Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/23863
DOI URL: http://dx.doi.org/10.21474/IJAR01/23863

RESEARCH ARTICLE

HOMO ERECTUS ON UNIFIED QUATERNARY PLATFORM OF INDIA AND CHINA

A. A. Khan[1] and Maryam Iftikha[2]

1. Ex-Director Government Of India.
2. Summer Volunteer Research Assistant, Contesttoga, High School Berwyn, PA_19087 U.S.A.

Manuscript Info

Manuscript History
Received: 12 May 2026
Final Accepted: 14 June 2026
Published: July 2026

Abstract

The Narmada Rift valley is conspicuous ENE-WSW to E-W trending prominent composite structural system across Indian sub-continent. It consists of various blocks which are dislocated and faulted along various faults and lineaments in space and time. The Narmada Rift System consists of various sub- basins like Hiran, Sher Shakkar, Dudhi, Tawa, which are minor basins are integratedandin built part of main rift System. These sub basins possess imprints of rinsing sinking and rifting events. These imprints are recorded in terms of manifestation and signature on landscape, drainage, of land form elements, present and paleo- meandering signature, river terraces, cut of meanders, paleo channels, scars, rock cut terraces, entrenchment and linear and curvilinear scars. These sub basins have developed transverse to the main axis of Narmada rifting and had deep cut across the quaternary blanket.The evolution of Narmada graben is differential and asymmetrical with rinsing and sinking valley floor. The Narmada basin contains fossiliferous Pliocene–Pleistocenevolcanic fabrics sediments and volcanic rocks which wereoccupied by early hominid populations. The Main Narmada rift is both symmetrical and asymmetrical in different segments along its length of about 1300 km. Several paleoanth ropological localities, archeological sites ranging in age from the Pliocene-Pleistocene times were discovered within these basins. The discovery of Human Skull Homo erectus form boulder conglomerate bed of Hathnora formation Khan (1992) by Sonakia (1984) De Lumley, and Sonakia, (1985): in Sehore district M.P. India was first fossil skull of man from Indian sub-continent.It is correlatedwith Homo-eructsof Chinaon QuaternaryPlatformisfoundto be the oldest homo-erectus in Asia Khan et.al (2013)

The known Pliocene–Pleistocene paleoanthropological localities have given us information about ancestors who were habitants and sparsely concentrated in the Narmada rift valley. This is not a coincidence, because the volcanic and tectonic activities that were responsible for the formation of the rift basins and formed the loci of Quaternary sedimentation & created ideal environments for the proliferation of life and the preservation of faunal and floral remains. The Quaternary volcanic eruption, ash fall, repeated tectonic dislocation and were responsible for the quick

Corresponding Author:- A.A.Khan
Address**:-**Ex-Director Government Of India.

burial and preservation of fossils during digenesis. The assemblages of sediments and granulometric parameters, digenetic processes involving silicification,calcification,feldspathization, clayformation,andpedogenesisall played vital roles in fossil preservation in the sediments.The various rock fabrics, ash bed, paleo- sole inter bedded with the fossiliferous sediments also provide temporal information about geologic processes, faunal evolution, pale - environment, and early hominid behavior and lithic technology. The skull cap of Narmada Man Homo erectus was found in Narmada Valley near village Hathnora (22 ° 52" N; 77 ° 52" E) in fossiliferous boulder conglomerate, in district Sehore, M.P., India.The skull cap is completelyfossilized undistorted,renal vault nearly complete except few left Supra-orbital and statures are nicely preserved. The various morphological features and robust form of skull and excessive thickness of the bones indicate that it belongs to adult male individual (Sonakia, 1984).

The discovery of skull cap ofHomoerectusinfossiliferousboulderconglomerateinassociationofothermammalian fossilis record and stratigrphic columnof Quaternarydeposits at the depth of 83m, where estimated total thickness of deposits is about(325 m).This blanket consist of sediments of three domain viz. glacial, fluvio-glacial and fluvial, which were deposited in distinct environment during Pleistocene to Holocene time (Khan & Sonakia (1992), (Khan et.al. in press).The statistical analysis of sediments form these different domain in vertical column has been conducted to ascertain the environment of sedimentation and trace the breaks in climate (Khan et.al. in press).An attempt has been made for the first time Khan et.al (2013) to correlate thevarious stratigraphic columns of associated hominidfossils of Narmada valley (325 m) India and that of Luochuan sequence,(90-120 m) Chenjiawoe (50m) andCongwanling sequence(36 m)of China onunifiedQuaternary platform tied up and developed at mean sea level. The studyr evealed that the depth of occurrence ofNarmada skull capon unifiedQuaternary platform is a bout (83 m) as compared to with that of Chenjiawo and Gongwangling of Chinawhich occur at veryshallow depth of 38 and 26 m respectively.

The estimated age of Narmada Man based on these parameters is about 1.38 m.y. (+), which is greater than Homo erectus of Chenjiaw 0.65m.y.and Gongwangling 1.15 m.y.of China An Zhishengand HoChuanKun(1989) Onthemerits of correlation of startigraphic columns of Quaternary of Narmada, accumulation of sediment, rate of sedimentation, palaeo- environments, lithostratigraphy and biostratigraphic position of boulder conglomerate in unified Quaternary Platform, author consider it as one of the earliest and oldest Homo erectus in Asia. Khan e t.al (2013). The study of morphometric parameters of skull cap of Narmada man and palaeo-environmental setting of Hominid locality in Narmada Rift System indicates that it belongs to an adult male individual and lived in dry cold and seasonally humid climate in Narmada Valley during middle Pleistocene time

Introduction:-

TheNarmada river originatesfromtheAmarkantak plateau of Satpura Range at elevation of about 1057 m (220 40' - 810 45') flows westerly course for about 1284 kms length across the middle of Indian subcontinent before entering Gulf of Cambay in the Arabian sea near Baroda in Gujarat state. It enters the fertile alluvial plain and passes through the gorge of about 19 kms long consisting of Marble rocks near Jabalpur.It then takes westerly turn through the alluvial tract, situated between the Satpura and Vindhyan hills. The river course of Narmada conspicuously straight and is controlled by ENE_WSWto E_W lineament, is bounded byVindhyan in the north and Satpura in the south the valley has maximum width of about 32 kms. The principal tributaries of Narmada River are Sher and Sakkar in Narsingpur, the Tawa and Ganjal in Hoshangabad, and Gaur in Jabalpur.They all originate from the Satpura hills to the south of the trunk channel. The only important tributary on the north is Hiran River, which emanates from the The Vindhyanhills in Jabalpur district. Most of these tributaries have short and precipitous course after they debouch from the hills. The Quaternary tract of Narmada basin covers an area of abut 12950 sq. km starting from west of Jabalpur (230070790530) to east of Harda (220 29'; 760 58') for a distance of about 320 km.It is found to be ideal locus of Quaternary sedimentation in Central India as witness by multi-cyclic sequence of Quaternaryterraces in the valley. The general elevation of Narmada alluvial plain varies between265.7 and 274.3m above the sea level. The general gradient of this plain in this stretch is about 1m /Km towards West.

Plate No. HE-1 The Narmada Fossil is a part of a skull cap; (bottom) its artificial reconstruction (Photographs Courtesy: Arun Sonakia)

December 5, 1982. On the banks of the Narmada at Madhya Pradesh's Hathnora village, geologist Arun Sonakia stumbled upon what turned out to be the most tantalizing fossil discovery of a human ancestor. Narmada Human was the discovery of the century. Kids in our school learn about Java Man and Peking Man but hardly anyone knows about Narmada Human. The discovery not only put India on the world fossil map, it proved the presence of early humans in the subcontinent and filled a void in our knowledge about human evolution, says D K Bhattacharya, former head of anthropology department at University of Delhi. "The discovery opened a new chapter in terms of hard evidence of evolution in south Asia," he says. "Unlike Africa, where stone tools were found along with human skeletons, all over India we were finding prehistoric stone tools, but there was no fossil evidence." Narmada Human, initially named Narmada Man, belongs to the category of Homo erectus, preceding Homo sapiens sapiens, the modern human species. Home erectus are believed to have inhabited the planet 1.8 million to 200,000 years ago. "On the basis of associatedfauna, palaeomagnetic dating studies by the Geological Survey of India (GSI) and morphological features compared with other fossils of known antiquity, the Narmada fossil could be 500,000 to 600,000 years old, " says Sonakia, now retired from GSI.

The fossil could be of an individual aged between 25 and 30 years, he adds. Antiquity of fossils has always been controversial. Some think the Narmada fossil may belong to the late Homo erectus category. Many believe the fossil could be of a female."The evidence is not even a full skull. It is rather a skull cap with a little bitoforbitalroof," says Bhattacharya. The finding has been scientifically analyzed. "We think it represents a human form that had colonized India at least 400,000 years ago," he adds. Homo erectus had successfully adapted to savannah grasslands, says Bhattacharya. Theyhad domesticated fire, did group hunting and used stone tools. In French Riviera, at a site called Terra Amata, there is evidence of an artificial hut with hearths—and even a foot print—believed to be the handi work of Homo erectus from 400,000 years ago. Surely, one fossil can never tell the full story. So, why don't we have more fossils from India? In some regions presence of fossils depends on preservation conditions such as soil chemistry and erosion rates, says Parth Chauhan, research associate with US-based non-profit Stone Age Institute, and with the anthropology department at Indiana University, US. In other regions, either enough systematic survey has not been done or potential hominid fossil material has been over looked. In India, palaeoanthropology or study of human origins is in a very neglected state, he says. Developmental projects such as dams on the Narmada, mining andoildrilling activities, intensive agriculture and population pressure have taken a toll on fossil study. "Hundreds of palaeoanthropological and Stone Age sites are getting destroyed across the subcontinent," says Chauhan.

