Homo Sapiens (Archaic) Baby Fossil of the Middle Pleistocene

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Abstract

On 14th October 2001 a suspected fossil was discovered within the ferricret at Odai in Villupuram district of Tamil Nadu in South India. In order to prove the existence of a faunal fossil within the ferricrete it was subjected to various radiological methodology such as X-ray, Scanning 2D, 3D, and 3D software, and Scanning Electron Microscopy (SEM). X-ray had identified, for the first time, the presence of a faunal fossil within the ferricrete. Subsequently 2D scanning was applied, and could distinguish the human cranium within the ferricrete. Then with the 3D scanning hundreds of images were taken that identified it as a human baby skull. It was further scanned with 3D software which identified three cervical vertebrae with the skull. Then SEM was applied to understand various characteristics of the skull in detail that recorded perfect nature of fossilized cranial bone structure, blood vessels, membranous tissues, brain tissues, RBC etc. It shows a peculiar type of preservation of the fossil within the ferricrete. In this context the absence of any micro organisms within the skull is significant. In order to make one to one comparison a human foetus skull has been examined under SEM and proved beyond doubt that the entombed fossil is that of a human child.

Introduction

Ancient human remains from the archaeological context in India were found from the Mesolithic, Neolithic, Chalcolithic, and Megalithic cultural phases which were existed during the Holocene period. However, there are a few Palaeolithic sites which have yielded human remains of the Pleistocene period, and they include Hathnora (Sonakia.1984:159-172.,1991:475-496.,1998:391-393) and Bhimbetka (Wakankar.1962:132., 1973:23-32.,1975:7-29., Misra et. al. 1977., Kennedy et. al.1998., Kennedy. 2000) etc. Among them the skull cap from Hathnora is considered as the oldest belonging to the Homo erectus of the Middle Pleistocene.

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Hundreds of hominid fossils ranging from a few lakhs to over three million years old are known from different parts of the world and most of them have been found in stratified context. However, none were found within the hard ferricrete and therefore, most of them had been retrieved with out much damage. It is, for the first time, a fossil has been discovered within the ferricrete.

Stratigraphy

Fossiliferous site at Odai is situated hardly 1 km inland from the Bay of Bengal at an altitude of 10 m asl (Fig. 1a). The land surface constitutes of white sand and is underlain by ferruginous soil having several strata of aeolian and fluvial deposits down to 6 m. and the prehistoric tools were found in stratified contexts. Archaeological excavation has revealed nine layers with in 5.7 m thickness and they comprise four aeolian and seven colluvio alluvial strata intermittently. They indicate dry and wet phases. From the depth of 5.7m ferricrete begins and it continues downwards. During the excavation Mesolithic and Upper Palaeolithic tools were found respectively at 2.5 m and 4.5 m depth (Fig. 1b). Both the industries were with in the colluvio alluvial strata indicating human habitation during the wet phase. One of the significant factor noted is the absence of Stone Age artifacts anywhere with in the ferricrete.

Soil excavation in the region by the Public Work Department has exposed ferricrete at 8 m depth in several places. Observation on such a ferricrete surface lying 50 m away from the excavation site resulted in the discovery of a suspected faunal fossil on 14 th October 2001 at 12.40 pm within the ferricrete. As a result of the ferricrete at the site being quite hard and due to difficulty in visual identification of the entombed matter it was dug out along with the matrix. Close examination of it revealed that it would be detrimental to remove the surrounding ferricrete.

The normal palaeontological approach to this sort of problem is to extract the fossil in its entirety from the matrix. This can be done chemically, by dissolving the matrix away to leave the fossil or by dissolving the fossil away to leave a hole from which a latex cast can be made, or by physically digging the fossil out with fine needles or drills. In this case, none of these approaches were particularly useful, and therefore, the entombed fossil was dug out along with the surrounding ferricrete for further study (Fig. 1c).

