sediments of Kachchh. Furthermore, the record of moeritheres in Kachchh as well as in the Himalayas (NW India, Pakistan) indicates that the centre of their origin and early evolution was probably located in the Indo–Pak tethyan belt.

Recently, based on cladistic analysis, the ancestry of proboscideans and sirenians has been traced to Palaeocene times[10], which is in conformity with the conclusions reached herein. However, the sirenian–moerithere differentiation attempted in the present study is based on the assumption that the early moeritheres possessed the same enamel ultrastructure characteristics as the genus *Moeritherium*, which is so far known only from the African late Eocene–early Oligocene deposits[8, 11, 12]. This is a valid assumption in view of the striking similarity in their dental remains as well as in the habitat in which the Kachchh and the African forms are found to occur. However, further studies are needed to gain better insight into the evolutionary relationships of enamel ultrastructure patterns in these problematic primitive tethytheres.

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RADIOCARBON DATING OF CHARCOAL FROM PRE-INDUS CIVILIZATION FIREPLACE, UPPER INDUS VALLEY, LADAKH

K. K. SHARMA, G. RAJAGOPALAN* and V. M. CHOUBEY

Wadia Institute of Himalayan Geology, Dehra Dun 248 001, India.

**Birbal Sahni Institute of Palaeobotany, Lucknow 226 007, India.*

DURING geological studies in the remote areas of the Leh district of Jammu and Kashmir in 1979, two of the present authors (KKS and VMC) discovered a thin layer of charcoal embedded in clay and sand of the Indus terrace near Gaik, about 100 km east of Leh. The manner in which this charcoal layer was embedded with the sediments, initially suggested that the charcoal was possibly transported from a site of natural fire in some nearby forest by water and deposited on the river terrace along with other sediments. A small quantity of charcoal was sampled and subsequently analysed in the Radiocarbon Laboratory of the Birbal Sahni Institute of Palaeobotany, Lucknow.

Encouraged by these results two of us (KKS and VMC) did further excavation on this site during the summer of 1980 and discovered a fire place "Chullah" made by the pre-Indus civilization man on the terrace of the Indus River using three boulders (figure 1). The fire was put up by the pre-historic man to roast meat since a few pieces of thick bone, possibly of some goat-like animal, were also collected from the ash and the charcoal from this fire place (figure 2a–c).

The procedure followed for the dating of samples by C-14 method in the BSIP Radiocarbon Laboratory was earlier described[1]. The charcoal sample was cleaned off all the surface contaminants and was then given chemical pre-treatment to remove contamination due to dead carbon and modern carbon.

Approximately 5 g of pre-treated charcoal in large

Figure 1. Boulders used to make fire place "Chullah" on Indus Terrace.

pieces was oxidized to CO_2 by dry combustion in a quartz tube. The CO_2 sample thus produced was used to synthesize CH_4 in a stainless steel reaction vessel using the catalyst ruthenium oxide on alumina pellets maintained at 475°C. Radioactivity was measured by filling the CH_4 sample in a Oeschger–Houterman C-14 gas proportional counter at a gas pressure of 900 mm Hg[2].

The C-14 age of the charcoal sample (BS-200) has been found to be 6710 ± 130 yrs BP.

The Lower Indus Valley in the plains of Pakistan is known for the oldest civilization of Mohonjo–Daro and Harappa in the Indian Sub-Continent and is one of the three earliest civilizations of the old world. The Mohonjo–Daro and Harappa civilizations date back to 2500 BC (4500 yrs BP). Recently, Jarrige and Meadow[3] have reported their findings of the excavation at Mehrgarh in Pakistan. These workers have found Early Neolithic period permanent farming settlement in Mehrgarh and consider this to be antecedents of the Indus Valley civilization and at least 3000 years earlier than that of the Mohonjo–Daro and Harappa (i.e. 7500 yrs BP).

The present discovery of a fire place on the terrace of the Indus River in Ladakh which has been dated 6710 ± 130 yrs BP, provides an important clue for further studies to trace back man's activities before the onset of the permanent settlement and the establishment of Indus Valley civilization. Old caves were observed by one of the authors (KKS) in the high terraces of the tributaries to Indus and Shyok rivers in Ladakh (figure 3). Their detailed study would possibly provide a wealth of information of archaeological interest.

