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FIELD GUIDE

INMID - 10

LATE QUATERNARY GEOLOGY, FLUVIAL GEOMORPHOLOGY, GEOARCHAEOLOGY, AND LANDSCAPE EVOLUTION IN THE MIDDLE GANGA PLAIN: EVIDENCE FROM THE JAJMAU AND BITHOOR CLIFF SECTIONS

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Late Quaternary Geology, Fluvial Geomorphology, Geoarchaeology, and Landscape Evolution in the Middle Ganga Plain: Evidence from the Jajmau and Bithoor Cliff Sections

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Abstract

The Middle Ganga Plain preserves one of the most complete Late Quaternary fluvial archives in South Asia, documenting the complex interplay of tectonics, climate, river dynamics, and human occupation. This field guide presents a comprehensive account of the Late Quaternary geology, fluvial geomorphology, geoarchaeology, and landscape evolution of the Middle Ganga Plain through a field transect extending from Lucknow to Kanpur with special emphasis on the cliff sections at Jajmau and Bithoor. These natural exposures provide exceptional opportunities to examine the stratigraphic architecture of the Ganga foreland basin, revealing stacked channel sands, overbank silts and clays, palaeosols, calcrete horizons, and terrace sequences (T0, T1, and T2) that record repeated phases of river aggradation and incision during the Late Quaternary. The guide highlights the geomorphological evolution of the Kanpur region, including braided bars, natural leveesand active floodplains, and discusses their significance in reconstructing fluvial processes and landscape evolution under changing monsoon conditions. The field transect also emphasizes the geoarchaeological importance of the region. The Jajmau cliff sections preserve archaeological horizons associated with long-term human occupation. On the other hand, floodplain deposits of Bithoor section modified by soil-forming (pedogenetic) processes, followed by the development of lacustrine (lake) and eolian (wind-blown) depositional environments. The integration of geological, geomorphological, geochemical, chronological, and archaeological datasets offers a holistic understanding of landscape evolution and human–environment interactions within the Middle Ganga Plain. In addition, the guide provides information on regional geology, geomorphology, flora, fauna, climate, geoheritage, archaeological significance, local culture, field safety, and logistical considerations for scientific excursions. Collectively, the Bithoor–Jajmau transect represents a unique natural laboratory for investigating Late Quaternary environmental change and serves as an important reference section for interdisciplinary research in the Indo-Gangetic foreland basin.

