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Geographical backdrop for the study of prehistoric cultures in Middle Ganga Plain

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Abstract

Middle Ganga Plain holds the distinction of being an area of attraction for humans since times immemorial. It forms a part of one of the largest fluvially controlled depositional systems of the world namely the Gangetic Plain. It represents a large physical area with immense human, cultural and economic significance which makes it the heart region of India. Its high grounds of settlements, plenty of water, rich flora and fauna, fertile lands have been integral to the growth of various cultures. Therefore, study of geographical backdrop that conditioned the cultures that emerged, grew and declined in this very stretch of land assumes utmost significance.

Keywords: Geography, Geomorphology, Prehistoric cultures, Fluvial system, Tectonics.

Geography, to a great extent, determines key aspects of culture a man creates. Its effect on conditioning adaptations humans would make was more closely seen during prehistoric times when man's ability to adjust to his geographical setting was quite limited. That is why, for understanding the pattern of development of prehistoric cultures, geographical factors assume significance. This is true in case of Middle Ganga Plain too which is a part of Indo-Gangetic Plain and provides a model situation for the study of the prehistoric cultures that arose in this geography.

Srivastava attributes 'inter-continental collision and thrust folding' to the flexing of the lithosphere that led to the formation of Gangetic foreland basin in mid Miocene (Srivastava *et al*.2003:15). This foreland basin received a large number of sediments from Himalayas. These sediments were then spread out by the action of various fluvial processes and formed wide spread alluvial plains (Singh, 2004:7). As one sees from east to west, this Plain exhibits a few distinct variations in landforms, terrain roughness, rainfall pattern, cropping pattern and channel designs. As a result of these disparities, Ganga Plain was divided into three separate regions- Upper (Western) Ganga Plain, Middle (Median) Ganga Plain and Lower (Eastern) Ganga Plain by geographers and geologists alike (Singh, 2005: 6).

Nevertheless, Middle Ganga Plain is not a perfectly chalked out physical unit. The task of defining the limits of this plain has been endeavored by many scholars who used diverse baselines like temperature distribution, rainfall pattern and cropping pattern for the same. Spate and Learmonth define Middle Ganga plain as "what is left between the Upper Ganga Plain and Bengal, roughly third of Uttar Pradesh and the northern half of Bihar" (Spate & Learmonth, 1984:563). According to Stamp, "the western and the eastern boundaries of Middle Ganga Plain coincide with 100cm and 175cm annual isohyets and it may be identified as an intermediate region between Upper and Lower Ganga Plain with a mixture of wet and dry zone crops" (Stamp, 1986:277, 323). As per Singh, "Middle Ganga Plain

covers the Bihar plains and eastern Uttar Pradesh (mostly Purbia plain) in their entirety, lying on the either side of the Ganga and Ghaghra within the Himalayas and the Peninsular ramparts on the north and south respectively. There is no physical boundary as the plain imperceptibly opens up in the west from out of Upper Ganga Plain and so invisibly dies out into Lower Ganga Plain in the east" (Singh, 1971:183-187). However, I.B.Singh believes that this region "marks the middle part of the Ganga plain and can be taken to indicate the area between Kanpur and Patna" (Singh, 2005:7).

