



XXII INQUA INDIA 2027

FIELD GUIDE

INPRE - 8

HUMANS, LANDSCAPES AND ANIMALS OF THE
NARMADA VALLEY ONE MILLION YEARS OF
PALEOANTHROPOLOGY

Parth R. Chauhan, Prabhin Sukumaran
and Nupur Tiwari



बीरबल साहनी पुराविज्ञान संस्थान

Birbal Sahni Institute of Palaeosciences

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INQUA INDIA 2027

Field Guide Book

INPRE-8

Humans, Landscapes and Animals of the Narmada Valley: One Million Years of Paleoanthropology

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Abstract

The Central Narmada Valley preserves one of the most important Quaternary sedimentary records in the Indian subcontinent. Developed within the tectonically active Narmada-Son Lineament, the basin contains a thick succession of fluvial and colluvial deposits that record the interactions among tectonics, river evolution, environmental change, vertebrate palaeontology, and human occupation from the Early Pleistocene to the Holocene. The basin also contains the only known fossil remains of an archaic hominin recovered from the Indian subcontinent, together with abundant vertebrate fossils and one of the richest records of Palaeolithic archaeology in peninsular India. This field excursion traverses representative exposures of the seven formal lithostratigraphic units recognised within the Central Narmada Valley: the Pilikarar, Dhansi, Surajkund, Baneta, Hirdepur, Bauras, and Ramnagar Formations. Participants will visit key geological and archaeological localities that document changes in sediment provenance, fluvial architecture, tectonic activity, palaeoenvironmental conditions, and human occupation throughout the Quaternary. The excursion provides opportunities to examine several current research themes, including the evolution of a tectonically controlled fluvial basin, the chronology of Quaternary sedimentation, the archaeological context of the Narmada hominin, changes in sediment provenance and basin development, palaeoenvironmental reconstruction using sedimentological, geochemical, and isotopic proxies, and the relationship between environmental change and technological transitions during the Palaeolithic and Mesolithic. Particular emphasis is placed on evaluating the chronology of fluvial archaeological sequences through the integration of palaeomagnetism, electron spin resonance (ESR), optically stimulated luminescence (OSL), radiocarbon dating, and stratigraphic investigations. The excursion also introduces recent applications of sedimentary ancient DNA (sedaDNA) for investigating microbial preservation and palaeoenvironmental reconstruction in Quaternary deposits. The itinerary includes visits to Dhansi, Pilikarar, Hathnora, Sardarnagar, the Tawa River, Naganpur, Chikli, Talpura, Adamgarh, and other representative localities that collectively illustrate the geological, archaeological, and palaeoenvironmental evolution of the Central Narmada Valley. The excursion is intended to facilitate scientific discussion on Quaternary stratigraphy, basin evolution, geochronology, palaeoecology, palaeoanthropology, and geoarchaeology within one of South Asia's most extensively studied Quaternary basins.

Day 1: Arrive in Narmadapuram from Bhopal. Visit town ghats on north bank.

Day 2: Pilikarar, Pandadoh & Talpura.

Day 3: Tawa River, Dhansi, paleochannel at Panwasa, Bandraban beach.

Day 4: Hathnora, Naganpur, Chikli, Sardarnagar

Day 5: Ginnaurgarh Fort and if time, Salkanpur Temple

Day 6: Adamgarh rockshelter in the morning. Depart Narmadapuram by afternoon for Bhopal.

Preamble

The Central Narmada Valley represents one of the most important Quaternary sedimentary basins in the Indian subcontinent. The basin preserves a thick Quaternary succession deposited within the tectonically active Narmada–Son Lineament and contains a diverse record of fluvial sedimentation, tectonic deformation, vertebrate palaeontology, prehistoric archaeology, and environmental change. Together, these archives provide an important framework for investigating the interactions among tectonics, climate, landscape evolution, and human occupation during the Quaternary. The Narmada River originates in the Amarkantak Plateau and flows westwards for approximately 1,312 km before entering the Gulf of Khambhat. Throughout much of its course, the river occupies a structurally controlled valley bounded by the Vindhyan highlands to the north and the Satpura highlands to the south. Within the Central Narmada Basin, repeated tectonic activity has resulted in the accumulation of nearly 400 metres of Quaternary sediments, preserving one of the most complete fluvial records in peninsular India.

The Narmada Valley in Quaternary Research

The Central Narmada Valley has been the focus of geological, palaeontological, and archaeological investigations for more than 150 years. The basin contains the richest record of Pleistocene vertebrate fossils and stone tool assemblages in peninsular India and remains the only locality in the Indian subcontinent where fossil remains of an archaic hominin have been recovered. The hominin fossils discovered at Hathnora, consisting of a partial calvarium and associated post-cranial remains (at different times and by different researchers), continue to be the subject of discussion regarding their taxonomic attribution. Proposed affinities have included *Homo erectus*, *Homo heidelbergensis*, archaic *Homo sapiens*, and *Homo* sp. indeterminate. Their occurrence within a complex fluvial depositional environment also highlights one of the principal challenges of Quaternary research in large river systems: establishing reliable chronologies for fossils and archaeological materials that may have undergone post-depositional reworking. Addressing these chronological uncertainties requires the integration of multiple dating techniques, including palaeomagnetism, electron spin resonance (ESR), optically stimulated luminescence (OSL), and radiocarbon dating, together with detailed sedimentological and stratigraphic investigations.

Tectonic Evolution and Basin Development

The excursion traverses the principal lithostratigraphic units of the Central Narmada Valley, including the Pilikarar, Dhansi, Surajkund, Baneta, Hirdepur, Bauras, and Ramnagar Formations. These formations collectively document the evolution of the basin from the Early Pleistocene to the Holocene. The Dhansi Formation preserves the oldest dated Quaternary succession currently recognised in the basin. Preliminary palaeomagnetic investigations place the lower part of the sequence within the Matuyama Chron (>780 ka), while basal gravels have yielded in situ non-diagnostic expedient lithic assemblage that represents the earliest stratified and dated archaeological evidence presently known from

central India. Middle Pleistocene deposits assigned to the Surajkund Formation preserve well-developed soft-sediment deformation structures interpreted as seismites, providing evidence for syndepositional tectonic activity associated with reactivation of the Son-Narmada North Fault. These structures offer valuable insights into the influence of tectonics on sedimentation and landscape evolution within an active intracratonic basin. Recent sedimentological and heavy mineral investigations have demonstrated significant changes in sediment provenance throughout the Quaternary succession, reflecting alternating sediment contributions from the Vindhyan Supergroup to the north and the metamorphic and Gondwana terrains of the Satpura region to the south. These provenance shifts provide important constraints on basin evolution and fault-controlled drainage development.

