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FURTHER EVIDENCE OF HOMINID REMAINS FROM THE PINJOR FORMATION, INDIA

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Recent finds in the basal Pinjor Formation outcropping at Nadah, 10km south-east of Chandigarh, suggest the presence of a hominid like form. One of these finds represented by a left maxillary central incisor is described here. The Nadah section represents one of the better studied sequences of the Pinjor Formation on faunistic, sedimentological, palaeoecological and palaeomagnetic grounds. The upper incisor is represented by a bilateral symmetrical crown, flaring occlusally. Metrically the incisor is slightly larger the known limits of *Homo erectus*. Enamel ultrastructural studies undertaken by Scanning Electron Micrography, both by replica method and direct micrography indicate the presence of pattern-1 prisms on superficial distal surfaces examined and a pattern-3 structure on the occlusal surface near mid-enamel thickness. The SEM data is not conclusive. The incisor-yielding beds of the Nadah section indicate that these are pre-Olduvai event deposits ranging in age from about 2 to 2.2Myr. Further resolution in dating these deposits is not available at present. Palaeoecological reconstruction indicates a predominantly braidcd stream complex and an open grassland community consisting of *Equus*, *Elephas*, *Rhinoceros*, antlered *Cervus* and baboon.

Key Words : Pinjor Formation; Incisor; *Homo erectus*; Nadah

INTRODUCTION

THE Pinjor Formation represented by type section in east of Chandigarh spans a time interval corresponding approximately to the lower and middle part of the

Matuyama palaeomagnetic epoch. In view of the hominid remains found in other parts of Asia and Africa within this temporal span one of us (M.P.S.) for the last eight years has been engaged in extensive field exploration for the remains of early man in the outcrop of the Pinjor Formation exposed 10km southeast of Chandigarh along the Ghaggar river in a series of escarpments (Fig. 1). This detailed study has resulted in the finding of at least three teeth (of three different individuals) by him; which are of hominid affinity. The tooth described in the present paper was discovered in April 1985 from the buff-coloured mudstones situated on a summit of approximately east-west tending escarpments. The present locality is situated 0.5km south of Nadah village in Haryana, north India. The two previous incisors were also discovered from the same locality, but about 100 meters away from the present locality.

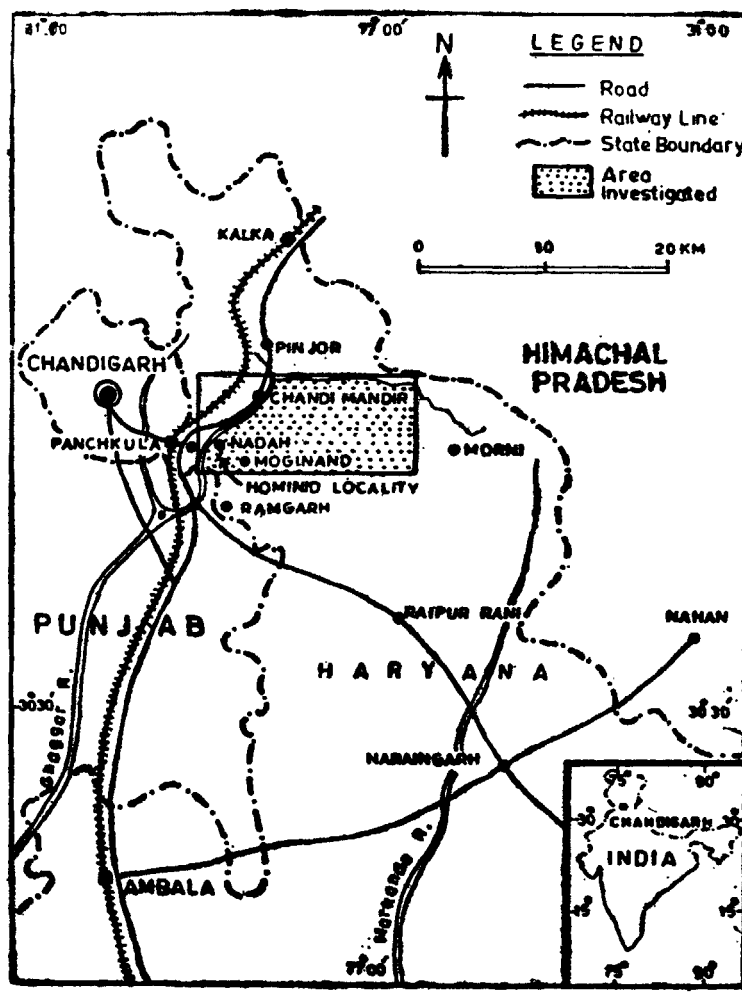

FIG 1 Location map of study area, Pinjor Formation, Haryana.