Bhattacharya says India still follows the archaic 18th century mode of palaeontology. The country does not even have a national palaeontology institute. Guidance, experience and trained expertise are also lacking, says Chauhan. Palaeoanthropology is rarely practised in India in its pure form through multi-disciplinary approaches as in other regions such as Africa. Barring some exceptions, most studies in India have been non-system atic and not comprehensive, he says.The Hathnora Skull Fossil from Madhya Pradesh, India The Fossil Repository Unit, Curatorial Division, Central Headquarters, Geological Survey of India, Kolkata maintains a huge collectionof fossils since the inception of GSI more than 150 years ago. These fossils were collected by geologists both from GSI and outside GSI. Some of these fossilsare "GSI Types" in status.

These are unique specimens representing the single or duplicate samples of the known species. These 'Types' become invaluable, particularly when they represent extinctanimals and are rare in occurrence throughout the world.

The Broken skull speciman of Homo erectus, first & only of its kind in India, discovered by Dr. Arun Sonakia, Ex-Director, Palaeontology Division, Geological Survey of India, Central Region,Nagpur is one of such rare collection. This skull was discovered on 5th December, 1982 in the middleoftheNarmadavalley in Hathnora, Madhya Pradesh.

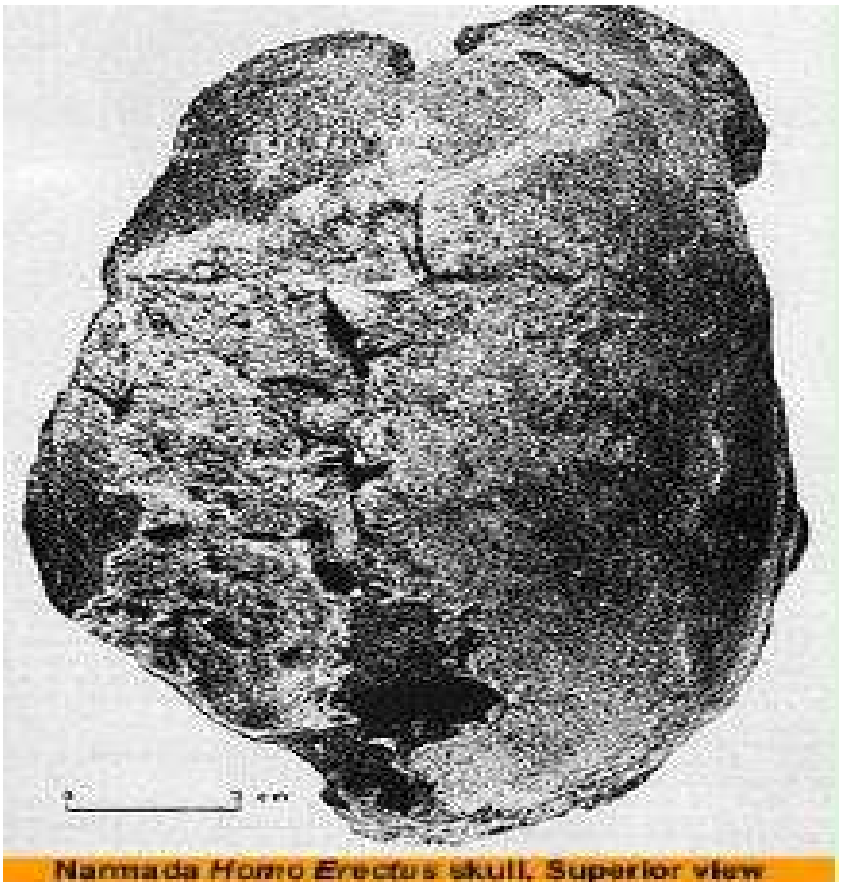


Plate No. HE-2 Narmada Homo erectus Skull Superior View. This Fossil carries a double Interest:

- It is the most ancient human remains so far discovered in the Indian subcontinent.
- It was discovered in situ which allow a precise determination of its stratigraphic, Paleontological and cultural context all attributable to the Middle Pleistocene (around 500,000 years ago) age in the geological time scale.

The material is a part of the cranium which may be ascribed toa female individual at the age of thirty's The skull was studied by Arun Sonakia in 1982 and Marie-Antoinette de Lumley in 1984 based on morphological camparisons with similar fossils discovered in Europe and Asia. The study revealed that the Narmada Man was a Homo erectus i.e. archaic man. At that time, it was impossible to do CT scan. Now, with the help of Geological Surveyof India, Prof. Henryde Lumley, Mariede Lumley, Amilie Vialet from the Institute of Human Palaeontology, Paris are working upon a project based on serial CT scan data of skull. The CT scan was arranged by the geological Survey of India at AMRI, Kolkata.This advanced study with CT scan at around immintervalve along 3different orientations will enable generation of 3-D images from which inferences could be drawn on internal structures of skull. Besides, reconstruction of entire skull will be made, from which the relative position of the Narmada man of Hathnora in the Human evolutionary trend could be more precisely understood.

Plate No. HE-3 Narmada Homo erectus Skull Basilar View

Previous work & Review of the literature:-

Splishbury (1833) was first to initiate the paleontological studied of Quaternary deposits of Narmada valley. Princep (1834) described the Splishbury collection, which now forms the part of fossil collection in British museum. Falconer (1859) and Ledekker (1880, 1882, 1884) have given the detail account of vertebrate fauna from Narmada valley. Theobold (1886) was first to study the Quaternary deposits of Narmada in Hoshangabad and surrounding area. He referred the quaternary deposits of Narmada of Pleistocene age. He divided these deposits in lower and upper Groups and reported an axe from reddish clays of the Upper Group. In the following year Late (1881) recorded a human cranium (transported), which was identified as Homo sapient, supposed to have come from conglomerate bed of Lower Group. Unfortunately the cranium specimen was lost in the museum of the Asiatic society of Bengal, hence the find remained inconsequential. Pilgrim (1905) reported variousstoneimplements andconsideredthedepositsto be Pleistoceneage. De Terra and De Cardian (1936), De Terra and Petterson (1939) correlated these deposits with the Pleistocene of Northern India. Broadlytheyagreed to the classification of Narmada in to lower and as opined by Theobold (1860). The Homo sapient cranium, which Theobold thought, came from the conglomerate bed, according to them it could have come from a younger deposit Khan (1984) carried out through detailed, geological, geomorphologicaland sedimentological studies and identified three prominent terraces in the Central sector of the Narmada.

The alluvial, deposits of the Narmada valley represent the thickest quaternary deposits in peninsular India. They contain the richest vertebrate fossil assemblage including only known Hominid fossil from the Indian sub-continent (Sonakia 1984)The boulder bed which yielded Hominid fossilfirst time reported for the firstto be of glacial & fluvial origin(Khan&Sonakia1992).Besideoccurrencesofassociationofashbedswith fossileferousboulderconglomerate(Khan &Rahate1991)indicatessomeofthevolcanic source.Itappearsthatclosetothecompletionofcycleofdepositionofthebouldе rbedthere was powerful volcanic eruption and subsequent settling of the ash. The occurrences of association of two marked horizons at different levels further reveal the cyclic eruption and settling of volcanic matrix during sedimentation. Khan and Sonakia (1992) reported for the first time glacial and interglacial deposit in the Narmada valley, Central India which is represented by arid and humid cycles.The morpho andlithostratigraphyof Narmada valley describedby Khan(1984), Khan & Benarjee (1984), Khan & Rahate (1990-91), Khan & Sonakia (1992), Khanet al (1991), Rahate & Khan (1985), Khan (1991), Khan & Sonakia (1992), Yadav & Khan (1996). The Narmada valley forms a ENE-WSW lineament and Quaternary deposits in it are confined to trough like basin, with profound asymmetry in northern and southern valley walls. The Narmada valley in Peninsular India forms a prominent lineament with profound geomorphologic and geological asymmetry between the northern and southern valley walls, giving it a tectonic significance.

The alluvial deposits of the Narmada valley represent the thickest Quaternary deposits in peninsular India. Beside association of fossils and tool assemblage and stone implements with Quaternary deposits of Narmadawhich are well described, quarries on various aspects ongeologygeomorphology, sedimentolgy, provenance of sediments, stream kinetics, stratigraphy, chronology ,tectonics, neotectonic, subsurfacegeometry, and overallmodel of Quaternarysedimentationof Narmada in faulted and sinking platform under structural riparian rift trench remained silent and unrevealedhidden miseries and needs attention. A lot of data has been generated on Narmada Valley Quaternary deposits during last 150 years.The different workers have studied the subject separately in the line of their specializations Roy, A.K. (1971)but there has been very little coordinated approach towards understanding and building up the Quaternary sedimentlogical history of the valley. In the present work an attempt has been made for the first time to conduct detailed sedimentlogical studies with a objective to build- up and conceive the Quaternary sedimentological model with Environment of sedimentation of the Hominid locality Hathnora in Narmada valley.About150sediment sample werec ollected from surface and subsurface quaternary deposits a nd from ongoing drilling project logs upto180 m below the ground surface and carried out detailed statistical analysis in the laboratory (Table No HE_1 to_3 & Table No 1 to 3

QuaternaryGeology of Homonid Locality Hathnora The Narmada valley forms a ENE-WSW lineament and Quaternary deposits in it are confined to trough like basin, with profound asymmetry in northern and southern valley walls. The Narmada valley in Peninsular India forms a prominent lineament with profound geomorphologic and geological asymmetry between the northern and southern valley walls, giving it a tectonic significance. The alluvial deposits of the Narmada valley represent the thickest Quaternary deposits in peninsular India. These sediments were deposited in faulted and sinking platform under structural riparian rift trench remained silent and unrevealed.The quaternary blanket of Narmada consists of sediments of various domain which were deposited in different environment in vertical chronology in faulted trough in time andspace. The statistical parameters viz MZ, STD, SKI, and KG of 150 sediment samples were computed from vertical column of 180 m of Quaternary blanket of Narmada. The synchronized study of these parameters revealed that the quaternary blanket consists of sediments of three domain exhibiting three distinct phases of sedimentation viz glacial, fluvio-glacial and fluvial. The study of statistical parameters and their binary relation distinctly display contrasting and relative heterogeneity in sediment characteristics throughoutacrosstheQuaternaryblanketinNarmadavalley.