Fig. 1a: Panoramic View, Odai

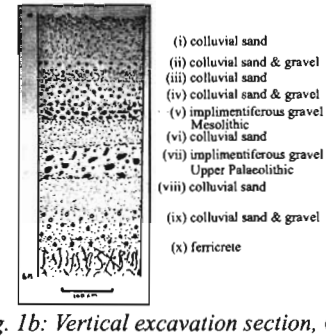

Fig. 1b: Vertical excavation section, Odai

Fig. 1c: Fossil within Ferricrete

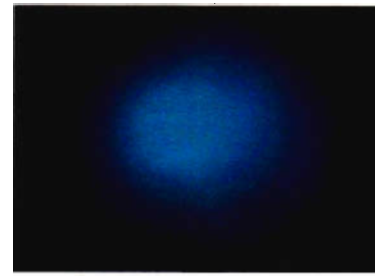

Fig. 1d: Axial high resolution C T image

Methodology

Since no precedence was known to study such a specimen the most important aspect was to find out suitable methodology to study the entombed fossil. Since no earlier example was available it was decided to image the fossil inside the nodule using technologies developed for medical scanning.

Initially, attempts were made with X-ray to identify whether there is an entombed fossil within the ferricrete. X-rays were passed into the specimen from all 360 angles and detected by a row of detectors on the opposite side. The difference in the material is reflected as the difference in the intensity of X-rays. This difference is projected as an image by a complicated reconstruction algorithm. Thus an oval structure surrounded by the hard matrix could be identified, for the first time, and the existence of a faunal fossil within the hard ferricrete of the Pleistocene age was proved (Fig. 1d).

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This was followed by 2 D scanning by which AP Scanogram slice from above, AP Scanogram with image planes, Cross-sectional images, and Lateral scanogram views were taken. These analyses identified a human cranium within the matrix (Fig. 2a).

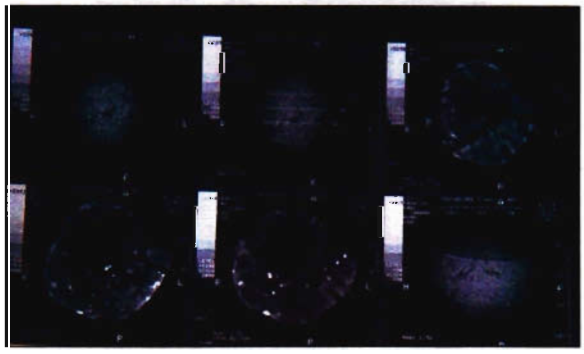

Fig. 2a: 2 D images of the skull

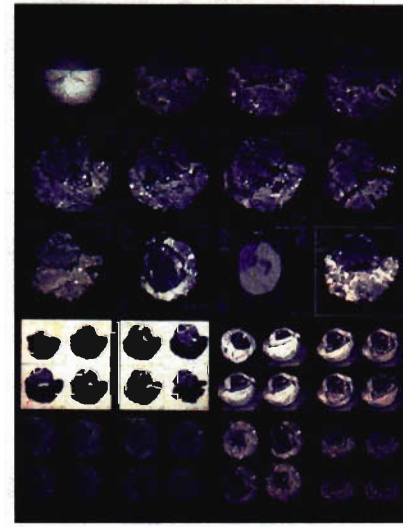

Fig. 2b: High resolution axial images and 3 D reformation

Search for new methodology, however, continued since several questions regarding its full morphology, cranial characteristics, orientation etc remained inconclusive. Some new literature regarding the reconstruction of Herefordshire fossil with 3 D scanning helped solve further queries (obtained from the Internet, Briggs and Crowther. 2001). The article showed that the medical methodologies such as X-ray and 2 D scanning initially carried out were correct methodologies and 3 D scanning would further help resolve issues.