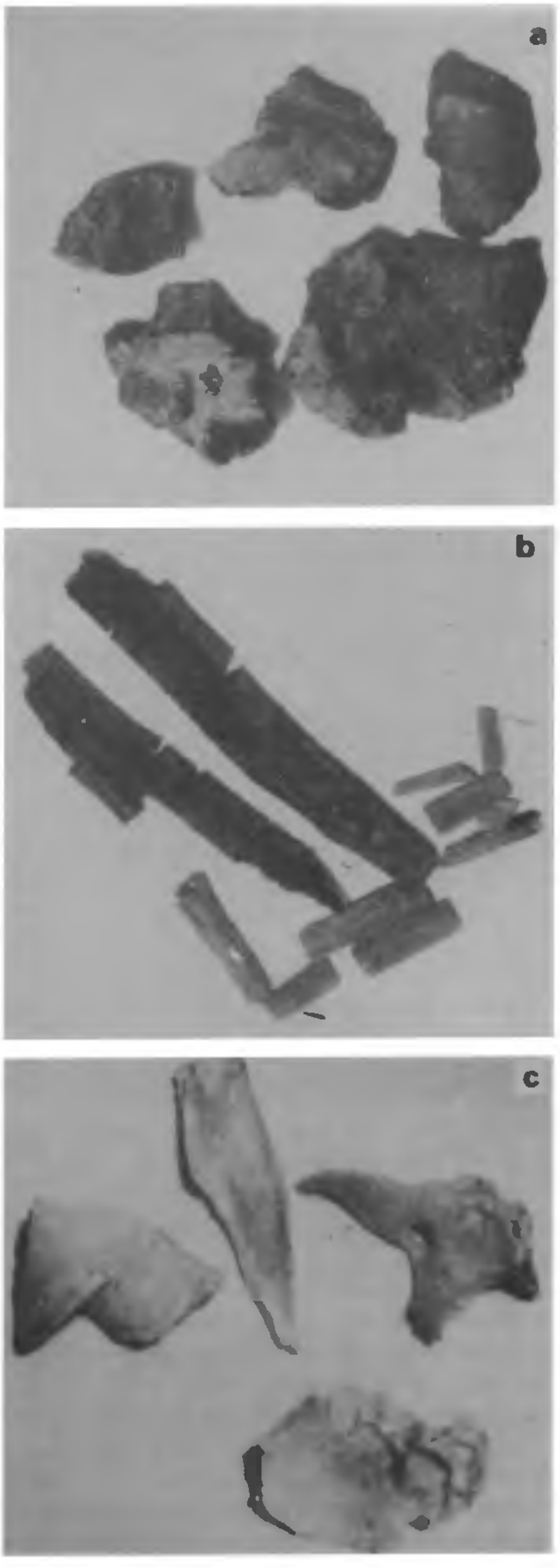

Figure 2a–c. Archaeological material; **a.** Charcoal; **b.** Unburnt wood, and **c.** Bones.

