laid down.

The pipe-sandstone can be traced also for many miles up the Zambezi along the sides of the valley, and a sandstone believed to represent it occurs also beneath the alluvium of the valley between the Ngwezi and Machili Rivers, and again beneath alluvium at Mulanga, in the Upper Machili Valley. The common siliceous, desilicified, and ferruginous forms of the pipe-sandstone occur further up the Zambezi at or near the Katima Mulilo and Sioma rapids and again at Senanga, about 210 miles (340km.) above Livingstone, as well as beneath the Kalahari sands in a little valley six miles (9·7km.) west of Mankoya, and in the Luena Valley seven miles (11km.) east of Mankoya. At Mankoya a ferricrete derived largely from a weathered sandstone, with white cement, also probably represents the same bed; at Sioma the sandstone is said to be 20 feet (6·1m.) thick. Sandstones of similar character underlie the Kalahari sands of large parts of Barotseland, Balovale and Mwinilunga, even to the Congo border. For example, at and southwards of Balovale the sandstone occurs along the east bank of the Zambezi to a maximum exposed thickness of 70 feet (21·3m.), and the bed crops out also along stream beds as far east as the Kabompo River on the Kasempa road. Again, at Chizera, 96 miles (155km.) from Kasempa on the Balovale road, there occurs rubble of the sandstone, as well as of chalcedony. Moreover, much of the "chalcedonic quartzite" recorded by Lamplugh at many places within 60 miles (97km.) eastwards of the Falls is considered by Maufe to represent the pipe-sandstone or a slightly earlier phase of the Kalahari beds. Finally, the sandstone extends at least 150 miles (240km.) north of the Zambezi at Victoria Falls to Namwala, and 150 miles south-west to the Gwaai Reserve of Southern Rhodesia.

Silicified surface deposits comparable with the pipe-sandstone occur also in the Lower Rufunsa Valley and in a neighbouring part of the Lower Luangwa Valley.

It is of interest to consider the relation of the pipe-sandstone both to the chalcedony and to the surface of erosion on which these beds were laid down. Considered broadly, this surface north of the Zambezi is a well-graded one, so that it rises gradually away from the Zambezi for many miles on either side, but the pipe-sandstone was not laid down until after the silicification and some considerable erosion of the chalcedony had taken place (Maufe 1938). This erosion slightly modified the old surface, especially in that the valleys were deepened appreciably. For example, in the Falls area, according to Maufe (1941), the lowest exposure of the basal chalcedony is 75 feet (23m.) above the crest of the Falls, whilst the pipe-sandstone comes down to at least 40 feet (12·2m.); but in a section close to the Eastern Cataract, standing just above water level, a thickness of about 10 feet (3m.) of light-coloured sand (due to the disintegration of a pale sandstone with white cement, fretted fragments of which still remain) lies between the basalt and the Older Gravel. This bed appears to represent the pipe-sandstone.

Similarly, for some miles along the Lower Maramba, pipe-sandstone lies on the basalt at or near river level, whereas in a section (O-P in Fig. 8) at right-angles to the river, the chalcedony does not appear beneath the pipe-sandstone until a considerably greater height, possibly 70 feet (21m.) is reached about 2½ miles (4km.) further back. Nevertheless, both the chalcedony and the pipe-sandstone lie on well-graded surfaces accordant with the general form of the present Maramba Valley. It may, therefore, be concluded that between the deposition of the chalcedony and that of the pipe-sandstone, the Zambezi, and its tributary, the Maramba, were unable to deepen their beds considerably. The amount of deepening cannot be given with any certainty, but it clearly did not exceed 60 feet (18m.) and was probably much less. Since the deposition of the pipe-sandstone the further deepening of these valleys has evidently been trifling, in spite of the impressive erosion accomplished in Pleistocene times below the Falls.

Accordingly, in view of these observations and of Lamplugh's account of the pipe-sandstone ("chalcedonic quartzite") of the Matetsi Valley (p. 19 above), it may be concluded that, at the time the pipe-sandstone was laid down, the form of the Zambezi Valley above the Falls was much as it is now; that below the gorges the valley was widely opened much as at present, although not so deep, but that in the meantime the gorges have been carried many miles up-stream by recession of the Falls to their present position.

When the chalcedony and the pipe-sandstone are followed away from the Zambezi on the northern side, it is found that, while they occur in association at intervals right up to the Zambezi-Kafue watershed at Kalomo, and again down into the Kafue Valley, yet at other localities in this considerable area the pipe-sandstone rests directly on the older rocks. This is clearly due in part to local erosion of the chalcedony, but it may also be due in part to the limitations of original deposition. For example:

1. On the track to Kaunza, 3,250 feet (990m.), 5 miles (8km.) north-north-west of Livingstone, both chalcedony and pipe-sandstone occur.
2. Natebe Station, 3,349 feet (1,020m.), 9 miles (14·5km.) north of Livingstone, both chalcedony and pipe-sandstone.
3. Near Senkobo Station, 3,510 feet (1,070m.), 12 miles (19km.) north of Livingstone, neither chalcedony nor pipe-sandstone.
4. Between Senkobo Station and Kalambo Halt (Zambezi Sawmills Railway), pipe-sandstone only.
5. North of Senkobo Station, 3,650 feet 1,112m.), 20 miles (32km.) northwards of Livingstone, pipe-sandstone (ferruginized) only.
6. Near Kabuyu Station, 3,830 feet (1,136·5m.), 30 miles (48km.) northwards of Livingstone, pipe-sandstone (ferruginized) associated with gravelly ferricrete containing chalcedony.
7. Upper Kalomo Valley, 4,150 feet (1,265m.), 70 miles (113km.) northwards of Livingstone, both chalcedony and pipe-sandstone.
8. Kafue Valley, 3,350 to 3,400 feet (1,020 to 1,035m.), 10 to 20 miles (16 to 32km.) east and east-south-east of Namwala. In different localities chalcedony and pipe-sandstone may both be absent, or they may occur in association or separately, in all cases overlain by Kalahari sands.

It may be added that in general the pipe-sandstone suffered considerable erosion, and was sometimes overlain by gravels, prior to the deposition of the Kalahari sands.

The question of the origin and conditions of deposition of the chalcedony and the pipe-sandstone are of special interest in view of their respective uniformity of character, their fine grain and apparent freedom from contemporary pebbles, and their small thickness of only a few feet, combined with their great extent of some 200 miles (320km.) along the Upper Zambezi, at least 150 miles (240km.) north of the Upper Zambezi into the Kafue Valley, and probably fully as much south of the Zambezi; moreover, the pipe-sandstone extends at least as far as Balovale, about 420 miles (675km.) up-stream of Victoria Falls. It should be noted, too, that north of the Zambezi these beds have not been recognised outside the region covered by the Kalahari sands, except, possibly, in the Rufunsa Valley.

With reference to the Falls area, Maufe showed that the chalcedony was derived from the subsequent silicification of thin beds of freshwater limestone, in which, however, well-rounded quartz grains occur; whereas he considered the pipe-sandstone, with its characteristic pipe-structure, to be due to the subsequent silicification of a reed or sedge bed. The explanation as to the chalcedony doubtless holds throughout the whole area, but with regard to the pipe-sandstone (resting as it does on a wide variety of ancient rocks, and consisting largely of wind-blown sand of even character distributed over a considerable vertical range) wind action must have played an essential part in its accumulation, although the quarter-inch (6mm.) pebbles described by Maufe from the Falls area show that water action must also have played a part, at least locally. Also freshwater fossils occur in the pipe-sandstone at Victoria Falls (Dixey, 1949).

Accordingly, following on a long period of normal erosion in which the end-Tertiary surface was formed, these beds may be taken as marking two perhaps minor oscillations of climate from wetter to drier conditions; these were followed by renewed wet conditions in which considerable erosion of the pipe-sandstone, chalcedony, etc., took place, leading to the formation of gravels, including the Older Gravels. There followed finally a major arid phase in which the Kalahari sands accumulated over the same area to a thickness, in some places, of upwards of 200 feet (60m.).

As already seen, the pipe-sandstone was not laid down until after silicification and some erosion of the chalcedony had taken place; accordingly (since the latter rests on the end-Tertiary surface, and the former was followed by some considerable erosion and then by the deposition of the Older Gravels, probably in the early Middle Pleistocene) the age of the pipe-sandstone may be taken as falling within the Lower Pleistocene, and the fossils so far found in it are not inconsistent with this. Nevertheless, no worked stones of any kind have as yet been found in this bed.

7 and 9—*The Kalahari Sands*

The Kalahari sands extend along both sides of the Zambezi Valley in the Falls area and thence, on the one side, into the Kalahari and Southern Rhodesia, and on the other over the whole of the Upper Zambezi Valley and part of the Kafue Valley and into Angola and the Belgian Congo, where they are known as the "Plateau Sands" (Veatch, 1935). In the Falls area they give rise to a gentle scarp standing one to three miles (1·6 to 4·8km.) back from the river and about 200 feet (61m.) in maximum height, as in places on the Livingstone-Katombora road. Between the scarp and the river extends the basalt floor of the valley, locally overlain by the Older and Younger Gravels and associated deposits.

About 60 miles (100km.) below the Falls, near the confluence of the Matetsi with the Zambezi, the Kalahari sands extend down the open sides of the Zambezi Valley almost to water level; moreover, they rest in part on 8 to 10 feet (2·4 to 3m.) of "chalcedonic quartzite", with 10 to 15 feet (3 to 4·5m.) of siliceous and calcareous material below (Lamplugh, 1907, p. 199), which closely resembles and doubtless represents the pipe-sandstone. Hence in this part of its course the Zambezi had already developed a deep normal valley before the pipe-sandstone and and the Kalahari sands were laid down, and the main gorge, or a large part of it, has been eroded subsequently (see also p. 52 above).

On archæological grounds the sands may be divided into:— (1) Kalahari Sands I, 200 feet (61m.) in maximum thickness. Sterile. (2) Kalahari Sands (redeposited) 40 feet (13m.) in maximum thickness, yielding implements of the Rhodesian Sangoan culture in the lower levels. (3) Kalahari Sands (redeposited) exposed up to 8 feet (2·4m.) or possibly more, deposited by wind action at the end of the Third Pluvial, and yielding Magosian tools. The first sands are usually pale, the second bright red in colour, and the third (owing to the presence of both leached and oxidised material) pink.

Maufe (1938) has described the sands in the vicinity of the Victoria Falls. The description may be taken as applying to the first of the redeposited Kalahari sands, since the sand in the railway-cuttings overlying the carstone rubble-bed, containing Rhodesian Sangoan implements, is to be included with these beds. In the cuttings the sand is bright red in colour and presents a maximum thickness of about 40 feet (12·2m.), throughout which it maintains a remarkably uniform character, apart from the soil and sub-soil of the uppermost six inches (15cm.). It shows the usual texture of a few large well-rounded quartz grains scattered apparently indiscriminately amongst a much larger number of sub-round ones, and it is entirely free from pebbles. The sand is sufficiently well compacted to stand without slumping in the faces of the cuttings. The cementation is due to red iron oxide; the individual grains, even when not cemented, are covered by a film of the oxide, and it is to this that the deposit owes it colour. In the Falls area (particularly on the spurs between the gorges) there are thin deposits of paler, wind-redistributed Kalahari sand, and the white river sand of the Zambezi itself probably represents leached Kalahari sand derived up-stream.

Away from the Falls area (as in the Kafue Valley and a large part of Barotseland) the sands are mainly of a white to pale-grey colour, which in general becomes pinkish in depth (Murray-Hughes, 1929). Along the Victoria Falls-Bulawayo road pale-grey and reddish sands alternate. Between Sawmills and Gwaai (on the Southern Rhodesia railway about 80 miles (130km.) north of Bulawayo) sections show that here also the colour of the deeper parts of the Kalahari sand is red, the pink and buff upper sand appearing always to have been leached of its iron oxide (Maufe, 1929).

The pale-greyish sands of the Kafue Valley east and south-east of Namwala, overlying pipe-sandstone and chalcedony, are much finer in grain and contain a smaller proportion of well-rounded grains than the common Kalahari sands of the upper Zambezi Valley.

6—The Older Gravels. 8—The Younger Gravels. 10—Sandy Calcareous Alluvium.

A detailed account of the Older and Younger Gravels and associated sands, and the later alluvium, has been given in the section on *Stratigraphy and Sequence of Cultures*, and their relations in cross-section are shown in Figures 5-16, accordingly, it will not be necessary here to do more than refer to some points of a general nature.

Above the Falls the Older Gravels usually lie on a basalt surface that rises very gently as traced away from the river, and on this surface they have been observed at a maximum height of 50 feet (15·25m.) above river-level. At the Eastern Cataract, where the gravels rest on a bed of disintegrating sandstone, referred to the pipe-sandstone, they stand only several feet above river level; a fact demonstrating the negligible extent to which the Zambezi in this locality has been able to deepen its bed since Lower and Middle Pleistocene times. Along the Maramba (as also along the Masue) the Older Gravels locally lie even below river-level. Presumably in subsequent times the rivers during each Pluvial or Wet Phase have been unable to do more than remove (to a greater or less extent) the sediments accumulated towards the end of the preceding Wet Phase. Nevertheless, below the Falls during the same period of time, the Zambezi has lowered its bed by some hundreds of feet.

Along the Zambezi, in the vicinity of the rock-barriers (p. 25), the surviving remnants of the Older and the Younger Gravels are rarely more than a foot or two (30 to 60cm.) in thickness, whereas between the barriers they are much thicker, the Younger Gravels and associated sands, for example, being 12 to 14 feet (3·6 to 4·2m.) thick.

The elements of the Older and Younger Gravels contain a high proportion of chalcedony and of pipe-sandstone, and but little basalt; but with increasing erosion of the chalcedony and pipe-sandstone these rocks are represented less and less in the later accumulations, while the proportion of basalt increases.

In general, the Younger Gravels form a terrace lying below that of the Older Gravels, while the later alluvium forms a still lower terrace only 5 to 10 feet (1·5 to 3m.) above the Zambezi (Fig. 5).

Along the Zambezi the terrace of the Older Gravels, forming the upper terrace (Fig. 5), comprises for the most part only a foot (30cm.) or so of coarse gravel resting on a rock platform eroded in basalt, on which a few thin patches of chalcedony remain; the successively later terraces of the Younger Gravels and the later alluvium are terraces of aggradation, each built up of gravels followed by grit and sand. Along the Maramba above the golf course, the thin Older Gravels I rest on a rock platform, while the thicker deposit comprising Older Gravels II forms a terrace, succeeded by two later terraces due to the Younger Gravels and the later alluvium respectively (Fig. 9).

Along the Maramba below the golf course, the Younger Gravels are associated with grits and sands and reach a maximum thickness of nearly 30 feet (9·14m.). Furthermore, along this river the Younger Gravels are divisible into three groups (I to III) each comprising gravels below and grits and sands above. Of these, groups I and II are the more important, and group II sometimes forms a terrace, lying 5 to 20 feet (1·5 to 6·1m.) below group I (Fig. 8). In the section below Legg's farm the erosion following group II was insufficient to remove even the sands of this group, and from the contained implements group III does not seem to be appreciably later than group II; group III would appear, therefore, to represent a wet sub-phase following very shortly after that of group II, and of short duration as compared with those of groups I and II. Group III has not been recognised along the Zambezi, and may have been removed by erosion.

On the flat floor of the Zambezi Valley above the Mambova rapids, in the Ngwezi and Machili Valleys, and to a less extent in the Maramba Valley, deposits tentatively correlated with the Older Gravels and the Younger Gravels are succeeded in each case by a considerable thickness of fine sands and clays. On the Zambezi flats, for example, there are upwards of 10 feet (3m.) of sands and clays, resting on a weathered sandstone referred to the pipe-sandstone, and the Simulaha flats, extending from just above the Mambova rapids up the Machili Valley to Mulanga, No. 12 Police Post (a distance of 45 miles, 72km.), are underlain by a stiff grey clay. A pit put down at Mulanga through this clay showed about 14½ feet (4·4m.) of clays and fine sands overlying 6 feet (1·8m.) of coarse sands, grits, and gravel, tentatively ascribed to the Second or Third Pluvial (Older and Younger Gravels). Nearer the river are sandy clays probably laid down during the Third Pluvial (Younger Gravels). The two main stages of clayey alluvium of the Umgusa Valley, north-west of Bulawayo (Maufe, 1930), may possibly be related to these clays.

Comparable deposits of fine alluvium were laid down in the Vaal River Basin during the Second and Third Wet Phases (Söhnge, Visser and van Riet Lowe, 1937, p. 49).

It should, however, be noted that the Simulaha flats represent an extension of the Linyanti depression (du Toit, 1933), which runs north-east and south-west across the courses of the Zambezi, Linyanti and Okavango Rivers (see p. 12); the great extent of the Simulaha flats is accordingly due to the development of this depression, which would appear, therefore, to have taken place shortly before or during the First Pluvial (Lower Pleistocene or early Middle Pleistocene).

The Older and Younger Gravels of the Zambezi were each followed by a possibly less humid phase in which greater or less ferrification of the gravels took place. In the diminishing thickness of the Older Gravels, the Younger Gravels, the later alluvium, and the associated arid deposits, there is a suggestion of diminishing duration and intensity in the accompanying climatic variations.

2.—Siliceous and Calcareous Surface Deposits

The chalcedony and the pipe-sandstone already described constitute the oldest known siliceous and calcareous surface deposits in the Upper Zambezi Valley; but there occurs in addition a range of younger surface deposits of somewhat similar composition that is of great interest in relation to the geology and former climatic conditions of the area. Mention may here be made of Livingstone's record of thick calcareous deposits in a higher part of the Zambezi Valley, as quoted by Lamplugh (1907, p. 203).

The Zambezi Gorge extends down-stream from the Falls for a distance of nearly 60 miles (100km.), where it gives place somewhat suddenly to a broad open valley, 800 feet deep (245m.), which is, none the less, still in the basalt. Lamplugh (op. cit.), in the course of a traverse over the basalt plateau on both sides of the river, crossed the Zambezi at Makwa, some miles below the gorge and midway between the Matetsi and Gwaai Rivers. During this traverse he recorded, in addition to the "silcrete" cropping out from beneath the Kalahari sand of the plateau (op. cit, p. 213), a number of other deposits in the Zambezi Valley and its tributaries at various depths below the level of the plateau.

He described particularly deposits from the Lower Matetsi Valley, which he recorded as a broad valley, with steep sides 800 feet (245m.) deep. He stated (op. cit. p. 199): "The greatest thickness of this surface-rock that came under my observation was in the sharp south-eastern rim of the Matetsi Valley, some 500 feet (150m.) above the alluvial flat at Tsheza's, five miles (8km.) from the mouth of the Matetsi. Here the beds cropped out at the margin of a high, sand-covered upland in a bold krantz, which showed 8 to 10 feet (2·4 to 3m.) of chalcedonic quartzite with 10 to 15 feet (3 to 4·5m.) of partly siliceous, partly calcareous, brecciated or conglomeratic material below, resting on much-weathered spheroidal basalt. The position of this bed in relation to the valley appeared to denote its considerable antiquity. Thinner patches of chalcedonic rock occurred, however, on the stepped slopes along the opposite side of the valley at all elevations. . . . . Although the rock frequently caps the highest ground, it occurs in abundance also on the lower terraces and even in the bottoms of valleys."

Lamplugh (op. cit. p. 203) described also calcareous and siliceous rocks from near the Zambezi at Makwa (referred to above) where the river, having emerged from the Batoka Gorge, has again expanded into a wide shallow stream, bordered by an irregular flat diversified with steep-sided basaltic kopjes of varying height. Two of these hills, and probably others, too, are capped by about 20 feet (6m.) of a superficial rock that is partly siliceous and partly calcareous, and it shows a rugged cellular structure throughout the mass. From the description given the deposits appear to stand about 100 feet (30m.) above the river, and they are said to be about 400 feet (120m.) below the very similar rocks on the rim of the Matetsi Valley (described in the preceding paragraph) which lie 7 or 8 miles (11 to 13km.) to the north-west. Moreover, the same kind of material is plentiful at still lower levels, as in the banks and dry bed of a stream running past the foot of one of the capped hills. Lamplugh accordingly concluded (op. cit. p. 204) that these surface rocks had been formed on flats, marking different stages in the erosion of the valleys.

The above siliceous and calcareous rocks accordingly lie at a number of more or less well-defined levels over a vertical range of 800 feet (245m.) extending from the edge of the end-Tertiary basalt plateau to the bottom of the modern valleys. These may be expected to correspond to a greater or less extent with the various silicified rocks and the sandy calcareous alluvium, calc-tufa, and other deposits characteristic of arid to semi-arid conditions already recognised in the Pleistocene sediments above the Falls, where, however, they occur within a vertical range of only a few score feet. It will be recalled, for example, that the chalcedony and the pipe-sandstone reveal two separate periods of silicification in the Falls area (p. 16 of text).

3.—Rock-barriers; Warping; Terraces

In the bed of the Zambezi above the Falls there are several low rock-barriers (due to the outcrop of the harder basalts) that have greatly influenced the character and thickness of the deposits of Pleistocene and recent times.

Two of these barriers, situated in the vicinity of Livingstone, are clearly seen in air photographs of this area. The upper is at Anderson's Drift and the lower at and immediately above the Victoria Falls (Plate 21). At these barriers, each of which forms a long series of rapids, both the valley floor and the stream channel are constricted, whereas they widen considerably in the interval between the barriers; similar conditions prevail up-stream where additional barriers occur.

That the barriers at Anderson's Drift, for example, have been resisting erosion over a long period of time is shown by the fact that coarse gravels of both the Second and Third Pluvials lie near the existing rapids and only a few feet above their general level. For example, the Older Gravels stand 40 feet (12m.) above the rapids and 900 yards (825m.) from them, on an eroded surface of basalt, dipping gently down towards the river, while the Younger Gravels lie only 20 feet (6m.) above the rapids and 75 yards (70m.) from them. Similar conditions exist at the Victoria Falls rapids, where these gravels lie even closer to the modern river channel. The undisturbed Older Gravels here lie less than 8 feet (2·4m.) above the river and almost on its bank, while the Younger Gravels overlie them only 100 yards (90m.) farther back.

It will be clear that the alternation of rapid and gentle flow in the river, due to the presence of rapids and quiet reaches, would lead to variation in the texture of the deposits laid down at any particular time. Furthermore, while in the vicinity of the rapids deposition would be slight (except for the occasional development of flood gravels) and small in extent, in the wider part of the valley a short distance down-stream flood-plain conditions would develop, leading subsequently to the formation of deep broad terraces of finer material.

Thus at Anderson's Drift the deposits laid down during the Second and Third Pluvials consist almost entirely of coarse gravels, rarely attaining a depth of more than a foot (30cm.) or so, and are often, especially those of the later period, a mere scattering of pebbles and rolled implements spread over the eroded basalt, although these characteristics have doubtless been accentuated by subsequent erosion. Farther down-stream, on the other hand, where the valley floor is wider, the corresponding deposits form broad terraces; the deposits of the Third Pluvial, for example, are on an average 12 to 14 feet (3·6 to 4·3m.) thick, and consist of evenly-bedded fine gravels and sands containing a succession of cultural stages. As the down-stream barrier (at which are situated the Victoria Falls) is approached the deposits again become coarser and thinner, as at the upper barrier.

The deposits which accumulated during the Third Pluvial, immediately below this barrier, are thin gravels containing much resorted and derived material and a miscellaneous collection of implements over-lying earlier deposits on the one eroded platform or terrace to be seen here.

The effects of these barriers on the terraces and the included sediments are thus comparable with those of the rock-barriers occurring along the Vaal River (Söhnge, Visser and van R. Lowe, 1937, p. 36). But while the Zambezi barriers have arisen partly in consequence of the presence of resistant rocks in its bed, they are due also in part to the warping that resulted in the Okavango-Linyanti depression and to associated movements—for the Katima Molilo rapids and the Mambova rapids occur respectively at those points where the Zambezi enters and leaves the depression, and the Falls barrier stands at the head of a section of the river bed that has been given a down-stream tilt (see p. 13).

As described above, the terraces of the Older Gravels along the Zambezi are usually eroded rock-platforms with merely a thin covering of gravel, whereas the terraces of the later deposits are usually terraces of aggradation showing an upward gradation from coarser to finer deposits. Nevertheless, near the rock-barriers the deposits of both the Second and Third Pluvials tend to be thin and to rest on rock-platforms. Each terrace of aggradation showing the usual succession of coarse gravels to fine sand or clay reveals the same archæological phase throughout, and such terraces may have been formed by the normal swinging of meanders across the valley, with the almost simultaneous deposition of coarse gravel, sand and silt on the concave side of the beds. The sandy calcareous alluvium of the First Post-pluvial Wet Phase on the other hand, is of remarkably even texture throughout and the bedding is poorly defined. It forms the lowest terrace and it is about 5½ feet (1·65m.) thick. This terrace thus appears to have accumulated by aggrading river-action over an appreciable interval of time, since near the entrance to the Livingstone Game Park, for example, Rhodesian Magosian implements occur at the base and Upper Rhodesian Wilton at the top.

4.—Changes of Climate

In the Victoria Falls area of the Upper Zambezi Valley pronounced oscillations of climate between wet and arid phases are revealed in the post-Tertiary sedimentary succession (see Table 1 and Figs. 17, 18). In the later Tertiary a late mature to senile topography was developed by erosion in the Upper Zambezi Valley, and upon this there accumulated (probably in the early Pleistocene a discontinuous sheet of gravels, largely water-worn, under the influence of a climate yielding an appreciable rainfall. This more or less humid phase was probably of long duration (see Section 5). Then an arid phase set in, as indicated by the æolian sands laid on the gravels; but there were temporary returns to wetter conditions, as shown by widespread thin sheets of limestone laid down in shallow freshwater lakes and subsequently silicified. Then followed thin æolian sands and the pipe-sandstone (probably indicating swamp conditions). Then the main arid phase set in, during which the whole of the area discussed was subjected to silicification of the sands and sandstones. Man made his first appearance in this region shortly after the onset of this arid phase.

There followed two Pluvials separated by two arid phases, in which additional wind-borne sands were laid down, and two minor Wet Phases of decreasing intensity.

During the *Second Pluvial* the Zambezi re-established itself in its old bed, and at the same time effected some erosion of the pipe-sandstone, chalcedony and basalt, and proceeded, or continued, with the erosion of the lower gorges. At this stage we have the record of the earliest men so far recognised in the Victoria Falls area, namely, the makers of the Pre-Chelles-Acheul culture. On the earlier of the two basalt terraces at a time of diminishing rainfall the river laid down the Older Gravels I, increased rainfall caused the erosion of a similar terrace at a lower level, followed by the accumulation of the Older Gravels II and associated grits and sands which extend at some places down to river level. During these two cycles the makers of the Chelles-Acheul and Hope Fountain culture lived in the valley.

In the Machili Valley, and to a less extent in the Maramba Valley, thick clays occur amongst the deposits of the Second Pluvial.

This steadily diminishing rainfall led to conditions in which much iron oxide was deposited in the gravels, with the formation of ferruginous nodules and masses of ferricrete. There followed the accumulation of Kalahari Sand I; the lower part of the sand contains pisolitic ironstone which dies out in an upward direction and thus indicates an increasing aridity. Man continued to live in the valley during the earlier part of this arid phase.

A similar succession of events took place during the *Third Pluvial* and the following semi-arid and arid phases, which culminated in the redeposition of Kalahari Sand.

The *First Post-pluvial Wet Phase,* in Rhodesian Magosian and Wilton times, was much less intense than the two preceding wet phases, and was accompanied by the deposition not of coarse gravels and grits but of only a few feet of sands with faintly-marked bedding, which form the lowest terrace, 5 to 15 feet (1·5 to 4·5cm.)

above the river; moreover, these sands are calcareous, and deposition of iron oxides (as in the deposits of the two earlier wet phases) does not appear to have taken place. Then followed, in the time of Lower Rhodesian Wilton man, a brief arid phase with the deposition of 6 to 12 inches (15 to 30cm.) of fine wind-blown sand, containing some humic matter, and the formation of calc-tufa.

Thus it is seen that in the Zambezi Valley the three main climatic cycles are sharply marked off one from the other, and that each is characterized by the succession—erosion, deposition of alluvium, formation of ferricrete or calc-tufa, accumulation of æolian sands.

It may be noted, too, that in the arid phase preceding the Second Pluvial calcareous, siliceous and also ferruginous surface deposits were all well represented. Under the semi-arid conditions occurring towards the beginning of the Second and Third Pluvials ferricrete was extensively developed, while calcareous deposits were rare; but following the First Post-pluvial Wet Phase only calcareous deposits appear to have been formed within the sediments.

5.—Correlation with Other Areas

From Table 3 it is clear that as regards climatic changes and the succession of archæological cultures a very satisfactory connection can be established between Northern Rhodesia and the Vaal River Basin, 800 miles (1,300km.) to the south, as well as with East Africa, about 1,600 miles (2,575km.) to the north-north-east.

The results so far obtained from Bechuanaland are accordant with those of the Vaal River Basin (Söhnge, Visser and van R. Lowe, 1937). In Southern Rhodesia, in the Umgusa Valley (Maufe, 1930), there occur gravels yielding *bouchers* or *coups de poing*, and a later brownish-clayey alluvium, 40 feet (12·2m.) thick, and a rust-coloured sandy alluvium. The latter recall the two clay terraces of the Machili Valley, ascribed to the Second and Third Pluvials, but further archæological evidence is required before any correlation can be effected.

In the Kasai-Lunda region of the Angola-Congo border, about 750 miles (1,200km.) north-north-west of the Victoria Falls, valleys eroded about 300 feet (90m.) into the end-Tertiary peneplain reveal several periods of erosion and terrace formation ascribed to the Pleistocene. Also, on the peneplain surface occur the Plateau Gravels, overlain by a maximum thickness of about 150 feet (45m.) of Plateau or Kalahari sands; similar sands, considered to be of later date, overlie the terraces (Veatch, 1935).

Beetz, as quoted by Veatch (op. cit.) assigns the cutting of the valleys to the period since the Mindel period of Europe, and the oldest artifacts, occurring in one of the older terraces, to the Riss period; but both these periods are considered to fall within the space of time covered by Pluvial I of East Africa, which represents a pluvial phase preceding the First Wet Phase (Second Pluvial) of the Vaal River Basin and the Upper Zambezi Valley (see below). Also, the succeeding and more abundant series of artifacts (occurring in the terrace marking the next period of erosion) is ascribed by Beetz to the Würm period, correlated with Pluvial II of East Africa, and thus to the First Wet Phase (Second Pluvial) of the Vaal River and Northern Rhodesia.

Accordingly, on the basis of the above age determinations of the artifacts, there is here a clear indication of a period of considerable river erosion and terrace formation later than the end-Tertiary surface but prior to the Second Pluvial; moreover, the Plateau Sands may be correlated with the thick Kalahari Sands I. On this interpretation the earlier Pleistocene events of the Kasai-Lunda region correspond in main outline with those of the Upper Zambezi Valley and the Vaal River Basin.

More detailed consideration may now be given to the comparison of the Upper Zambezi Valley with the Vaal River Basin. From Table 3 it is seen that in each area a First, Second and a Third Pluvial is recognised, each with its appropriate sedimentary and cultural succession, and in each area, too, the Second Pluvial is divisible into three minor climatic cycles. Also, such palæontological evidence as is available is consistent with the correlation of the areas on other grounds. Moreover, in each area the Second Pluvial was preceded by a prolonged arid phase, culminating, in the Vaal River Basin, in the deposition of Kalahari sands, and this by a humid phase in which widespread ancient gravels were laid down at different levels; this latter phase was one of variable rainfall intensity comparable with that of the Second Pluvial (Söhnge, Visser and van Riet Lowe, 1937, p. 48). In the Vaal River Basin the youngest of these gravels yield early Chelles-Acheul (Stellenbosch I) tools, while the preceding higher gravels, which sometimes contain implements of the Pre-Chelles-Acheul Pebble culture, are regarded as Lower Pleistocene. Comparable gravels have not yet been recognised within the Upper Zambezi Valley.

In the memoir on the Vaal River Basin the climatic and archæological succession of this area is compared with that of East Africa (op. cit. pp. 36, 54 and Table III, p. 133-134), and it is shown that, in the Middle Pleistocene and subsequently, there is a remarkable correspondence (see Table 3). At the base of this succession, for example, the First Wet Phase (Second Pluvial) of the southern area is compared with Pluvial II of the northern area, and each yields African Chelles-Acheul tools. A similar correlation exists with the Upper Zambezi Valley.

Since there is thus a general correspondence in the main climatic and archæological phases of the Middle and Upper Pleistocene in the southern and northern areas, one might reasonably enquire whether any such correspondence is observable also in the Lower Pleistocene — there is some evidence to show that there is.

The question at once arises as to whether Pluvial I and the long arid Interpluvial of the north are represented in the south, but it should first be observed that in the north these phases occupied the whole of the Lower Pleistocene, and their course can be followed in a long series of physiographical and cultural changes. Wayland (1934, p. 333), for example, shows that the Kafuan pebble culture (which occupied the Lower Pleistocene) is divisible into the Earliest and Early Kafuan. The former continued throughout Pluvial I and into the Late Kafuan, which continued well into the Interpluvial dry phase. In contrast with this the Lower Pleistocene pebble culture of the Vaal River is confined to one of the lower of a long flight of terraces. Moreover, the formation of these relatively thin southern gravels is considered to have immediately preceded the oncoming of the Kalahari arid phase. In the Kasai-Lunda region also the oldest implements are confined to one terrace, while the preceding terrace and plateau gravels are barren.

In view of the facts already given there can be but little doubt that the long Interpluvial of the north, occupying a large part of the Middle Pleistocene, is represented in the south in part by the stage in which the earliest Kalahari sand of the Vaal River Basin accumulated. Moreover, in the Upper Zambezi Valley, there was a possible semi-arid phase in which the formation of shallow lacustrine or vlei deposits (the chalcedony and the pipe-sandstone) alternated with drier conditions in which these deposits were silicified.

Again, in the Vaal River Basin, the accumulation of these earlier Kalahari sands was preceded by a generally wet or humid phase, sufficiently prolonged and intense to give rise to a spread of gravel over a peneplaned or base-levelled surface of Pliocene age, to enable the Vaal River and its larger tributaries to incise broad valleys into this surface nearly 400 feet (120m.) deep, and to form a flight of terraces on the valley sides. Of these ancient terraces it is for the most part, the the lower and latest (now 100 to 60 feet (31 to 18m.) above the Vaal River) that has yielded the earliest tools of this area. East of Lusaka high-level gravels extend above and beyond the gravels yielding the earliest tools, and in the Kasai-Lunda region of the Angola-Congo border valleys eroded 300 feet (90m.) into the end-Tertiary surface show stepped terraces of which, as in the Vaal basin, only the lower are recorded as yielding stone implements (Veatch, 1935).

In the light of these facts the view is advanced that, in the southern areas as in the north, between the uplift of a base-levelled (end-Tertiary) surface and the development of a great dry phase, there intervened a prolonged period of erosion, valley-deepening, and terrace formation. In the north as also in the south, this period is known as Pluvial I. It seems probable that the initiation of this phase was at least in part due to the continental uplift that immediately preceded it.

As judged by the magnitude of the erosion and deposition attributed to them this First Pluvial Phase and the succeeding arid phase were more prolonged and intense than any of the later wet or dry phases, and in this respect also they are comparable with the corresponding stages of the north (Wayland, 1934). In both regions the climatic oscillations appear to have proceeded on a diminishing scale from the late Tertiary down to recent times.

Finally, attention may now be directed to the fact that, whereas in East Africa the Kafuan pebble culture continued throughout Pluvial I and well into the dry Interpluvial, in the southern areas the comparable pebble culture is seen rather nearer the end of the First Pluvial Phase, shortly before the onset of the arid phase.

In this there is clearly the suggestion that possibly man of the pebble culture did not reach southern Africa until after he was established in Eastern Africa. An even later advent is indicated in Nubia and Upper Egypt, where man did not reach the Nile until Chellean times—for Plio-Pleistocene terraces standing 300, 200 and 150 feet (90, 60 and 45m.) above the present river carry no traces of human handiwork, whereas the 100-50 feet (30-15m.) terraces have respectively yielded Chellean and Acheulean implements, while Middle Stone Age artifacts occur only in still lower terraces.

Part II

ARCHAEOLOGY

1. Stratigraphy and the Cultural Succession

2. Description of Cultures

3. Rate of Retrocession of the Zambezi through the Batoka Gorge

4. Correlation

Stratigraphy and the Cultural Succession

The main physiographical features, the deposits and their interpretation are described in Part I, so that it is only necessary to deal here with the sequence of events and the stratigraphical evidence in so far as they concern the archæological remains.

Attention, may, however, be called to the important part played by the low basalt barriers of the Zambezi in influencing the character and thickness of the deposits of Pleistocene and Recent times, as described in Part I, page 25.

Below the Victoria Falls barrier, and at each of the barriers up-stream as far as the Sioma Falls, only coarse-grained deposits exist, and these occur for the most part as a scattering of gravel on the surface of the basalt plateau. At best only a foot (30cm.) or so of each gravel is represented and in several instances the earlier gravel has been completely eroded. Between these barriers the deposits are much thicker, with well-defined terraces on which the finer grained material was able to accumulate and where the stratification is much more complete.

The following description of the stratigraphical sequence has been divided into:

I. River Terrace and Alluvial deposits to be seen in the Zambezi and certain of the tributary valleys.

II. The Terrestrial Deposits of the Sand Scarps.

I

The Zambezi

The deposits will be divided into (A) those between the Katombora Rapids and the Batoka Gorge, and (B) the fine-grained deposits of the Simulaha Flats and Sesheke Plain, which extend from immediately above the Katombora and Mambova Rapids as far as Katima Molilo.

By far the richest and thickest exposures are found on the northern bank of the Zambezi and it was from this side of the river that the most important results were obtained. Fig. 5 is a cross-section through the deposits on the north bank along the line R-S. The greater accumulation of alluvial material on this bank is due to the fact that the Zambezi has been, and is still largely, eroding its southern bank and depositing on its northern side. An example of this can be seen in progress today in the reach of river above Loanda or Long (now King George VI) Island, adjacent to the north bank. Twenty years ago the small island up-stream from this known as Canary Island, was non-existent, but fine-grained sediments have been deposited across the reach between Long Island and the north bank to such an extent that it will be necessary to remove artificially a large quantity of this material from the river at the northern end of the island, in order that the pumping station which supplies Livingstone with its water should continue to operate. If the rate of deposition continues as it is doing today in a few years time the whole reach will become silted up and sand bars will have been built up, thus forcing the river to erode an ever-deepening and widening channel on the south side.

A.—THE DEPOSITS BELOW THE KATOMBORA RAPIDS

1.—*High-level Gravels*

No implements have so far been recovered from the gravels of the end-Tertiary surface in spite of careful search and, while the Kalomo, Kabuyu and Makoli ferruginized gravels and rubble have yielded primitive pebble and flake tools, the implements and composition of the deposits indicate that they date from the end of the Middle or beginning of the Upper Pleistocene and it is improbable that any of them are earlier. The writer is convinced, however, that further search in the plateau gravels proper should, in course of time, yield implements of the men who ante-dated the Handaxe Culture in Rhodesia.

Pebble tools greatly abraded occur in the Older Gravels I of the Zambezi, but they are not stratigraphically divisible from the Chelles-Acheul culture there though usually tools of the latter culture when *in situ* are less heavily abraded. The only high-level river-deposits that have yielded pebble tools and no later artifacts are the 40-50 feet (12-15m.) gravels of the Hunyani at Lydiate in Southern Rhodesia (Jones, N., and Bond, G., 1948), and some doubtful specimens from the earlier ferricrete in the Kalomo Valley; but there is also additional evidence, which is discussed later and which lends support to the belief that a pre-Chelles-Acheul culture existed in Rhodesia (see p. 66).

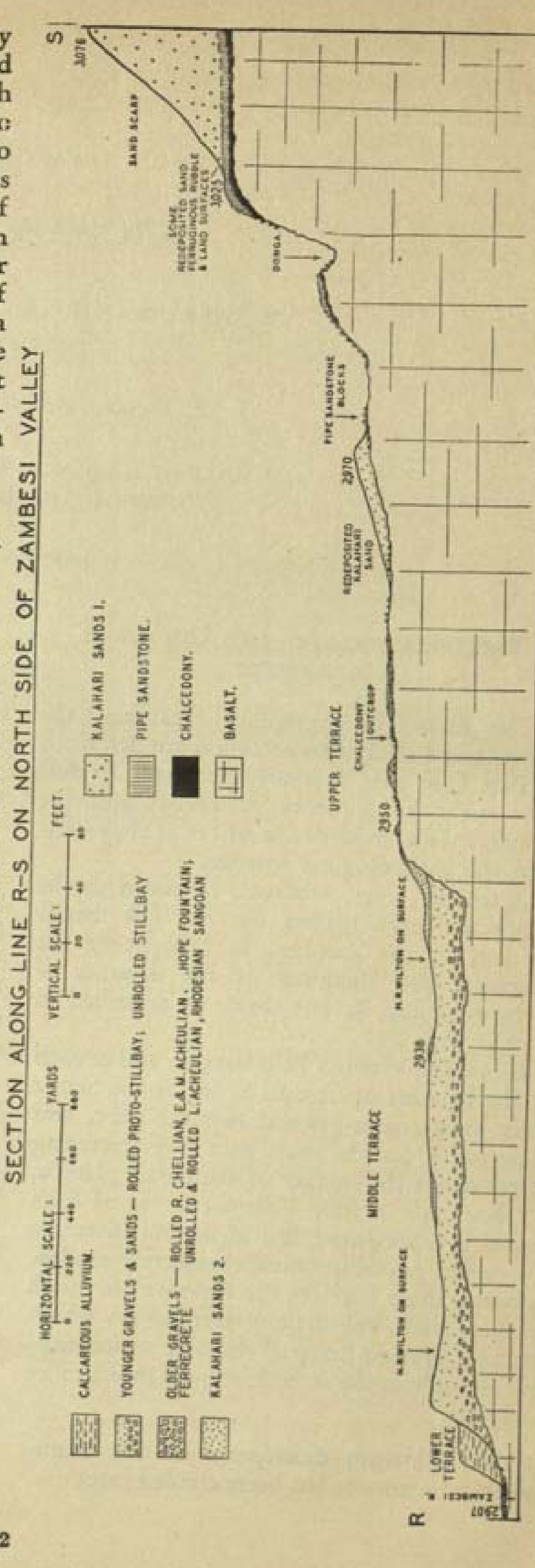


Fig. 5

2.—*The Pipe-sandstone*

Lying at heights varying from 120 to 20 feet (36 to 6m.) above the river it stretches over a comparatively wide area, and was examined for evidence of artificially fractured stone at a number of points, but no trace of human workmanship could be found. If, as we believe, this deposit is of Lower Pleistocene date, it is not unlikely that in course of time primitive implements may be found within it, for it is very probable that man was able to live at least on the fringes of the vlei deposit which then filled the valley. During the 1948-1949 seasons, however, evidence was obtained which suggests that conditions very similar to those which resulted in the formation of the pipe-sandstone existed during the long interpluvial between the Middle and Upper Pleistocene Pluvials, and led to incipient pipe-sandstone formation (see p. 16). The possibility of two periods of pipe-sandstone formation must now, therefore, be considered.

The pipe-sandstone had already been indurated at some time prior to the close of the Middle Pleistocene and to the formation of the ferricrete, as nodules of the ferruginous pipe-sandstone are found as erratics in the Older Gravels, and when occurring in the ferricrete are easily distinguishable from it, being much harder, close grained and "siliceous". The imperfectly siliceous nature of this ironstone may be the result of either alteration of partially silicified pipe-sandstone which has retained its original cement and pipe structure, or else may represent a separate event later than that which produced the ferruginization. Dr. Dixey considers the former to be the most probable explanation. The pipe-sandstone was sometimes also used for artifacts during the early Upper Pleistocene. Some massive ironstone outcropping from beneath the Kalahari sands on the Hubert Young Drive, in the region of Site Z.L.40 and fringing the Zambezi and Sinde scarps along the lower reaches of the latter river, appear to represent this ironstone and siliceous ferricrete deposit *in situ*. All trace of it has, however, been removed from the centre of the valley. The fact that erratics in the form of pebbles, though rare, do occur in the Older Gravels I at Anderson's Drift (Site Z.Y.40) suggests that the ferruginization of the pipe-sandstone took place before the main accumulation of the Older Gravels; though it must be borne in mind that it may represent a drier sub-phase during their accumulation, comparable to the "Red Bed" at Oldoway Gorge or to the "M Horizon" in Uganda. The Kalomo River evidence (see p. 48) suggests, however, that the former theory was, in fact, the correct one, and that this siliceous ferricrete or indurated pipe-sandstone represents the onset of wet conditions at the beginning of the Second Pluvial.

3.—*The Older Gravels* (Plate 22)

These are found at heights varying from 40 to 50 feet (12 to 15m.) at Anderson's Drift to 15 to 20 feet (4·5 to 6m.) above the old river bed on the plateau a mile south of the Falls. They have yielded extensive evidence of the Handaxe and Hope Fountain Cultures. Two separate accumulations can be recognised (best seen in the valleys of the Maramba and Masue rivers) separated by a drier interval.

The gravels nearly always contain large well-rolled blocks of chalcedony, and a number of quite smoothed elliptical pebbles one to two inches (2·5 to 5cm.) long. The amount of glaze seen on the components of the Older Gravels is never as high as that on derived specimens in the Younger Gravels, and it is not infrequent to find little or no glazing on artifacts *in situ* in the Older Gravels. The highest deposits of the Older Gravels formed a terrace some 40 to 50 feet (12 to 15m.) (variable by reason of the rock-barriers) above the bed of the river. During the 1948-1949 seasons, however, it became apparent that the Older Gravels also occurred at lower altitudes, down, in fact, to present river-level. A low line of rocks at the Old Drift running out two-thirds of the way across the river and exposed only at low water, was found to consist of ferricrete (and not of a basalt bar as previously thought) containing typical chalcedony pebbles in the upper levels, and passing down into a ferruginized, sandy deposit with irregular pipe structure, possibly to be identified with the pipe-sandstone but more probably of end-Middle Pleistocene age.

The base of this deposit was below water-level.* In the same way patches of Older Gravels and ferricrete in the Maramba occur down to present low-water level and below, while similar patches occur in the Masue Valley down to 15 feet (5m.) or so above the river. From this it would appear that the very gradual dessication, which set in at the end of the long Second Pluvial, reduced the size and power of the rivers until they had shrunk to mere streams or had ceased to flow entirely. These gravels rest largely on basalt in the Zambezi Valley but are also found overlying chalcedony and pipe-sandstone, particularly in the tributaries. During the accumulation of the Older Gravel I the valley was inhabited by the makers of the Pre-Chelles-Acheul and the Chelles-Acheul Cultures, the former being the earliest culture so far recognised here. The pebble tools when found *in situ* are always the most heavily rolled and patinated. In the same gravels (but of later date for they do not show the same extensive abrasion as those of the Chellean phase of the Chelles-Acheul Culture) are found rolled implements of the Early Acheulian phase and of the Hope Fountain Culture. The finest assemblages come from the undisturbed Older Gravels I of the 40-foot (12m.) terrace at Anderson's Drift (Z.Y.40), but large collections from the Older Gravels in the Conduit (Z.D.38) and Storm Drain (Z.E.38) sections of the Victoria Falls have also been made. Fig. 6 shows sections of these gravels.

The old river sand underlying Older Gravel at the Eastern Cataract (Z.C.38) is evidence presumably of some overloading of the river before the deposition of the Older Gravels. It has so far yielded no recognisable implements.

The Older Gravels II contain implements of the Late Acheulian and of the Rhodesian Sangoan (Bembesi) Culture. A number of well-made handaxes characteristic of the former have been recovered from the Conduit Section and from the Songwe Gravels (Z.P.38).

* At the Sioma Falls in Barotseland the ferricrete is found overlying the sandstone on what was once the bed of the Zambezi before the gorge was cut. Here the ferricrete spread right across the river bed and it now occurs on a level with the bed of the upper river above the Falls. A good representative collection of Rhodesian Sangoan tools is found in the ferricrete at Sioma.

SECTIONS OF OLDER AND YOUNGER GRAVELS : ZAMBESI VALLEY

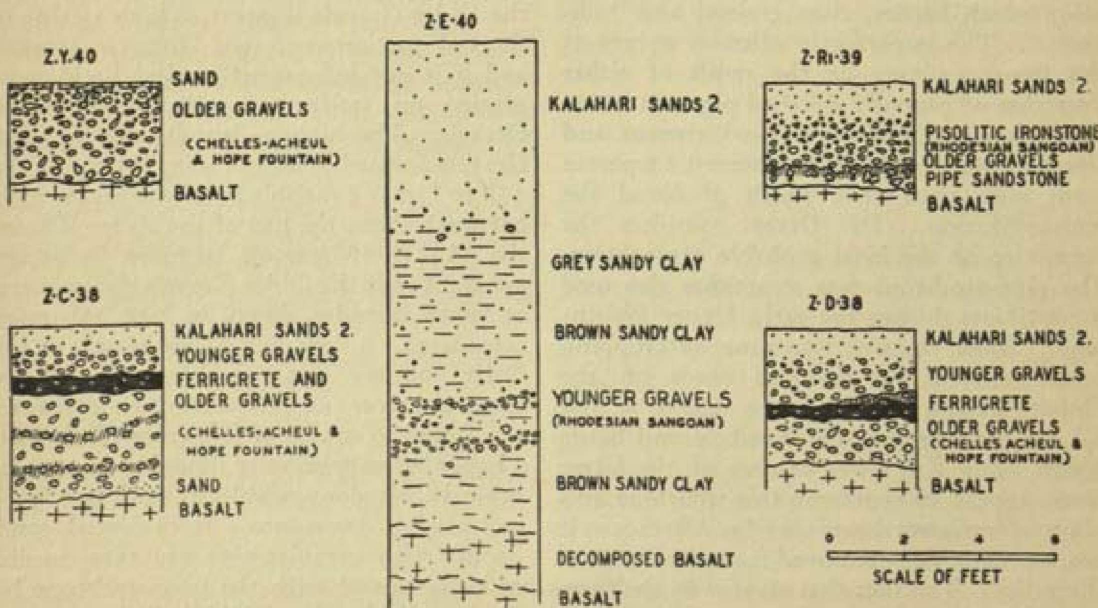


Fig. 6

At Anderson's Drift unrolled Late Acheulian and Rhodesian Sangoan implements are found in some numbers on and in the earlier accumulation of the gravels, while the Acheulian tools appear rolled and unrolled in the later deposits of the Older Gravel.

These gravels are usually cemented and overlain by pisolitic ironstone or ferricrete as at Anderson's Drift, the Conduit, Storm Drain, Songwe and Masue (Z.I.38) sections. Where the depth of the deposit is not more than a foot (30cm.) or so the ferricrete is found from top to bottom, but in the deeper sections the lower levels of the gravel are oxidised only and often show calcareous concretions. This ferricrete deposit is evidence of a drier period separating the Second and Third Pluvials, and is important, as where the Third Pluvial deposits overlie those of the Second Pluvial, the ferricrete effectively and conclusively separates the two gravels.

In a road-ballast pit near the Immigration Post on the north bank at the Falls the Older Gravels are overlain by ferricrete, veins of which pass down into the gravel below. The gravels here are markedly calcareous, in fact, the matrix is a calcrete with kunkar nodules in its upper levels. This calcrete is also found exposed at intervals along the north bank between the Eastern Cataract and the Livingstone Game Park. On the Plateau above the Silent Pool it was found to contain the remains of an elephant (*Palaeoloxodon darti Cooke*, Site Z.E.38) and at Anderson's Drift a small patch of this calcrete occurred underlying the Younger Gravels.

4.—*Ferricrete* (Plates 23 and 25)

As stated above, the Older Gravels are, almost without exception, overlain by a surface ironstone known as ferricrete. This occurs usually as a band or bed of indurated sand, often extremely hard and varying in thickness from a few inches to over a foot. It consists of sand grains cemented by hydrated iron oxide and incorporates water-worn pebbles of chalcedony, basalt and quartz with numerous rolled and unrolled implements.

In this form the ferricrete is well seen underlying the Younger Gravels on the old Zambezi terrace on the north bank between the Victoria Falls and the Songwe Gorge, some 6 miles (9·7km.) down-stream, where it is often associated with lenses and thin veins of hæmatite and limonite. The ferricrete also occurs as a loosely-cemented deposit of pisolitic ironstone set in a matrix of red sand. In this form it is best seen at Site Z.Y.40 at Anderson's Drift, and again at the Maramba. The top of this bed, where not removed by subsequent erosion, is cemented into a hard ironstone cap, with some incipient pipe structure. Pipe structure of this form is again seen in some of the sections at the confluence of the Masue and the Zambezi, on the right bank where the Older Gravels, resting on the upper terraces, are overlain by a partially consolidated deposit of oxidised sands with vertical fracture planes and in which the initial stages of pipe structure are in evidence. The form in which the ferricrete occurs on the scarps will be described later. In all these occurrences it is the Older Gravels which the ferricrete deposits cement.

It appeared at first that the ferricrete was deposited during the dry period which superseded the Second Pluvial. It was, therefore, assumed to date to the Interpluvial marking the end of the Middle Pleistocene, and to have been followed by the accumulation of the Kalahari Sands within the Zambezi Valley. In support of this dating the tools of the earlier phases of the Chelles-Acheul Culture were always rolled when found in the ferricrete, while those of the Late Acheulian and Rhodesian Sangoan were usually unrolled. Some Rhodesian Sangoan tools were, however, rolled and could not be explained away. Subsequent work on the ferricrete, both in the valley and on the scarps, has now shown that in the higher levels Sangoan tools are always fresh and unrolled, but also that the percentage of abraded artifacts in the lower levels nearer the river is greater than was at first recognised. It is difficult to reconcile the small disc-cores and flakes with faceted striking-platforms, which occur rolled in the ferricrete in sites between the Victoria Falls and the Songwe on the north bank, with an end-Middle Pleistocene date. On the scarp the rich Sangoan sites all lie above the rubble bed and ferricrete and are found in the lower level of the sands which overlie these deposits. Ferruginization sometimes occurs also at the base of the Younger Gravels. The excavation at Site Z.S.38 showed, at the base, thin lenses of ferricrete passing up into the Younger Gravels, as also did a pit near the Forestry House at Katombora. In the Conduit Section at the Eastern Cataract (Site Z.D.38) the pink, partially-cemented gravel (previously described under the term Younger Falls Gravel I, Cooke and Clark, 1938) represents the initial phase of ferricrete formation, and lenses of this pink gravel pass downward into the ferricrete, and conversely, lenses of the latter occur in the pink gravel. In the Storm Drain (Site Z.E.38) three or more thin layers of ferricrete separated by lenses of red sand occur overlying the calcretes and Older Gravels.

On the scarps the ferricrete does not appear to underlie the Kalahari Sands except on the fringes. Sections show that the deposit is thickest at the foot of the scarp and that it thins out and upwards, following the contour of the underlying geology. (See p. 50.)

The view previously expressed by the writer in regard to the ferricrete formation was that it represented the final phase of dessication prior to the accumulation of the Kalahari Sands; that is to say, that the Older Gravels gradually gave place to calcretes and the formation of kunkar which in turn was superseded by ferricrete formations and æolian sands. This would imply that the formation of ferricrete required a lower rainfall than that resulting in the formation of kunkar, whereas, in fact, the direct opposite is the case. It would appear that a moderately high rainfall with strongly contrasted wet and dry seasons is essential to the formation of ferricrete, which results from the concentration of iron oxides in the sub-soil (du Toit, 1939, pp. 413-4). The formation of kunkur or kunkar, on the other hand, is associated with a rainfall of certainly less than 25 inches (60cm.), probably more in the region of 15 inches (38cm.) a year.

It was, therefore, apparent that, while there may have been some ferricrete formation during the closing stages of the Second Pluvial, the greater part of this deposit must now be assigned, not to the beginning, but to the end of the Interpluvial and to the beginning of the Third Pluvial, when the climate was becoming wetter. While, therefore, the Rhodesian Sangoan Culture first appears at the very end of the Second Pluvial, its main development now falls at the beginning and during the earlier part of the Third Pluvial. Such a date is completely borne out by the associated cultural material.*

Armstrong and Jones first pointed out the usefulness of this ferricrete deposit for dating purposes, sealing as it effectively does the Older Gravels. Only tools of the Chelles-Acheul Culture and Hope Fountain industries are found below the ferricrete. Within it artifacts of the earlier part of the Early Stone Age are always rolled but the Late Acheulian and Rhodesian Sangoan tools are more usually fresh and unabraded. Particularly is this the case in the higher level ferricrete deposits, but nearer the river in the lower slopes tools of these cultures are also found in a rolled state. Thus, in the Younger Gravels only derived tools of these cultures are found, sometimes with concretions of ferricrete still adhering to them. All Rhodesian Proto-Stillbay and later cultural material is free from any signs of ferricrete incrustation and is first found in the Younger Gravels which overlie the ferricrete.

5.—*Kalahari Sands I*

The Kalahari Sands are discussed in greater detail under the section on the deposits of the scarp. Where not subsequently eroded these unstratified sands everywhere overlie the chalcedony, the pipe-sandstone and, locally the Older Gravels and ferricrete. They contain no evidence, except in their lower levels, of the presence of man, and it is probable that the Zambezi had ceased to flow during their accumulation across parts of its valley. In view, however, of the new evidence from the scarps, during 1948 and 1949, it is now necessary to consider some at least of the

* Since the above was written, the writer has learned in conversation with Dr. Bond that, working independently, he has reached similar conclusions as to the age of the Ferricrete.