Geomorphology

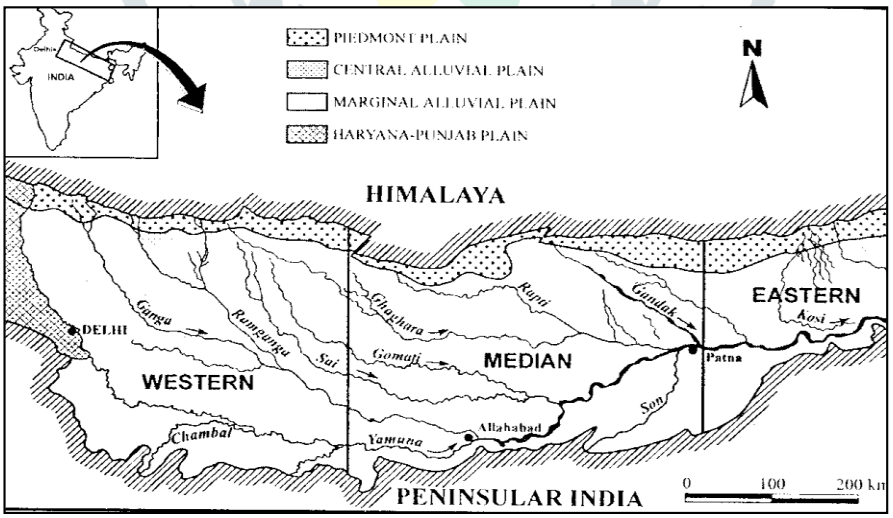
Middle Ganga Plain represents a low-lying asymmetrical depression having a mild eastern slope. Traditionally, two morpho-stratigraphic units identified here as 'Bhagar or the older alluvium and Khadar the newer alluvium' (Singh, 1971: 190). Wadia agrees with Singh with regard to identification of aforementioned geomorphological deposits of Middle Ganga plain (Wadia, 1989:371). I.B.Singh modified this traditional classification and recognized six diverse geomorphic surfaces in Middle Ganga Plain (Singh, 1996:114). A brief description of these main geomorphic surfaces of Ganga plain is summarized in table 1 below.

S.N.	GEOMORPHIC UNIT	PROBABLE AGE	MAIN FEATURES
1.	Upland Terrace surface (T2).	128 to74 kyr BP (OIS-5) formation age 51 to 7 kyr BP upper part.	• Regionally spacious. • Oldest surface. • Active river channels currently incised here. • No evidence for tributary network of river channels. • Cutoff meanders, Lakes and ponds • Gentle slope towards SE
2.	Marginal Plain Upland Surface (MP).	128 to 74 kyr BP (OIS-5) formation age. 76 to 32 kyr BP upper part.	• Regionally expansive • Oldest surface • Sediments resulting from the Peninsular craton. • North to northeast slope. • Undulant topography • Tectonic features such as tilting & fracturing.
3.	Megafan Surface (MF)	74 to 35 kyr BP (OIS-4) formation age. 26 to 22 kyr BP upper part.	• Presently inactive. • Surface modified by surficial developments. • Merges with T2 surface. • Exhibits evidence of minor fans superimposed on bigger ones indicating lesser fan building activity across time.
4.	River valley Terrace Surface (T1).	35-25 kyr BP (OIS-3 & OIS-2) formation age. 5-2 kyr BP upper part.	• Placed below T2 surface within the river valleys. • Deposits not easily accessible. • Generally exhibit meander cutoffs, abandoned channels, linear water bodies and alluvial ridges.

			• Reveals that current rivers were larger and carried greater water load in earlier humid phase.
5.	Piedmont Fan surface (PF)	25 to10 kyr BP (OIS-2) formation age. 9 to 3 kyr BP upper part.	• Overlies T2, T1 and MF surfaces. • Contains Bhabar and Terai region. • 3–4-degree high slopes • Gravelly sediments containing muddy deposits. • Shrinking fan building activity.
6.	Active Flood Plain Surface (T0)	10 kyr BP to Present (OIS-1) formation age. 0.2 to 0.2 kyr BP upper part.	• Newest surface. • Ingrained in T2 surface. • Active river channels & associated flood plains. • Diverse fluvial landforms like channel bars, natural levees, meander cutoffs and swamps.

Table 1: Geomorphology of Ganga plain

Different elevations and spatial dispersal of these surfaces specifies that these were shaped in different times and under different climatic regimes and were modified by neo tectonics and base-level variations. All these surfaces are depositional zones and contain a sequence of deposits modeled above them which are earlier than them. The topmost few meters on all these geomorphic surfaces belong to Holocene age. The Epi-Palaeolithic and Mesolithic sites are found lying on top of old river terraces or bhagar formations. Neolithic sites in area under study are commonly reported from newer alluvium or khadar with few exceptions. The geomorphology of Middle Ganga Plain also needs to be understood in terms of depositional sediments responsible for creating surfaces. This was attempted by Singh and he classified Ganga Plain into three separate zones from north to south and is shown in map 5 below (Singh, 1996:102).



Map 5: Schematic Map of Ganga Plain (After Singh, 2005).

These three divisions are described below.