The present area lies between 30°40′ N and 76°55′–77°33′E. It falls in the Survey of India toposheet No. 53B/14. The Pinjor Formation in the area under investigation shows simple structure (Fig. 2*a*), and the beds dip gently eastward with a north-south strike at an angle varying from 10–35°. The total thickness of the Pinjor Formation is not known since the top of it is not exposed in the east of the Sabilpur Fault as the Nahan Formation is directly thrust over the Pinjor Formation. On the western side of the Sabilpur Fault, the base of the Pinjor Formation is not exposed as the Tatrot is completely absent.[3]

The stratigraphic column which yielded the hominid incisor was measured near the Nadah village. The column is 275m thick and consists of grey and greenish sandstones interbedded with brown and purple siltstone. The cemented conglomerate and hard sandstone are also encountered at a number of places in the present column. The sandstones at places show current bedding, load casts and armoured mud balls, etc. The present incisor was recovered from the buff-coloured mudstones bed about 200m from the base (Fig. 2*b*).

The incisor yielding locality occurs in the basal part of the Pinjor Formation situated about 10km south of the Pinjor type section. These beds having proximity to Chandigarh have received maximum attention by vertebrate palaeontologists.[3–6] The palaeomagnetic dating of these sections is yet at a preliminary stage.[7–9]

The Pinjor Formation consists primarily of fine sandstone, mudstone sequence in a braided stream environment. The present locality is situated about 200m above the inferred boundary obscured by the alluvial silt of the Ghaggar river. The locality thus represents the basal part of the Pinjor Formation, which has a thickness of about 680m.[9]

There is a consensus of opinion that the Tatrot-Pinjor boundary corresponds to a marked faunal change at about 2.47Myr.[10] This event is marked by the presence of an assemblage comprising *Elephas*, *Equus*, and antlered *Cervus*. The

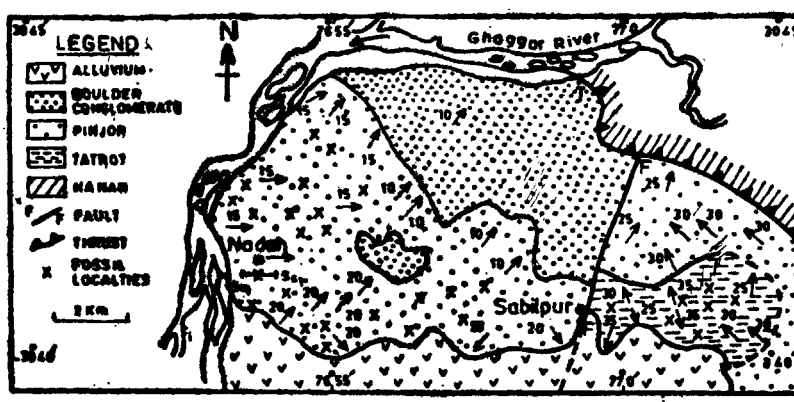

FIG 2*a* Geological map of a part of Naraingarh tehsil, district Ambala (after Nanda and Halstead, 1975).[3]