SECTIONS OF YOUNGER GRAVELS: ZAMBESI VALLEY

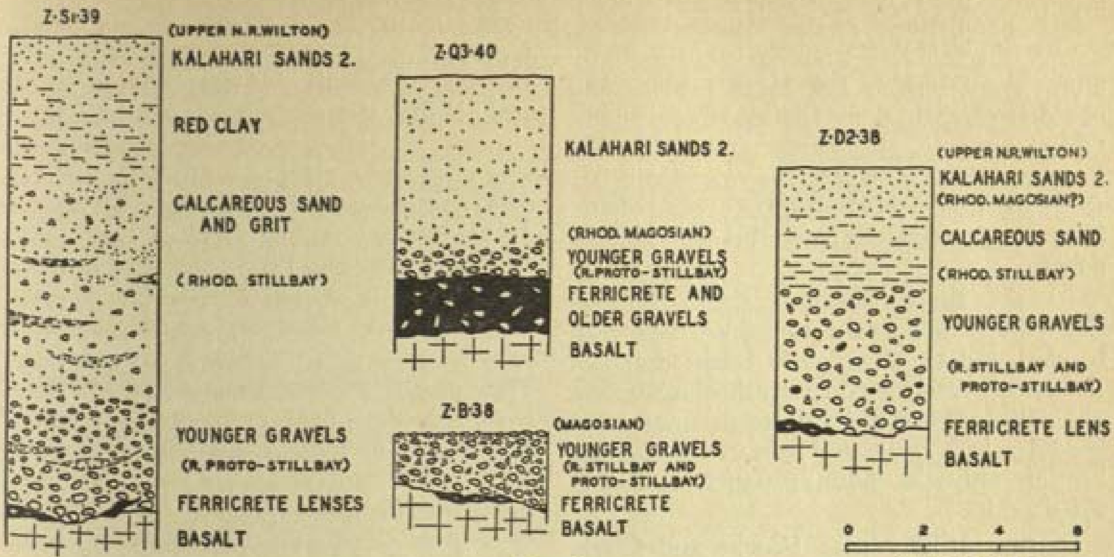


FIG. 7

fringing sands as being re-deposited under wetter conditions at the beginning of the Third (or Gamblian) Pluvial. The time has also come when it is necessary to consider whether some of these Kalahari Sands cannot also have been deposited by strong winds during a semi-arid or wet climate. (See p. 54.)

The Kalahari Sands I are usually pale in colour while the first redeposited sand is red to orange and the second pink in colour.

6.—*Younger Gravels* (Plate 24, 25 and Fig. 7)

Increasing rainfall, marking the peak of the Third Pluvial, resulted in the local erosion of the Older Gravels and ferricrete, and the deposition of the Younger Gravels and sands. These occur directly overlying the ferricrete in the Conduit and Storm Drain sections and at numerous other sections exposed in the terrace gravel above the gorges; elsewhere the earlier deposits have been eroded and the Younger Gravels rest upon decomposed basalt. At the rock barriers these gravels occur as thin spreads, often no more than a foot (30cm.) in depth, the overlying finer-grained river deposits being absent. Between the barriers, however, deeper sections have been opened up showing 3 feet (90cm.) of gravel and 9 or 10 feet (2·7 or 3m.) of grits and sands. In the reach between Anderson's Drift and the Falls these gravels and sands stand at 20 to 30 feet (6 to 9m.) above the river. (Z.S.39.)

South of the Falls much disturbance of the Younger Gravels has taken place as the result of action by dongas now flowing for a few hours only after rain, which have been eroding the gravels and redepositing them in small banks of detrital material. Only the evidence from areas which have not been subsequently disturbed either naturally or artificially have been used for dating purposes. Such sections show the gravel evenly bedded, the lower levels usually calcareous, and resting disconformably upon the underlying deposits.

Typical assemblages of the Younger Gravels comprise a very large number of artificially fractured stones showing various degrees of abrasion. A considerable quantity of debitage and artifacts of the Early Stone Age is derived from the Older Gravels, and this always shows heavy abrasion and a heavily-glazed patina. Pebbles of ferricrete from the eroded earlier beds are also of common occurrence. Contemporary debitage and tools of the Middle Stone Age are also found in considerable quantities and, on a percentage basis, it would appear that there was a much larger population in the Zambezi Valley during the Middle Stone Age than in Early Stone Age times. The large pebbles and boulders of chalcedony that are found in the Older Gravels are rarely found in the Younger Gravels, where the ingredients are all either small pebbles of quartz, chalcedony, agate and ferricrete or abraded factory débris.

In the deeper sections these Younger Gravels are highly calcareous, but at the rock barriers and on the plateau below the Falls the gravels rarely attain a depth of more than 18 inches. Here the calcareous matrix has been leached away and surface weathering has left only the more resistant elements in the deposit.

In my earlier report (Cooke and Clark, 1938) I stated that the Younger Gravels could be divided into two parts—the earlier being a red gravel partly cemented by iron oxides and representing in all probability ferricrete in process of formation. This deposit is now known to occur only in the Conduit Section and in a small area in the Storm Drain. It contains "pebbles" of ferricrete, believed to have been formed *in situ*, and some crude flakes and cores with faceted striking platforms were recovered from it, and were considered at that time to be evidence of an industry of Developed Levallois affinities. Later work has now shown, however, that these artifacts should be ascribed to the Rhodesian Sangoan and that the "pink gravel" represents an immature stage of ferricrete formation as previously described.

The patches of gravel occurring at the rock barriers, at slightly higher levels than the terrace gravels proper and known as the Flood Gravel, are (as the name implies) thought to have been deposited at times of seasonal flooding by the Zambezi over its shallow valley-floor, during the Third Pluvial. This Flood Gravel contains derived material and rolled implements of the Rhodesian Sangoan, Proto-Stillbay and Stillbay cultures. It is found intermittently throughout the area examined, but is best seen at altitudes above the terrace gravels below the Victoria Falls.

The Younger Gravels contain rolled derived implements of the Early Stone Age and also rolled and unrolled tools of Middle Stone Age date. Implements, comprising choppers and flake tools of the Rhodesian Proto-Stillbay Culture showing various degrees of abrasion (though never as much as the Early Stone Age tools) first appear here. In the terrace gravel south of the Falls, these implements are more heavily rolled than those of the Rhodesian Stillbay, which are for the most part unrolled or only slightly rolled. They usually occur in greater numbers at the base of the deposit. In excavations at the Old Drift (Z.S.39) Rhodesian Proto-Stillbay tools are contained in the gravels, while the Rhodesian Stillbay implements are found for the most part unrolled in the grits and sands immediately above.

The deepest deposit of the Younger Gravels yet found (excluding the sand) occurs at the Eastern Cataract (Z.D2.38) where, in a section dug in the car-park, the gravel attained a depth of 3′6″ (1m.). It was here highly calcareous, except at the base where occasional ferruginous lenses occur, and was overlain by a deposit of 1 to 2 feet (30 to 60cm.) of calc-tufa and redeposited Kalahari sand.

A trench excavated on the road joining the Katombora Road with Knight's Drive, 4 miles (6·5km.) west of Livingstone near the foot of the sand scarp (Site Z.E.40), showed two, possibly three, deposits of clay, the lower two separated by thin gravel lenses containing a few Rhodesian Sangoan or Proto-Stillbay tools.* The whole was cemented by buff to yellow redeposited Kalahari Sands. It would appear that these beds are in the nature of a dambo deposit, lying on a level with or just above the terrace of the Younger Gravels, and is similar to the black cotton dambos or "vleis" found in identical circumstances today. Viewed in conjunction with the evidence from the tributary rivers to be

* The Rhodesian Proto-Stillbay culture appears to be derived directly from the Rhodesian Sangoan.

described below, it would appear that three sub-divisions of the Younger Gravels and sands exist. The first embraces in large measure the ferricrete, the second (the major accumulation) includes the Younger Gravels proper, and the third the sands and calcretes. The Rhodesian Sangoan is contemporary with the first, the Proto-Stillbay with the second, and the Stillbay proper with the third.

7.—*River-deposited and Wind-blown Sand* (*Kalahari Sands II*)

Wherever circumstances have permitted the aggradation of the finer-grained sediments there is found overlying the Younger Gravels a deposit of yellow to grey river sand or grit, which rests apparently conformably upon the underlying gravels. These sands are usually calcareous and small nodules of kunkar are commonly present. They contain unabraded or very slightly rolled Rhodesian Stillbay tools, and typical sections are those exposed in excavations at Sites Z.D2.38 and Z.S1.39.

The leached, calcareous sands pass imperceptibly into a pink to red sand of typical rounded grains, which was blown off the sand scarp at the end of the Third Pluvial and accumulated in irregular patches in the valley below. On the old river-bed and terrace south of Gorge 4 this sand overlies the Younger Gravel directly, and no leached sands are present. A number of similar sections exist below the Falls but not above the Fourth Gorge. (See Map, Fig. 4.) These pink, æolian sands are on an average 3 to 4 feet (90 to 120cm.) thick, but they may be as little as 6 inches (15cm.) or as much as 6 feet (1·8m.). On the scarp they are found covering an old land surface at the top of the Kalahari Sands I, or else spread out at the foot of the scarp. They are dated by the associated artifacts. In the valley of the Sinde River, near the foot of the scarp and up-stream of the homestead on Drummond Park Farm, excavations showed 4 feet (1·2m.) or so of redeposited sand overlying rubble. Intermittently within this sand occur debitage and artifacts of the Rhodesian Magosian.

On the scenic drives (Knight's Drive and the Hubert Young Drive) along the Zambezi scarp between the Sinde and the Victoria Falls the Magosian is found within the Kalahari Sands II. Near the northern end of the Storm Drain Site (Z.K.38) the Magosian is found on a temporary land surface between two deposits of red sand. At Site Z.Q.40 a fresh factory débris of microlithic proportions, ascribed to the Rhodesian Magosian, underlay the red sand and rested directly upon the surface of the Younger Gravels. At the excavation near the Windsor Hotel (M.P.39) in the Maramba Valley, a Late Middle Stone Age factory débris of Magosian affinities lay on a land surface under 5′6″ (1·7m.) of red sand, which in its lower levels changed from a pink to a grey leached sand. At Katombora, in a pit near the Forestry Department house, a fresh factory débris and a few artifacts of Magosian type overlay the Younger Gravels and were covered by 3 feet (·9m.) or so of pink sand. The red sand is always underlain by the Rhodesian Stillbay and overlain by the Wilton. It is contemporary with the Magosian.

On the above evidence this redeposited Kalahari Sand II is considered to have accumulated at the end of the Third or Gamblian Pluvial, during the occupation of the valley by the Rhodesian Magosian hunters. If, however, subsequent work shows that a disconformity exists between the Younger Gravels and the leached river-sands which overlie them, then it is possible that the accumulation of some, at least, of this red æolian sand may have to be put forward into the dry period at the end of the First Post-Pluvial Wet Phase.

8.—*Calcareous Alluvium* (Fig. 15)

This deposit forms a low-level terrace usually below that of the Younger Gravels and at heights of from 5 to 15 feet (1·5 to 4·5m.) above the river. Except that it is sometimes absent at the rock barriers this deposit occurs on both sides of the river upstream of the Victoria Falls. Good sections can be seen at the Municipal Pumping Station and at several sections up-stream to Old Livingstone. The deposit consists of evenly-bedded, usually loosely-compacted brown and grey sands and fine grits. It is usually calcareous. Elsewhere this deposit is more claylike and consists of a dark grey, sandy clay, turning to a typical black alluvium in the upper levels. There is thus a suggestion that two phases may be represented here.

On Constantia Farm, 15 miles (24km.) north-west of Livingstone, and on "Fairyland", 8 miles (12·9km.) north, sections through this calcareous, sandy alluvium have yielded waterworn Rhodesian Stillbay and earlier tools. On the river bank near the entrance to the Livingstone Game Park are old midden sites resting on the calcareous alluvium. Excavations exposed (from the surface down) 2 feet (·6m.) of fine grey sand, sterile of implements; 2 feet of grey to brown sand with kunkar nodules, containing implements, debitage and faunal remains from a living site of the Northern Rhodesian Wilton Culture; and, at the base, 3′6″ (1·1m.) of compact, calcareous sand and tufa, with occasional abraded Rhodesian Stillbay debitage and earlier derived material from the Younger Gravels.

Although the calcareous alluvium of the First Post-Pluvial Wet Phase has not yet yielded any Magosian tools *in situ*, it is apparent from sites elsewhere in the territory that this culture must also have been in part contemporary with this wet phase, and by a fairly long process of gradual development must have passed into the Northern Rhodesian Wilton Culture towards the end of this period.

9.—*Dirty Wind-blown Sand*

At sections exposed on Sutherland's Farm at Katombora, and again on the Katombora Road five miles (8km.) beyond the Sinde River, are found Northern Rhodesian Wilton sites resting on the Younger Gravels and sands. They are covered by from six inches to one foot (15 to 30cm.) of dirty wind-blown sand, of very fine texture and apparently containing some humic matter. At the section previously described near the entrance to the Livingstone Game Park, the topmost deposit (overlying the calcareous alluvium) appears to be similar, so that drier conditions at the end of the First Post-Pluvial Wet Phase, when the alluvium was laid down, appear to be responsible for this further deposit of wind-blown sand.

10.—*Erosion to Present Contours*

The sequence is completed by the erosion of the existing river channel which was interrupted by the formation of a low degradation-terrace a few feet above the river. Numerous abandoned channels can be seen, particularly in that part of the river between the Victoria Falls and Anderson's Drift barriers, near Old Livingstone. The river meandered through these now abandoned channels before erosion was resumed. The majority of the sand-islands were also formed during this phase, a typical example being Long Island (now King George VI Island), as can be seen from the aerial photograph (Plate 21). In tributary streams falling steeply into the gorge below the Falls, some tufa formation occurred, and in some instances growth has not yet ceased.

B.—THE DEPOSITS BETWEEN KATIMA MOLILO AND KATOMBORA

Deep deposits of fine-grained sediments are present between Katombora and Kazungula, and again above the Mambova Rapids, while a band of grey Mopane clays is recorded by Trapnell (Trapnell and Clothier, 1937; also 1947) as extending from Sesheke on the Zambezi to Namwala on the Kafue, on the line of the Linyanti Depression (du Toit, 1933). The Simulaha Flats are composed of a stiff grey clay covered by Mopane bush, and extend north of the river as far as Mulanga, No. 12 Police Post on the old Barotse Cattle Cordon. The underlying rock is here a friable Karroo sandstone as far down as the Mambova rapids, where the harder basalt again occurs, forming a barrier. Above this barrier at the junction of the Ngwesi and Machili rivers with the Zambezi, extensive erosion of the Karroo Sandstone, also of pipe-sandstone and Kalahari sand, has taken place. Warping and ponding have here resulted in the formation of a wide but shallow valley, subsequently filled with fine-grained sediments.

That there was formerly pipe-sandstone overlying the Karroo sandstone in this area can be seen from a section, exposed in a well, situated between the foot of the Kalahari sand scarp and the Zambezi further up-river in the Sesheke district near the Zambezi Sawmills compound at Kasika Forest. The section showed from top to bottom: dark sand to 4 feet (1·2m.) with a definite horizon at that level; light sand with kunkar nodules to 10 feet (3m.) with a definite horizon again at that level; a whitish clay sand with sandstone fragments (probably rotted pipe-sandstone) at the top, to 40 feet (12m.); pipe-sandstone to 52 feet (15·8m.); below this again is a white, loose, water-bearing sand, resting presumably on the Karroo beds.

Near Mulanga in the " Mopane Clay belt " a pit, sunk through the grey clay, showed the following sequence of deposits (from the top downwards): 0 to 3 inches (0 to 8cm.), loose sand and brown clay; 3 inches to 2 feet (8 to 60cm.), stiff, slate-grey clay; 2 to 7 feet (·6 to 2·1m.), the same clay, containing numerous kunkar nodules (the greatest number occurring near the five-foot level, some of them as much as 1½ inches (35mm.) in diameter); from 7 to 9½ feet (2·1 to 2·9m.) lies a clay, lighter in colour and devoid of kunkar; 9′6″ to 14½ feet (2·9 to 4·4m.), a fine sand, stained reddish by the action of iron; 14′6″ to 17½ feet (4·4 to 5·3m.), a coarse ferruginous sand with gravel lenses; at 18 feet (5·4m.), a six-inch layer of slate-blue clay (with some kunkar at the top), with beneath it 2 feet (60cm.) of current-bedded coarse sands, grits and gravels. This gravel is composed of small nodules of pisolitic ironstone and pebbles of quartz and sandstone. At this depth—20 feet (6·1m.)—on one side of the pit occurs a lense, three inches (10cm.) thick of clay, while on the other side the gravels and sands continue to a depth of 21′3″ (6·5m.), when they are replaced by flat pieces of well-compacted sandstone, white to yellow in colour. Below occurs compacting sand, with frequent small pebbles and white veins of calcium carbonate, perhaps representing fossil roots. The excavation was not taken below this level.

The only outstanding break in the deposits occurs at 21′3″ (6·5m.) where the gravels give way to the flat sandstone fragments. This sandstone and the underlying compacting sand is believed to be the pipe-sandstone, unsilicified, as it is identical in appearance and composition with certain sections of pipe-sandstone in the neighbourhood of Livingstone.

The slate-blue clay deposit at 18 feet (5·4m.) may perhaps be taken as indicative of a stratigraphical break, particularly if viewed in conjunction with the evidence from the Maramba River; but it will be necessary to obtain additional sections in order to confirm this. The overlying deposit shows a continuous progression from coarse current-bedded sands and gravels, through grits and sands to clay; clearly the result of deposition during a single climatic pause, with perhaps two minor climatic fluctuations within it.

Almost two miles (3·2km.) south of the Forestry Department house at Machili a well showed, from the surface down: 1 foot (30cm.) of grey clay; 26 feet (8m.) of white sand with alternating compact and loose layers; 1 foot (30cm.) of fine gravel resting on Karroo sandstones. At the back of the Veterinary Department house at Kazungula a well was sunk through the alluvial deposits approximately ¼ mile (400m.) from the river bank. This showed, from the top down: 15 feet (4·5m.) of grey, sandy clay underlain by approximately 1 foot (30cm.) of fine gravel at the base, comprising pebbles of chalcedony, quartz and silicified pipe-sandstone. This rests disconformably on 10 to 12 feet (3 to 3·6m.) of white to yellow, semi-compact, calcareous sand, with some harder lenses of a siliceous nature. The base of this deposit was not seen. The lower bed possibly represents the pipe-sandstone, but the writer is inclined to consider that it is of later age. No artificially fractured stone was recovered.

During 1948 sections were examined between Katombora and Kazungula on the north bank. Here the sand scarp falls fairly steeply towards the river and the Quaternary deposits end in a short but steep scarp, at the foot of which is found the low-level terrace of sandy alluvium, giving directly on to a large area of swamp into which the valley of the Bovu dambo drains. The scarp overlooking the swamps is built up largely upon a freshwater limestone with nodules of chalcedony formed *in situ,* and silicified sandstone, identical with the exposures in the Maramba Valley. This limestone was found in places to be between 40 and 50 feet (12 and 15m.) thick and to continue down to water-level. Immediately inland, and to the north of the barrier at Katombora, however, the limestone was found at heights of between 120 and 140 feet (36·5 to 42·5m.) above the river, but not below that level. It is here 20 to 30 feet (6 to 9m.) thick and rests on basalt and forms the resistant capping to the scarp on which lie the Kalahari sands. The fall in river-level between the top and the bottom of the barrier (a distance of approximately one mile or 1·6km.) cannot be great enough to account for this difference in height unless erosion at and below the barrier can be considered to have caused the removal of the limestones at lower altitudes nearer the river. It may later be found that some gentle warping of the surface has taken place here.

Above the barrier at Katombora deep gullies have been eroded through the limestone and silicified sandstone to a depth below water-level and these have become filled to a depth of 30 feet (9m.) or more with a calcified, cemented sand, yellow in colour in the lower levels, orange to red in the upper. The upper (red) levels of this deposit usually spread over the flanks of the gullies also, thus covering the limestone and silicified sandstone to an undetermined depth. The deposit showed no evidence of stratification, but contained some chalcedony and basalt as erratics, and must have been accumulated after a wet phase during which deepish gully erosion took place.

These consolidated red sands or sand-rock, the limestone and the silicified sandstone have been subjected to fairly extensive erosion when the 30-foot (9m.) scarp abutting on the swamp was formed, and on the top of the scarp are found occasional pebble erratics.

It is hardly possible that the sand-rock can represent the pipe-sandstone, and it must be considered to indicate an accumulation under arid conditions between two wet periods of major duration. The writer is of the opinion that this deposit represents the Kalahari Sands

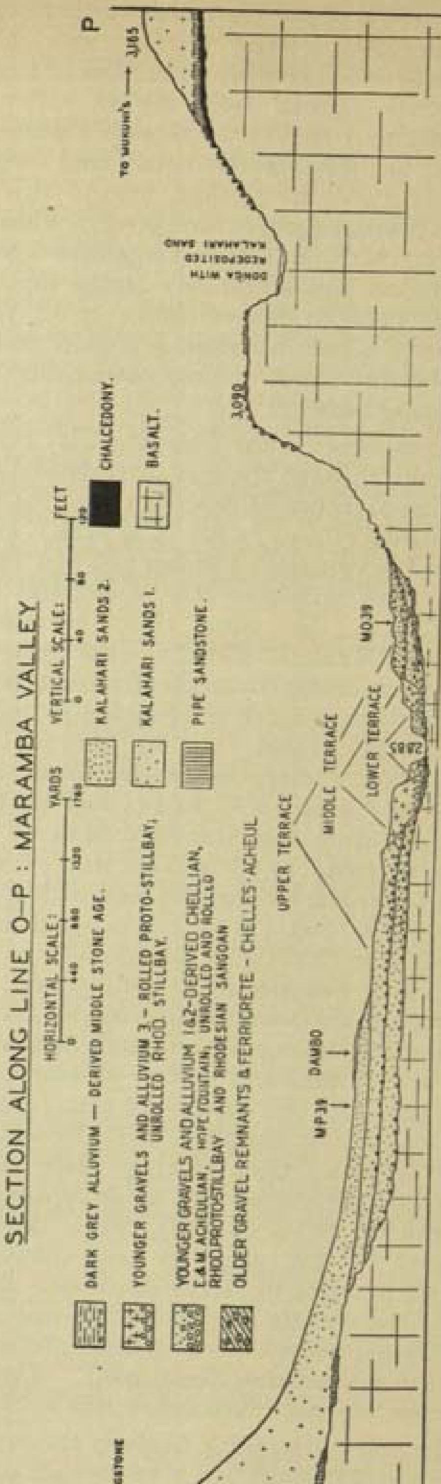


FIG. 8

I which, being near the centre of the valley where water may be considered to have been most abundant, became compacted by a calcareous cement.

Regrettably, no archæological evidence is as yet available from these deep clays and sands. It is not, therefore, possible to date them with any certainty. Apparently underlying the superficial deposits is the pipe-sandstone attaining much greater depths than those observed in the Zambezi Valley near Livingstone. The deposits of the Second Pluvial cannot as yet be recognised with any certainty, though the sands and gravels below the clay belt at the 18-foot (45cm.) level in the pit at Mulanga may in part represent them. It is now considered that the main aggradation of sands and clays must be assigned to the Third, or Gamblian, Pluvial, though whether they are replaced near the flanks of the Valley by deposits of Second Pluvial date still remains to be proved.

The Maramba

The succession of deposits here is typical of that in the greater number of other tributaries visited, while the archæological evidence is important as it forms an effective check on the succession in the parent river. A cross-section along the line O—P is seen in Fig. 8.

1.—*The Pipe-sandstone*

This occurs at heights varying from 5 to 140 feet (1·5 to 43m.) above the river. As in the Zambezi no evidence of humanly-worked stone has yet been recovered from it. A section in the Nansanzu stream shows the pipe-sandstone with its uppermost level indurated (siliceous ferricrete ?), outcropping in the present stream-bed and overlain by gravels and alluvium of the Third Pluvial. Another section, through the upper terrace opposite Legg's Farm, shows 1 foot (30cm.) of Older Gravel and 4 feet (1·20m.) of pipe-sandstone, very friable, but with silicified nodules embedded in it.

2.—*The Older Gravels* (Plates 23 and 27, Fig. 9 and 10)

In the upper reaches above the Golf Course these gravels are found at two main levels. The upper terrace occurs at heights varying between 40 and 50 feet* (12 and 15m.) above the river and almost invariably rests upon eroded silicified pipe-sandstone. The finer and less resistant ingredients have, for the most part, been eroded, leaving a thin residual gravel composed of chalcedony and pipe-sandstone pebbles, occasional pebbles of " siliceous ferricrete ", and stone implements some of which are probably contemporary with the gravel, though the greater number must be considered to be of later incorporation. This upper terrace is well seen on both sides of the river between the Municipal Gravel Pits (M.C.39) and Site M.A.38, but below this it is for the most part obscured by the later alluvial deposits.

* Rare occurrences are sometimes found above this height.

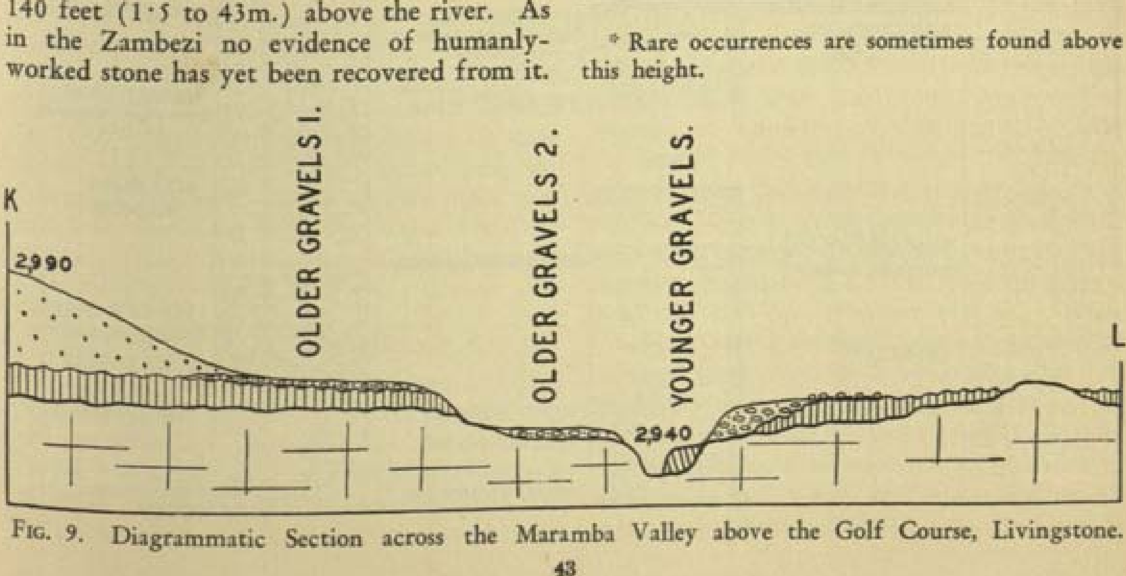


Fig. 9. Diagrammatic Section across the Maramba Valley above the Golf Course, Livingstone.

At heights approximately 10 to 15 feet (3 to 4·5m.) above the river there occurs the second terrace of the Older Gravels. It rests on basalt and is loamy, particularly in its upper levels. It varies between 3 and 15 feet (1 and 4·5cm.) in thickness and is evenly bedded with occasional lenses of sand and grit, except towards the base. Here the gravel is of a coarser nature, containing in places boulders of pipe-sandstone up to 2 feet (60cm.) across. The gravel is often ferruginous throughout and shows evidence of oxidisation resulting from semi-arid conditions; the pisolitic ironstone nodules found in the topmost levels presumably representing the ferricrete. On the higher levels the gravel is overlain by a pink redistributed sand; on low ground it is covered by a thin deposit of grit and alluvium which, near the present river bed, shows evidence of redistribution and is probably of more recent occurrence.

The gravel has suffered a considerable amount of erosion and resorting. Small streams and dongas (now running only during the rains) have dissected the gravels at right angles to the main stream, with the result that the former terrace now stands out as small, isolated, flat-topped hillocks above the redeposited material in the stream-beds below.

Tools of the Late Acheulian Culture are contained in these Older Gravels II. The site yielding the best assemblage is on the right bank between the Golf Course and the Municipal Compound (M.A.38). Excavation in a home and factory site of this period produced handaxes and cleavers often of exquisite workmanship; the material used for their manufacture is almost exclusively silcrete and silicified pipe-sandstone.

Implements of the Rhodesian Sangoan Culture are also found, rolled and unrolled, on and sometimes in these gravels. However, whereas the makers of the Handaxe Culture preferred silcrete and basalt, almost every tool of the Rhodesian Sangoan was made from chalcedony or occasionally from quartz.

A quarter of a mile (400m.) south of Legg's Farm the basalt dips sharply down and is lost to view for the whole distance to the railway bridge. In this section of the rivers, between Legg's Farm and the confluence with the Zambezi, deeper deposits have accumulated; but a small patch of the earlier terrace

SECTIONS OF RIVER GRAVELS: TRIBUTARY VALLEYS

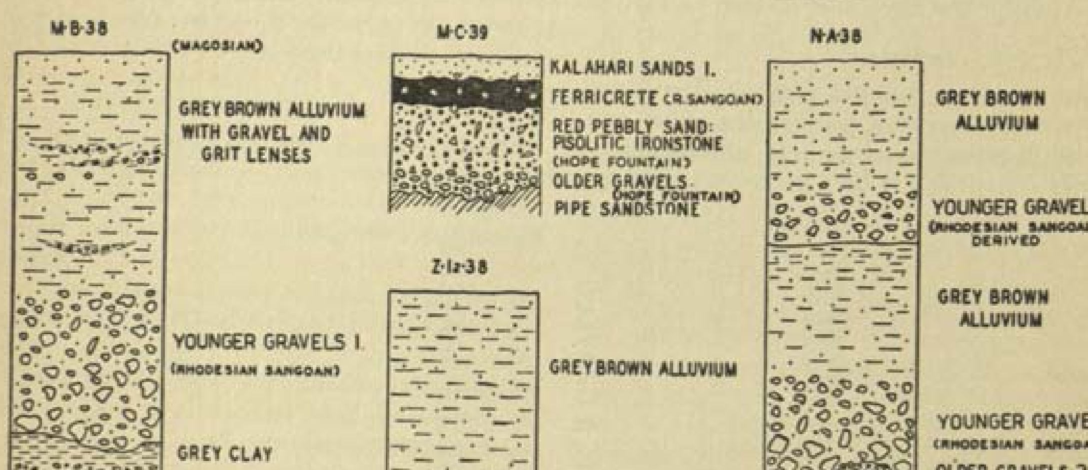


FIG. 10

of the Older Gravels is seen again on the left bank at Site M.K.39, though here again it is of a residual nature. Within this reach also there are two other deposits which antedate the Younger Gravels. The first is a fine gravel, cemented by pisolitic ironstone clearly identical with the ferricrete in the main river. This deposit outcrops in places at water-level, notably at Sites M.D.39 and M.B.38, and also passes below water-level. So far no implements have been found within it. It is considered to represent the lowest accumulation of the Older Gravels or, more probably, the level of the river at the very beginning of the Third Pluvial.

The second of the two deposits referred to above is exposed as remnants of the Older Gravels II on the left bank between Sites M.H.40 and M.O.40. The deposits take the form of sands and fine gravels, intercalated and overlain by thick deposits of calcrete and kunkar. They have yielded some typical Late Chelles-Acheul and Rhodesian Sangoan tools. Nearer Site M.O.40 the deposit becomes much more sandy until it consists entirely of rather coarse sands. The surface of the deposit is very uneven, due to external erosion, and is usually overlain by the earliest accumulation of the Younger Gravels and Alluvium. The lower levels are inclined to clay-like consistency aned there are lenses of a fine, white, almost diatomaceous deposit. The sands are yellow, turning to white at the base and to red at the surface. They are compact and form a very friable sand rock. The upper levels are almost identical with the basal levels of the sub-rubble-bed sands in Trench 2 of the Knight's Drive excavation. In some places the uppermost levels show incipient " pipe-formation ". Only at one place was seen what appeared to be the original surface of the terrace. It was here capped by a 2-foot (60cm.) thick bed of calcrete and kunkar at a height of approximately 25 feet (7·6m.) above the river. The undulating and eroded surface of these sands, underlying later deposits, is marked by a red bed. In this and occasionally immediately below it, is found a fresh debitage of Rhodesian Sangoan affinities. The red bed is equated with the ferricrete. The sands contain also rare pebbles of siliceous ferricrete; silicified pipe-sandstone, chalcedony, quartz and some basalt. These calcretes and sands most probably represent the final depositional phase of the Second Pluvial, and the eroded remnant of Kalahari Sand I which must thus have filled most of the valley.

3.—*The Younger Gravels* (Plate 26, Fig. 10)

These deposits of the Third Pluvial sometimes show three separate accumulations of gravels, grits and alluvium; while elsewhere only two or even one deposit can be distinguished. Between Legg's Farm and the railway bridge the Younger Gravels comprise a clearly defined terrace approximately 20 to 30 feet (6 to 9m.) above the river. It was at first thought that these deposits represented the Older Gravels, but it has since been established that this is definitely not the case; the factory débris and occasional implements found in the lowest and earliest of the gravels can now clearly be assigned to the Rhodesian Sangoan.

One good section can be seen a few hundred yards south of Schenk's Brickyard (M.D.39). At the base, and resting presumably on the basalt, is the fine gravel recorded above, cemented with numerous pisolitic ironstone nodules. Overlying this is a black clay layer, in places eroded but in others as much as 3 feet (90cm.) thick. This is in the nature of a vlei deposit, laid down during the semi-arid period at the very beginning of the Third Pluvial. From the top of this layer teeth of *Cervicapra* (Reedbuck) have been recovered, preserved in nodules of kunkar. Above this clay layer are from 6 to 15 feet (1·8 to 4·5m.) of fine gravels, grits and alluvium interbedded with sands. Much current-bedding is here in evidence, especially in the lower levels which are also ferruginous. The whole deposit is reddened and has irregular vertical veins of kunkar running through the alluvium. From it have been recovered Rhodesian Sangoan implements and factory débris. The surface of this bed has been eroded and is overlain by gravels, grits and alluvium from 4 to 8 feet (1·2 to 2·4m.) thick, laid down during the second accumulation of the Younger Gravels.

Overlying this second aggradation is a third deposit of fine gravel, grits and alluvium, which in places overlie disconformably the bed beneath, but in most areas rest conformably upon it. The two upper aggradations are for the most part sterile or contain no recognisable artifacts.

This section is fairly typical of others that can be seen, in the Nansanzu stream (N.A.38), at McKillop's Brickyards, at sections ¼-mile (400m.) above and ½-mile (800m.) below these brickyards (M.B.38) and in several sections below the railway bridge. In this last, however, the earliest aggradation of the Younger Gravels is below water-level, the river not having eroded to its previous base-level.

An interesting section is also seen in an excavation at Site M.P.39 near the Windsor Hotel, approximately ½-mile (800m.) from the river. At the surface 6 inches (15cm.) or so of greyish red humic soil; then approximately 6 feet (1·8m.) of red, redistributed Kalahari Sands II, which pass gradually in the lowest levels into a light grey sand, where occurred a factory débris of Magosian affinities. At 5′6″ to 6′ (1·6 to 1·8m.) the deposit changed rapidly into a grey, sandy clay containing small pebbles of chalcedony and some ironstone pellets. A minor disconformity is present at this level. Below is a sterile bluish-grey clay with no apparent bedding planes for a depth of approximately 4 feet (1·2m.). The clay passes gradually down into a red alluvium which turns to grey in the lower levels, thickness 6 feet (1·8m.). At the base of this alluvium is a second land-surface with pisolitic ironstone nodules and some largish pebbles of basalt. There also occurs a sparse, unrolled factory-débris of Middle Stone Age affinities, one good disc core being of especial note. Below this land-surface occurs a brownish black alluvium with small pebbles of chalcedony and basalt scattered sparsely throughout. The thickness is 6′6″ (2m.) and it rests on rotten basalt at a depth of 19′4″ (6m.).

It must be stressed that the occurrence of three accumulations of the Younger Gravels is usually only a local phenomenon, elsewhere and more commonly only two divisions (or even one) are recognisable; but whether three aggradations or fewer are represented it is clearly apparent that these deposits comprise aggradations within a single climatic cycle, where three are present they always directly overlie each other.

4.—*The Deposits of the First and Second Post-Pluvial Wet Phases* (Plate 26)

The succeeding wet period, which resulted in the aggradation of the gritty brown alluvium and gravel is well represented in the Maramba. Between the Municipal Compound and Legg's Farm this deposit, with its covering of reddish brown alluvium, occurs at a considerably lower level than the Younger Gravels; that is to say, from 15 to 5 feet (4·5 to 1·5m.) above the present river bed. It comprises angular gravels at the base, with gravel, current bedded grits and fine brown alluvium above. The angular gravel shows a large increase in basalt pebbles and boulders and contains very rare rolled Middle Stone Age implements.

At a consistently lower level and approximately 5 feet (1·5m.) above the present river bed, is found a denudation terrace on which a coarse angular gravel of basalt pebbles sometimes rests. This gravel is presumably the result of torrent action and at McKillop's Brickyards, for example, are current-bedded grits and sands. This lowest aggradation terrace and the subsequent denudation terrace can best be seen immediately below the junction of the Maramba and the Nansanzu, and again where the Maramba meanders over a wide course between McKillop's Brickyards and the Livingstone Dairy Farm. The sands in this reach were laid down during this time.

The Masue River

The Masue enters the Zambezi about 5 miles (8km.) below the Victoria Falls by two waterfalls over 400 feet (122m.) in total height at the end of a short but precipitous tributary gorge. This rejuvenation at the confluence has enabled the river to cut into the rock barriers found in its middle course, and at the bridge where the Great North Road crosses the river it has cut down some 20 feet (6m.) into the basalts. Like the other tributary rivers in the lower reaches of the Upper Zambezi the valley is flanked by bults of Kalahari sand.

The terrace of the Older Gravels is well represented in the area of Jafuta Siding and again on the right bank near the foot of the scarp below the road bridge. On the left bank at Jafuta the Older Gravel forms a capping about 2 feet (60cm.) thick to the flat isolated kopjies in the valley. It has now spread out down their slopes into a scree and has become mixed with later deposits on the lower slopes. These kopjies stand approximately 75 to 100 feet (23 to 30m.) above the river. On the right bank the gravels are well represented again and are cemented by the ferricrete. They contain, in a rolled state, flakes and handaxes of an early stage of the Chelles-Acheul Culture and also some Hope Fountain tools. In the upper levels unabraded Rhodesian Sangoan artifacts are found. The Older Gravels gradually give place on the upper slopes to the ferruginous Rubble Bed with similar components. The deposits of the scarp itself have been described on p. 50.

Below the road bridge the high terrace of the Older Gravels is identical with that described above and rests on basalt or more commonly chalcedony of the usual form. Below this terrace, however, the contour of the valley slopes gently downwards to form a flat some 25 feet (8m.) above the river on an average, covered in places by a recent black cotton-soil of no great depth, with mounds and ridges rising above it on which lie the eroded remnants of the later aggradations of the Older Gravels. The erosion of these beds took place during the Third Pluvial and a sparse, redistributed, oxidised gravel of this date now litters the flat. In this gravel weathered and abraded tools of Middle Stone Age type are sometimes found. The Younger Gravels are best seen, however, at Jafuta, near the dam, where good assemblages occur of Rhodesian Proto-Stillbay and Stillbay tools. The Younger Gravels occur here as a thin gravel resting on a low basalt platform about 10 to 15 feet (3 to 4·5m.) above the river. The Younger Gravel terrace is also well seen on the plateau close to the right bank of the gorge at its confluence with the Zambezi. Here the gravels bend round in an L-shape and follow the course of the parent river, passing beneath deposits of redeposited Kalahari Sands II.

Below the bridge basalt-bars have allowed of the accumulation of deeper deposits of the Younger Gravels behind them. One such section is seen in the left bank 1½ miles (2·4km.) below the bridge. Here there are two calcareous river gravels and sands, some 3 feet (1m.) of the lower gravel being exposed, the remainder passing below river-level. This gravel contains a few Rhodesian Sangoan tools. Its surface is irregular and it is overlain by a thin deposit, never more than 1 foot (30cm.) in thickness, usually less, of bright red, gritty sand. It is surprising that this has not been entirely eroded when the later gravel was deposited. The upper gravel

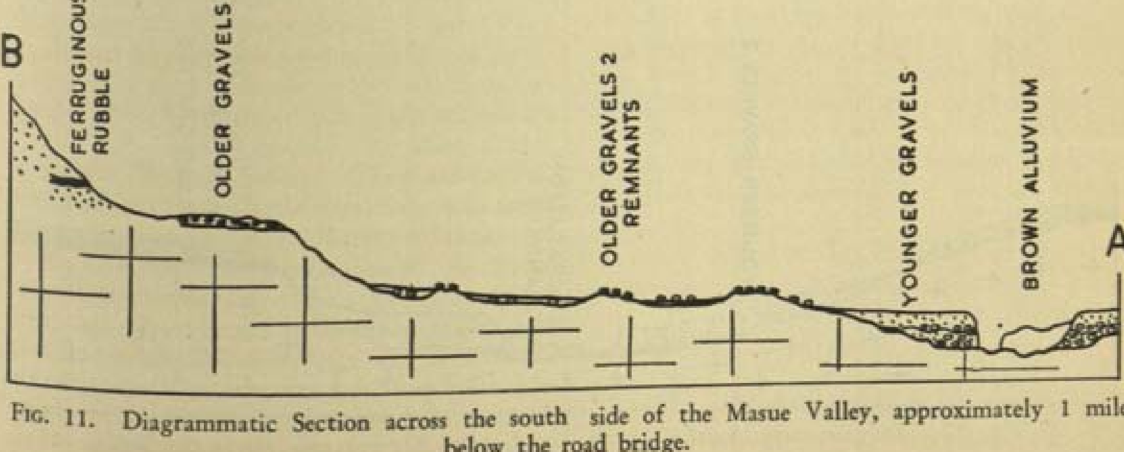


FIG. 11. Diagrammatic Section across the south side of the Masue Valley, approximately 1 mile below the road bridge.

is overlain by a deposit of calcrete, above which is a reddish brown alluvium 4 to 8 feet (1·2 to 2·4m.) thick. This was found to be sterile.

The coarse gravels and gritty brown alluvium of the First Post-Pluvial Wet Phase can be clearly seen at most places as a low terrace 5 to 10 feet (1·5 to 3m.) above the river, below the bridge, and above the bridge at about 5 feet (1·5m.) above the river. It occasionally contains some Rhodesian Stillbay flakes, considered to be derived.

Fig. 11 shows a diagrammatic section across the Masue River in its lower course.

The Kalomo River

Important sections yielding cultural material are found in the valley of this river near the town of Kalomo.

Railway cuttings 6·4 miles (9·7km.) southwards from the Kalomo Drift along the Great North Road show the following sequence from the base upwards:

1. Weathered granite complex, surface gently undulating.
2. Ferricrete, hard and compact, with pebbles and quartz fragments locally. The upper levels have yielded good collections of Rhodesian Sangoan tools both fresh and abraded. The surface is wavy, following the undulations in in the bed-rock, and the thickness 2 to 4 feet (·6 to 1·2m.). There is a suggestion that the well-consolidated lower part of this may be earlier than the upper part. No implements have been found in the basal levels.
3. Unsorted gravel, close packed in sparse grey sand and containing pebbles of quartz, quartzite, chalcedony and fragments of ferricrete; also numbers of Rhodesian Sangoan tools, both abraded and fresh, some with ferricrete adhering. This gravel fills hollows in the underlying bed and the surface is fairly uniform and only gently undulating. The thickness is approximately 2 feet (60cm.).
4. Unsorted, grey dusty sand, with its larger grains angular. It was sterile except that at one point two fresh Middle Stone Age flakes in milky quartz were found. The average thickness is 2 feet (60cm.).

Again, between the railway bridge and the Drift on the left bank the succession of deposits can be clearly seen, and is shown in the section in Fig. 12. Here the ferricrete cementing the Older Gravels stands at heights of 20 to 30 feet (6 to 9m.) and more above the river. At some points this gravel has yielded good specimens of the Late Acheulian stage of the Chelles-Acheul Culture and also some Rhodesian Sangoan tools.

This gravel is overlain and considerably eroded by the Younger Gravels I, consisting of unsorted pebbles, often of large size, with derived Chelles-Acheul and Sangoan tools and

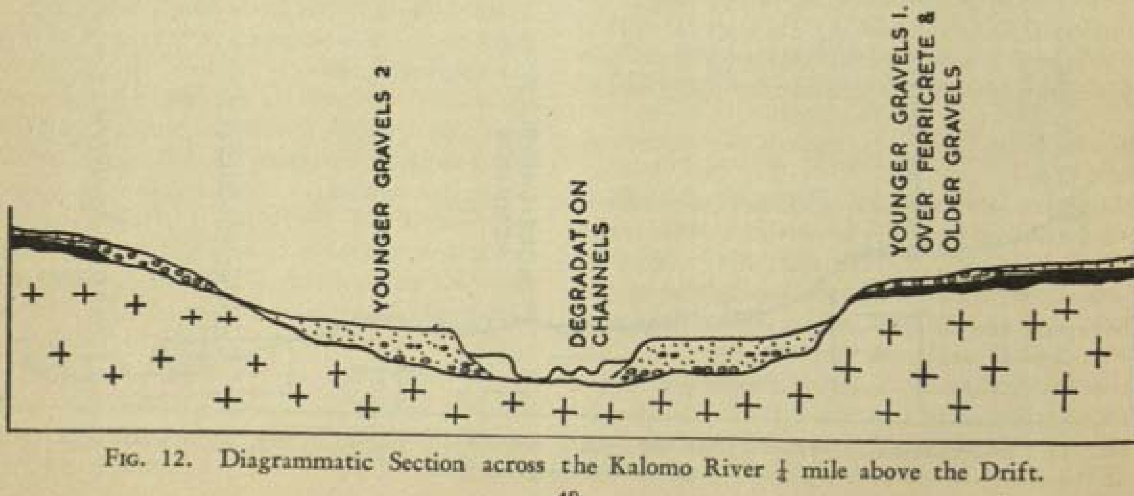


Fig. 12. Diagrammatic Section across the Kalomo River ¼ mile above the Drift.

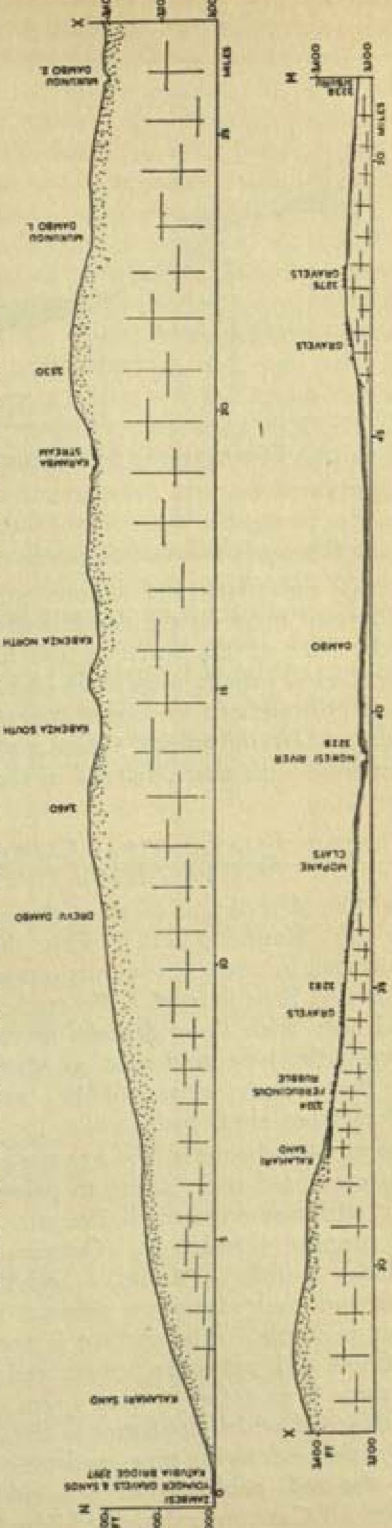
contemporary Rhodesian Proto-Stillbay tools, showing an interesting variation on the usual assemblages, since they are made from quartz and quartzite pebbles and often present a very primitive appearance. Below this gravel there occurs a further aggradation of Younger Gravels and alluvium, possibly divisible into two stages; below this again the lowest alluvial terrace of the First Post-Pluvial Wet Phase deposits occur. An abandoned channel is well seen cutting into this terrace. The two lower alluvial deposits are sterile of any recognisable artifacts.

Other Tributaries

The same sequence of events and cultures can be seen in the other tributaries examined—in the Machili, Mulobesi, Ngwezi, Sinde and Nansanzu rivers. The shallow, mature valleys of all five are flanked by the gently rising Kalahari Sands which at one time stretched right across them. The sands have been largely removed from the lower reaches of the Ngwezi and Machili rivers, but remnants are still found on the higher ground, i.e., the Siburu Sands. Figure 13 shows a cross-section from the Zambezi at Katubia to Siburu on the west side of the Ngwezi river.

The gravels of the eastern side of the Ngwezi stand at a much higher level than those to the west, are much better developed and, in the higher levels, probably antedate the Older Gravels. At these high-level exposures they stand about 80 feet (24m.) above the Ngwezi Siding. In the upper part these eastern gravels are about 10 feet (3m.) thick and largely cemented in hard, red ferricrete; they pass directly under the Kalahari Sands. The Western gravels at the maximum stand only approximately 20 feet (6m.) above the Ngwezi Siding. They are unconsolidated and very little ferricrete was seen; these also pass under the Kalahari Sands.

Fig. 14 shows a section across the Sinde River on the line G—H on the map. The Younger Gravels are well represented, but the Older Gravels have not yet been identified with certainty, though they probably rest on a denuded basalt terrace near the foot of the scarp on the left bank.



SECTION N-M ALONG ZAMBESI SAWMILLS RAILWAY BETWEEN KATUBIA AND SIBURU

Fig. 13

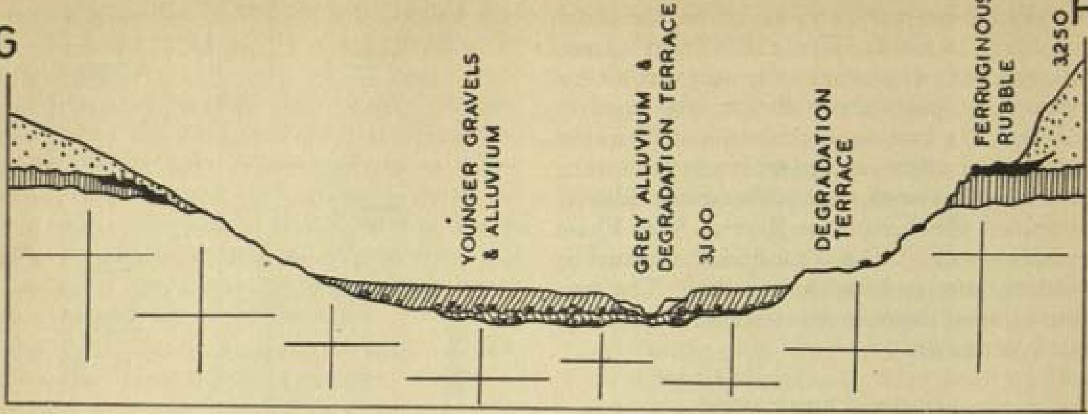


FIG. 14. Diagrammatic Section across the Sinde River at the homestead, Beaton's Farm.

II

THE DEPOSITS OF THE SAND SCARPS

During the 1948-1949 seasons work was concentrated more on the deposits to be seen near the base of the scarp of the Kalahari Sands which is usually present on each side of the river throughout its upper course. The cultural and stratigraphical sequence seen here was equated with that observed in the valley proper.

VICTORIA FALLS RAILWAY CUTTINGS (Z.T.39, Z.B.39)

The first description of these deposits was given by Maufe (1938) who described sections seen in two railway cuttings south of the Victoria Falls Station. We are here concerned only with those deposits immediately overlying the pipe-sandstone, as Maufe and, later, the present writer (1939) recovered artifacts from these beds.

The pipe-sandstone is here a coarse-grained, feebly cemented rock, white to pale pink in colour, with numerous small, irregular, hollow pipes running through it. Occasional sub-angular, ¼-inch (6mm.) pebbles of quartz and chalcedony are present, but the deposit is sterile. The surface is wavy and ill-defined and passes up into a red pebbly sand some 2 to 4 feet (·6 to 1·2m.) thick, the surface of which conforms to the undulations of the underlying pipe-sandstone. Overlying the red, pebbly sand is a rubble-bed (termed a " Carstone rubble-bed " by Maufe) consisting of pisolitic and larger nodules of ironstone or ferricrete. In this respect the bed differs from the usual ferricrete formation of the valley bottom, but it is closely similar to that found on the upper flanks associated with the terrace of the Older Gravels. The rubble-bed in the railway cutting sections forms a wavy line from 2 to 4 inches (5 to 10cm.) thick on an average, but thickening into pockets between 1 and 4 feet (·3 and 1·2m.) deep which coincide with the hollows in the pipe-sandstone. The Kalahari Sands overlie the rubble-bed to a depth of between 15 and 40 feet (4·5 and 12·2m.) and are structurally uniform with no signs of bedding.

Artifacts of undoubted human workmanship were recovered from the rubble-bed, and were described by the present writer as having Pre-Abbevillian affinities (Clark, J. D., 1939) mainly on the strength of a well-finished rostro-carinate tool and on the geological evidence, which placed the overlying Kalahari Sands in the Lower Pleistocene. Since 1938, however, further discoveries have shown that the note of caution sounded at the time of the earlier report was well founded. Additional collections from these sections have yielded rare but well-finished tools which have enabled us to determine accurately the industry represented here. In addition to the " rostro-carinate " or pick mentioned above we now have flakes with indisputable faceted striking platforms (a few with primitively faceted platforms, it will be noted, we recorded from the 1938 collection) and one very fine example of a side-scraper, found by Mrs. M. D. Leakey in the rubble-bed exposed in the left wall of the southern cutting. It can now be confidently stated that the industry contained in and on (and in very rare instances, just above) the rubble is of typical Rhodesian Sangoan facies.

A mineralogical analysis by Dr. W. Pulfrey of the content of the Kalahari Sand, the red pebbly sand and the pipe-sandstone from the northern cutting suggests that either the red pebbly sand and the pipe-sandstone are of dissimilar derivation, or (if the former is derived from the latter) that new sedimentary matter was mixed with it at the time of deposition. The Kalahari Sand sample shows a closer comparison with the pipe-sandstone.

Hubert Young Drive Sections (Z.F.39, Z.L.40, Fig. 15)

The scarp here is formed in its lower two-thirds of basalts, the upper third being made up of rubble and Kalahari Sands which, on barometric readings, show a maximum thickness of 100 feet (30m.). Some irregular vein-chalcedony is exposed overlying the basalt but is not typical. The majority of sections show the following stratification from the base up: solid basalt, giving place to decomposed rock; this, Dr. Pulfrey suggests, is a clay which had cracked and allowed sands to penetrate it rather in the manner of a breccia. Hence, whether the clay portion was derived *in situ* by weathering of the basalt, or by sedimentation, some break in the sequence (though possibly only of short duration) is indicated. Overlying the clay and decomposed basalt (usually not more than 1 to 2 feet (30 to 60cm.) thick) occurs an irregular, chalcedony rubble, comparatively loose and composed of angular nodules of poor chalcedony showing iron staining but no ferruginization, set in a coarse red sand matrix. In thickness the chalcedony rubble-bed is seldom more than 18 inches (45cm.) (See Plate 28) while in some sections it is absent and its place taken by an apparently true laterite of approximately the same thickness. Overlying the laterite and

SECTIONS OF ALLUVIUM & LAND RUBBLES: ZAMBESI VALLEY

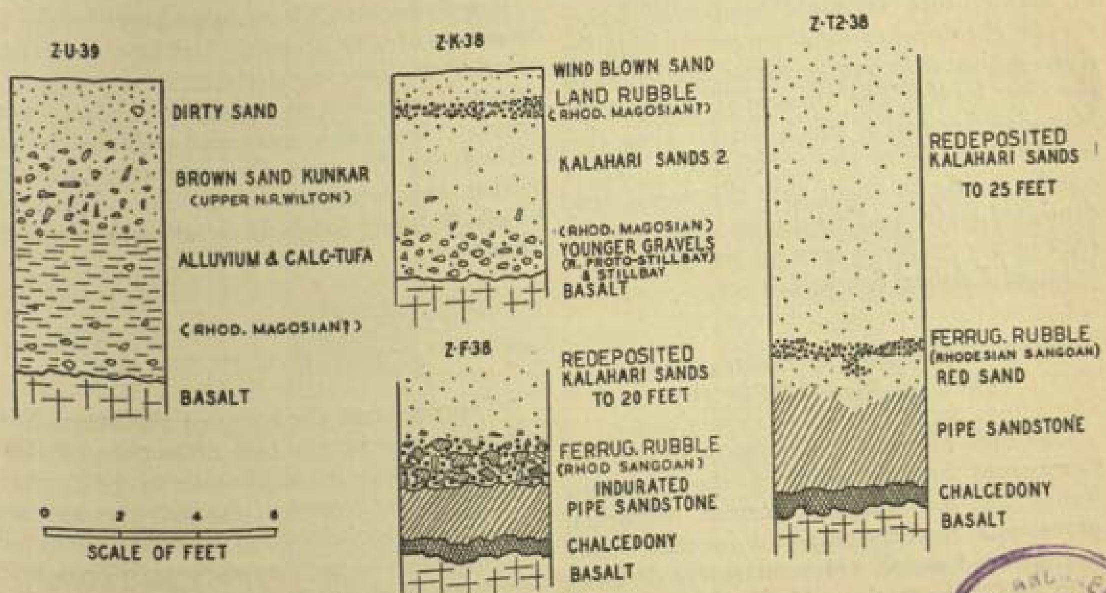


Fig. 15

chalcedony is a rubble-bed identical with that described for the previous sections, except that it is usually thicker, being on an average between 1 foot and 1 foot 6 inches (30 and 45cm.) thick. Besides small pisolitic nodules of ferricrete (which, where exposed, are often cemented together) it also contains larger nodules and sometimes rounded boulders of a more silicified ironstone or ferricrete with irregular pipe structure. (See p. 33.) In at least two sections this earlier ferricrete is seen *in situ*, approximately 2 feet (60cm.) thick and apparently overlain by the pisolitic ferricrete.

On (and, more rarely, in) this rubble-bed occur numerous fresh pieces of factory débris and some artifacts of the Rhodesian Sangoan Culture. It would appear that these tools also extend up into the lowest levels of the Kalahari Sand which overlies the rubble, but this is not fully confirmed at this site. The sands are again structureless, but near the top (at a depth of 4 to 6 feet, 1·2 to 1·8m.) are numerous floors yielding Magosian artifacts and debitage, indicative of a land-surface and a stratigraphical break—though if it were not for the presence of the artifacts this would not be discernible. Magosian tools also extend down the slopes of the sand in places, and it would appear that the makers of this culture favoured temporary living sites on the slopes of the scarp overlooking the river, rather than camps nearer the banks of the river itself. The topmost sand above the Magosian horizon is much coarser than that immediately above the rubble-bed. There can be no doubt at all that this was a sand deposited under arid conditions. Its counterpart in the valley is seen in the pink redistributed Kalahari Sands II.