Key words: Middle Ganga Plain, Cliff section, Late Quaternary, Fluvial, River

Preamble

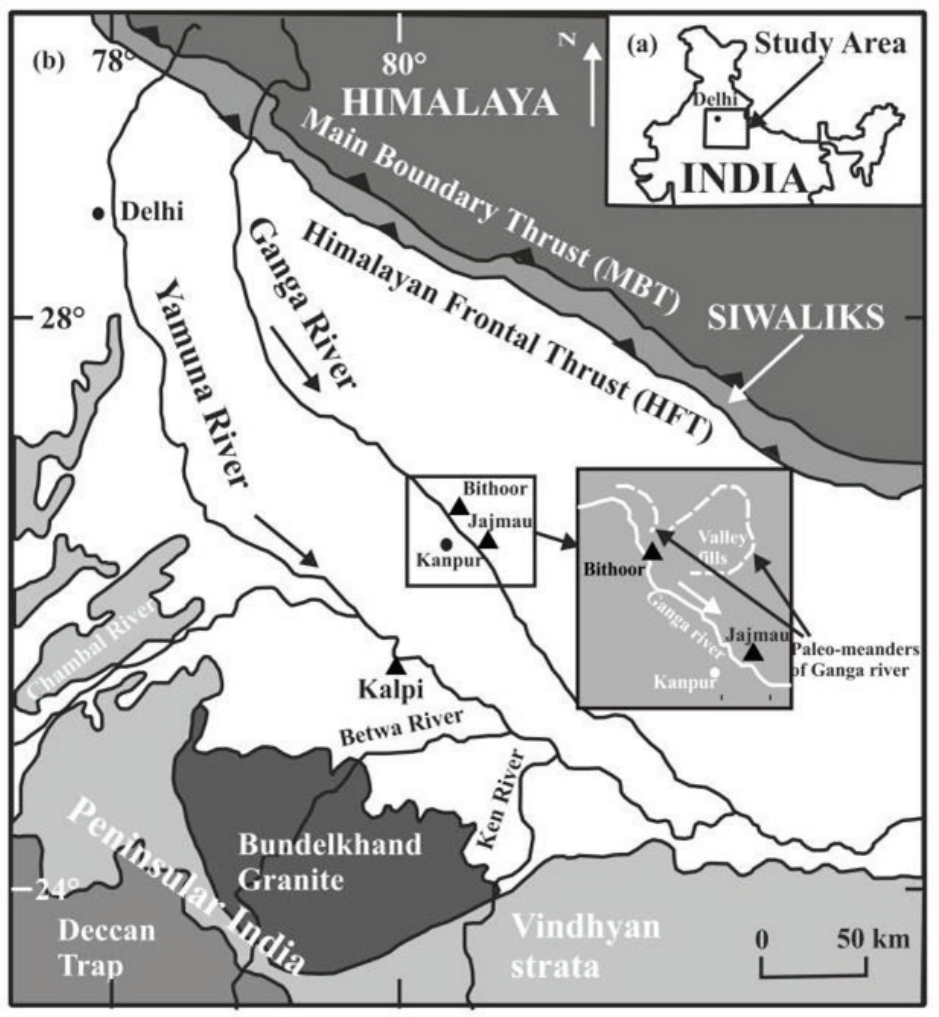
The Middle Ganga Plain is one of the most significant Quaternary sedimentary basins of the Indian subcontinent. Formed through the long-term interaction of tectonic movements in the Himalayan foreland basin, climatic fluctuations, and fluvial processes, the region preserves an extensive archive of environmental and landscape evolution spanning the Late Quaternary Period. Thick alluvial deposits laid down by the Himalayan and Peninsular rivers record successive phases of sedimentation, channel migration, floodplain development, and soil formation, making the plain an ideal natural laboratory for studying Quaternary geology, fluvial geomorphology, palaeoenvironmental change, and geoarchaeology.

Among the numerous late Quaternary exposures within the Middle Ganga Plain, the cliff sections at Bithoor, and Jajmau are of exceptional geological and geoarchaeological importance. These natural river-cut exposures provide continuous stratigraphic sections that reveal variations in sediment texture, depositional facies, pedogenic horizons, palaeosols, calcrete development, and evidence of fluvial activity over time. Their accessibility and well-preserved sedimentary succession make them important reference sections for investigating the Quaternary stratigraphy of the Ganga basin.

Bithoor Cliff: located along the right bank of the Ganga River near Kanpur, exposes a thick succession of alluvial sediments that provide valuable evidence of channel migration, floodplain sedimentation, and landscape development. The deposits record a transition from floodplain to lake and wind-blown (eolian) environments, with evidence of soil formation and changing depositional conditions. This shift indicates a major change in sedimentation, likely caused by reduced discharge from major rivers.

Jajmau Cliff: situated along the Ganga River overbridge near Kanpur, represents another important late Quaternary exposure where fluvial deposits are associated with archaeological remains belonging to successive cultural periods. The stratigraphic succession at Jajmau illustrates the close association between environmental changes, sediment accumulation, floodplain evolution, and human occupation. Geoarchaeological investigations at this locality contribute significantly to understanding the influence of river dynamics on settlement patterns and cultural development within the Middle Ganga Plain.