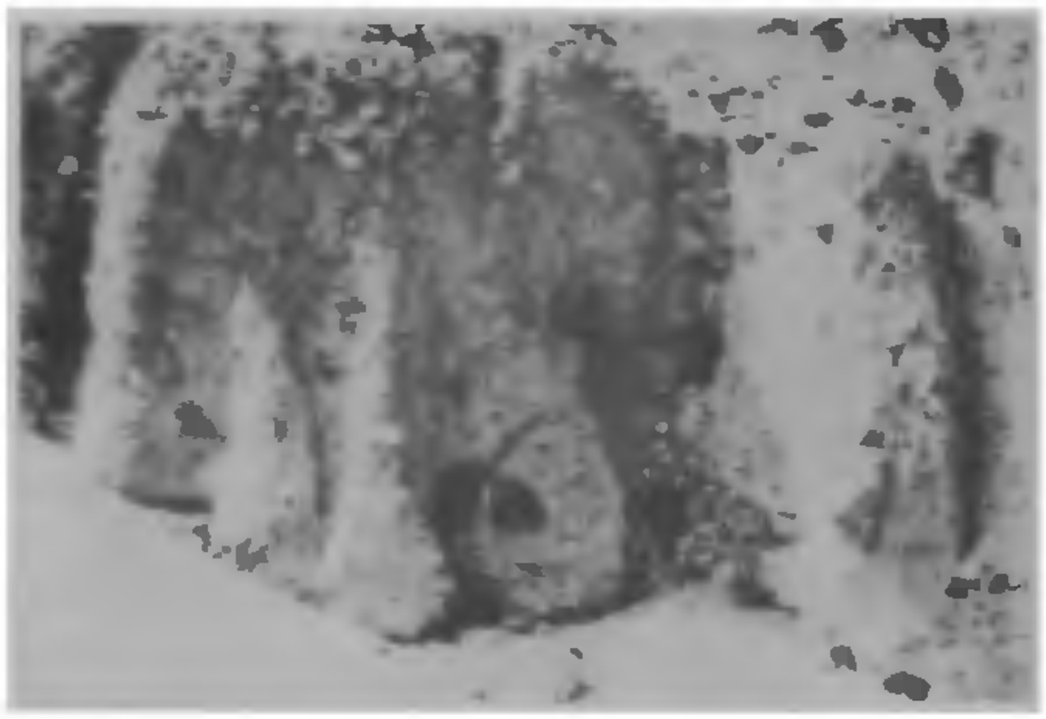

Figure 3. Old abandoned caves in terraces.

In the context of the present radiocarbon dating of charcoal from Indus Valley it may be interesting to mention that the earlier C-14 dates for the existence of man (viz. 35,000 and 32,000 BC respectively) are given by charcoal from Taxas in North America and the Shanidar Cave in Iraq[4]. In India, the oldest Neolithic charcoal dated from Burzahom, Kashmir is 4325±115 yrs BP[5]. Three samples collected in July 1980 from a dwelling pit from this site at 1.83, 2.60 and 3.13 m depth were analysed recently at the BSIP Radiocarbon Laboratory as 3910±110, 3750±130 and 3820±120 yrs BP respectively. Some lithic and bone tools, animal burials and a wheel made of red-ware pot with a bull in black on it, are unique items found for the first time in India. Dwelling pits from the key site of the northwestern Neolithic culture in Burzahom, India, also indicated the earliest traces of man who settled in the Kashmir Valley after the lakes had drained off and the valley, though partly swampy, was fit for human habitation. A close contact with Central Asia and China is indicated on the basis of this finding (T. N. Khazanchi, personel communication).

The present discovery of fire place "Chullah" and the nearby presence of large scale cave dwellings in the Upper Indus Valley, Ladakh, dated nearly 2,000 years older than the Indus Valley settlement in the Lower Indus Valley, is quite significant. The purpose of the this paper is to focus the attention of the archaeologists to this find from the remote areas of Ladakh for further detailed work in these cave dwellings. These dwellings might provide valuable information and possible links between Lower Indus Valley (Mohonjo–Daro and Harappa), Burzahom (Kashmir) and Mehrgarh (Pakistan) civilizations with Central Asia and China via easily negotiable route through Upper Indus Valley (Ladakh). The presence of thick bone of a goat or sheep-like animal from Ladakh further points to another possibility that the process of domestication might have started locally.

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CALLUS GROWTH AND PLANTLET REGENERATION IN SOME INDIAN CULTIVARS OF *SORGHUM*

L. GEORGE and S. EAPEN
Bio-Organic Division, Bhabha Atomic Research Centre, Bombay 400 085, India.

SORGHUM or jowar is the major staple diet in India next to rice and wheat, especially in the dryland areas. Therefore improvement of this crop will have a great effect on the socio-economic status of the people in the rural areas where *Sorghum* is widely cultivated. Although there are reports on morphogenesis *in vitro* in *Sorghum*, data based on detailed investigations on Indian cultivars are not available. Tissue culture studies of this crop were taken up with the following objectives: (i) to standardize techniques for the *in vitro* multiplication of important Indian cultivars, (ii) to study the phenomenon of somaclonal variation and select lines possessing