C.—Maramba Quarries Site
(M.C.39, Plate 27, Fig. 10)

One mile (1·6km.) north of the Municipal Compound on the edge of the Maramba Valley are situated the former Municipal gravel pits, recently reopened for the extraction of road metal. Here extensive diggings have laid bare sections of the deposits lying between the Kalahari Sand and the basalts. The chalcedony is apparently absent here and overlying the lavas is a bed 3 to 4 feet (·9 to 1·2m.) thick of pipe-sandstone with typical pipe structure, usually silicified. This pipe-sandstone has been subjected to more or less intensive erosion and in places has been entirely removed. Overlying it there occurs a residual or eluvial gravel, of which the finer and less resistant constituents have been removed, leaving the larger components as residuals. This gravel is identified with the Older Gravels and is here approximately 60 to 70 feet (18 to 21m.) above the river and ¾-mile (1·2km.) distant therefrom. It consists of pebbles and nodules of chalcedony and quartz with occasional pebbles of siliceous ferricrete; but it also contains a large number of artifacts of a primitive nature and which have been described under the term "Hope Fountain Culture" (See p. 79). The artifacts are usually abraded and also sometimes show little or no signs of rolling. The gravel is ferruginous and is only some 6 inches (15cm.) thick. It is overlain by an unsorted, coarse, red, pebbly sand with pisolitic nodules of ferricrete scattered fairly thickly throughout. This bed varies between 3 and 5 feet (·9 and 1·5m.) in thickness. It contains tools of the Hope Fountain Culture in its lower levels. It passes gradually up into a bed of consolidated ferricrete approximately 2 feet (60cm.) thick, in the top of which, and lying on its surface, are fresh tools and debitage of the Rhodesian Sangoan Culture, typical picks, flakes and handaxes having been recovered. Pink Kalahari Sands II overlie the ferricrete horizon.

D.—Knight's Drive Section
(Z.B.48, Plate 27, Fig. 16)

This area and the scarp of the Masue have yielded some of the best collections of Rhodesian Sangoan material made in the Zambezi Valley. As, however, the stratification was somewhat obscure two excavations which will be referred to as Trench I and Trench II, were made through the deposits at the base of the sand.

From the bottom upwards the section through Trench I is as follows:

1. Decomposed basalt at 13′9″ (4·2m.).
2. Sandy clay, streaked grey and red with rolled nodules of basalt and chalcedony. 13′9″ to 13′ (4·2 to 3·9m.).
3. At 13 feet the clay is gradually replaced by sand, now red in colour but still showing some "stiffening" due to clay content.
4. Red sands, paler and more cemented at the base, passing into a loose red sand of fine texture at the top. 13′ to 4′ (3·9 to 1·2m.).
5. At 4 feet there occurs a rubble-bed composed of angular nodules of silicified pipe-sandstone with comparatively sharp edges, set in a red sand matrix. There was nowhere any evidence of the pipe-sandstone *in situ*. The rubble was almost 1 foot (30cm.) thick and passed rapidly up into the bed above.
6. A rather massive ferricrete about 2 feet (60cm.) thick with pipe structure and in some places a siliceous appearance. The upper levels were composed of pisolitic nodules firmly cemented together, but the two forms of ferricrete passed almost imperceptibly the one into the other. The surface of this bed had been denuded and represents a land-surface on which occur artifacts and debitage of the Rhodesian Sangoan. It is overlain by a thin deposit of dark red sand, considered to have been washed and blown down the sand slopes, of which the main one is some 400 to 500 yards (350 to 450m.) distant from the excavation.

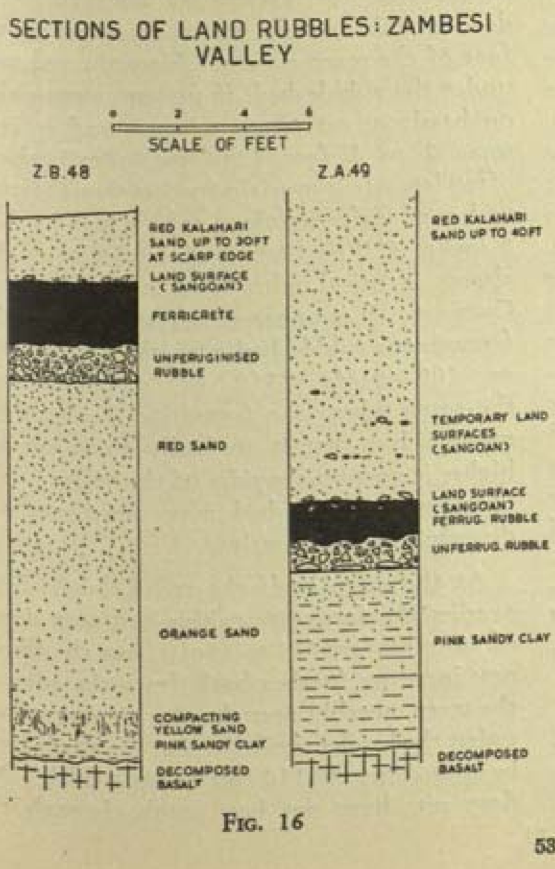


FIG. 16

Trench II showed a closely similar section:

1. Decomposed basalt at 15′6″ (4·7m.).
2. A pink clay-sand with grey streaks and small basalt nodules. 15′6″ to 15′ (4·7 to 4·55m.).
3. An orange to yellow friable but compact sand with white streaks, which apparently indicate the beginning of incipient pipe structure. 15′ to 14′6″ (4·55 to 4·4m.) This compact sand passed imperceptibly up into the overlying deposit.
4. An orange sand with white streaks running irregularly through it. 14′6″ to 11′ (4·4 to 3·3m.) This sand becomes gradually looser near the top and also changes to a red colour.
5. Fine red sand, 11′ to 5′ (3·3 to 1·5m.), finest and reddest in the topmost levels.
6. At 5 feet (1·5m.) the red sand was replaced by a loose land-rubble of angular fragments and nodules of silicified pipe-sandstone and chalcedony set in a matrix of red sand.
7. At 4 feet (1·2m.) this unferruginized rubble gave place to a massive ferricrete with pipe structure, passing into the cemented pisolitic ferricrete. The surface of this bed stood at 2′9″ (85cm.) and had been eroded in varying degree. Cemented into the top of the ferricrete were sometimes ¼-inch (6mm.) pebbles of quartz and chalcedony. On this land surface (but never within the ferricrete) occurred a typical Rhodesian Sangoan debitage.
8. The ferricrete was overlain by approximately 2 feet (60cm.) of fine red Kalahari Sand.

These two excavations showed, therefore:

1. Erosion of the lavas and chalcedony.

2. Deposition of between 9 and 10 feet (2·7 and 3m.) of sterile red sand, coarse and partially consolidated in its lower, and fine in its upper levels.
3. A rubble-bed, the lower half of which is unferruginized, and the upper half of which shows evidence of considerable ferruginization.
4. A land-surface with Rhodesian Sangoan tools.

These sections are amplified by numerous natural exposures between Livingstone and the Sinde River. In the same area as the two trenches described above there is exposed a friable sandstone or sandrock, white to yellow in colour, with small pipes running irregularly through it. It is similar to the pipe-sandstone recorded in the Railway Cuttings referred to above and in some of the Maramba river-bed exposures. There is some 6 feet (1·8m.) of this deposit and it rests on decomposed basalt. Nowhere is there any sign of silicification. In Trench II the basal levels of the sand under the rubble are allied to this deposit seen in the natural exposures. In fact, it appeared to the writer that this basal sand represented the initial stages of pipe-sandstone formation. Most regrettably the age of the sands under the rubble is unknown as (where examined) they are sterile; the rubble-bed itself has also yielded no cultural material at these sections. If the rubble-bed represents the earlier "siliceous ferricrete" then the sands below it must be of Lower Pleistocene age and must represent the broken-down or else unconsolidated surface of the pipe-sandstone. It is hard to believe that a depth of 10 feet (3m.)* or so can be the result of residual weathering or that these sub-rubble sands represent the original, unconsolidated sands in process of transformation to pipe-sandstone, while elsewhere the surface of the pipe-sandstone has been well silicified. An analysis by Dr. Bond of the sand samples from these pits strongly suggests that the sub-rubble sands represent a distinct phase of sand accumulation later than the Pipe Sandstone. (See Appendix D.)

After considering all the available evidence the writer is of the opinion that the sub-rubble sands represent the initial phase of Kalahari Sand accumulation at the end of the Middle Pleistocene (Second Pluvial). This implies that some of the friable "pipe-sandstone" formations may be as late as the end of the Middle Pleistocene and must be clearly distinguished from the silicified rocks of a similar nature. This, however, has still to be proved.

Except in some parts of Trench II the ferricrete rubble does not have the appearance of belonging to the "siliceous formation". When the deposit was traced up to the base of the scarp itself, where it is exposed in recent erosion gullies, it was seen that the bed slopes gently up towards the scarp, following the contours of the underlying bedrock. The deposits thin out the nearer they get to the foot of the scarp proper. Here the red sand under the rubble-bed, if present, rests either on basalt or on pipe-sandstone and is only some 2 to 3 feet (1·8 to 2·7m.) thick, often less. It is overlain by 6 inches (15cm.) or less of unferruginized rubble and by 4 to 5 inches (10 to 12cm.) of ferricrete rubble almost identical with that in the Railway Cuttings. It is apparent, therefore, that this ferruginous rubble-bed is thickest about 400 or 500 yards (350 or 450m.) from the scarp where the formation is sometimes massive, but that it gradually thins out the higher it goes up the sides of the valley. The ferruginous rubble-bed may sometimes rest directly upon the basalt.

At the scarp itself the red Kalahari Sand overlies the ferricrete rubble-bed to a depth of 50 to 60 feet (15 to 18m.), but the thickness increases further back from the edge of the scarp, notably near the new airport where, unless the basalts similarly rise, the sands must be approximately 150 feet (45m.) thick. No deep pits have yet been sunk through the

* There are indications, too, elsewhere in the vicinity, where the deposit fills old erosion gullies cut in the basalt, that the depth is much greater.

sands at these points, however.* A borehole at Mulobezi, well within the centre of the belt of Kalahari Sand, showed at the surface a white sand, which after 11 feet (3·3m.) gradually changed to 13 feet (3·9m.) of yellow sand and clay. At 24 feet (7·2m.) from the surface this rested on a red sandstone, considered by Maufe to represent the Karroo Forest Sandstone. Thus the Kalahari Sand at this point would not appear to be thicker than 24 feet (7·2m.) at the most.

Two boreholes on the flank of the Luwange Mulapo, nearly 3 miles (4·8km.) from the Zambezi Sawmills Camp at Masese, showed approximately 100 feet (30m.) of undifferentiated white to orange Kalahari Sand, under which was 27 feet (8·2m.) in one borehole and 20 feet (6·1m.) in the other, of what is described as " a very fine white clay ". This rests on a porous limestone or sandstone the depth of which is not known. At Masese itself another borehole showed 100 feet (30m.) of Kalahari Sand, underlain by 5 feet (1·5m.) of grey clay, underlain by further sand to an unknown depth.

Above the rubble-bed the Kalahari Sands are much finer in consistency in their lower levels, where there is a not inconsiderable clay content. Associated also are occasional pebbles of quartz up to ½-inch (13mm.) in diameter or more, and weathered nodules and blocks of massive ironstone of a siliceous nature. The sands become progressively coarser the higher the samples are taken, until (at a depth of 2 to 6 feet (·6 to 1·8m.) from the top) the Magosian horizon is encountered; the sands overlying this are always coarse.

Lying on the rubble-bed and in the lower 10 feet (3m.) approximately of the Kalahari Sand there are found temporary living-floors of the Rhodesian Sangoan peoples. The debitage is very thick and this and the finished tools are always in " mint condition". There are no definite horizons to be seen which suggests that the surface of the sands was changing fairly rapidly) and the temporary land-surfaces are distinguishable only by the floors of debitage and artifacts. The tools show thin patinas of varying colours or else no patina at all, and invariably have a matt finish.

Higher up the slopes of the sand there are found living-floors of the Rhodesian Proto-Stillbay peoples. Tools are common and always show a fairly thick white patina, not infrequently glossy. They occur also at no definite level or levels in the sand, except that they always lie above the Sangoan. It would thus appear that some erosion of the sand-slopes took place after the accumulation of the sands in which the Rhodesian Sangoan floors are found, and that the makers of the Rhodesian Proto-Stillbay industries formed temporary camps on these eroded slopes.

It is of interest to note that the sands below the rubble-bed (which shows certain similarities with the "M-horizon " in Uganda) are fairly coarse at the base and fine at the top, while those above the rubble are

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* It is of interest to note here the evidence recorded by the late J. D. Martin, formerly Forestry Officer at Machili in the western part of our area, regarding the Kalahari Sands which bear the *Baikiaea plurijuga* forests. Martin found that the more fertile the sand, judged by the vegetation it supported and by its utility for native agriculture, the greater the proportion of fine sand to coarse sand present. He also found that in these sands above the rubble bed the proportion of fine sand to coarse increased with depth and recorded mechanical analysis figures in support of this. The best Baikiaea forests he found to occur as fringing forests round the edges of the Kalahari Sands where the lower levels of these sands are exposed. Two pits dug through the Kalahari Sands (one at the back of the Forestry House at Machili and one in Lonze Forest, about 10 miles (16km.) away from the first, showed approximately about 7 feet (2·1m.) of sterile light brown to yellow sands, overlying an horizon some 6 inches (15cm.) thick containing charcoals, sterile yellow sands to 23 feet (7m.), at which level intermittent charcoals occurred over a total thickness of 2 to 3 feet (60 to 90cm.), sterile yellow sands to 30 feet (9m.) at which depth excavation was discontinued.

Forestry Department officials inform the writer that throughout the whole of this area the upper charcoal level is well developed. It is thought by the writer not improbable that it should be equated with the horizon underlying the Kalahari Sands II, sometimes yielding a Magosian industry.

fine at the base and coarser at the top. An additional clue to the climatic conditions under which the lower part of the Kalahari Sand, above the rubble-bed, was deposited is given by the occasional pebbles and large, rounded nodules of ironstone found within it, and by the amount of clay content in the sand. It is suggested, therefore, that at the beginning of the Third Pluvial much sand was washed down the scarp of the valley (perhaps assisted by wind-action) and redeposited on these lower slopes. On this sand the Rhodesian Sangoan peoples settled.* These redeposited sands were accumulated under comparatively wet conditions and are found only on the lower slopes of the scarp, never in the bottom of the valley.

Further erosion of the sands (including these "wet" sands) accompanied by the deposition of fresh sand, was contemporaneous with occupation by the Rhodesian Proto-Stillbay peoples, during the second subphase of the Third Pluvial.

Masue River Sites

(Z.A.49, Z.C.48, Plate 28, Fig. 16)

Three areas have yielded good sections:

1. On the right bank of the Masue near its junction with the Zambezi and along the Zambezi scarp for a distance of 4 miles (6·4km.) south-east.
2. On the left bank of the Masue from the Railway crossing to a distance of 5 miles (8km.) up-river.
3. On the right bank of the Masue 3 miles (4·8km.) north of Jafuta siding.

1.—The sections at Area 1 above are as follows: At the shoulder of the Masue Valley, where it joins that of the Zambezi, the high-level terrace of the Older Gravels rests on the basalt and passes beneath the sands. The gravels are loosely cemented by a pisolitic ferricrete and are overlain by sand. Sections a few hundred yards further south-east show a loose and friable white sandstone, with some silicified nodules within it—rather in the nature of flint nodules in chalk. This is tentatively identified with the pipe-sandstone. This formation appears to fill an old valley to a depth of 40 to 50 feet (12 to 15m.) or more. Overlying this is a compact, pebbly, red sand 3 to 4 feet (90 to 120cm.) thick on an average, partially cemented into a sand-rock. Above the red, pebbly sand is the rubble-bed, typical of that seen in the Railway cuttings near the Victoria Falls Station. On this bed (though never in it) occur Rhodesian Sangoan tools. Overlying the ferricrete rubble are the Kalahari Sands, identical in formation with those described from Knight's Drive. The Rhodesian Sangoan tools are found in the lower part of these "wet" sands. On the upper slopes the Magosian is well represented, and some Rhodesian Proto-Stillbay material is also found in the middle and upper levels.

About 1 mile (1·6km.) south of this exposure is a wide embayment. The sands and their contents, exposed here above the rubble-bed, are identical with those described above. The upper, ferruginous part of the rubble-bed is also similar, except that it is sometimes more consolidated and massive. Below the ferruginous rubble, however, the sequence is different. The lower part of the rubble-bed is not indurated, but there occurs a rough rubble in which are found thin veins and nodules of chalcedony. This appears to have been formed *in situ*. The veins are not more than ½-inch (12mm.) thick and the chalcedony is of a translucent blue-grey colour. This bed is about 4 to 5 inches (10 to 12cm.) thick at most and rests on a sandy clay more than 15 feet (4·5m.) thick. The deposit is quite friable in its upper levels, where the sand content is greatest, but compact in the lower levels. There can be little doubt that this clay was derived in the main

* At one site at Anderson's Drift (Z.Y.40), however, an isolated area of yellow to orange sand, approximately 20 feet (6m.) thick or more, overlies ferricrete with Sangoan tools. This occurrence would seem to suggest that some at least of the sand was wind-blown and was probably accumulated after the Sangoan peoples had left the area, but before the makers of the Proto-Stillbay Culture reached it, as debitage of the latter is found in some cases down the slopes. Allowance should therefore be made for a short arid phase between the first and second erosion phases of the Third Pluvial.

from decomposed basalt; the base was not seen although it is presumed to rest on the lavas.

2.—At Area 2 sections show 3 feet (90cm.) of siliceous pipe-sandstone, white and pink in colour, overlain by some 2 to 3 feet (60 to 90cm.) or less of partially cemented red sand, or friable sand-rock. The surface of this sand is indurated and represents the rubble-bed with Sangoan tools and land rubble above it. Kalahari Sands overlie the rubble to a presumed depth of 100 feet (30m.) or more.

Further up-stream old erosion gullies, cut into the bed-rock of the scarp, have been exposed in section. These gullies, some 20 feet (6m.) deep, pass beneath the sand of the upper half of the scarp; the flanks stand out at its foot as denuded spurs. *In situ* on these spurs occurs chalcedony of normal structure, overlain by the rubble-bed, which in places is scattered down the slopes. In the bottom of the old gully is a redeposited Kalahari Sand. The nature of the original filling of the gully could not, however, be determined as sands washed down from the scarp obscured the underlying geology, though it is thought that the filling consisted of compact red sand similar to that described in the preceding paragraph. Rhodesian Sangoan tools are associated with the chalcedony and rubble on the old spurs; but only Middle Stone Age artifacts and occasional derived specimens are found in the red sand now filling the bottoms of the gullies.

3.—At Area 3 are further good exposures of the rubble-bed. A typical section showed, at the base, decomposed basalt overlain by a reddish sandy clay to a depth of 5 to 6 feet (1·5 to 1·8m.). Above this was the rubble-bed, subdivisible into a lower non-ferruginous and an upper ferruginous phase. The lower half showed pellicles and flattened, spherical concretions of a brownish-blue chalcedony or chert, which appeared to have been formed *in situ*. In some instances the usual assemblages of Rhodesian Sangoan tools were incorporated within the rubble, but were usually found on or just above it. Tools also occurred in the lower 12 feet (3·6m.) or more of the overlying Kalahari Sands. On the slopes were typical Magosian and Late Middle Stone Age tools; these also occurred within redeposited red sand filling shallow gullies at the foot of the scarp.

Additional Areas

Additional areas where the rubble-bed is exposed are in the Sinde and Kalomo rivers and at the foot of the Zambezi scarp approximately 20 miles (32km.) up-river from Livingstone. Here the Katombora road passes through a former railway cutting and the following exposure is seen: 5 feet (1·5m.) or more of red, sandy clay (the base of which is not exposed) overlain by approximately 1′6″ (45cm.) of unferruginized rubble. The lower half consists of blocks of chalcedony, apparently formed *in situ*, and the upper half of many sharp, fractured pieces of the same rock, some of which show artificial fracture. This rubble is overlain by 2 feet (60cm.) or more of red, sandy marl.

Summary

The evidence from the sand scarps may be summarised as follows:

1. A period of erosion of the pipe-sandstone, chalcedony and basalt. Climate: wet.
2. A period during which climatic conditions allowed of the decomposition of the lavas and the formation of a thickish layer of clay. Climate: wet.
3. The gradual accumulation of yellow and later red sands. Climate: semi-arid to arid.
4. The formation of a non-ferruginous rubble-bed. Climate: very arid.
5. The formation of ferricrete, not infrequently massive. Possibly contemporary with 4 but more probably later. Climate: semi-arid. Rhodesian Sangoan Culture ?
6. Accumulation of red sands around the edges of the scarp, partly as a result of redeposition by water-action and partly by wind-action. Climate: semi-arid to wet. Rhodesian Sangoan Culture.
7. A temporary halt in the accumulation of sands. Climate: semi-arid.
8. Renewed erosion and redeposition of the sands and formation of temporary land-surfaces on exposed slopes. Rhodesian Proto-Stillbay Culture. Stabilisation of the sands. Climate: semi-arid to arid.

9. Accumulation of red sands under wind-action. Rhodesian Magosian Culture. Climate: arid.

10. Erosion of scarp to present contours.

As yet no cultural material has been found associated with stages 1 to 4. It is possible that these events belong to an early period in the physiographical development of the valley. On the other hand, it is more probable that they date to Second Pluvial times; either to the first half of this Pluvial (the rubble-bed representing the dry period separating the two sub-phases) or else to the second half, when the onset of arid conditions, initiating the long Interpluvial, resulted in the accumulation of the main deposits of Kalahari Sand within the valley, followed by the formation of a typical land-rubble on the higher slopes. The present writer considers this latter hypothesis to be the more probable.

The sands of phase 3 above are therefore considered to represent the initial and major accumulation of Kalahari Sands (i.e.,

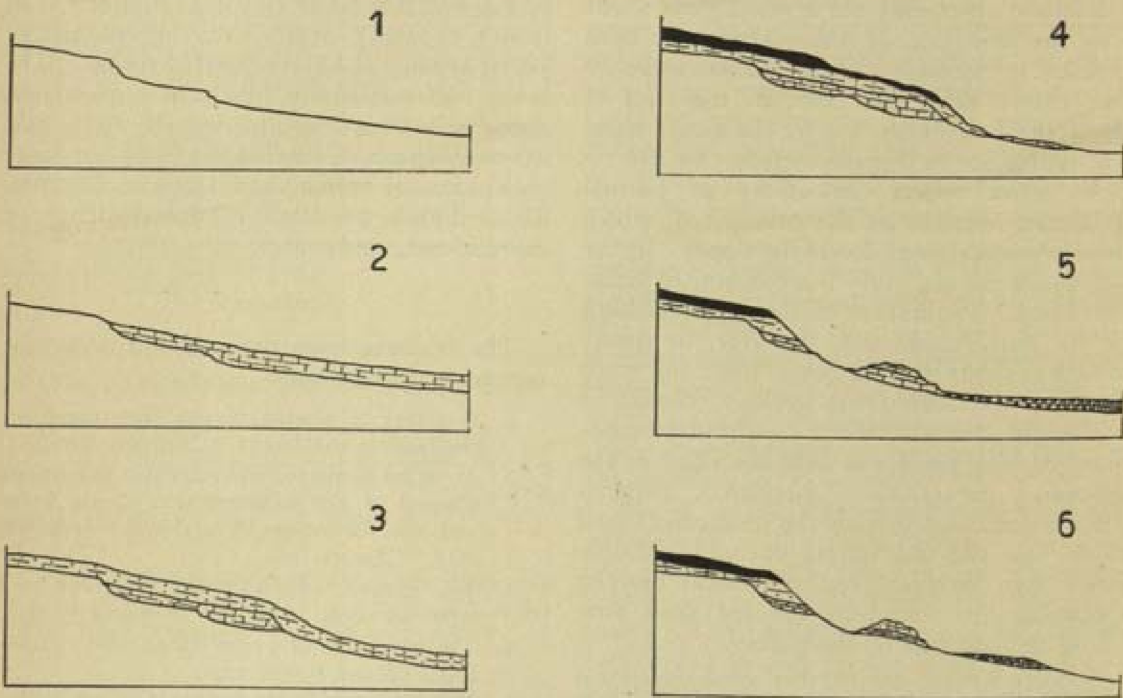

FIG. 17. DIAGRAMMATIC SECTIONS ILLUSTRATING STAGES OF THE PLEISTOCENE SUCCESSION IN THE UPPER ZAMBEZI VALLEY

1. Erosion and formation of the end-Tertiary Valley Peneplain.
2. Deposition of sands and freshwater limestones, followed by the conversion of the latter to chalcedony. Lower Pleistocene.
3. Erosion followed by the deposition of sands and some limestones, followed by silicification and conversion to pipe-sandstone. Gentle warping may have taken place at the end of this period. Lower Pleistocene.
4. Initiation of the Second Pluvial. Induration of the pipe-sandstone and formation of Ferricrete I, followed and accompanied by erosion. Middle Pleistocene. Pre-Chelles-Acheul Culture (?).
5. Erosion and aggradation of the Older Gravels I on the 45-foot Terrace. Middle Pleistocene. Rhodesian Chellean and Early Rhodesian Acheulian Cultures.
6. Erosion of the Older Gravels I and general deepening of the channel to present river level and below. Middle Pleistocene. Early Rhodesian Acheulian Culture (?).

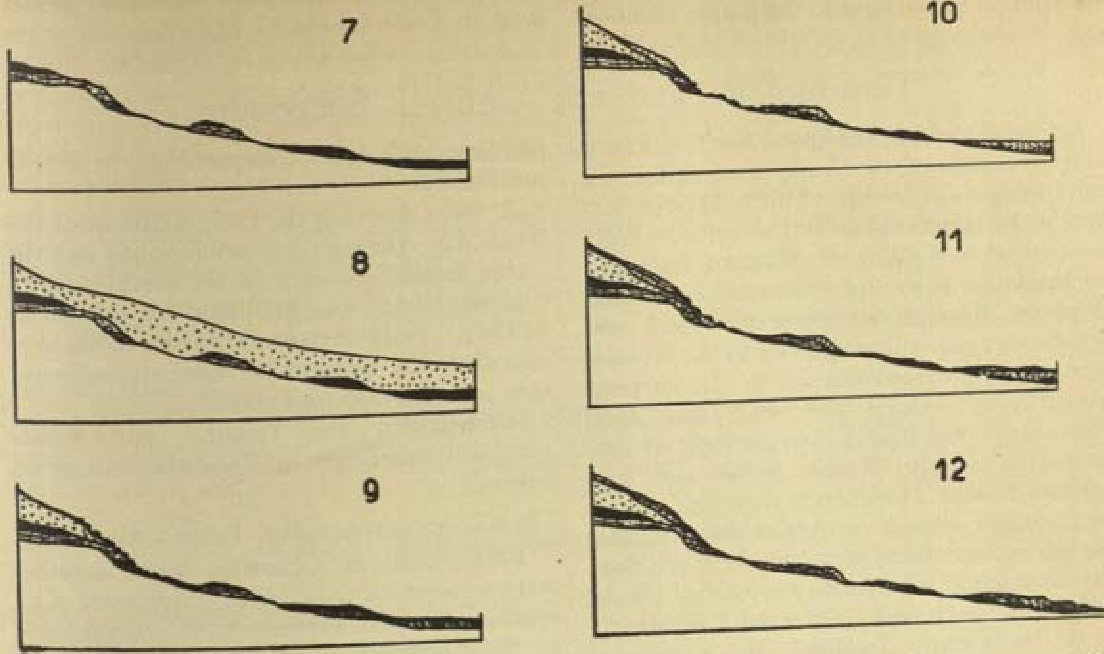

FIG. 18. DIAGRAMMATIC SECTIONS ILLUSTRATING STAGES OF THE PLEISTOCENE SUCCESSION IN THE UPPER ZAMBEZI VALLEY

7. Aggradation of the Older Gravels 2 from 15 feet to present river level. Decline of the Second Pluvial. Middle Pleistocene. Middle and Late Rhodesian Acheulian and Hope Fountain Cultures.
8. Calcification and accumulation of Kalahari Sands I across the valley. Inter-Pluvial. Lower Rhodesian Sangoan Culture (?).
9. Initiation of the Third Pluvial. Removal of the Kalahari sands from the centre of the valley and formation of Ferricrete II covering Older Gravels and Scarp Rubbles. Upper Pleistocene. Lower and Upper Rhodesian Sangoan Cultures.
10. Continued erosion followed by the aggradation of two, sometimes three, deposits of Younger Gravels and Alluvium. Much redeposition of Kalahari sand on the scarps under wet and short semi-arid conditions. Upper Pleistocene. Upper Rhodesian Sangoan, Rhodesian Proto-Stillbay and Rhodesian Stillbay Cultures.
11. Calcification and accumulation of aeolian redeposited Kalahari sand, marking the end of the Pleistocene. Rhodesian Magosian Culture.
12. Erosion followed by the aggradation of calcareous alluvium forming the 10-foot Terrace, followed by the formation of degradation channels, with some deposition of dirty sand by wind action, and erosion to Present Contours. First and Second Post-Pluvial Wet Phases. Lower and Upper Rhodesian Wilton.

Kalahari Sands I) and are most probably to be equated with the Katombora-Kazungula sands (see p. 41). The rubble-bed would then represent the hill-slope accumulation during the very dry Interpluvial between the Second and Third Pluvials. The ferruginization of the upper half of this rubble-bed represents, therefore, the onset of wetter conditions at the beginning of Third Pluvial times. At some sites (for example, on Knight's Drive and again near Dale's Kopjie and along the Hubert Young Drive) artifacts and debitage of Rhodesian Sangoan affinities are incorporated within the rubble-bed.

The remainder of the deposit is dated by the contained cultural material.

The sequence of geological events, climates and Stone Age Cultures in the Upper Zambezi Valley and its tributaries is set out in tabular form in Table I, Figs. 17 and 18.

Terminology and the General Succession

Before describing the Stone Age Cultures it will be necessary to clarify and define the terminology employed. South African terminology has suffered several vicissitudes from the orthodox rigidity of Western European terminology with its clear-cut horizontal divisions, through an essentially local terminology, again allowing little or no latitude between the horizontal divisions. In the years immediately before the war this local terminology was modified in the light of new discoveries in the North, South and East African fields. Nowadays, therefore, where the cultures found in Africa bear a close enough technical and stratigraphical relationship to those in Europe they are called by the same name prefixed by the word "African", or, if sufficiently localised, by a regional adjective such as "Rhodesian". Cultures which are of regional distribution only and occur only in Africa are given African names.

This modified terminology was further amended as a result of resolutions passed by the Pan-African Congress on Prehistory in 1947, and the terminology employed in this work is that recommended at this Congress. The term Chelles-Acheul has been substituted (with the appropriate use of regional terms) to describe the major divisions in the cultural succession of the Old Palæolithic or Early Stone Age. The term Pre-Chelles-Acheul is used to describe the cultures antedating the handaxe cultures, the earlier and later stages of these developments being known as Kafuan and Oldowan, with suitable regional qualifications prefixed.

The names used to describe advanced and localised derivatives of the Chelles-Acheul Culture are still retained; e.g., the Fauresmith; the Sangoan, again with suitable regional qualifications, for instance, the Rhodesian Sangoan.

The use of the terms "Clacton" and "Levallois" to describe technical processes has been discontinued in Africa and the expressions "block-on-block" and "faceted platform technique", respectively, have been substituted.

A chart showing the main divisions of the Stone Age, the cultural subdivisions and the "type fossils" of each of the subdivisions in Central Africa was published by the writer (1939). Since then modification of the terminology has necessitated some amendments, now incorporated in Table II.

Summarised, the cultural and stratigraphical succession in Rhodesia is as given below:

PRE-CHELLES-ACHEUL PEBBLE CULTURE.

Pebble-tools of Oldowan form, together with some thick flakes with unprepared platforms are the earliest tools recognisable in the Rhodesias.

In the Zambezi Valley they first occur heavily rolled in the earlier aggradation of the Older Gravels.

THE CHELLES-ACHEUL CULTURE

Rhodesian Chellean

Crude handaxes, executed by a "stone-technique", together with numbers of unprepared and thick flakes, some with steep, almost vertical, secondary retouch are the predominant tools; a few rostroid handaxes also occur.

In the Zambezi Valley they are found first in a rolled state in the Older Gravels I.

Early Rhodesian Acheulian

Tools are rare, the predominant form being a very large and thick pear-shaped handaxe; cleavers now first make their appearance.

Implements always show some degree of rolling and are found within the Older Gravels I in the Zambezi Valley.

Middle Rhodesian Acheulian

Tools include typical forms of the Acheulian stage of the African Chelles-Acheul Culture and comprise ovate and pear-shaped handaxes, some flakes and cleavers, these latter (having been made from lava) are

TABLE II.

TABLE SHOWING DIVISIONS OF THE NORTHERN RHODESIAN STONE AGE AND ITS CULTURES

(Read from below upwards)

EUROPE	NORTHERN RHODESIA		
Broad Typological Equivalents	Main Divisions	Cultural Subdivisions	Main Tool Types
Neolithic	Late Stone Age	Nachikufu Culture	Microliths, bored stones, polished axes, hollow scrapers
		Rhodesian Wilton	Microliths and diminutive scrapers
Mesolithic		Rhodesian Magosian	Microliths, scrapers and diminutive points
Palæolithic	Middle Stone Age	Rhodesian Stillbay	Pressure-flaked points, scrapers, burins and bolas
		Rhodesian Proto-Stillbay	Simple points, scrapers, burins and bolas
		Rhodesian Sangoan	Handaxes, picks, flake-tools and bolas
	Early Stone Age	Hope Fountain	Flake-tools and choppers
		Chelles-Acheul: Rhodesian Acheulian	Handaxes and cleavers
		Chelles-Acheul: Rhodesian Chellean	Handaxes and flakes
		Pre-Chelles-Acheul	Pebble-tools
Eolithic			

rare on account of the readily disintegrating nature of this rock on exposure.

First found rolled in the Older Gravels II in the Zambezi and tributary valleys.

Late Rhodesian Acheulian

Tools include pointed, ovate and pear-shaped handaxes both large and small; cleavers struck from both end- and side-flakes with parallelogram or biconvex section; some flake-tools and polyhedral stone balls.

Unrolled, or sometimes slightly rolled within the Older Gravels II in the Zambezi Valley and tributaries.

The Hope Fountain Culture

In the course of the archæological survey of the lower part of the Upper Zambezi Valley the presence within the Older Gravels of certain particular types of implement suggested elements similar to those previously identified and described by Neville Jones (1929) under the term "Hope Fountain Industry", after the name of the site at which implements of this type were first found. Of considerable importance was the discovery in 1939 of the Maramba Quarries site near Livingstone. Here typologically similar implements are found (rolled and sometimes unrolled) in a denuded eluvial gravel, resting on the high terrace of the Maramba River, and underlying ferricrete and carstone rubble containing Rhodesian Sangoan implements. The whole was sealed by Kalahari Sands.

In 1942 Dr. L. S. B. Leakey found similar implements (rolled and fresh) in sealed, old lake-deposits of Kamasian Pluvial age at Ol Orgesailie in the Kenya Rift Valley. The beds in which these tools occur are intercalated with others on which rest living-sites of the Acheulian stage of the Chelles-Acheul Culture.

In the Zambezi Valley, Hope Fountain elements underlie (and therefore antedate) the Rhodesian Sangoan. Their contemporaneity with the Rhodesian Chelles-Acheul Culture is indicated by the fact that, at many widely separated sites, rolled implements of both cultures are found equally abraded within the undisturbed Older Gravels.

The culture is very crude and characterised by a variety of small flake-tools and crude choppers with steep retouch, but lacks many of the more developed forms that were present at the type-site, by reason of the mixed and surface nature of the latter.

THE RHODESIAN SANGOAN CULTURE

The great quantity of Sangoan tools that are found within Northern Rhodesia would appear to indicate the presence of man in

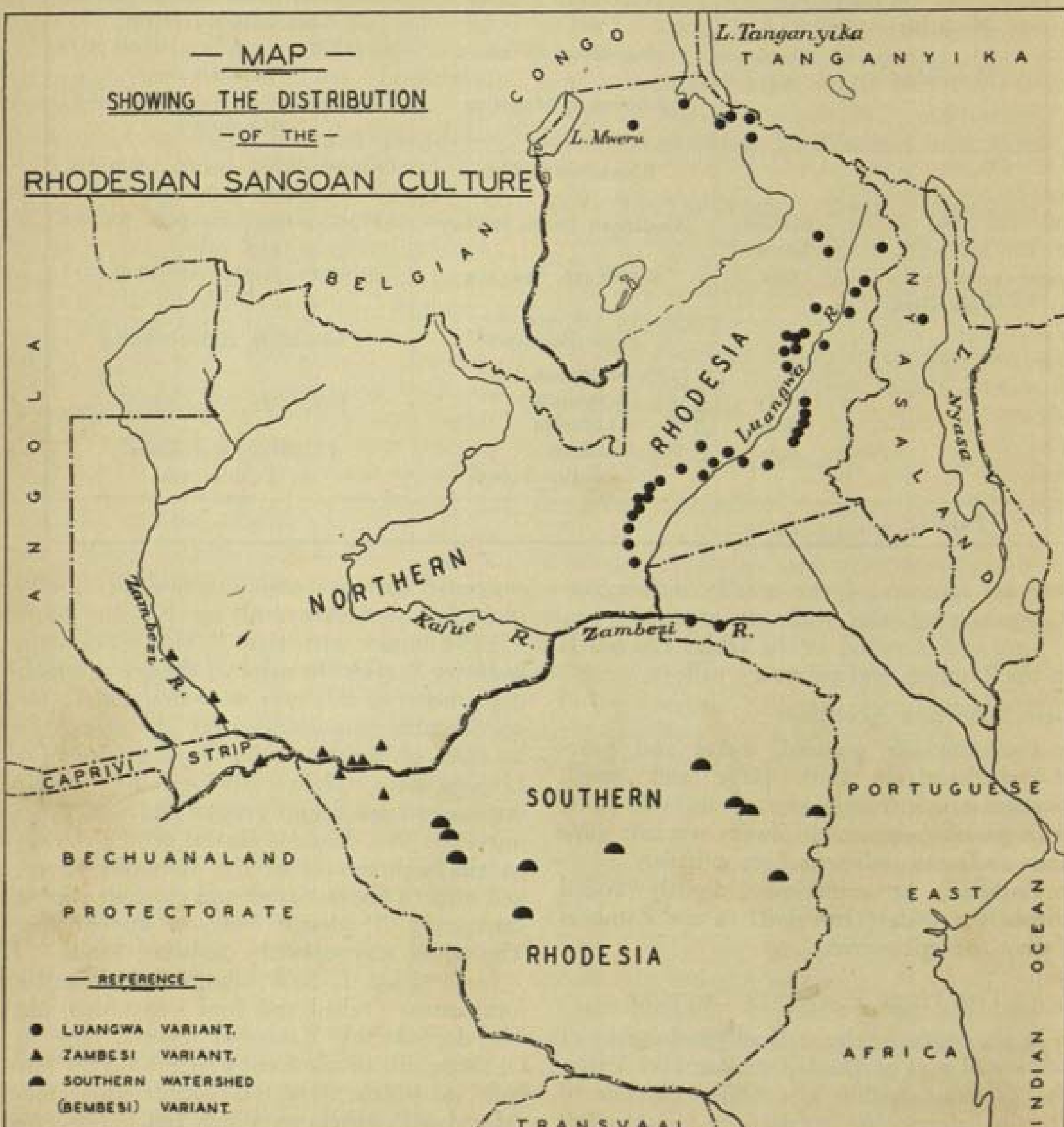

FIG. 19

greater numbers than had previously been the case during the Second Pluvial; tools of the Chelles-Acheul Culture are never plentiful except on the watersheds. Coinciding, as does the Sangoan Culture, with the long dry period which follows the Middle Pleistocene and with the return of wet conditions at the beginning of the Third Pluvial, it would seem not improbable that the thick, tropical forest presumed to have covered most of our area during the Middle Pleistocene, effectively prevented penetration by man except in small numbers. It was only when forest gave way to savannah that migration and settlement on an increased scale was permitted to take place.

Jones (1949) in his recent monograph on *The Prehistory of Southern Rhodesia* has retained the term " Bembesi " to describe the cultural assemblages of core and flake-tools on the Southern Rhodesia high-veld, as they show certain typological variations from those to be described from the Upper Zambezi Valley. As will be shown, the writer considers that both the Bembesi and the Zambezi Sangoan are but regional variants of the very widely diffused Sangoan Culture Complex. The writer proposes, therefore, to use the terms " Southern Rhodesia variant ", " Zambezi variant ", " Luangwa variant ", etc., to distinguish the different regional phases, rather than to continue to employ or to introduce new cultural terms.

Lower Rhodesian Sangoan

Throughout the Rhodesias the earliest occurrence of tools of this culture is within the ferricrete and scarp rubbles, which are immediately post-Middle Pleistocene in date.

The type tools include picks, handaxes (some elongated and pointed, others pear-shaped with unworked butts), large prepared and unprepared cores and flakes, discoidal trimming-stones and bolas. The technique throughout is that of a stone hammer; " wood technique " does not occur. In technique and tool-types this culture approximates to the East African Middle Sangoan.

Upper Rhodesian Sangoan

Living-sites are found on the upper slopes of the valleys, where they rest on the ferricrete and scarp rubbles, and extend up into the basal part of the redeposited Kalahari Sand (clay-sand).

In the centre of the valleys tools first occur, rolled and unrolled, within the ferricrete and in the Younger Gravels I of the tributaries.

Tools include handaxes, choppers and picks, small and large, prepared and unprepared flakes and cores, and polyhedral stone balls.

An interesting and important variant of this culture is the Zambezi Valley variant, where (in addition to the usual tool-types) there occur small Micoque-type handaxes as well as several well-made larger forms; unifaced and very occasional long, bifaced points, true side-scrapers, and many bolas. Secondary work is of a fine, resolved nature.

Rhodesian Proto-Stillbay

A direct derivative of the Rhodesian Sangoan. The larger tool-elements have now for the most part dropped out, but the occasional handaxe and chopper are still found. The bolas, disc-core and faceted flake are the predominant forms, the latter being worked into scrapers and unifaced (and, more rarely, bifaced) points.

Tools first occur, unrolled and slightly rolled, within the Younger Gravels in the Zambezi Valley, also in caves and rockshelter sites.

Rhodesian Stillbay

This culture is already well known. The Northern Rhodesian variant contains numbers of bolas-stones, but points are not as common as they are in industries south of the Zambezi.

Implements are first found unrolled within the sands overlying the Younger Gravels in the Zambezi, while temporary living-sites were established on the eroded, redeposited Kalahari Sands on the scarps. A number of rockshelter sites also exist.

Rhodesian Magosian

First found under and within wind-redeposited Kalahari Sand accumulated at the end of the Third Pluvial; also within the Youngest Terrace (sandy alluvium) in the Zambezi Valley.

Tool-types include small, flat and discoidal prepared cores and faceted flakes, blades and blade-cores, small unifaced and bifaced points, end-, round- and thumbnail-scrapers, microliths and some large backed blades, burins, *lames écaillées,* fabricators, grinding and rubbing stones.

Specialisation has resulted in several local variants.

NORTHERN RHODESIAN WILTON

This is the prototype from which the Wilton in Southern Rhodesia is developed. The earlier phase occurs beneath dirty wind-blown sand in the Zambezi Valley, and comprises small blade-cores and blades, large and microlithic backed blades and crescents, thumbnail- and round-scrapers, burins, *lames écaillées,* fabricators, rubbing and grinding stones.

The later phase occurs on the surface, in middens on the lowest terrace in the Zambezi and in rockshelters. Tools comprise microliths and a few large backed blades, thumbnail-scrapers, etc., together with polished axes and bored stones, ostrich and *Achatina* shell beads.

NACHIKUFU CULTURE

In the northern and eastern parts of the territory, on the Tanganyika Plateau and along the Zambezi/Congo Watershed, there occur industries showing characteristics absent in the Wilton which render them sufficiently distinctive to warrant the use of a new cultural term.* These industries have now been found stratified in three caves and rock-shelter sites excavated by the writer during the dry seasons of 1948 and 1949, and it is intended that they should be given cultural status under the term "Nachikufan culture ". The full report on this culture will form the subject of a separate monograph, but the main characteristics are briefly described and illustrated in the present work.

* See page 116.

Patination

A short note is necessary here on the particular polish or glazed patina seen on the majority of the artifacts and other constituents of the Younger (and to a lesser extent of the Older) Gravels in the Upper Zambezi Valley.

The patina, or glaze, is well developed on the Older Gravels which have been exposed on the surface over a long period. It is feebly developed or not present at all on artifacts from the deeper sections of these gravels, or where they are sealed by the ferricrete. It is best seen on artifacts from the Younger Gravels or the ferricrete, being most pronounced on specimens derived from earlier deposits. Thus, when *in situ*, the Chelles-Acheul implements show little or no glazing; the Rhodesian Sangoan and derived tools show the thickest glaze; the glaze on the Rhodesian Proto-Stillbay tools is often well developed, whilst on the Stillbay specimens it is very thin or else absent. Later cultural material shows little or no glazing, but the Magosian specimens sometimes present a glossy patina, though never a true glaze.

Several suggestions have been made as to the origin of this glaze: that it is due to the action of sand during immersion in the river; to burnishing by wind-blown sand; to some sub-aerial operation; or to the same phenomenon as produced " desert varnish " (Phaup 1932).

The colour of the patina on the chalcedony specimens varies in degree with the natural colour of the chalcedony, but generally speaking it may be stated that the implements showing the thickest glaze have a dark chestnut-brown patina, while those with the least glaze show only a yellow patina; all shades of brown between these two extremes varying with the thickness of the glaze. A few of the later, unrolled Stillbay specimens (particularly those found among the flood-gravel between the Eastern Cataract and the Fifth Gorge) show a thin glaze on the upper face exposed to the atmosphere, while the under surface shows little or no glazing. This suggests that the agency producing the glaze was sub-aerial.

Phaup (op. cit.) has shown from a chemical analysis that the patina is made up of a smooth layer of silica in the form of chalcedony, stained by hydrated iron oxides, which gives to the specimens their extraordinarily brilliant lustre. He further showed that the interior of the chalcedony may quite well be the source of the iron now concentrated near the surface.

Of the theories that have been propounded to explain this glazed patina, that of polishing by water or fine sands can be discounted, because of the tools on which the unexposed undersurface is unpatinated. The unequal polishing produced by wind-blown sands is never observed on the Zambezi specimens. As Phaup has pointed out, erosion by water or æolian sands would first attack the minor projections and leave the cavities unaffected, whereas the glaze is here distributed evenly over the whole surface of the specimen. Phaup showed that in its physical and chemical properties this glaze is identical with " desert varnish ".

Experiments carried out by the writer with this chalcedony have shown that material which has been lying in the sun all day (often such a specimen is too hot to hold in the bare hand) is very difficult, if not impossible, to fracture properly. It would appear, therefore, that some change in the degree of resistance has taken place, most probably due to the change in moisture content of the stone. The moisture absorbed by the stone during the night from ground mists (or perhaps sporadically during the day from spray from rapids and waterfalls or through other agents) would, during the heat of the day, be drawn to the surface of the stone by capillary action, and the mineral matter held in solution (in this case iron oxides) would be deposited as a thin film on the surface of the stone. The growth of the film would produce the characteristic glaze. The writer is of the opinion, therefore, that the glazing probably results from the effects of a fairly well-marked diurnal variation in temperature. It would also presuppose a climate neither very wet nor completely dry but of fairly low humidity. Glazing is still taking place within the Batoka Gorge and at certain places in the upper river. It is particularly noticeable in the gorge, where the blackened basalt rocks just above the flood-platform show a thin, black surface-polish or glaze, which (there can be little doubt) is due to the same causes as those which produced the glazing on the terrace-gravels. The glazed and blackened surface of the basalts in the Batoka Gorge is closely analagous to that of the basalts of the Nile Cataracts which, according to Lucas (1905), is due to water evaporating from the rock. It is also not improbable that lichen and algæ may be a contributary cause to the glazing seen in the Batoka Gorge (Laudermilk (1931)). It is a point of interest that the tools showing the thickest glazing are abraded specimens, occurring in the ferricrete, deposited during the rather dry but changing climate marking the beginning of the Third Pluvial.

The Raw Materials of the Stone Age in Rhodesia

A good summary of the raw materials used by Stone Age man in Southern Rhodesia has been given by Bond (1948). He has shown that the greatest variety of materials is to be associated with the Chelles-Acheul Culture, where almost any material with no fracture planes was used. In the later cultures, where fineness of grain was a requisite of typological specialisation and diminution in tool size, selection was more restricted and only the more homogeneous rocks were used. Generally speaking, therefore, the later the culture the greater the degree of specialisation in the choice of raw materials.

In the Zambezi Valley the local chalcedony was always ready to hand and provided a most suitable homogeneous medium from the very beginning of the cultural sequence. It is not surprising, therefore, that this rock was the almost universal raw material employed by all cultures in the valley from the earliest to the latest. The same state of affairs held good in the Luangwa Valley, where the quartz and quartzite pebbles of the Cretaceous Beds formed the invariable medium.

In the Ngwesi Valley, cut into the Basement Complex rocks, quartz is the usual medium. In the Kalomo Valley, where some chalcedony and silicified sandstone outcrop, both these rocks and also quartz were used. It can be seen, therefore, that the raw materials used were those ready to hand; there was little or no importing of material over long distances. That materials were carried over short distances, however, is apparent from such excavated sites as the Mumbwa Caves and Nachikufu Caves, where, in the former, chalcedony and chert were used though they do not occur locally; in the latter there was specialisation in large quartz crystals and chert, and in diorite for the larger tools, the nearest outcrop in this case being some 60 miles (95km.) away on the edge of the Luangwa Valley.

Selection within local limits was, however, carried out. For example, the Rhodesian Sangoan peoples who squatted on the sand scarps in the Zambezi preferred to use river-rolled pebbles of chalcedony, which they had to carry as much as 3 miles (5km.), or even more, from the river, rather than make use of the chalcedony from outcrops immediately below the sands on which their camps were situated. The reason for this was that the chalcedony from the outcrops was always full of fissures and hollows and extremely irregular, whilst that from the gravels had had the external irregularities worn away, and the rock had already been broken along any fissures, so that only the more flawless parts remained.

While chalcedony was the more normal medium in the Zambezi Valley other materials were also employed. The Chelles-Acheul peoples used silicified sandstone, quartz, quartzite and basalt—the latter particularly for cleavers. The Rhodesian Sangoan peoples made use of all these rocks and siliceous ferricrete in addition; for their bolas stones they preferred quartz. Later cultures show a steady increase in specialisation and selection of the raw materials used, and the vast proportion of the tools are made from selected chalcedony.

It has long been apparent to the writer that raw material has practically no influence on typology. Particularly is this the case in regard to the Chelles-Acheul Culture. There are, of course, limits (for example, handaxes of fossil wood from Viziwa in the Luangwa Valley cannot be expected to show so fine a finish as specimens made from silicified pipe-sandstone in the Maramba), but bearing in mind such limitations, raw material has influenced typology to an almost negligible degree, thus demonstrating man's technical mastery of his raw material; a mastery amply confirmed in the works of Leakey, Bond and others.

THE CULTURES

THE PRE-CHELLES-ACHEUL PEBBLE CULTURE

Stratigraphy

The earliest tools recovered from the Zambezi are first found heavily abraded in the Older Gravels I of the Second Pluvial, notably at Site Z.Y.40, and can therefore be considered to antedate the gravels in which they are found. Somewhere within the valley the remains of the deposit from which these tools were derived must still be preserved, and it is possible that they were contemporary with the period of formation of the "siliceous ferricrete", assigned to the beginning of the Second Pluvial. Although the Pre-Chelles-Acheul has not yet been found underived and *in situ* in a contemporary deposit, either in the Zambezi or any of its northern tributaries, the circumstances of its occurrence within the Older Gravels I leave no doubt that the culture was present within the valley itself. The two important sites, discovered by Bond (1946) and Jones (1946 and 1949; see also Jones and Bond 1948) on the Southern Rhodesian high-veld, which have yielded pebble-tools *in situ*, confirm beyond a doubt that a true pebble culture is present at the beginning of the Rhodesian cultural sequence. At both sites — at Lydiate where the industry is preserved in the 40 to 50 feet (12 to 15m.) terrace gravels of the Hunyani River, and at Lochard and on the Inkwinkwezi River where they are found in Alluvium

I — true Pre-Chelles-Acheul pebble industries are found in the earliest recognised alluvial deposits and antedate beds containing tools of the Chelles-Acheul Culture.

One other site worthy of mention is that at Willoughby's Halt, Somabula, again on the Southern Rhodesian high-veld. Here in 1938 the writer found pebble-tools within an eluvial pebble-bed, immediately overlying the Arkose group of beds, and representing the highest superficial deposit (with the exception of a covering sand-mantle) above the Somabula Spruit. The bed varies from 3 to 6 feet (·9 to 1·8m.) in thickness and several pebbles showing unabraded human workmanship were found distributed throughout it.* Within later alluvial deposits at lower levels were found rolled pebble-tools mixed with later cultural material.

Several other sites yielding pebble-tools are known and some of the Southern Rhodesian sites are mentioned by Jones (1949, pp. 16-20). In Northern Rhodesia there are others,

* Tools are in the National Museum of Southern Rhodesia at Bulawayo.

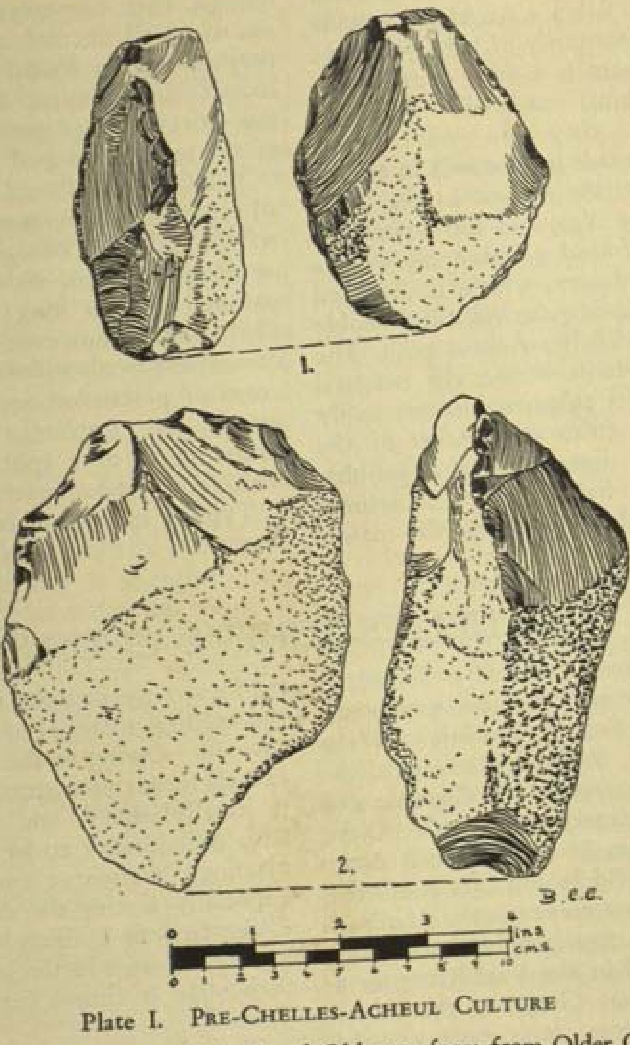

Plate I. Pre-Chelles-Acheul Culture

1. Heavily abraded and glazed tool of developed Oldowan form from Older Gravels I. Site Z.Y.40. Zambezi Valley. Material — chalcedony.
2. Heavily abraded and glazed Oldowan-type tool from Older Gravels I. Site Z.Y.40. Zambezi Valley. Material — chalcedony.

notably at Kalomo and the Ngwesi Railway Bridge, but as stratigraphical evidence is here either inconclusive or absent they must necessarily remain suspect.

Geological Horizon

The early part of the Second Pluvial.

Climate

Semi-arid to wet.

Implements

Almost all the tools are made on river-pebbles, but a few from the Zambezi are on thick, large flakes. An artifact made from a pebble is necessarily of very primitive appearance and there is a very considerable danger in ascribing to such tools an antiquity which they do not merit. Pebble-tools were made in Rhodesia in almost every culture from the earliest to the latest stages of the Stone Age, and the writer has not infrequently found pebble-tools with a Late Stone Age industry, which, if divorced from their context, are quite indistinguishable from genuine Pre-Chelles-Acheul tools. The existence of such tools within the material economy of the later cultures does not imply the persistence of cultural elements of the Pre-Chelles-Acheul, but merely that pebbles, being ready to hand, were sometimes employed for rough work where the manufacture of a more developed tool could be dispensed with. Only pebble-tools found *in situ*, therefore, and in a datable deposit can with certainty be ascribed to a true pebble culture.

The artifacts hitherto recovered nearly all show developed characteristics and can be ascribed to the Oldowan or later stages of the culture—that is to say, they are approximately 4 to 5 inches (10 to 12cm.) in diameter and the edge has been formed by flaking from alternate sides of the tool. Tools of Kafuan type do, however, also occur; though, with the exception of the Somabula site where all the tools are of this earlier form, they are usually found in association with the later, Oldowan, type. It is thus apparent that the cultural stage represented must be that of the most developed tools.

The Oldowan forms from the Zambezi are all typical of those from the type-area in East Africa and show straight or convex cutting- or scraping-edges, either at right angles or parallel to the long axis of the pebble. Occasionally, however, large thick flakes of chalcedony, with wide-angled butts and semi-cones of percussion are found in association, as also are implements consisting of the utilised half of a split pebble. The same technique predominates.

Typical specimens from the Zambezi are illustrated at Plate I, Nos. 1 and 2.

THE CHELLES-ACHEUL CULTURE

The Chelles-Acheul Culture is found in the Rhodesias in the aggradation deposits laid down during the Second Pluvial. In the Older Gravels I (i.e., in the first terrace of the Upper Zambezi) are found the Chellean and Early Acheulian stages, and in the Older Gravels II (i.e., from 20 feet (6·1m.) down to river-level) the Middle and Late Achuelian stages. There is as yet no site in the Rhodesias where there exists a stratigraphical succession equal to that found in the Vaal River, or at such sites as Oldoway Gorge or the Kagera Valley in East Africa. It is most probable that such a site does, in fact, exist, perhaps in the Zambezi Valley but more probably in the lake-basins of Nyasa and Tanganyika. At the former the deposits are known to exist but the cultural material has not as yet been discovered. Owing to the shallow nature of the gravels in our area stratification within them is usually absent and cultural subdivisions have of necessity to be based on a study of typology, technique and physical condition. Especially is this the case in regard to the Older Gravels I, though the position is made somewhat easier in the later gravel as the Late Acheulian is almost invariably unrolled and fresh.