The integrated study of the Bithoor, and Jajmau cliff sections provides an excellent opportunity to investigate Late Quaternary geology, fluvial geomorphology, sedimentary processes, palaeoenvironmental reconstruction, and geoarchaeological evolution within a unified regional framework. Comparative analysis of these sections enhances our understanding of the spatial and temporal variability of alluvial sedimentation, climatic fluctuations, neotectonic influences, and river behaviour across the Middle Ganga Plain. Consequently, these cliff exposures serve as key reference sites for reconstructing the geological history and landscape evolution of one of the world's largest and most dynamic alluvial plains.



The map of India showing location of Bithoor and Jajmau Cliff section



Cliff section at Bithoor along Ganga River



Jajmau cliff section along Ganga River, Kanpur

Research problem

Late Quaternary geology is fundamentally concerned with understanding Earth's environmental and climatic history during the last ~2.58 million years through the study of sedimentary records, landforms, palaeosols, fossil assemblages, and archaeological evidence. Across the world, major river basins such as the Mississippi, Nile, Rhine, Danube, Yellow (Huang He), Yangtze, Amazon, and Ganga preserve extensive Late Quaternary deposits that record repeated episodes of climatic change, tectonic activity, river migration, and human occupation. These fluvial archives provide the basis for reconstructing past landscapes, understanding river evolution, and evaluating the response of sedimentary systems to global climatic fluctuations.

The Ganga foreland basin represents one of the largest active fluvial systems in the world and receives enormous quantities of sediment derived from Himalaya as well as Peninsular India. Continuous sediment accumulation throughout the Late Quaternary has produced an alluvial succession several hundred metres thick, making the Middle Ganga Plain. The geomorphic evolution of the Middle Ganga Plain has been influenced by variations in monsoonal intensity, sediment supply from Himalayan and Peninsular Indian Rivers, neotectonic activity, and changes in river dynamics during glacial and interglacial climatic cycles. These processes have resulted in a complex assemblage of river terraces, floodplains, abandoned channels, natural levees, palaeochannels, and cliff exposures that collectively preserve evidence of changing depositional environments and landscape evolution. Such sedimentary archives are invaluable for reconstructing the environmental history of northern India and understanding the interaction between climate, tectonics, river systems, and human occupation.

Regional Geology

The Kanpur region occupies a strategically important part of the Middle Ganga Plain within the central sector of the Indo-Gangetic Foreland Basin. The area is characterized by thick Late Quaternary alluvial deposits derived principally from the Himalayan (Ganga river systems). These sediments preserve an exceptional record of climatic oscillations, tectonic activity, fluvial processes, landscape evolution, and human occupation during the Late Quaternary Period. The river-cut cliff sections at Jajmau and Bithoor, provide continuous natural exposures of these deposits and serve as important reference sections for geological, geomorphological, and geoarchaeological investigations. The exposed stratigraphy of the Kanpur area is dominated by Late Quaternary alluvial deposits of Pleistocene and Holocene age. These sediments consist of alternating sequences of gravel, sand, silt, clay, palaeosols, and calcrete horizons deposited under changing fluvial environments.

A generalized stratigraphic succession is as follows:

Stratigraphic Unit	Lithology	Environment
Recent Alluvium (Holocene)	Sand, silt, clay	Active floodplain(T0)
Older Alluvium (Late Pleistocene–Holocene)	Fine sand, silt, clay, palaeosols	Older floodplain (T1)
Upper Older Alluvium (Middle–Late Pleistocene)	Sand, gravel, calcrete, palaeosols	High terrace (T2)
Basement	Precambrian crystalline rocks (not exposed)	Indian Shield

Although the Kanpur region appears geomorphically stable, its evolution has been influenced by subtle neotectonic movements within the Ganga Foreland Basin. The basin continues to respond to compressional forces generated by the ongoing Himalayan orogeny. Numerous concealed basement faults and lineaments influence river gradients, channel migration, sediment thickness, and local drainage patterns.

Regional tectonic activity has contributed to differential uplift and subsidence, development of fluvial terraces (T0, T1, and T2), river incision and valley formation, localized preservation of thick alluvial sequences, rejuvenation of drainage systems. Several studies suggest that episodes of river incision during the Late Quaternary reflect the combined effects of climatic fluctuations and neotectonic adjustments within the foreland basin.