Environmental Change During the Quaternary

The Central Narmada Valley preserves multiple independent proxies for reconstructing Quaternary environments. Stable carbon and oxygen isotope analyses of pedogenic carbonates and mammalian tooth enamel indicate that the Pleistocene landscape was characterised largely by C_4 -dominated grasslands and open savanna under semi-arid climatic conditions. In contrast, isotopic analyses of modern herbivores indicate a substantially greater contribution of C_3 vegetation, reflecting changes in monsoon dynamics together with increasing anthropogenic modification of the landscape. The occurrence of stratified ostrich eggshell (*Struthio camelus*) within the Quaternary succession provides an additional indicator of open and relatively arid environments during the Late Pleistocene. These datasets contribute to broader discussions concerning Quaternary environmental change in monsoon-dominated regions and the relationship between climatic variability and human occupation.

Emerging Approaches in Quaternary Research

Recent investigations in the Central Narmada Valley have expanded beyond traditional geological and archaeological methods to include molecular approaches. Ancient sedimentary DNA (sedaDNA) recovered from fossil-bearing deposits at Hathnora has demonstrated the preservation of microbial communities within Quaternary sediments. Such studies provide new opportunities for investigating microbial preservation, fossil diagenesis, and palaeoenvironmental reconstruction in tropical fluvial settings and complement conventional sedimentological, palaeontological, and geochemical analyses.

Historical Development of Research

Research in the Central Narmada Valley has developed through the contributions of numerous investigators and institutions over more than a century. Early geological observations by Theobald (1860) and later investigations by de Terra and Paterson (1939) established the importance of the Narmada Valley for Quaternary research. Subsequent studies by the Geological Survey of India, particularly the lithostratigraphic framework proposed by Tiwari and Bhai (1997), provided the basis for modern stratigraphic

investigations. Extensive archaeological surveys by S. B. Ota documented numerous prehistoric localities associated with the Narmada Sagar Dam Project, while studies by Sheila Mishra and colleagues contributed significantly to understanding prehistoric adaptations within Quaternary landscapes, especially identifying the first-known occurrence of the oldest microlithic technology at Mehtakheri. More recent multidisciplinary investigations have refined the chronology, sedimentology, palaeoecology, provenance, and palaeoanthropological significance of the basin through the integration of geochronology, geochemistry, isotope geochemistry, sedimentology, and molecular methods.



Topography and drainage of the area to be visited.

Objectives of the Excursion

The principal objectives of the field excursion are to:

1. Examine representative Quaternary stratigraphic successions preserved within the Central Narmada Basin.
2. Investigate the relationships among tectonics, fluvial sedimentation, and basin evolution.
3. Evaluate the geological context of key archaeological and vertebrate fossil localities.
4. Discuss current approaches to Quaternary geochronology and the challenges of dating fluvial archaeological sequences.

5. Examine evidence for environmental and climatic change using sedimentological, geochemical, palaeontological, and isotopic proxies.
6. Explore recent advances in multidisciplinary research, including sedimentary ancient DNA, in the reconstruction of Quaternary environments.
7. Promote scientific discussion on the Quaternary evolution of the Central Narmada Valley within a broader South Asian and global context.



Regional Geology

The Narmada River originates in the Amarkantak Plateau of central India and flows westward for approximately 1,312 km through the Vindhyan Hills and Satpura Basin before discharging into the Gulf of Cambay (Khambhat). Throughout much of its course, the river is confined between the Proterozoic Vindhyan Supergroup to the north and the Gondwana succession of the Satpura Range to the south, forming one of the most significant geological corridors in the Indian subcontinent. Since the nineteenth century, the Central Narmada Valley has been recognised as one of India's most important Quaternary archives. It contains the richest assemblage of Pleistocene vertebrate fossils and stone tools in peninsular India and is comparable in significance only to the Siwalik region for Quaternary vertebrate palaeontology. The valley preserves an exceptional record of tectonic activity, fluvial evolution, environmental change, vertebrate palaeontology, and hominin occupation, making it a key region for understanding Quaternary landscape evolution and human prehistory in South Asia. Owing to its geographical position, the basin also provides an important framework for examining patterns of faunal and hominin dispersal between Africa, western Eurasia, and Southeast Asia.

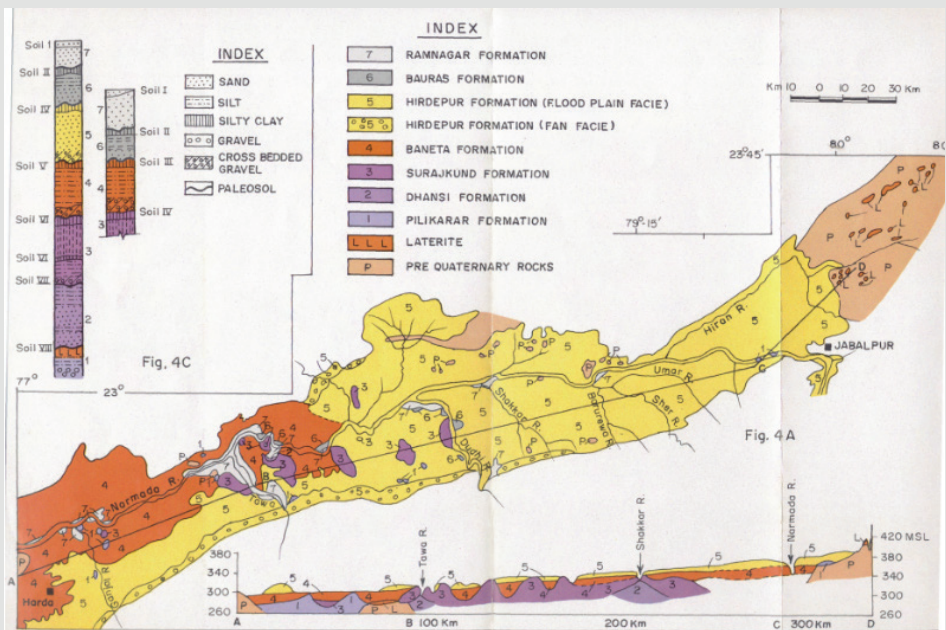
Structural Setting and Tectonic Framework