The study of sediments display diagnostic characteristics of glacial , fluvio-glacialand fluvial environment at different depth and levels 000.m to150, 150 to 350, and 350 to 550 m from glacial, fluvio-glacial fluvial , and fluvial deposit (150 samples).Thecritical analysis of theseparameters exhibits sediment textural linkage to long evolution in glacial, fluvio-glacial and fluvial environment in time and space in increasing antiquity in the valley. The characteristics inherited by the sediments from pre-existing domain of sediments are glacial & terrestrial & environment. The digenetic and diagnostic features; varying degrees of heterogeneity, sediment angularity roundness, degree of sortingindicate evolution and sedimentation of quaternary sediments in a high-energy turmoil glacial environment on tectonicallydislocated and unstable platform. The sediments confined up to 150 m below ground level represent paleo fluvial domain of Narmada and represent multi cycle sedimentation under varying energy condition on oscillating platform. The vertical variation in increasing antiquity in textural parametersand distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvialdepositswhich is related with change of climate and tectonic in watershed of Narmada The binary relation of these parameters effectively used in differentiating and fencing the sediments of these domains and their environment of sedimentation in time and space.

The binary plots of co-efficient of sorting v/s kurtosis and coefficient of sorting v/s mean diameter have been used as effective tool in delineating an area of occupation of glacial and its activity. The plots of skewness v/s mean diameter and kurtosis v/s mean diameter have alsobeenfound effective tosome extent indelineatingareas glacialandfluvial activity. The fluvio glacial sediments in all the above plots show most erratic behavior and are not to be bounded by any pair of parameters. But however, the plot kurtosis v/s skewness is positiveto some extent in demarcating a flexible boundary between glacial and fluvio-glacial sediments. In Homnid localityHathnora the area is occupied by thick Quaternary sediments which are classifiedon the basis of statistical parameters.quartz grain morphology of sediments, quartz grain morphology of quartz grain of paleosole, heavy mineral assemblage, and ash bed sedimentaryfeaturesandenvironments of sedimentation.The lower most units (Boulder bed) is or glacio-fluvial origin (Khan el al 1991) whereas the rest of fluvial origin. The top four formations (Sohagpur, Shahganj, Hoshangabad and Janwasa) are classified based on morphostratigraphic state (NTo-NT3), degree of oxidation, calcification and compaction. Janwasa formation comprises of sediments of active channel deposition and is the

olderthree (Sohagpur, Shahganj, and Hoshangabad formation) are related to older flood plains deposits of paleo-do-main of Narmada and are grouped under older alluvium. Boulder conglomerate of fluvio-glacial origin is assigned an independentformationalstatus based on distinct lithology and fossil assemblage. The sequence of Quaternary events and the history of sedimentation of Narmada indicate that the upper 70m top 90m of the Narmada alluvium was deposited in a single aggradations episode with minor pauses when dissection of the alluvium produced two terraces (NT3-NT2). The sediments of this aggradations episode constitute three lithostratigraphy units viz. Boulder conglomerate, Sohagpur and Shahganj formation. The sediments of the alluvial phase are underlain by a boulder bed of glacio-fluvialorigin.Thus,thefossiliferousboulderconglomerate,thebasalunitofalluviummarks a disconformity between the lower glacial-boulder layer and upper fluvial sediments.The fossiliferous basal boulder conglomerate is being of middle Pleistocene age (Khan 1992). On the merits of detailed study ofsedimentsQuaternary deposits ofNarmada valley divide in to three distinct group viz. glacial, fluvio- glacial and fluvial; their age, litho constituents, environments of deposition and associated geomorphic elements are given in the Table I below:-

Table I: Quaternary Formations of Narmada Valley

Age	Quaternary formations	Lithe constituents	Environments of Deposition	Associated geomorphic Phenomena
1	2.	3.	4.	5.
Recent	Younger Alluvium Fluvialterrace s /fluvialdeposi t of present domain of Narmada	Reworked sediments, mostlyrockgravel consistingboulder,cobbl e, pebbleofquartzite,gneiss , granite, schist, basics, slate,phyllite,limestone & shale in a matrix of coarse tofinesand	Channel & flood plain environments	Point bars, channelbar s, present day active flood plane and channel braids:luvi al terrace:NT-0.
Holocen e	Fluvial terraces fluvialdeposit s/ olderalluvium 9 Sediment of paleo-domianof Narmada	Coarsegravelconsistingof boulder, cobble, pebble, of quartzite gneiss granite, schist, phyllite, state, fossiliferous lime stone, shale & basic rocks in a matrinofcoarsetofine sand.	Channel & flood plain environments .	Fluvial terraces of Narmad a NT-0_1 toNT-3 .
Late Pleistoc e ne	Fluvio-glacial deposits	Sub-angular to sub rounded boulder, cobble, pebbleofquartzite,gneiss, granite schistwith subordinate amount of limestone,slate,phyllite& basic rocks with coarse to finesand& silt.	Fluvioglaci al environmen ts	Fluvio-glacial deposts"FG T"

Pleistocene	Glacialdeposit	A heterogeneous mix of sub- angular to angular boulder and cobble of predominately gneiss, granite,schist,&quartzite with subordinate an amount of slate phyllite and shale together with very fine sand, silt & clays.	Glacial environment	Glacial deposits "GT".

A brief description of above Quaternarydeposits is given below:

Boulder Bed (Glacial/Fluvio-glacial deposits):-
The glacial and fluvio-glacial deposits of Narmada unconformable overly theVindhyan and the basaltic Deccan Trap rocks. The sediments consist of a Hetero-genoius assemblage of sub-angular to angular, sub-rounded, unsorted, unstratified rock fragments ranging from boulders to small pebbles, predominantly of quartzite, gneiss, sandstone, basalt, jasper,chart, gneiss, sandstone, basalt, chart, altered feldspar, ferruginous nodules, in a matrix of very coarse to very fine-sand, silt and clay. These clastics are highly angular, generally poorly sorted and isotropically imprecated. Fine sediments comprise of reddish grayish and greenish sand with appreciable amount of mica flaks, altered feldspar, brick-red and buff silt, greenish-brownsih clay, and greenish, reddish and dark maroon hard and plastic clay. These fine sediments contain fairly good amount of ferruginous material, quartz, mica flakes and altered feldspar grain. Through these sediments are similar in composition to the other deposits of Narmada Valley, exhibit entirely different sedimentary pattern, sediment characters and mineral composition. These rock clastics are largely angular, very poorly sorted and demonstrate isotropic imbrications pattern in the valley.The sediments of glacial domain of Narmada occur between and average elevation of about 20-265 m above m.s.l. and were deposited in glacial environments during Pleistocene time. These deposits are concealed under boulder conglomerate in the valley.

Boulder Conglomerate (Fluvio-glacialdeposits):
TheVindhyan Group of rocks and Deccan Trap in the Central sector of the Narmada Valley form the basement for the Quaternary deposits. The conglomerate bed that constituted the fossiliferous horizon of Narmada is sandwiched between older Alluvium and the glacio-fluvial bounder bed. This conglomerate bed is a very persistent marked horizon indicating a distinct phase of sedimentation in the Narmada Valley. It is exposed in the bluff/scrap of Narmada around Sardar Nager, Hathnora, Surajgarh, Budhni, Hoshangabad, Khoksa, Tigharia, Demawar and Bhariya-Ghat at the base of terraces NT2(Khan, 1984).The measured thickness of the exposed boulder conglomerate varies from 1.5 to 6.5m and average thicknss is 5m. The boulder conglomerate predominantly consists of sub-rounded to well rounded boulder, cobble and pebble of quartzite, gneiss, sandstone, basalt, agate, jasper, chert, chalcedony tightly cemented in a matrix of sand and silt. The finer sediments include different grade of sand and silt, brown and maroon in color often laminated and cross laminated. The boulder conglomerate is fossil and skull cap of early man Homo erectus (Sonakia, 1984) , the boulder conglomerate consists of three sub-litho units; each sub-unit characterized by distinct rock fragment shape, size, lithological abundance and allied sediment characters.