The Quaternary succession preserves a variety of palaeobiological evidence useful for environmental reconstruction. These include freshwater molluscan shells deposited in floodplain and oxbow lake environments, carbonized plant remains, fossil wood fragments, pollen and spores preserved within fine-grained sediments, and phytoliths derived from grasses and other terrestrial vegetation. These fossil assemblages provide valuable information regarding past vegetation, monsoonal intensity, floodplain ecology, and climatic conditions during the Late Pleistocene and Holocene.

The Quaternary geology of the Kanpur region records repeated cycles of sediment aggradation, floodplain stability, soil development, and river incision associated with glacial–interglacial climatic oscillations and variations in monsoonal intensity.

The principal lithological components include channel sands, gravel lenses, overbank silts and clays, palaeosols, calcrete horizons, organic-rich floodplain deposits etc.

Three geomorphic surfaces are well developed:

T0 Surface: Represents the active floodplain presently affected by seasonal flooding. It contains braided bars, point bars, natural levees, abandoned channels, and recent alluvium.

T1 Surface: Forms an older floodplain terrace characterized by mature soils, palaeosols, and relatively stable geomorphic conditions. Much of the agricultural land around Kanpur occupies this surface.

T2 Surface: Represents the oldest preserved terrace in the area and is extensively dissected by ravines and Badlands.

The Quaternary succession records repeated alternations between phases of river aggradation during humid climatic conditions and incision during periods of reduced discharge or tectonic uplift.

The area serves as an important natural laboratory for multidisciplinary studies involving Quaternary geology, sedimentology, fluvial geomorphology, palaeopedology, palaeoclimatology, geoarchaeology, and neotectonics. Its exceptional cliff exposures, well-preserved terrace sequence, and rich archaeological record make the Kanpur transect one of the most significant field areas for understanding the evolution of the Middle Ganga Plain and the interaction between climate, tectonics, river systems, and human societies during the Quaternary.

Climate, weather conditions, Flora and Fauna

The Kanpur region lies within the subtropical monsoon climatic zone of northern India and experiences a continental climate characterized by hot summers, a humid monsoon season, and cool winters. The climate is primarily controlled by the southwest monsoon, which supplies nearly 80% of the annual rainfall. Seasonal variations in temperature and precipitation have played a major role in shaping the geomorphology, hydrology, soil development, and Quaternary sedimentation of the Middle Ganga Plain.

The region experiences three principal seasons:

Summer (March–June): Summers are extremely hot and dry, with maximum temperatures commonly ranging from 40°C to 46°C during May and June. Hot, desiccating winds locally known as loo frequently blow across the plains, enhancing evaporation and reducing soil moisture. Dust storms are common before the onset of the monsoon.

Southwest Monsoon (Late June–September): The arrival of the southwest monsoon brings heavy rainfall and significantly lowers temperatures. Average annual rainfall ranges between 800 and 1,000 mm, most of which falls during this season. The Ganga rivers experience increased discharge, resulting in flooding, channel migration, overbank sedimentation, and the formation of natural levees, braided bars, and flood basins. These seasonal floods are fundamental to the continued evolution of the floodplain.

Winter (November–February): Winters are generally cool and dry, with minimum temperatures occasionally falling below 5°C, while daytime temperatures remain between 18°C and 25°C. Dense fog commonly develops during December and January due to high humidity and temperature inversions. Winter precipitation associated with western disturbances occasionally contributes light rainfall.

The pronounced seasonal contrasts in temperature and rainfall have significantly influenced Late Quaternary landscape evolution by controlling river discharge, sediment transport, soil formation, and vegetation patterns.