The Central Narmada Valley is located within the ENE-WSW-trending Narmada-Son Lineament, one of the oldest and most persistent tectonic lineaments of the Indian Shield. This tectonic zone has remained active from the Paleoproterozoic to the present and forms part of the Central Indian Tectonic Zone. The Quaternary basin occupies a graben bounded by the Son-Narmada North Fault (SNNF) and the Son-Narmada South Fault (SNSF). Repeated reactivation of these faults during the Quaternary resulted in the accumulation of nearly 400 m of alluvial and colluvial sediments within the basin. The present structural configuration reflects continued compressional stresses generated by the northward movement of the Indian Plate. These tectonic processes are expressed in the sedimentary succession through syn-sedimentary faults, intraformational folds, slump structures, and other soft-sediment deformation features. The graben is further segmented by several

north-south-trending tear faults, producing differential subsidence of individual blocks by as much as 200 m. Geomorphic evidence for continued tectonic activity includes bedrock gorges, waterfalls, strath terraces, and locally displaced fluvial surfaces. Instrumental seismicity, including the Mw 6.0 Jabalpur earthquake of 1997, demonstrates that the Narmada-Son Lineament remains an active tectonic zone.

Quaternary Stratigraphy

The Quaternary succession of the Central Narmada Valley is formally divided into seven lithostratigraphic formations based on lithological characteristics, stratigraphic superposition, erosional unconformities, palaeomagnetic polarity, pedogenic features, and geochronological constraints. Together, these formations preserve a detailed record of environmental, tectonic, palaeontological, and archaeological evolution during the Quaternary (see the GSI map below published by Tiwari and Bhai, 1997).



Pilikarar Formation (Early-Middle Pleistocene)

The Pilikarar Formation forms the basal Quaternary unit and rests unconformably on either the Late Cretaceous Deccan Traps or the Precambrian Vindhyan basement. It consists predominantly of proximal alluvial fan and colluvial deposits, including a basal boulder conglomerate developed above lateritic surfaces. Heavy mineral analyses indicate the highest mineralogical maturity within the Quaternary succession, with an average ZTR (zircon-tourmaline-rutile) index of 65.36%, suggesting extensive recycling of sediments



derived from the Vindhyan Supergroup. Archaeological investigations have yielded typologically Early Acheulean artefacts, including asymmetrical bifaces, large trihedral picks, and cleavers preserved in fresh condition near the foothills of the Vindhyan escarpment.

Dhansi Formation (Early Pleistocene)

The Dhansi Formation represents the oldest dated Quaternary succession in the basin and has been assigned to the Matuyama Chron (>780 ka) based on palaeomagnetic investigations. The deposits comprise palaeochannel sediments with palaeoflow directions predominantly towards the north and northwest, indicating sediment supply from southern and southeastern source areas. Basal gravels have yielded a non-diagnostic core-and-flake assemblage preserved in situ, representing potentially the earliest securely stratified archaeological evidence for hominin occupation in central India. The associated vertebrate assemblage is sparse and consists primarily of fragmentary remains attributable to *Elephas/Stegodon* and *Hippopotamus*.

Surajkund Formation (Middle Pleistocene)

The Surajkund Formation is the most fossiliferous unit within the Quaternary succession and records deposition within a mixed-load meandering fluvial system. Recent OSL dating from Sardarnagar yielded an age of 145.72 ± 16.09 ka, corresponding to the Ionian Stage of the late Middle Pleistocene, while previous magnetostratigraphic investigations indicate an age range between approximately 500 and 128 ka. This formation is of exceptional palaeoanthropological significance because it yielded the Hathnora hominin remains, including the partial calvarium and associated post-cranial elements. It also contains stratified Late Acheulean bifaces together with Middle Palaeolithic artefacts. Soft-sediment deformation structures, including slump folds and warped floodplain deposits, are interpreted as seismites produced by Middle Pleistocene tectonic reactivation of the Son-Narmada North Fault.

Baneta Formation (Late Pleistocene)

The Baneta Formation is the most laterally extensive lithostratigraphic unit within the basin. It comprises fining-upward successions of pebbly conglomerate, sandstone, and siltstone representing channel lag deposits, point bars, and overbank floodplain environments within a mixed-load meandering river system. Sediments chronologically associated with this formation also preserve Younger Toba Tephra at some sites in the Narmada Basin. OSL ages from select sections of the Baneta Formation range from approximately 83–82 ka, while radiocarbon ages obtained from bivalve shells and carbonaceous clay range from approximately 35 ka to 13 ka. These deposits broadly correspond to the interval spanning Marine Isotope Stages (MIS) 5a to MIS 2. Pedogenic calcretes, including nodular and bedded varieties together with abundant rhizoliths, indicate repeated periods of subaerial exposure under semi-arid climatic conditions.

Hirdepur Formation (Late Pleistocene)

The Hirdepur Formation records a major change in sediment provenance associated with renewed tectonic activity along both graben-bounding faults. Compared with older formations, coarse clastic sediments exhibit a marked increase in metamorphic and Gondwana-derived lithologies sourced from the southern highlands. Heavy mineral assemblages are characterised by increased abundances of garnet and hornblende. The formation is associated with the later Upper Pleistocene archaeological record.