- **Piedmont plain:** This represents the area near Himalayas with a southwardly slope. It is believed to have formed sometime around late Pleistocene-Holocene that is around 25 to10 Ka BP (Shukla, 2016:13). It consists of two belts- the 'bhabhar belt' containing gravelly coarse sand sediments, transient streams and steep

slopes and the 'terai belt' characterized by shallow waterlogged parts near bhabhar with ponds, swamps and small rivers.

- **Central Alluvial Plain:** It forms the chief part of Middle Ganga plain. It is sandwiched between the Piedmont plain and Ganga river. The south-eastern slope of this zones made the rivers flow southeasterly. In addition, there also exists a northwardly slope component in this area. Distinct slope from Kanpur to Faizabad is also witnessed (from Ganga to Ghaghara).
- **Marginal Alluvial Plain:** This surface is considered coeval to T2 surface (Shukla, 2016: 12). It lies to the south of Ganga river and has sandy rivers flowing in north-east direction due to its northwardly slope. It is fabricated from the sediments from peninsular craton. The southern portion of this plain displays extensive bad land topography and prominent ravines.

Fluvial systems:

Middle Ganga plain is worked upon by many fluvial processes- rivers, meanders, lakes and ponds etc. Due to the presence of numerous rivers, Middle Ganga Plain displays a varied range of channel patterns. These were modelled during the Late Pleistocene-Holocene under the influence of different climatic conditions. The river networks have responded to climatic shifts and neo-tectonic events in numerous ways such as 'the vertical incision, lateral migration in single direction, channel disruption and avulsion' (Singh, 2004:441). The chief rivers that drain this area includes Ganga, Yamuna, Rapti, Ghaghara, Gandak besides others. These rivers are in various stages of evolution, mostly displaying aggradation and abandonment. The rivers here provide compensatory topographic breaks in the overall flatness of the Middle Ganga Plain. They are even responsible for attributing sub regional/local individuality to the different stretches of land (Singh, 1971: 193). The rivers in area under study are categorized by geographers on the basis of their origin, water carrying capacity, typology and the width of channels. The Ganga is the axial river of the Middle Ganga plain and receives all the fluvial lines in the region. Overall drainage here can be categorized into three subsystems- Gandak system, Ghaghara system and additional tributary drainage to Ganga. The rivers flow on a surface with gentle slope and transport fine grained sediments. Due to their sediment load and discharge ratios, the evidence for channel pattern variability is also observed here. Various segments of a single river generally exhibit different channel features. All of the active rivers are of under fit category and display a varied grade of incision and restricted lateral movement. They have far-reaching river valleys as in case of Ganga and Ghaghra. The drainage basins of the rivers commencing within the alluvial plain are often narrow and elongated and hence have ill-defined water divides and a low density of drainage. The rivers are chiefly controlled by south-west monsoon system. Due to the explicitly south-west monsoon-controlled climate, the fluvial bodies in Middle Ganga plain obtain most of their water share during monsoon. Nonetheless, regardless of their origin, all the rivers here possess a main discharge input from underground water and surface runoff during monsoon. The rivers frequently get flooded and also cause flooding in neighboring low-lying areas. As a result, majority of the sediment transference and deposition in the Middle Ganga plain occurs during the monsoon (Singh, 1996:434). In other seasons, there is barely any dynamic activity in the fluvial arrangement. Consequently, the rivers of area under study exhibit prominent discharge oscillations (Singh, 2005:10-11).

Besides rivers, lakes, ponds and cutoff meanders, compose an integral part of the fluvial itenary in Middle Ganga Plain. Sediment profile studies on lakes and ponds of the interfluve region points to their evolution from river channels. It was deduced that majority of these came into existence during 8-5 kyr BP. It was noticed that the tectonic pulsations between 8 to 5 kyr BP produced surface undulations which caused disruptions and abandonment of minor tributaries. Owing to increased siltation, these tributaries then converted into lakes and later to smaller ponds (Singh, 2005:15).

Climate:

In Middle Ganga Plain, there is complete absence of physical barriers to regulate the sweeping winds from Himalayas. As a result, this region has an interim character between the relatively dry Upper Ganga Plain and pre-humid Lower Ganga plain (Singh, 1971:197). The climate here is humid subtropical and the rainfall is chiefly defined by the intensity of south-west monsoon system. The mean annual rainfall in Indo Gangetic plain is shown below in Map 4 and one can notice its pattern is different in Middle Ganga Plain.