To extract the cranial features of the fossil, 3 D scanning in thin helical runs of the entire specimen on different planes was carried out and reconstructed at 2 mm interval (Fig. 2b). The scanogram has revealed a hemi-spherical solid object with a spherical object within it having a few lucent areas. Serial axial section shows the same hemispherical solid object with a central, slightly hypo-dense ovoid-spherical object having air-containing clefts within. The spherical object is covered by a fossilized structure measuring 1-2 mm which has been identified as the fossilized part of the cranial bone having CT attenuation of 1192 HU (Hounsfield Unit). The CT attenuation of the fossilized brain within the cranium as ovoid-spherical object ranges from 1137 to 1765 HU, which is lower than the outer hard matrix (ferricrete) having CT attenuation ranging from 1628 to 2383 HU. The CT attenuation of the teeth ranges from 1322 to 1984 HU. The length and breadth of the cranium were measured to be 10.1 and 8.6 cm respectively and its capacity has been calculated, based on the Ellipsoid formula, to be 312 cc. Studies have been repeated on many planes at different angles and hundreds of images have been reconstructed, thereby identified various morphological features of the human skull.

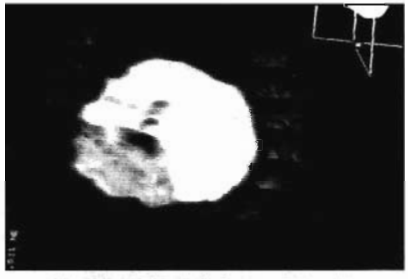

Fig. 2c: 3 D Minimum intensity projection image of the skull

Fig. 2d: 3 D Minimum intensity projection image of the face

Important signatures identified in the 3 D images of the fossilized skull include: frontal bone, orbital cavity, nasal bone, maxilla, mandible, parietal bone, sphenoidal fontanella and occipital bone (Fig. 2c); eye within the orbit and nasal bone (Fig. 2d); ferricrete, cranial bone and brain tissue (Fig. 3a); nasal bone, posterior nasal aperture, foramen ovale, zygomatic arch, carotid canal, foramen magnum and foramen lacerum (Fig. 3b); frontal pole and longitudinal tissue (Fig. 3c); cranial bone, brain tissue and teeth within the maxilla and mandible (Fig. 3d); coronal suture, anterior fontanella and sagittal surure (Fig. 4a) etc. (Rajendran.2003:7., Rajendran et al. 2003:754-756).

Fig. 3a: Axial 3 D Maximum intensity projection image of the entombed skull

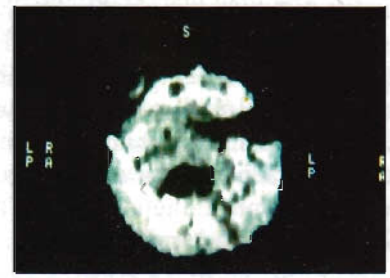

Fig. 3b: Axial basal image of the skull

Fig. 3c: 3 D Minimum intensity projection image of the brain

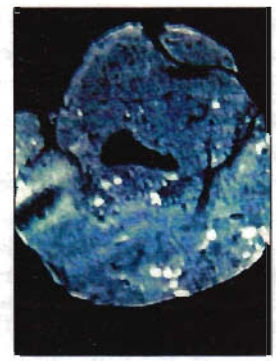

Fig. 3d: Axial 3 D Maximum intensity projection image with teeth within mandible & maxilla

Fig. 4a: Plane axial section of cranium

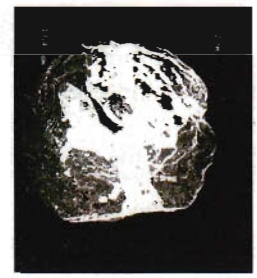

Fig. 4b: 3 D software image of cervical vertebrae and the cranium

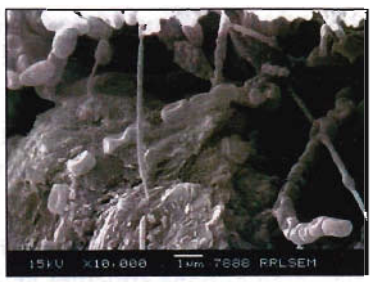

Fig. 4c: SEM image of fossilized RBC in dumbbell shape, blood vessels and bone structure of skull