Bauras and Ramnagar Formations (Holocene)

The youngest Quaternary deposits are represented by the Bauras and Ramnagar Formations. The Bauras Formation represents Middle Holocene fluvial activity characterised by cut-and-fill terraces and headward erosion, with radiocarbon ages of approximately 8.7 ka. The Ramnagar Formation, younger than approximately 4.5 ka, records recent fluvial sedimentation and has yielded sub-fossil mammalian remains together with microlithic archaeological assemblages.

Palaeontological and paleoanthropological research

The Central Narmada Valley preserves one of the most important Pleistocene vertebrate records in peninsular India and provides a critical framework for investigating faunal evolution, environmental change, and hominin occupation. The mammalian assemblage includes several extinct taxa, notably *Stegodon namadicus*, *Bos namadicus*, *Bubalus palaeindicus*, *Hexaprotodon palaeindicus*, and *Equus namadicus*. The discovery of stratified ostrich eggshell (*Struthio camelus*) within the Surajkund Formation at Hathnora provides an additional proxy for reconstructing arid environmental conditions during the Pleistocene. Hathnora remains the only locality in India to have yielded fossil remains of an archaic hominin. The assemblage comprises a partial calvarium together with associated post-cranial elements. Although the taxonomic attribution of these fossils remains debated, they are currently regarded as *Homo* sp. indeterminate. Recent ESR dating of associated mammalian teeth provides a minimum depositional age of 49 ± 1 ka; however, the fossils are considered reworked within the fluvial succession and are likely to be substantially older than the enclosing sediments. Recent investigations have also demonstrated the preservation of ancient sedimentary DNA (sedaDNA) within fossil-bearing Middle Pleistocene deposits at Hathnora. Recovered microbial taxa, including members of the Actinobacteria and Proteobacteria, exhibit adaptations that facilitate long-term survival under environmental stress. These data provide a new proxy for reconstructing palaeoenvironmental conditions and microbial ecosystems associated with Quaternary sedimentary archives.

Palaeoecology and Climate

Stable carbon ($\delta^{13}\text{C}$) and oxygen ($\delta^{18}\text{O}$) isotope analyses of pedogenic calcretes and mammalian tooth enamel document significant environmental changes throughout the

Quaternary. During much of the Pleistocene, the valley was dominated by C_4 grassland and scrubland ecosystems under predominantly semi-arid climatic conditions, providing suitable habitats for large grazing mammals such as *Bos namadicus*. In contrast, the Holocene and modern landscape is characterised by increased dominance of C_3 vegetation, reflecting changes in monsoon dynamics together with increasing anthropogenic modification of the landscape. Available palaeoclimatic evidence indicates relatively strong monsoon conditions between approximately 100 and 70 ka, followed by progressive aridification during the Last Glacial Maximum, which favoured the expansion of C_4 grassland ecosystems.

Scientific Context of the Field Excursion

The Central Narmada Valley field excursion provides participants with an integrated overview of the basin's geological, tectonic, palaeontological, archaeological, and palaeoenvironmental evolution through direct examination of representative Quaternary exposures.

Dhansi (Day 3) provides access to the oldest recognised Quaternary succession (>780 ka), where participants will examine the oldest dated fluvial deposits in the basin and discuss evidence for Early Pleistocene hominin occupation.

Pilikarar (Day 2) illustrates the development of proximal alluvial fan deposits along the Vindhyan foothills and their association with typologically Early Acheulean lithic assemblages.

Hathnora (Day 4) focuses on the locality of the Narmada hominin discovery, providing an opportunity to discuss the challenges of chronology within complex fluvial systems, taphonomic processes, and recent advances including sedimentary ancient DNA analyses.

Sardarnagar (Day 4) exposes stratified Late Acheulean archaeological horizons together with Middle Pleistocene seismites, providing direct evidence for the interaction between tectonic activity and sedimentation.

Adamgarh (Day 6) presents an important concentration of prehistoric rock art and Mesolithic archaeological remains, extending the Quaternary record into the Holocene cultural landscape.

Collectively, these localities provide an opportunity to examine the relationships among tectonics, fluvial processes, environmental change, vertebrate evolution, and human occupation within one of South Asia's most important Quaternary sedimentary basins. The excursion is intended to facilitate discussion on stratigraphic correlation, geochronology, palaeoenvironmental reconstruction, archaeological context, and the broader significance of the Central Narmada Valley in Quaternary science.

Flora, Fauna, Climate and weather conditions

The Central Narmada Valley forms an important ecological transition zone between the Vindhyan Highlands to the north and the Satpura (Gondwana) highlands to the south. The field excursion traverses landscapes that lie adjacent to protected forest areas, including the Satpura and Ratapani Tiger Reserves, providing an opportunity to observe the relationship between the modern ecosystem and the Quaternary landscapes preserved in the geological record.

Flora

The present-day vegetation of the Central Narmada Valley is dominated by tropical dry and moist deciduous forests, interspersed with grasslands, scrublands, and agricultural landscapes. The forest structure is typically organized into three vegetation strata. The upper canopy (15–25 m) is dominated by teak (*Tectona grandis*), accompanied by *Diospyros melanoxylon*, *Terminalia tomentosa*, *Anogeissus latifolia*, and *Hardwickia binata*. The middle canopy (10–15 m) commonly includes *Lagerstroemia parviflora*, *Boswellia serrata*, and several species of *Acacia*. The understory consists of shrubs, herbs, and seasonal grasses that vary according to local moisture availability and disturbance.

Palaeovegetation

One of the major themes of Quaternary research in the Narmada Valley is the reconstruction of vegetation change through time. Stable carbon isotope analyses of pedogenic carbonates and mammalian tooth enamel indicate that the Pleistocene landscape was dominated by extensive C_4 grasslands and open savanna ecosystems under predominantly semi-arid conditions. These environments supported large grazing mammals, including *Bos namadicus* and other extinct megaherbivores. In contrast, isotopic analyses of modern *Bos indicus* enamel indicate a predominance of C_3 vegetation in the present-day diet, reflecting a landscape that has undergone substantial modification through changes in monsoon intensity, expansion of agriculture, and increasing woodland cover. This transition from C_4 -dominated Pleistocene ecosystems to the modern C_3 -rich landscape provides an important framework for interpreting long-term environmental and ecological change in central India.