Weather

Weather conditions in the Kanpur region are highly seasonal and directly influence geomorphic processes. During summer, prolonged dry conditions favour wind erosion, desiccation of exposed sediments, and stabilization of river bars. With the onset of the monsoon, intense rainfall generates surface runoff, bank erosion, channel migration, and large-scale sediment transport by the Ganga rivers. Winter weather is relatively stable, with low evaporation rates and frequent morning fog that influences local microclimatic conditions. Extreme weather events such as high-intensity rainfall, floods, droughts, and heat waves periodically affect the region and contribute to the dynamic evolution of the alluvial landscape.

Flora

The natural vegetation of the Kanpur region belongs to the Tropical Dry Deciduous Forest type, although much of the original forest cover has been replaced by agriculture and urban development. Natural vegetation is now largely restricted to riverbanks, ravines, protected areas, and village groves.

Common tree species include Azadirachta indica (Neem), Ficus religiosa (Peepal), Ficus benghalensis (Banyan), Acacia nilotica (Babul), Dalbergia sissoo (Shisham), Syzygium cumini (Jamun), Tamarindus indica (Tamarind), Mangifera indica (Mango), Shrubs commonly found include Calotropis procera, Carissa spinarum, Ziziphus nummularia, Lantana camara (in disturbed habitats), the floodplains and wetlands support grasses such as Saccharum spontaneum, Imperata cylindrical, Cynodon dactylon, Vetiveria zizanioides, and aquatic vegetation in oxbow lakes, marshes, and ponds includes Typha angustifolia, Phragmites karka, Nelumbo nucifera (Lotus), Nymphaea spp. (Water lilies), Hydrilla verticillata etc. Agriculture dominates the landscape, with major crops including wheat, rice, mustard, chickpea, lentil, sugarcane, potato, and vegetables.

Fauna

The fauna of the Kanpur region reflects the diversity of floodplain, wetland, agricultural, and riverine habitats. Common mammals include Nilgai (Boselaphus tragocamelus), Golden Jackal (Canis aureus), Indian Hare (Lepus nigricollis), Rhesus Macaque (Macaca mulatta), Common Mongoose (Herpestes edwardsii), Indian Palm Squirrel (Funambulus pennantii), Fruit Bat (Pteropus giganteus) etc. Small carnivores such as jungle cats and foxes occasionally found in less disturbed habitats.

The Ganga floodplains support a rich avifauna throughout the year. Resident birds include Indian Peafowl, Red-wattled Lapwing, Black Drongo, Cattle Egret, Indian Pond Heron, White-throated Kingfisher andRose-ringed Parakeet. Winter attracts numerous migratory waterbirds, including Northern Pintail, Gadwall, Common Teal, Bar-headed Goose, Ruddy Shelduck and Eurasian Wigeon. Further, Riverine habitats also support cormorants, river terns, stilts, sandpipers, and herons.

Common reptiles include Indian Cobra, Rat Snake, Checkered Keelback, Garden Lizard, Monitor Lizard and Freshwater turtles. The sandy banks of the rivers provide nesting habitats for several turtle species.

The Ganga rivers sustain diverse freshwater fish communities, including Rohu (Labeo rohita), Catla (Catla catla), Mrigal (Cirrhinus mrigala), Common Carp (Cyprinus carpio), Wallago (Wallago attu) and Various catfish species. These fish play an important ecological and economic role in the region.

The flora and fauna of the Kanpur region are closely linked to the geomorphology of the Middle Ganga Plain. Seasonal flooding maintains fertile floodplains, wetlands, and riparian habitats that support high biodiversity. Braided bars, natural levees, palaeochannels, and flood basins create a mosaic of ecological niches for plants, birds, mammals, reptiles, and aquatic organisms.

