played by the nucleolus in the protein and nucleic acid metabolism may be estimated with a reasonable amount of certainty. Unfortunately, however, in animal cells, this relationship between the chromosomes and the nucleolus has not been established with the same amount of unmistakable regularity. Only in the salivary gland nuclei of Diptera have the nucleoli an appreciably similar disposition. In *Chironomus*, where the nucleolus is extremely large, it is associated with the small chromosome IV. [18,19] It is important that in so far as animal cells are concerned, the nucleolus requires further study, not so much from its functional aspect, but from the aspect of its relation with the chromosomes.

The present position in regard to the nucleolus would be that it is largely composed of histone and ribose nucleic acid which it receives from the chromosomes during telophase and which later diffuses into the cytoplasm, where it stimulates the synthesis of proteins and other metabolic products. In fact, a definite connexion has been established between the size of the nucleolus and protein production, the nucleolus being largest in cells where rapid protein production is going on, and relatively small in cells where no protein is being made.[6]

In this connection, the study of the nucleolus of the Sertoli cells of the testis is full of interest. In his description of the cytology of the Sertoli cells in the testis of Apoda (Amphibia), one of us[20] noticed a number of nucleoli in the Sertoli nuclei, all taking up hæmatoxylin. Re-examination of these nucleoli and selective staining by Feulgen-light-green showed that the nucleolus (of *Siphonops annulatus*) was really a compound structure; the centre, a spherical body stained green, to the periphery of which were plastered a number of pink bodies. This picture of the nucleolus demanded a new orientation of our ideas of the nucleolus. Undoubtedly here we had a compound nucleolus with a central Feulgen negative sphere in which there was a preponderance of histone while the periphery was made up of a varying number of Feulgen positive bodies in which there was an accumulation of desoxyribose nucleic acid. The association of desoxyribose nucleic acid with histones in the nucleolus is an interesting discovery and is in our opinion, a visual demonstration of the truth of the association of the two components. Until now such an association between the desoxyribose nucleic acid and the histone in the chromosomes was only inferred by indirect methods such as have been recalled earlier. The fact of the association of the two demonstrated by staining technique adds precision to the picture.

It has, however, not been possible, in the Sertoli cells, to establish a connection between the nucleoli and the chromosomes. Sertoli cells are nutritive and supporting cells of the testis and mitoses in them are either rare or wanting. We have to regard them as cells which have attained a condition of permanent rest. Under the conditions, it is therefore impossible to establish a relationship between the chromosomes and the nucleoli. But the relatively large nucleolar content of Sertoli cells in the Apoda may be understood by the assumption of their importance in protein production but here we would like to be on surer ground before assuming the fundamentals of the behaviour of Sertoli cells. A systematic examination of different types of animal and plant cells is being made in these laboratories with a view to harmonizing our present divergent ideas regarding the origin and significance of nucleoli.

In this connexion, we would like to enter a strong plea for the provision in this country, of adequate equipment for modern methods of biological investigation. The wide possibilities opened up by ultra-violet absorption spectroscopy developed by Caspersson as long ago as 1934 or the immense advantages of the Electron microscope are denied to workers in India, and we would like to take this opportunity to urge on the premier Scientific Institutions and Societies, and the Governments in the country to make available these modern facilities for biological investigation.

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THE AGE OF MICROLITHIC CULTURE IN GUJARAT

By H. D. SANKALIA

WHILE reviewing our work, "The Second Gujarat Prehistoric Expedition in Search of Microlithic Man in Gujarat", it was said in *Nature*[1] that the microlithic industries in India were not older than the 2nd century B.C. and in no way comparable to the Mesolithic of Europe either culturally, or in time.

Microliths have a very wide distribution in India. They have been found not only in the Mahadeo Hills, C.P., but, as Foote and subsequent investigators have shown, all along the southeast coast, in the Hyderabad and Mysore States, Central India, Gujarat, Kathiawar, Cutch, Sind and the Punjab. It would indeed be strange if in all these areas, some of which were the centres of highly advanced metal civilizations, at least from the 3rd century B.C. onwards, microliths were still used

as tools. The material culture—tools, weapons, etc.,—depicted in the sculptures at Amaravati, Nagarajunikonda, Bharhut, Sanchi and elsewhere as well as finds from the excavations at Kondapur, etc., indicate that much larger tools of metal were common. For a number of these areas, however, the question must remain open, until excavations reveal a stratigraphic sequence which will enable us to assign the microlithic industries to any definite period. Latterly such an evidence has been forthcoming from two areas for a prehistoric dating of the microlithic culture, and it is pointed out briefly in this note.