Fauna

The forests and riverine habitats of the Central Narmada Valley support a rich assemblage of wildlife, with more than 50 species of mammals and over 200 species of birds recorded from the region. Among the large carnivores are the tiger (*Panthera tigris*) and leopard (*Panthera pardus*). Large herbivores include gaur (*Bos gaurus*), sambar (*Rusa unicolor*), chital (*Axis axis*), and nilgai (*Boselaphus tragocamelus*). Other characteristic mammals include the sloth bear (*Melursus ursinus*), dhole (*Cuon alpinus*), striped hyena (*Hyaena hyaena*), and Hanuman langur (*Semnopithecus entellus*). The Quaternary fossil record documents a markedly different faunal community. Participants will visit localities that have yielded remains of the Narmada hominin together with extinct megafauna such as *Stegodon namadicus*,



Hexaprotodon palaeindicus, *Bos namadicus*, and *Equus namadicus*. The discovery of stratified ostrich eggshell (*Struthio camelus*) within the Surajkund Formation provides additional evidence for the presence of open, arid environments during the Late Pleistocene.

Climate During the Field Excursion

The field excursion is scheduled during the winter season (late January–early February), which offers the most favourable conditions for geological fieldwork in central India. Daytime temperatures are generally comfortable, with maximum temperatures of approximately 27°C, while night-time temperatures commonly fall to around 10°C. Rainfall during this period is minimal, and humidity remains low, resulting in clear skies and excellent visibility for field observations. These dry conditions also expose numerous riverbank sections, gravel bars, and terrace deposits that are inaccessible or obscured during the southwest monsoon season. Consequently, winter provides optimal conditions for examining sedimentary successions, stratigraphic contacts, archaeological localities, and fossil-bearing horizons throughout the Central Narmada Valley.



Literature Review

***Only the most relevant publications have been listed below. For additional suggested readings on other parts of Narmada Basin, please contact the excursion leaders**

Athreya, S. (2007). Was *Homo heidelbergensis* in South Asia? A test using the Narmada fossil from central India. In M. D. Petraglia & B. Allchin (Eds.), *The evolution and history of human populations in South Asia: Inter-disciplinary studies in archaeology, biological anthropology, linguistics and genetics* (pp. 137–170). Dordrecht, Netherlands: Springer.

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Field Transect



Sites to be visited

- 1) Dhansi
- 2) Pilikarar & Pandadoh
- 3) Hathnora
- 4) Tawa River
- 5) Talpura
- 6) Naganpur
- 7) Chikli
- 8) Sardarnagar
- 9) Adamgarh
- 10) Ginnaurgarh Fort



Section belonging to the Baneta Formation at Hathnora

Location(s) description

The following localities represent key geological, archaeological, and palaeoenvironmental sites within the Central Narmada Valley. Together they document the evolution of the basin from the Early Pleistocene to the Holocene and preserve evidence for tectonic activity, fluvial processes, vertebrate palaeontology, and human occupation.

1. Dhansi

Location: Northern bank of the Narmada River. ~200 meters walk from road & 20 m climb.

Dhansi is the type locality of the Dhansi Formation and preserves the oldest known Quaternary succession in the Central Narmada Valley. The exposed section is approximately 15 m thick and records fluvial sedimentation during the Early and Middle Pleistocene. Sedimentary structures, including northerly directed cross-lamination and northwesterly oriented trough cross-bedding, indicate deposition within a palaeochannel system with sediment supplied from the south and southeast. Heavy mineral assemblages differ markedly from the underlying Pilikarar Formation, with a lower average ZTR index (17.69%) and increased abundances of augite and garnet, indicating a significant change in sediment provenance. Palaeomagnetic and luminescence investigations place the lower succession within the Matuyama Chron (>780 ka), although the Brunhes–Matuyama polarity boundary is not preserved in the exposed section. The basal pebble-gravel horizon has yielded in situ Mode 1 core-and-flake assemblages, representing one of the earliest stratified archaeological occurrences currently known from India. Fragmentary remains of *Elephas/Stegodon* and *Hippopotamus* have also been recovered from the basal deposits.



Type-section of the Dhansi Formation in which lithics are found in situ below the Brunhes–Matuyama boundary.



Stone artifact recovered in excavations (right) at Dhansi.

2. Pilikarar and Pandadoh

Location: Approximately 2 km north of the northern bank of the Narmada River. ~200 meters walk from road; moderate slopes.

Pilikarar is the type locality of the Pilikarar Formation and represents deposition within a proximal alluvial-colluvial fan developed along the foothills of the Vindhyan escarpment. The succession is characterized by a basal boulder conglomerate, locally exceeding 3 m in thickness, resting unconformably on lateritized Vindhyan bedrock. Heavy mineral analysis indicates the highest mineralogical maturity within the Quaternary succession, with an average ZTR index of 65.36%, reflecting extensive recycling of sediments derived from the Vindhyan Supergroup. The locality preserves one of the richest Early Acheulean assemblages in the basin, including asymmetrical bifaces, large trihedral picks, cleavers, and other large cutting tools recovered from stratified fine-grained deposits, fan gravels, and the modern Kaliadoh stream channel. Although originally assigned to the Early Pleistocene, recent technological and typological assessments suggest a probable Middle Pleistocene age.

3. Hathnora

Location: Northern bank of the Narmada River. ~1 km of total walking from road; mostly flat.