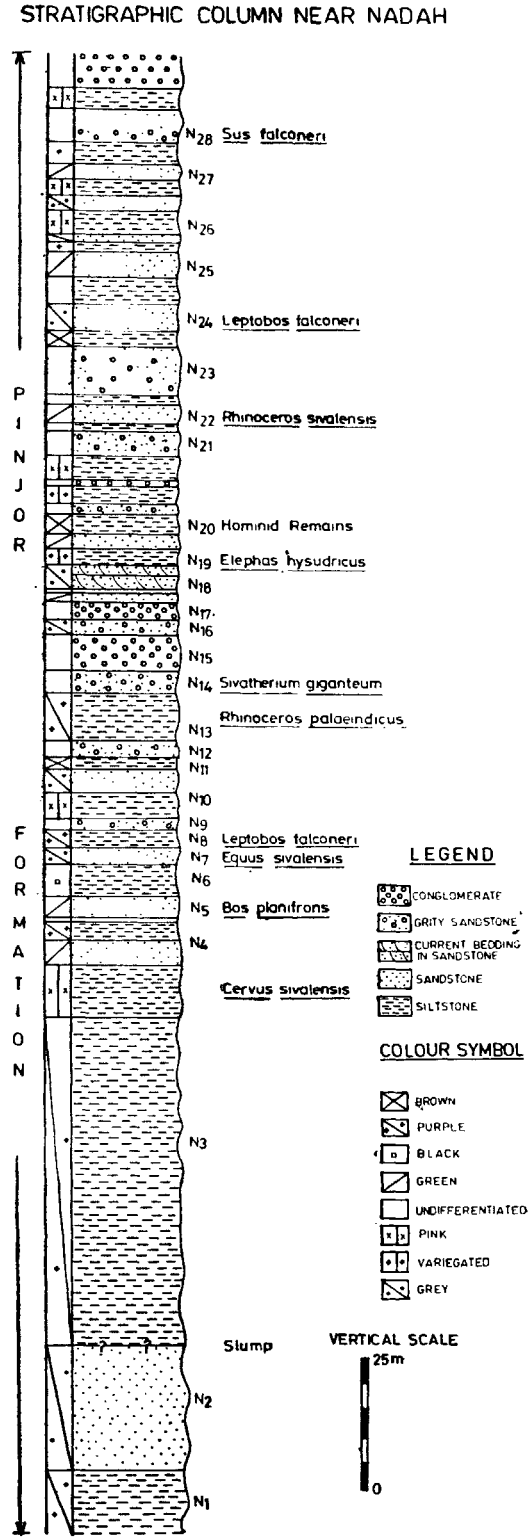

FIG 2*b* Stratigraphic column near Nadah showing the mudstone formation (about 200 m from the base) from which the incisor was recovered.

latter assemblage is first recorded from the basal Pinjor beds in the region indicating a general contemporaneity with the corresponding sections in other parts of India and Pakistan.

The age of the hominid bearing horizon itself is obviously younger to that inferred for the Tatrot-Pinjor contact beds, and falls within the Reunion event corresponding to a time interval approximately 2 to 2.2Myr. Future studies may provide better resolution and dating. All palaeomagnetic studies suggest that the fossil locality described here is slightly older than the Olduvai event. A distinct change in sedimentological facies is discerned at the Olduvai event in the Pinjor section with the coarsening of the clastics to form the Boulder Conglomerate.

Description of the Find

The present find consists of an isolated left maxillary central incisor with the root broken at some distance below the cervical margin. About one third of the crown is worn off due to use; enamel is present on the labial side but absent on the lingual side.

Unlike the incisor of the extant great apes, the labial outline of the tooth is symmetrical. The mesial border is almost straight and in line with the mesial border of the root. The distal border, in contrast, seems to swing out in a smooth curve. The mesial and distal lines of the crown converge sharply towards the root (Fig. 3A). The tooth is heavily worn off and one third of the crown is absent. A characteristic occlusal abrasion pattern similar to hominids[11] is discernible (Fig. 3B). Similarly, it had a hominid like arched occlusal contour.[12]

On the lingual side, there is a considerable loss of dentine and the enamel rim is completely absent (Fig. 3C). This type of occlusal wear is apparently similar to the stage of occlusal surface wear as seen in human incisors and canines, i.e., large dentine area with enamel rim lost on one side.[13,14] The cervical margin is somewhat sinuous and V-shaped on the mesial aspect of the tooth (Fig. 3D).

The longitudinal axis of root and crown form an obtuse angle, open distally, a condition usually met in hominids.[15-19] Tratman[20] considers such an axial curvature to be characteristic of the Mongoloid race. In this feature it differs from the maxillary central incisor of *Ramapithecus* in which crown and root form a straight line. The transverse section of the root at cervix is triangular with rounded angles, in which the lingual side is more arched than labial (Fig. 3E). Metrically the incisor is within the range of hominids (Table I).