Literature review

Initial geological studies of the Middle Ganga Plain were primarily concerned with describing the alluvial stratigraphy and geomorphology of the Indo-Gangetic Basin (Singh, 1996; Singh et al., 1999). Early workers recognized the distinction between Older Alluvium and Newer Alluvium and documented the occurrence of river terraces, palaeochannels, calcrete horizons, and floodplain deposits. These studies established that the Late Quaternary succession was closely related to Himalayan tectonics, monsoon-driven sediment supply, and repeated episodes of river aggradation and incision (Singh, 1996; Singh et al., 1999; Gibling et al., 2005; Sinha et al., 2007). Subsequent regional geomorphic mapping demonstrated that the Middle Ganga Plain preserves multiple geomorphic surfaces (T0, T1, and T2) associated with different stages of Late Quaternary landscape evolution (Singh, 1996; Singh et al., 1999).

Bithoor Cliff Section: Bithoor Cliff is an important exposure along the Ganga River. Sedimentological investigations have recognized a succession of floodplain, lacustrine, and aeolian deposits interbedded with palaeosols and carbonate-rich horizons (Singh et al., 1989; Sinha et al., 2005; Gibling et al., 2005; Sinha et al., 2007). The section records changes in depositional environments associated with Late Pleistocene climatic fluctuations.

Studies have shown that parts of the Bithoor succession contain lacustrine deposits overlain by aeolian silts, suggesting intervals of reduced fluvial activity and increased aridity during the Late Quaternary. These findings provide important evidence for variations in monsoon strength and sediment availability (Gibling et al., 2005; Sinha et al., 2007).

Geomorphological investigations have also documented terrace development, floodplain evolution, and channel migration along the Ganga River, demonstrating the importance of Bithoor for understanding the evolution of the central Ganga floodplain.

Jajmau Cliff Section: The Jajmau Cliff has been investigated primarily from a geoarchaeological perspective because of its long history of human occupation. Excavations have revealed archaeological remains representing multiple cultural phases preserved within Late Quaternary alluvial deposits (Archaeological Survey of India, 2016). Geological studies indicate that the archaeological horizons are closely associated with floodplain sedimentation and palaeosol development, making Jajmau an important locality for investigating interactions between environmental change and settlement history. Sedimentologically, Jajmau section comprises extremely silty sandy mud (47%), very silty slightly sandy mud (31%), extremely silty slightly sandy mud (11%) and slightly clayey silt (11%) (Kanhaiya et al., 2017).

Major Scientific Contributions

- Research conducted in the Kanpur region has significantly advanced understanding of:
- Quaternary stratigraphy of the Middle Ganga Plain.
- Fluvial architecture and sedimentary facies of large alluvial rivers.
- Evolution of floodplains and river terraces (T0, T1, and T2).
- Monsoon-driven cycles of aggradation and incision.
- Development of palaeosols and calcrete under semi-arid climatic conditions.
- Late Quaternary palaeoenvironmental reconstruction.
- Relationships between geomorphology and archaeological settlement.
- The role of Himalayan tectonics and foreland basin evolution in controlling river behaviour.

The Bithoor–Jajmau transect therefore represents one of the most valuable natural laboratories in the Ganga foreland basin for advancing Late Quaternary geological research and provides considerable opportunities for future interdisciplinary investigations.

Field Transect

The Lucknow–Kanpur transect represents a classic north–south to northwest–southeast traverse across the Middle Ganga Plain, crossing major geomorphic surfaces of the Ganga fluvial systems. The route provides an excellent exposure of Late Quaternary stratigraphy, fluvial geomorphology, and neotectonic landforms, transitioning from older interfluve surfaces near Lucknow to active floodplains and river-cut cliff sections near Kanpur. The transect broadly follows National and State Highways connecting Lucknow–Unnao–Kanpur–Bithoor, cutting across T2, T1, and T0 geomorphic surfaces and exposing representative sedimentary facies of the Ganga basin.