Hathnora is the most significant palaeoanthropological locality in India and the only site to have yielded fossil remains of an archaic hominin (*Homo* sp. indet.), including a partial calvarium and associated post-cranial elements. The exposed succession comprises an unconformable contact between the Surajkund Formation and the overlying Baneta Formation, preserving alternating cemented pebble-gravel beds and unconsolidated sand, silt, and clay deposits. The basal boulder conglomerate represents deposition within a high-energy fluvial environment. Geochemical investigations of associated mammalian teeth reveal elevated uranium concentrations, interpreted as resulting from prolonged

interaction with uranium-rich groundwater under evaporative conditions. Recent studies have also demonstrated the preservation of ancient sedimentary DNA (sedaDNA) within the vertebrate fossil-bearing deposits. ESR dating of associated mammalian teeth provides a minimum depositional age of approximately 49 ± 1 ka (Early Uptake model), while linear uptake models indicate ages between approximately 83 and 162 ka. Radiocarbon dating of the overlying Baneta Formation yields ages between approximately 35 and 24 ka. The locality has also yielded Middle and Upper Palaeolithic artefacts together with the first stratified occurrence of ostrich eggshell (*Struthio camelus*) documented from the Narmada Basin. Most recently, a section belonging to the Baneta Formation at the site has yielded one of the most complete proboscidean fossil skeletons in India.



General view of the fossil hominin site of Hathnora.

4. Tawa River

Location: Approximately 6 km east of Narmadapuram. Roadside stop.

The Tawa River is the largest southern tributary of the Narmada River and originates within the Gondwana sedimentary terrain of the Satpura Range. At its confluence with the Narmada, the river provides an excellent modern analogue for sediment transport from the southern highlands. The active channel exceeds 2 km in width at its broadest point and is dominated by sand-rich deposits. The river supplies sediments derived from Gondwana sedimentary rocks and metamorphic terrains, providing an important modern reference for interpreting the provenance of younger Quaternary formations, particularly the Hirdepur, Bauras, and Ramnagar Formations.



5. Talpura

Location: Vindhyan foothills north of the Narmada River. ~1.5 km walking up and down hill. Moderate to steep slopes.

Talpura is an important archaeological locality where painted rock shelters occur in close association with Buddhist stupas. The rock art records multiple phases of occupation extending from prehistoric through protohistoric to historical periods. The site provides an excellent example of long-term human occupation within the Vindhyan landscape and is protected by the Archaeological Survey of India.

6. Naganpur

Location: Vindhyan foothills north of the Narmada River. ~1 km walk roundtrip from road.

Naganpur preserves stratified microlithic assemblages within sandy-silty deposits. Optically Stimulated Luminescence (OSL) dating indicates a Late Pleistocene age for the archaeological horizon. In addition to the microlithic industries, the locality has yielded evidence of earlier Palaeolithic occupation, providing an important record of technological continuity during the Late Quaternary.

7. Chikli

Location: Vindhyan foothills north of the Narmada River. ~400 meter walk roundtrip.

Chikli contains stratified microlithic assemblages preserved within silty deposits containing well-developed pedogenic calcrete. OSL dating places the archaeological horizon within the Late Pleistocene. The locality lies adjacent to one of the largest concentrations of painted rock shelters in the Narmada Valley, providing an opportunity to examine the relationship between Late Quaternary sedimentation, archaeological preservation, and prehistoric occupation.

8. Sardarnagar

Location: Northern bank of the Narmada River. ~300 meter walk roundtrip from road.

Sardarnagar exposes an excellent section through the Surajkund Formation, comprising fining-upward fluvial successions of massive pebble conglomerates, cross-bedded sandstones, and overbank siltstones deposited within a mixed-load meandering river system. OSL dating of fine-grained channel deposits yielded an age of 145.72 ± 16.09 ka, placing the succession within the Ionian Stage of the late Middle Pleistocene. The locality is particularly notable for preserving soft-sediment deformation structures (seismites), including slump folds characterised by broad synclines and narrow anticlines, interpreted as the result of Middle Pleistocene seismic activity associated with movement along the Son-Narmada North Fault. The site has yielded stratified Late Acheulean miniature bifaces together with Middle Palaeolithic flakes and associated vertebrate fossils.

9. Adamgarh rockshelter complex

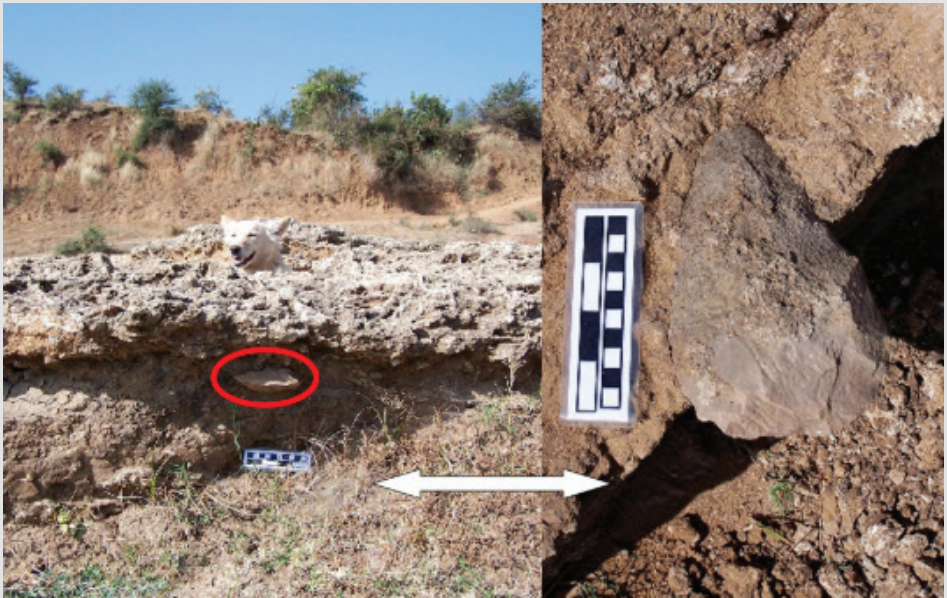
Location: Outskirts of Narmadapuram. ~1 km walk roundtrip; moderate slopes.

Adamgarh contains the largest concentration of painted rock shelters within the Narmada Valley. Systematic excavations conducted by R. V. Joshi during the 1950s documented archaeological deposits spanning the Upper Palaeolithic, Mesolithic, Chalcolithic, and Historic periods. The site is protected by the Archaeological Survey of India and represents one of the most important archaeological localities in central India.

10. Ginnorgarh Fort

Location: Approximately 50 km northwest of Narmadapuram. ~3km walk roundtrip; moderate to steep slopes.