The sub-units are composed of variable assemblage of quartzite, gneiss, basalt, sandstone, agate, jasper, chalcedony, chart, sand and silt (Khan1992) These sub-litho units display facies variation in the valley and upper units grades into gritty sandstone upstream of Hathnora The basal unit of boulder conglomerate and is characterized by sub-rounded to rounded boulders cobbles, pebble of quartzite (38.50%), gneiss (18.50%) sandstone (14.50%), basalt (6.50%), agate and other rock fragments (3.50%). These clastic are tightly cemented in a reddish brown and maroon sand and silt which exhibit lamination, cross-lamination and cut and fill feature. It is capped by a pebbly layer containing vertebrate fossils and a humanskull of early man (Sonakia, 1984). The average measured thickness of this layer is about 2.25m. The middle sub-unit of boulder conglomerate characterized by an abun-dance of spherical, discoidal and bladed cobbles, pebbles of quartzite (31.50%), gneiss (14.00%), jasper (8.50%), sandstone (15.00%), basalt (10.50%), agate (12.50%), chart (6.50%) and otherrock fragments chart (1.50%). These coarse clasitic are tightly cemented by a deep brown and maroon sand, silt and clay. The finer clastics display sedimentary feature like lamination, cross-bedding load structure, small ripples and, cut and fill feature. Out of this sedimentary structure the cross bed units of boulder conglomerate vary from 3.15 to 4.5 and average about is 2.5. The cross beds laminated units are often truncated by a pebbly layer at the top. This sub unit bear mammalian fossil and some

stoneimplements.The average measured thickness of these sub-units is about 2m.The upper sub-units of the boulder conglomerate, consists of sub-rounded to well rounded pebble of quartz (23.50%), gneiss (11.50%), sandstone(14.50%),basalt(13.50%),agate(15.50%),jasper(11.50%),chart(8.00%)and other rock fragments (2.00%). These clasitics are cemmented by grey and brownish sandand silt containing appreciable amount of calcareous matrix. These deposits identified between an average elevations of 245 to 300 m above m.s.l. the basal unit of boulder conglomerate identified is marked at an elevation of about 268 mabove m.s.l, exposed on the northern bank of Narmada around Hathnora (22 ° 52 ” N - 77 ° 52 ” E) at the depth of about 83 m in strstigraphic column of Quaternary sediments of Narmada. The boulder conglomerate is of middle Pleistocene age equivalent to Siwalik boulder conglomerate (India), Trinil bed of Java (Indonasia) and boulder conglomerate of Tapti (Khan. These deposits have yielded skull cap of early man, Homo erectusNarmadensis along with other mammalian fossils (Sonakia, 1984). The Ash bed of Quaternary age is recorded associated with these deposits around Timrawan upstream of Hathnora is of aeolian nature and perhaps indicates volcanic activity during middle Pleistocene time. (Khan 1992)

Flood plain deposit of paleodomain of Narmada (Fluvial deposit):
Theolderalluviumconformablyoverliestheboulderconglomerateandrepresentstheflood-plain fancies of palaeo-domain of the Narmada. The sediments of the fancies predominantly consist of clay silt and sand, discontinuous nodules and plates. The beds are horizontal, exhibit upward fining sequence typical of fluviatile deposits. The older alluvium ofNarmada can be divided into three formations based on lithology, sediment assemblage, shape and size of rock clastics, relative disposition and diagnostic sedimentary characteristics. These formations are, viz. (i) Shohagpur, (ii) Shahganj, and (iii) Hoshangabad Formations respectively. These formations represent the sediments of the palaeo-domain of Narmadadepositedin channelandflood plainenvironments duringUpper Pleistocene times. Sohagpur Formation: The lowest Sohagpur Formation is named after Sohagpur town. The unit occurs along the outer flanks of Narmada Valley bounded by Vindhyachal range to the north and Satpura to the south. It consists of sediments of paleo-domain of Narmada comparable with Sohagpur geomorphological surface (NT3). It is represented by a thick sequence of clay, silt-sand and rock gravels. The unit is divisible into three sub-litho unit. Thebasalsub-unitischieflyredandbrownishsand, silt, claycontainingappreciableamount of cal matrix. The average measured thickness of this sub-unit is about 6.25m. The middle sub-unit consists of yellow and brownish silt, clay with subordinate sand and occasionalrock gravel lenses. The average measured thickness of this sub-unit is about 5.50m. The upper sub-units predominantly consist of compact yellow clay, silt and calcareous concretion. The average measured thickness of this sub-unit is about 3.25m. The Sohagpur formation is often association with discontinues and impersistent pebbly horizon containing well sorted polymodal gravel of quartzite, gneiss, basalt, agate, jasper and chart in thematrix of course to fine-sand. The gravel is general discoidal, spherical and exhibits higher indices of sphericity and roundness indicating their derivation from distance and mixed provenance during sedimentation.

Shahganj Formation:- The Shahganj formation is named after Shahganj, where this formation is best developed. It forms litho-stratigraphic unit overlying boulder conglomerate and occupies large area in the central part of the valley. It is exposed in the bluff section of Narmada around Narayanpur, Sardarnagar, Hathnora, Shahganj and Hoshangabad. This formation is equivalent to the Shivpur formation described by Khan (1984) from the down stream of Hoshangabad. It consists of sediments of palaeo-domain of Narmada and is comparable of Shahganj surface (NT2).Itisrepresentedbyclay, silt, sand accompanied by inconsistent pebbliferous bed containing quartzite, gneiss, basalt, chart, agate. The average measured thickness of this formation is about 15m. These sediments constitution three units each characterized by distinct lithology, rock classics and diagnostic sediment characters. The lower unit is predominantly composed of pinkish and brownish, silty clay association with cal-nodules, lime concretionand profused vein lets of calcareousmatrix.Themeasured thickness of this unit is 5.50m. The middle units comprised of yellow clay, silt with inconsistent bands of pebbles of quartzite, basalt, chart, agate, in the matrix of course-tofine-sand. This unit is profusely calcareous due to lime concretion and vein let of calc-matrix. It contains fossil and stone implements. The average measured thickness of this unit is 7.50m. The upper unit is represented by yellowand brownish hard compact clay, silt with kankar.Ithasdevelopedtransversecrackswhichareoccupiedbythe calc-matrixandkankar and is capped by black soil 2m in thickness consisting of clay and silt.

Hoshangabad Formation: It is named after Hoshangabad where it is best developed. It is the younger formation of the Narmada and is represented by the flood plain facies. It forms a distinct morphostratigraphy unit, above the present day flood plain of the Hoshangabad surface (NT1). It is crescent-shaped and is confined within the meander looped of the Narmada. This formationcomprises three units. The basal unit predominantly consists of rock gravels of quartzite, gneiss, basalt and agate imbricated in the grayish sand and silt. The middle unit is represented by unconsolidated imbricated matrix of sand and silt supported by bimodally sorted gravel of quartzite, basalt, agate

and chart. The upper unit contains yellowish and brownish silt and clay with occasional calcium concretion. It is capped by black soil. The measured thickness of the units is 6.5m, 5.00m and 3.5m respectively. The sediments of fluvial domain of Narmada identified between elevations of 268 to 350 m above m.s.l. and were deposited in channel and flood plain environments during upper Pleistocene lime Plate No QG_28 to_31 Plate No QG_50 to _51)

Younger Alluvium (Younger flood plainde posited):-

The younger alluvium is represented by sediments of active flood plain, point bar and sand bar facies of present domain of Narmada and consist of unconsolidated imbricated, stratified, polymodal sorted rock-gravel supported by very coarse to very fine-sand and is named as Janwasa formation, after the village Janwasa where is it best developed. The measured thickness in the valley is about 5 m. (Plate No. GH_3 to_7) Table-No. QG-11. The stratigraphic sequence of Quaternary sediment in the fossil locality of Hominid fossil around Hathnora. Black cotton soil (2 m) to black cotton soil predominantly clay with silt with rock fragments of agate, chert and zeolite.Yellow and brownish, hard and compact clay, silt with Kankar.Yellow clay silt with inconsistent pebble bed with Shahganj formation sand consisting of quartzite, basalt, chert and agate (12 m) profused by calcareous nodules, lime concretion and veinlet of calc matrix with mammalian fossil and stone implements.Pinkish silty clay with lime concretions and veinlets of calc matrix.Hathnora formation (400 m) Boulder conglomerate hard compact consist of tightly cemented spherical, discoidal, bladed, boulder, cobble and pebble of quartzite, basalt, gneiss, sandstone, agate, chalcedony, chert, coarse to fine sand, silt and calcareous matrix with Hominid and other mammalian fossil, stone implements (scraper), hand axes, scraper and sharp edge blade. Upper Cretaceous to Deccan Trap Lower Eocene.

Quaternary tectonics, sedimentation and the paleontological and paleo-anthropological record inthe in Narmada Rift System presence of the KatniFormation with angiosperm flora suggests that sedimentation continued during Mio-Pliocene in localized lakes. The relative disposition of such lakes and subsequent deformation and structural dislocation on oscillating valley platform clubbed with rifting and faulting during Quaternary period has shifted thesite of the lakes towards the present alluvium-coveredarea between Harda and Jabalpur as presumed: where as the present study of various aspects of Quaternary blanket in SONATA lineament ZONE reveled that quaternary sedimentationwas asequentialandcontinuousprocessinriftvalleysystemfrom Mio-PliocenePleistocene time, has deposited complete sequence of glacial, fluvio-glacial lacustrine and fluvial deposits with changing environments and climate in time chronology. The present disposition of quaternary blankets in Son Narmada Tapti and Purna basin is due to post deposition Quaternary tectonicswhich is solely responsible for dislocation, faulting and shifting of different blocks and distorting quaternary blanket ecology in rift system. The occurrence of Boulder bed and Boulder Conglomerate in Son Narmada Tapti and Purnawith similar rock assemblages and suites of rock fabrics, heavy mineral assemblages, quartz grain morphologyin critical and crucial sections across the SONATALINEAMENT ZONE strongly support tearing and rifting of quaternary blanket during late Pleistocene time.