1. Lucknow to Kanpur Sector (Interfluve Upland to Active Floodplain Transition)

This segment is dominated by older alluvium (T2 and partly T1 surfaces) of the Ganga–Ghaghara interfluve. The terrain is relatively flat but locally dissected by minor channels, palaeochannels, and seasonal nalas. Key Geological Features are thick oxidised silty-clay deposits with kankar nodules, well-developed palaeosols indicating long subaerial exposure, discontinuous palaeochannel belts, minor incision by tributary systems (e.g., Sai and Gomti interflue zone), and transition towards younger floodplain deposits near Kanpur etc

2. Kanpur Region (Ganga Floodplain and Cliff Exposure Zone)

The Kanpur sector marks a major geomorphic transition into the active Ganga floodplain (T0) and younger terrace surfaces (T1). This area is one of the most important Quaternary research zones in the Middle Ganga Plain. Key Features are active meandering to locally braided channel belts, extensive natural levees and point bars, floodplain deposits of sand–silt–clay alternations, development of braided sand bars during low-stage flow, incised valley margins exposing stratified alluvium

Important Field Stops:

Bithoor Cliff Section (Ganga River)

- Floodplain stratigraphy
- Channel sands and overbank muds
- T_1 terrace exposure

Jajmau Cliff Section (Ganga River)

- Geoarchaeological deposits
- Thick floodplain successions
- Cultural layers within Quaternary sediments

Excellent exposure of Late Pleistocene–Holocene evolution

Location(s) Description

1. Jajmau Cliff Section (26°26'14.92"N; 80°24'42.68"E)

Location: The Jajmau Cliff is situated on the right bank of the Ganga River near Kanpur city, Uttar Pradesh. It lies within the central Middle Ganga Plain and represents an important geomorphic and archaeological locality.

Geomorphology: Jajmau is developed on a T1 floodplain terrace, adjacent to the active T0 floodplain of the Ganga River. The area is characterized by natural levees, abandoned channels, and floodplain depressions. The cliff exposure represents a river-cut section along a migrating channel belt.

Sedimentology: The sedimentary succession consists mainly of fine to medium sand, silty clay, and overbank flood deposits. A distinctive feature is the presence of archaeological horizons embedded within fluvial sediments, indicating repeated interaction between river dynamics and human occupation



Cliff section at Bithoor along Ganga River

2. Bithoor Cliff Section (L26°37'22.4"N; 80°16°11.3"E)

Location: The Bithoor Cliff is located near Bithoor town, approximately 25 km northwest of Kanpur, along the right bank of the Ganga River. It forms part of the active to semi-active floodplain zone of the Middle Ganga Plain.

Geomorphology: Bithoor is situated on a T1 terrace surface adjacent to the active T0 floodplain. The geomorphology is characterized by meander scars, natural levees, and abandoned channel fills, reflecting dynamic channel migration of the Ganga River.

Sedimentology: The exposed sequence consists of channel sand bodies, point-bar deposits, overbank silts, and clay-rich floodplain sediments. Sedimentary structures such as cross-bedding, lateral accretion surfaces, and fining-upward sequences are common, indicating meandering river deposition with episodic avulsion.



Different lithounit in the Bithoor section

Chronology: The Bithoor succession is broadly Late Pleistocene to Holocene in age. Stratigraphic relationships suggest repeated phases of floodplain aggradation during enhanced monsoon intervals and surface stabilization during reduced discharge conditions.

Geoheritage, UNESCO heritage, cuisines, and culture

The Jajmau–Bithoor corridor in the Middle Ganga Plain represents one of the most significant fluvial geoheritage landscapes of northern India, where active river processes, late Quaternary stratigraphy, and long-term landscape evolution are exceptionally well preserved in natural cliff exposures and terrace systems. The Bithoor and Jajmau cliffs (Ganga River system) preserving floodplain architecture, channel migration histories, and terrace formation processes (T0–T1–T2 surfaces). Collectively, these sites form a continuous geoarchive of Himalayan-derived sedimentation in a foreland basin setting, making them highly valuable for Quaternary stratigraphy, palaeoclimatic reconstruction, and fluvial geomorphology.