The characteristic tool is, of course, the handaxe, with, in the earlier stages, numerous flake-tools. The cleaver makes its appearance in the Acheulian but is always a rare tool in the Zambezi. The reason for this is no doubt the nature of the rock from which the tools were made. A cleaver must have a tough and resistant, but not necessarily a sharp, cutting edge, and chalcedony was apparently found to be too brittle for manufacturing into cleavers. In the Zambezi they were, therefore, usually made of basalt, a tougher rock but one which weathers badly on exposure. The tools made from it might, therefore, be destroyed in a comparatively short time, which would be sufficient to account for the comparative rarity of cleavers in the Zambezi.

Handaxes, on the other hand, are almost invariably manufactured from chalcedony, which seems to indicate that sharpness rather than toughness was the result aimed at. This medium enabled the Late Acheulian people to produce some very finely-made specimens which compare favourably with any from Western Europe or North Africa.

The Rhodesian Chellean

Stratigraphy

The only area known to the writer which has produced tools of Chellean facies in the Rhodesias is the Upper Zambezi Valley, where the Chellean occurs rolled in the Older Gravels I at sites Z.Y.40, Z.C.48, and again on Jafuta Farm on the Masue River. Unfinished handaxes presenting a primitive appearance have been recovered from several other areas, but they are usually associated with later forms, which precludes their being ascribed to a Chellean stage of culture.

Geological Horizon

The first peak of the Second Pluvial.

Climate

Wet.

Implements

The characteristic tool is a rather short and thick handaxe made either on a core or on a thick flake, but handaxes of rostro-carinate form occasionally occur, and numerous large and thick flakes which often show signs of secondary trimming are also associated.

Handaxes (Plate 2, Nos. 1 and 3). All those recovered to date have been made from chalcedony.

(1) *On cores.* Preference was given to suitably rounded, flattish and elipsoidal nodules, which were worked into rather crude pointed or ovate handaxes by percussion flaking with a stone hammer. Flakes were removed alternately from both surfaces round the sides and end of the tool, to give an uneven cutting edge; the butt was usually left untrimmed. Handaxes vary in length from 3 to 6 inches (7·5 to 15cm.) or more, and often show a thick section.

A few, rather rare, specimens are of rostroid form; but whether this is intentional or fortuitous could not be accurately determined, although in view of the rostro-carinates associated with Stage I of the Chelles-Acheul Culture in the Vaal River, it might be argued that the Zambezi specimens were also intentional.

(2) *On flakes.* A number of handaxes have been made on large, thick, primary flakes. These were probably struck from any convenient outcrop by block-on-block technique, and considerable force would have been needed to remove such thick flakes. The striking platforms are usually still present and show a comparatively wide platform, inclined at a broad obtuse angle to the main flake surface. The bulb is prominent and often shows a semi-cone or cones of percussion. These flakes were then treated as if they had been cores and the tools show the same method of crudely controlled primary flaking.

Choppers and Cleavers. In addition to the handaxes there occur also a few pebble-choppers of Oldowan form. The cleaver had apparently not then made its appearance as none has yet been found.

Flake-tools (Plate 2, No. 2). These are numerous and, in fact, considerably more flakes occur than handaxes. Whether this is due to the nature of the raw material is not certain, but it is thought that this may well be the reason. Flakes are invariably large in size and broad. They show steeply inclined, unfaceted striking platforms with prominent bulb. The edges

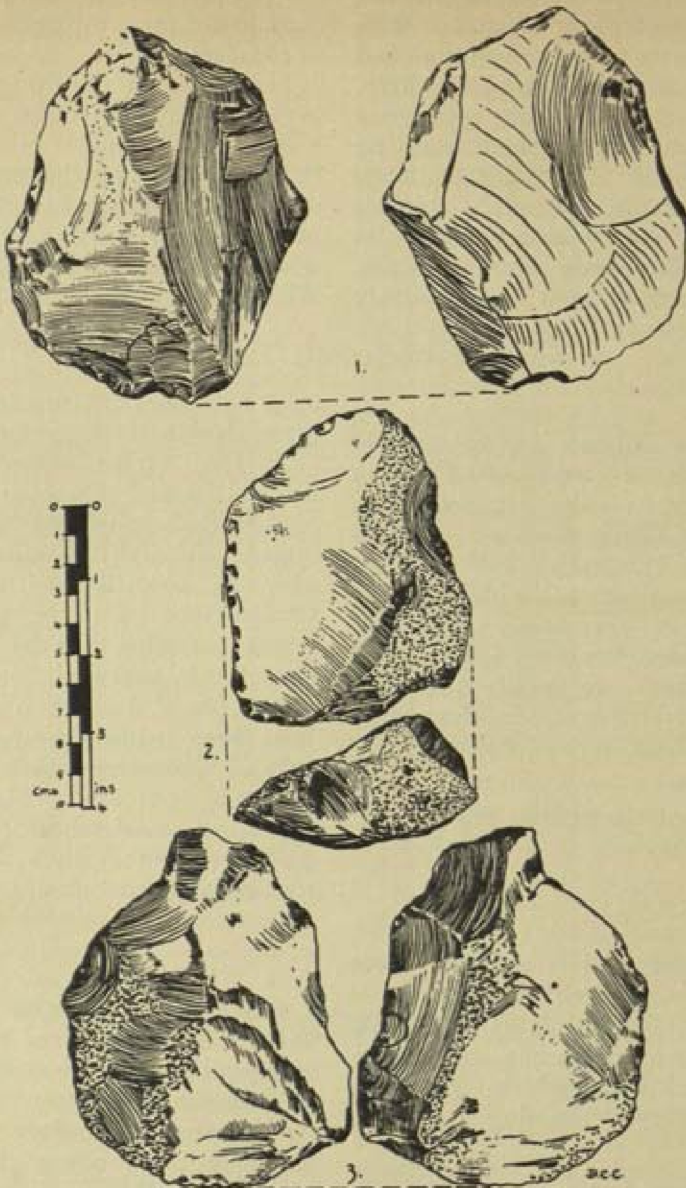

Plate 2. Chelles-Acheul Culture. Rhodesian Chellean

1. Rolled handaxe made on a thick, broad flake, from the Older Gravels I. Site Z.Y.40. Zambezi Valley. Material — chalcedony.
2. Rolled, utilised flake with plain, inclined striking platform; from the Older Gravels I. Site Z.Y.40. Zambezi Valley. Material — chalcedony.
3. Rolled handaxe from the Older Gravels I. Site Z.Y.40. Zambezi Valley. Material — chalcedony.

show varying degrees of secondary working, usually bold and steep, down part or the whole of one edge. Lowe (Söhnge, Visser and Lowe, 1937, p. 78) has shown that flake-tools are an integral part of the early stages of the Chelles-Acheul Culture in the

Vaal, and O'Brien (1939, p. 101) found this to be true also of the Uganda Chellean. This can now be shown to be the case in Rhodesia also, and there is no reason whatsoever for dissociating the flakes from the handaxes.

Technique. This is always typical stone-technique and there is never any evidence of the use of wood or bone. The cutting edges are always irregular and wavy, showing bold primary flake-scars, with rarely any more careful secondary trimming of the edge itself. For the detachment of flakes the block-on-block method was the invariable technique employed. No cores have been found and it is supposed that the flakes were removed from any convenient large blocks or outcrops of the chalcedony.

The Rhodesian Acheulian

As has been pointed out there is as yet insufficient stratigraphical evidence in Rhodesia to provide any clear-cut sub-division of this culture, with the exception of the Late Acheulian Stage. The Late Acheulian is sufficiently distinguished stratigraphically and sufficiently widely distributed for it to be comparatively well known, but the earlier stages have fared less well and so far are known only from the Zambezi and perhaps also from the Umgusa at Sawmills (Jones, 1944). Within the Zambezi Valley the culture has been tentatively further sub-divided into an Early and a Middle Stage, but this is tentative only and is based almost entirely on a combination of typology, technique and *état physique*.

The Early Rhodesian Acheulian

Stratigraphy

First found rolled, within the Older Gravels I in the Zambezi and a few tributaries, e.g., the Masue. No other occurrences are known in either Northern or Southern Rhodesia.

Geological Horizon

Decline of the first rainfall peak of the Second Pluvial.

Climate

Wet, getting drier.

Implements

These are for the most part rare and consist almost entirely of large and thick handaxes on cores. Cleavers are now apparently present and some flake-tools probably also belong.

Handaxes (Plate 3, Nos. 1 and 2, and Plate 4). These are characteristic and unmistakable, but are not common. They usually consist of large heavy tools, long in proportion to their width, made on cores and they may be a foot (30cm.) long or more. They show a fairly even pear-shaped outline and the technique employed shows a considerable advance on that found with the Rhodesian Chellean. The flaking is more carefully directed from both sides of the tool; the edges and point are straighter and show a considerably more careful preparation, which gives to the tool a comparatively symmetrical appearance. In some instances flake-scars show that wood-technique was occasionally used, and there can be no doubt at all that the specimens belong to an early Acheulian and not a late Chellean stage.

Cleavers. One cleaver of chalcedony was recovered—it is made on a side-flake and shows steep, almost vertical trimming down one edge and the butt. The opposite edge is composed of the striking platform and a slight attempt has been made to remove the bulb.

Flake-tools. A few flakes showing plain, unfaceted platforms and wide-angled butts also probably belong. They show rather more refinement than the Chellean flake-tools and tend to be longer, but in other respects, and in the absence of any definite type of tool, they are identical.

Technique. A combination of stone- and wood-techniques. Clearly of Acheulian facies.

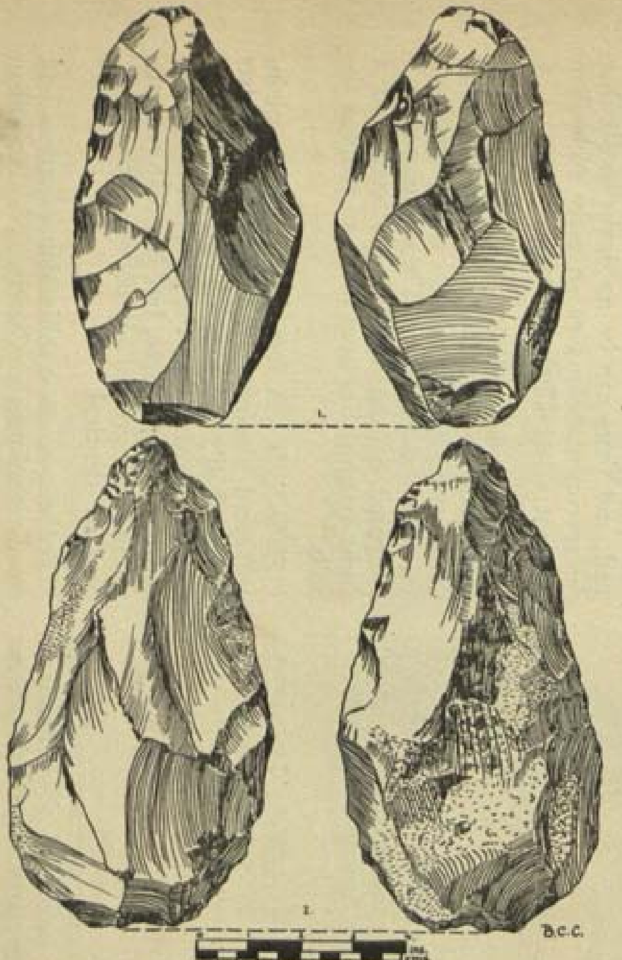

Plate 3. CHELLES-ACHEUL CULTURE. EARLY RHODESIAN ACHEULIAN

1. Large high-backed handaxe, rolled and glazed; from the Older Gravels sealed by ferricrete. Site Z.D.1.38. Zambezi Valley. Material — basalt.
2. Large abraded and glazed handaxe from ferruginized gravel. Site Z.M.38. Zambezi Valley. Material — chalcedony.

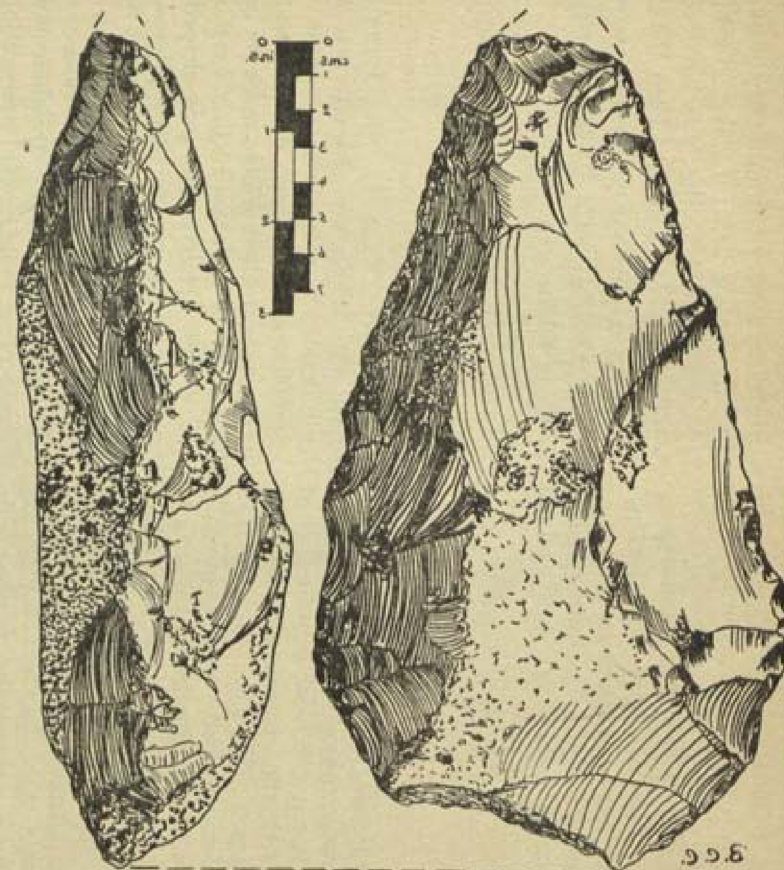

Plate 4. CHELLES-ACHEUL CULTURE. EARLY RHODESIAN ACHEULIAN

Large abraded and glazed handaxe from the Older Gravels I. Site Z.Y.40. Zambezi Valley. Material — chalcedony.

The Middle Acheulian

Stratigraphy

First found rolled in the Older Gravels II in the Zambezi.

Geological Horizon

Beginning of the second peak of the Second Pluvial.

Climate

Semi-arid to wet.

Implements

Type-tools are again handaxes (both on cores and on flakes) and cleavers. The flakes show Tachengit technique[1] and the secondary work is often of a fine nature, showing considerable mastery of the raw material.

Handaxes. (1) *On cores.* The typical form is pear shaped, ovate or *limande.* The handaxes are now much flatter and usually show an even bi-convex cross-section. The tools have been worked over the whole of both faces by controlled wood-technique. The edges are straight and finely finished and the butts are usually carefully rounded. Specimens are on an average 6 or 7 inches (15 or 17cm.) in length.

(2) *On flakes.* There is as yet no suggestion that cores of either Victoria West I or II types occur in the Rhodesias associated with the Chelles-Acheul Culture. Handaxes made on flakes are common but the technique appears to be Tachengit; never Victoria West. In this respect the Rhodesian form of the culture is comparable with that from East and North Africa, where it is only in the evolved derivatives that the faceted platform technique first makes its appearance. The flake handaxes associated with the Middle Acheulian are usually ovates or *limandes* on which all or most of the upper face has been worked. The under-face (the main flake-surface) usually has the striking platform trimmed away by one or two trimming blows, and shows varying degrees of secondary work round the edges. It is rarely that the whole of the under-surface is worked.

Cleavers. These are invariably made from flakes, and again the primary flaking is of Tachengit form. They are made either from side- or end-flakes; the former show a parallelogram cross-section, the latter a trapezium.

Flake-tools. It is possible that certain broad flakes with a-typical secondary retouch are to be associated.

The Late Acheulian

Stratigraphy

First found rolled and unrolled in the Older Gravels II in the Zambezi and the northern tributaries, and on the surface of Alluvium I in the headwaters of the southern tributaries, on the watershed area of Southern Rhodesia.

The main sites in the Zambezi are at Anderson's Drift (Z.Y.40), and from beneath the ferricrete at the Canal and Storm Drain Sites at the Victoria Falls (Z.D.38 and Z.E.38), at site M.A.38 in the Maramba River, and at the Drift Site on Hewitt's Farm on the Kalomo River. With the exception of two doubtful sites in the Luangwa Valley[2] and several isolated finds of handaxes in different parts of the territory, the Acheulian is known only from its occurrence in the Upper Zambezi and its tributaries.

The headwater sites on the Zambezi-Limpopo watershed, at the Embusini River, near the Turk Mine, at Ematjeni on the Esipongweni River, at Inyati on the Inkwinkwesi, on the Tegwani near Plumtree, and at Popota have been known for a number of years,[3] but so far as can be ascertained no detailed description of their industries has yet been published. Together with the recently-discovered site at Lochard they include certain forms which, in the Vaal, would be

[1] Goodwin, A. J. H. Some developments in technique during the Earlier Stone Age. *Trans. Roy. Soc. S. Afr.* XXI. 1933. pp. 109-124.

[2] A site on the Lundi River, discovered by Macrae in 1938, and a site near the junction of the Lunsemfwa and Mulungushi rivers where, in 1909, Molyneux discovered and described a cleaver. (Molyneux, 1909.)

[3] (Jones, N., 1926, pp. 57-61.) The writer wishes to acknowledge his indebtedness to Mr. Neville Jones for permission to examine these collections.

classed as Middle Acheulian, and again other forms which are definitely Late Acheulian. For the present, however, it is considered that these sites should all be classed as Late until such time as stratigraphical evidence provides the clear-cut subdivision which is impossible at this stage.

Geological Horizon

The declining phase and end of the later rainfall peak of the Second Pluvial.

Climate

Wet, becoming semi-arid.

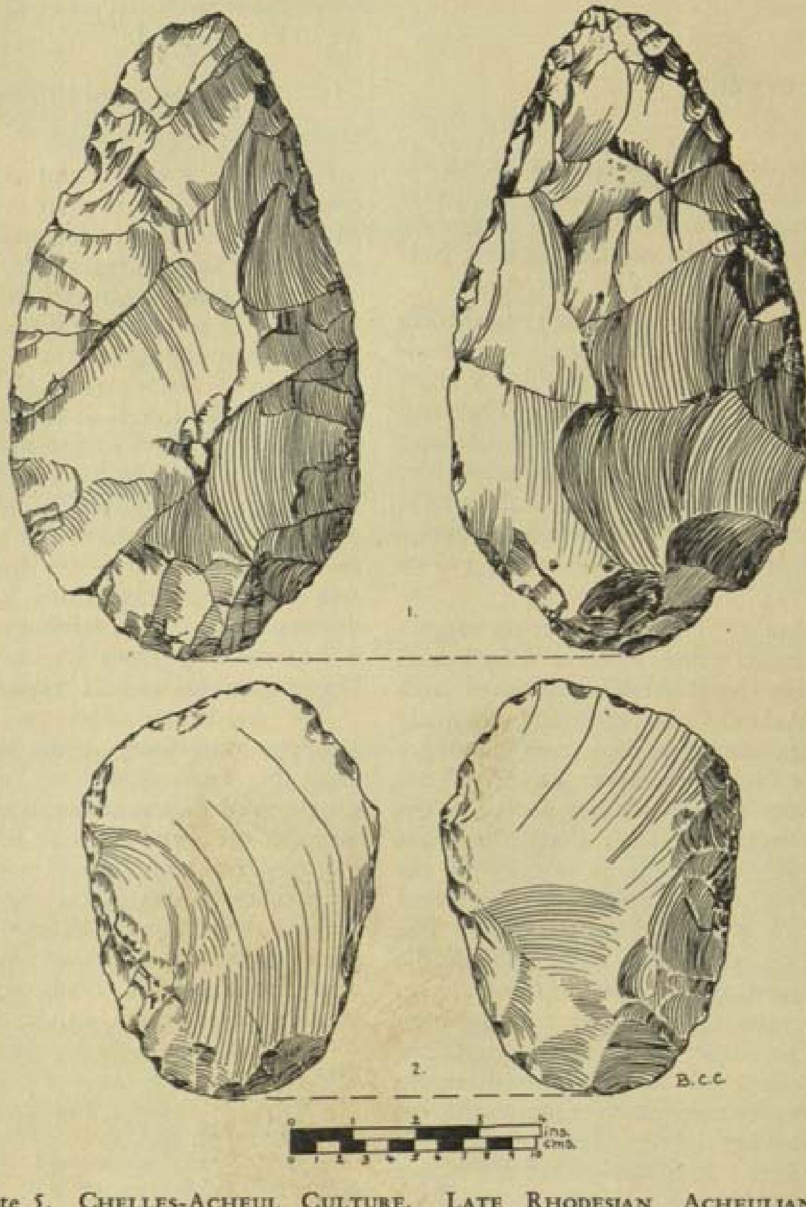

Plate 5. CHELLES-ACHEUL CULTURE. LATE RHODESIAN ACHEULIAN

1. Large unabraded and well-made handaxe from the Older Gravels II. Site M.A.38. Maramba Valley. Material — silicified sandstone.
2. U-cleaver or an oblique side-flake, abraded. From the Older Gravels II. Site M.A.38. Maramba Valley. Material — silcrete.

Implements

The typology of the Zambezi form will be considered first and comparison then made with the forms found on the southern watershed.

The Zambezi Industries

Both home- and factory-sites are known and the tool-types comprise a variety of forms; handaxes on cores and flakes, cleavers, flake-tools, polyhedral and bolas stones. No true cores have yet been found. The excavation at the Golf Club site on the Maramba River has yielded a good representative series of finished tools as well as a quantity of factory débris.* In the Maramba and the Kalomo valleys the material used for handaxes was predominantly silicified sandstone; in the Zambezi chalcedony and basalt were used in addition to the silicified sandstone. This last material (which is very similar to the *gré polymorphe* of the Congo) provides one of the best media known in Central Africa; very beautiful specimens are often produced from it.

Handaxes (Plate 5, No. 1, and Plate 6, Nos. 1 - 3). These vary greatly in size, from large specimens 12 inches (30cm.) long to diminutive examples some 3 inches (7·5cm.) only in length. The shape also varies considerably, the large handaxes being pear-shaped, pointed, ovate, *limande* or pointed with a constriction approximately one-third of the way down from the point. This type of handaxe is found with Acheulian IV in Kenya and at Oldoway, and with the final stage of the Chelles-Acheul Culture in the Vaal (Larsen type); they are usually made from flakes.

Tools made from flakes are now more common than specimens made from cores. The flakes are usually large and either side- or, more often, end-flakes. On the latter the striking-platform is always obliquely, never centrally, placed and usually towards the right-hand corner of the butt. Again the essential technique is Tachengit; no single instance of either a " henbeak " or circular " horsehoof " core has yet been found. Certain small flakes and flake-blades may have been struck from proto-biconical cores of which a small number were found during the Maramba excavations.

The most characteristic handaxe, whether large or small, is pointed and approximates to the Micoque form. This type shows finely controlled wood-technique at the point and sides, but the butt is usually thick and quite unworked. In the case of the ovates and of the pearshaped handaxes, the butts are usually carefully rounded; almost as much work has gone into shaping this end as the point of the tool. In section they are usually either plano-convex (made from flakes), biconvex (made from flakes and cores) or, more rarely, lenticular.

Cleavers. These are made on both side- and end-flakes with obliquely placed bulb, and are more numerous than in the earlier stages of the culture. They are of two main types: U-shaped cleavers with well-rounded butts, made on side- or end-flakes with biconvex or trapezoid cross-section; and sub-rectangular cleavers, sometimes with pointed ends and trapezoid section. Some of the cleavers on which the striking-platform is still preserved show crude preparation of it. The cleavers are always made from the harder rocks. Plate 5, No. 2 and Plate 7, No. 1.

Flake-tools. Several undoubted flake-tools are associated. The primary flake is either long (flake-blade) or broad. The platform is usually plain, but a few examples show crude preparation which may not be entirely fortuitous. The flakes have been worked into scrapers and, more rarely, into points or diminutive handaxes. Plate 6, Nos. 4 and 5.

* New sites have recently been located by Father Jerome of the Catholic Mission near the Kashitu Location and by the present writer in December 1949 and January 1950. These sites are situated on the 40-foot terrace of the Older Gravels of the Maramba River. They are yielding numbers of handaxes, cleavers and a quantity of flake-tools, flakes and other debitage of the Late Rhodesian Acheulian. Almost all the forms found in the Vaal River and on the Southern Rhodesia Watershed sites occur here. Excavations have uncovered living and workshop sites which are yielding valuable evidence of the extent to which flakes were utilised in Rhodesia during final Chelles-Acheul times.

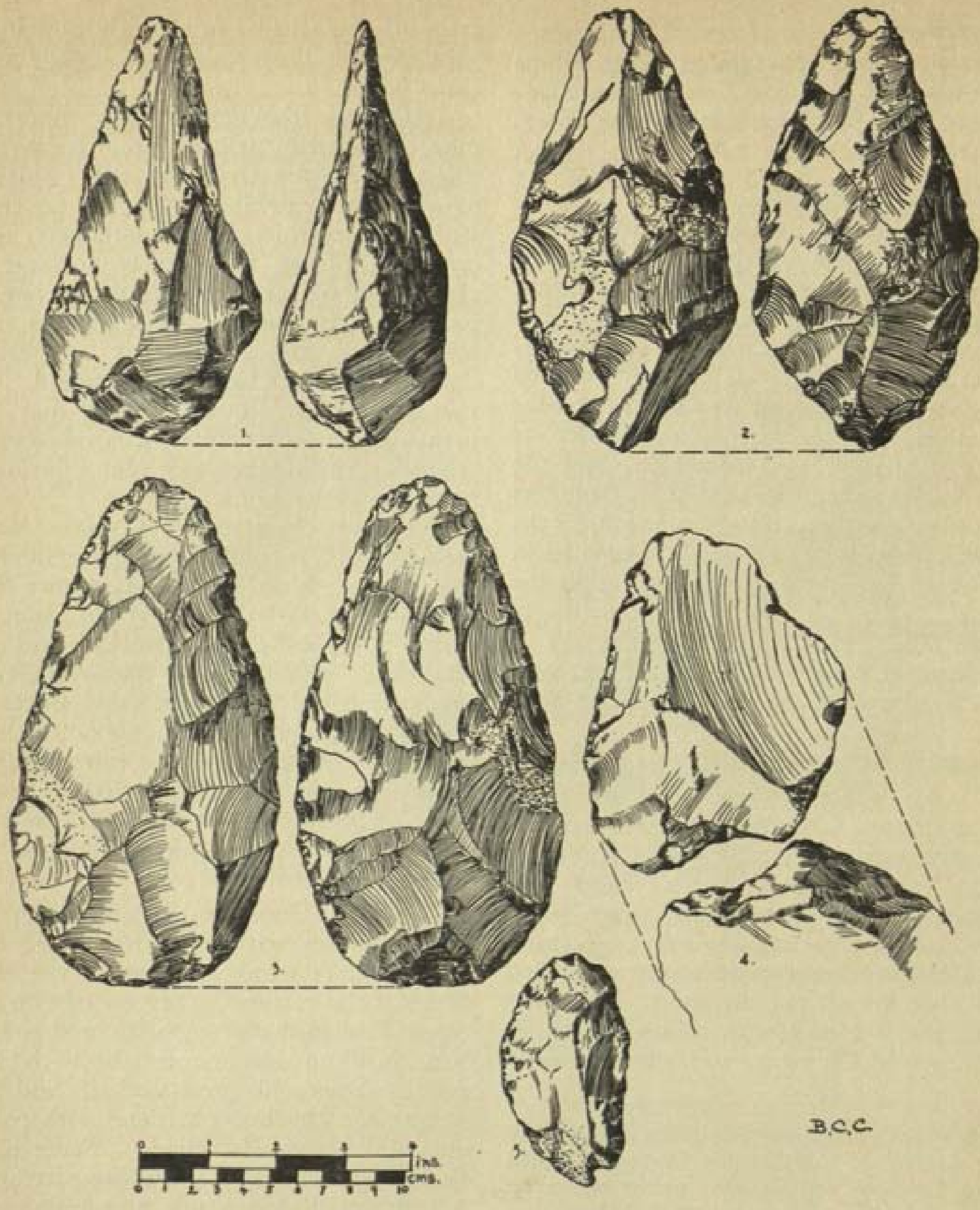

Plate 6. Chelles-Acheul Culture. Late Rhodesian Acheulian.

1. Pointed handaxe, abraded, from the Older Gravels II. Site M.A.38. Maramba Valley. Material — basalt.
2. Handaxe, unabraded, from the Older Gravels sealed by ferricrete. Site Z.D.1.38. Zambezi Valley. Material — chalcedony.
3. Handaxe, unabraded, from the Older Gravels II. Site M.A.38. Maramba Valley. Material — silicified sandstone.
4. Side-scraper on a large side-flake showing reduction of the striking platform. Unabraded, from the Older Gravels II. Site M.A.38. Maramba Valley. Material — silicified sandstone.
5. Small flake tool, abraded, from the Older Gravels II. Site M.A.38. Maramba Valley. Material — silicified sandstone.

Polyhedral and Bolas Stones. The Maramba and Kalomo Drift sites have yielded some good specimens of bolas which are large and irregularly faceted and made from quartz or quartzite. A few similar polyhedral specimens and same small discoidal tools also occur on the Zambezi sites. Plate 7, No. 2.

Technique. The Tachengit technique still appears to be that predominantly employed for the removal of large primary flakes. The crudely faceted striking-platforms, found on some of the cleavers and flake tools, does not altogether preclude the possibility that the use of the large, prepared core was known; though the Maramba site ought to have yielded some examples of this core if it had

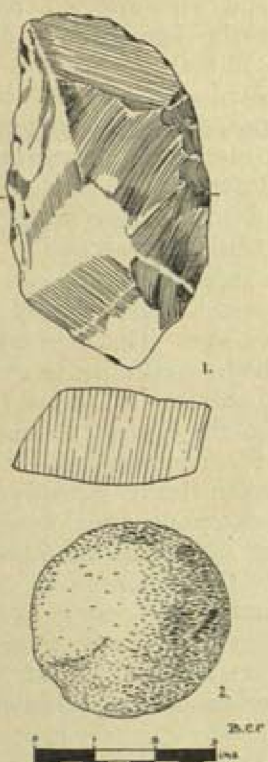

Plate 7. Chelles-Acheul Culture. Late Rhodesian Acheulian

1. Parallelogram-sectioned cleaver on an end-flake, weathered but unabraded, from the Older Gravels II. Site M.A.38. Maramba Valley. Material—basalt.
2. Large bolas-stone from the Older Gravels sealed by ferricrete. Drift site — Kalomo Valley. Material — quartz.

already been made. The secondary flaking is always a fine wood-technique, but sometimes (particularly on the flake-tools) a certain amount of resolved flaking is apparent. Numerous flakes removed in the manufacture of implements are found on the Maramba site and these are of two kinds: the usual primary flake with plain, inclined striking-platform, flattish bulb and average thickness; and the product of wood-technique, a small, thin flake with little or no platform and a very flat bulb. A quantity of both these kinds of flake occurs in the debitage recovered from the Maramba excavations.

The Southern Watershed Industries

With the exception of Lochard, only a brief description of the southern watershed sites has so far been given (Jones, 1926). Jones (1946) has described the Acheulian from Lochard in his account of the archæology of that area. The site was a factory site and most of the tools are therefore unfinished. Both ovate and pointed or pearshaped handaxes occur, some of the latter being just over 3 inches (7·5cm.) long. Cleavers are U-shaped with either parallelogram or biconvex section, and polyhedral artifacts are also found. Jones (1946, p. 121) tentatively equates this industry with Stellenbosch V of the Vaal River, and states that its " main feature is the variety of specialised forms of handaxes and cleavers exhibiting an advanced technique, a wide range of hard rocks being used ".

With regard to the other southern watershed sites it will be of interest to record here, for comparative purposes, the more important tool types which occur here.

At Embuzini the majority of the tools are made from quartz-porphyry. The commonest form of handaxe is the ovate and *limande*, a variation of which is a rather elongated *limande* form. Sections are biconvex and the tools are finely finished and made on both flakes and cores. When made on flakes the section is sometimes plano-convex. In addition, both large and small pointed handaxes occur though they are not common; the section in this type is biconvex. The small pointed tools are from 4 to 6 inches (10 to

15cm. long) and are usually made on flakes. The majority of the handaxes are made from side- and end-flakes; the latter usually show an obliquely placed butt, half way between a side- and an end-flake. A very few utilised flakes occur. The primary flaking on the upper face of the end-flakes is always directed from the platform end. A few discoidal or polyhedral stones, between 5 and 2½ inches (12·5 and 6·3cm.) in diameter, are also associated, as well as two probable bolas stones. There are also a few flakes (probably of later age than the handaxe industry) which show typical well faceted striking-platforms and preparation of the upper surface. The cleavers are numerous and typical; the commonest form is a U-cleaver on an end- or sometimes a side-flake, either with sides converging to form a blunt-pointed butt, or with parallel sides and evenly rounded butt. The cross-section is biconvex. Variations on this form are the rectangular cleavers on end-flakes with biconvex or trapezium section, and the U-cleaver with everted or splayed sides at the cutting edge and biconvex section—this is a form characteristic of the Chelles-Acheul III in the Vaal River Valley. When made on side-flakes, the forms with converging sides at the butt and with parallel sides always show a parallelogram cross-section. It will thus be seen that, with the exception of the triangular cleaver, all the forms present in the Chelles-Acheul III in the Vaal are represented here.

At Inyati, on the Inkwinkwesi, the handaxe industry is derived and not *in situ* as at Embuzini. The commonest form is the pointed pearshaped handaxe, probably made on a flake and some 6½ inches (16cm.) long, but some specimens are also found which are quite small and thin in section. The elongated *limande*, though rare, is again seen here, and the Embuzini ovate form is also represented. The cleavers are of the U-shaped variety; the forms on end-flakes with blunt-pointed and rounded butts are the commonest. Here the sides are more nearly parallel, or even converge slightly at the cutting-edge; the cross-section is biconvex. These forms also occur on side-flakes but then show a parallelogram section. There is one specimen of the U-cleaver with splayed cutting-edge. Polyhedral discs are also found here. Except for the preponderance of the pointed handaxe over the ovate, there would appear to be little difference between Embuzini and Inyati.

At Ematjeni exactly the same forms of handaxe and cleaver occur as before and the polyhedral discs are once again present. The tools are here *in situ* in a gravel, sealed by a later gravel containing Middle Stone Age tools.

At Popota the pointed and *limande* handaxes and U-cleavers on end-flakes are once again the type tools, although one or two cruder forms may be earlier. Artifacts are all rolled and presumably derived from a resorted gravel. The Tegwani site at Plumtree again yields the same tools. The handaxes are pearshaped and of the elongated *limande* forms, the latter being made on side-flakes with bi-convex or semi-parallelogram section. Cleavers are on side- and end-flakes, though the former type is more common and shows a parallelogram section.

There is little or no evidence available at present that will allow of any sequence of types at these sites. That they compare fairly closely with the Acheulian in the Zambezi is well seen, but there are certain differences: for example, the elongated *limande* form is absent in the Zambezi, and the degree of specialisation in cleaver form is not so great. With the exception of the wide Zambezi Valley, the Acheulian in Rhodesia would appear to be confined more to the watershed area than to the lower courses of the tributary rivers. Since the lower courses of these tributaries are inaccessible and rarely visited by field-workers this supposition may prove to be erroneous. If subsequent work should prove this to be correct then it would mean that the high veld was the country preferred by Acheulian man; either by reason of the failing water supply in the main valleys (which is unlikely unless the Acheulian should be dated to the very end of the Second Pluvial) or on account of the probably thick, moist, tropical forest which filled the valleys and made penetration in anything other than very small numbers a matter of difficulty.

THE HOPE FOUNTAIN CULTURE (Early Stone Age)

Stratigraphy

First found rolled in the Older Gravels I in the Zambezi. Good series can be collected from these gravels at Anderson's Drift and Old Livingstone, but the main site where the characteristic tools were first found rolled and unrolled *in situ* is the Maramba Quarries Site (M.C.39). Here implements in considerable quantities are preserved beneath an undisturbed deposit of ferricrete containing an unabraded Rhodesian Sangoan industry.

Geological Horizon

Second Pluvial—more particularly the second half.

Climate

? Wet.

Implements (Plate 8, Nos. 1 - 15)

The "type fossils" in the Zambezi are small flake-tools showing irregular, usually steep, secondary retouch, together with core and pebble choppers. The Hope Fountain from the type site was described by Jones (1929). More recently the same writer (1949, pp. 69-70) gave a summary of the characteristics exhibited by the industry from this type-site. The site shows certain characteristics in common with that at Gwelo Kopje. (See p. 93.) In each case the raw material is a rather intractable ironstone. Hope Fountain is a surface factory-site, and appears to have been occupied over a considerable period of time. There the characteristic tools on flakes and nodules are mixed with handaxes, rostroid tools and occasional flakes with faceted platforms, which strongly suggests to the present writer that a Rhodesian Sangoan element is intermingled here. As we have already seen, in the Zambezi and Maramba valleys the Hope Fountain stratigraphically underlies the Sangoan, and the more advanced elements found with the culture at the type site are absent from it in these valleys.

As the majority of the implements are made from flakes of no particular shape, it is not considered advisable to employ a very specialised terminology. Many of the implements suggest uses for scraping, paring, boring and cutting, while a number of the core tools appear to have been used as choppers, handaxes, etc., but there are still many for which it would be difficult to suggest a use. It has been found advisable, therefore, to employ a classification similar to that evolved by Paterson (1937, p. 87) in his description of the Barnham industries of East Anglia, whereby tools are classified according to shape and character of the working edge, without making any reference to their possible function. Implements have initially been divided into two groups: those made on flakes and those made on cores.

Tool Types

A—Simple Tools

Made on End-flakes

1. Straight Edge (*a*) Single.
   (*b*) Double.
2. Concave Edge. Single.
3. Convex Edge. Double.
4. Pointed.
5. Nosed.
6. Notched.
7. Concavo-convex (opposing) edges.
8. Convex-straight.

Made on Side-flakes

1. Straight Edge. Single.
2. Concave Edge. Single.
3. Convex Edge. Single.
4. Notched.
5. Concavo-convex (opposing) edges.

Made on Cores

1. Chopping Tools.*
   (*a*) Straight Edge. Single.
   Straight Edge. Double.
   (*b*) Convex Edge. Single.
   Convex Edge. Double.
   (*c*) Concave Edge. Single.
2. Beaked (rostroid).

* The term "Chopping Tool" has been retained as it best describes the appearance of the working edge of certain implements.

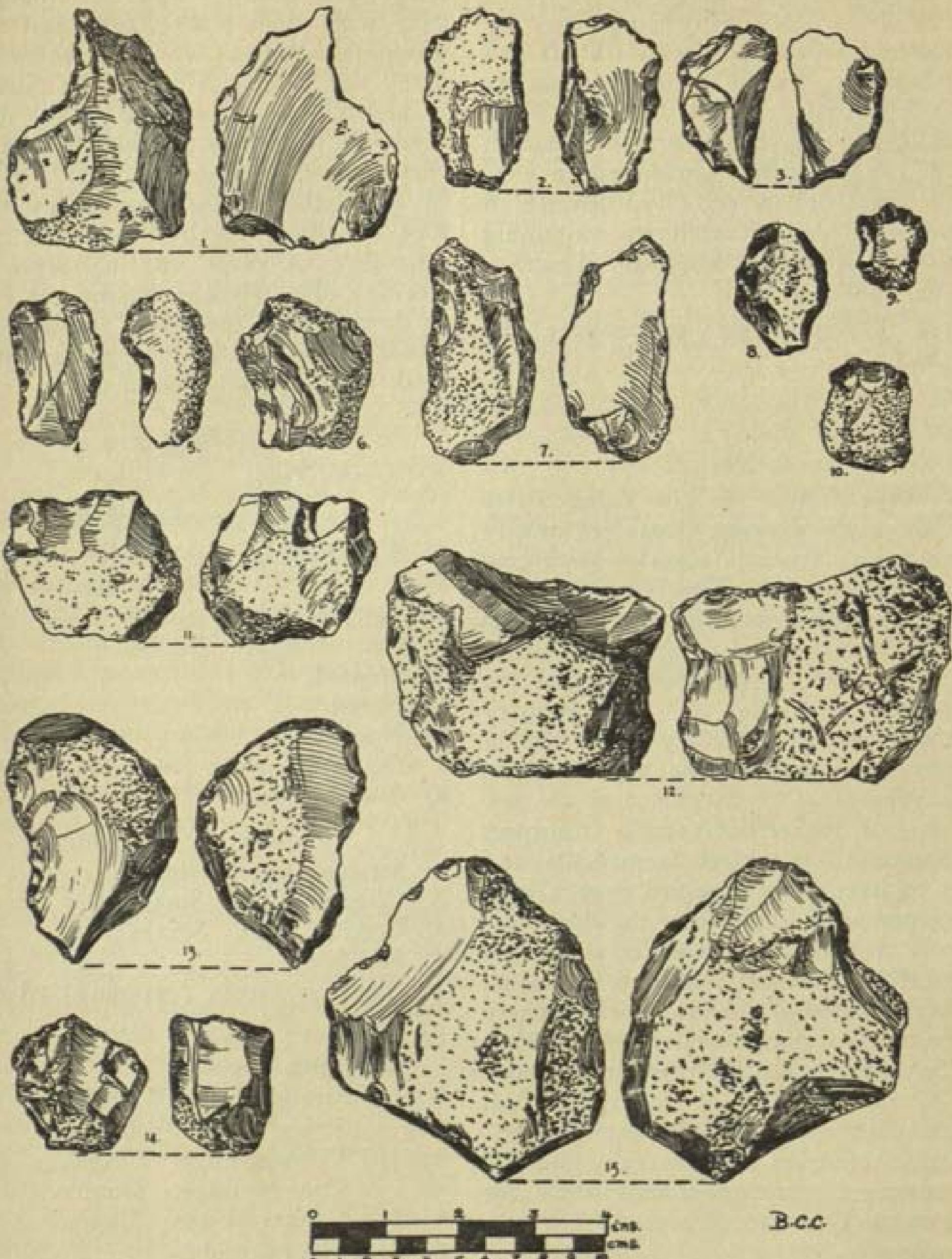

Plate 8. Hope Fountain Culture.

B—Composite Tools

Made on End-flakes

1. Straight Edge with notch.
2. Convex Edge with notch.
3. Concave Edge with notch.
4. Concavo-convex (opposing) Edges with notch.

Made on Side-flakes

1. Convex Edge with notch.
2. Concavo-convex (opposing) Edges with notch.

Made on Cores

1. Convex Edge with notch.
2. Straight Edge with notch.

The most representative collections in Northern Rhodesia come from sites M.C.39 and Z.Y.40. At the former site they are rolled and unrolled; at the latter they are always rolled and for the most part heavily abraded. The important Maramba Quarries Site has yielded large quantities of implements. Moreover, by reason of the fact that little, if any, subsequent disturbance of the deposit has taken place, the implements are found in certain definite relationships to one another, and (taking into account physical condition, patination and stratigraphical position) allow for subdivision into groups which show certain interesting points of divergence and development. Five distinct groups can be recognised, but until further stratigraphical evidence of a similar nature is forthcoming the culture will be described in general terms only.

Out of 410 worked flakes and cores excavated from the quarries 249 were implements. Of these, 118 were made on end-flakes, 56 on side-flakes and 75 on cores. Of these latter, 47 were cores showing signs of subsequent use as tools, while the remaining 28 were core tools proper. Thus nearly half are made on end-flakes, under a quarter on side-flakes, while less than one-eighth are core-tools proper. Collections from Sites Z.Y.40, Z.D.38, and Z.C.39, etc., show a similar preponderance of tools on end-flakes. By far the larger number of tools (85%) are made from chalcedony, especially suited to the production of the small flake-tools, while the other 15% is composed of tools of quartz, quartzite and silcrete.

Flake-tools. An average flake shows the following characteristics: a prominent to medium bulb, often exhibiting nipple-like cone or semi-cone of percussion; the sub-concentric rings surrounding the bulb are prominent; the striking-platform is usually small, always unfaceted and inclined at an average angle of 113° to the main flake-surface. End-flakes predominate, and are of medium thickness. The bulbar scar, where

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Plate 8. Hope Fountain Culture

1. Side-flake with concavo-convex working edges.
2. Side-flake with straight working edge, abraded.
3. Side-flake with concave working edge, slightly abraded.
4. End-flake with convex and straight working edges, abraded.
5. End-flake, notched, slightly abraded.
6. Nodule with single concave working edge and notch, abraded.
7. End-flake, abraded, with convex and straight working edges.
8. Thick end-flake with double convex working edges and notch, abraded.
9. Broken flake, worked into a nosed tool with notch, abraded.
10. End-flake — nosed and abraded.
11. Small chopping tool on a nodule with single straight working edge, abraded.
12. Chopping tool on a nodule with double straight working edges set at right angles, abraded.
13. Chopping tool on a nodule with straight edge and notch, abraded.
14. Small, asymmetrical, biconical (or steep) core with two platforms, abraded.
15. Chopping tool with double convex working edges.

All tools are from the residual Older Gravels I at site M.C.39. Maramba Valley. Material — all in chalcedony.

present, is usually large and the whole assemblage indicates the use of a stone—and not a wood—technique.

Secondary working is of two kinds, the first being the commoner and earlier, but both were in use at the end of the sequence:

1. *Resolved flaking* (typical of the whole culture) directed always from the main flake-surface, showing small, resolved flake-scars which combine to form a thick but tough cutting edge. This technique is combined with a steep, sometimes vertical angle of edge flaking, varying between 90° and 45° with an average of 72°.

2. *"Feather-edge" flaking*, not unlike the secondary retouch seen on Clacton 3 implements from High Lodge. The working has been directed from the main flake-surface in such a way that numbers of thin, narrow and often minute flakes have been removed producing small parallel flake-scars. This form of retouch is found most commonly on the unabraded specimens, but is never as common as the resolved flaking. The secondary working on the High Lodge implements was, according to the Abbé Breuil, produced by a wood-technique and it is not impossible that the makers of the Hope Fountain Culture acquired this technique through contact with the African Chelles-Acheul Culture.

Of the tools made on end-flakes four types may be considered to occur in sufficient numbers and to be sufficiently specialised to constitute type-fossils. These are tools with concavo-convex (opposing) edges, often with notch (14%), convex-straight (9%), notched (28%), and pointed (25%). Notched tools occur more frequently than any other, the implements being usually of a composite nature. But the concavo-convex and convex-straight are also common, the characteristic of the latter being a nearly vertical resolved secondary flaking up the straight edge. The convex edge shows either working of a similar nature or else is left practically unworked. This type of tool is described by Neville Jones as a pseudo-burin. The resulting tool bears a certain resemblance to a crudely-backed blade, except that it is the straight edge that constitutes the working part of the tool. Pointed implements, although not very common, are sufficiently characteristic to be included as a type-fossil. Edge flaking is usually not so steep, the "feather-edge" variety being met with on these tools. Implements with notches and concavo-convex (opposed) edges are the two most characteristic types made on side-flakes, but, as is to be expected, their number is not large. Secondary working is for the most part of a resolved nature.

Cores. Several different varieties are found:

1. An asymmetric core showing no previous preparation, flakes being removed from any convenient flat surface; these cores vary in size from 3 inches to over 9 inches (7·5 to 22·9cm.) in greatest length.

2. A core with a single striking platform from which flakes were struck from two directions at right angles to each other; end-flakes were removed down one side of the core, after which a flake or flakes, usually short and broad, were removed in a direction at right angles to the end-flakes but from the same platform. This procedure could be repeated until the core became too small for further use. It can easily be seen how flakes struck in this way may sometimes show fortuitous faceting of the striking platform.

3. A proto-biconical core; flakes have been removed from either side of an edge.

4. A biconical core; flakes have been removed from both sides round the circumference of the core.

Core Tools. The commonest varieties (apart from cores showing only slight evidence of secondary use) exhibit single straight, convex or concave working edges and might possibly have been used as choppers. The working edge, which is either across the end or down the side of the core, is formed by the intersection of a number of large flake-scars, struck from one or both sides, which combine to form an irregular cutting or chopping edge. In size they vary from 2½ to 4 inches (6·4 to 10·2cm.) or more in greatest diameter.

Summarising, therefore, it can be said that the culture presents all the attributes of a pure flake and chopper culture. The only primary technique employed is block-on-block. From experiments carried out by the writer and from the nature of the cores and flakes themselves (which are all small) it would appear that the flakes were removed by resting the core on an anvil and striking it with a hammer-stone rather than by striking the core itself against the anvil. The secondary working is almost always of an irregular, resolved nature and is usually very steep. The industry as a whole presents a very crude and primitive appearance and, apart from Leakey's stratified sites at Ol Orgesailie, appears to be quite unparalleled elsewhere on the African continent.[1] This group of industries has rather hesitantly been given cultural status here; but it remains to be seen whether future research will prove such a step to have been justified.[2]

[1] The Older Gravels of the 100-foot terrace of the Vaal at Duncanville, Vereeniging, has yielded an industry which typologically shows similarities with the Hope Fountain of the Zambezi and Ol Orgesailie though it has not yet been described. I am indebted to Professor C. van Riet Lowe for his kindness in showing me this site and the collections that have been made from it.

[2] The new Late Chelles-Acheul sites at the Kishitu Location in the Maramba Valley have also yielded a number of primary flakes similar to the Hope Fountain flake but mostly without the characteristic secondary retouch and without the small unprepared cores. It is difficult to distinguish the ordinary primary flake found with the Acheulian and resulting from the "roughing out" of handaxes and cleavers from unworked Hope Fountain-type flakes. The evidence from these sites suggests that these flakes belong to the Acheulian and not to the Hope Fountain though it would not be surprising to find a certain mixing of types as the two are near contemporaries. Perhaps also the possibility that these Hope Fountain industries represent some as yet unrecognised expression of the Chelles-Acheul complex must not be entirely dismissed though it is hard to see at present how they can be associated.

THE RHODESIAN SANGOAN

It is only in recent years that the Rhodesian form of the Sangoan has been recognised as a distinct culture and its place determined in the Cultural and Climatic Succession, the earliest record having been made by Jones (1938). The culture makes its first appearance at the very end of the Second Pluvial when the climate was rapidly becoming, if it had not already become, very dry. From its known distribution it is apparent that it spread over the whole of Northern Rhodesia, much of Angola and the high-veld of Southern Rhodesia from its centre of origin in the Congo. While the quantity of Early Stone Age material is never very great, the amount of Sangoan material is prodigious and must be taken to indicate a very considerable increase in the Stone Age population of Rhodesia. This may perhaps be accounted for by the fact that the thick, tropical forest which must have covered most of the country during the Second Pluvial was unable to survive the drier conditions and was replaced by more open savannah country. It is possible also that the rift movements in East Africa may have been responsible for a migration of population away from the more unstable areas.

Throughout Rhodesia the Sangoan is found associated with the ferricrete, either contained within it or immediately overlying it, and often covered by Kalahari sands. Numbers of sites are known within the Zambezi and its northern tributary valleys. The Luangwa Valley is particularly prolific in sites of this culture, but this area is today by no means healthy and large parts are uninhabited. Presumably the drier conditions eliminated the tsetse-fly and opened the valley as one of the main migration routes to South Africa.

In the north the culture approximates most closely to the type Sangoan of East Africa

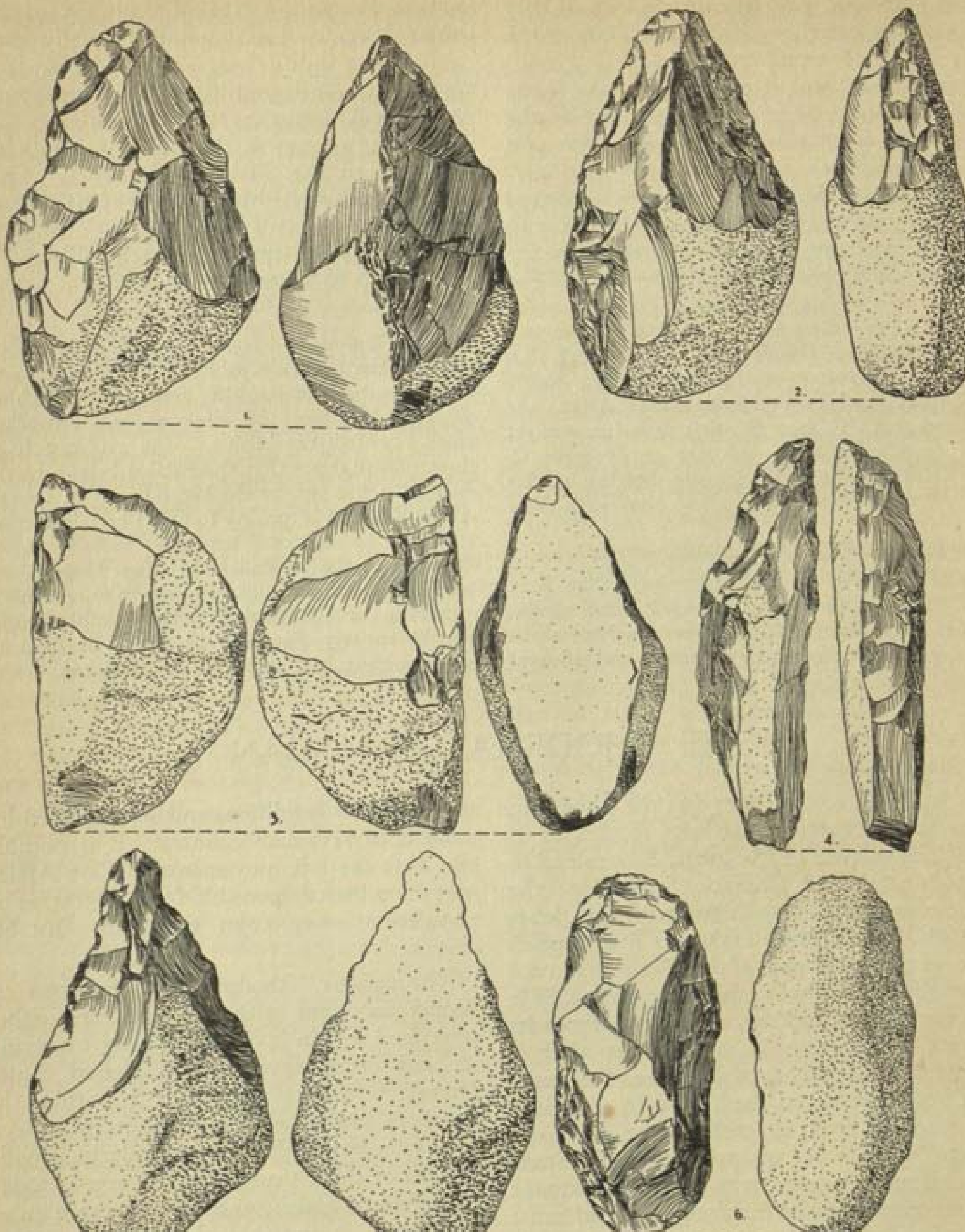

Plate 9. RHODESIAN SANGOAN CULTURE. LUANGWA VARIANT.

and the Congo, but the further south, the more apparent are the traits and material forms that it has inherited from the Chelles-Acheul culture complex. The three variants (the Luangwa, the Zambezi and the Southern Rhodesian or Southern Watershed) will, therefore, be described separately. A distribution map of the Sangoan in the Rhodesias is seen at Fig. 19, p. 62.

The Luangwa Variant

Stratigraphy

Within the wide valley of the Luangwa and its tributaries, the Lundi, Lusemfwa and Lukasasi, etc., Sangoan sites are particularly numerous and good representative collections have been made by F. B. Macrae and D. G. Lancaster from some thirty or more sites between the headwaters and Beit Bridge above the gorge.

Post-Tertiary erosion has left the end-Tertiary surface as a bench flanking both sides of the valley (Dixey, 1944, p. 39). Below this bench the earliest Pleistocene deposit is an extensive gravel composed predominantly of large pebbles of quartz and quartzite, most probably derived from the Cretaceous Sediments. This deposit is tentatively correlated with the Older Gravels and is found at heights varying from 150 to 200 feet (45 to 60m.) above the river, down to 30 feet (9m.) above. It has so far yielded no artifacts, but Sangoan tools in quantity overlie it. In the upper and upper middle reaches of the river it would appear that this gravel extends down to present river-level and perhaps below; in the central parts of the valleys here it is overlain by thick white to grey clays. In the Lundi tributary the upper levels of these clays have yielded Sangoan tools.

Ferricrete deposits occur widely in the Luangwa, particularly in the upper reaches. It is not yet clear whether they overlie the clays and " Older Gravels " or whether only the latter, though it is thought that they may cover both deposits, in which case the clays would be of late Second Pluvial age. There is no reason for considering that the ferricrete is not of the same age as the ferricrete in other parts of Rhodesia and it similarly yields quantities of Sangoan tools. Subsequent to the deposition of the ferricrete, a denudation terrace was cut in the clay deposits; on this terrace is found a second gravel deposit, concentrated for the most part in mounds and hummocks and yielding developed Middle Stone Age artifacts. Still later denudation has further entrenched the river within the clays and allowed the aggradation of alluvium.

The Sangoan tools are usually fresh and unrolled when found on the surface of the " Older Gravels ", and they appear also to be unrolled when *in situ* in the ferricrete, but several specimens, both with and without ferricrete incrustation, are found to be abraded, though this is considered to be due to later erosion.

Not only does the Luangwa variant of the Sangoan occur in the valley of that river, but it is found also in the Lake Tanganyika basin and on the Tanganyika Plateau.

Geological Horizon

Closing stages of the Second Pluvial?, the Interpluvial and the beginning of the Third Pluvial.

Plate 9. Rhodesian Sangoan Culture. Luangwa Variant

1. Crude handaxe with concretions of ferricrete, unrolled. Material — quartzite. From Chikunku, Isoka District, Luangwa Valley.
2. Flattish, unifaced handaxe or pick, unrolled. Material — quartzite. From Zimbo River, Luangwa Valley.
3. High-backed pick with sub-triangular section, slightly rolled. Material — quartzite. From Mpangala, Luangwa Valley.
4. Boat-shaped point or pick, unrolled. Material — quartzite. From Mpangala, Luangwa Valley.
5. Flattish, unifaced handaxe or pick, unrolled. Material — quartzite. From Mtipila, Lukusasi River, Luangwa Valley.
6. Pick, unrolled. Material — quartzite. From Chikunku, Isoka District, Luangwa Valley.

Climate

Semi-arid to arid, changing again to semi-arid.