Ginnorgarh is a historic Gond hill fort situated within the Ratapani Tiger Reserve on the Vindhyan sandstone plateau. The locality illustrates the strong influence of regional geology and geomorphology on settlement patterns and defensive architecture while also highlighting the ecological significance of the Vindhyan landscape within the modern protected area network.



A fluvial section belonging to the Surajkund Formation near the type-site and in situ Acheulean handaxe.



Fossilised *Stegodon* cranium and post-cranial elements from Amonda, Narmada Valley.



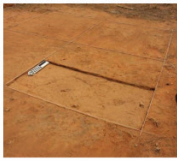
Mapped vertebrate fossil localities and specimens in the eastern zone of the Narmada Basin.



Geological type-section of the Pilikarar Formation.



Multiple perspectives of an Acheulean biface from Pilikarar.

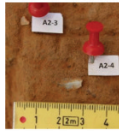


Naganpur

Semi-primary context

~100 microlithic specimens
within 1 x 1 m test trench,
(depth of 25 cm)

OSL dating indicates Late
Pleistocene age



Geoarchaeological test-pit at the microlithic site of Naganpur.

Rock art at Baba ka Tila in the Narmada Basin.
(Pic courtesy: Rajesh Poojari)

Geoheritage, UNESCO heritage, archaeological sites in the vicinity, cousins and culture

The Central Narmada Valley is one of the most significant geoarchaeological regions in the Indian subcontinent, preserving an exceptional record of Quaternary geology, vertebrate palaeontology, prehistoric archaeology, and historical heritage. The region contains numerous geological and archaeological localities that collectively document environmental change and human occupation from the Early Pleistocene to the Historic period.

1. World Heritage Context: Bhimbetka Rock Shelters

The **Bhimbetka Rock Shelters**, located in the Vindhyan foothills of Raisen District, constitute the nearest **UNESCO World Heritage Site** to the excursion area. The site preserves one of the longest archaeological sequences in South Asia, with evidence of human occupation extending from the Lower Palaeolithic (Acheulean) through the Mesolithic and into the Historic period. Excavations have documented successive lithic industries and stratified archaeological deposits, providing an important regional framework for interpreting the archaeological record of the Central Narmada Valley. The extensive rock art assemblage preserves depictions of wildlife, hunting scenes, and other aspects of prehistoric life, offering valuable insights into the cultural development and palaeoecology of central India.

2. Protected Archaeological Sites

Several archaeological localities within the excursion area are protected by the **Archaeological Survey of India (ASI)**. **Adamgarh**, located on the outskirts of Narmadapuram, contains the largest concentration of painted rock shelters within the Narmada Valley. Archaeological excavations conducted by R. V. Joshi during the 1950s documented a cultural sequence extending from the Upper Palaeolithic through the Mesolithic, together with abundant microlithic assemblages. **Talpura** and **Saru Maru** preserve archaeological evidence spanning prehistoric, protohistoric, and historical periods. Both localities contain painted rock shelters associated with lithic artefacts and Buddhist monuments, illustrating the long-term continuity of human occupation within the Vindhyan landscape. The coexistence of prehistoric rock art and historical Buddhist remains makes these sites particularly valuable for understanding the evolution of cultural landscapes in central India.

3. Hathnora: A Key Palaeoanthropological Locality

Hathnora is the most significant palaeoanthropological locality in India and the only site in the Indian subcontinent to have yielded fossil remains of an archaic hominin. The recovered material includes a partial calvarium together with post-cranial elements currently attributed to *Homo* sp. indeterminate. In addition to the hominin remains, Hathnora has yielded diverse vertebrate fossils, Palaeolithic artefacts, and the first stratified occurrence of ostrich eggshell (*Struthio camelus*) reported from the Narmada Basin. Despite its international scientific importance, the locality is not presently protected under the Archaeological Survey of India or other formal heritage protection frameworks.

4. Historical and Cultural Heritage

The excursion area also includes several sites of historical and cultural importance that illustrate the continued use of the Narmada landscape beyond prehistory. **Ginnorgarh Fort**, situated within the Ratapani Tiger Reserve northwest of Narmadapuram, is a historic hill fort associated with the Gond rulers of central India. The fort occupies a prominent position on the Vindhyan sandstone plateau and demonstrates the influence of regional geology and topography on settlement and defensive architecture. The nearby **Salkanpur Temple** is one of the major religious centres of the region and reflects the continuing cultural significance of the Vindhyan hills and the Narmada Valley within central India. Narmadapuram town, place of stay, also preserves remnants of a medieval fort and other historical structures including the riverside ghats.

5. Geoheritage Significance

The Central Narmada Valley preserves an exceptional concentration of Quaternary geological and archaeological sites. Stone tool assemblages, vertebrate fossil localities, fossil-bearing sedimentary successions, rock art sites, and historical monuments are distributed throughout the basin, often occurring as clusters rather than isolated localities. Together, these sites provide an integrated record of landscape evolution, tectonic activity,

environmental change, vertebrate evolution, and human occupation extending from the Early Pleistocene to the present. The close spatial association of geological and archaeological evidence makes the Central Narmada Valley one of the most important natural laboratories for multidisciplinary Quaternary research in South Asia.



*The historical site of Ginnaurgarh
(<https://tickettollywood.travel.blog/2018/07/04/ginnorgarh-fort-a-lan-d-lost-in-time/>)*

Local Conveniences

Closest hospitals, police station, pharmacies, markets etc. are in Narmadapuram town, the place of stay during this excursion.

Narmadapuram Police Station

Phone number: +91-075742 52480

Google location: <https://share.google/pVtS9CsvIPaJJRYkD>

Narmadapuram City Hospital (NCH)

Babai Road

Google location: <https://share.google/jrTct8llbvWITw6tL>

Maa Sharda Hospital

Ishan Parisar, ITI Rd, opp. Galla Mandi. Phone: 075744 90903

Google Location: <https://share.google/0IRCx7KEs0plpqtq1>

Royal Multi Speciality Hospital

Hariyali Chowk, near ITI Road, besides Union Bank of India.