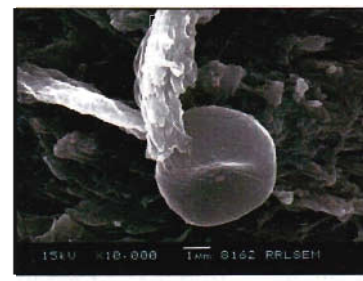

Fig. 4d: SEM image of the vessels, membranous tissue & RBC in dumbbell shape of foetus

Software 3 D scanning application has resulted in getting the complete picture of the skull bones, besides identifying the first three cervical bones along with the skull (Fig. 4b). It fully confirms my earlier observation that it is not a detached skull. Based on Steiners analysis on the fossil skull it has been found that nasion, gonion and pogonion are almost in straight line indicating bimaxillary prognathism (Fig. 4c). This is one of the characteristics noted among the adults in the early human evolutionary stage and it has greater importance owing to their prominent nature even in its infancy. It clearly indicates its greater antiquity and evolutionary characteristics.

In order to obtain the micro-characteristics of the fossil Scanning Electron Microscopy was carried out under various magnifications ranging from x100 to x15,000 in 15 KV and several images were taken. They have unraveled various vital issues which were not identified earlier in a fossil entombed in ferricrete of the Middle Pleistocene antiquity. The images include fossilized bone structure, RBC in dumbbell shape, blood vessels, membranous tissues and brain tissues etc (Fig. 4d). For a comparative study a recent human foetus cranial sample was studied under SEM which facilitated one to one comparison thereby proving it as a human baby fossil.

Chronology

Stratified in situ occurrence of the human fossil from Odai facilitated good evidence to assess both Relative and Absolute chronology. Occurrence of the fossil within the ferricrete, capped by 8 m colluvio alluvio aeolian deposits directly indicated Pleistocene antiquity of the fossil.

Since dating of the fossilized bone is difficult, attempt was made to find out the age of the matrix in which it was found. The ferricrete which covers exactly over the cranium has been taken for Thermoluminescence dating. The TL date of 0.166 + / - 30 M of the ferricrete clearly shows its age to the Middle Pleistocene and the same chronology has been taken as the approximate age of the entombed human fossil (Rajendran et al.2004:1-4).

Discussion and conclusion

The anatomical features drawn from several scanned images of the fossil clearly proved it as a well preserved, fossilized, pediatric human baby, intact, and appears to be less than five months of post delivery age. The extraordinary state of preservation of the fossil, with the fossilized brain inside the cranium, appears similar to that of the Taung fossil (Dart, 1925:195-199).

It is, for the first time, a human fossil has been discovered, intact, within the ferricrete of the Middle Pleistocene, and it has disproved the hypothesis that no organic remains stay within a deposit once the matrix undergoes ferricretization.

SEM study has revealed Pile of coins arrangement of the RBC and their clear revelation in dumbbell shape. Presence of fossilized brain tissues, cranial bone structure and blood

vessels are unique and remarkable. Images have proved the perfect nature of fossilization and preservation of the organic remains in its totality.

The TL date of the matrix places the entombed fossil approximately to the Middle Pleistocene. In the human evolutionary stage the Odai human fossil, named 'Laterite Baby,' belongs to the Homo sapiens (archaic), and it is the Second Oldest human fossil, next to the Narmada fossil, from India. Above all it is the first ever discovered human fossil within the ferricrete. The human fossils from Odai and Hathnora probably bear significant implications for the current "Out of Africa" verses "Multiregional" debate concerning the place of origin and antiquity of humans, and Asia's importance in the story of hominid evolution.

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