The presence of thick boulder bed in Harda inliers area, such as at Chandgarh and north east of Barwaha, boulder bedin confluence are of Tapti and waghur around Khadgaon in Tapti valley Khan et.al (1984) supports this assumption.TheNarmada Rift System provides a unique setting for Quaternary geological sedimentological pedological paleontologicalandarcheologicalinvestigationswhich indicateshuman origins and evolution. Skeletal and cultural remains of hominids havebeen recovered from many locations within the basins.The important paleontological paleoanthropological and archeological sites occur within the Narmada Rift System. The most of localities occur on the rift floor in between Jabalpur_Harda, in the east and Barwaha _ Rajpipla in the west in the valley. The present analysis is based on studies carried out during 1982-1992 over a decade, and tremendous data on various aspects was of Quaternary geology, sedimentology, pedology, archaeology, tectonic, neotectonic and other related studies were acquired and accrued from the ground by systematic field work, on official assignment as part of government duty. The virgin and previously unknown areas of the rift basins were studied and inventory of paleoantoological and paleoanthropological resources were made.The survey indicated the potential of the Mio-Pliocene Pleistocene time and late and early Pleistocene Quaternary sediments of the Narmada Rift System for paleoantoological paleoanthropological research. The remarkable preservation of faunal and floral remains in the Pliocene–Pleistocene sedimentary rocks was possible because of quick burial by sediments. Moreover, these source rocks of rift system the Quaternary sediments and interbedded tuffs provided the necessary chemical components for the preservation of the fossils during digenesis.

There is a strong link between these dynamic processes, rapid sediment deposition, and fossil preservation. The most important primary and contextual data (fossils and artifacts) were embedded and preserved in sedimentary deposits until the recent exposure by tectonicdriven erosional processes.The time-stratigraphic data obtained from tephra interbedded withfossiliferousQuaternarysedimentarydepositsprovided animportantframeworkforthe study of hominid origins, evolution, adaptations, and cultural changes. Thepaleoantological Paleo- anthropological information from these localities is remained closely associated with Quaternary sedimentary deposits boulder conglomerate and boulder bed often related to the trench Quaternary sedimentation, formation and development of rift and linear basin caused by repeateduplift, and the development of rift basins that began in the middle to late Pliocene and Pleistocene period.The unfortunate part of theses depositsis that due repeated tectonic dislocation and faulting they are dislocated ad distorted ad at present areconcealed under the thick pile of sediments of present and paleo domain of Narmadaof late Pleistocene and Holocene time. These deposits do not provide adequate opportunity to researcher to study the human remain as postulated, except limited section where they are exposed.

In Narmada valley the most of the hominid remains and associated artifacts would havebeenfound associatedwithMiocenePliocene–Pleistocene sedimentsinincreasingantiquity unfortunately same are not exposed due rift system and tectonic setting. In the rift systemthe type development of Quaternary blanket is confined between Jabalpur Harda which posses thecomplete sequence ofall three domain in increasing antiquity from the bottom of the rift trench Boulder bed (glacial), Boulder conglomerate (fluvial-glacial) sediments of paleo-domain of Narmada (fluvial).The intense tectonic activities within the basins of the Narmada Rift System during the Neogene and Quaternary periods have destroyed fossil record except the fossiferous horizons exposed in river sections. The erosional-sedimentary cycle has persisted in the rift valley environment for millions of years as a result of the interplay between depositional and erosional forces driven by tectonic processes; there are numerous gaps in the fossil record, particularly in the important time period between Mio-Pliocene Pleistocenetimes.It is pertinent to understandthe origin of Hominid during the late Miocene, but it is difficult to disclose mysteries of human evolution in Narmada due to concealed nature of these deposits in rift system, however the complementary part of Tapti-Purna Quaternary blanke tmay be potential and possessive of human remain and should be studied to trace further the imprints of fossil man taking in to account of SONATA LINEAMENT ZONE as single ecosystem for evolution of man in Indian subcontinent.However,evidence of the effects of tectonics on fauna and flora are distinct and its signatures on dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined in the ecosystem in the valley during the Pliocene–Pleistocene periods. The boulder conglomerate which yielded the skull cap of Homo eructsin Narmada rift from Hathnora Sonakia (1984) remained onlydiscovery of hominid fossil in last two and half decade due to concealed and hidden natureof Mio-Pliocene Pleistocene deposits in rift system and inconsistency in exposure of fosiliferous horizon due faulting, dislocation ad subsidence of Quaternary blanket of Narmada rift system.

It is specifically incorporated that the Boulder Conglomerate which is of fluvio-glacial origin and has yielded human skull Sonakia (1982) Khan & Sonakia (1992) is exposed impersistently in scarp section of Narmada at few places only. The type section of Boulder Bed and Boulder Conglomerate which are potential sedimentsof human remainsof Pliocene Pleistocene time are hidden and concealed under sediments of present and paleo- domain of Narmada in the valley.The quaternary sequence anddepth of occurrence of skull cap,rate of sedimentation of Hominid locality Hathnora (22o52’77o52’) (325 m) India,has been correlatedwith theQuaternary of Luochuan (90-120 m) Chenjiawo (50m) and Congwanling sequence (36 m) of China on unified Quaternary platform tied up and developed at mean sea level to ascertain the depth of occurrence and ofage ofskull capof Narmada Homo erectus Sonakia (1984), at the depth of (83 m) Khan et.al (1213) indicates that the human skull Homo erectus of Narmadais oldest in Asia.(Plate No HE_9)

Human Remain of Narmada:-

In India, the Quaternary alluvial deposits of the Siwalik region, the peninsular river valleys, and certain cave deposits have been searched for the skeletal remains of early humans. Over a century ago, Theobald (1881) mentioned the discovery of a human fossil skull that was lost before being described, but Kennedy (1980) has observed that this was from Umhut on the Koana and not from the Narmada Valley, as has been widely supposed. Dinois, before and after his discovery of the Homo erectus speciments from Java, hypothesized that the Siwalik region of India might yield skeletal remains of Pleistocene hominids (Hordlicka 1930:17), and Khatri (1961) described the remarkable suitability of the Narmada Valley as the locus of a flourishing Palaeolithic culture, remarking prophetically that from this part of the valley (central part of the Narmada Valley) we expect to have one daythe most cherished discovery of fossil man”. As Research projectof Geological Survey of Indiabio-stratigraphic study of thePleistocene Narmada alluviumwas taken up byShri A. Sonakia in October 1982 in partsof Sehore &

Hoshangabad district of M.P. The discovery of the skull cap of a hominid was made on December 5 of that year 1982(Sonakia 1984). A press release was distributed by the Government of India on July 21 and 22, 1983.

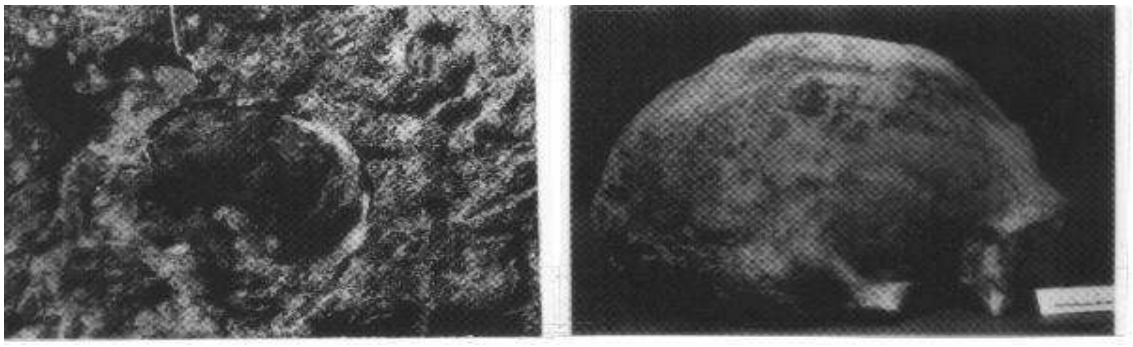


Plate No HE 4 Figure 1.a, Narmada Homo erectus skull in situ in conglomerate bed. b, Narmada Homoerectu sskull, after recovery frominsitu position – right lateral view.

The Hominid site is located near Hathnora, a village on the northern bank of the Narmada River, and 40 km northeast of Hoshangabad town in Madhya Pradesh state (22º 40' N:81º 40' E). The Hominid site embraces quaternary blanket which is about 18 m thick at Hathnora. The main Pleistocene and Holocene alluvial deposits is part of a trough of about 320 km in length between Jabalpur to the east in Harda to the west and 20–50 km in width. These deposits have brought to light one of the richest Pleistocene mammalian assemblages in India. De Terra and Teilhard De Chardin (1936) have presents a generalized section through the Narmada Pleistocene alluvium in the Hoshangabad area which was sketchy with undefined boundaries of lith units of quaternary strata. The fossilized skull cap was recovered from its basal gravel-conglomerate bed, which was exposed as a 100-m × 17-m wide erosional platform. This bed is nearly 3 m thick and it directly overlies the Deccan Trap basalts of Eocene age exposed in the river bed. The skull cap lay embedded in the gravel with its right temporal bone resting on the base of the deposit. The other well preserved mammalian skeletal remains, including **Bos namadicus**, **Stegodon ganesa**, **Stegodon insignis**, **Hippopotamus namadicus**, **Equus namadicus**, and **Cervus** sp., were found associated with the skull in the gravel conglomerate horizon. In the immediate area of occurrence of skull cap stone implements, including large and medium sized hand axes, flakes, cleavers, and choppers made of compact quartzite. In addition, medium-sized flint and chert scrapers were present.

These tools resemble those of an Acheulian Industry. The implements were embedded in the basal gravel layers. The discovery of the Hathnora hominid hopes and prospects have definitely increased for more discoveries of skeletal remnants of primitive hominids in the geographic province that constitutes the Indian sub-continent. Twenty-two years have since elapsed after theNarmada Homo erectus skull was discovered at Hathnora in Sehore district of the central India State of Madhya Pradesh. Surveys have been vaguely and sporadically conducted, but still any authentically reported news is very much awaited. Most of the surveys have been just of prospecting type, like scanning the lithological units similar to that of Narmada gravels in the Narmada River channel and other alluvial deposits, but what is really called for is a systematic and logic based search by multidisciplinary faculties of academic and surveying organizations and institutions With the deep paucity of skeletal material, it is very difficult to evolve a model to exhibit true and absolutely flaw less picture of human radiation. Then there has been another ambiguity that human evolution and radiation is being generally observed in isolation formed other contemporary mammals that essentially formed an integral component of the food web. Secondly, entire mammal legacy in the peninsular India is looked up as totally descended from the Mio-Pliocene Siwaliks. Not only the peninsular Indian but furthermore the mammals of the Indonesian Archipelago have been described as very closely related to the Narmada Quaternary fauna.