Implements

These are almost invariably made from quartz and quartzite pebbles and present a crude and clumsy appearance. The industries are almost identical with the East African Middle Sangoan (previously termed "Lower Tumbian", Leakey, 1945, etc.), except that the lance heads are apparently absent. A representative series is now illustrated for the first time (see Plates 9 and 10). The makers of this culture often chose flattish, elipsoidal pebbles from which to make their tools and it is usual to find that the upper face only has been worked.

1. The commonest tools are crudely pointed picks, either high backed with plano-convex or sub-triangular section (Plate 9, No. 3) or flat with a more rounded plano-convex section, presenting the appearance of a unifaced handaxe (Plate 9, Nos. 2 and 5).
2. Crude handaxes. These are always thick with the butts invariably unworked and the edges of the tool irregular; in fact, if found out of its context, the tool would be considered to be of Chellean facies (Plate 9, No. 1, and Plate 10, No. 2). These also are very common.

   Other characteristic but less abundant tools are:
3. Picks more characteristic of the original Tumbian type (Plate 9, No. 6).
4. Round scrapers on cores (Plate 10, No. 7).
5. Crude end-scrapers—the one illustrated being made on a large flake struck from a previously prepared core (Plate 10, No. 6).
6. Oval and discoidal prepared cores, both struck and unstruck (Plate 10, Nos. 3 and 5).
7. Flakes with faceted striking-platforms sometimes worked into scrapers and points (Plate 10, No. 1).
8. Large, broad and long primary flakes, some showing primitive faceting of the striking-platform and signs of utilisation (Plate 10, No. 4).
9. A boat-shaped point or pick (Plate 9, No. 4).
10. Pebble-choppers.

Technique

This is always stone-technique, primary flaking being of a very crude nature. The tools are usually large and heavy and convey the impression that the Sangoan people must have been on the whole of a rather brutish nature! As a rule there is very little secondary work seen on the tools, but this may in some measure be due to the nature of the raw material, as quite a sharp edge was obtained by primary flaking backed against the flat undersurface. Where present, secondary work is always of a resolved nature and sometimes, as in the case of the unifaced point illustrated (Plate 10, No. 1) a shapely tool resulted.

Such, then, is the Luangwa variant of the Sangoan. It is probable that more than one phase of the culture is represented here, but in general the correlation is with the contemporary Middle Sangoan of East Africa.

The Zambezi Variant

Geological Horizon

Final phase of the Second Pluvial, the ensuing Interpluvial and the beginning of the Third Pluvial.

Stratigraphy

First found rolled and unrolled in the ferricrete in the valley proper, in and on the ferricrete rubble-bed on the upper slopes and in the lowest levels of the overlying Kalahari Sand.

Climate.

Semi-arid to arid, changing to semi-arid.

Implements

Whether is it due to contact with a late Chelles-Acheul stage of culture or to the nature of the fine grained chalcedony available in the Zambezi, the Sangoan here is

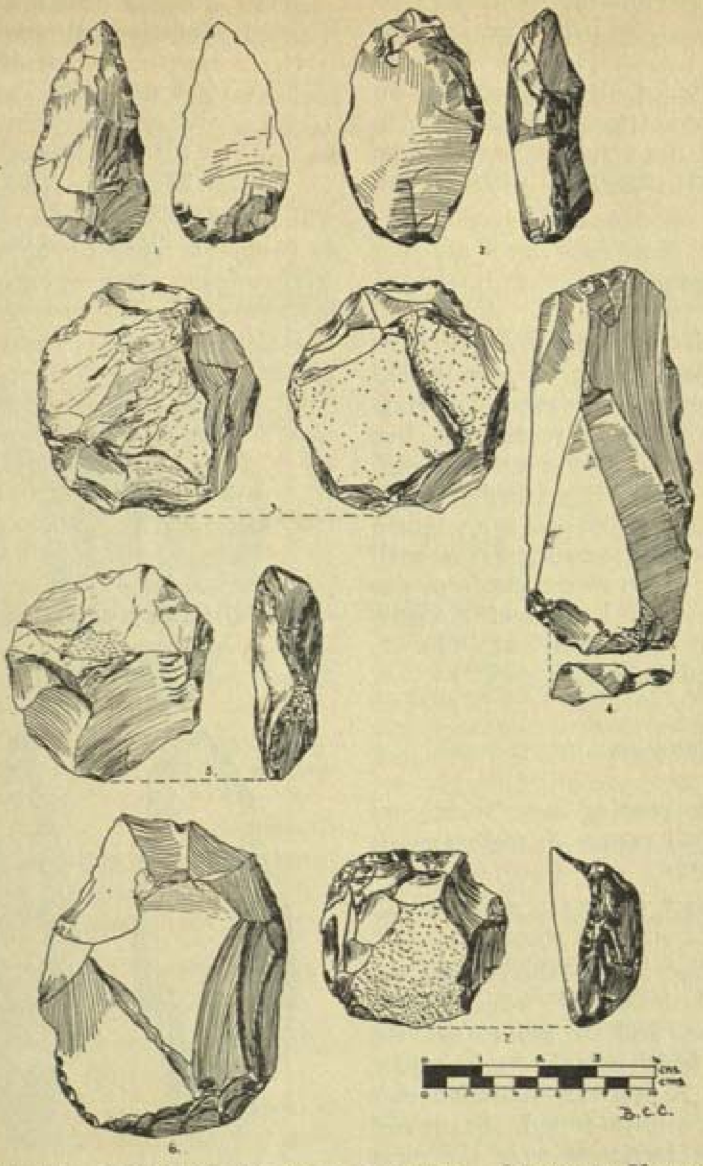

Plate 10. RHODESIAN SANGOAN CULTURE. LUANGWA VARIANT

1. Unifaced point, unrolled. Material — quartzite. From Chikunku, Isoka District, Luangwa Valley.
2. Small handaxe, rolled. Material — quartzite. From Lundu area, Luangwa Valley.
3. Prepared disc-core, unrolled. Material — quartzite. From Chikunku, Isoka District, Luangwa Valley.
4. Large flake-blade with crudely faceted striking platform, unrolled. Material — quartzite. From Mpangala, Luangwa Valley.
5. Prepared disc-core, struck, unrolled and with ferricrete concretions. Material — quartzite. From Mpangala, Luangwa Valley.
6. End-scraper on large prepared flake, the butt and platform have been trimmed away to form the scraping edge, unrolled. Material — quartzite. From Kavengulo River, Luangwa Valley.
7. Discoidal core scraper, unrolled. Material — quartzite. From Chikunku, Isoka District, Luangwa Valley.

typologically and technically in advance of the Luangwa variant, and some finely made tools are found. This variant has been tentatively sub-divided into a Lower and an Upper Phase. The former is correlated with the earlier half of the period covered by the Sangoan as a whole, the latter with the end of this period.

Lower Zambezi Sangoan

This needs little description, as the tools are in general closely similar to those listed and illustrated from the Luangwa. The same pick and handaxe forms are represented, but the latter here usually show a more careful finish and are as a rule more pointed in shape. Pebble-choppers, large flakes with plain striking-platforms, and smaller flakes with and without preparation of the platform also occur, associated with large and circular, crudely prepared cores. Plate 11, No. 1, shows a typical specimen of a pick.

Upper Zambezi Sangoan

Several most interesting new forms are found and the full range of tool types is therefore illustrated:

1. Picks, both high backed and flat. The former approximate closely to the rostro-carinates, but in the case of the Sangoan tools it was the edges of the ventral surface and the point (not the dorsal edge) which was the working part of the tool. A few rare sub-triangular pointed picks are also found. Basalt and even siliceous ferricrete were the most common materials but specimens in chalcedony and pipe-sandstone also occur (Plate 11, No. 2, and Plate 12, Nos. 1, 2 and 8).

2. Handaxes are of three kinds and show bi-convex or plano-convex sections, viz.:

   (*a*) Large, thick forms of the usual Middle Sangoan type, made of chalcedony, and more rarely of silcrete (Plate 13, and Plate 14, No. 2).

   (*b*) Fine, delicately made, pointed or lanceolate forms of La Micoque type. The secondary work was directed towards producing a fine and delicate point and the butt is left quite unworked. They vary in length from 6 inches to 2½ inches (15 to 6cm.). These tools show the highest degree of workmanship

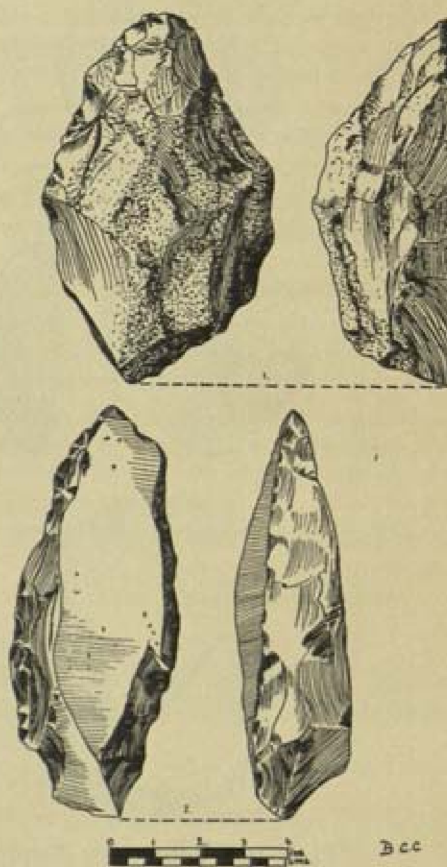

Plate 11. RHODESIAN SANGOAN CULTURE.

1. ZAMBEZI VARIANT (*Lower Division*). Crude pick from ferruginous rubble bed under Kalahari sand. Weathered but unrolled. Material — chalcedony. Knight's Drive, Livingstone.

2. ZAMBEZI VARIANT (*Upper Division*). Large pick with chisel ends, from ferruginous rubble bed. Hubert Young Drive, Victoria Falls. Unrolled. Material — basalt.

found with the Sangoan in Rhodesia (Plate 14, Nos. 3, 4, 7, 8 and 11).

(*c*) More usual pearshaped, ovate and diminutive cordiform handaxes, distinguished, however, from the Late Chelles-Acheul forms by the technique employed in their manufacture, particularly in regard to the secondary work. These again vary considerably in size, from 7 inches to just over 2½ inches (17·5 to 6cm.) in length: a proportion of handaxes showing S or Z twist is usually found (Plate 14, Nos. 1, 5 and 6).

(*d*) Another characteristic form is the *limande*, pointed at both ends (Plate 12, No. 3).

3. Small unifaced points showing resolved retouch (Plate 14, Nos. 14 - 16).
4. Small side-scrapers, sometimes with a crudely serrated edge (Plate 14, Nos. 9, 10, 12 and 13).
5. Boat-shaped tools, showing a flat underside, and step-flaking round the circumference of the tool.
6. Bolas stones (a type fossil) made usually from quartz and quartzite, but also of sandstone and siliceous ferricrete. A form with one flattened side is sometimes found.
7. Polyhedral stones.
8. Pebble-choppers (Plate 15, No. 6).
9. Thick, round and steep-nosed core-scrapers (Plate 15, No. 1).
10. Quantities of large flakes with plain or primitively faceted striking-platforms, (Plate 12, No. 5) and smaller flakes and flake-blades with plain (Plate 12, No. 6) or well faceted platforms, many of which show signs of utilisation of one or more edges, but rarely any secondary retouch. The predominant form, however, is the flake with inclined striking platform of Tayacian type. There also occur proto-biconical and asymmetric cores (Plate 15, No. 7) for the removal of flakes by block-on-block technique; circular and disc cores (Plate 12, No. 4) and sub-triangular forms of core (Plate 15, No. 2), from which flakes were removed. These cores occur both struck and unstruck; some are of very fine workmanship showing radial flaking of the upper surface.
11. The true cleaver does not occur, but the typical cleaver-edge of two large intersecting flake-scars is found on a very few large end-flakes, which have also a small amount of secondary work on the edges. A rare tool is also a crudely prepared handaxe, exhibiting an oblique cleaver-like edge similar to implements from the "Cave of Hearths" at Makapan (van Riet Lowe, 1938).
12. Some of the picks and some rare flakes show burin-facets which strongly suggest that they were used as genuine burins (Plate 15, Nos. 4 and 5).

Technique

Stone-technique predominates, but there is a suggestion of the knowledge of wood-technique on a few rare tools. Whether an unprepared or a prepared core was used, the hammer was always a stone one. With the exception noted above, the secondary work is of a fine resolved nature, both on handaxes and flake-tools; and totally different from that employed by the Chelles-Acheul peoples. In fact, the degree of finish in the tools of this latter culture is vastly superior, while the Sangoan exhibits a degree of crudity which, to the writer, is very difficult to explain, except by supposing either a migration of a new ethnic group, or more probably a complete revolution of technique forced upon the remnants of the Chelles-Acheul population as a result of the changed climatic conditions.

The culture in the Zambezi is still, therefore, basically Sangoan; but it has incorporated or developed certain more specifically regional characteristics, sufficient to justify a regional designation.

The Southern Rhodesia (or Southern Watershed) Variant

The typology of this variant is already sufficiently well known from the work of Neville Jones not to need further recapitula-

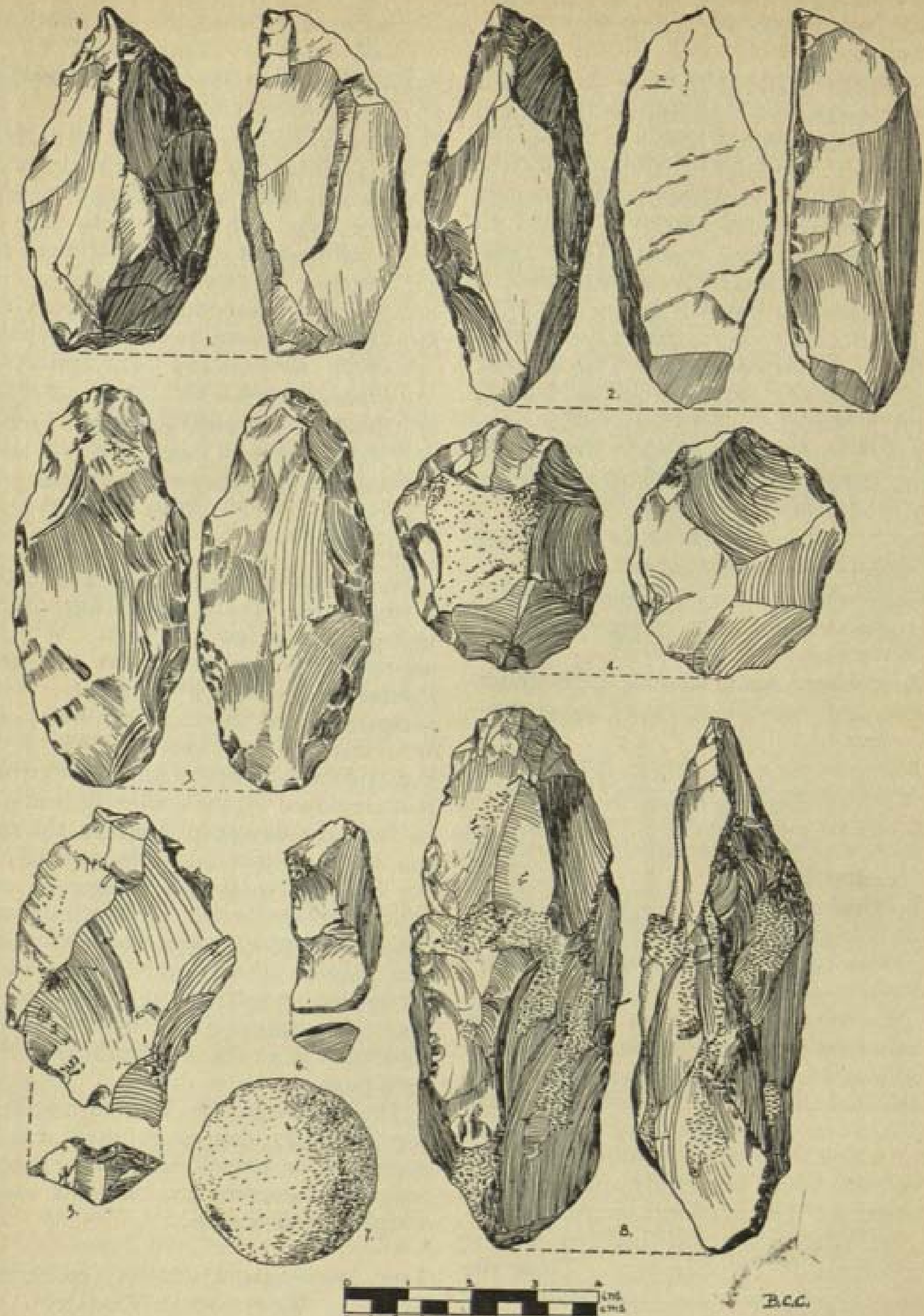

Plate 12. RHODESIAN SANGOAN CULTURE. ZAMBEZI VARIANT (*Upper Division*)

tion, but it will be necessary to compare it with the Northern Rhodesian forms, in order to ascertain whether or not these industries can be included within the Sangoan culture-complex.

The type site is Bembesi (Neville Jones, 1938) where the tools are made from silcrete, and the true picks appear to be absent, but the writer is not entirely convinced that this is the case, for the rostroid tool illustrated at Fig. 8 of Jones' description of the type site is strongly reminiscent of some of the Zambezi forms; that illustrated in Fig. 9 is even more so. There is also one large and typical pick in the collection not illustrated. The typical handaxes are:

(*a*) The large and crude form with unworked butt.
(*b*) Handaxes with plano-convex section.
(*c*) Diminutive handaxes with pointed ends.
(*d*) Crude ovates.
(*e*) Pearshaped handaxes with worked butts showing a fair degree of resolved secondary retouch.

The remaining characteristic tools (apart from the numerous flakes and flake-blades with plain and faceted striking-platforms) are choppers, steep-nosed scrapers, polyhedral stones, and both unprepared and prepared cores.

Plate 13. RHODESIAN SANGOAN CULTURE. ZAMBEZI VARIANT (*Upper Division*).

Large pointed handaxe from ferricrete, Sioma Falls, Barotseland. Slightly rolled. Material — silicified sandstone.

Plate 12. RHODESIAN SANGOAN CULTURE. ZAMBEZI VARIANT (*Upper Division*)

1. High-backed pick with sub-triangular section. Ferruginous rubble bed. Railway cutting, Victoria Falls. Unrolled. Material — pipe-sandstone.
2. Parallel-sided pick with chisel end. From ferruginous rubble bed, Jafuta Farm, Masue River. Unrolled. Material — basalt.
3. Limande handaxe with lenticular section, from ferricrete, Sioma Falls, Barotseland. Rolled. Material — chalcedony.
4. Prepared disc-core, struck, slightly rolled, from Younger Gravels I, Legg's Farm, Maramba River. Material — silicified pipe-sandstone.
5. Flake with faceted striking-platform, unrolled. From redeposited Kalahari sand, immediately overlying the ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
6. Utilised flake with plain striking platform from redeposited Kalahari sand immediately overlying the ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
7. Bolas stone, from ferricrete, site Z.P.38. Above the Songwe River Gorge. Material — quartzite.
8. Pick with biconvex section, from ferricrete. Site Z.L.39. Victoria Falls. Unrolled. Material — chalcedony.

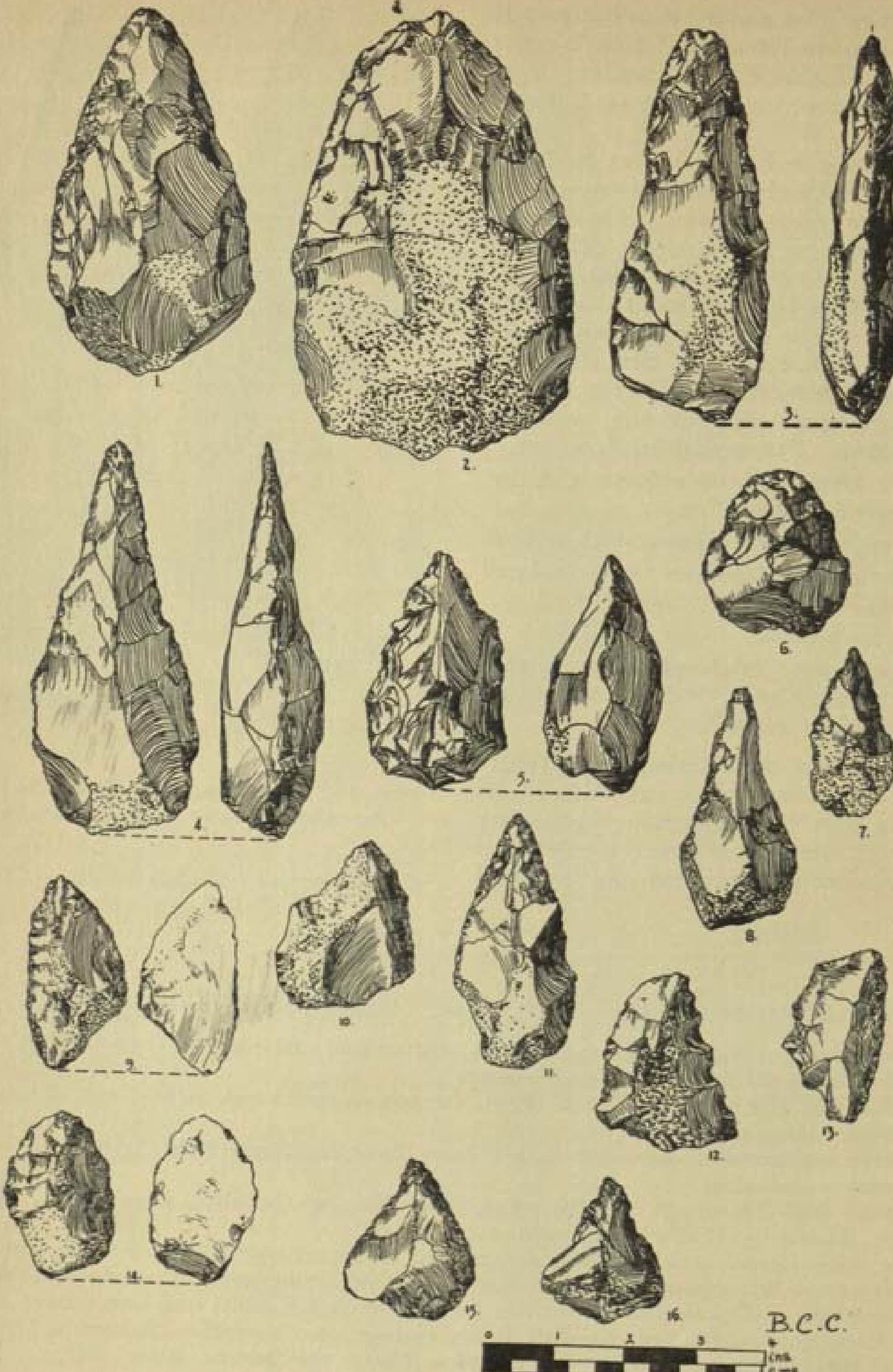

Plate 14. RHODESIAN SANGOAN CULTURE. ZAMBEZI VARIANT (*Upper Division*)

More closely related to the Zambezi variant is the industry from Mondoro (Jones, 1940b) in the neighbourhood of the Beatrice Mine near Salisbury, in fact, it might be said that it is entirely similar. The crude, thick handaxe, the pebble-chopper, the pointed triangular and rostroid picks or handaxes and the *coup de poing* of more finished workmanship all occur with characteristic flake-tools and cores. The industry lay on an old landsurface, and the accumulation of all these types of tool in a single industry explains the apparent typological and cultural jumble.

The Wedza site (Robinson, 1938, 1941) in the Upper Sabi Valley contains picks of Rhodesian Sangoan type associated with plain and faceted flakes, handaxes and large circular prepared cores. It is probably of Sangoan affinities, though it appears to be mixed with later material.

The Inyazura (Jones, 1946(*a*), p. 128), Insuza, Serowe and probably Maun and Inyanga sites are all of Bembesi form. The Umgusa River at Sawmills (Jones, 1926, fig. 10, p. 49) has also yielded Bembesi tools as well as an entirely typical pick. The writer believes also that the Gwelo Kopje Site and the later cultural material at Hope Fountain are pure Sangoan.

Summary

The main differences between the Zambezi and the Bembesi forms appear to be:

1. The pick is rare in the Bembesi form, but very rare cleavers are probably to be associated.

Plate 14. Rhodesian Sangoan Culture. Zambezi Variant (*Upper Division*)

1. Handaxe, unrolled. From redeposited Kalahari sand immediately overlying the ferruginous rubble bed. Knight's Drive, Livingstone. Material — chalcedony.
2. Crude handaxe, unrolled, from redeposited Kalahari sand immediately overlying the feruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
3. Handaxe, slightly rolled from ferricrete. Site S.P.38. Above Songwe River Gorge. Material — chalcedony.
4. Micoque-type handaxe, unrolled. From redeposited Kalahari sand immediately overlying ferruginous rubble bed. Site Z.C.38, Masue Valley. Material — chalcedony.
5. Small handaxe with plano-convex section, unrolled. From top of ferricrete overlying Older Gravels I with rolled Hope Fountain tools. Site M.C.39. Maramba Valley. Material — chalcedony.
6. Small, cordiform handaxe, unrolled, from redeposited Kalahari sand overlying ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
7. Diminutive, Micoque-type handaxe, unrolled, from redeposited Kalahari sand over ferruginized pebble bed, Knight's Drive, Livingstone. Material — chalcedony.
8. Micoque-type handaxe, unrolled, from redeposited Kalahari sand immediately overlying ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
9. Side-scraper, unrolled. From redeposited Kalahari sand immediately overlying ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
10. Side-scraper, unrolled. From redeposited Kalahari sand immediately overlying ferruginous rubble bed, Jafuta Farm, Masue Valley. Material — chalcedony.
11. Micoque-type handaxe, unrolled. From redeposited Kalahari sand immediately overlying ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
12. Serrated scraper, unrolled. From redeposited Kalahari sand immediately overlying ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
13. Side-scraper, unrolled from rubble bed in southern railway cutting. Site Z.T.2.38. Victoria Falls. Material — chalcedony.
14. Unifaced point, unrolled. From top of basal grey clay (Younger Alluvium I). Site Z.E.40. Zambezi Valley, Livingstone. Material — chalcedony.
15. Unifaced point, unrolled. From redeposited Kalahari sand immediately overlying ferruginous rubble bed, Jafuta farm, Masue Valley. Material — chalcedony.
16. Unifaced point, unrolled. From redeposited Kalahari sand immediately overlying ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.

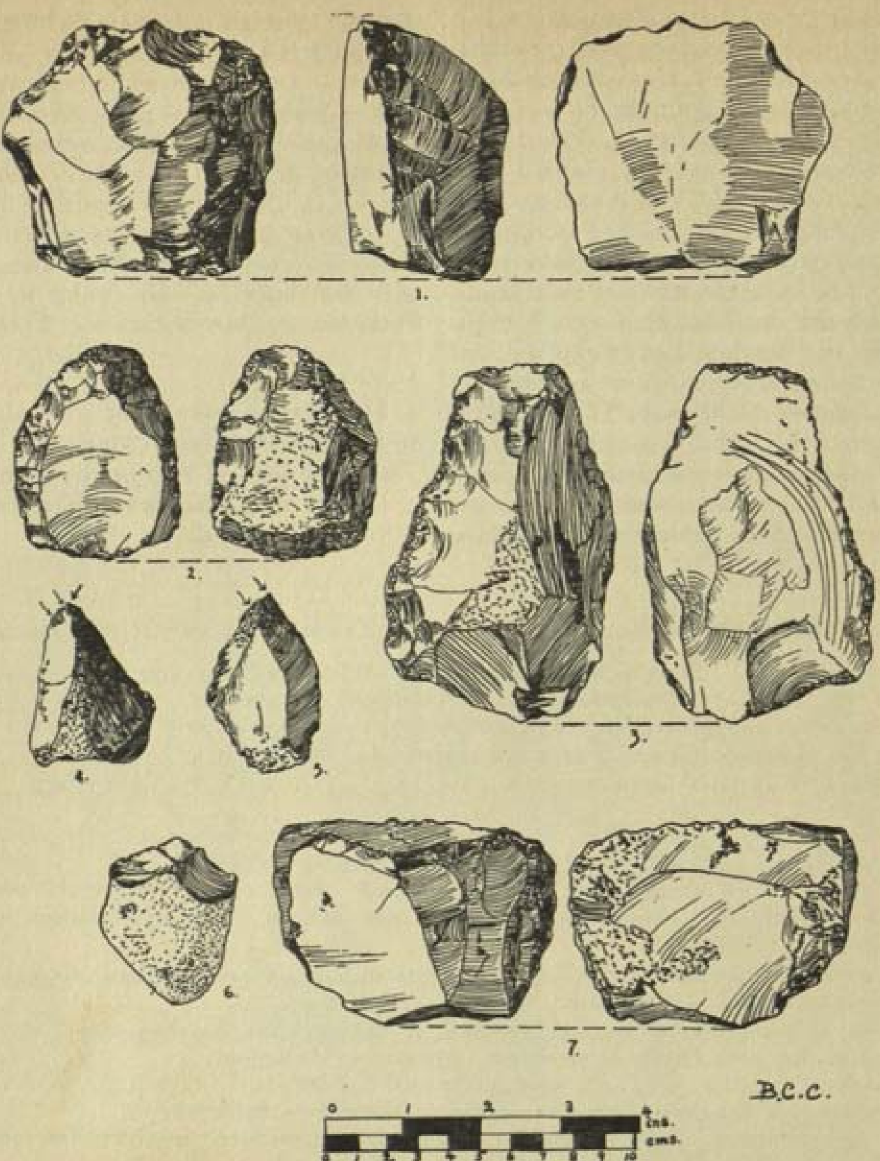

Plate 15. Rhodesian Sangoan Culture. Zambezi Variant (*Upper Division*)

1. Round scraper on a thick flake, slightly rolled. From the Younger Gravels I, Legg's Farm. Maramba Valley. Material — basalt.
2. Sub-triangular prepared core. From ferricrete. Site Z.P.38. Above Songwe River Gorge. Unrolled with ferricrete concretions. Material — chalcedony.
3. Large side-scraper, unrolled. From redeposited Kalahari sand, immediately overlying the ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.

4.-5. *Bec-de-flute* burins, unrolled. From the redeposited Kalahari sand overlying the ferruginous pebble bed, Knight's Drive, Livingstone. Material — chalcedony.

6. Small pebble chopper, unrolled. From redeposited Kalahari sand immediately overlying the ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.
7. Flake-blade core, showing side and top (platform) views, unrolled. From redeposited Kalahari sand immediately overlying the ferruginous rubble bed, Knight's Drive, Livingstone. Material — chalcedony.

2. The bolas, the fine La Micoque forms of handaxe, the unifaced points and the side-scrapers are absent or rare in the Southern Rhodesian form, but it should be stated that the unifaced point does occur at Sawmills *in situ* in the ferricrete (N. Jones, 1944).

The Bembesi form occurs, however, in exactly the same stratigraphical position as does the Sangoan on the Zambezi. This is well seen in the Bembesi and Insuza sections (the latter found by the present writer in 1939), and also in the Gwaai Railway Ballast Pit (re-examined by Maufe in 1939). All of these have yielded artifacts incorporated in or resting on the ferricrete and overlain by Kalahari Sand. When the Bembesi form is viewed in relationship to that found in the Zambezi and in the Luangwa, it is at once apparent that it constitutes an integral part of the Rhodesian Sangoan, although regional modification is further developed south of the Zambezi than it is in the Zambezi Valley itself. As Jones (1949, p. 31) has pointed out, the logical development of the Rhodesian Sangoan (to which all these variants belong) may be found in the earlier stages of the Pietersburg Culture in the Transvaal, but there can be no doubt at all that the Tugela Culture of the Natal coast is an intimate part of this culture complex. I am much indebted to Professor Lowe for allowing me to examine the collections of the Tugela Culture in the South African Archæological Survey (Lowe, 1947(*a*) and (*b*)).

THE RHODESIAN PROTO-STILLBAY

The Proto-Stillbay is a direct derivative of the Rhodesian Sangoan, and recent research has considerably clarified our knowledge of this culture. Jones' recent work at Bambata (N. Jones, 1940 (*a*)), and with Bond at Sawmills (*Ibid.*, 1944), and Lochard (*Ibid.*, 1946(*b*)) has recovered the Proto-Stillbay stratified, and has enabled its position in the climatic succession to be more accurately determined. In the Zambezi it is true to say that, together with the Sangoan, the Proto-Stillbay is the most prolific culture represented in the valley; in fact, the Younger Gravels in the immediate neighbourhood of the Victoria Falls appear to contain an almost unlimited number of Proto-Stillbay tools. In the preliminary report this culture was described under the term " Lower Rhodesian Stillbay "; the amended terminology is now preferred, however.

Stratigraphical Horizon

First found rolled and unrolled in the Younger Gravels and on temporary living-floors on the eroded slopes of the Kalahari Sands on the valley sides.

Geological Horizon

The main part of the Third Pluvial, from the maximum of the first to the end of the second peak rainfall period.

Climate

Wet.

Implements

The main method of manufacture is by faceted-platform technique, exemplified by the prepared flake, and the discoidal or sub-triangular prepared core. The majority of tools consist of utilised flakes, some worked into points and scrapers, with carefully faceted striking-platforms.

Cores (Plate 16, Nos. 11 and 12). The cores vary in diameter from 5 inches to 2 inches (12·5 to 5cm.) and are usually flattish rather than high-backed. The method of preparation of the upper surface was by radial flaking, the cores being designed for the removal of one flake only before re-preparation. The flake-blade core is also present. It shows usually a single platform, flake-blades having been removed down the length of one face at right angles to the platform; they sometimes show fortuitous faceting.

Flakes (Plate 16, Nos. 6, 7 and 10). Flake-tools exhibit either a faceted or a plain butt. It is not uncommon to find that the platform and bulb have been removed by Tabalbalat technique, and a typical specimen is illustrated (Plate 16, No. 10). Both Levallois-type and Mousterian-type flakes

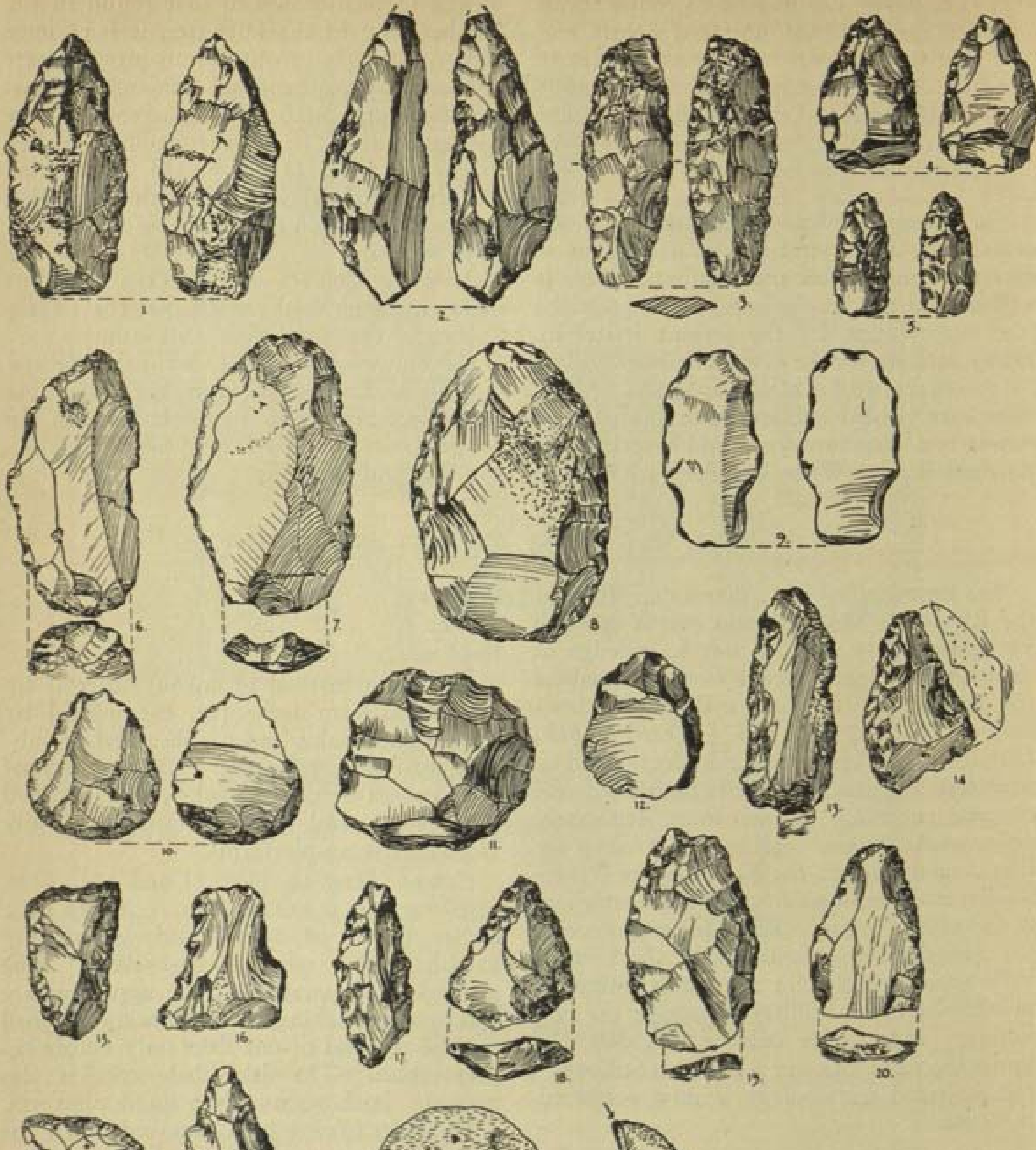

Plate 16. RHODESIAN PROTO-STILLBAY CULTURE.

occur, the former being either broad or long and often quite thin. They rarely show any great amount of secondary work, which is usually confined to nibbling and squamous flaking round the edges of the tool (Plate 16, No. 7). The sub-triangular, Mousterian-type flakes with converging flaking on the upper face, and an obliquely or acentrally placed, faceted or plain striking-platform, have not infrequently been worked into points, side- or side-and-end scrapers, by resolved retouch.

Points, unifaced. These are usually sub-triangular in shape, but more pointed forms also occur. The retouch is predominantly resolved, but squamous flaking is also found. The platform is usually retained (Plate 16, Nos. 17 - 20 and 22).

Points, bifaced. These are rare and of two kinds: (*a*) the more normal, laurel-leaf form (sub-triangular) and (*b*) pointed and foliate. Less than a dozen of the latter tools

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Plate 16. Rhodesian Proto-Stillbay Culture

1. Crude bifaced foliate point from living site on eroded Kalahari sands and sealed by redeposited Kalahari Sands II, Knight's Drive. Site Z.B.48. Unabraded. Material — chalcedony.
2. Bifaced lanceolate point from living site on eroded Kalahari sands, and as 1 above. Site Z.B.48. Knight's Drive. Unabraded. Material — silicified sandstone.
3. Bifaced lanceolate point, unabraded. Believed eroded from spur of redeposited Kalahari sands, opposite the Fourth Gorge, South of the Victoria Falls Hotel. Material — chalcedony. K. R. Robinson Collection.
4. Parti-bifaced point, abraded. From Younger Gravels. Site Z.O.38. Victoria Falls. Material — chalcedony.
5. Diminutive bifaced point, abraded. From Younger Gravels. Site Z.P.38. Songwe Gorge, Zambezi Valley. Material — chalcedony.
6. Flake-blade with marginal retouch and reduction of bulb and striking platform. Slightly abraded. From Younger Gravels. Site Z.N.1.38. Zambezi Valley. Material — chalcedony.
7. Flake with marginal retouch and faceted striking platform. Slightly abraded. From Younger Gravels (Flood Gravels). Site Z.L.39. Zambezi Valley. Material — chalcedony.
8. Ovate handaxe, slightly abraded. From Younger Gravels. Site Z.B.38. Zambezi Valley. Material — chalcedony.
9. Crudely tanged flake-blade, abraded. From Younger Gravels. Site Z.B.38. Zambezi Valley. Material — silcrete.
10. Prepared flake with Tabalbalat-type reduction of bulb and striking platform. Abraded. From Younger Gravels. Site Z.N.1.38. Material — chalcedony.
11. Unstruck, prepared discoidal core, unabraded. From living site on eroded Kalahari sand (as 1 and 2 above), Knight's Drive. Site Z.B.48. Zambezi Valley. Material — chalcedony.
12. Sub-triangular prepared core, struck (as 1 above). Material — chalcedony.
13. Side-scraper on an end-flake, unabraded (as 1 above). Material — chalcedony.
14. Side-scraper on a side-flake, unabraded (as 1 above). Material — chalcedony.
15. Double edge- and end-scraper on an end-flake, unabraded (as 1 above). Material — chalcedony.
16. Serrated scraper with notch, unabraded (as 1 above). Material — chalcedony.
17. Unifaced point with serrated edges, unabraded (as 1 above). Material — chalcedony.
18. Unifaced point with faceted striking platform, slightly abraded. From Younger Gravels. Site Z.M.38. Zambezi Valley. Material — chalcedony.
19. Utilised flake or unifaced point with faceted striking platform, unabraded (as 1 above). Material — chalcedony.
20. Unifaced point on a flake with plain striking platform. Unabraded (as 1 above). Material — chalcedony.
21. Sub-triangular scraper on a flake, unabraded (as 1 above). Material — chalcedony.
22. Unifaced point with serrated edges, unabraded (as 1 above). Material — chalcedony.
23. Bolas stone in quartz. From Younger Gravels. Site Z.Y.40. Zambezi Valley.
24. Single-blow burin, unabraded (as 1 above). Material — chalcedony.

have been found, but of these several occurred in circumstances which indicate their association with the Proto-Stillbay. They vary in length from 4 to under 2 inches (10 to 5 cm.) and in thickness from 19mm. to 10mm. (Plate 16, Nos. 1 - 5).

Scrapers. These may be side-scrapers on side-flakes, single and double side-scrapers on end-flakes, side- and end-scrapers on end-flakes, concave and notched scrapers or scrapers with serrated edges. There also occur core-scrapers of the form noted with the Rhodesian Sangoan (Plate 16, Nos. 13 - 16 and 21).

Handaxes and Choppers. These are rare, but an industry is always found to yield one or two of these tools. They are usually of poorer workmanship than the Sangoan specimens (Plate 16, No. 8).

Bolas. These are smaller and carefully rounded; made from quartz, quartzite and sandstone (Plate 16, No. 23).

Burins. Genuine burins of single-blow and *bec-de-flute* forms occur (Plate 16, No. 24).

Tanged Flakes. One much abraded tanged flake of silcrete was found in the Younger Gravels at Site Z.B.38. It is tentatively ascribed to the Proto-Stillbay on account of the degree of rolling, but, as tools made of silcrete always show a greater degree of abrasion than contemporary tools made of chalcedony, it is possible that this specimen may be later, and should therefore be associated with the Stillbay proper. There is, in the opinion of the writer, little doubt that this is a genuine tanged flake, as the reduction which has produced the tang has been directed from opposite sides of the flake. Other rare flakes found with the Proto-Stillbay and Stillbay proper show crude tangs, but it is uncertain whether these are fortuitous or not. The specimen illustrated (Plate 16, No. 9) should be compared with those from the Cape Middle Stone Age (Malan and Goodwin, 1939, p. 17).

Two interesting industries from the Luangwa and from Kalomo are worthy of mention, as they show the adaptation of faceted platform-technique to quartz and quartzite pebbles as raw material.

The first comes from the right bank of the Luangwa near Mulopwe Village in the upper reaches of the valley. The disc cores are made by preparing the upper surface of a suitable pebble and leaving the underside largely composed of the original cortex. Both struck and unstruck forms are common, and the flakes obtained from these cores show the typical faceted striking-platforms. Associated, however, are a number of pebble choppers and small, crude handaxes, no doubt a legacy from the industry's Sangoan ancestry.

In the Kalomo River valley the same forms of prepared disc core and faceted flake occur, the material being quartz and, rarely, silcrete; but numbers of pebble-choppers are also associated; many of these would pass typologically as Pre-Chelles-Acheul tools. Besides being employed as choppers, pebbles have also sometimes been worked into scrapers of the usual kinds.

The industry from the Broken Hill cave (Clark, J. D., and others, 1950) is of Rhodesian Proto-Stillbay type. Of considerable interest is the fact that, in addition to the usual flake-tools and bolas, there are found primitive bone-tools worked into gouges and points. These are thus the earliest bone-tools yet recovered from Southern Africa. The mineralogical, faunal and stratigraphical evidence strongly suggests that the remains of *Homo rhodesiensis* are to be associated with this Proto-Stillbay industry. If this is indeed the case it may be suggested that the makers of the Rhodesian Proto-Stillbay culture were most probably of palæo-anthropoid stock.

The Zambezi Proto-Stillbay compares closely with that from Southern Rhodesia (from Bambata, Lochard and Sawmills), the main difference being that at these sites in the south the bolas appears to be absent, while the foliate points are as yet only doubtfully present at Sawmills and absent from the other two sites.

THE RHODESIAN STILLBAY

Stratigraphy

Tools first appear unrolled or very slightly rolled, on and in the top levels of the Younger Gravels. They are often covered by the Kalahari Sands II.

Geological Horizon.

The final wet phase and decline of the Third Pluvial.

Climate.

Wet to semi-arid.

Implements

The Rhodesian form of the Stillbay is already well known and needs no very detailed description here. The Southern Rhodesian form is typified by the industry from Bambata, described by Armstrong (1931, p. 239) and again by Jones (1940a, p. 11). The Northern Rhodesian form as exemplified in the Mumbwa Caves has been described by the present writer (Clark, 1942, p. 133).

In the Zambezi Valley the Stillbay proper is nowhere as common as is the Proto-Stillbay, and it would seem that the centre of focus had tended to move from the Valley to the Plateau. The Stillbay is best known from cave- and rock-shelter sites, and, in fact, would appear to be a rock-shelter rather than an open-station culture.

With the exception of one site (Z.F.39), the factory and home sites of the Stillbay in the Zambezi Valley are not on the whole very representative. There is, however, a sufficiently wide collection of finished artifacts to show that some very finely made pressure flaked-tools were possible using the local chalcedony as material (see Plate 17, Nos. 1 - 13).

The characteristic tool is, of course, the leaf-shaped point, of which both bifaced (Plate 17, Nos. 1 and 2) and unifaced (Plate 17, Nos. 3 - 8) specimens occur. These points are always flat, and the bifaced specimens show a bi-convex or lenticular section. Side-scrapers on end-flakes, side- and end-scrapers on end-flakes, hollow and notched scrapers, and, more rarely, butt-end and large round scrapers (Plate 17, No. 13) all occur. The bolas (Plate 17, No. 11) is still a type-tool though now it has been reduced in size. Crudely backed flakes (Plate 17, Nos. 9 and 10), flakes with Kasouga retouch, single-blow and *bec-de-flute* burins are also typical. Choppers are occasionally present. The prepared cores are now almost invariably discoidal or circular, and are usually flat or bi-convex in section. The unprepared flake-blade core with one or more platforms is present. Both types show a general diminution in size when compared with those found with the Proto-Stillbay. The flakes from the prepared cores nearly always show a very finely faceted striking-platform, which is not so wide nor so broad as in the earlier culture.

The Stillbay proper exhibits a degree of specialisation and finish rarely, if ever, seen with the Proto-Stillbay. True pressure-flaking, as distinct from the wood-technique seen on some of the tools of the earlier culture, is employed on the finished Stillbay points, and the crude, serrated edge-flaking has been replaced by controlled percussion-flaking.

The Zambezi Stillbay is generally typical of the industries from the recognised type sites from which it diverges in no essential details. The main difference between the Northern and Southern Rhodesian Stillbay is that the bolas is absent from the latter. There has also been a greater degree of specialisation in points in the south than in the north.

THE LATE STONE AGE CULTURES

In Northern Rhodesia it is now apparent that during the Late Stone Age there are two main cultural zones. The one (which may conveniently be termed the North-Western Rhodesia zone) is bounded in the north by the Zambezi-Congo Watershed, and in the north-east and east by a line drawn at the Lusemfwa and Luangwa rivers. In the south this cultural zone stretches across the Zambezi into Southern Rhodesia. In the west its

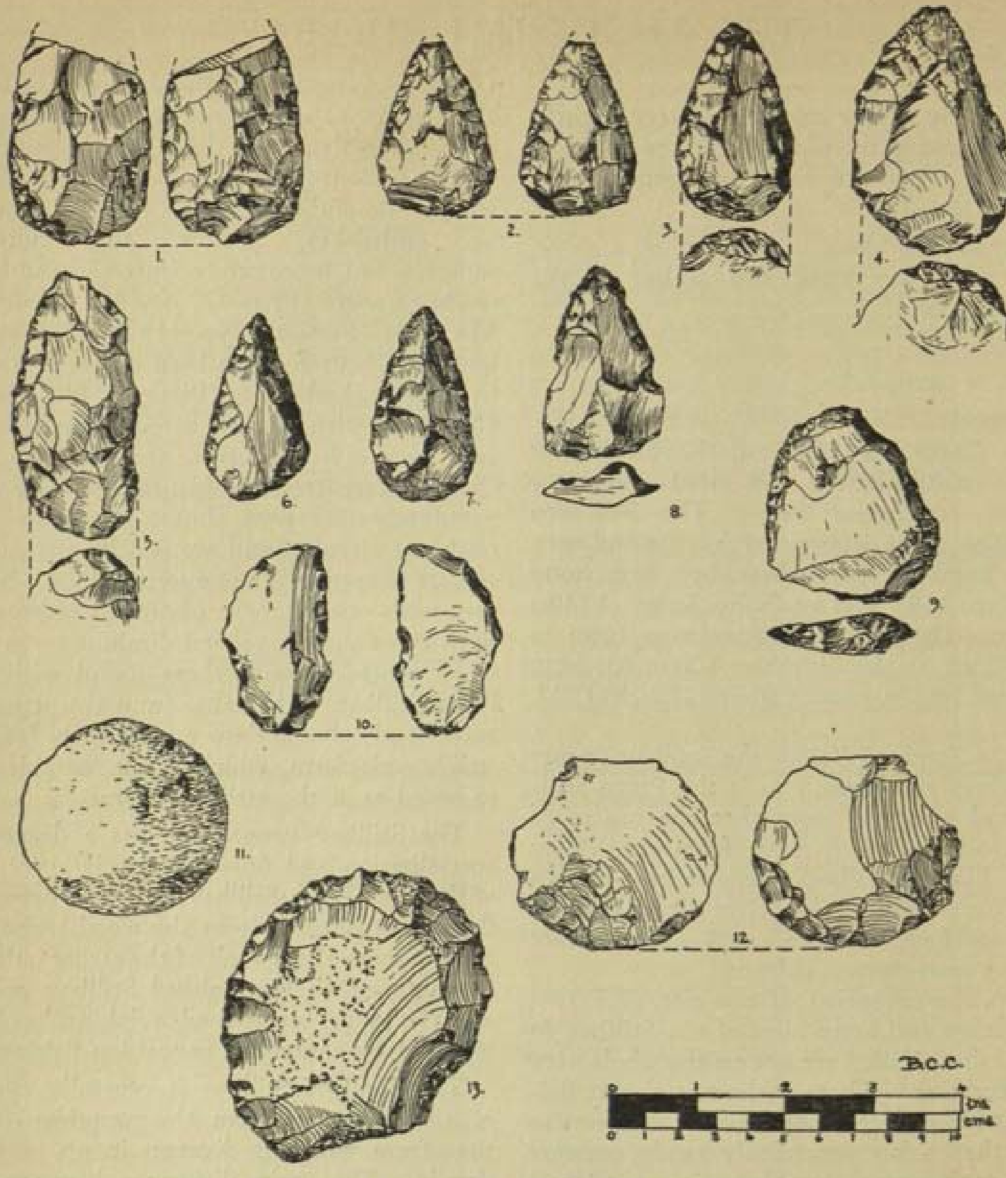

Plate 17. Rhodesian Stillbay Culture

1. Broken bifaced point, unabraded. From surface of the Younger Gravels. Site Z.M.38. Zambezi Valley. Material — chalcedony.
2. Bifaced point, unabraded. From eroded Kalahari sands, Knight's Drive. Site Z.B.48. Zambezi Valley. Material — chalcedony.
3. Unifaced point, slightly abraded. From surface of the Younger Gravels. Site Z.M.38. Zambezi Valley. Material — chalcedony.
4. Asymmetric, bifaced point, unabraded. From surface of the Younger Gravels. Site Z.O.40. Zambezi Valley. Material — chalcedony.
5. Unifaced point or utilised flake, unabraded. From eroded sands, Knight's Drive. Site Z.B.48. Zambezi Valley. Material — chalcedony.
6. Unifaced point, slightly abraded. From Younger Gravels. Site Z.B. 38. Material — chalcedony.

bounds are as yet unknown owing to the absence of sites (or even stone) in the Kalahari Sand country and the silt-plains of Barotseland. From what little is known of the Late Stone Age industries of Angola, however, it would appear that, in the north-west, at any rate, this cultural zone probably does not extend much farther west than the 21st parallel of longitude.

The region lying to the north and east (which we may refer to as the North-Eastern Rhodesia zone) is bounded on the north and east by the Tanganyika-Rukwa-Nyasa Rifts; but in the west it stretches into the Katanga Province of the Belgian Congo, and in the south across the Katanga pedicle, along the Zambezi-Congo Watershed, and into Angola.

There are indications that it may later be necessary to sub-divide the North-Eastern zone into an eastern and a western region, using the Luangwa River as the dividing line.

There is some overlapping between the two zones, in the country between Ndola and the Zambezi-Luangwa confluence, but for the most part the industries of each zone are sufficiently characteristic to be readily distinguishable.

THE NORTH-WESTERN RHODESIA ZONE

THE RHODESIAN MAGOSIAN

Up to a few years ago this culture was known only from the industry found by Jones (1924) at Sawmills, but recently its distribution has been extended in Northern Rhodesia by the Zambezi Valley sites and by others, while in Southern Rhodesia an important industry has been found at Khami. The culture is typologically transitional between the Middle and the Late Stone Ages, and bridges the gap between the end of the Third Pluvial (which marks the end of the Pleistocene) and the First Post Pluvial Wet Phase. It belongs, therefore, to a time when the prevailing climatic conditions were drier than they are today.

Stratigraphy

The date of the Rhodesian Magosian is based on the relationship of this culture to the Kalahari Sands II in the Zambezi Valley. As has been shown (see p. 38 above), occupation-levels are found under and in this sand at a number of sites, but it is possible that the culture also continues into the succeeding Wet Phase. All the stratigraphical evidence so far adduced points to the Kalahari Sands II as having been accumulated during the dry period following the Third Pluvial.

Since as yet it has nowhere been found overlying the calcareous sandy alluvium of the First Post Pluvial Wet Phase (Makalian),

7. Unifaced point, unabraded. From eroded sands. Site Z.O.40. Zambezi Valley. Material — chalcedony.
8. Unifaced point with lateral hafting (?) notches and plain striking platform, slightly abraded. From surface of the Younger Gravels. Site Z.M.38. Material — silcrete.
9. Backed flake with retouch on the working edge and a faceted striking platform. Slightly abraded. From surface of the Younger Gravels. Site Z.L.39. Zambezi Valley. Material — chalcedony.
10. Backed flake, unabraded. From surface of the Younger Gravels. Site Z.O.38. Zambezi Valley. Material — silcrete.
11. Bolas stone. From Younger Gravels. Site Z.O.38. Material — chalcedony.
12. Utilised flake struck from a prepared core showing reduction of bulb and striking platform. From eroded sands, Knight's Drive. Site Z.B.48. Zambezi Valley. Material — chalcedony.
13. Large, discoidal scraper or trimming stone on a flake, unabraded. From surface of Younger Gravels. Site Z.L.39. Material — chalcedony.

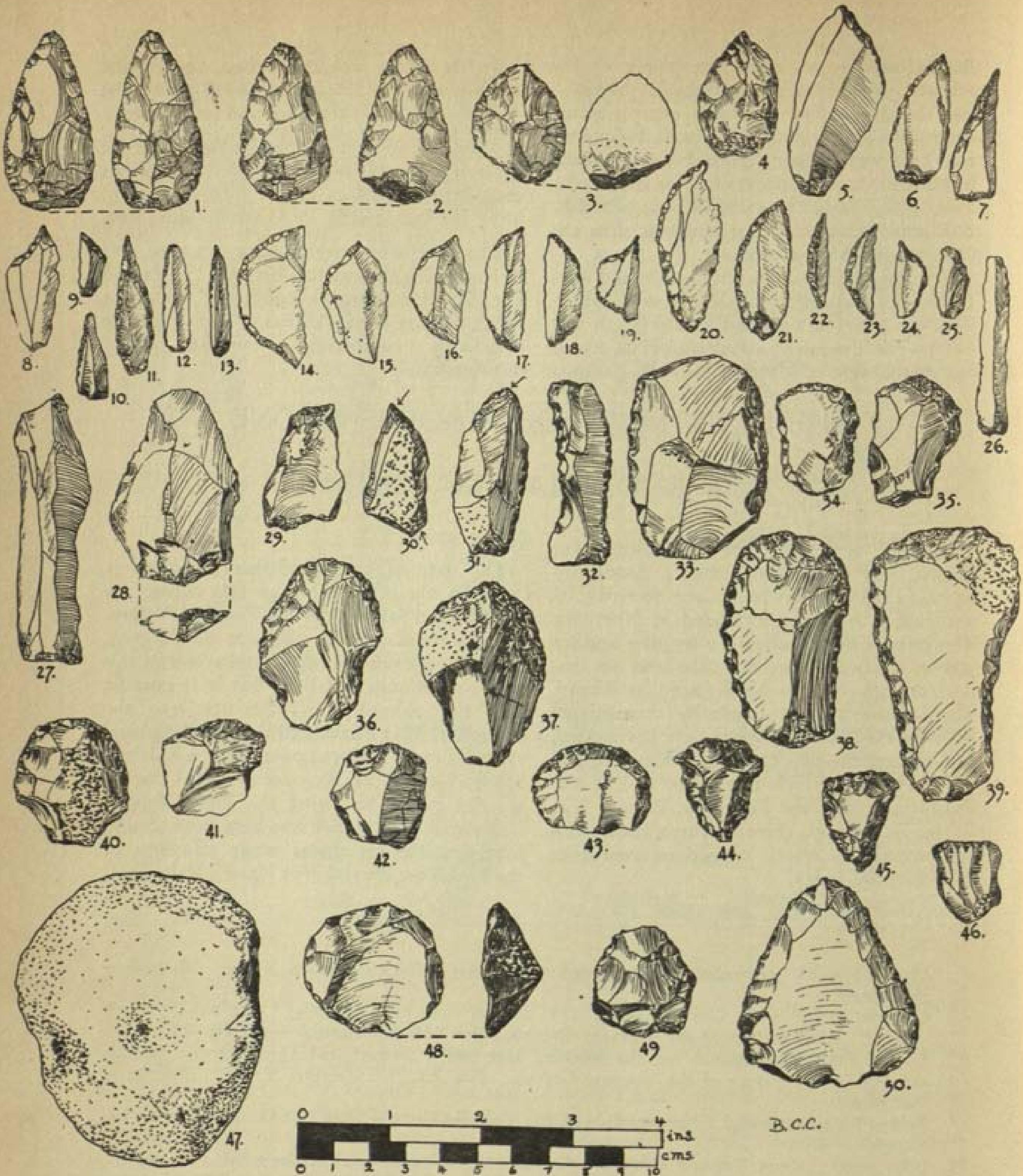

Plate 18. Rhodesian Magosian Culture

the Magosian must date to the time immediately following the Third Pluvial. Should, however, subsequent work show that the accumulation of the Kalahari Sands II is later than the deposits of the First Post-Pluvial Wet Phase, then the Magosian must also be later, and the calcareous alluvium would accordingly represent the last aggradation phase of the Third Pluvial.