One of the earliest studies to determine the enamel prism packing pattern of primates was that of Carter.[21] Since then, though numerous investigations have been undertaking on a number of primate species, the significance of primate enamel patterns as an aid to taxonomic identification has remained ambiguous. However, the recent works of Gantt *et al.*[22] Vrba[23] and Boyde and Martin[24] have laid a firm foundation for the use of enamel structure for taxonomy. Boyde and Martin[24] in the most thorough analysis todate have studied the enamel pattern of several holotypes of fossil primates by a nondestructive method using the Tanden

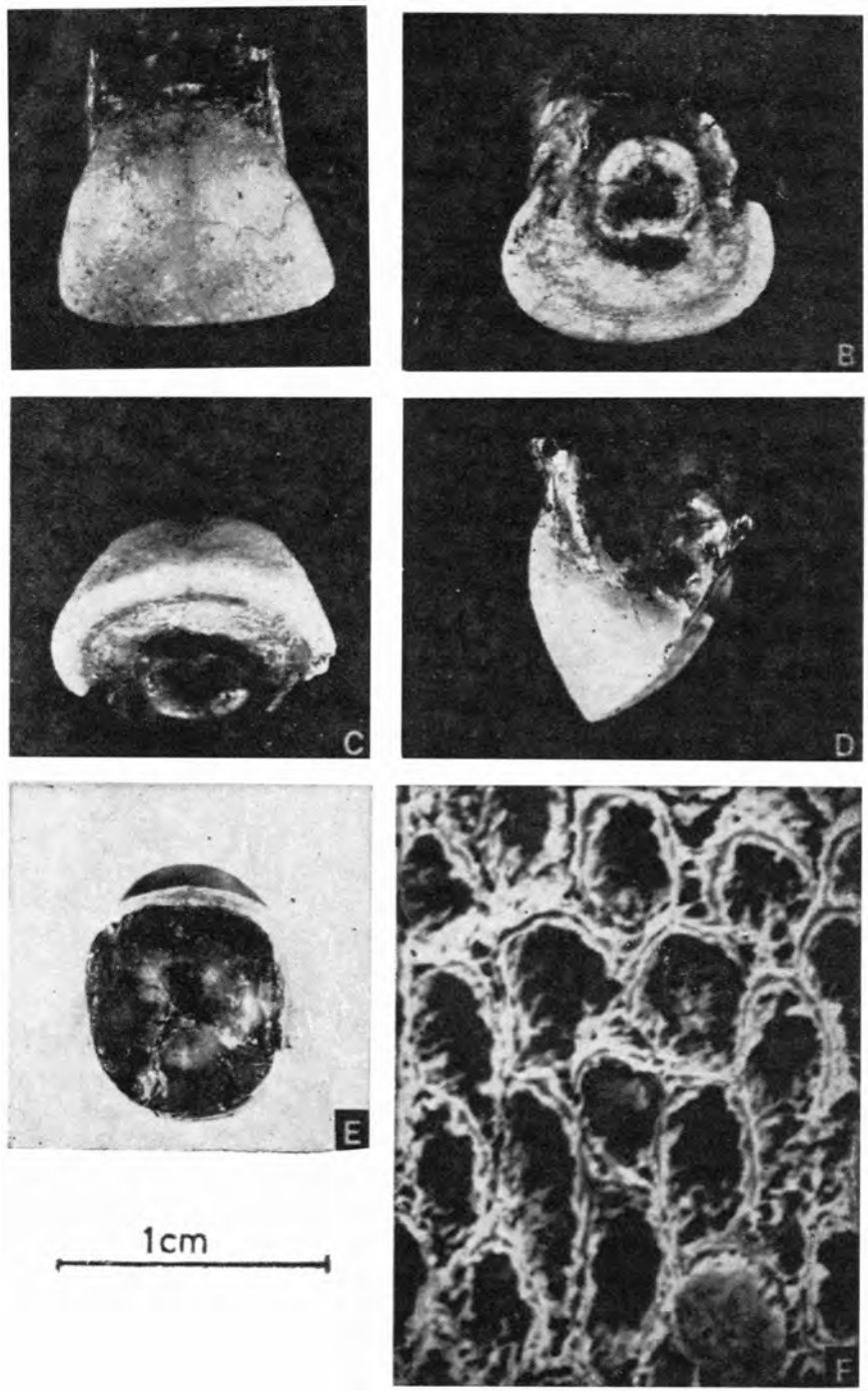

FIG 3 Different views of the incisor: A : Labial; B : Lingual; C : Incisal; D : Mesial; E : T. S. of Root; F : S. E. M. enamel prisms. Print base 16 microns.