However, the story of continuity of primate legacy is full of spatial gaps and negative options. It is matter of debate that inspite of development of complete quaternary column and hospitability of sediment in rock basin and succession of sediment from Miocene Pliocene ad Pleistocene Geoscientist, paleontologist and Anthropologist are failed to extract ay further skeletal remain from Narmada valley. The Narmada Homo erectus remains comprising fairly complete neuro-cranium have provided evidence of early human existence in peninsular India. For quite long,

the Narmada Valley has yielded one of the richest collections of gradually evolving Pleistocene mammals in their stratigraphic disposition. The Narmada Homo erectus possesses some of the typical. Homo erectus features based on both metrical and non-metrical features summarized by Andrews, viz., the very low disposition of maximum cranial breadth,flatand gently receding frontal, strong and bulging mastoid and supramastoid crests, opisthocranioncoincidin gwithinion,pronouncedpost-orbitalconstriction,strong supraorbital torus, flat parietal, low temporal squama, angularity between the axis of the petrous bone and the thick tympanic plate, the later being in coronal plane, the occipital bone, strong but abraded than capital torus, thick external and internal tables of skull wall, metopic prominence, a median keel in parietal junction area, flanked by parasagittal depressions, and a clearly brought out bregmatic depressions and a clearly brought out bregmatic eminence. Kennedy utilizing multivariate analysis and highlighting negative factors only, however, differ in taxonomic assignment and prefer to designate the Narmada cranium as 'archaic' Homo sapiens.

Kennedy however, quote that "the Narmada calvaria is the only wellpreserved and authenticated discovery of a Middle Pleistocene fossil hominid revovered from the Indian sub-continent and its geographical mid-point situation between the east and relatively richer fossil hominid sites in far Est and Southeast Asia, and in the Eurasian and African land masses afford it a unique place." The Narmada Homo erectuswas excavated along with typical Middle Pleistocene fauna, like Stegodon namadicus and Sus narmadicus inthe gravel conglomerate layer in whichit wasfoundin situjust overlying the Matuyama-Brunhes palaeomagnetic reversal shown by deeply oxidized silt. Thisreversal is dated at 0.78 Ma. Besides Since 1830s the Central Narmada Valley has yielded innumerable Paleolithic artifacts and Pleistocene mammalian fauna. 150 years later, the year 1984 saw a discoveryof Middle Pleistocene hominine partial cranium (Sonakia, 1984), followed later by the discovery of two clavicles and a partial left 9th rib (Sankhyan, 1997a, 1997b, 2005) from a layer just above near the same site, Hathnora. These findings brought Central Narmada valley to the forefront of human evolution in South Asia and generated considerable debate on the taxonomic status of Narmada hominin. The partial craniumreceived greater attention from Lumley & Sonakia (1985), who con-ceived it as of an "evolved" Homo erectus, the stand more re-cently continued by another French scholar, Mallasse (2009). This was followedbyanother studybyKennedyet al.(1991),whohighlightedseveral advancedtraits and therefore referred it, to an "archaic" Homo sapiens. Several scholars viewed thecranium in the same manner on different grounds (Badam et al., 1986; Sankhyan, 1999, 2006; Kennedy, 2000; Cameron, 2004). Of late, the terms "evolved" Homo erectus"archaic" or "ar-chaic" Homo sapiens cladistically received different connotations, and therefore, Narmada partial cranium was referred to a much wider Old World species, Homo heidelbergensis (Ken- nedy, 2007; Athreya, 2007; Sankhyan, 2010).

Initially, the two clavicles and the rib fossils were thought to have been derived from the same cranially known Middle Pleistocene hominine on grounds of stratigraphic proximity and inferred female sex and similar estimated age at death (Sankhyan, 1999). But, they remained enigmatic mismatch (Pearson, 2000) to the cranium, and therefore were ignoredby notable scholars like Kennedy (2000) in discussion on hominin evolution in Narmada valley. Of course, they do not corroborate in the estimated body dimensions of a single hominine, and appeared morphologically distinct (Sankhyan, 2007), and therefore open up a possibility of a hitherto unknown Pygmy-sized species or archaic population in Narmada valley (Sankhyan & Rao, 2007; Van Heteren & Sankhyan, 2009), strengthened by a recent study (Sankhyan, 2010). The fossilized skull of Narmada Homo erectus was found embedded in a conglomerate bed in the Narmada valley of central India. This bed occurs at the basal part of a formation sandwiched between two other formations of 0.73 Ma and 74000yrs BP. The conglomerate bed has also preserved fossils of Hippopotamus namadicus, Equus namadicus, Stegodon namadicus, Sus namadicus, etc. having Middle Pleistocene affinity. All these stratigraphic and palaeontological evidences point to a Middle Pleistocene age of the Narmada Homo erectus. A hundred years of investigation on human ancestry in India was rewarded in the year 1982 with the discovery by the first author of a skull cap of Homo erectus from the Quaternary alluvial deposits of the Narmada valley in central India1.

In its first report, a Middle Pleistocene age was assigned to it based on apreliminarystudy of the associated mammalian fossils. But being the only authentic record of Homo erectus from the Indian subcontinent, its precise taxonomic position and age is still under discussion amongst palaeoanthropologists and paleontologists the world over. Consequentupon the skull find the detailed investigation of vom of fossil ,its lithostratigraphy, Khan & Sonakia (1991) sedimentology ,Khan (2015) Quartz grainmorphology sedimentcolumn,Khan (2014-15) Quartz grain morphology of pale- sole, , Khan(2014-15)Heavy mineral assemblage Khan(in Press) tephrastratigraphy, , Khan et.al (1991) Khan & Maria (1912) magnetostratigraphy, and bio-stratigraphyandcorrelationof sediment columnsintravalley wise , inter valley wise and on unified Quaternary PlatformKhan et.al (2012) focusing on hominid localities of Chinathese deposits have thrown fresh light on theage of the Narmada Homo erectus.

Discoveries of volcanic ash beds and palaeomagnetic reversal in these deposits for the first time for peninsular India are break throughs in fixing the chronologic position of the skull. Fresh data on the age of the Narmada Homo erectus are also available by additional finds of fossil mammals and a detailed taxonomic study along with a thorough review of some families of mammals.

The Homo erectus skull was discovered embedded (Figure 1) in a conglomerate bed within the Quaternary alluvial deposits of the Narmada Valley. Several lithostratigraphic classifications have been suggested fo rQuaternary deposits of Narmada (Table QG No1,2,3) The conglomerate bed designated as Hathnora Formation This formation has a 19 m thickness at its type section and a 50 m compiled thickness. This Hathnora Formation Formation is sandwiched between two formations, the older one Boulder bed of glacial origin showing Matuyama reversed polarity chron3 (0.73Ma) and the younger one of fluvial origin with tephra layer equivalent to Toba ash4,5 of 74,000 yrs BP. Some upper layers of these Narmada Valley alluvial deposits have also been proved to be older than 25,000 yrsBP by 14C dating which represents youngest deposits of present domain of Narmada. Mammalian fossils of the families Bovidae, Elephantidae, Hippopotamidae, Equidae, Stegodontidae and Cervidae were found associated with the Hominid skull. The Surajkund Formation, which has yielded the hominid skull, has also preserved fossils of Suidae and Canidae which play a significant role in biozonation. Two extinct species of Hippopotamidae, namely, Hippopotamus namadicus and Hippopotamus palaeindicus occur in successive biozones in the Narmada Valley Quaternary alluvium.

H. namadicus is associated with the Homo erectus skull. This H. namadicus stands in between the other two Indian species H. sivalensis and H. palaeindicus in skull characters, nature of incisors, etc.9, and and10. While H. sivalensis is reported from the Lower Pleistocene Siwalik deposits, H. palaeindicus isreportedfromtheadjacent Upper PleistocenetoLower Holocene SonValley deposits also.. Thus H. namadicus occupies a position between Lower Pleistocene and Upper Pleistocene. Species of the Equidae family found associated with the Hominid skullis Equus namadicus. It is either closely related12 to Lower Pleistocene E. sivalensis or inseparable13–15 from that. E. namadicus also shows resemblance to Late Villafranchian E. stenonis of Europe and Central China16. This E.namadicus was subsequently replaced by E. hemionus khur during theUpper Pleistocene.A preliminary study indicated the presence of Stegodon ganesa associated with the Hominid skull1. Further study, however, shows that these specimens do not preserve all diagnostic characters of S. ganesa and should better be assigned to Stegodon sp. A new species Stegodon namadicus with all diagnostic charactersis also reported from the Narmada valley17. This species shows close affinity to Middle Pleistocene S. orientalis of South East Asia.Fossils of Suidae, on the other hand, were not recorded during excavation of the hominid skull. However, a fair number of specimens of fossil Suidae, Sus namadicus have been reported from the Quaternary alluvial deposits ofthe Narmada valley elsewhere.