Google Location: <https://share.google/A2OPh3UZLPh9dVXbZ>

Narmadapuram Train Station

Google location: <https://share.google/HASDmbnp138Ywfvzi>

Conclusion

The Central Narmada Valley preserves one of the most comprehensive Quaternary records in the Indian subcontinent, integrating evidence of tectonic activity, fluvial sedimentation, environmental change, vertebrate palaeontology, and human occupation within a single sedimentary basin. The succession provides an important framework for investigating the interactions among landscape evolution, climate variability, and hominin occupation throughout the Quaternary. The localities included in this excursion illustrate the diversity of geological and archaeological archives preserved within the basin, ranging from the oldest recognised Quaternary deposits and Early Palaeolithic archaeological horizons to Middle Pleistocene hominin-bearing strata, Late Pleistocene environmental records, and Holocene archaeological landscapes. Together, these sites demonstrate the value of integrating sedimentology, stratigraphy, geochronology, palaeontology, archaeology, geochemistry, and emerging molecular approaches in the reconstruction of Quaternary environments. Despite considerable progress, important questions remain regarding the chronology, depositional history, and taphonomic context of many fossil and archaeological assemblages preserved within the fluvial succession. Continued application of complementary approaches, including palaeomagnetism, luminescence dating, electron spin resonance, stable isotope geochemistry, provenance analysis, and sedimentary ancient DNA, offers opportunities to further refine the Quaternary history of the basin. It is hoped that this field excursion will provide a platform for scientific discussion and encourage future collaborative research on the geology, archaeology, palaeoecology, and palaeoanthropology of the Central Narmada Valley. The integration of diverse datasets from this basin will continue to contribute to a broader understanding of Quaternary environmental change and human evolution in South Asia and within the wider context of the Old World.



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- Local villagers
- Archaeological Survey of India
- Directorate of Archaeology, Archives and Museums, Government of Madhya Pradesh



Shrine dedicated to Shiva adorned (unknowingly) with Acheulean artifacts and a ringstone at Panwasa.

Annexure

Field Excursion Guidelines: Do's and Don'ts

To ensure the safety of all participants and to promote responsible scientific field practices, all participants are requested to adhere to the following guidelines throughout the field excursions.

Keep a valid passport (for international participants) or a government-issued photo ID (for Indian participants) with you at all times during the field excursion.

Do's	Don'ts
1. Follow the instructions of the excursion leaders, coordinators, and local authorities at all times. 2. Remain with the group and inform the excursion leader before leaving the designated route. 3. Wear appropriate field attire, including sturdy closed-toe footwear, full-length trousers, a hat or cap, and weather-appropriate clothing. 4. Carry sufficient drinking water, personal medications, sunscreen, insect repellent, and other essential field supplies. 5. Keep a valid photo identification and your excursion registration details with you during travel. 6. Respect local customs, religious sites, cultural heritage, and private property. 7. Follow the Leave No Trace principles by carrying back all waste and helping to keep field sites clean. 8. Use designated trails and approved observation areas to minimise environmental disturbance. 9. Observe geological, ecological, archaeological, and cultural features carefully without causing any damage.	1. Do not collect rocks, fossils, archaeological artefacts, biological specimens, or any other materials without prior authorization. 2. Do not damage, deface, or remove material from geological outcrops, caves, monuments, heritage structures, or other natural features. 3. Do not wander alone or separate from the excursion group without informing the field leaders. 4. Do not climb unstable slopes, cliffs, rock formations, or enter hazardous areas unless specifically instructed or supervised. 5. Do not swim or enter rivers, lakes, lagoons, or coastal waters unless expressly authorized by the excursion leaders. 6. Do not consume alcohol, recreational drugs, or engage in unsafe or irresponsible behaviour during the excursion. 7. Do not operate drones or other restricted equipment without obtaining the necessary permissions. 8. Do not photograph restricted installations, sensitive locations, or local residents without prior permission.

10. Record field observations systematically and collect samples only with prior permission from the excursion leaders and the relevant authorities.

11. Exercise caution near cliffs, riverbanks, caves, unstable slopes, road cuts, and other potentially hazardous terrain.

12. Respect wildlife by maintaining a safe distance from animals, birds, reptiles, insects, and their habitats.

13. Immediately report any illness, injury, emergency, or hazardous situation to the excursion organizers.

14. Be prepared for changing weather conditions and comply with all safety advisories issued by the excursion leaders.

9. Do not create excessive noise or disturb local communities, religious activities, wildlife, or natural habitats.

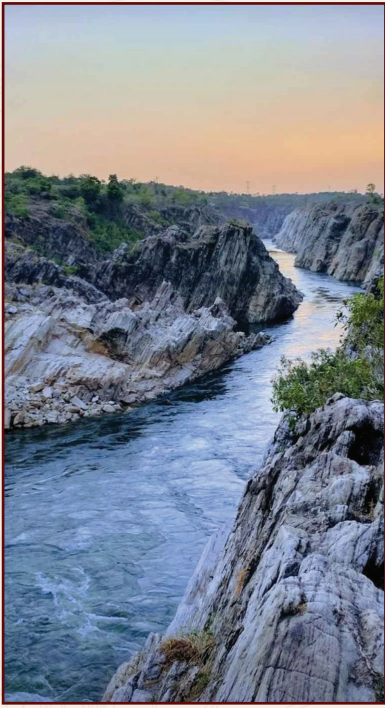
10. Do not leave valuables unattended or rely solely on mobile phone connectivity in remote areas.

11. Do not undertake any activity that may compromise your safety, the safety of fellow participants, or the conservation of the area's geological, ecological, archaeological, or cultural heritage.

Disclaimer

Participation in the field excursions is entirely at the participant's own risk. While the Organising Committee and excursion leaders will make every reasonable effort to ensure participant safety and provide appropriate guidance, they shall not be held responsible for any personal injury, illness, loss of personal belongings, property damage, delays, or unforeseen incidents arising during travel or field activities. Participants are expected to act responsibly, follow all instructions issued by the excursion leaders, and comply with applicable local laws and regulations throughout the excursion.







Scan for
Field Guide Book



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