The evidence from Mahadeo Hill paintings discussed by Colonel Gordon[2] is not much helpful, for there is neither stratigraphic nor cultural relationship between the microliths and the rock-paintings. The former might be older, or contemporary with the paintings, which are themselves not of one period, but seem to extend over a thousand years. Very recently in the excavations at Brahmagiri in the Mysore State, Dr. M. H. Krishna[3] found microliths in association with neoliths in comparatively higher levels and *only* microliths in the lowest levels, the whole culture sequence including more than one stratum of iron age followed by the historic period attributed to the early centuries before Christ.

The Mahadeo Hill evidence may thus be regarded as exceptional and local and cannot constitute a rule for the dating of microlithic culture throughout India.

The latest evidence comes from the loess mounds at Langhnaj in Northern Gujarat, where digging has been in progress for the last three seasons. Here, as also in the small digging in the loess site at Hirpura, no metal objects have been found, as ordinarily they should have been, had the use of microliths survived as late as the 10th century A.D. Langhnaj along with many other localities in N. Gujarat was a flourishing village and has been in continuous occupation since then. These microlithic sites of N. Gujarat are not very far removed from the political and cultural centres throughout the historical period, while, as the Mahadeo Hill region is cut off from the main centres of civilization, we may assume there the survival of the Stone Age tradition to a later date. If the microliths at Langhnaj were so late as even the 2nd century B.C., some contemporary evidence in the shape of Indo-Greek or punch-marked coins, terrocottas, pottery, etc., should have been found along with the microliths.

So far we have discovered microliths and fossilized (calcified) skeletal remains after about 3 feet of digging in an unstratified loessic soil. These really constitute much more important evidence than the negative one. The juxtaposition and inter-relation in which these skeletons occur with animal remains, bone- and pebble-conglomerates, and microliths about the four-foot level, and the fact that human and animal remains are equally fossilized point to all of them being contemporaneous deposits. There is thus no ground to suppose that we have to deal with any but a prehistoric Stone Age culture.

The age of this microlithic culture in Gujarat rests largely on the degree of fossilization of our finds. Our studies on this point have so far been confined to ascertaining the exact nature of fossilization and its relative proportion to finds of old bones from preferably comparable deposits. On the latter point we find that bones discovered from historical sites, about 2,000 years old, are not at all fossilized; nor are the human and animal remains unearthed at Mohenjodaro and Harappa. Comparison with finds by Dr. De Terra[4] from an excavation in the upper loessic deposits at Uchali near Naushahra, in the Salt Range, Punjab is still more instructive. He found stray microliths and remains of *Homo sapiens* of dolicocephalic type and funerary pottery of handmade neolithic type. These remains were bleached and very brittle.[5] Such a poor state of preservation, as well as a general paucity of vertebrate fossil remains in the Potwar loess was attributed by De Terra to a high percentage of lime carbonate in the soil, which he considers really wind-borne silt, deposited in late Pleistocene to sub-recent times.

De Terra seems to be wrong in regarding the lime carbonate as destructive of bones. Usually it is believed to help compaction and mineralization. Many of the fossil remains in India and outside have been from limestone caves.

The mineral composition and chemical analysis of the Gujarat loess shows that it is almost of identical nature as the Potwar loess. It is in fact the alluvium of the Sabarmati and other rivers wafted back by wind and deposited all over the Gujarat plain as well as on high altitudes like the Taranga Hill. It contains a high percentage of lime, and a small proportion of the other constituents: magnesia, potash, phosphoric acid and nitrogen.

The present climatic conditions in N. Gujarat are not very much different from those in the N.W. Punjab. There are extremes of cold and heat, and periodic but not heavy rains. But unlike the Punjab, in the top soil of the loess we find human and animal remains which are not only highly calcified, but the proportion of fluorine to that of phosphoric acid is more than in the bones of the diluvian period in Europe. (Unfortunately, there is no data from India to compare with.) Like the Coldrum remains described by Sir Arthur Keith,[6] chalk has completely permeated the porous texture of the bones, there is a porcelain-like ring and the tongue adheres to the freshly fractured surface, showing that there is no organic animal matter left. And though, "there is no change of the nature of petrification or mineral replacement as in the true Siwalik mammalian fossils, still the change of the tissue" (says Mr. Wadia after kindly examining our specimens), "undergone by the bones, lying in a matrix of unconsolidated kaolin silt in the comparatively arid climate is sufficiently marked to give some index of their age".