The Sawmills industry occurs in a red, sandy hillwash which overlies a red alluvium (Jones 1944 loc. cit.). The latter is correlated by Bond (1946, p. 104) with the calcareous alluvium in the Zambezi, which he further equates with the Makalian Wet Phase. If this correlation is substantiated then the Magosian and Kalahari Sands II must be Post-Makalian.

Plate 18. RHODESIAN MAGOSIAN CULTURE

1. Fine bifaced point in transparent chalcedony— thickness at mid-point 4mm. Jafuta Farm, south flank of Masue Valley. K. R. Robinson Collection.
2. Bifaced point — thickness at mid-point 6mm. (as 1 above).
3. Unifaced point (as 1 above).
4. Unifaced point. In redeposited Kalahari Sands II, Beaton's Farm. Sinde Valley.
5. Truncated flake-blade. Jafuta Farm, south flank of the Masue Valley.
6. Truncated micro-blade from north flank of the Masue Valley, below the old railway cutting. K. R. Robinson Collection.
7. Microlithic backed-blade. Under redeposited Kalahari Sand II, Knight's Drive. Site Z.B.40. Zambezi Valley.
8. Truncated microlithic blade (as 6 above).
9. Truncated microlith. Site Z.L.40. Zambezi Valley.
10. Backed blade (as 9 above).
11. Backed blade. Site Z.B.48.
12. Obliquely backed blade. Jafuta Farm (as 5 above).
13. As 12 above. Site Z.L.40.
14. Trapezium. Jafuta Farm (as 5 above).
15. Trapezium (as 4 above).
16. Trapezium (as 5 above).
17. Trapezium. Site Z.L.40.
18. Trapezium. Site Z.B.48.
19. Eared trapezium (as 6 above).
20. Backed blade. Site Z.L.40.
21. Backed blade. Site Z.F.39.

22.-25. Microliths. Site Z.L.40.

26.-27. Utilised blades. Site Z.L.40.

28. Typical flake from prepared core with faceted striking platform. Site Z.B.48.
29. Double-ended *outil écaillé*. Fifth Gorge. Site Z.V.43. Zambezi Valley.
30. Double-ended bec-de-flute burin. Site Z.F.39. Zambezi Valley.
31. *Bec-de-flute* burin and end-scraper. Site Z.F.39. Zambezi Valley.
32. Serrated hollow scraper on blade. Site Z.B.48. Zambezi Valley.
33. Double side-scraper on end-flake. Site Z.B.48. Zambezi Valley.

34.-35. Short end-scrapers on end-flakes. Site Z.B.48. Zambezi Valley.

36. End-scraper on prepared flake. Site Z.B.48.
37. Short end-scraper. Site Z.F.39.
38. End-scraper on the butt-end of a flake-blade. Site Z.B.48.
39. End- and side-scraper. North scarp, Natebe site. Maramba Valley.

40.-45. Short end- and thumb-nail scrapers. No. 40 from Site Z.B.48, the remainder from Z.F.39.

46. Small conical blade core. Site Z.B.48.
47. Anvil and hammer stone with dimple scar. Site Z.C.48. Masue Valley.

48.-49. Struck and unstruck disc cores. Site Z.F.39.

50. Struck sub-triangular prepared core. Jafuta Farm (as 5 above).

All of chalcedony and in fresh condition.

Geological Horizon

Immediately following the Third Pluvial?

Climate.

Arid.

Implements (Plate 18)

The culture represents, technically, a fusion of a developed Middle Stone Age with a Late Stone Age technique. The Middle Stone Age element is characterised by diminutive disc and sub-triangular cores, together with the flakes struck from these cores, worked into all the characteristic tools found with a typical Middle Stone Age material culture. The Late Stone Age element is provided by the blade-producing cores and the microliths.

As no recent detailed account of the Rhodesian form of the Magosian exists, it will not be out of place here to describe the industry as found in the Zambezi Valley and then to compare it with that from Sawmills.*

Sites occur both within the valley and on the sand-scarps.

Points: Both unifaced (Plate 18, Nos. 3 and 4) and bifaced (Plate 18, Nos. 1 and 2) points occur. These are always small, between 1 and 2 inches (2·5 and 5cm.) long, usually sub-triangular in shape. The secondary working on the unifaced examples is mainly confined to the edges of the tool. These points have been made from sub-triangular flakes with converging flake-scars on the upper surface and well faceted striking-platforms. Resolved flaking predominates over pressure flaking.

Points are rare in the Zambezi. On the north side only half a dozen poorly-made points have been found, while on the south side of the river there are more, and some typical specimens occur on the scarp sites though they are still a rare tool here.

Backed Blades and Microliths. These two types of tool are grouped together, as the larger specimens grade imperceptibly into the true microliths, so that any rigid division into macrolithic and microlithic would be an artificial one.

The larger specimens are produced either from flake-blades or from true blades. The backing may either truncate the blade (Nos. 5 and 6) or else be carried down its whole length, to produce a blade with curved back or Châtelperron type (No. 20). It will be seen from the specimen illustrated, therefore, how the Stillbay backed-flake grades into the truncated flake-blade, and so into the true microlithic backed blade, by a gradual process of diminution in size and specialisation in the production of blades.

The microliths themselves are almost always larger than those found with the Northern Rhodesian Wilton and are of the following kinds:

1. Truncated blades; these forms have been noted from the Wilton at Mumbwa (Clark 1942 op. cit.) (Plate 18, Nos. 8, 9, 12 and 13).
2. Trapezes; these are a derivative of type (1), in that the butt end has now been removed by snapping the blade across, or by reduction of the bulb and platform, then backing the lower end also. This is an entirely typical form (Nos. 14-19).
3. Backed blades; the backing being evenly convex; more rarely, straight backing also occurs. The bulb and platform may either be left or may be trimmed away. In the smaller, more pointed forms it has usually been removed. The majority of microliths are of this type (Nos. 7, 10, 11, 24 and 25).
4. Crescents; both large and small crescents and lunates occur, down to ½ inch (12mm.) in length (Nos. 21-23).
5. Backed blades showing retouch on the cutting edge. A few specimens are found which show Kasouga-flaking down one face of part or all of the cutting edge. This working is presumably the result of utilisation but the exact manner in which it was produced is not yet known.

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* Since the above was written, a good description of the Magosian from Khami, Southern Rhodesia, has been published. Jones, N., and Summers, R.F.H., 1949. I am grateful also to Mr. Summers for a comparative series from this site, which typologically represents an early form of the Magosian.

The backing of 98 per cent. of the microliths is produced by fine pressure flaking from the under- or main flake-surface of the tool. This working is flat, and curls gently over on to the upper surface of the blade. The other 2 per cent. of blades show vertical backing from one or both sides, to produce a somewhat clumsy tool with wedge-shaped section. Occasional " eared " microliths are also found (Plate 18, No. 19).

Burins. Typical *bec-de-flute,* polyhedral and single-blow burins are fairly common; very rare angle-burins of the oblique, straight variety also occur, though it is possible that these last may well be fortuitous. The *bec-de-flute* burins may be simple or double, and are made either on a piece of a flake-blade or on any convenient fragment (Nos. 30 and 31).

Scrapers. The larger scrapers (made on flake-blades, or flakes with faceted striking-platforms) are side- and end-scrapers on end flakes (No. 36) single, double (No. 33) or composite; butt end-scrapers on faceted flakes; hollow and notched scrapers on flakes and blades (No. 32); and, more rarely, core-scrapers.

In addition, however, there also occur end-scrapers on flake-blades and blades (Nos. 38 and 39); short end-scrapers on broad flakes (Nos. 34, 35, 37 and 40); large thumbnail (Nos. 41-43) and a few duckbill scrapers (Nos. 44 and 45). One variety of thumbnail-scraper is short and fan shaped, while another shows working down both side-edges of the tool in addition to that on the scraping edge. On these latter, the butt has been reduced by secondary retouch on the edges, to produce a sub-triangular-shaped scraper. The battering sometimes present on the edges is probably due to hafting. It should be noted that similar battering is not infrequently seen on Smithfield B scrapers.

Utilised Blades (Plate 18, Nos. 26 and 27). A number of longish blades 2 to 3 inches (5 to 7·5cm.) in length show signs of utilisation down one or both edges, but usually no deliberate secondary retouch. They were possibly used for cutting, sawing and scraping purposes. They show signs of fine Kasouga retouch and very fine nibbling or serrations, though the latter are rare.

Outils Ecaillés. These are the typical fabricators, and are made either on a fragment of a flake or on a discarded blade core. They are usually single-ended; the characteristic écrasé scars are always prominent (No. 29).

Anvil and Hammer Stones (No. 47). Usually any convenient river-pebble was used as a hammer-stone. The anvils are interesting in that they not infrequently show a small centrally placed circular depression on the flat working surface, which van Riet Lowe (1946) has shown to be an essential adjunct to the bipolar technique.

Rubbers and Grindstones. Several of these have been found. The grindstones are usually flat slabs of sandstone about 6 inches (15cm.) or less in greatest diameter, with one or sometimes two grinding surfaces, which on some specimens may be very slightly concave.

Grooved Stones. One block of sandstone from Site Z.L.40 shows one rubbing surface, and a number of shallow grooves which can only be due to rubbing-down bone, or perhaps hardwood points. This is as yet the only evidence of the use of bone-tools by the Magosian peoples, unless certain blades which suggest use for scraping bone can also be cited.

Bored Stone. The broken half of a small bored stone was found resting on the rubble bed in the proximity of site Z.L.40. There is no particular evidence to associate it with the Magosian living site; though it is of interest that the lowest of the Late Stone Age occupation levels in the Nachikufu Caves (tentatively equated in point of time with the Zambezi Magosian) yielded a number of bored stones.

Pottery

It is not unusual at the sites on the eroded slopes of the sand-scarp to find small, much-weathered fragments of pottery. It is as yet uncertain whether these should be considered as forming an integral part of the Magosian material culture. They have not yet been found *in situ*, so that, until sherds are found in indisputable association, it is possible to note only that the makers of the Magosian culture in the Zambezi may possibly have used pottery. The writer is of the opinion that the pottery must be considered to be of later date, and that the association with the Magosian on the sand-scarp is not a true one. Bearing this out, a few of the sherds show decoration which is always of the traditional R.I. form, though they sometimes also show evidence of staining by iron oxides. Excavations show that no pottery is ever associated with the Magosian in a sealed site.

Technique

The commonest form of prepared core is discoidal, small (1½ inch, 4cm., in diameter) and usually shows flat, careful preparation of the upper surface (Nos. 48 and 49), but occasional sub-triangular specimens of equal workmanship also occur (No. 50). On an average approximately one-third of the cores found are prepared, and the remainder are blade and flake-blade cores, but it is almost impossible to generalise on this point as almost every Magosian assemblage is different. The blade and flake-blade cores usually show one platform, sometimes two at opposite ends of the core, but rarely more (No. 46). The circular-platformed, conical core occurs but is not common in the Zambezi.

The larger specimens (up to 3 inches, 7·5 cm., in length) were probably worked in the usual way by direct percussion, but the smaller cores (some of which go down to ¾ inch, 18mm., or less in length) must have been struck by bipolar technique, using a wooden or stone anvil. With a wooden anvil flakes would be removed only from the upper end of the core, but using a stone anvil the result would be a typical double-ended bipolar core, though these latter are not particularly common.

The industry from the Umgusa at Sawmills compares closely with the Zambezi form of the Magosian, with the exception that points are rare in the Zambezi while at Sawmills, although they are not common, this type of tool is sufficiently well represented. Burins are present and of the usual forms, the *outils écaillés* are made usually on the end of quartz crystals. The commonest tools are backed blades and microliths, always large when compared with the Wilton: both curved- and straight-backed forms occur as well as truncated blades, trapezes and, rarely, triangles; crescents, some of them " eared ", are also typical forms; there also occur a few double-backed microliths. The scraper forms are again similar to those found in the Zambezi—end-scrapers on blades and flake-blades, short end- or round-scrapers, a few side-scrapers on end-flakes and core-scrapers or trimming-stones, and thumbnail-scrapers of the two forms found in the Zambezi, the only difference being that the battering on the under sides of some of the Zambezi examples is not seen on those from Sawmills. The core and flake forms are almost identical.*

As we have seen, the Magosian as a culture had a comparatively long existence, from the beginning of the dry period at the end of the Third Pluvial, persisting throughout the whole of this arid phase and into the succeeding wet phase. During this time it was undergoing a gradual change. The earliest, sub-sand, industries are fairly closely allied to the Rhodesian Stillbay; but in its final form the Magosian is an industry undoubtedly directly ancestral to the Northern Rhodesian Wilton. The writer was previously of the opinion that the Magosian was the outcome of culture contact between the established Middle Stone Age peoples and migrant people of Late Stone Age (Bush) stock; thus accounting for the introduction of the microlithic technique and the changed economic conditions which this implies. There is now a considerable weight of evidence, however, that points to the hypothesis that the

* Typologically the Zambezi Valley Magosian with its preponderance of blades and blade-cores is more developed and later than the Khami Magosian where the blade and microlithic element is uncommon. It is more closely comparable with the Magosian described by Malan from the Okavango River, on approximately the same latitude as the lower reaches of the Zambezi. (Malan, B.D., 1949.)

Magosian was not the immediate result of culture contact of this nature, but that it was the inevitable outcome of a developed Middle Stone Age; the supersession of the Middle Stone Age spear by the Late Stone Age bow and arrow could equally have been the result of diffusion of a culture-trait as of a direct migration of peoples. The development of the microlithic backed-blade, from the crudely-backed flakes of the Stillbay to the finely-finished microliths of the Wilton, can be seen in all its stages in the Zambezi Valley, the intermediary forms being provided by the truncated blades and trapeziums and large crescents of the Magosian. The differences between the Magosian industries may be explained by the fact that they represent regional forms, but it must also be remembered that such differences, if sufficiently localised, may represent earlier or later forms of a steadily-developing and long-lived culture. Particularly must this be true of differing industries in a comparatively limited natural area, such as the Southern Plateau in Northern Rhodesia, or the Matabeleland Plateau in Southern Rhodesia. Whether this cultural development was assisted or determined by the introduction of new "racial" elements into the sub-continent cannot as yet be determined with any exactitude, and will not be until the physical anthropologists have decided whether the Bush physical type developed from the Boskop. The foregoing does, however, help to show that culturally the Magosian could have been and almost certainly was the direct outcome of the Middle Stone Age, and the immediate ancestor of the Late Stone Age Wilton industries.

THE NORTHERN RHODESIAN WILTON

The type site is the Mumbwa Caves which are situated approximately 125 miles (240km.) west-north-west of Lusaka. The industry from this cave has previously been described and illustrated by the writer (Clark, 1942). It was found to consist of numerous rather large and rather clumsily-made crescents and backed-blades in crystalline and semi-crystalline quartz and some chalcedony; scrapers were rare, but a few typical thumbnail specimens occurred. The industry also included a few small, quartz pestle-stones, four polished axes and five fragments of bored stones. Bone-tools were practically unknown, and ostrich eggshell beads were entirely absent, though some mollusc shell (Unio) beads occurred. The industry is divisible into two parts; an earlier, when only stone tools were used, and a later, when pottery and rare iron objects occurred. It is, however, possible that the latter may have to be ascribed to a Bantu occupation of the caves. There were no paintings. The faunal remains from the Wilton layer at Mumbwa are all of typical grassland species, showing very little variation from those found in the district today. The Mumbwa industry shows clear affinities with the Southern Rhodesia Wilton sites, but is of considerably less developed form than the Matabeleland Wilton. Typologically it represents an earlier expression of the Wilton complex, and is presumed to be the ancestral form of the Southern Rhodesia Wilton. It persisted, little modified, north of the Zambezi, alongside this more evolved form in the south.

The Wilton from the Zambezi Valley closely resembles that from Mumbwa, while in Southern Rhodesia the industries appear to take on a more developed appearance the further south they occur. The Wilton from the rock-shelter at Bumbusi,* near Wankie, is closely analogous to the Northern Rhodesia Wilton, while that from Bambata is typologically transitional between the Bumbusi Wilton and the developed forms from the type sites of Nswatugi and Madiliyangwa (N. Jones, 1933).

In the Upper Zambezi Valley a number of Wilton sites are known, and, on stratigraphical and typological evidence, the culture may be divided into an upper and a lower Wilton.

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* Examined by kind permission of Mr. Roger Summers of the Bulawayo Museum.

The Lower Northern Rhodesian Wilton

Stratigraphy

This is as yet known only from two sites in the Zambezi Valley. One is situated at approximately 12 miles (20km.) up-river from Livingstone, and here some 3 feet (90cm.) of redeposited, dirty, white Kalahari Sand covers a Wilton occupation site, resting on the sands forming the upper part of the Younger Gravels terrace. The second site is half a mile (800m.) downstream from the Forestry Department house at Katombora. Here between 3 and 1 foot (90 and 30cm.) of dirty, wind-blown sand covers a fairly extensive occupation site, which again rests on the terrace of the Younger Gravels. No fauna is preserved.

These industries clearly post-date the formation of the calcified sands overlying the Younger Gravels, since they rest upon them, while it would appear that they must be dated to a climatic phase earlier than the present one, as they are covered by wind-blown sands which are certainly later than the Kalahari Sands II containing the Magosian, and which are not being formed to-day.

Geological Horizon

The end of the First Post-Pluvial Wet Phase.

Climate

Semi-arid.

Implements (Plate 19, Nos. 34-65)

These are all quite fresh and unpatinated and are made from local chalcedony. The tools lie scattered on the land surface under and, in some instances, within, the overlying sand, and are found associated with quantities of factory débris.

The Katombora site was a home- and factory-site which overlooked what must have been marshy ground or a shallow lagoon, between it and the river about half a mile (800m.) distant.

Microliths. The most characteristic form is a rather large crescent, about an inch to an inch and a quarter (25 to 30mm.) in length, and symmetrically shaped (Nos. 57-62). The backing has been directed usually from the under surface of the tool, but retouch from both faces is not infrequently met with, down part or the whole of the back. These crescents show the typical wedge-shaped section characteristic of Wilton microliths.

Numbers of smaller crescents and backed blades are also found down to ½ inch (12mm.) in length (Nos. 49, 51, 53 and 54). Variants on the above forms are a few straight-backed microliths, similar to those found with the Magosian (Nos. 63-65), and rare microlithic triangles (Nos. 50 and 52). Very seldom, if ever, is the working at the butt end carried over on to the working edge. There occur also a few thick, crudely made crescents and backed-blades about 1½ inches (35mm.) or less in length; some show signs of Kasouga retouch at the middle or down the length of the working edge, usually on the under side of the tool (Nos. 55 and 56). Their use is problematic and will be discussed when considering the upper Northern Rhodesian Wilton. No double-backed microliths have been found.

Scrapers. These are of two kinds:

(*a*) Delicately-made short end-scrapers on flake-blades or blades, the working edge being always on the end of the blade opposite the butt which is left unworked. The scraping edge is evenly convex, but sometimes the working may also be continued down the length of one edge (Nos. 46 and 47).

(*b*) Thumbnail scrapers into which the scrapers of type (*a*) grade—the working end is usually convex but sometimes straight (Nos. 42-45).

Burins. True burins are rare, but two apparently true angle-burins have been found at Katombora. The usual rather debatable single-blow and *bec-de-flute* burins occur (Nos. 40 and 41).

Outils Ecaillés. These are single or double ended and are made on any convenient worked-out core, flake or fragment. There is little to distinguish them from the specimens found with the Magosian except their size.

Utilised Blades. A number of microlithic blades are found with evidence of utilisation down one or both edges, but no secondary retouch.

Discs. Three flat discs occur, typical of those found with the Magosian. Two of these specimens show signs of patination and may therefore be derived; but there can be little doubt that the third, with a diameter of 1 inch (25mm.), is associated (No. 38).

Miscellaneous. Included are one well-made, double-ended rubbing-stone (No. 48), an anvil-stone, and several utilised primary flakes. No points, ostrich eggshell or mollusc shell beads, bone-tools or pottery occur.

Cores (No. 34). These are almost all for the production of microlithic blades, and comprise cores showing one platform (straight, semi-circular or circular, i.e., conical, core); flat cores with two platforms, on opposite ends, indicative of the use of bi-polar technique; or knobbly cores with three platforms, these last being fairly common. No prepared disc-cores were recovered with the exception of the discs described above which might doubtfully have been used as cores.

Flakes and Blades. Besides the two main forms of redirecting flake (down the length of the core at right angles to the platform, and in the same plane as the platform to remove the whole or part of the platform) there occur the usual broad and thickish primary flakes, with plain and inclined striking-platforms, which represent the flakes removed in reducing the core to workable proportions.

There also occur, however, very rare flake-blades and one small specimen with parallel flaking which shows preparation of the striking platform. These are considered to preserve the Magosian tradition (Plate 19, No. 36).

The multitude of microlithic flakes and blades require no description, and are typical of those found with any Southern African Wilton assemblage.

These two Wilton sites in the Zambezi Valley must be considered to represent the earliest true Wilton assemblages that have yet been found in the Rhodesias. They still preserve in the size of the microliths, the very rare discs and the faceted flakes, the Magosian tradition from which they are directly derived, though the *tout ensemble* is unquestionably that of a true Wilton.

The Upper Northern Rhodesian Wilton

A number of sites have been located in the Zambezi and its tributary valleys and a few are known also from the plateau. In the valley sites the material is predominantly chalcedony, and on the plateau semi-crystalline quartz was used. Barotseland and the Kalahari Sands have yielded some Wilton sites along the Zambezi itself, but none has ever been found in the sand areas.* This absence is not greatly to be wondered at, as stone of any kind is entirely absent from large tracts of Barotseland, so that the Late Stone Age hunters who (even if only seasonally) undoubtedly must have frequented an area so rich in game and water, must have substituted wood or bone or some other impermanent material for stone, to supplement a few carefully-guarded stone implements which would have been carried in from a distance.

The typical form of the Upper Wilton is that already described from the Mumbwa Caves, but the industries from the Upper Zambezi show several interesting variations due, no doubt, to their riverine nature.

Stratigraphy

The distribution of the Wilton sites in the vicinity of the Victoria Falls is marked on the map (Fig. 3, p. 4). In every instance it will be seen that they lie on the calcareous sandy alluvium of the First Post-Pluvial Wet Phase, or on earlier deposits surrounding the black alluvium. Sites are never found overlying the black alluvium, so that it must be presumed that this deposit was in process of formation at the time the Wilton people inhabited the area. It is considered to have formed in marshy ground, probably in shallow creeks and dambos, which were subject to seasonal flooding by the river. Around the edges of these creeks and dambos the Wilton people had their camps. Judging by the extent and amount of occupation material, these camps were of an impermanent

* One unassociated microlithic crescent was found by the writer, eroded from sand in the valley of the Machili River at the Forest Station of Machili, Eastern Barotseland.

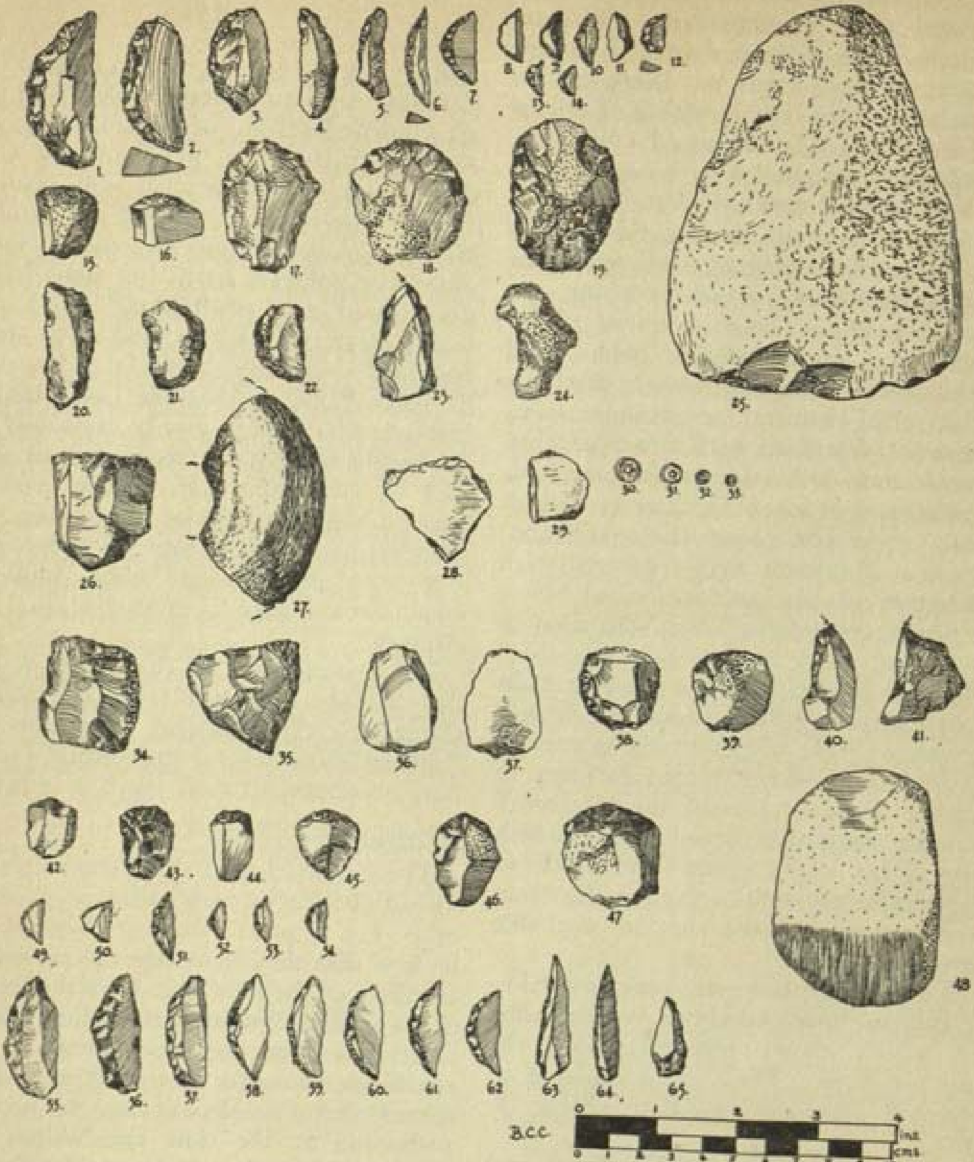


Plate 19. UPPER NORTHERN RHODESIAN WILTON CULTURE Nos. 1 — 33.

1.-3. Large backed blades. Nos. 1 and 2 with Kasouga retouch. Nos. 1 and 3 from Site Z.S.39. No. 2 from Site M.J.2.39. Zambezi Valley.

4.-14. Microlithic backed blades and crescents. No. 4 from site Z.J.2.39, and the remainder from Z.S.39. Zambezi Valley.

15.-16. Thumb-nail scrapers. No. 15 from site Z.D.38. No. 16 from site Z.S.39.

17.-18. Short end-scrapers. No. 17 from site Z.D.38. No. 18 from site Z.U.39.

19. Round scraper or trimming stone from site Z.S.39.

20.-22. Crude backed blades with Kasouga retouch. Site Z.J.2.39.

23. *Bec-de-flute* burin. Site Z.J.2.39.

24. Strangulated scraper from ¼ mile upriver from site Z.G.39.

and seasonal nature, and it is suggested that they formed the fishing camps of these hunters who, when the river began to recede after the flood, eked out their diet with fish —caught most probably by building weirs, supplemented by reed-traps, and by spearing. A very few sites also occur on the sand scarp about ½ to 1 mile (800 to 1600m.) distant from the river, and one site has been found on the plateau surface (once the old river bed) above the Fifth Gorge.

The majority are surface sites, the tools being derived from the surface levels of the calcareous alluvium covered by a few inches of humic soil. However, near the entrance to the Livingstone Game Park along the bank of the river, there are midden sites which have yielded faunal remains in addition to cultural material.

Geological Horizon

Second Post-Pluvial Wet Phase and Present Phase.

Climate

Semi-arid.

Implements (Plate 19, Nos. 1-33).

Microliths. These comprise the usual crescents and backed blades as well as a very few triangles, trapezes and "eared", or concave-based, microliths (Nos. 4-12).

The most characteristic and common tool is, however, a rather large and clumsy crescent, usually made on a thick wedge-shaped flake or blade, with backing which has been worked from one or both sides (Nos. 1-3 and 20-22). These vary in length from ¾ inch to nearly 2 inches (1·8 to 5cm.). The cutting-edge often shows squamous flaking, or Kasouga retouch, on the underside—sometimes also on the upper face. It is difficult to know what such tools were used for; they did not occur at Mumbwa and there seems to be little doubt that they are connected in some way with fishing; whether they can have served as scrapers for smoothing down reeds or withies, for shredding down bark or sansaveria fibre, or for some other purpose must as yet remain conjectural.

Scrapers. Thumbnail scrapers are rare, but a few typical specimens occur at most sites—that at the Eastern Cataract of the Victoria Falls (Z.D.38) in particular (Nos. 15 and 16).

There are also found a few short end-scrapers (No. 17 and 18), hollow-scrapers, and side-scrapers on flake-blades and blades. Occasional elliptical or oval core-scrapers or trimming-stones are also represented (No. 19). A type of waisted hollow-scraper or double hollow-scraper is also occasionally found in the Zambezi Valley. No very typical examples of these tools have as yet been found on any of the Wilton sites, but they occur at several localities in the vicinity of the Victoria Falls, usually where the Younger Gravel is exposed along the banks of the river. They are fresh, frequently made on part of a Middle Stone Age

25. Pecked and polished stone axe. Max. length 12·2cm., max. width 9·3cm. Width at cutting edge 8·2cm. Thickness at central point 4cm. Material — basalt. Site Z.U.39.
26. Single-platformed blade core. Site Z.J.2.39.
27. Fragment of bored stone. Site Z.F.39. Material — basalt.
28.-29. Potsherds. No. 28 from site Z.U.39. No. 29 from site Z.S.39.
30.-33. Ostrich egg and mollusc shell beads.

All stone tools in chalcedony except Nos. 25 and 27. All fresh.

LOWER NORTHERN RHODESIAN WILTON CULTURE. Nos. 34—65.

34.-35. Double-ended micro-blade core.
36.-37. Diminutive flake with faceted right-angled striking platform.
38.-39. Diminutive disc.
40.-41. Angle-burins.
42.-47. Thumbnail and short end-scrapers.
48. Rubber.
49.-65. Microliths.

All from Katombora site, Zambezi. All in chalcedony (except 48 in quartzite) and all fresh.

flake, and must be ascribed to the Late Stone Age (No. 24).

Burins. Single blow, *bec-de-flute* and rare, polyhedral burins occur, as also microlithic forms of the first two.

Outils écaillés. Typical.

Grindstones, Rubbers and Pestle-stones. One large basalt boulder with a shallow grinding surface on one side was found in the midden site (Z.U. 39), and a portion of another was found at site Z.S.38. Most sites have yielded one or two small rubbers and pestle-stones.

Polished Axe. One good specimen was recovered from the midden site (Z.U. 39). When found it was almost entirely covered by a thick coating of calcium carbonate, as are all artifacts and bone from this site. On cleaning, however, it was found to consist of a sub-triangular polished axe of basalt, with a cutting edge badly broken by use, for which cause, no doubt, it was discarded. The method of manufacture could be clearly seen. A conveniently shaped pebble of basalt was chosen, and was probably reduced by free primary flaking. It was further reduced by pecking; the edge and lower portion of the tool were then ground and polished. It can also be seen how an attempt was made at further reducing the tool, after the edge had been shattered. The shattering is confined largely to one face, which suggests that the specimen may have been used as an adze or a hoe rather than as an axe (No. 25).

This is the only polished axe so far recovered from the Zambezi. Such axes are always rare when found with the Wilton, but they are an essential part of the material culture of the Late Stone Age industries in our North-Eastern Zone.

Bored Stones. No bored stones have as yet been found on Wilton sites in the Zambezi Valley. The broken fragment from site Z.F.39 on the sand-scarp should probably be ascribed to the Wilton, and a second fragment in basalt (?) from the Ngwesi is also ascribed to this culture. Both these specimens show hour-glass perforation, and were approximately spherical. The dimensions of the former (as far as can be estimated) are: maximum exterior diameter 9cm., minimum diameter of bore 2·8cm., maximum diameter of bore 4·7cm., height 5·2cm. The dimensions of the second one are: maximum external diameter 10·6cm., minimum diameter of bore 3·3cm., height 4·5cm. (No. 27).

Shell Beads. Both ostrich eggshell and mollusc shell beads occur—the latter being made usually from Unio shell. Beads vary in diameter from 10mm. to 4mm. The bore is of hourglass shape (Nos. 30-33).

Pottery. Several sites, including the middens, have yielded sherds of a thickish, red ware which occasionally shows evidence of comb-decoration. The paste is on the whole good, and the pots well fired. These sherds can be identified with those of Schofield's RI type and no doubt represent the remains of pots received by barter from a contemporary, more advanced people (Nos. 28 and 29).

Factory Débris. This comprises the usual assortment of cores (No. 26), primary flakes, hammerstones, etc., which show little variation from those described with the Lower Northern Rhodesian Wilton.

Art. As yet no painted rock-shelters or caves are known from the North-Western Zone. This is understandable in Barotseland, on most parts of the Southern Plateau, and where the Batoka basalts are found; but it is considered very likely that paintings will be found to exist in the Zambezi escarpment country and in the Gwembe Valley, and in fact one such shelter has already been reported, though not yet examined. It is to be expected that this art-style will prove to be naturalistic.

Human Skeletal Remains. These comprise the bulk of the material from the Mumbwa Caves, a fragmentary burial from the Maramba River, and further fragmentary remains from a cave at Leopard's Hill, about 30 miles (48km.) east of Lusaka, and from a cave at Chipongwe between Lusaka and Kafue.

The remains from the Mumbwa Caves were first described by Dart (1931) and later by

T. R. Jones (1940, pp. 313 and 319). The specimens are for the most part extremely fragmentary, the most complete being three partial crania. The determinable features of these remains are principally those of the Bush and Boskop types, as found in the later Stone Age in South Africa, but certain specimens show the intrusion of other physical characters which have not yet been identified.

In 1939 the writer discovered an important fossil burial close to the edge of the Maramba River, near the Nurseries for the Livingstone Game Park (Fig. 20). The burial, which was being eroded by a small water gully, was only about 10 feet (3m.) from the edge of the Maramba, owing to the gradual cutting back of the bank at this point by the action of the river. Many small fragments from a fossil cranium were found lying on the surface of the eroded side of the gully; these on examination proved to have formed part of the left parietal and occipital bones. The rain had done its work too well, however, and in spite of careful search the greater part of the right parietal and much of the frontal and occipital bones were missing. Excavation exposed the mandible and much of the maxilla, while the shafts of the long bones were also preserved. The body was buried in a contracted position, with the knees up to the chin and the arms flexed. It was lying on its left side, facing west. The head had, however, been tilted slightly, so that the face pointed at an angle towards the lower left side of the grave, and was thus preserved from erosion by the gully. At one time the burial must have been covered by as much as six or more feet (1·8m.) of earth, but nearly all of this had been removed by rain action. With the burial were found two Late Stone Age microlithic flakes. The bones were encrusted with a thick deposit of calcium carbonate.

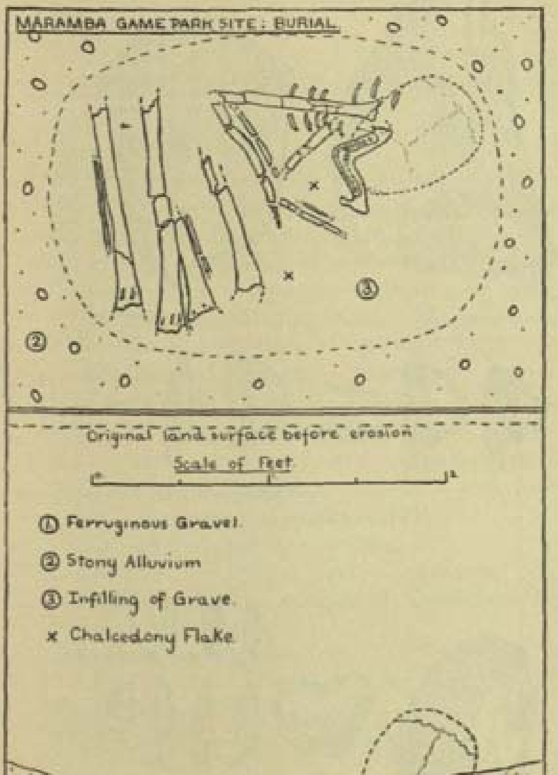


Fig. 20

The remains were submitted to Dr. L. H. Wells of the Department of Anatomy, Witwatersrand University. Dr. Wells says that they are comparable in extent, though not precisely in character, with that of the material from Mumbwa.

At Chipongwe the Italian Scientific Expedition (1929) recovered a partial cranium of Bush type from the surface of a cave in the Lusaka limestone series, together with other scattered bones and a few Wilton artifacts.

The skeletal remains from the Leopard's Hill Cave probably came from a layer about 9 feet (2·7m.) below the surface, in a guano partially consolidated into a cave-earth. The remains, which were identified by Dr. Wells, comprised the greater part of the occipital bone from a skull of Bush type. It had been found by a farmer while digging guano and was associated with numbers of partially and wholly fossilised animal bones. The edges of the human fragments are worn, which suggests that they had been detached from

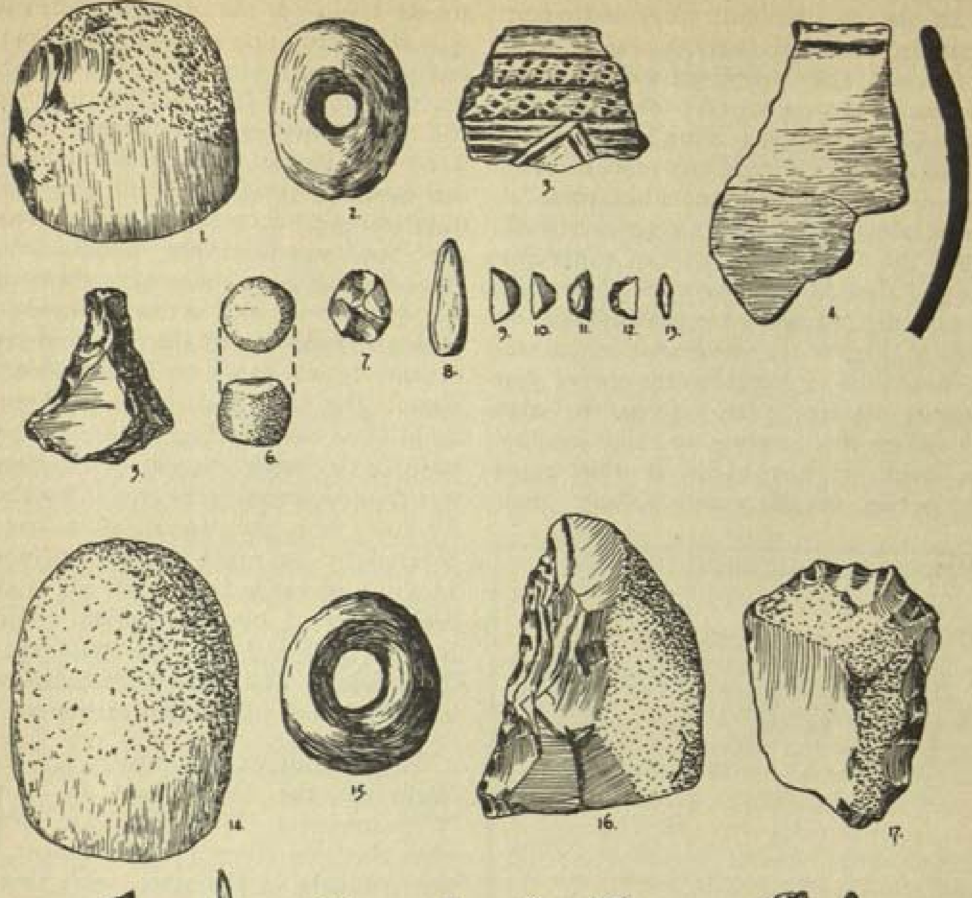


Plate 20. Nachikufan Culture

the rest of the skull for a considerable time. This is the reason, perhaps, why no further human skeletal remains were found at that level. These fragmentary remains indicate that the physical type to be associated with the Wilton Culture in Rhodesia is apparently Bush or Bush-Boskopoid. For a more detailed account of the fossil human remains see Appendix C.

Bantu Tribal Tradition

There is no tradition or legend of the co-existence of Bantu and Bush peoples in our North-Western Zone, but this must be qualified by the fact that the Bantu tribes inhabiting this area (most notably the Tonga of the Southern Plateau) have little or no history before the time when they were visited by David Livingstone; an exception are the Lozi of the Central Barotse plain.

It is possible that the BaTwa living in the Lukanga Swamp (Shekleton 1908 and Macrae 1929), in the Kafue Flats (Smith and Dale 1920, pp. 6 *et seq.*) and other areas in the Territory are the descendants of the original inhabitants; but if this is the case any physical differences have long since disappeared due to intermarriage.

There still exist, however, three or four scattered bands of Hukwe Bushmen in the extreme south-western corner of Barotseland (for the most part between the Mashi and Zambezi rivers) who still live predominantly by hunting. They are known as the Makwengo by the Shanjo and Lozi among whom they live.

Plate 20. NACHIKUFAN CULTURE

Nachikufan III, Nos. 1-13.

1. Polished axe — diorite.
2. Small bored stone — schist.
3. Sherd of red paste with impressed decoration from a pot with a simple rolled rim.
4. Sherd from a thin-walled fine pot of dark brown paste, undecorated except for a line below the rim; probably from a deep bowl.
5. Scraper of Smithfield 'N' type with opposed, concave edges. Material — chert.
6. Small cylinder of quartz, perhaps a lip plug.
7. Microlithic pseudo-disc core. Material — quartz.
8. Flat, tear-shaped piece of polished bone, possibly a lip plug.

9.-12. Microlithic crescents — quartz.

13. Double-backed microlith — chert.

All from Layer C, Nachikufu Cave 1.

Nachikufan II, Nos. 14-26.

14. Polished axe — diorite.
15. Small bored-stone — soapstone(?).
16. Crude side-scraper — quartzite.
17. Large end- and side-scraper — quartzite.
18. Strangulated hollow scraper of Smithfield 'N' type — chert.
19. Polished bone point.
20. Discoidal core scraper.

21.-25. Semi-circular, triangular and trapezoid microliths — quartz.

26. Micro-drill — chert.

All from Layer D, Nachikufu Cave 1.

Nachikufan I, Nos. 27-37.

27. Small bored-stone — schist.
28. Large end-scraper — quartz.
29. Side-scraper — quartzite.
30. Bipolar core utilised as an *outil écaillé*.

31.-35. Microlithic backed blades and crescents — crystalline quartz.

36. Micro-drill — chert(?)
37. Trapezium — crystalline quartz.

All from Layer E, Nachikufu Cave I.

NORTH-EASTERN RHODESIA ZONE

THE NACHIKUFU CULTURE

The industries from this zone are known largely as the result of surface collections, some excavation east of the Luangwa by D. Gordon Lancaster and F. B. Macrae, and the excavation by the writer in 1948 of the Nachikufu Caves near Mpika, west of the Luangwa and in the Muchinga Escarpment, and again in 1949 of Nsalu Cave, and a rockshelter at Bimbe wa Mpalabwe in Serenje District. The material from these caves has not yet been studied in detail and, as further excavations in this area are projected during 1950, the publication of the full results must wait for a later monograph. Several points have emerged from the preliminary studies, however, which may be set down here.

Stratigraphy

The Nachikufu Caves have yielded a maximum thickness in the area excavated of over 13 feet (4m.) of Late Stone Age deposit, which contained three different cultural horizons. These rested on a thin stratum containing a Middle Stone Age industry, which in turn rested on bed rock. These three Late Stone Age horizons are overlain by a Bantu occupation level. At Nsalu the lowest horizon contained a Magosian, overlain by the first and third of the Late Stone Age Industries of Nachikufu. Thus for the first time the form of industry which existed on the Tanganyika Plateau during the Late Stone Age is found stratified within a single deposit. This discovery has materially assisted in explaining the various, at first puzzling, surface industries from the same area. Stratified Late Stone Age middens on the shore of the lake at Mpulungu, Lake Tanganyika, have yielded the same tool assemblages.

Geological Horizon

Second Post-Pluvial Wet Phase and Present Phase.

Climate

Wet to semi-arid.

Implements

Macrolithic and microlithic elements are present in each industry. The lowest of the Late Stone Age horizons at Nachikufu contains the following tool-types (Plate 20, Nos. 27-37):

Very small pointed microliths and rare trapezes and triangles (Nos. 31-35 and 37).

Very small bipolar cores (No. 30).

Double-backed microliths, for the most part pointed rather than lenticular in shape.

Micro-drills; these are crudely pointed boring tools, which have had the points rounded and worn smooth by rotation in use (No. 36).

Grindstones, mullers and pestle-stones—the latter of the Smithfield rather than of the Wilton type.

Haematite pencils with rubbed facets, and grindstones which have been used for grinding pigment.

Numerous fragments of bored stones—small and large and intermediate forms being represented (No. 27).

Anvil-stones with dimple-scarring, the direct result of bipolar technique.

Bone points, rare.

End-scrapers, crude side-scrapers or trimming stones and choppers (Nos. 28 and 29).

One fragment of a polished axe is also doubtfully to be ascribed to this horizon.

The middle layer at Nachikufu shows a considerable change in the microlithic element (Plate 20, Nos. 14-26):

Rare pointed microliths occur, but the characteristic forms are now large trapezes, triangles and semi-circular microliths which presumably were used as *tranchets* or transverse arrowheads (Nos. 21-25). The same mullers, grindstones and pestle-stones are found in quantity. There also occur:

Micro-drills (No. 26).

Haematite pencils and grindstones for pigment.

Dimple-scarred anvil-stones, some with scars on four surfaces.

Hollow and strangulated scrapers of Smithfield "N" type (No. 18) and some large trimming stones and choppers (Nos. 16 and 17).

Bored stones in quantity and varying sizes (No. 15).

Bone points (No. 19).

Bipolar and pseudo disc, microlithic cores.

Polished axes—the almost invariable form being sub-rectangular (No. 14), and adzes.

The upper layer was overlain and in some places effectually sealed by Bantu occupation.

The tool-types (Nos. 1-13) included small, well-made, semi-circular and crescent-shaped microliths (Nos. 9-12) and rare pointed forms (No. 13); grindstones, mullers and pestle-stones in quantity; polished haematite, bored stones (No. 2), anvil stones with dimple-scars, pseudo disc-cores (No. 7), bone points (with both circular and lenticular section), shell beads (a trace only); hollow and strangulated scrapers of Smithfield "N" type (No. 5); polished axes (No. 1) and adzes; pottery (Nos. 3 and 4)—mainly from thin-walled, spherical pots and bowls, with plain, rolled-over rims and no decoration.

While the industries from these three layers at Nachikufu and from Nsalu and Bimbe show certain Wilton affinities, yet the writer was dubious of describing them as Wilton. Accordingly type series from each of the three horizons at Nachikufu were recently submitted to Professor C. van Riet Lowe and Dr. L. S. B. Leakey, members of the Standing Committee on Nomenclature, set up by the Pan African Congress on Prehistory in 1947. They are both agreed that the assemblages present new characteristics and have accordingly recommended that a new cultural term be used to describe them. It is proposed, therefore, to use the term "Nachikufu Culture" I, II and III, after the site where typical industries were found in situ. These industries differ from the Wilton as found in Rhodesia in the type of microliths that occur (e.g., the large number of transverse arrowheads), in the quantity of bored stones of all sizes (nearly 100 specimens in all are reported from the three layers), in the comparatively large number of polished axes found,* in the number and form of the grindstones, mullers and pestle-stones, in the number of anvil-stones with dimple-scarring, the number of bipolar cores, in the macrolithic, heavy, end- and side-scrapers, and the hollow and strangulated scrapers of Smithfield "N" type. There is also a suggestion of certain new elements not yet fully identified. A small selection of tools from each of these occupation layers at Nachikufu is shown on Plate 20. The fauna associated with the Nachikufu industries is all of grassland-woodland type, such as is found also with the Wilton in the south.

As yet no skeletal remains have been found associated, apart from an ulna, a phalange and three isolated teeth.

The Late Stone Age industries are intimately associated with two further cultural manifestations: (1) a basic, naturalistic art tradition which is superseded by a schematic art style; and (2) grooved rocks near the banks of streams and rivers.

Art

A brief description with illustrations of several of the painted caves and rock-shelters has previously been given by Professor van Riet Lowe (1937) and by the writer (Clark 1939). They occur throughout the North-Eastern Rhodesia zone wherever the solid geology permits, and they are there known from Kilwa Island in Lake Mweru to Kasama, Lundazi, Fort Jameson, Mkushi, Ndola and Solwezi.

The naturalistic art-style is presumably the earlier, though no very clear superposition of the schematic style is known. Figures in this style are usually not so well drawn as those from Southern Rhodesia or the Union of

* The shelter at Nyazongo in the Penhalonga District of Southern Rhodesia provides an exception. Here 12 polished "axes" were found in association with a Wilton industry. (Martin, C., 1938.)

South Africa, and should perhaps be termed semi-naturalistic. However, a drawing of an eland in faded red pigment, discovered recently in a rockshelter at Zawi Hill about 20 miles (32km.) north-east of Fort Jameson, compares favourably with many of those south of the Zambezi (see Fig. 21).* It is closely similar in style to some of the Tanganyika paintings (Leakey 1936, cap. VIII, Kohl-Larsen, 1938). Both animal and human figures are known. The group from Nachikufu (Fig. 22) is representative of the style for the human figures. These naturalistic and semi-naturalistic paintings in black pigment at Nachikufu are followed by a completely different art style. There is apparently a sudden change to entirely stylised drawings—circles, ladders, strokes, capital U's and I's, crescents, tectiform designs and combinations of lines, dots and circles. Certain more complicated motifs are considered by some orientalists to represent a debased form of some kind of Arabic writing, drawn by illiterate or semi-literate persons, in imitation of some ornamental piece of decoration or writing. As yet it is impossible to date this art style, though it has been tentatively suggested that the main glyph on Fig. 23 may be a debased version of the Cufic word for "Allah", and date to the 12th century A.D. or later. The smaller glyph may be a corrupt form of "There is no God but God".

At Nachikufu this schematic style of painting is associated with the third and last of the Late Stone Age occupation layers.

In addition to the paintings there are engravings in the same style. They are known from one rockshelter, but more usually are found on flat, exposed rock surfaces near the banks of streams or rivers. Some of these have been previously briefly described by the writer (Clark, 1939, op. cit.).

It will be appreciated that these paintings and engravings are of the utmost importance as when more is known about them it may be possible to give a date in terms of years to the Late Stone Age in Rhodesia. A significant fact is that the distribution of this schematic art style appears to coincide with the known areas of Arab penetration of the sub-continent. Similar paintings occur in Tanganyika superimposed on the naturalistic art group (Kohl-Larsen, 1938, op. cit.), in the Katanga Province of the Belgian Congo (Dart, 1931), and in the district of Tete, in Mozambique (dos Santos Jr., 1931).

Grooved Rocks

There are four recorded localities where such grooves exist—on the west shore of Lake Bangweulu at the mouth of the Kasamba Stream, in the Ngona River at Cazembe's, near Kasama, and at Nsalu Cave; a number of other areas are also believed to exist. They are all in the immediate vicinity of water. The flat rock has in every instance been deeply scored by numbers of grinding-grooves. These grooves are segmental in section, about an inch deep and in shape are lenticular. They are identical with similar grooved rocks in the Gold Coast and other parts of West Africa and in the Kanda kanda and Kasenga regions of the Belgian Congo, where they were the result of grinding and polishing stone celts (Shaw,1944). At Nsalu the rock surfaces show two or more grinding grooves but in addition there are a number of portable grindstones showing identical grooving.

There can be little doubt that the new elements in the stone industry in our North-Eastern Rhodesia Zone are derived from the North-West—from the Katanga Province of the Belgian Congo and from further north, from the Congo Basin. The polished axes are usually of the rectangular, Katanga type and the large crescents and trapezes also have their counterpart in the Congo. The industry described by Mortelmans (1947) as Kasikian appears to contain elements similar to our Nachikufu industries, and he also records Smithfield elements from other areas of the Katanga. Of particular note are the Middle Smithfield type end- and side-scrapers found by van den Brande in association with an engraved stone (Breuil, Cabu and van Riet Lowe, 1944, p. 172).

* Printed before plates in separate section.

Scrapers reminiscent of Smithfield "N" forms have been found by Janmart (1946, pp. 56-57) in the Dundo area of North-Eastern Angola, and the fragments of schist engraved with schematic motifs (found with an industry the description of which sounds remarkably similar to that from Nachikufu) is of considerable importance, as it strongly suggests that in Angola also a schematic art-style is associated with the Late Stone Age industries.

FIG. 22. Semi-Naturalistic Paintings in faded black pigment from Cave No. 1 Nachikufu, Mpika District.

(Fig. 21 is printed as the first of the reproductions in half-tone towards the end of this volume.)

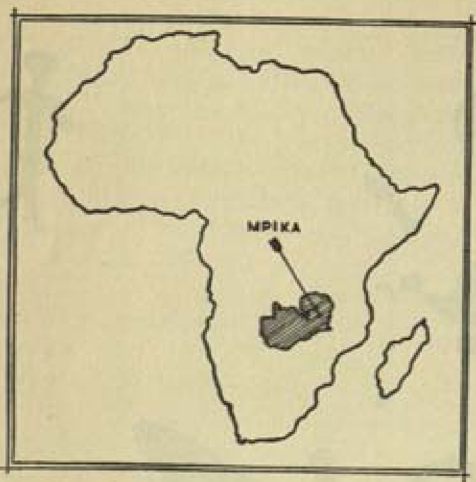


FIG. 23. Geometric Painting in faded red (vermilion) paint from Cave No. 2 Nachikufu, Mpika District.

Again scrapers of Smithfield " N " type are recorded from the Madinga District of French Equatorial Africa (Bergeaud, 1947), and a proto-Smithfield occurs in the Kavirondo district of Kenya.

The occurrence of these typologically Smithfield elements in our North-Eastern Rhodesia zone has considerable bearing on the question of the origin of the South African Smithfield Culture. As early as 1934 Goodwin (1934) suggested the possibility of a Rhodesian origin for the characteristic Smithfield " N " type of scraper; it would appear that, while occasional industries containing these elements occur as far south as the Victoria Falls and Mazoe, the centre of origin must now be placed further to the North-West in the Congo Basin. It is considered probable that diffusion routes led, on the one hand, through Angola to South-West Africa and the Free State, and on the other, across North-Eastern Rhodesia down the Luangwa Valley (and perhaps the Nyasa Rift) to Portuguese East Africa and Natal.* In the centre, in North-Western Rhodesia, Southern Rhodesia and the Transvaal, was the main Wilton Area.

Bantu Tribal Legend

There are three main areas in North-Eastern Rhodesia which have yielded records of the inhabitants prior to the coming of the present Bantu tribes, who all migrated from the Congo Basin. On Kilwa Island, near the south end of Lake Mweru are several paintings of the schematic art group. These were discovered recently by Mr. I. Cunnison,

* The hollow and strangulated scrapers from Natal are remarkably similar to those from North-Eastern Rhodesia and their relationship in one instance with a polished stone axe is perhaps significant. (Lowe, C. van Riet, 1947, pp. 325-331.)

to whom I am indebted for the following note. The present inhabitants say that these paintings are connected with the Butwa—the religious dancing of the Mbolela-pano, the original inhabitants of Kilwa, who are said to have been Pygmies. Mbolela-pano means " I rot here ", and the tale is that these men were small and had big heads. If you shook them they fell down and could not rise again because they were top heavy; it was in this way that they died out. The Mbolela-pano on Kilwa were all destroyed with the exception of one, Katemunwa, and his wife, in a fire lighted inadvertently by Kaponto of the Bwirile tribe on his arrival on the island.

In the Lala country in Mkushi district there are several legends of a small people known as the " Utunanukamafumo " or " Utalalamafaso ", who were renowned hunters of small stature and were living in Lalaland until some 80 years ago.

On the plateau east of the Luangwa River there is also a well-founded tradition among the Nsenga, Kunda and other tribes of the original inhabitants who were called the Bakafula. These people were small, bearded hunters who used bows and arrows and used to steal from their Bantu neighbours. Because of this habit of stealing the last of the Bakafula were killed in Nsenga country sometime between 80 and 100 years ago.

Again Mr. Cunnison informs the writer that there is a tradition of Pygmies west of Lake Mweru in the Kundelungu. They are known as " Utuntelemafuma " or " Utunku twa Mulungu " and are said to speak Chi-Bemba. The story told of these people is identical with that told by the Lala of Mkushi district.

Whether these people were Bushmen or whether they were Pygmies remains to be proved. All accounts agree, however, that they were small of stature. The reference to large heads and the reproduction of this characteristic in the rock paintings rather suggest that in the north they may have been Pygmies. Some support is also lent to this suggestion by the fact that six families of Pygmies were recently reported as living near the southern tip of Mweru Marsh or Mweru Wantipa. The tribal map of the Belgian Congo, published by the Tervueren Museum, shows three groups of Pygmies living between the northern end of Lake Mweru and Albertville, half-way up the west side of Lake Tanganyika, and one group at the south end of the Bangweulu Swamps in Northern Rhodesia.