Later a fragmentary RM3 (A993, GSI, Nagpur) of this species has been collected from the same locality and same litho-unit which has yielded the Hominid skull. Sus namadicus shows affinity to Lower Pleistocene Siwalik Sus falconeri; the species is also reported from the Upper Pleistocene Kurnool Cave deposits18. S. namadicuspossessessimilarcharacterstoMiddlePleistoceneChou-Ken-TienformSus lydekkeri19.A single specimen (GSI Type No. 20425) of fossilized mandible of Cuonaplinus has been collected20 from the litho-unit which has preserved the Hominid skull. The specimen showing M3absent and M2much reduced is somewhat intermediate between Middle Pleistocene European C. a. priscus and C. a. fossilis21. Though slightly larger, the Narmada form is also comparable to Middle Pleistocene Chinese C. a. antiquus22,23. Most common fossils in the Narmada valley are of Bovidae. Major members of this family, namely, Bos namadicus and Bubalus palaeindicus are reported to range from Middle Pleistocene to Lower Holocene. However, during the last two decades, a large number of collections of fossil Bovidae have been made which deserves a thorough review to makethis prolific family more useful for precise biozonation. The other dominant member, Elephas namadicus is also considered to be of Middle Pleistocene to Lower Holocene age. But this form possibly includes two24 or three25 species or subspecies.

On the other hand, itis again suggested that European E. antiquus and some Japanese forms belong to E. namadicus26. These controversies are to be resolved to understand the role of this form in biozonation. Another family, Cervidae is not very abundant in Narmada valley. An up-to-date review work or even a proper taxonomic description is lacking for this family and thus its due significance in biozonation is yet to be recognized. Fossils belonging to Hippopotamidae, Equidae, Stegodontidae, Suidae and Canidae are mainly relied upon for biozonation of the Narmada deposits. Fossils of these families collected along with the Homo erectus skull or from the same geological horizonscontaining the skull point to a Middle Pleistocene (in all probability its lower horizon) ageof the Narmada Homo erectus. Studies on lithostratigraphy, magnetostratigraphy and tephrastratigraphy reveal that Narmada Homo erectus is from a bed just above a formationof 0.73Ma and at least 19m below a layer of 74,000 BP.

The discovery of Indian Homo erectus bridges the gap between African H. erectus in the west and Chinese and Javan H. erectus in the east and south east respectively. There is a general consensus of opinion that Afro-Asian H. erectus ranges in age from Lower Pleistocene to Middle Pleistocene.

Indian H.erectus falls within this range.Arun Sonakia*andS.Biswas The geographically nearest H. sapiens that have been studied by Wakankar (personal communication) are from the well-known UNESCO Heritage caves of Bhimbetka, located barely 40 km northwest of the Hathnora Homo erectus site. The Vidhyan caves, rockshelters complex, well known for rock paintings, have also yielded bones of 10,000-12,000-year-old Homo sapiens with highly evolved features in a dorsally enlarged neuro-cranium, although there are innumerable caves in the low-dipping Vindhyan quartzite strata comprising the Vindhyachal mountain range that runs very close to the Narmada River channel on its northern side. The Bhimbetka complex is however much different from other rock shelters and since there is practically no stratified cave deposit of prominence, the chances of getting human or other cave dwelling animals are very meager. However, the thick pile of debris, just in front of these rock shelters, appears to be a potential ground for locating remnants of possible inhabitants. The artifact sites in the sub-continent are numerous, but if Ure take into account the human skeletal remains, the geographically next location is that of Sarai Nahar Rai and Mahadaha remains of the Pratapgarh district of Uttar Pradesh. These remains were dug up accidentally during construction of irrigation canals.

A large number of basal Holocene human remains with modern features have been systematically excavated here by Allahabad University scholars. Still older or contemporary could be a mandible from the later Pleistocene Mogasarayanigondi cave deposits in Kurnool district, of Andhra Pradesh with broad retro molar area and large mental foramen. This individual appears to be an aging adult surviving in a hibernating environment. In an overall granitic tenrrain in the southern peninsula, very thin veneer of alluvium is observed. Sankhyan (2007) from Anthropological survey of India described two new hominine fossils from Netankheri up stream of Hathnora in the Central Narmada valley. They include a partial left humeral diaphysis NTK-F-02-07 (Figure 1) and a distal shaft fragment of the left femur NTK-F-07-05 (Figure 2), housed at Kolkata in the Palaeoanthropology Repository of the Anthropological Survey of India. These were derived from two different stratigraphic levels of a new fossil locality, Netankheri, located about 3 km upstream of Hathnora, along the northern bank of River Narmada (Figures 3 and 4).Sankhyan et.al (2012. havebrought to light two more hominine fossils a humerus and a femur from a new locality, Netankheri. The femur is derived from the Middle Pleistocene stratigraphic horizon as the Hathnora skullcap, and shares similar “archaic” mosaic morphology of Homo heidelbergensis, also attested by new bio-stratigraphic and Paleolithic data. The humerus is derived from the pre-YTA (~75 Kya) Upper Pleistocene strata in association with unique fossilized bone artifacts and documents the early emergence of anatomically modern Homo sapiens in South Asia

Quaternary Coloumns & Correlation Of Homo Erectus of Narmada India With Homoeructus of China:-

The skull cap of Narmada Man Homo erectus was found in Narmada Valley near village Hathnora (22 ° 52” N; 77 ° 52” E) in fossiliferous boulder conglomerate, in district Sehore, M.P., India. The skull cap is completely fossilized undistorted, renal vault nearly complete except few left Supra-orbital and statures are nicely preserved. The various morphological features and robust form of skull and excessive thickness of the bones indicate that itbelongs to adult male individual (Sonakia, 1984). The discovery of skull cap of Homo erectus in fossiliferous boulder conglomerate in association of other mammalian fossil is recorded in stratigrphic column of Quaternary deposits at the depth of 83 m,where estimatedtotal thickness ofdeposits is about(325 m).Thisblanketconsistofsedimentsofthreedomainviz.glacial,fluvioglacialandfluvial,whichweredepositedindistinctenvironmentduringPleistocenetoHolocenetime(Khan& Sonakia (1992), (Khan et.al. in press).The statistical analysis of sediments form these different domain in vertical column has been conductedto ascertain the environment of sedimentation and trace the breaks in climate (Khan et.al. in press).In present paperan attempt has been made for the first time to correlate thevarious stratigraphic columns of associated hominid fossils of Narmada valley (325 m) India andthat of Luochuan sequence,(90-120 m) Chenjiawoe(50m)andCongwanlingsequence(36m)ofChina on unifiedQuaternary platform tied up and developed atmean sea level.

The study revealed that the depth of occurrence ofNarmada skull capon unifiedQuaternaryplatform isabout(83 m) as compared towith thatof Chenjiawo and Gongwangling of Chinawhich occur at veryshallow depth of38 and 26 m respectively. The estimated age of Narmada Man based on these parameters is about 1.38 m.y. (+), which is greater than Homo erectus of Chenjiawo 0.65 m.y. and Gongwangling 1.15 m.y. of China An Zhisheng and Ho Chuan Kun (1989). On the merits of correlation of startigraphic columns of Quaternary of Narmada, accumulation of sediment, rate of sedimentation, palaeo-environments, lithostratigraphy and biostratigraphic position of boulder conglomerate

in unified Quaternary Platform, author consider it as one of the earliest and oldest Homo erectus in Asia. The study of morphometric parameters of skull cap of Narmada man and palaeo-environmental setting of Hominid locality indicates that it belongs to an adult male individual and lived in dry cold and seasonally humid climate in Narmada Valley during upper segment of lower to middle Pleistocene time. Key words: Ash beds, Boulder conglomerate, fluvial, fluvial-glacial, glacial, Homo erectus, Pleistocene, quaternary, quaternary platformand sedimentation. TheNarmadariveroriginatesfromtheAmarkantakplateauofSatpuraRangesinRewaatan elevation of about 1057 m (220 40' -810 45'), flows westerly course for about 1284 kms length across the middle of Indian subcontinent before entering Gulf of Cambay in the Arabian Sea near Baroda in Gujarat state. It enters the fertile alluvial plain and passes through the deep gorge of about 19 kms long consisting of Marble rocks near Jabalpur. It then takes westerly turn through the alluvial tract, situated between the Satpura and Vindhyan hills.

The river course of Narmada conspicuously straight and is controlled by ENE_WSW to E_W lineament, is bounded by Vindhyan in the north and Satpura in the south. The valley has maximum width of about 32 kms. The Quaternary tract of Narmada basin covers an area of abut 12950 sq. km starting from west of Jabalpur (230070790530) to east of Handia (220 29'; 76058') for a distance of about 320 km.It is found to be ideal locus of Quaternary sedimentation in Central India aswitness by multi-cyclic sequence of Quaternary terraces in the valley. The total estimated thickness of Quaternary sediments in the central sector of Narmada is about 325 m. In present paper attempt has been for the first time to correlate the Quaternarysequence of HominidlocalityHathnora(22o52'77o52')(325 m)India,with thatofLuochuan(90-120 m) Chenjiawo(50m) andCongwanling sequence (36 m) of China on unified coded model ofQuaternary platform tied up and developed atmean sea level to ascertain the depth of occurrence andage ofskull cap of NarmadaHomo erectus Sonakia (1984) which has been recovered from boulder conglomeratein the vom of Narmada .(Plate No HE_9) Splishbury (1833) was first to initiate the paleontological studied of Quaternary deposits of Narmada valley. Princep (1832) described the Splishbury collection, which now forms the part of fossil collection in British museum. Falconer (1859) and Yedekker (1880, 1882, 1884) have given the detail account of vertebrate fauna from Narmada valley.