We are, therefore, driven to the conclusion from

(1) the absence of metals,
(2) the paucity of pottery,

(3) the state of preservation of human and animal remains,

that the Gujarat microlithic culture is far older than that of Mohenjodaro. Of course, further evidence is necessary, and this may be had when detailed examination is made of animal remains, such as the exceptionally huge rib and shoulder blade, which appear to belong to certain animals, now extinct in Gujarat.

With regard to the comparison of the Gujarat microlithic culture with the European mesolithic or early neolithic there is no stratigraphic evidence yet available, except the meagre data from Mysore. However, attention may be drawn to certain features ... such as roundish pierced hammer-stone or mace-head with the hole splayed from above and below,, bone tools, absence of pottery, etc. ... of the Gujarat microlithic culture which can be compared to the European microlithic culture, without implying culture contact or even contemporary in time.

1. *Nature*, March 31, 1945, p. 386, *cf.* also *Nature* February 10 1945, p. 185. 2. *Indian Art and Letters*, 1936, pp. 35–41. 3. Presidential Address, Section of Anthropology, 29th *Seience Congress*, Baroda, 1942. 4. *Studies on the Ice Age in India and Associated Human Cultures*, pp. 275-78. 5. Even the remains of sub-recent fossil horse, dog, camel, and bovid discovered by Mr. D. N. Wadia, were, as he kindly informs me, very friable and difficult to extract from the ground, 6. Antiquity of Man, Vol. I, p. 8.

THE OCCURRENCE OF *PARROTIA JACQUEMONTIANA* DCNE. IN THE PLEISTOCENE OF KASHMIR

By G. S. PURI, M.Sc., Ph.D.

Introduction

AMONG the photographs of the Karewa fossils sent by Dr. R. R. Stewart to Dr. H. de Terra in 1938 and later published by the latter in his memoir (see de Terra and Paterson, 1939, pls. 53, 54), one photograph (*loc. cit.*, pl. 53, fig. 3) illustrating two leaves of *Parrotia Jacquemontiana* Dcne., was reproduced under an incorrect name of *Quercus dilatata* Lindl. It may be recalled that Dr. Stewart under whom the author was working during 1937-1939 on de Terra's collections from the Karewa (Pleistone) deposits of Kashmir (Puri, 1939), sent to de Terra at his request twenty photographs and a preliminary list of the fossil species, so far identified by me, to show that the work on this material is in an advanced stage. But these photographs, together with the incomplete list of species, were published by de Terra in his above-quoted memoir (Puri, 1940), without any reference to me. The object of this note is to illustrate and briefly describe for the first time the fossils hitherto referred to *Quercus dilatata*, under the correct name of *Parrotia Jacquemontiana*, a large Himalayan shrub of the Celastraceæ.

Description

Parrotia Jacquemontiana Dcne.

The fossil leaves (attached to a twig) illustreated in Fig. 1 were collected by Dr. H. de Terra, the leader of the Karakoram Expedition to India in 1932, from the Karewa deposits, exposed in a stream-bed, near Liddarmarg (alt. 10,600 ft.; lat. 33° 48′; long. 74° 39′), a temporary encampment of Kashmiri shepherds, on the northern slopes of the Pir Panjal Range. The leaves, which were embedded in a blackish-grey clay, that splits fairly neatly along bedding planes, are rather poorly preserved and do not show finer details of venation. The leaf-lamina, which is somewhat obovate or nearly oblong in outline, is narrowed at the base and has an acute apex. The margins are irregularly and sharply toothed.

The venation is strict-pinnate and reticulate, it consists of a fairly broad midrib and 5–7 pairs of secondaries, which are about half as thick as the midrib, and diverge in an alternate manner at angles varying from acute to slightly abtuse. Some of the laterals bifurcate near the margins. The tertiary and finer reticulations are not well preserved but such

Fig. 1

as can be seen resemble closely those of living leaves of this species (Fig. 2). Organic matter of the leaf, too badly cracked to yield a good cuticular preparation, is present in both the leaves.

In shape, size, margins and details of venation our fossils are identical with *Parrotia Jaquemontiana* Dcne. (Fig. 2), a large shrub of the Western Himalayas. They are altogether different from *Quercus dialatata* (Fig. 3), under which they were placed by de Terra apparently by a mistake.

Number of specimens: Two only.
Occurrence: Liddarmarg, at 10,600 ft., Pir Panjal Range, Kashmir.
Collector: H. de Terra, 1932.
Reg. No. of figured specimen: Loc. 3L 36.