The western disturbances which are responsible for winter rains in Upper Ganga plain, have slight bearing here. For most of the year, the rainfall varies from 100 to 200 cm thus making it an area with modest to fairly high rainfall. It is vital to note that Middle Ganga Plain receives about 80% of the rainfall from July to September owing to south-west monsoon. The annual seasonality in the middle Ganga plain is classified by Singh thus-

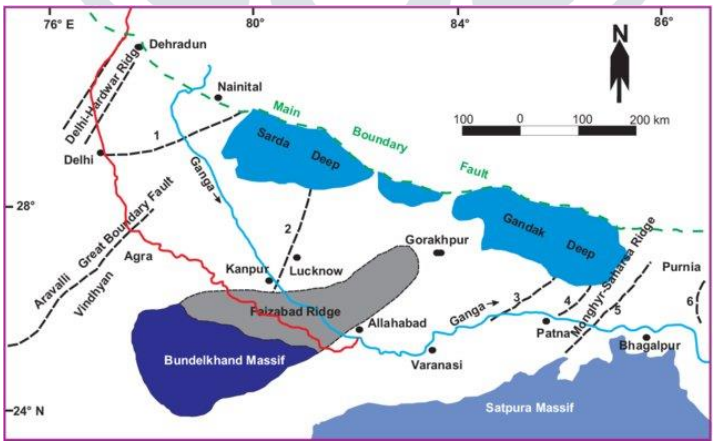
S.N.	Season	Months	Maximum temperature	Rainfall
1.	Warm-rainy season	July to October.	30 degrees.	High rainfall owing to southwest monsoon.
2.	Cold-dry season	November to February.	20 to 35 degrees.	Little rainfall owing to western disturbances.
3.	Hot-dry season	March to June.	40 to 46 degrees.	Thunderstorms, dust storms owing to north-west dry winds.

Table 2: Annual seasonality in the Middle Ganga plain (After Singh, 2005:5)

It becomes evident from this table that overall, the climate in Middle Ganga Plain was mostly pleasant with the exception of summer season where temperatures reach as high as 46 degrees Celsius.

Tectonics:

The depositional history of Middle Ganga Plain is basically controlled by 'a tectonic process in the Himalayan orogen in response to the lithosphere below the Ganga plain and in the southern Craton'. This subsurface tectonic framework in Ganga Plain is shown in map 6 below.



Map 6: Subsurface geology and tectonic framework of the Upper and Middle Ganga Plain (After, Singh, 2015)

From this map, it becomes clear numerous tectonically controlled geomorphic features can be found in Middle Ganga Plain (Singh, 1996:125). The tectonic process processes operating here are also responsible for the slow but gradual process of flexing of the northern part of Middle Ganga Plain towards Himalayan orogen. This flexing lithosphere below the Ganga plain caused inhomogeneities like ridges and basement faults (Sastri *et al*. 1971:223).

These basement structures regulate the deposition of alluvial fill and guide the river channel behavior on the land surface (Singh 2004:44; Singh, 2005:11). It is presumed that this changing river behavior in Holocene due to tectonic movements would have affected the human settlements. Scholars believe in repeated occurrences of neo tectonic action in Ganga plain during the Late Quaternary period. Of these, the three events are ascribed chronometric constraints.

S.N.	Timeframe	Evidence	Reference
1.	45 kyr BP	Seismic event at Kalpi in Yamuna valley.	Srivastava & Shukla 2009:87.
2.	20 kyr BP	Ganga river incision in its mega-fan deposits.	Srivastava *et al*. 2003:91
3.	8 to 5kyr BP	Upwarping of terrestrial surface, interruption of river channels & formation of ponds.	Singh *et al*.1997:1115

Table 3: Tectonic events in Middle Ganga Plain

Conclusion:

This overview of the geographical background of Middle Ganga Plain aptly demonstrates that Middle Ganga Plain was a thrust area for human habitation on account of the resources and opportunities it offered. In Ganga plain, human settlements exhibit successful adaptations to geographically distinctive habitats. It thus represents a large physical area with immense human, cultural and economic significance, that render it the epithet of 'area of attraction' for humans since prehistoric times.

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