THE RATE OF RETROCESSION OF THE ZAMBEZI THROUGH THE BATOKA GORGE

The gorge of the Zambezi below the Victoria Falls, termed the Batoka Gorge by Lamplugh (1908), zigzags for approximately 60 miles (100km.) through the Karroo basalt lavas, maintaining throughout this distance its trench-like character; then, still in the basalts, it suddenly opens out into the wide Middle Zambezi (or Gwembe) Valley, where the main river is joined by the Matetsi River (Plate 31 (2)). It is of considerable interest to attempt an estimate of the rate at which the Zambezi has cut its way back through this gorge, particularly if this can be related to past climatic phases and to the Stone Age cultural succession.

Armstrong and Jones (1936) first attempted to relate successive stages in the recession of the Victoria Falls with the cultural periods, but subsequent work has shown that much of their correlation must now be modified.

The geology of the gorge is well known as a result of the work of Molyneux (1905), Lamplugh (1907), Maufe (1929 and 1936), and others. Molyneux first showed that the gorge was due to river erosion and Lamplugh studied it at intervals throughout its course; he is, so far as is known, the only geologist to have done so. Later, Maufe was able to identify a number of former lips of the falls in that part of the gorge immediately below the Victoria Falls, and to show that the second and fifth of the five uppermost gorges had been eroded along faults with an appreciable throw. The jointing, "shatter-belts", and faulting can be clearly seen from the air; particularly in the lower reaches, where they are not obscured by Kalahari Sands, these faults can be seen stretching in a straight line for several miles across the dissected surface. The Zambezi Gorge and the tributary gorges are all eroded down such lines of weakness, and it cannot have taken any great length of time for the erosive force of the river to excavate one of these joints or faults, once any protective barrier of solid rock had been removed.

This is strikingly borne out by sections which are exposed in the canal way-leave, leading water from above the Eastern Cataract to the Power Station in the bottom of the Third Gorge. Here the northward continuations of the "shatter-belt" and fault (along which the line of the present Falls and of the Second Gorge respectively have been eroded) is exposed in the sides of the canal. These faults are filled with a loose, calcareous breccia of decomposed basalt, calcite and sand which is very friable and only loosely compacted. So friable is this deposit that it was necessary to cement the bottom part of the canal wall at these points in order to prevent a major collapse of the sandy breccia, which would thus have blocked the canal. If this is a true sample of the deposit which filled the faults along which the length of gorge has been eroded, then it can have taken very few years for the river to have opened up a new gorge. As Maufe has pointed out, the gorge was not eroded uniformly but by saltations. Erosion was reduced to a minimum when the river was flowing over a barrier of solid lava, but was greatly speed up when it had succeeded in cutting its way into a new fault line. Where these faults lie obliquely or at right angles to the direction of flow, as they do in the upper reaches, it is to be expected that the junction between the gorges and the upper river was effected by a waterfall; but where the faults lie sufficiently parallel to the direction of flow, as they do mostly in the lower reaches of the gorge, then this junction must have been effected by a line of rapids.

Judging from photographs taken by Messrs. Sykes and Percy Clarke in 1905-6, there has been no appreciable recession of the lip of the Falls since that time. Some undercut rock-masses have fallen since the present writer has observed the Falls, mostly after the very high flood of 1948; in particular a large undercut rock on Cataract Island just above the Devil's Cataract, disappeared at this time. In the gorge there was a substantial fall of rock from the north wall in the narrow channel above the Boiling Pot, and a similar fall on the south wall of the Fifth Gorge. There is no recognisable change in the cleft in Cataract Island, but the open joint (which is the extension of this cleft, running diagonally to the north bank) shows up clearly in air photographs, and is presumably being slowly deepened. At low-water it is possible to walk out from the north bank along the top of the Falls as far as Livingstone Island. The lip is much more broken and fissured than might be expected. Potholes 6 feet (1·8m.) deep or more are numerous, while the water has also opened joints which run back fifty or a hundred yards (45 or 90m.) from the lip, and for a few yards back from the lip itself are 10 to 15 feet (3 to 4·5m.) deep or more.

The opening up of cross-joints, which are abundant, has isolated and will continue to isolate and remove large areas of rock, but there is as yet no means of estimating the rate at which this is taking place today.

The sketch map (Fig. 24) of the Batoka Gorge, from the Victoria Falls to nearly as far as the confluence with the Kalomo River, was drawn from vertical air-photographs taken by the R.A.F. in 1947.* An attempt has been made to indicate fault-lines wherever these are sufficiently well marked; it will be seen how in the lower reaches the individual gorges become much longer and have been eroded for several miles at a stretch, directly along the fault-lines. In the photograph (Plate 30) taken in the course of an aerial reconnaissance survey, the river turns almost

* The writer is indebted to the Director of Surveys and Land, Livingstone, for permission to make tracings from these photographs.

at right angles to the left and so enters another gorge, while the fault along which it was eroded (marked by a line of tree growth) can be seen to stretch for several miles over the bare plateau surface. The sketch map also indicates the approximate distribution of the Kalahari Sands in relation to the gorge.

As far as the writer has been on foot down the gorge (a distance of approximately 18 miles, 30km.) the gorge maintains its character, as seen in any of the gorges immediately below the Victoria Falls. That is to say, the walls are either vertical (in the uppermost 7-9 gorges) or slope at a very steep angle to the river. There is no indication at all of any terrace or bench that is not of structural origin, and no gravel or artifacts, such as are found on the plateau surface at the top, occur within the gorge. The depth of water obviously varies very greatly dependent upon the bars and barriers across the stream. Varian (1934) states that under the railway bridge the deepest sounding at lowest water in 1906 showed a depth of 56 feet (17m.), and that the highest flood-marks found at that time were some 45 feet (13·8m.) above the lowest water-level; this makes the depth of water at flood-level approximately 101 feet (30·8m.). At other points, where rock-falls from the side of the gorge or barriers of harder rock obtrude, the depth must be appreciably less, though the flood-level would presumably remain uniform. The flood-platform is well seen at the confluence of some of the tributary streams and rivers, such as the Siababi (Fifth Gorge) and the Songwe (Seventh Gorge), and the high-water level is clearly marked throughout the length of the gorge by the beginning of the tree line. Below the tree line are only blackened rocks which are sometimes glazed.

According to Lamplugh (1908) the river falls approximately 1,000 feet (1,070 feet or 325m.) between the bottom of the Victoria Falls and the beginning of the gorge at the Matetsi river. The gorge is 358 feet (109m.) at its deepest (Dept. Surveys and Land, 1938) at the Victoria Falls, and 830 feet (253m.) deep at Namuruba, approximately 8 miles above the Matetsi confluence (Lamplugh, op. cit.). At the Chimamba Rapids, 25 miles (40km.) below the Falls, the depth is given by Lamplugh as 650 feet.

Using Lamplugh's barometric readings, the river falls (1 in 180) approximately 30 feet in a mile between the bottom of the Victoria Falls and the Chimamba Rapids. Between the Chimamba Rapids and the junction of the Matetsi, approximately 35 miles (56km.) south-east, the fall is not quite 9 feet a mile (1 in 590), while in the Middle Zambezi Valley itself the fall between the Matetsi and Makwa, near the Deka confluence, is only about 0·8 feet a mile (1 in 6600). The plateau surface itself falls more rapidly in the upper 25 miles (40km.) than it does in the lower part of the gorge. The fall is then 18 feet per mile (1 in 300) in the upper 25 miles, and probably not more than 7 feet per mile (1 in 750) at the most in the lower part. Even when this is taken into account it does not altogether explain the fall of 30 feet per mile (1 in 180) in the upper gorges. It would appear, therefore, either that there was a halt in the recession of the river in the vicinity of the Chimamba Rapids (which enabled the river to grade the lower reaches of the gorge more nearly with the Middle Zambezi Valley), or also it indicates the existence of a new erosion-cycle which is still working its way up-river.

The Batoka Gorge can be divided into two sections, a western and an eastern, the junction being effected about 3 to 4 miles (5 to 6km.) upstream from the Chimamba Rapids.

The western section shows a youthful valley, dissecting a comparatively young plateau surface (Frontispiece). The sides of the gorge, as has been stated above, are vertical or very steep. The plateau surface is flattish and is only interrupted by the fairly short gorges of the tributary streams. On this plateau there occurs old river-terrace and river-bed gravel. The confines of the former river-bed are fairly well marked, and the upper slopes of the valley are usually covered by Kalahari Sand, at the base of which are exposed land-surfaces which yield finely preserved Rhodesian Sangoan artifacts.

The old terrace and river-bed gravel between the Fifth Gorge and the Victoria Falls was studied by Armstrong and Jones (1936).

They were of the opinion that the southern portion of Gorge Five had probably been eroded before the end of Chellean (sic.) times, and that since that period the river had receded 2½ miles (4km.) to the present gorge. This opinion was based on the physical condition of the various groups of artifacts collected by Armstrong from the terrace and river-bed gravel. It presupposes that the lower 58 miles (94km.) of gorges were excavated at a period anterior to the beginning of the Middle Pleistocene.

As has been shown in the present work, the Younger Gravel extends the whole distance between the Falls and the Fifth Gorge, and many well-rolled and abraded artifacts of Rhodesian Proto-Stillbay type can be found throughout the distance between these gorges. It is apparent, therefore, that the erosion of the upper five gorges must have taken place since the Younger Gravel was deposited, during the decline of the maximum of the Third Pluvial in the Upper Pleistocene. The writer has examined the plateau surface above the gorge for a consecutive distance of approximately 12 miles (20km.) below the Falls, and in the whole of this distance the Younger Gravel was seen, sometimes in the form of a terrace (as at the Songwe confluence overlying the ferricrete), or else as a flood-gravel spread out over the plateau surface. This gravel, throughout the whole of the twelve miles, contains rolled pebbles of ferricrete, and typical rolled and well-glazed tools of Rhodesian Proto-Stillbay and Sangoan type, and it lay in positions which entirely precluded any suggestion of secondary deposition. It is impossible, therefore, to reach any conclusion other than that the whole of this area of gorges was being eroded during the Upper Pleistocene and later. The gorge was visited again by detour from the sand-scarp at a point about 18 miles (30km.) below the Falls. Here the plateau was more dissected and no gravel was found, but no very extensive examination was possible. Also the sides of the gorge were here less steep.

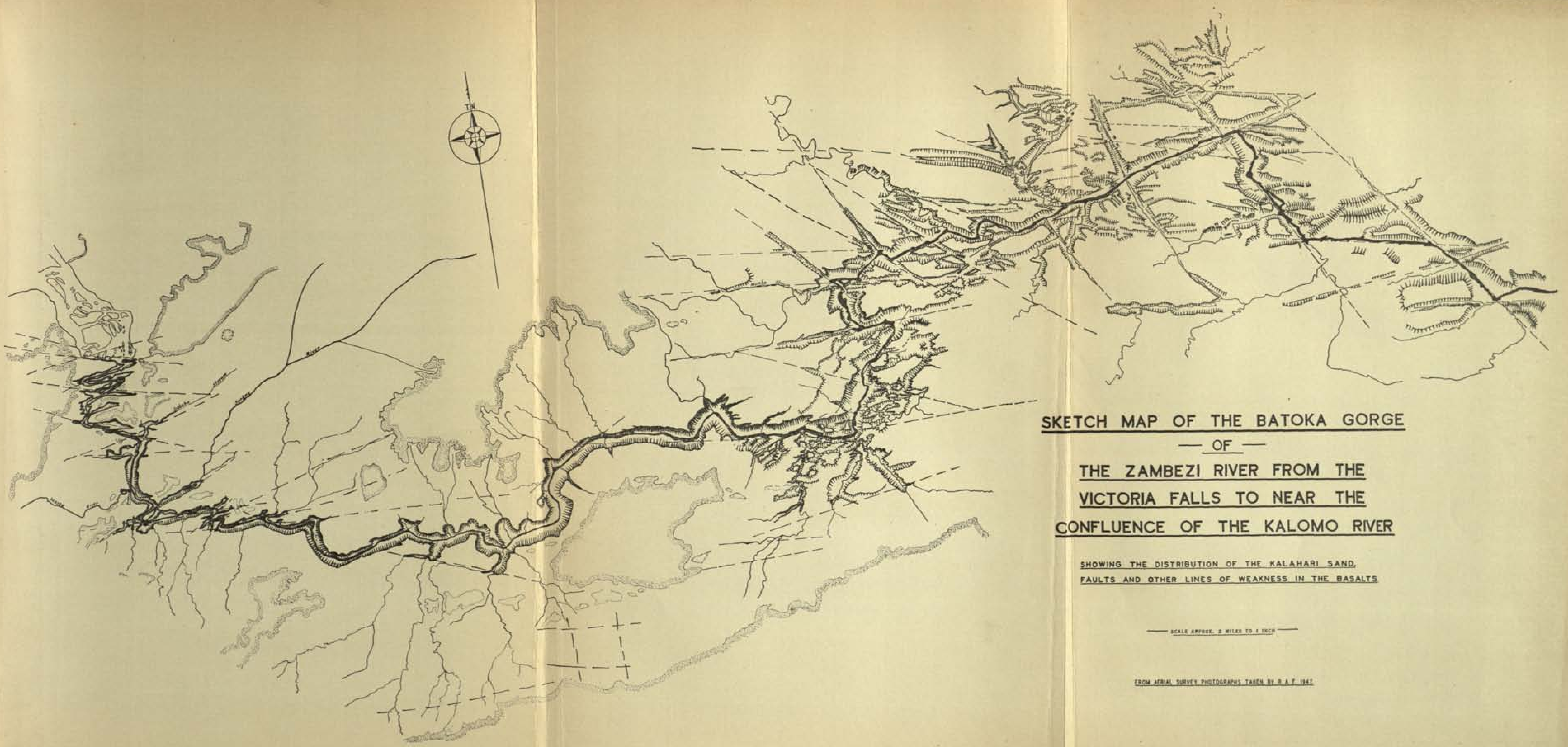
Besides the trough-like nature of the Zambezi Gorge itself, those of the tributary streams and rivers lend support to the theory of the comparatively rapid rate at which erosion has taken place. These gorges always show vertical sides, and where they end they frequently truncate the broad, shallow valleys of the earlier drainage-system, to which is graded (where present) the terrace of the Older Gravels (Masue, Songwe).

Maufe has shown that the Kalahari Sand II (redeposited pink sand) occurs on the spurs south of the Fourth Gorge, where it overlies old river-bed gravel. As we have seen, the Rhodesian Magosian Culture is in part contemporary with this sand, and it is dated to the dry period, following the Third Pluvial and marking the end of the Upper Pleistocene. As this Kalahari Sand II is not found to overlie the old river-bed further upstream than the spur south of the Fourth Gorge, it would appear that the upper gorges cannot have been in existence at the time the sands were accumulated. It may be fairly confidently stated, therefore, that the upper three gorges have been eroded since the beginning of the Makalian or First Post-Pluvial Wet Phase.*

As has been said, about 3 to 4 miles (5 to 6km.) up-river from the Chimamba Rapids the plateau surface becomes fairly rapidly broken up by tributary gorges; the flanking Kalahari sand-bults recede and the river enters the second or eastern section. The sides of the gorge are now less steep, the angle of slope varying between about 60° and 45°. The valley is still youthful but the plateau is here fairly maturely dissected. The further downstream one goes the more dissected the topography becomes, until, in the vicinity of the confluence of the Kalomo River, typical "bad lands" country, quite uninhabited, is encountered (Plate 31).

The Chimamba Rapids (Plate 30) are of interest, as they are the only rapids where there is any appreciable waterfall in the whole length of the Batoka Gorge, though the greatest fall here is only 20 feet (6m.) high. This may appear very insignificant, but it created a very considerable impression on

* If, however, subsequent work shows the Kalahari Sands II to be post-Makalian in age, then the erosion of the upper three gorges must be assigned to Nakuran and present times.



SKETCH MAP OF THE BATOKA GORGE

— OF —

THE ZAMBEZI RIVER FROM THE VICTORIA FALLS TO NEAR THE CONFLUENCE OF THE KALOMO RIVER

SHOWING THE DISTRIBUTION OF THE KALAHARI SAND, FAULTS AND OTHER LINES OF WEAKNESS IN THE BASALTS

SCALE APPROX. 2 MILES TO 1 INCH

FROM AERIAL SURVEY PHOTOGRAPHS TAKEN BY R.A.F. 1947

Lamplugh, who says: ". . . When one stands on the bank of the Lower Cataract and sees the whole volume of the great Zambezi converging into a single pass only 50 to 60 feet (15 to 18m.) in width, shuddering, and then plunging for 20 feet in a massive curve that seems in its impact visibly to tear the grim basaltic rocks assunder, one learns better than from the feathery spray-fans of the Victoria Falls what force there is in the river, and one wonders no longer at the profundity of the gorge."

Immediately below these rapids there is seen, for the first time, evidence of a degradation-terrace which stands out on both sides of the gorge and as islands above the level of the flood-platform. The photograph (Plate 30(1)) shows this degradation-terrace fairly clearly, while from the air it could be seen that a similar feature exists at intervals in the more protected portions of the gorge (i.e., in the elbows of the gorge) the whole of the way to the Matetsi confluence.

If this can be taken to represent a true degradation-terrace, then it is possible that gravel or ferricrete may in places be preserved resting on it. It is apparent, therefore, that an examination of this area from the ground is much to be desired. Until a ground survey can be undertaken, any conclusions in regard to this terrace must remain conjectural, but it appears to the writer from the evidence already available, that this terrace is the result of a phase of erosion which commenced subsequent to the excavation of that part of the Batoka Gorge below the Chimamba Rapids. The change of profile of the river, the change from a young to a maturely dissected plateau surface, and the change in the nature of the tributaries (which now run in long gorges with sloping sides) all suggest that the erosion of the western and upper section of the gorge above the Chimamba Rapids was a much more recent event than that of the lower 35 miles (56km.) below these rapids.

On the evidence of the well-rolled Proto-Stillbay tools in the Younger Gravel, 12 miles (20km.) below the Falls, it is now suggested that that part of the gorge between where the dissected plateau starts (about 3 to 4 miles, 5 to 6km., above the Chimamba Rapids) and the Fourth Gorge, a distance of about 20 miles (32km.) was eroded during the Upper Pleistocene. The portion of the gorge below the Chimamba Rapids must, therefore, have been eroded at some time prior to the Upper Pleistocene, and there is some evidence to suggest when this erosion probably took place. Lamplugh (1906, p. 213) states that "silcrete" (identified by Dixey with the chalcedony and pipe-sandstone) outcrops at intervals on the plateau surface for the whole length of the gorge He records its presence also outcropping from beneath the Kalahari Sand in the Matetsi and middle Zambezi valleys. As Dixey has indicated, these latter occurrences show that the wide, open valleys of the Matetsi and middle Zambezi were already in existence when the chalcedony and pipe-sandstone were laid down. The presence of these rocks on both sides of the mature Zambezi Valley, above the shoulders of the Batoka Gorge, is also indicative of the fact that the gorge cannot have been in existence at the time of their formation, which is placed by Dixey in the Lower Pleistocene. Evidence suggests, therefore, that the erosion of the Batoka Gorge below the Chimamba Rapids should be placed in the Middle Pleistocene.

On the basis of Zeuner's (1946) time-scale for the Pleistocene based on Milankovitch's radiation curve it has taken 248,000 years to erode the 39 or 40 miles (64km.) of lower gorges; 162,000 years to erode the next 22 miles (35km.) of gorge; and approximately 10,000 years to erode the last mile (1·6km.)*. It therefore took approximately 7,300 years to erode each mile of the upper 22 miles, and 6,200 years to erode each mile of the lower 39 or 40 miles of gorge; so that the lower gorges were eroded 1⅝ times as quickly, and the next 22 miles approximately 1½ times as quickly, as the last mile.

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* This must be reduced to 2,800 years approximately, if this erosion is post-Makalian.

Summary of Conclusions

(i) The topography of the Batoka Gorge can be divided into two parts, (*a*) from the Victoria Falls to a point about 3 to 4 miles (5 to 6 km.) above the Chimamba Rapids, a distance of approximately 22 miles (35km.), where the plateau surface is well preserved; (*b*) the gorge below this point, a distance of approximately 39 miles (63km.), where the plateau is maturely dissected.

(ii) The uppermost three gorges were eroded after the deposition of the Kalahari Sands II, i.e., since the beginning of the Makalian or First Post-Pluvial Wet Phase, and since the makers of the Magosian Culture inhabited the area.

(iii) The gorges from the Fourth Gorge to at least 15 miles (24km.) below the Falls (probably to the end of part (*a*) of the gorge) have been eroded since the maximum of the Third Pluvial, or the earlier part of the Upper Pleistocene, since numbers of rolled Proto-Stillbay and Rhodesian Sangoan tools are found in the Younger Gravels, which occur on the flat plateau surface above the gorge.

(iv) During the Middle Pleistocene the Zambezi was probably cutting its way through the lower gorges (part (*b*)).

THE CORRELATION OF CULTURES AND CLIMATES IN THE UPPER ZAMBEZI VALLEY WITH THOSE IN OTHER PARTS OF THE AFRICAN CONTINENT

Before passing to a consideration of the evidence from other areas of the continent, it is first necessary to consider the degree of correlation that is possible within Rhodesia. Bond (1946) has correlated the Pleistocene succession in Matabeleland with those found in the Zambezi, in the Vaal and in East Africa. Comparing the succession at Lochard with that in the Zambezi the correlation is remarkably close, particularly when it is remembered that Lochard is in the southern headwaters. The Chelles-Acheul is found in the lowest alluvial deposits, and the Bembesi or Sangoan in the ferricrete — which the present writer has indicated should now, in his opinion, be dated to the beginning of the Third Pluvial, and not to the end of the Second Pluvial. Kalahari Sand overlies the Rhodesian Sangoan and/or Bembesi tools in both cases. The deposits of the Third Pluvial are missing from Lochard, but they are present in the Umguza at Sawmills, where the second terrace has yielded the same cultural material as the Younger Gravels in the Zambezi. The Wilton and Magosian cultures are also approximately of the same age in both areas.

Thus it can confidently be stated that correlation is very close in these two areas and, in addition, interpretation of the cultural and climatic succession in each of the rivers in the Rhodesias where work has been undertaken, differs in no major degree from the succession in the Upper Zambezi Valley. The Pre-Chelles-Acheul and the Chelles-Acheul cultures show no major divergence. The Bembesi differs in degree only from the Zambezi Variant of the Rhodesian Sangoan — notably in the presence of very rare cleavers on some of the Southern Rhodesian sites. None were found at the type-site, two much-weathered specimens were found with the Mondoro industry, and one rolled specimen occurs at Inyazura. In the opinion of the writer this is insufficient evidence for ascribing the Bembesi industries to a Fauresmith rather than to a Sangoan origin, in face of the large body of contrary evidence; the writer would rather consider that the cleavers (if indeed they are truly associated with the industries) are the result of culture contact with the true Fauresmith immediately to the south. The Proto-Stillbay and the Stillbay proper show only minor regional differences as also do the Magosian and the Wilton.

When, however, the Rhodesian cultural succession is compared with those in the Vaal River, the Congo Basin and East Africa, the cultural evidence as such assumes a heightened importance due to the scarcity, as yet, of faunal remains from the Rhodesias. We find that the Pre-Chelles-Acheul culture does not appear in the Zambezi Valley until the beginning of the Second Pluvial, while it was already established in East Africa (Leakey, 1936, pp. 38-41) and in the Vaal River* in First Pluvial times. Typologically both Kafuan and Oldowan forms are found identical in all the areas; but the Rhodesian industries must in the main be ascribed to the later stage, and must be considered as being late in the cultural development. The typological and stratigraphical correlation is a close one between the East African Oldowan from Bed I at Olduwai, and the Pre-Chelles-Acheul from the Zambezi Valley and Hunyani.

In the Congo the First Pluvial is followed by a period of earth-movement, perhaps to be correlated with the crustal warping which produced the Okavango-Linyanti Depression. The equivalent of the Second Pluvial in the Rhodesias appears in the Belgian Congo to be found in the high-level gravels at Kamoa (Breuil, Cabu and van Riet Lowe, 1944), while it corresponds to the Second Pluvial in South Africa and to the Kamasian Pluvial in East Africa. The deposits ascribed to the Second Pluvial and its equivalents have in each case yielded tools of the Chelles-Acheul culture. In the Congo the Late Acheulian is perhaps associated with sandy clays (*argile sableuse kaolinifère*) which may correspond to the white clays in the Barotseland boreholes.

The desert conditions that followed the Chelles-Acheul culture in Rhodesia, when the Kalahari Sand was deposited, approximately correspond to a dry period in the Vaal, when the Younger Sands were calcified and red Kalahari Sand was deposited (du Toit, 1947, p. 36). In Angola, Janmart (1946) has found Kalahari Sands covering the Chelles-Acheul gravels. This, according to Mortelmans (1947), is the case also in the Congo Basin. A period of earth movement in the Congo at this time indicates a correlation with the Great Interpluvial at the end of the Kamasian Pluvial in East Africa (Leakey, 1936).

The cultures of the succeeding Third or Gamblian Pluvial for the first time begin to show marked regional differentiation. In Rhodesia we find the Sangoan in ferricrete under red Kalahari Sands and in the Younger Gravels. In the Vaal we find the Fauresmith in the Youngest Gravels and the overlying sands, covered by red aeolian sand. In the Congo the high-level terrace of the Kasai, its overlying sands and red (aeolian?) sand contain the Middle Sangoan (Kalinian), while in East Africa the corresponding culture is the Lower and Middle Sangoan, occurring in the deposits of the Gamblian Pluvial.

Mortelmans (loc. cit.) finds the Middle Sangoan (Kalinian) in lateritic deposits in the Congo, and Janmart (loc. cit.) also finds the Middle Sangoan (Kalinian) in association with ferricrete in Angola. But the Middle Stone Age in the Congo is also associated with ferricrete (Breuil, Cabu and van Riet Lowe, loc. cit.) and so too is the Pre-Chelles-Acheul in both the Congo and Angola (Mortelmans and Janmart, op. cit). It would thus appear that at least two or even three distinct periods of ferricrete or laterite formation must have occurred in the Congo Basin. This type of deposit cannot therefore as yet provide the valuable dating evidence that it does in the Rhodesias.

There is a remarkable similarity between many of the tool types of the Rhodesian, Congo and East African Sangoan and of the Fauresmith. The Congo and East African forms of the Sangoan are more closely related than the Rhodesian forms, but the relationship and ancestry of these latter are unmistakably similar. Many of the picks, picks with chisel ends, handaxes and flake-tools of the Congo

* Söhnge, P. G., Visser, D. J. L., and Lowe, C. van Riet, 1937 *Op. cit*. Breuil, H., Lowe, C. van Riet, and du Toit, A. L., 1948. Early Man in the Vaal River Basin. *Arch. Survey. Arch. Series*, No. VI.

Middle Sangoan are identical with those from the Zambezi Valley, but the lanceheads of the Congo are absent here. Industries very similar to the Luangwa Variant of the Rhodesian Sangoan are illustrated by dos Santos (1941), from Chitavi and Nhancuaze in the Zambezi Valley between Zumbo and Chicova, where they appear to be derived from a former terrace of the river. The relationship of the Fauresmith to this Sangoan culture complex is, however, somewhat obscure; does it represent an entirely distinct complex, or is it in fact the South African manifestation of a complex of single entity, be it called Fauresmith or Sangoan? In East Africa and the Congo the contemporary cultures are sufficiently distinctive to warrant cultural designation; but in Rhodesia, particularly in Southern Rhodesia, the distinction becomes blurred, and the picture needs cleaning before the details can be clearly seen and appreciated.

The later part of the Younger Gravels and the overlying sands in the Zambezi finds its counterpart in the gravels and sands of the Fourth Pluvial in the Vaal. The Middle Stone Age cultures which each contain must therefore be contemporary. In each case they are overlain by windblown sands. The corresponding culture in the Congo basin appears to be the Upper Sangoan (Djokocian). The Rhodesian Stillbay industries are much more akin to the general form of the South African Middle Stone Age than to that of the Congo, and as yet the fine "dagger" and "lance" heads of the Congo Middle Stone Age are unknown in Rhodesia, though the bifaced point illustrated on Plate 16, No. 3, may be taken as indicating some influence from that area. It is still, however, a matter for conjecture whether the Upper Gamblian in East Africa with its contained Stillbay culture is the equivalent of the South Africa Fourth Pluvial and of the deposits yielding the Stillbay in Rhodesia, or whether it is earlier and the Makalian Wet Phase is the East African equivalent.

It has for some time been the accepted theory that the cultural evolution in southern Africa after the Second Pluvial lagged behind that in East Africa — a theory which has been challenged by du Toit (1947). If the East African Makalian is to be correlated with the Fourth Pluvial in South Africa, and with the later accumulation of the Younger Gravels (Third Pluvial) in the Zambezi, then cultural evolution must be considered to have lagged behind in the sub-continent. If, on the other hand, it can be shown that it is coincident with one of the southern Post-Pleistocene climatic fluctuations, then it is not necessary to suppose any such tardy development in the south.

Cooke (1940) has pointed out the insecurity of correlation between East and South Africa, and du Toit (1947) has expressed a doubt as to the reality of much of the "pluvials" or of their universality. du Toit goes on to say ". . . . it would seem that the salient palaeolithic climatic oscillations were practically coincident over the interior of South Africa as far north as the Zambezi, but that they failed to synchronise with those over East Africa, the agreement then becoming wider". With such uncertainty, therefore, any correlation of these two areas (East and South Africa) must of necessity remain very tentative, and it is strikingly borne out that much more systematic work in the intervening country is required before any accurate correlation can be obtained which will stand the test.

The correlation between South Africa and Rhodesia can now be seen to be much closer than was at first thought — and for the Palaeolithic is fairly complete. Dr. Leakey informs me that his recent work in Northern Angola has shown that the succession there compares well with that in the Upper Zambezi; but when we go further afield we encounter inconsistencies in the climatic and cultural succession which still render any close correlation work suspect. The Table which follows (Table 3) is an attempt, however, to summarise what is at present known of the correlation between the sub-continent and East Africa.

TABLE I TABLE OF GEOLOGICAL EVENTS, CLIMATES AND STONE AGE CULTURES IN THE UPPER ZAMBEZI AND TRIBUTARY RIVERS

(Read from below upwards)

	Geological Events in the Zambezi and Tributary Valleys		*Climate over the Zambezi Valley*	*Culture*
Second Post-Pluvial and Present Phases.	Erosion to present contours and formation of low-lying sand islands. Formation of low-level degradation terrace and abandoned channels. Black Alluvium. Erosion.		Semi-arid	* Upper Northern Rhodesian. † Wilton.
	Accumulation of dirty, wind-blown sand and formation of calc-tufa.		Arid	
First Post-Pluvial Wet Phase.	Aggradation of sandy, calcareous alluvium forming 15 to 10 foot (4·5 to 3m.) terrace; minor erosion of Kalahari Sand from scarps.		Semi-arid	† Lower Northern Rhodesian Wilton.
	Erosion of Older and Younger Gravels and Basalt.		Wet	
	Redeposited Kalahari Sand accumulated by wind-		Arid	Rhodesian Magosian
Third Pluvial.	Calcification of Younger Gravels and Sands ?	Kunkar formation Younger Gravels III and Alluvium III formed in some tributaries	Semi-arid	Rhodesian Stillbay
	Erosion	Erosion	Wet	
	Temporary living sites formed on eroded sand slopes	Kunkar formation Aggradation of sands and Younger Gravels in main valley and of Younger Gravels II and Alluvium II in tributaries.	Semi-arid	Rhodesian Proto-Stillbay.
	Erosion	Erosion	Wet	
	Much redistributed Kalahari Sand (clay-sand) on scarp slopes with nodules and pebbles of ferricrete and temporary living sites	Kunkar formation Aggradation of the earlier part of the Younger Gravels overlying the 15-20 foot (4·5-6m.) terrace in main valley Younger Gravels I and Alluvium I in tributaries	Semi-arid	† Upper Rhodesian Sangoan.
	Erosion	Erosion	Wet	
	Formation of ferruginized scarp rubbles	Formation of ferricrete in the valleys	Semi-arid	† Lower Rhodesian Sangoan. ↓
	Commencement of removal of Kalahari Sands from river valleys and scarps.			
Inter-Pluvial.	Unferruginized Land-Rubble. Kalahari Sands I accumulated under desert conditions of long duration; smaller tributary rivers dry up. (?Ferricrete formation.)		Very arid	
Second Pluvial.	Formation of Calc-tufa and Kunkar.		Arid	↑
	Deposition of the Older Gravels II on the 15 to 20 foot (4·5 to 6m.) terrace.		Semi-arid	Late Rhodesian Acheulian.
	Erosion.		Wet	Middle Rhodesian Acheulian. Hope Fountain
	?Ferruginization of Older Gravels. Deposition of Older Gravels I on 45± foot (13·5m.) terrace.		Semi-arid	
	Erosion of Pipe-sandstone, Chalcedony and Basalt.		Very wet	Early Rhodesian Acheulian. Rhodesian Chellean.
	Induration of the Pipe-sandstone and formation of siliceous ferricrete on the upper slopes.		Semi-arid	Pre-Chelles-Acheul.
	Silicification of Pipe-sandstone. ? Gentle warping.		Very arid	
	Deposition of freshwater limestones, followed by sands along the floor of the Zambezi Valley.		Wet	
First Pluvial.	Silicification of limestones and associated sands with conversion of the former to chalcedony.		Very arid	No recognised culture.
	Deposition of freshwater limestones and associated sands along the floor of the Zambezi Valley. Deposition of Scattered pebbles over eroded surface.		Semi-arid	
	Erosion of basalt and formation of End-Tertiary Peneplain.		Very wet	

† Indicates that faunal remains have been found in association.
* Indicates that human remains have been found in association.

TENTATIVE CORRELATION OF CLIMATES AND CULTURES IN THE UPPER ZAMBEZI VALLEY, SOUTH AFRICA, THE BELGIAN CONGO AND EAST AFRICA

North of Southern Rhodesia

ZAMBEZI VALLEY GEOLOGICAL EVENTS	*Congo Basin Events*	*Congo Basin Cultures*	*East Africa Events*	*East Africa Cultures*
Erosion to present contours Low-level denudation terrace	Downcutting to Present Contours	Tsitolian	Present phase Nakuran Wet Phase	Wilton Gumban B Stone Bowl Culture, etc.
Wind-blown sand			Dry	Wilton Gumban A
Calcareous Aluvium erosion	Sands	Lupemban	Makalian Wet Phase	Wilton A and B Early Kavirondo Smithfield Magosian, etc.
Kalahari Sands II	?	—	Dry	Aurig. Phase C Magosian
Calcification and Pink Alluvium III in some tributaries Minor erosion Younger Gravels and Sands Erosion	Gravels and sands of lower terrace of the Kasai Erosion	Upper Sangoan (Djokocian)	Gamblian Pluvial	Stillbay Late Kenya Aurignacian Proto-Stillbay Upper Sangoan
Redeposited Kalahari Sand	Red sands		with	
Younger Gravels Erosion Ferruginization	Sandy clays Gravels Erosion and formation of high-level terrace of the Kasai Ferruginization	Middle Sangoan (Kalinian) Middle Sangoan (Kalinian)	three sub- Maxima	Upper Kenya Aurig. Middle Sangoan Lower Kenya Aurig. Lower Sangoan Levalloisian
Land rubble Kalahari Sands I	Kalahari Sand?		Volcanicity	
Older Gravels II Ferruginisation? Older Gravels I Erosion Ferruginization	Sands and fine clays (Ruashi) High-level Kamoa gravels	Congo Chelles-Acheul	Kamasian Pluvial	East African Chelles-Acheul Pre-Chelles-Acheul (Oldowan)
Silicification	Kalahari Sand? Earth movement		Volcanicity	
Freshwater limestones and sands High-level pebble-beds Formation of end-Tertiary Peneplain	Plateau gravels	Pre-Chelles-Acheul	Kageran Pluvial	Pre-Chelles-Acheul (Kafuan)

TENTATIVE CORRELATION OF CLIMATES AND CULTURES IN THE UPPER ZAMBEZI VALLEY, SOUTH AFRICA, THE BELGIAN CONGO AND EAST AFRICA

South of Northern Rhodesia

ZAMBEZI VALLEY GEOLOGICAL EVENTS	*Zambezi Valley Climate*	*Zambezi Valley Cultures*	*South Africa Events*	*South Africa Cultures*
Erosion to present contours Low-level degradation terrace	Second Post-Pluvial Wet Phase	Upper Northern Rhodesian Wilton	Final Wet Phase	Wilton and Smithfield
Wind-blown sand	Dry			
Calcareous Alluvium Erosion	First Post-Pluvial Wet Phase	Lower Northern Rhodesian Wilton		
Kalahari Sands II	Dry	Rhodesian Magosian	Wind-blown sand	—
Calcification and Pink Alluvium III in some tributaries Minor erosion Younger Gravels and Sands Erosion	THIRD PLUVIAL Wet Wet	Rhodesian Stillbay Rhodesian Proto-Stillbay	Fourth Pluvial (Grits, sands and clays) Erosion	Middle Stone Age
Redeposited Kalahari Sand	Semi-Arid		Red aeolian sand	
Younger Gravels Erosion Ferruginization	Wet	Rhodesian Sangoan Rhodesian Sangoan	Third Pluvial Calcified sands Youngest Gravels Erosion	Upper Fauresmith Lower Fauresmith
Land rubble Kalahari Sands I	Dry		Kalahari Sand ? Calcification	
Older Gravels II Ferruginization Older Gravels I Erosion Ferruginization	SECOND PLUVIAL WITH TWO SUB-MAXIMA	Chelles-Acheul (Late Rhod. (Acheulian (Middle Rhod. (Acheulian (Hope (Fountain (Early Rhod. (Acheulian Rhod. Chellean Pre-Chelles Acheul. (Oldowan)	Second Pluvial with three submaxima	South African Chelles-Acheul I-V
Silicification	Dry Crustal warping?		Kalahari Sand?	
Freshwater limestones and sands High-level pebble-beds Formation of end-Tertiary Peneplain	FIRST PLUVIAL		First Pluvial Older Gravels Basal Older Gravels Peneplanation	Pre-Chelles-Acheul

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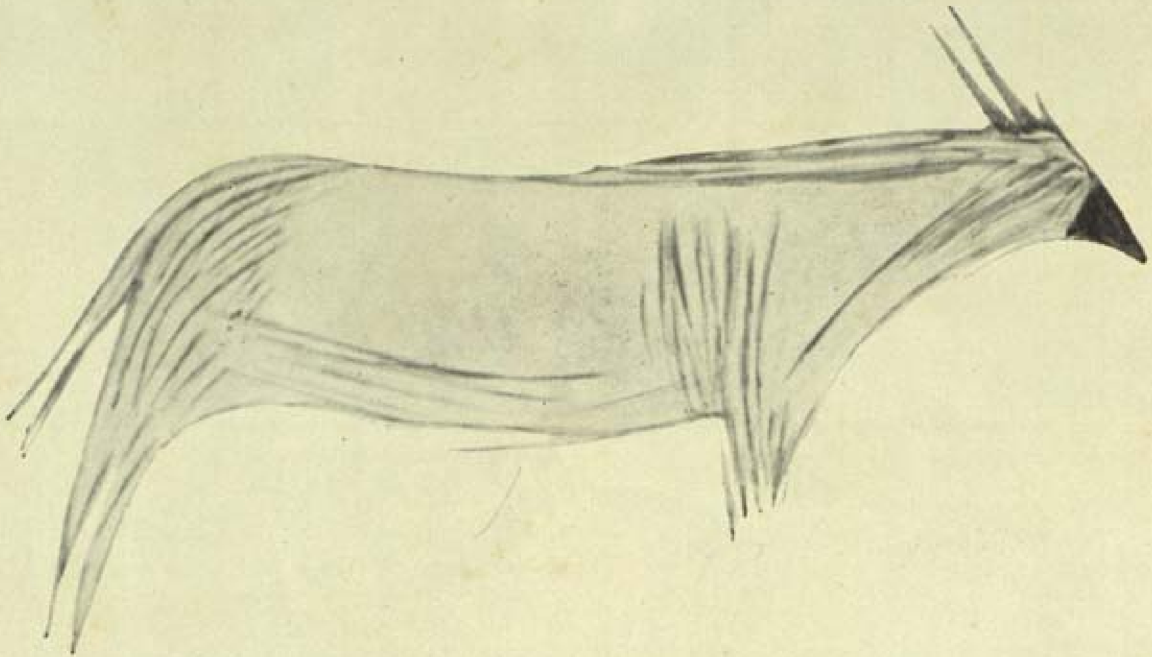


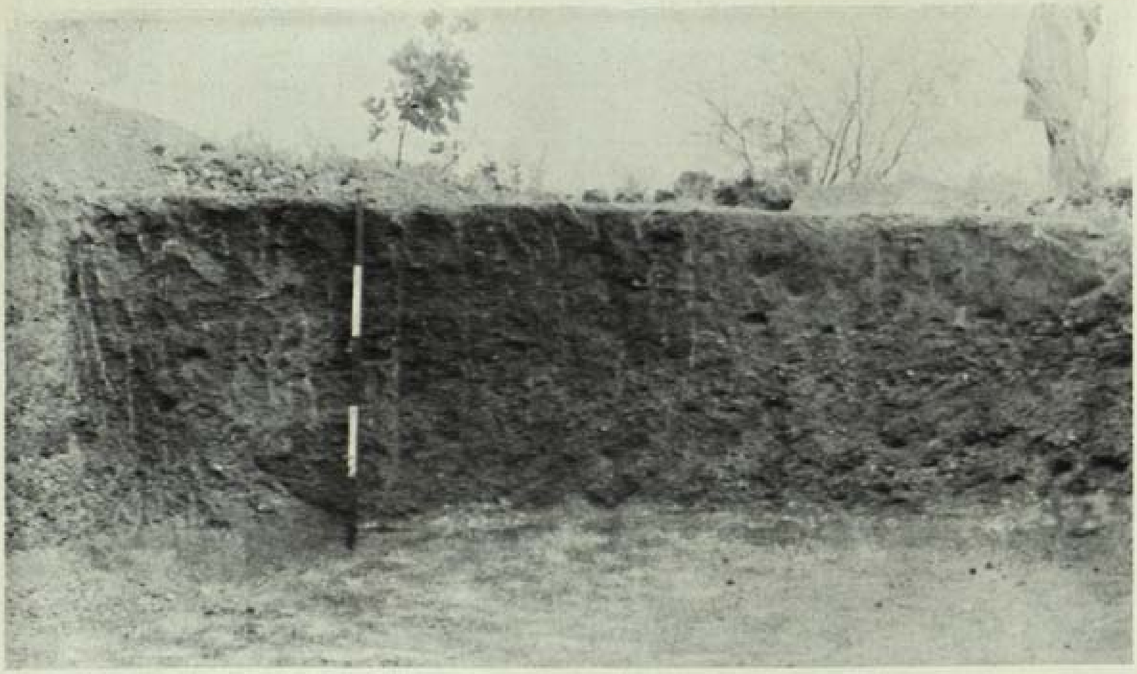
Fig. 21. Painting of an Eland (?) in faded red (vermilion) pigment from a rock shelter at Zawi Hill, Fort Jameson District. Associated with a painting of an ostrich in similar paint. Traced by J. A. Barnes.

Photograph reproduced by courtesy of the Aircraft Operating Company of South Africa Ltd.

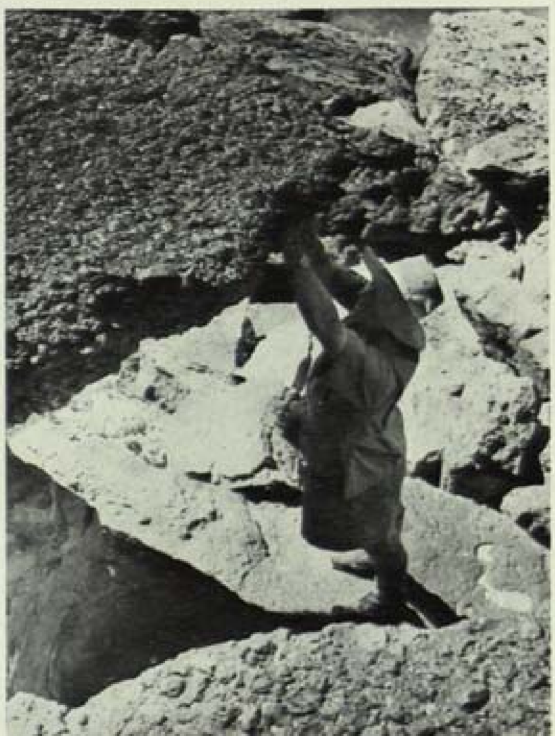
PLATE 21. Aerial photograph of the Victoria Falls, showing the sand-islands and deeper alluvial deposits above the rock barrier, the upper five gorges and the Kalahari sand. The continuation of the faults and shatter belts, along which the fifth, second and first gorges have been eroded, can be clearly seen. Further lines of weakness can be seen upstream of the Falls — notably immediately above and to the left of Cataract Island.

1. Freshwater limestone, the upper levels showing partial conversion to chalcedony. Found *in situ* outcroping in the bed of the Maramba River at Legg's Farm.

2. ± 45-foot Terrace of the Older Gravels I at Anderson's Drift. Site Z.Y.40. Zambezi Valley.



1. Excavation in the terrace of the Older Gravels II. Site M.A.39. Maramba River. The Older Gravels II are here overlain by alluvial wash of later date. This site yielded an important home and factory site of the Late Rhodesian Acheulian Culture.

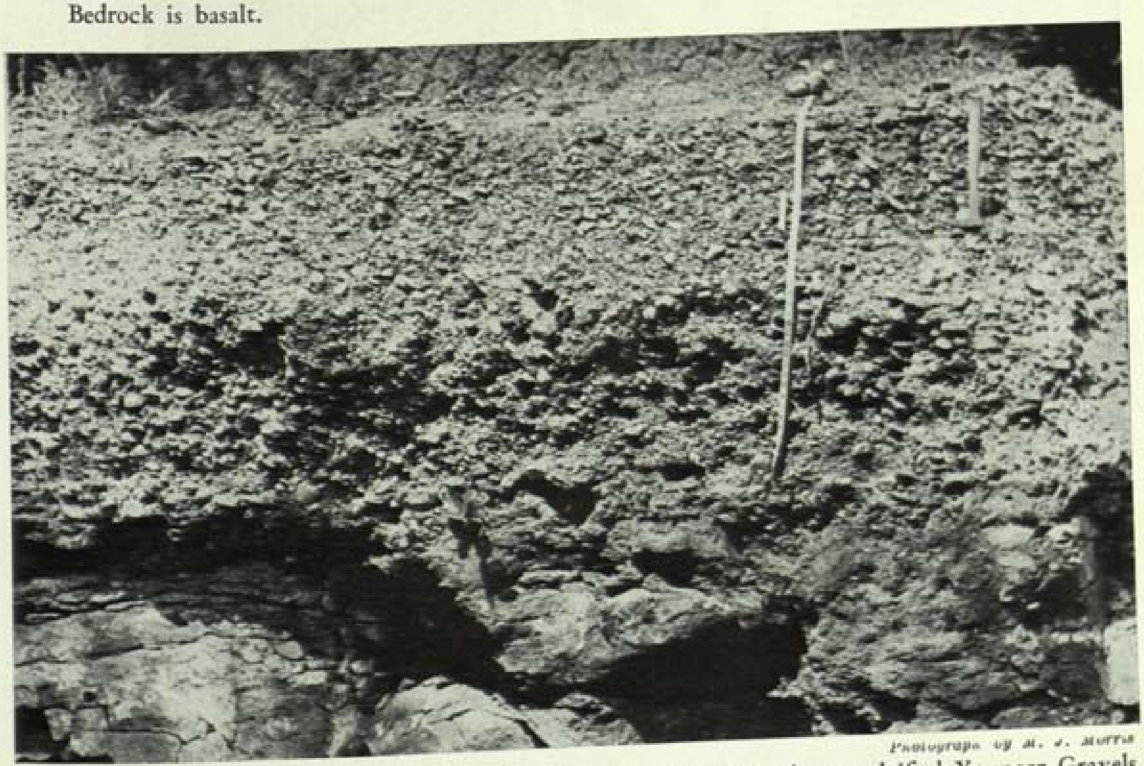


2. Showing undercut blocks of ferricrete at the Sioma Falls, Barotseland. The ferricrete yields Rhodesian Sangoan implements and rests on the silicified upper layer of a friable yellow to pink sandstone.

Photograph by the Northern Rhodesia Information Department

Photograph by M. J. Morris

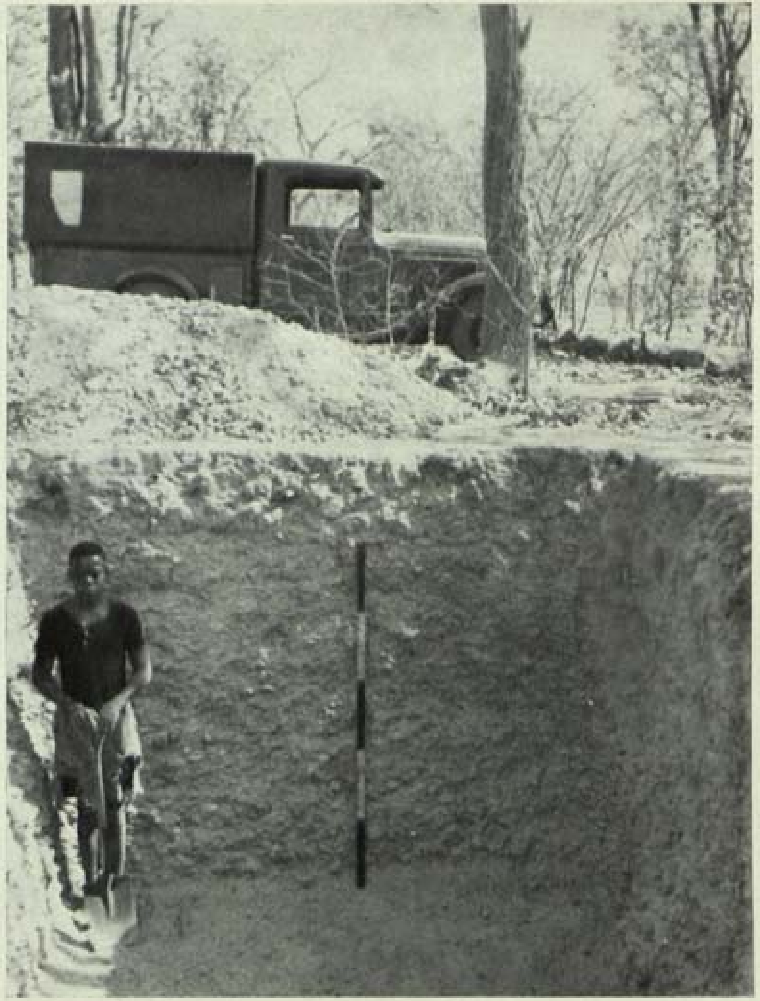
1. Canal bank, Eastern Cataract, Victoria Falls. Site Z.D.1.38. The upper deposit is Younger Gravel which rests on ferricrete, which in turn seals and overlies a thin spread of Older Gravels. Bedrock is basalt.

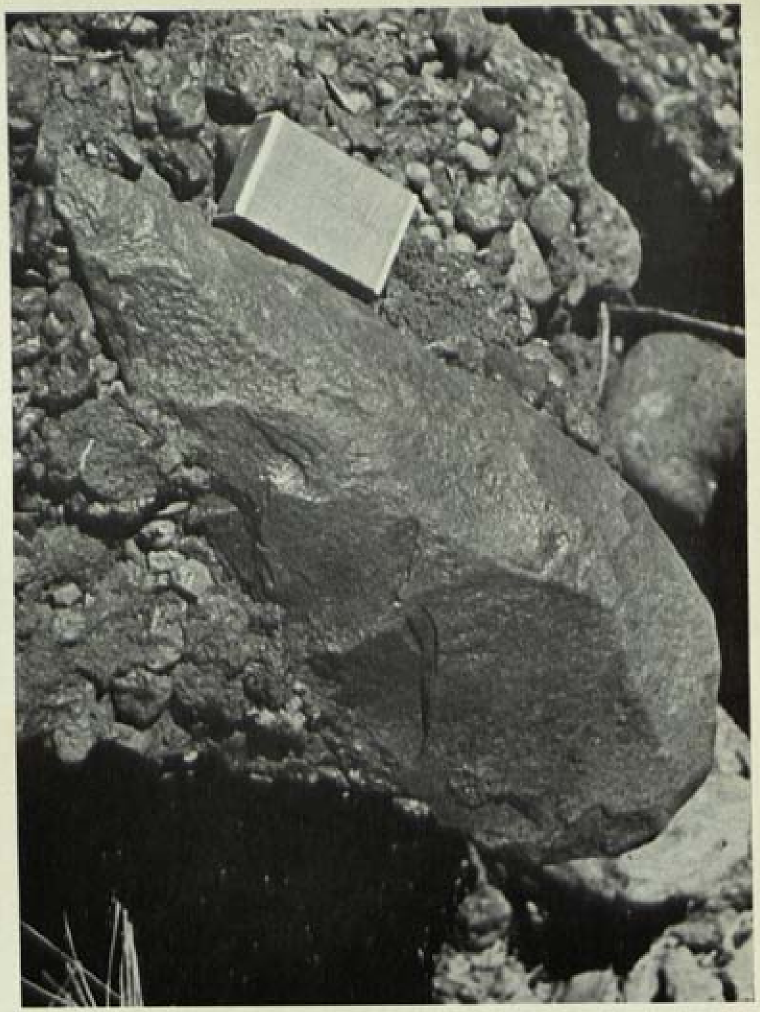


Photograph by M. J. Morris

2. Canal bank, Eastern Cataract, Victoria Falls. Site Z.D.1.38. Shows calcified Younger Gravels resting on basalt and overlain by water-deposited and windblown pink sands (Kalahari Sands II).

PLATE 25.





Photograph by the Northern Rhodesia Information Department

1. Eastern Cataract, Victoria Falls. Excavation showing, at the top — mixed river-deposited and windblown sand, in the upper levels of which occurs a Northern Rhodesian Wilton industry, overlying calcified sands yielding occasional Rhodesian Stillbay debitage; overlying Younger Gravels to bedrock, containing Rhodesian Proto-Stillbay and Sangoan artifacts (the latter always rolled), and earlier derived implements.

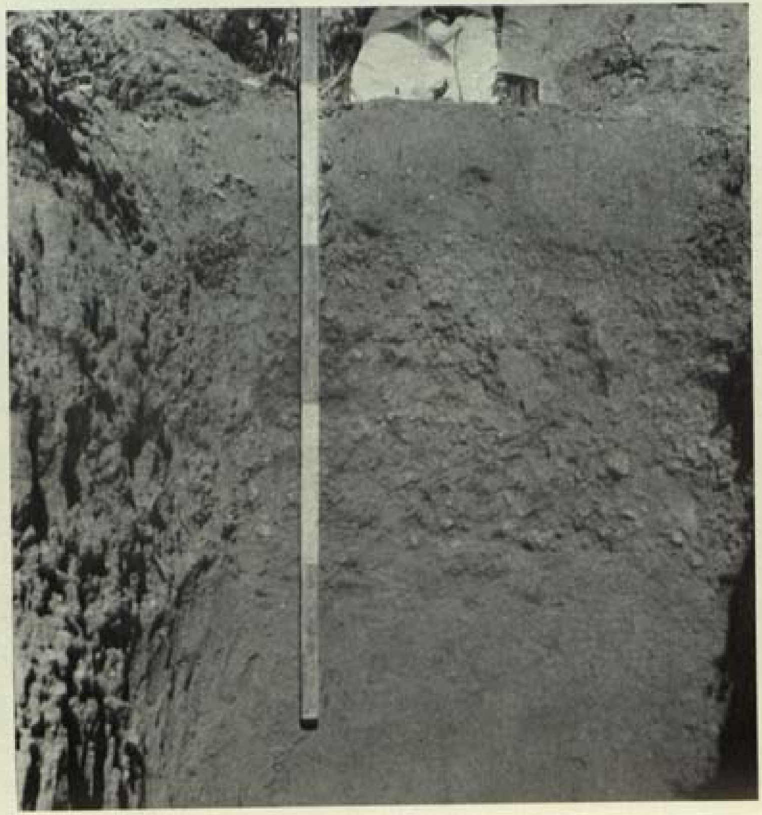
2. Large partially-rolled handaxe in silicified sandstone embedded in ferricrete; Sioma Falls, Barotseland.

1. Site M.D.39. Maramba River. Showing 3 accumulations of current-bedded Younger Gravels, grits and alluvium, the lowest passing below water level. The upper two are sterile, the lowest gravel has yielded Upper Rhodesian Sangoan artifacts.

2. Site M.B.38. Maramba River. Showing later terraces of the Maramba River. The uppermost terrace is that of the Younger Gravels, the second consists of the alluvium and current-bedded gravels of the 1st Post-Pluvial Wet Phase, and the lowest terrace is a degradation terrace cut in the second with some redeposited sandy grits overlying it.

PLATE 27.

1. Site M.C.39. Maramba Valley. Maramba Quarries site <— showing silicified pipe-sandstone at the base, overlain by denuded Older Gravel containing abraded Hope Fountain tools in abundance (lower marker); red, pebbly sand with pisolitic ironstone containing some Hope Fountain implements overlies the gravel. The top half of this deposit has been cemented with a ferricrete on and in the top of which are fresh Rhodesian Sangoan tools. Kalahari sand (redeposited) overlies the ferricrete.