TABLE I

Mesiodistal and labiolingual measurements of the Pinjor incisor compared with Plio-Pleistocene hominids, modern hominid, great apes ond Gigantopithecus blacki (mm)

Group	Medsiodistal diameter				Labiolingual diameter				Shape Index	
	n	*x*	SD	Range	*n*	*x*	SD	Range	*x*	Range
Australopithecus africanus[16]	3	9.6	0.41	9.3–10.0	2	8.3	0.09	8.2–8.3	113.9	112.1–115.9
Australopithecus robustus[30]	8	9.5	0.88	8.3–10.8	6	7.6	0.20	7.3–7.8	124.1	106.4–142.1
Homo erectus[16]	4	10.3	0.49	9.8–10.8	5	7.7	0.26	7.5–8.1	131.6	124.1–144.0
Homo neanderthal[30]	41	9.85	0.15	8.0–12.0	34	8.59	0.12	7.5–10.6	115.0	106.6–113.2
Homo sapian[30]	254	8.92	0.52	6.0–11.0	244	7.44	0.05	5.50–10.6	106.3	103.7–109.0
Chimpanjee[29]	14	12.6	0.82	10.5–13.5	15	10.1	0.76	9.0–11.3	118.0	116.6–119.4
Gorilla[29]	3	14.7	0.15	14.5–15.0	2	11.6	0.00	11.6–11.6	122.9	120.9–125.0
Orangutan[29]	4	14.7	0.96	13.3–15.4	6	13.4	1.76	10.4–15.2	114.5	101.3–127.8
Gigantopithecus blacki	8	12.84	1.11	11.8–15.2	7	13.27	1.78	11.2–16.8	97.8	90.4–105.3
Ramapithcus	—	10.3	—	—	—	7.6	—	—	135.5	—
Pinjor incisor (Absolute)	—	10.8	—	—	—	9.0	—	—	120.0	—
Pinjor Incisor (Estimated)	—	12.0 (Approx)	—	—	—	10.0	—	—	120.0	—

1. Tobias (1967)
2. Wolpoff (1971)
3. Swindler (1976)

Scanning Reflected Light Micrography (TSRLM). These authors feel that delineation at various taxonomic levels is possible if a more complete comparative sample is present for fossil and extant species of primates. They have shown that pattern 3 prisms are present in the anthropoid primates, when enamel is sectioned at depth.[25] Superficial sections usually exhibit pattern-1 structure. In India, the enamel structure of *Sivaladapis*[26] and *Ramapithecus* and *Sivapithecus*[27] have been examined in detail using a plastic replica and sample etch technique. Both these hominoids show the characteristic pattern-3 enamel structure.

In the present investigation of enamel structure both replica and specimen etch techniques were employed. Etchant used was 2 per cent HNO_3/HCl for a period of 12 seconds. The labial and occulusal surfaces were etched by enlash of brush to localise the action of the acid. Washing and cleaning by ultrasonic vibrator was carried out.

While superficial sections on the labial side abounded in pattern-1 prisms, the main structural organisation of the enamel when viewed at depth and on the occlusal surface showed characteristic pattern-3 prisms (Fig. 3F). The prisms are closely packed, with a blunt apically directed margin and an acute angled cervically oriented border.

Pattern-3 prisms are found in a number of other mammalian orders (Carnivora and Proboscidea). However, the gross detailed morphology of the Pinjor incisor precludes it from belonging either to the Carnivora or a Proboscidean. The present enamel structural studies support the assignment of the incisor to a highly evolved Primate.

PALAEOECOLOGY

Palaeoecology of the Pinjor Formation, reconstructed on the basis of faunal, floral and sedimentological evidence, suggests dry, cool, open savannah, graminivore with 90 per cent grassland and the area turned so arid that even patches of desert appeared.[5,28] It is quite unlike the habitat of their fruit and leaf eating pongid ancestors, who had been predominantly arboreal and adapted to tropical rain forests.[29]

In the foregoing discussion, it had been shown that morphometrically functionally and palaeoecologically the Pinjor incisor resembles a hominid tooth.

REPOSITORY

The incisor lies as a personal collection of the first author.

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