Although not formally inscribed as UNESCO World Heritage Sites, the region forms part of the broader Ganga River cultural–geomorphic system, which has been recognized globally for its Outstanding Universal Value in terms of living cultural traditions, sacred geography, and river–civilization interaction. Sites like Varanasi's riverfront (a UNESCO tentative listing context) highlight the broader cultural landscape to which Kanpur–Bithoor belongs.

Although no UNESCO World Heritage Site is located in the vicinity of Jajmau and Bithoor cliff, several internationally significant heritage sites occur within the broader region. The nearest UNESCO World Heritage property is Fatehpur Sikri, Agra Fort and Taj Mahal, while the sacred city of Varanasi has long been considered for UNESCO recognition because of its exceptional cultural and religious importance. The Ganga Plain itself is recognized globally for its archaeological richness and long history of human occupation.

The Kanpur region of the Middle Ganga Plain represents a culturally diverse landscape where riverine geography, historical trade routes, and agricultural abundance have significantly influenced local cuisine and cultural traditions. Situated along the fertile alluvial plains of the Ganga, settlements reflect a blend of Awadhi, Bundeli, and central Gangetic cultural elements, shaped by long-term human occupation and regional mobility.

1. Cultural Setting

Kanpur, a major industrial and urban centre, exhibits a cosmopolitan cultural character influenced by migration, colonial history, and modern economic development.

Despite this contrast, both regions share common cultural foundations based on:

- River-centric settlement patterns
- Agricultural cycles of the Ganga floodplain
- Religious festivals and seasonal rituals
- Strong oral and folk traditions

2. Cuisine of Kanpur

Kanpur's cuisine reflects a blend of Awadhi richness and modern urban food culture, with influences from North Indian, Mughlai, and street-food traditions.

- Strong presence of spicy, rich, and oil-based dishes
- Extensive street food culture
- Influence of Mughlai culinary traditions
- Rapid adaptation of modern fast-food styles

Popular Dishes

- Thaggu ke Laddoo (famous sweet delicacy)
- Kachori-Sabzi
- Chaat varieties (aloo tikki, pani puri, dahi bhalla)
- Biryani and kebabs (influenced by Mughlai cuisine)
- Samosa, pakora, and jalebi as common snacks

Kanpur is widely known as a street-food hub of Uttar Pradesh, with a vibrant evening food culture centered around markets and roadside stalls.

Conclusion

The Jajmau, and Bithoor cliff sections collectively represent a continuous and highly significant late Quaternary fluvial and geoarchaeological transect of the Middle Ganga Plain, recording the interaction between fluvial dynamics, monsoon variability, sediment provenance, tectonic adjustment, and human occupation. These sites expose well-developed alluvial terrace systems (T0, T1, and T2 surfaces) and preserve thick successions of channel sands, overbank floodplain muds, palaeosols, and calcrete horizons, reflecting repeated cycles of river incision and aggradation under changing climatic conditions. Bithoor and Jajmau represent the Ganga floodplain system with active meandering processes, natural levees, point bars, and braided sand bar development in the channel belt. Geochemically, these sequences record mixed sediment provenance, with varying contributions from Himalayan and Peninsular sources, while isotopic and pedogenic signatures reflect monsoon-driven environmental fluctuations during the Late Quaternary. Chronologically, the deposits broadly span the Middle Pleistocene to Holocene, capturing multiple phases of climatic instability and landscape reorganization. Importantly, Jajmau and Bithoor also preserve rich geoarchaeological archives, where human settlements, cultural layers, and historical occupation are interbedded with fluvial deposits, demonstrating a strong linkage between river dynamics and human habitation patterns.

From a field perspective, these cliff sections are not only scientifically valuable but also logistically sensitive due to unstable slopes, active erosion, and floodplain hazards, requiring strict safety protocols and systematic observation methods. Overall, the Jajmau–Bithoor corridor forms an exceptional natural laboratory for Quaternary geology, fluvial geomorphology, geoarchaeology, and landscape evolution studies, offering a rare integrated record of Earth surface processes and human–environment interaction within the Indo-Gangetic foreland basin.

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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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