2. Pit No. 1, Knight's Drive, site Z.B. 48 showing Kalahari Sand I(?) to 11½ feet (base not seen), ferruginized rubble to 1 foot; ferricrete to 1 foot, with Rhodesian Sangoan tools on the surface. Redeposited Kalahari sand to the surface. —>

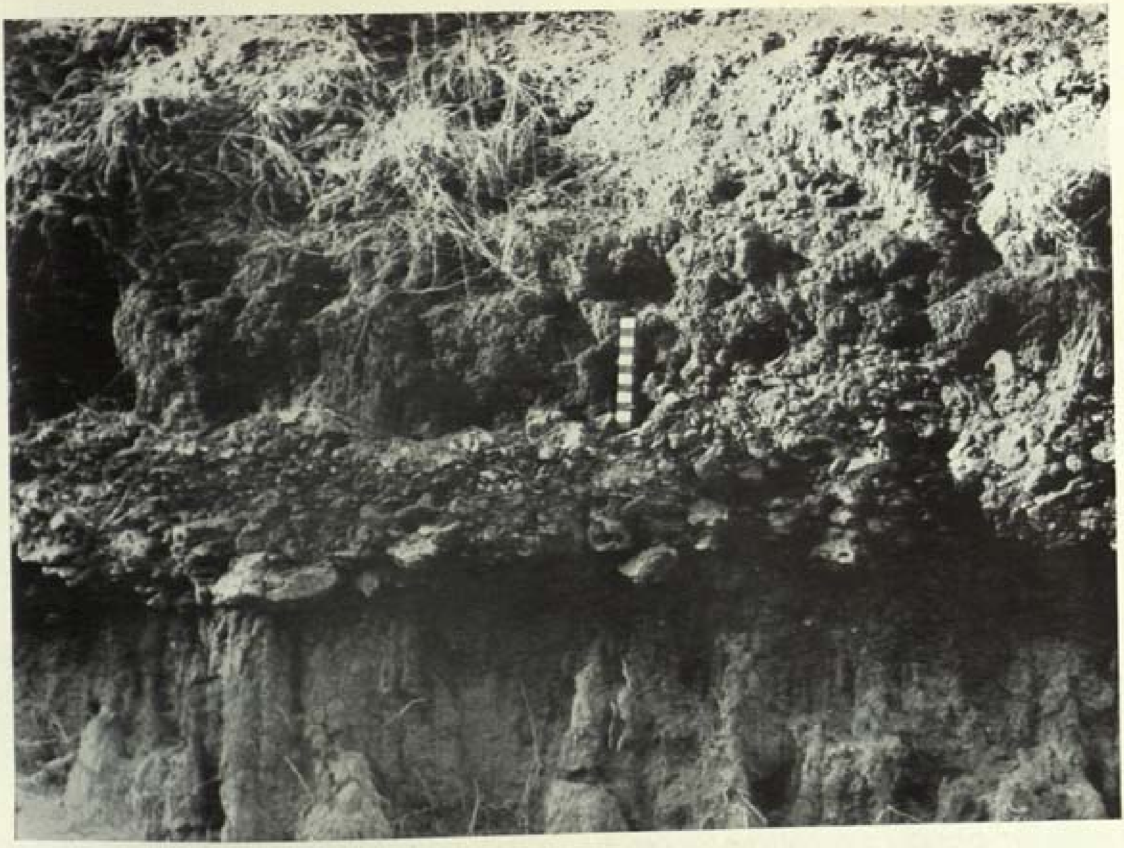
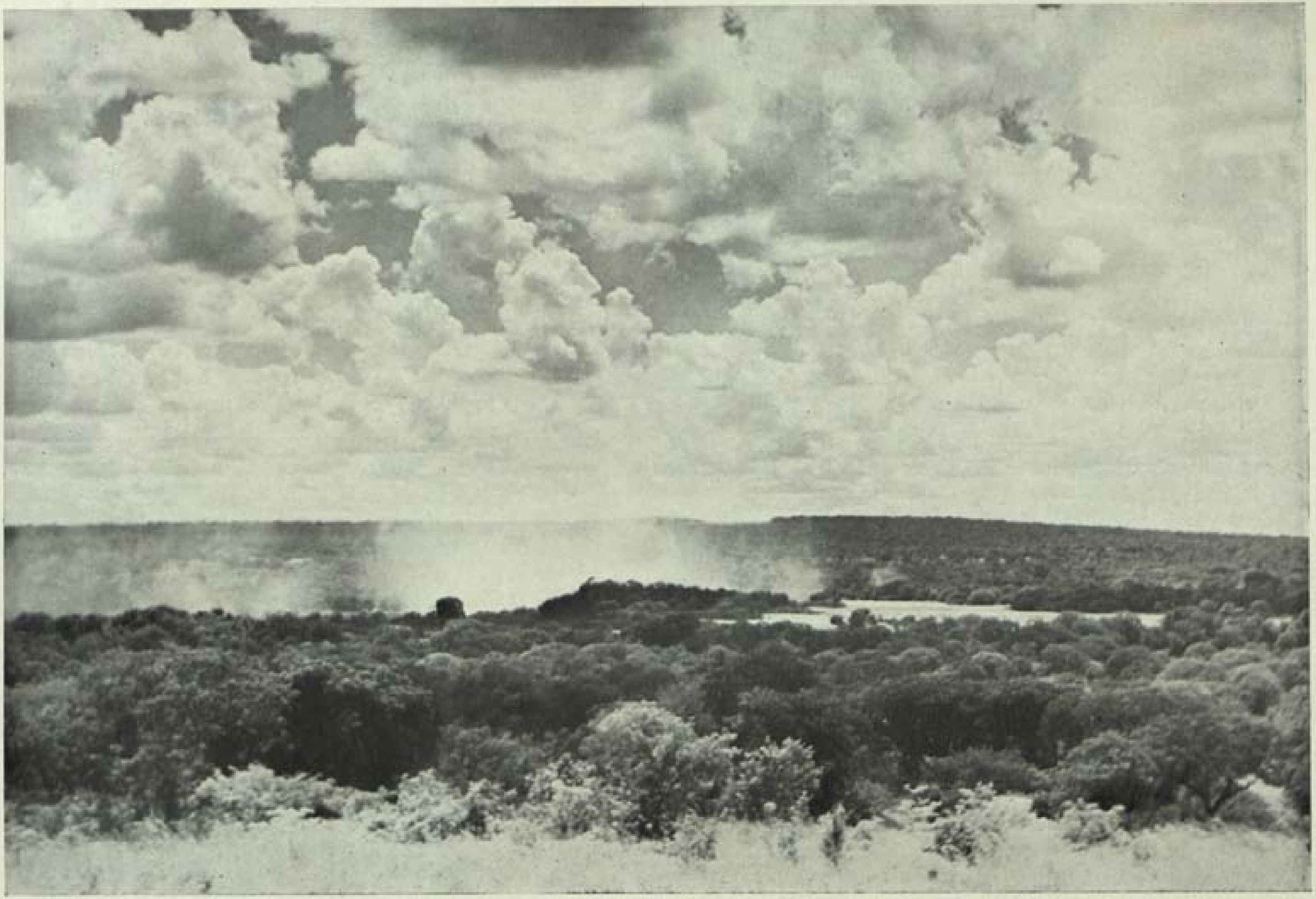


PLATE 28.

1. Site Z.C.48 Masue/Zambezi confluence, south scarp, showing red clay sand to ±15 feet (base not seen); unferruginized rubble 4 to 5 inches; ferruginized rubble ±6 inches, with Upper Rhodesian Sangoan tools on the surface; Kalahari sand (redeposited) to ± 30 feet, with Upper Rhodesian Sangoan tools in lower 4 to 5 feet.

2. Site Z.F.39. Hubert Young Drive, Zambezi Valley, north scarp, showing the irregular nature of the rubble bed which contains Rhodesian Sangoan implements both in and on the surface, resting on a non-ferruginized broken-down bed of chalcedony which in turn rests on decomposed basalt. Nodules of Ferricrete I can be seen incorporated in the ferruginous rubble which dates to Ferricrete II times.



1. General view across the Zambezi Valley at the Victoria Falls, showing the wide, flat valley immediately above the Falls and the gently sloping scarp of the Kalahari sand, which bounds the valley in the greater part of the upper reaches.

1. The Chimamba Rapids in the Batoka Gorge 25 miles, approximately, below the Victoria Falls. Showing a degradation terrace within the Gorge.

2. The Batoka Gorge between the Chimamba Rapids and the confluence with the Kalomo River, approximately 35 miles below the Victoria Falls. The continuation of the fault along which the gorge has been eroded can be clearly seen on the plateau surface beyond.

PLATE 31.

1. The Batoka Gorge approximately 4 miles above the confluence of the Kalomo River, showing the dissected nature of the plateau in the lower part of the Gorge.

2. The beginning of the Batoka Gorge at the confluence of the Matetsi River with the Zambezi, approximately 60 miles below the Victoria Falls. The river here widens out into a broad, flat valley, still in the Batoka Basalts.

APPENDIX A.

Since writing the section on the past climates and cultures of Rhodesia and their correlation with other areas of the continent there has been published Dr. L. S. B. Leakey's important study of the Pleistocene succession in North-Eastern Angola.* It is therefore of value to compare very briefly the Northern Rhodesian and this new evidence from Angola.

It is immediately evident that there is a very close correlation between these two adjacent areas, and Angola now forms an important link between Rhodesia and the Congo Basin. In both areas the major climatic changes of the Quaternary together with the particular stages of culture which belong may be readily identified and compared. Although we have as yet to find the high level terrace in the Zambezi to correspond to the 20m. and 40m. terraces in Angola with their contained Kafuan pebble culture, it would appear that the early Middle Pleistocene Laterite I in Angola correlates with the 'siliceous ferricrete' (or Ferricrete I) in the Zambezi. The 10m. terrace and the lower gravels of the 4m. terrace of Angola may be closely correlated with the Older Gravels I and II in the Zambezi; the culture content of both is identical. In both areas also we find the main accumulation of Kalahari Sand taking place during the interpluvial between the Middle and the Upper Pleistocene. Such a comparison also brings out very clearly the differences that must be expected between two areas where precipitation has been unequal. While the major oscillations from wet to dry and vice versa are sufficiently well discernible the variations in degree between these are seen to differ. For example with the possible exception of Laterite I and Ferricrete I the laterites and ferricretes of the two areas are not synchronous. In Angola the laterites formed, according to Dr. Leakey, during the dry phases, while in the Zambezi they formed as the result of the onset of wet conditions. During the dry phases the climate was too arid to allow of the formation of ferricrete in the Zambezi. It is very important that this point should not be overlooked.

It is possible to identify with certainty only one of the two redeposited Kalahari Sands in Angola with similar sands in the Zambezi. This is the sand covering the land surface on which is found the Lupemban Culture and it correlates with the second of the redeposited sands in the Zambezi, which covers and contains the Rhodesian form of the Magosian Culture. It may be that in the Zambezi the counterparts of both the Angola redeposited Sands occur but that the earlier has not as yet been differentiated; only future research will show. The supposedly 'wet' sands in the first redeposition in the Zambezi must be earlier than the redeposited Kalahari Sand I in Angola on the evidence of the cultural contents: the one covers a developed Middle Sangoan, the other the Final Sangoan. On the other hand Leakey gives an alternative dating for the Middle Sangoan in Angola and states that if the Kalahari Sand which covers this culture is redeposited sand washed down during the beginning of the wet conditions which followed the dry period when the Kalahari Sands proper were formed, and is not original, then the Middle Sangoan must be dated to the time when wet conditions were again setting in. This agrees with the date assigned to the Sangoan (typologically Middle Sangoan) in Rhodesia. The above comparison helps to emphasize that a rigid correlation of similar sets of Quaternary geological deposits in areas where the precipitation has been unequal cannot always be made and should not necessarily be expected.

The climate over most of Rhodesia during the dry interpluvials must have been much more arid than it was in Angola—judging by the calcareous nature of many of the deposits accumulated during these periods in Rhodesia. Kunkar, or secondary limestone, is not

* LEAKEY, L. S. B. (1949). Tentative study of the Pleistocene Climatic changes and Stone Age Culture Sequence in North-Eastern Angola. *Pub. Museu do Dundo. Publicacoes Culturais, No. 4.*

recorded by Leakey as occurring in the Pleistocene stratigraphy of north-east Angola so that it may perhaps be presumed that the climate never became sufficiently dry as to allow of its formation. If these factors are taken into account therefore the correlation between the Rhodesian and Angolan cultural and climatic succession is seen to be very close.

Culturally the correlations are also very close. While typologically the later cultures of each area are sufficiently distinctive to require a separate terminology yet when placed in the stratigraphical framework the stages of cultural development are seen to be the same and sufficient common denominators remain further to emphasize contemporaneity and correlation. Although the Kafuan has not yet been found in the Zambezi there appears to be no essential difference between the Chellean in the two areas, and this will probably be found to be true also of the Acheulian when more evidence becomes available from Angola. The governing factor of climate is further emphasized when we consider that during the very arid interpluvial at the end of Chelles-Acheul times man can have barely managed to exist in the Zambezi Valley. In Angola on the other hand where the rainfall was greatly decreased but not altogether absent we find a greatly increased population and the initial stages of the Sangoan culture. The proto- and lower Sangoan are absent in the Zambezi, as we might perhaps expect, and when this culture makes its first appearance here it is as a typologically Middle Sangoan contemporary (?) with the same stage of culture in Angola. The later division of the Rhodesian Sangoan and the proto-Stillbay are the Rhodesian equivalents of the Upper Sangoan in Angola. While in the latter area the emphasis is laid on the pick and the lancehead, in Rhodesia it is on flake-tools. It is nevertheless of interest to note that the small foliate points occur in both areas. The equivalent of the Rhodesian Stillbay is to be sought in the Final Sangoan in Angola.

There can be little doubt that the counterpart of the Magosian is to be found in the Lupemban now described and illustrated for the first time. Both belong to an arid phase and are found in association with redeposited Kalahari Sand. Leakey dates the Lupemban to the dry period separating the two post-Pluvial wet phases. This adds weight to my remarks on pages 101-103 of the present work that the redeposited Kalahari Sand II in the Zambezi and the Magosian should also date to this dry phase and not to the preceding one which marks the end of the Upper Pleistocene. The Zambezi form of the Magosian has the microlithic trapeziums, triangles and larger crescents in common with the Lupemban but the very large crescents, backed blades, and tranchets and the tanged points are absent. Once again while the cultures differ considerably in typology sufficient common factors remain apart from stratigraphy to make a connection recognisable.

We may also expect when the post-Lupemban cultures are studied in Angola to find that they will approximate to the Nachikufan of the North-Eastern Rhodesia plateau.

J. D. Clark.

APPENDIX B.

QUATERNARY FOSSILS FROM NORTHERN RHODESIA

by H. B. S. Cooke

The fossil fauna of Northern Rhodesia is still only scantily known and, as far as the Quaternary is concerned, the fossils so far recovered have been brought to light almost entirely through archæological researches. In most cases, therefore, there is some sort of archæological dating for the fossil material and it is convenient to consider the discoveries in groups according to the material culture associated with the faunal remains.

A—Early Stone Age Associations

1—*Victoria Falls Area*

A storm drain on the east side of the third gorge below the Victoria Falls yielded fragmentary remains of a primitive elephant *Loxodonta* (*Palaeoloxodon*) *darti* (Cooke and Clark, 1939). One complete upper molar and three fragments of other molar teeth were recovered, together with portions of rib bones, a fragment of an ulna, a portion of a fibula, a piece of the axis vertebra and other bone chips. The horizon is within the Older Gravels.

Six very fragmentary specimens of bone were found in an eroded ferricrete near the eastern end of the dry gorge south of the storm drain site. Some of the pieces are of very large size and may possibly belong to an elephant or hippopotamus.

Up river from the Falls, near Old Livingstone, the Younger Gravels yielded a very large astragalus, well mineralised and in good preservation, which seems to belong to a giraffid but not to the living giraffe. Broom (*in litteris*) has suggested that it may belong to the extinct *Griquatherium* (Haughton 1922) but this identification is not entirely satisfactory.

2—*Maramba River*

Two sites along the Maramba River, which is a tributary of the Zambezi, have furnished scanty fossil remains embedded in peculiar calcareous nodules somewhat resembling the "kunkar" of India. At both sites this deposit lies at the base of the Younger Gravels.

From Site M.D.39 three of the nodules contain recognisable teeth. Two upper molars seem to represent a reedbuck, and a lower premolar may belong to the same species. An upper premolar resembles that of the sassaby.

The nodules from Site M.O.40 are very weathered and few contain recognisable fossils. Several fragments of hippopotamus molars can be identified. One nodule contains an incomplete third molar of a wart hog. As preserved, this tooth is 51 mm. in length, although part of the anterior end is missing, and it is 17 mm. broad. These dimensions exceed the normal limits of size for the living species and it is probable that the fossil tooth belongs to one of the larger extinct species of *Phacochoerus*, possibly *P. compactus*. Another nodule contains two upper molar teeth similar to the corresponding teeth of the living Lichtenstein's Hartebeest. The same site has also yielded pieces of a scapula which cannot be certainly identified.

B—Middle Stone Age Associations

3—*Broken Hill Cave*

The fossil animal remains found associated with the human material in the Broken Hill Cave have been fully described (Mennel and Chubb 1907; Hopwood, Bate and Swinton 1928). The assemblage was referred almost entirely to living species, including three insectivores, a variety of rodents, a few carnivores, several ungulates, elephant, birds and some reptiles. Two species were described as extinct: a serval named *Leptailurus hintoni* Hopwood, and a rhinoceros, *Diceros whitei* Chubb. The latter species was founded upon two limbs bones—a tibia and a humerus. The tibia, however, does not seem to warrant distinction from that of the living black rhinoceros (*Diceros bicornis*) and the humerus proves on close examination to belong to a buffalo. The extinct rhinoceros thus disappears from the published faunal list. The buffalo very probably represents the living species but the bone is slightly stouter than that of *Syncerus caffer* and it is not impossible that it may belong to the extinct *Bubalus bainii*. Teeth of the white rhinoceros are said by Hopwood to be present in the collection but this is rather doubtful and it is likely that only the black rhinoceros is actually represented.

While it is not certain that all the specimens are of the same age or that they are of the age of the human material, there is nothing in the assemblage which is inconsistent with such a conclusion.

4—*Leopard's Hill Cave*

The fossils from this cave were recovered partly from a dump of excavated material and partly from a pit dug by a farmer in search of guano. All the specimens are well mineralised and the assemblage is fairly uniform in character. A large number of fragmental bones cannot be identified but probably represent a variety of ungulates. The less imperfect animal fossils which can be recognised include two small molluscs, a bird, tortoise, wart hog, bontequagga, buffalo, impala and two alcelaphine bovids. Of the last named, one has teeth comparable in size and in pattern with those of the living blue wildebeest, but the other is represented by a third molar which is distinctly larger and more closely resembles the extinct form described as *Alcelaphus robustus* from the Vaal River deposits (Cooke 1949), though it may not be identical with it.

C—Mixed Middle and Later Stone Age Associations

5—*Mumbwa Cave*

Three excavations of parts of this cave have been carried out but no record is available of fossil material collected during the first trials by Macrae in 1925. Dart and Del Grande (1931) mention a few fossils but their collection has not hitherto been described. Broom identified the collections made by Clark during his 1939 excavations and they are listed in the published account (Clark 1941). In the upper levels, associated with an Iron Age (Bantu) culture, domestic dog and domestic ox occur in addition to a few carnivores, rodents and ungulates. The middle levels, associated with a Wilton industry, include a few living ungulates and also three molluscs, identified by Barnard as *Achatina*, *Unio* and *Thapsia* (or *Gudeëla*). In the lower levels, associated with a Rhodesian Stillbay industry, the limited fauna includes only wart hog, an equine, reedbuck, hartebeest and the striped hyena.

In Dart and Del Grande's account, two tombs which were probably in the Wilton level are reported to have yielded "at least six different species of antelope, one wart hog molar and a lion's canine" as well as shell nacre and some smoothed bones.

A small undescribed collection placed by Dart in the Medical School, Johannesburg, and said to have come mainly from the Middle Stone Age levels, includes a variety of ungulates and a few rodents and carnivores. These are listed in the tabular summary on pages 140 and 141. In addition to material of the living buffalo, there are two teeth which seem to represent a somewhat smaller variety. It is also of interest to note that the hyena is *Crocuta* and not *Hyena*, and Dart has suggested (Dart 1936) that it resembles the extinct cave hyena (*Crocuta spelaea*) of Europe. A heavily mineralised upper molar of an equine in this small collection appears to be close to *Equus kuhni*, which is well known as a fossil in South Africa. *E. kuhni* is treated as an extinct form but it is possible that it represents an old southern race of the living Grevy's zebra (*E. grevyi*) now found only in the north-eastern part of Africa.

D—Later Stone Age Associations

6—*Nachikufu Cave*

The fauna from Clark's recent excavations at Nachikufu has not yet been fully studied but preliminary examination indicates that it is made up solely of living types of animal. The assemblages from the lower, middle and upper levels of the Later Stone

Age zone are closely similar and the whole fauna is listed together in the tabular summary. Overlying the Later Stone Age zone is a layer of Bantu occupational material and the animal remains from this deposit consist mainly of fragments of long bones. An unusual element is a milk molar of a baby elephant. No domesticated animals are represented.

7—Wilton Middens

Some middens in the Victoria Falls area, which contain Wilton tools, have yielded fragments of bone but nothing which is recognisable except a molar tooth doubtfully referred to the living Burchell's zebra.

8—Other Sites

The only other sites which have so far furnished fossil material are on Kilwa Island in Lake Mweru, where fragments of fossilized bone have been found in association with flakes of Later Stone Age affinities, in excavations undertaken recently by Clark in the Nsalu Cave near Serenje, and a specimen from deposits of the Third Pluvial period in the Kafue valley. The material from Nsalu has not yet been examined but superficially resembles that from the Nachikufu Cave 100 miles away. The fossil from the Kafue valley is part of the third molar of an alcelaphine which Broom has suggested (*in litteris*) might belong to *Connochaetes antiquus*.

Discussion

The fossil faunas so far known in Northern Rhodesia are not extensive and, for the most part, resemble the modern assemblages as far as these can be represented in the deposits examined. Few extinct species have been discovered, but the mere existence of some extinct forms at a few sites promises that wider exploration will yield a richer harvest.

It is not at present possible to suggest close correlation between the fossil-bearing deposits of Northern Rhodesia and those of South Africa and of East Africa. The fossil elephant from the upper part of the Older Gravels at the Victoria Falls is very similar to *Palaeoloxodon transvaalensis* and *P. hanekomi* of the Vaal River deposits (Cooke 1947). It is reasonable to suggest that there is a broad equivalence in age between the containing deposits at the Victoria Falls and the later part of the Younger Gravels of the Vaal River. The Victoria Falls elephant is, if anything, a more advanced type than is *P. recki* of Oldoway in East Africa, but this does not preclude the possibility of a partial overlap in time between the Victoria Falls Older Gravels and the Kamasian. More faunal evidence is required, however, before such a correlation can be made on a basis of fossil evidence.

As far as this can be assessed from the limited amount of material available in Northern Rhodesia, the Middle Stone Age assemblages there resemble those of South Africa in being essentially "modern" but with occasional evidence of the presence of a few extinct forms (Wells, Cooke and Malan 1942). *Equus kuhni* is one of the most characteristic of these. The large buffalo *Bubalus bainii* occurs frequently with the Middle Stone Age assemblages in South Africa: it or another buffalo may be present in one or two of the Northern Rhodesian deposits. *Phacochoerus aethiopicus* is more usual in these assemblages than is *P. africanus*, as is also the case in South Africa.

The Quaternary faunas of South Africa and of East Africa are now fairly well known and knowledge is expanding steadily; but direct correlation is still difficult and the link provided by further studies in Northern Rhodesia will be of the utmost value in helping to unravel the story of human development and changing climates in the continent of Africa.

	Victoria Falls Area	Maramba River	Broken Hill Cave	Leopard's Hill Cave	MUMBWA				Nachikufu Cave (L.S.A.)	Nachikufu Cave (Bantu)
					Lower Levels (M.S.A.)	Middle Levels (L.S.A.)	Upper Levels (Bantu)	Dart's Collection		
Wildebeest (*Connochaetes* sp.)								X	X	X
Sassaby (*Damaliscus* cf. *lunatus*)									X	
Damaliscus sp.		X						?		
Duiker (*Cephalophus* sp.)						X			X	X
Duiker (*Sylvicapra* cf. *grimmia*)							X	X	X	
Waterbuck (*Kobus ellipsiprymnus*)										X
Reedbuck (*Redunca* cf. *arundinum*)		X			X	X		X		
Reedbuck (*Redunca* sp.)							X		X	
Impala (*Aepyceros* sp.)				X						
Roan Antelope (*Hippotragus equinus*)						X		X	X	
Kudu (*Strepsiceros* cf. *strepsiceros*)			X			X		X		
Eland (*Taurotragus oryx*)			X			X		X	X	
Bush Buck (*Tragelaphus* sp.)			X							
Buffalo (*Syncerus* cf. *caffer*)			X					X	X	X
Buffalo (*Syncerus* spp.)			X	X				X		
Domestic Ox (*Bos taurus*)							X			
RODENTIA										
Dormouse										X
Mystromys sp.									X	X
Gerbil (*Tatera* sp.)			X							
Rat (*Otomys* sp.)			X							X
Rock Mouse (*Saccostomus* sp.)			X							
Mouse (*Arvicanthis* sp.)			X							
Pygmy Mouse (*Leggada* sp.)			X							
Lophuromys sp.			X							
Mouse (*Mus* sp.)			X							
Rat (*Rattus* sp.)			X							
Mole Rat (*Cryptomys* sp.)									X	X
Mole Rat (?*Georhychus* sp.)			X							
Cane Rat (*Thryonomys* sp.)							X			
Spring Hare (*Pedetes* sp.)									X	
Porcupine (*Hystrix* sp.)			X			X	X			X
AVES										
Owl (*Asio* sp.)			X							
Eagle (*Halia tus vocifer*)			X							
Crane (*Grus* sp.)			X							
Crane (*Bugeranus carunculata*)			X							
Francolin (*Francolinus* sp.)			X							
A passerine bird			X	X						
REPTILIA										
Tortoise (*Testudo* sp.)				X					X	X
Crocodile (*Crocodilus niloticus*)			X							
Lizard (*Varanus* sp.)			X							
Lizard									X	

	Victoria Falls Area	Maramba River	Broken Hill Cave	Leopard's Hill Cave	MUMBWA Lower Levels (M.S.A.)	MUMBWA Middle Levels (L.S.A.)	MUMBWA Upper Levels (Bantu)	Dart's Collection	Nachikufu Cafe (L.S.A.)	Nachikufu Cave (Bantu)
INSECTIVORA										
Elephant Shrew (*Elephantulus* sp.)			?							
Shrews (*Crocidura* spp.)			X							X
PRIMATES										
Monkey (*Cercopithecus* sp.)							X			
CARNIVORA										
Domestic Dog (*Canis familiaris*)							X			
Jackal (*Thos* cf. *adustus*)			X				X			
Mongoose (*Herpestes ichneumon*)			X							
Spotted Hyena (*Crocuta* cf. *crocuta*) ..			X					X		
Striped Hyena (*Hyaena brunnaea*)					X		X			
Serval (*Leptailurus hintoni**)			X							
Lion (*Felis leo*)			X					?		
Leopard (*Felis pardus*)			X							
Carnivora indet.								X	X	
TUBULIDENTATA										
Aard Vark (*Orycteropus* sp.)							X			X
HYRACOIDEA										
Rock Rabbit (*Procavia* sp.)								X		X
PROBOSCIDEA										
Mammoth (*Palaeoloxodon darti**)	X									
African Elephant (*Loxodonta africana*) ..			X							X
Elephant		?								
PERISSODACTYLA										
Black Rhinoceros (*Diceros bicornis*)			X						X	
Equus cf. *kuhni**								X		
Burchell's Zebra (*Equus burchellii*)								X	X	
Equus cf. *burchellii*			X	X						
Equus sp.					X	X				
ARTIODACTYLA										
Hippopotamus (*Hippopotamus* sp.) ..		X						X		
Wart Hog (*Phacochoerus* cf. *compactus**)		X								
Wart Hog (*Phacochoerus* cf. *aethiopicus**)			X	X						
Wart Hog (*Phacocherus* cf. *africanus*) ..								X	X	X
Wart Hog (*Phacochoerus* sp.)					X	X	X			
Bush Pig (*Potamochoerus* sp.)								?	X	X
Giraffe (*Giraffa camelopardalis*)			X							
Giraffid (?*Griquatherium**?)	X									
Hartebeest (cf. *Alcelaphus robustus**) ..				X						
Hartebeest (*Alcelaphus* cf. *lichtensteini*) ..		X								
Hartebeest (*Alcelaphus* sp.)					X			?	X	
Wildebeest (*Connochaetes* cf. *taurinus*) ..			X	X		X	X			

* Extinct or presumed extinct

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APPENDIX C.

FOSSIL MAN IN NORTHERN RHODESIA

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Northern Rhodesia has so far yielded only a few human relics which can confidently be assigned to any part of the Stone Age. Among these, the famous skull and other fragments found at Broken Hill in 1921 take pride of place. The Italian Scientific Expedition of 1930 was responsible for several valuable finds, which were entrusted for description to Professor R. A. Dart of the University of the Witwatersrand. More recently Dr. Desmond Clark has several times secured human remains more or less definitely associated with Stone Age industries, and all these have also been sent to the University of the Witwatersrand for study.

The Broken Hill Remains

These finds include the nearly complete skull which Sir Arthur Smith Woodward (1921) made the type of the species *Homo rhodesiensis* (Fig. 1), together with fragments of braincase and upper jaw belonging to one or more additional skulls, and other portions of the skeleton which also belong to at least two individuals. A detailed description of all these remains has been given by Pycraft (1928). The circumstances of the discovery have lately been reviewed by Dr. Desmond Clark, and his conclusions regarding the age and associations of the remains are crucial for any estimate of their significance.

The Broken Hill skull presents a remarkable and superficially very primitive appearance. Nevertheless, as Pycraft (1928) has emphasized, its distinctive features are for the most part not truly archaic but highly specialised. The appearance of an extremely low forehead is due almost entirely to the great vertical thickening of the eyebrow ridges, which almost obliterate the actual forehead. Much stress has also been laid upon the almost complete absence of a hollow (the canine or infra-orbital fossa) below the eye-socket. However, Weidenreich (1943) has shown that the modelling of this region in the Broken Hill skull is much less primitive than in Pekin Man. Apart from this the face is chiefly remarkable for its enormous size, and especially for the great distance from the lower border of the nose to the upper incisor teeth. In spite of the length of the face there is very little forward projection of the upper jaw. The upper dental arch is enormously long and wide, and Pycraft has pointed out that it must have been even larger before the teeth were affected by decay. The area on the underside of the braincase to which the posterior neck muscles are attached is very much enlarged, producing a distinct ridge around the hinder end of the skull. This feature clearly provided the necessary counterpoise for the enormous face and brows.

Although the capacity of the braincase is little below the average for modern human beings, the upper part of the braincase is unevenly expanded, reflecting a lack of development of the brain formerly lodged in it. This feature, which has been emphasized by Sir Grafton Elliot Smith (1928), argues a relatively primitive status for the Broken Hill man much more forcibly than do the external features of the skull.

Sir Arthur Keith (1925) acutely remarked that the differences between the Broken Hill skull and one of modern type are very similar to the effects of the glandular disorder known as acromegaly. He argues however that, while this suggests the mechanism by which the special characters of the Broken Hill type may have been produced, it does not warrant the conclusion that this skull is merely a pathological abnormality. My own experience of acromegalic changes in African skulls

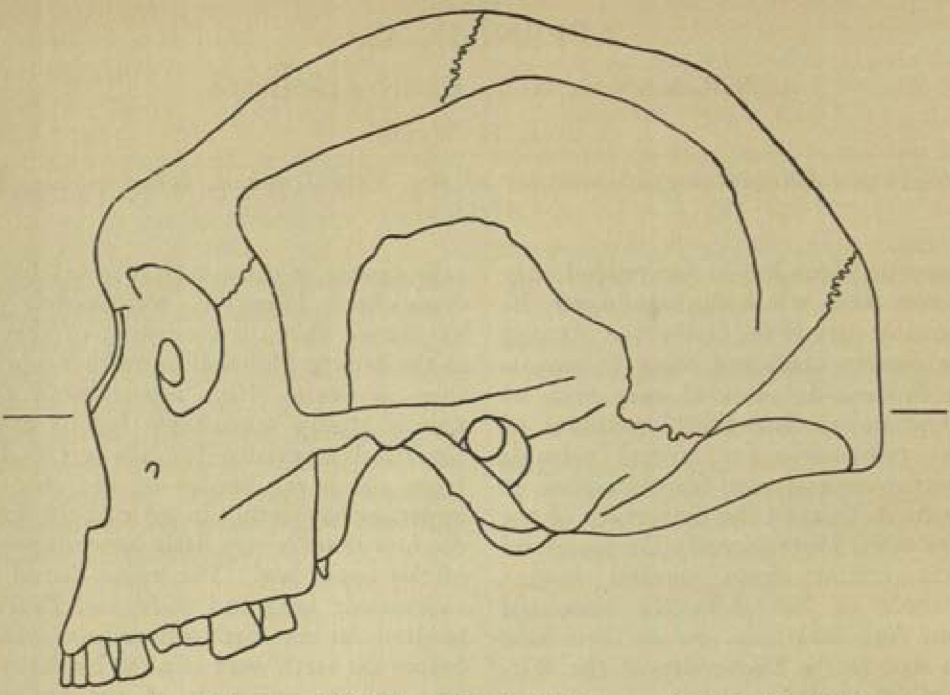

FIG. 1. Side view of Broken Hill skull (*Homo rhodesiensis*). $\times \frac{1}{2}$.

has convinced me of the justice of Sir Arthur Keith's reasoning.

It has sometimes been suggested that the fragments of braincase and upper jaw might belong to a type quite different from the complete skull. Having examined these fragments, I feel that neither of them could be assigned with confidence to a distinct type. The jaw fragment certainly formed part of a jaw which, although smaller than that of the skull, was larger than the largest recorded South African Negro or aboriginal Australian jaws. It differs from that of the skull chiefly in the shorter distance from the lower border of the nose to the upper incisor teeth, and in the distinct hollowing of the cheek below the eye-socket. I think that these differences are not beyond the probable range of variability of a single type. If so, the skull must be regarded as an extreme rather than a typical specimen of its kind.

Because of the heavy brow ridges and the form of the face, many authorities have been inclined to relate the Broken Hill man to the Neanderthal type of the Middle Palaeolithic period in Europe. Some have gone so far as to consider him to be essentially an African variety of Neanderthal man. But Weidenreich (1943), while including the Broken Hill man in the Neanderthal group, separates him into a distinct and relatively primitive sub-group. This seems to be another way of saying that the Broken Hill and Neanderthal types are separate developments from a common ancestral stock.

Keith (1925), Pycraft (1928), and Elliot Smith (1928), all agreed in considering the Broken Hill skull to be at once more primitive than the Neanderthal type and nearer to a generalised type of modern man such as the aboriginal Australian. If, as seems highly probable, Broom (1943) is correct in maintaining that the Neanderthal and modern human types have diverged from an ancestral stock most nearly resembling the aboriginal Australian, the Broken Hill man could well be regarded as an independent offshoot of the same stock. He might therefore be considered as nearly related to modern types of man as to Neanderthal man. This relationship would be most correctly expressed by Smith Woodward's original conclusion that the Broken Hill skull represents a distinct species of man, *Homo rhodesiensis*. It does not seem necessary to place this species in a separate genus (Cyphanthropus) as has been suggested by Pycraft.

In recent years it has frequently been argued that the Broken Hill skull represents an early stage in the ancestry of modern African types of man. If this fossil is not older than the Middle Stone Age such a supposition appears hardly tenable. The Broken Hill man may conceivably be directly related to the ancestral stock of the modern African types and not merely to the common ancestor of all varieties of modern man. Still I feel that he must be regarded as a highly specialised offshoot of this stock.

Weidenreich (1943) has suggested that the fragmentary skull from Lake Eyassi in Tanganyika, formerly regarded as very primitive in character and compared with the Pekin and Java fossil men, is in reality intimately related to the Broken Hill skull. Such a relationship appears highly probable; it is indeed possible that the Broken Hill and Eyassi skulls belong essentially to the same type, but the Eyassi remains are too imperfect for the exact degree of relationship to be established. It is noteworthy that Leakey (1946) considers the Eyassi skull to be associated with a Levalloisian culture roughly equivalent to the early stages of the Middle Stone Age in Northern Rhodesia.

The skull from Florisbad near Bloemfontein in South Africa, which probably belongs to the early Middle Stone Age but may be more ancient, has also been compared with the Broken Hill skull, especially as regards its low forehead and very wide massive eyebrow ridges. However, the Florisbad skull has a much larger braincase, and the infra orbital region of the face is deeply hollowed. It does not seem that either of these types can be regarded as descended from the other, as has sometimes been suggested but it is quite possible that they are divergently modified offshoots of the same ancestral stock.

The Mumbwa Remains

Of the three excavations carried out in the Mumbwa Caves, that of the Italian Scientific Expedition in 1923 alone yielded human remains of determinable physical type. Macrae had previously found none, and Dr. Desmond Clark subsequently recovered only isolated teeth from the uppermost part of the deposit, either late Stone Age or Iron Age. The Italian Expedition recovered fragments of at least sixteen individuals (Dart and del Grande 1931). These lay at depths varying from 40 cm. to nearly 2m. (upwards of six feet). Dart and del Grande note that " these remains were retrieved only with great difficulty. It was a common experience to find only the outline of the calvaria—almost the entire inner table of the skull being eroded —and a few teeth, the remaining bones having entirely disappeared. Even the portions found were fractured with the greatest facility, and reconstruction efforts were generally rendered abortive by the lack of sufficient contact surfaces." As a result, only three incomplete skulls are available for detailed study. These all came from a considerable depth (150-175 cm.) in the deposit. If the stratification determined by Dr. Desmond Clark holds good for the area excavated by the Italian Expedition, this horizon dates back to the Middle Stone Age. Judged by their state of preservation, however, the three skulls vary considerably in age, two of them (IV 1 and IV 2) being appreciably fossilized, the third (IV 3) only very slightly. All three probably owe their position in the deposit to burial, but at different periods during the occupation of the cave. These relics have been briefly discussed by Dart and del Grande (1931) and in more detail by Jones (1940).

Skull IV 1 is represented only by the roof of the braincase (Fig. 2) and belongs to an elderly individual whom Dart and del Grande, followed by Jones, identified as an impure Bushman type. This fragment seems to resemble most nearly the type which Dr. R. Broom (1923) has termed " Korana ". In Fig. 2 its outline has been superimposed on that of a female " Korana " skull from the neighbourhood of Kimberley in South Africa. The roofs of the two skulls correspond very closely; unfortunately we cannot tell whether the other parts were equally similar. This interpretation is not inconsistent with that reached by previous investigators, for the

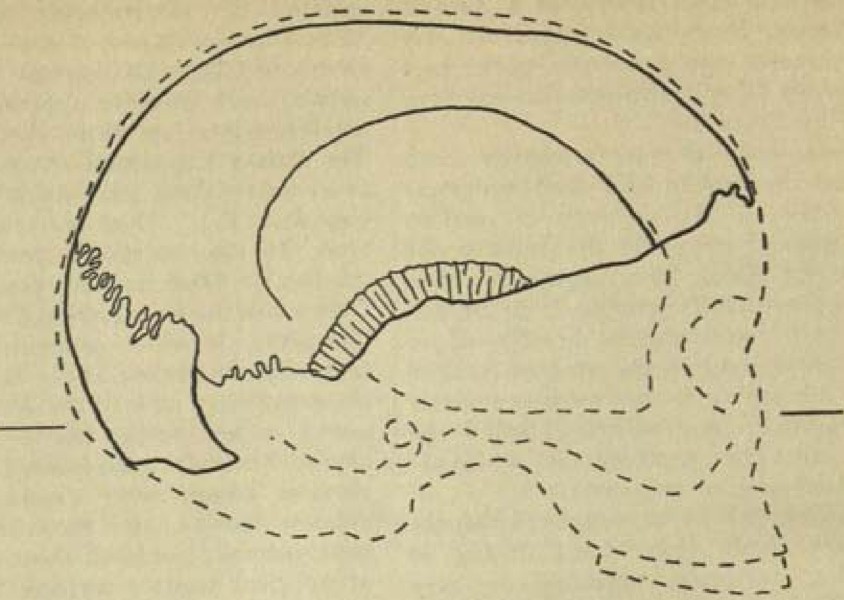

FIG. 2. Side view of Mumbwa skull fragment IV 1, superimposed on "Korana" skull from Kimberley district (interrupted outline). × ½.

"Korana" type is either intimately related to the Bushman or includes a considerable Bushman element.

The other fossilized skull (IV 2), that of a young adult, is represented by numerous fragments of the braincase and face, together with the nearly complete lower jaw. Jones found it impossible to reconstruct the braincase satisfactorily, and attributed this to earth pressure having distorted the bones, which are usually thin. Renewed study indicates that when all allowance for distortion has been made, the braincase must have been large and mis-shapen in appearance. This might be due, as Dart and del Grande supposed, to admixture of a large-headed type such as that represented by the Boskop fossil skull from South Africa, but combined with the remarkably thin bones and the peculiar infantile bulging forehead, it suggests that the skull belonged to an individual afflicted with hydrocephalus (water on the brain). If this were the case, the only undistorted parts of the skull from which its physical type could be inferred would be the ear region, the face and the lower jaw; all these are essentially Bushman in character.

Jones remarked on the fact that all four upper incisor teeth had been lost from this skull during life, and suggested that they may have been deliberately extracted. This practice has not been observed in Stone Age skulls from South Africa, but in North Africa it has been recorded as far back as the Upper Palaeolithic.

The types to which these two skulls appear most nearly akin are characteristically associated with the Late Stone Age in South Africa, but may extend back into the Middle Stone Age. It is therefore equally possible for these specimens to owe their position in the Mumbwa deposit to burial from a Late Stone Age or from a late Middle Stone Age level.

The more recent skull IV 3 is represented by the greater part of the braincase, with the bones forming the bridge of the nose and some fragments of the upper jaw. From the slenderness of the bones and certain other features, Dart and del Grande identified this skull as Bushman in type, but the braincase when reconstructed suggested to Jones that an element very different from the Bushman is also present. It is long and extraordinarily narrow, the maximum breadth being only

62·5 per cent. of the length. As Fig. 3 shows, the bridge of the nose projects boldly forwards, and any attempt to reconstruct the face demands a profile of distinctly Caucasoid (European) type, quite different from that of either the Bushman or the Negro.

Dr. L. S. B. Leakey has pointed out to me that close counterparts to this long, narrow and European-faced skull are to be found among " Mesolithic " and " Neolithic " skulls from Kenya, in particular the Neolithic skull No. II from Willey's Kopje (Leakey 1935). In South Africa, a similar long narrow braincase characterises the skulls from Kakamas on the Orange River, regarded by Dreyer and Meiring (1937) as historically Hottentot, but none of these skulls has so markedly European a facial profile as is indicated by the Mumbwa skull. Dreyer and Meiring suggest that the Kakamas skulls, although comparatively recent, may be descended from the much older long-headed types of East Africa. It is tempting to imagine that Mumbwa IV 3 forms a connecting link between these two groups.

In its state of preservation skull IV 3 falls between two groups of fragmentary remains from the upper part of the deposit. The remains forming one of these groups are in a fresh condition and clearly belong to a relatively recent Iron Age occupation; those of the other group are slightly fosssilized and are assigned by Dr. Desmond Clark to the Late Stone Age. Judged by this evidence, the skull IV 3 seems to belong either to the end of the Late Stone Age or the early part of the Iron Age.

The most recent group of remains includes fragments which are not Bushmanoid and are probably Negro in type. Some of the older fragments are of a slender Bushmanoid type, but others are more massive. Jones, like Dart and del Grande, has classified these as " Boskopoid ", using this term in the broad sense to embrace all pre-Negro types which are more robust than the Bushman. I have lately come to question the validity of this usage, and to feel that the term " Boskop type " should be confined to only one out of several such robust pre-Negro types. Nevertheless these types all appear to be fundamentally related to the Bushman, with whom they may be bracketed as constituting a " Bushmanoid " variety of modern man. The massive remains

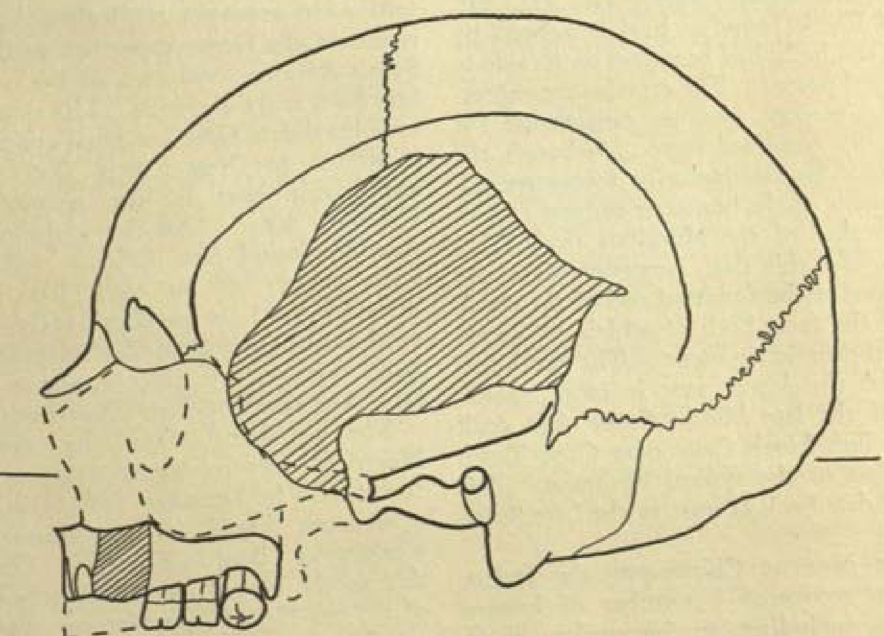

Fig. 3. Side view of Mumbwa skull IV 3; the interrupted outline indicates the most probable restoration of the missing facial parts. $\times \frac{1}{2}$.

from Mumbwa are too fragmentary to show whether they belong to the extremely large-headed Boskop type proper or to one of the other robust Bushmanoid types.

Dr. Desmond Clark (1942) suggests that in the uppermost levels the human remains were not buried but dumped with scant ceremony; possibly these were the last Late Stone Age occupants of the cave who were either killed or died from some epidemic. In the deeper layers there is evidence of ceremonial burial, sometimes in tombs built of piled-up stones.

Some fragments were found at an even greater depth than the three skulls described above. These remains are heavily fossilized, and it appears quite possible that they date back to the Middle Stone Age. They are predominantly of massive build, like most of the remains from the Middle Stone Age in South Africa, but a more slender Bushman type may also be represented. There is no reason for regarding any of these remains as other than Bushmanoid in type, and there is no suggestion among them of anything comparable with the Broken Hill skull.

Other Finds

At the Maramba Game Park site, Dr. Desmond Clark found a burial exposed by erosion. The body had been laid on its side in a contracted posture. The remains are regrettably fragmentary, but are remarkable for their heavily fossilized state. Although the skull cannot be satisfactorily reconstructed, the fragments of the braincase suggest a form similar to that of the Mumbwa skull IV 1 (Fig. 2). In this case, however, there are also portions of the forehead and of the cheek region of the face, both of which are essentially Bushmanoid in type. The teeth are small, and the lower jaw is more similar to that of the late Middle Stone Age skull from the Fish Hoek Cave near Cape Town than to that of the typical Bushman. This find must date back at least to the Late Stone Age.

From a cave at Chipongwe the Italian Expedition recovered a number of human fragments, including an incomplete skull. Some of these remains seem to be quite recent, but the skull is slightly fossilized and may be derived from a superficial Late Stone Age burial. Imperfect as it is, there can be no doubt that it is essentially Bushman in type (Fig. 4); indeed it is the best example of this type which I have so far seen from Northern Rhodesia. A fragment of the hinder part of a skull from Leopard's Hill cave near Lusaka also appears to be of Bushman type.

In his recent excavations in the Nachikufu Cave, Dr. Desmond Clark has recovered a few isolated human fragments from Late Stone Age levels, but no remains of skulls or teeth have as yet been found. All that can be inferred from these relics is that, like many of those from Mumbwa, they belong to a type larger and more robust than the Bushman.

A skeleton found in a prospecting trench near Kalomo and described by Gear (1926) was accompanied by pottery and therefore presumably belongs to the Iron Age. Gear concluded that the remains are those of a Negro possessing " Boskopoid " features. The most remarkable feature of this skeleton is the very large lower jaw, which greatly exceeds that of the average Negro; in its overall dimensions indeed it falls not far short of the famous Heidelberg fossil jaw from Europe. Schepers (1935) has shown that in spite of its great size the Kalomo jaw is much nearer to the Negro type than to those of the South African fossil men of Boskop, Springbok Flats and Fish Hoek. This does not however invalidate Gear's original conclusion that a robust pre-Negro type had played an appreciable part in the ancestry of the Kalomo man. Another skeleton more recently found near Kalomo and associated with pottery of an early Iron Age type (Clark 1942) is predominantly Negro in type but shows some Bushmanoid features. Such features are quite common in recent Iron Age skeletons from Northern Rhodesia.

The problem offered by these " pre-Negro " traits in Negro remains has been formulated by Drennan (1942) in discussing a skeleton found in a prehistoric copper working at Likasi in Katanga. They may be due to the Negro having absorbed elements of a " pre-Negro " population. But it is also possible that they are archaic features of the Negro stock which have persisted in a certain number of cases. Individuals with such archaic or "proto-Negro" features might be expected to be relatively numerous on the periphery of the Negro area, and so to be well represented among the first Negro colonists of a new territory.

A Tentative Synthesis

From so few specimens it is not possible to draw a complete picture of the prehistoric physical types of Northern Rhodesia. The sequence of the remains discussed appears to be:

Type.	*Site.*	*Age.*
Negro-Bushmanoid	[Kalomo [Mumbwa ?	Iron Age
Caucasoid	Mumbwa (IV 3)	?
Bushmanoid	[Chipongwe	[? Late Stone Age
	[Maramba [Mumbwa	[? Middle Stone Age
Homo rhodesiensis	Broken Hill	Middle Stone Age

It cannot be too strongly emphasized that this is a sequence of individual finds and not of types, and that the position of any type in this list need not represent either its first or its last appearance in this region.

These finds do not at present enable us to distinguish between the human types of the Late Stone Age and those of at least the later Middle Stone Age. Most of the remains belonging to either of these periods are fundamentally Bushmanoid; many of them however are not typically Bushman but belong to more robust types. As in South Africa, the Negro type does not seem to have appeared before the Iron Age.

So far the succession of human types in Northern Rhodesia appears to correspond with that observed in South Africa. But the "Caucasoid" type of Mumbwa IV 3 and the *Homo rhodesiensis* type of Broken Hill, although they have possible relatives in South Africa, are much more closely comparable with East African finds.

It has been pointed out above that Mumbwa IV 3 probably belongs either to the end of the Late Stone Age or to the early part of the Iron Age. But until this type is found in a more definite cultural context in Northern Rhodesia, its place in the sequence must remain uncertain. That it in some way links the Mesolithic and Neolithic types of East Africa with the protohistoric "Hottentots" of the south is a plausible speculation but nothing more.

The attribution to the Middle Stone Age of a Bushmanoid type at Mumbwa and of the *Homo rhodesiensis* type at Broken Hill may appear paradoxical. It is indeed quite

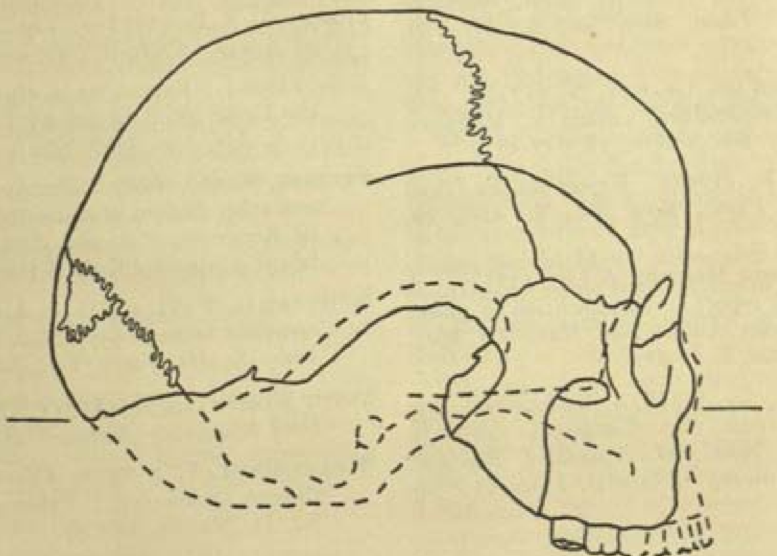

FIG. 4. Side view of Chipongwe skull (Bushman type); missing portions restored in interrupted outline. × ½.

possible that the Broken Hill skull belongs to a phase considerably earlier than the oldest remains from Mumbwa; in this connection it is to be remembered that the nearest counterparts to the Broken Hill specimen, those of Eyassi in East Africa and Florisbad in South Africa, are associated with industries of early " Middle Stone Age " character. But it seems highly improbable that the type represented at Mumbwa could be a lineal descendant of that of Broken Hill. The Bushmanoid type could more plausibly be traced back to the supposed Early Stone Age skulls from Kanjera in East Africa. At the same time it is possible that these are in their turn derived from a " proto-Australoid " stock which, as has been argued above, could equally have been ancestral to the Broken Hill and Neanderthal types as well as to all varieties of living man. If this is the case, the Broken Hill and Bushman types could be regarded as the extremes of divergent specialisation from this ancestral stock.

These data are at least sufficient to indicate that the pattern of human types in Northern Rhodesia does not coincide with that of either South Africa or East Africa, but appears to combine features of both. It would be easy, but surely premature, to elaborate hypothetical explanations of these regional divergences. For the time being we may accept them as demonstrating how crucial a position Northern Rhodesia occupies for any understanding of the history of human types in Africa.

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APPENDIX D.

THE DATING OF DEPOSITS OF "KALAHARI" SAND

by GEOFFREY BOND

In his outline of the Geology of Southern Rhodesia A. M. MacGregor (1947) states "Since archæological evidence . . . indicates that the Kalahari beds are geologically very recent, their position upon an ancient erosion surface presents difficult problems for future research". This is very true, and the different opinions which have been expressed in the past about the age of the Kalahari Sand serve to emphasize the difficulty.

A major obstacle is the lack of good exposures. The excavation of two pits on Knights Drive near Livingstone by Mr. Desmond Clark is therefore of great interest. Mr. Clark very kindly sent me samples taken at every foot in both pits, in the hope that a mineralogical examination might yield some information.

As I had already carried out similar examinations on samples from the railway cutting sections described by Maufe (1939) near the Victoria Falls Hotel, and at other places further South, I welcomed the offer of space for an appendix to this handbook to state such results as I have obtained, and to add a few remarks on some aspects of the Kalahari Sand problem.

Briefly, Mr. Clark asked for my views on the relations of the sands below the rubble bed, to the pipe sandstone below, and the Kalahari Sands above the rubble.

The succession in the Railway cuttings and the Knight's Drive pits is given below.

Railway Cuttings (after Maufe)	*Knight's Drive Pits*
Kalahari Sand (Supra rubble sand)	Kalahari Sand
Carstone Rubble Bed	Land rubble
Red pebbly Sand (Sub rubble Sand)	Red Sand
Pipe Sandstone	(absent)
Chalcedony	(absent)
(unconformity)	(unconformity)
Karroo Basalt	Karroo Basalt

The immediate problem was whether the sub-rubble sands represented broken down and weathered pipe sandstone, or were an entirely separate phase of accumulation.

In some exposures of undoubted pipe sandstone the top part has ben silicified to a hard quartzitic material. In the pits on Knight's Drive the lowest part of the sand has an incipient pipe structure, but there is no horizon of induration by secondary silica. Furthermore, in the overlying rubble bed there are fragments of the typical silicified phase of the pipe sandstone, which must, therefore, have been undergoing erosion at the time the rubble was formed. This suggests that the sub-rubble sands are a separate phase of deposition.

In the Victoria Falls railway cuttings described by Maufe (1939) there are a few feet of red pebbly sand between the pipe sandstone and the Carstone rubble bed. Maufe considered that silicification of the pipe sandstone had occurred before the deposition of this sand, and noted the irregularity of the contact. This indicates a non-sequence, and the silicified upper part of the sandstone was probably removed during this interval.

The sub-rubble sands resemble the overlying Kalahari Sands, but the possibility remains that they are local, and derived from the breakdown of pipe sandstone. In testing their affinities heavy mineral separations have been made from the various sand horizons in the railway cutting and the pits on Knight's Drive.

The treatment was more or less standard. Samples were first lightly panned in a porcelain dish to remove the clay fraction and some of the quartz grains, and then separated in bromoform. The concentrate was then separated magnetically, using a horseshoe permanent magnet with pointed pole pieces.

Only non-magnetic fractions were permanently mounted. A comparison was then made between pipe sandstone (unsilicified), sub, and supra rubble sands. In each separation 500-600 grains were counted and results expressed as percentages of the non opaque fraction.

	St	Ky	Ru	Gn	Mn	Ap	Tm	Zn	EP
Supra-rubble Sand (Railway cutting) ..	8	2	6				13	71	+
Sub-rubble sand (Railway cutting) ..	13	+	4	+			21	60	
Sub-rubble sand (Pit 2 Knight's Drive) ..	13	4	4	2			19	58	
Pipe Sandstone (Railway cutting) ..	5	2	4	7	2	4	15	61	+

Abbreviations :

St	Staurolite	Ap	Apatite
Ky	Kyanite	Tm	Tourmaline
Ru	Rutile	Zn	Zircon
Gn	Garnet	Ep	Epidote
Mn	Monazite	+	Trace (<1%)

These figures show that the sub-rubble sands of Knight's Drive and the Railway Cutting are similar, and that they are more like the supra-rubble sands than the underlying sandstone. They also show that the sub-rubble sands are sufficiently unlike pipe sandstone to warrant the view that they are a distant phase of deposition, and that breakdown of pipe sandstone can have contributed only a small amount of their formation.

Maufe (op. cit.) called the sand above the Carstone rubble bed Kalahari Sand. This implies that it is *in situ* and should be correlated with the main mass of sand which, further south on interfluves, reaches a thickness of 200 feet. It seems possible that the sub-rubble sands should be correlated with the main masss of sand, which rests on an old peneplain surface, and that most of it was removed by erosion in the Zambezi Valley before the Carstone rubble bed was deposited. The supra-rubble sands must, therefore, be considered as redeposited Kalahari Sand.

At Knight's Drive the sub-rubble sands rest directly on basalt. In the Railway cuttings they rest on eroded pipe sandstone. A period of erosion is thus indicated immediately before their formation. Away from the vicinity of the Zambezi River the Kalahari Sand rests on a surface which was probably a very perfect peneplain. This is now gently warped and the Zambezi seems to flow in one of the depressed parts. If the warping took place after the formation of Kalahari Sand I (i.e. the sub-rubble sands) the river would soon erode through the soft sands and form a low sand scarp on each flank. No cultural material is known to underlie the sub-rubble sands and these may be older than the Falls Older Gravels. But the redeposition of the sands took place at a time which can be dated by stone implements. These show that this occurred later than the formation of the older gravels.

Once sand scarps were formed, redeposition of Kalahari Sand could take place whenever the climate became suitable. In wet phases the scarps would be protected from erosion by vegetation, but in dry phases this restraint would be removed.

There is no difficulty in dating the various redeposited Kalahari Sands. The difficulty is with the dating of the earliest phase. These notes by no means resolve this difficulty but perhaps indicate the direction in which a solution may be found.

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