Theobold (1860, 1881) was first to study the Quaternary deposits of Narmada in Hoshangabad and surrounding area. He referred the Quaternary deposits of Narmada is of Pleistocene age. He divided these deposits in lower and upper Groups and reported an axe from reddish clays of the Upper Group. In the following year Late (1881) recorded a human cranium (transported), which was identified as Homo sapien, supposed to have come from conglomerate bed of Lower Group. Unfortunately the cranium specimen was lost in the museum of the Asiatic society of Bengal, hence the find remained inconsequential. Pilgrim (1905) reported variousstoneimplements andconsideredthedeposits to be Pleistoceneage. De Terra and De Cardian (1936), De Terra and Petterson (1939) correlated these deposits with the Pleistocene of Northern India. Broadly they agreed to the classification of Narmada in to lower and upper Group as opined by Theobold (1860). The Homo sapien cranium, which Theobold thought, came from the conglomerate bed, according to them it could have come from a younger deposit. They collected many Paleolithic tools, and stone implements but they were unsuccessful in coming across any mammalian fossil. Based on fossil assemblage and stone implements they compared the Quaternary of Narmada with those of Middle Pleistocene of North Western India characterized by fauna Elephas antiques (mammalian). Hoojier (1963) and Khatri (1980) studied various paleontological aspects of Quaternary deposits of Narmada valley. Triparthi (1968) compared and correlated the Quaternary deposits of Godavari Valley with the sediments of Narmada Alluvium, on the basis of fossil assemblage and stone implements.

According to him the Narmada fauna was equivalent to older alluvium fauna of Indo-Gangetic plain and slightly older than that of Kurnool cave deposits. Roy, A.K. (1971), studied various aspects of ground water of Narmada valley.Gupta (1974) studied geological and geomorphologic aspects of parts of Narmada valley. Adyalkar (1975) studied paleogeography of Narmada in relevance to ground water potential. Biswas and Dassarma. (1981) Badam (1979) and Dasssarma (1979) studied the fossil assemblage of Quaternary strata of Narmada valley. Khan(1984)carriedout detailedgeological,geomorphological andsedimentologicalstudies and identified three prominent terraces in the Central sector of the Narmada. (Khan Sonakia 1992), studied Quaternary deposit in vertical column in relevance to occurrence of Human Skull and reported glacial and fluvio- glacial deposit in Narmada valley for the first time. The boulder bed which yielded Hominid fossil for thefirst time reported to be of glacial - fluvial origin (Khan & Sonakia 1992). Beside occurrences of association of ash beds with fossileferous boulder conglomerate (Khan & Rahate 1991) indicates some distant volcanic source. Khan and Sonakia (1992) reported for the first time glacial and interglacial deposit in the Narmada valley, Central India which is represented by arid and humid cycles. Magneto-statigraphic studies are being carried out by (Rao, et.al 1997). The lithostratigraphyof Narmada valley describedby Khan(1984), Khan & Benarjee (1984), Khan & Rahate (1990-91),

Khan & Sonakia (1992), Khanet al (1991), Rahate & Khan (1985), Khan (1991), Khan & Sonakia (1992), Yadav & Khan (1996).

Thefirst author was associated with Narmada valleyproject as official assignment from 1982 to 1992 on the merits data base data synthesis and results obtainedheattemptedto build up the lithostratigraphy of sediment,to conceive the three dimensional model of Quaternary platform of Narmada with special reference to concealed and hidden fossiliferous boulder conglomerate to correlate the Quaternary of Hominidlocality Hathnora (22o52'77o52')(325 m) India, with thatofLuochuan (90-120 m) Chenjiawo(50m) andCongwanling sequence (36 m) of China on unifiedQuaternary platform. (Table No 1)

QuaternarySequenceof Narmada India:-

In Narmada Valley the area around Hominid locality of Hathnora is occupied by thick and multiple sequences of Quaternary sediments. Based on study of statistical parameters of sediment their deviation and breaks in vertical stratigrphic column between 00.00 to 260 m below the ground level indicate that the sediments consist of three domains viz. glacial, fluvio-glacialandfluvial.(Khanet.alinpress)Thestudyof these concealed sediments, their sedimentary environments and sedimentation and correlation both in vertical and horizontal columnsindicatesthatthe lowermostunits,Boulderbed(20to260m.belowgroundlevel)isofglacialorigin,whereasthefossiliferousbedBouldercongl omerate (260to278m. abovem.s.l.)isoffluvio glacialandtopfourformationsinincreasingantiquitySohagpur, Shahganj, Hoshangabad and Janwasa(278 to 350m. above m.s.l.) are offluvial origin and represent the complete sequence of Quaternary sedimentation in Central India. The Janwasa formationcomprisesofsedimentsofacti vechanneldepositwhereastheolderthree(Sohagpur, Shahganj, Hoshangabad formation) are related to older flood plains deposits of paleo-do-main of Narmada and are grouped under older alluvium. Boulder conglomerate of fluvio-glacial origin is assigned an independent formational status. Khan & Sonakia (1992). (Table No HE _1 to_3)

Indian Homo Erectus and evolution:-

(22°-52'N-77°52'–E)

The skull cap of Narmada man Homo erectus Narmadanesis was found in near village Hathnora (22 ° 52" N; 77 ° 52" E) in fossiliferous boulder conglomerate, (Sonakia, 1984)at an elevation of about 268m above the m.s.l. and at the depth of about 83m in Central Narmada Valley. These deposits are underlain by glacial deposits and overlain by fluvial deposits of palaeo-domain of Narmada. The Quaternary sequence of Hathnora is described by Khan & Sonakia (1992). The boulder conglomerate at Hominid locality Hathnora consist of stratified hard compact basal unit comprising of rook fragments of different shape and size of granite, quartzite, sandstone, agate, chalcedony, chart, basalt and calcareous nodules tightly cemented in the matrix of brown, red and grayish sand and silt. These rock clastics constitute various sub-litho units and are supported by grey and brownish, cross bedded sand. The sub-litho units consists of mostly pebble supported horizons which contains vertebrate fossils, stone implements, like chopper, scraper hand axes and core flakes mostly of quartzite, flint, chalcedony and quartzite. AmandibleofLantianhominidat Chenjiawo(China)wasfoundinpaleosole(S6)andatthe depthof 38mintheloess depositsA Zhisehnget. al.(1989).Assuminglyaroughlyuniform accumulation rate of sedimentation in the line of Ma. et.al. (1978) estimation of age, thedate of the Lantian mandible at Chanjiawois computedto be about0.65 m. m.y.r. Ho-chuan at the depth of 26m which were deposited in typical fluvial environments.In view of recovery of skull cap of Homo erectus (Narmada Man) from older deposits and from deeper level (83m.) as compared to Chinese Hominid, the claim of Lantian Hominid of Congwangling (1.15 m.y.r.) after A Zhisehng et. al. (1989)\ needs re-evaluation of reassessment of its age.

The rock basin of Narmada is occupied by the Quaternary sediments of three domains viz. glacial, fluvio- glacial and fluvial which were deposited in distinct environments during Quaternary time. The glacial deposit comprised of thick pile of sediments occupied base of rock basin and was deposited by glacial activities in dry and cold climatic condition during early Pleistocene time. The boulder conglomerate constitute fossiliferous horizon of Narmada, deposited in fluvio-glacial environments (interglacial). It is a marker horizon of Quaternarysedimentationin NarmadaValleyand as wellinCentral Indiaits dispositionand relation with other deposits in the valley, indicates a significant change in regional climate from cold dry to warm and humid, during which the sediment were re-worked from glacial front intermittently and deposited in the valley over a very long time.The skull cap of Home erectus (Narmada Man) and other fauna recorded along with calc- nodules within the boulder conglomerate; suggest that warm climatic phase prevailed long time. The Lantian hominid cranium at Gongwangiling was found in silty loess at the depth of about 26 m. and it Luochuan standard sequence the fossil bearing stratum un-doubted to the middle part of silty loess L-15 which at Luochuan was dated to be 1.09 to 1.20 m.y.r. The hominid fossil and associated faunas were discovered in the middle part of silty layer; the age of the fossils at Gongwanling can be pinpointed

narrowly to 1.15 m.y.r. This dates differs from theearliest (0.75-0-80 m.y.r.) of Ma. et. al. (1978) and from 1 m.y.r. estimate of Cheng et. al. (1978). The Lantian fossil hominid at Gondwangling is considered as earliest Homo erectus in China. Ho Chuan Kun (1986).

In India Narmada basin consideringthe one of a mainloci of Quaternarysedimentation, and assuming the uniform accumulation rate of sediment in the basin in the line of Ma. et. al. (1978) Yobin Sun & Zhisheng, An (2005) and comparing the Narmada sequence of Quaternary deposit (325 m.) with those of Luochuan standard sequence of Chenjiawo and Congwangling sequence of China. The skull cap of Homo erectus (Narmada Man)recovered from the boulder conglomerate of fluvio-glacial origin in middle part of Quaternary column from deep level of Narmada, at the depth of 83 m. above glacial deposits, in association of ash bed, as compared to Chenjiawo Hominid from inter bedded sequence of paleo sols loess and silty loess at the depth of 38 m. and Congwangling 26 m. frompaleo sols which are younger than Narmada deposits. The Narmada skull cap of Homo erectus which is recovered from the vom of basal unit of boulder conglomerate at the depth of 83 m. (278 m. above m.s.l.) is estimated to be of upper segment of lower Pleistocene age. It is older than the Homo erectus of Chenjiawo, Congwangling of China which were recovered from paleosole and loess deposit at the depth of 38 and 26 m. The Quaternary sequence of Narmada (325m.) as compared to Louchuan (136 m.) sections of China on unifiedQuaternaryplatformisolderandrepresentsthec ompleteandtypesequenceof Quaternary sedimentation in Central India. The occurrence of skull cap of early man at the depth of 83 m. in basal unit of boulder conglomerate of fluvio-glacial origin in Narmada Valley is one of the earliest and oldest Homo erectus in Asia. (Plate No HE_9 Plate No GH_3 to_7)

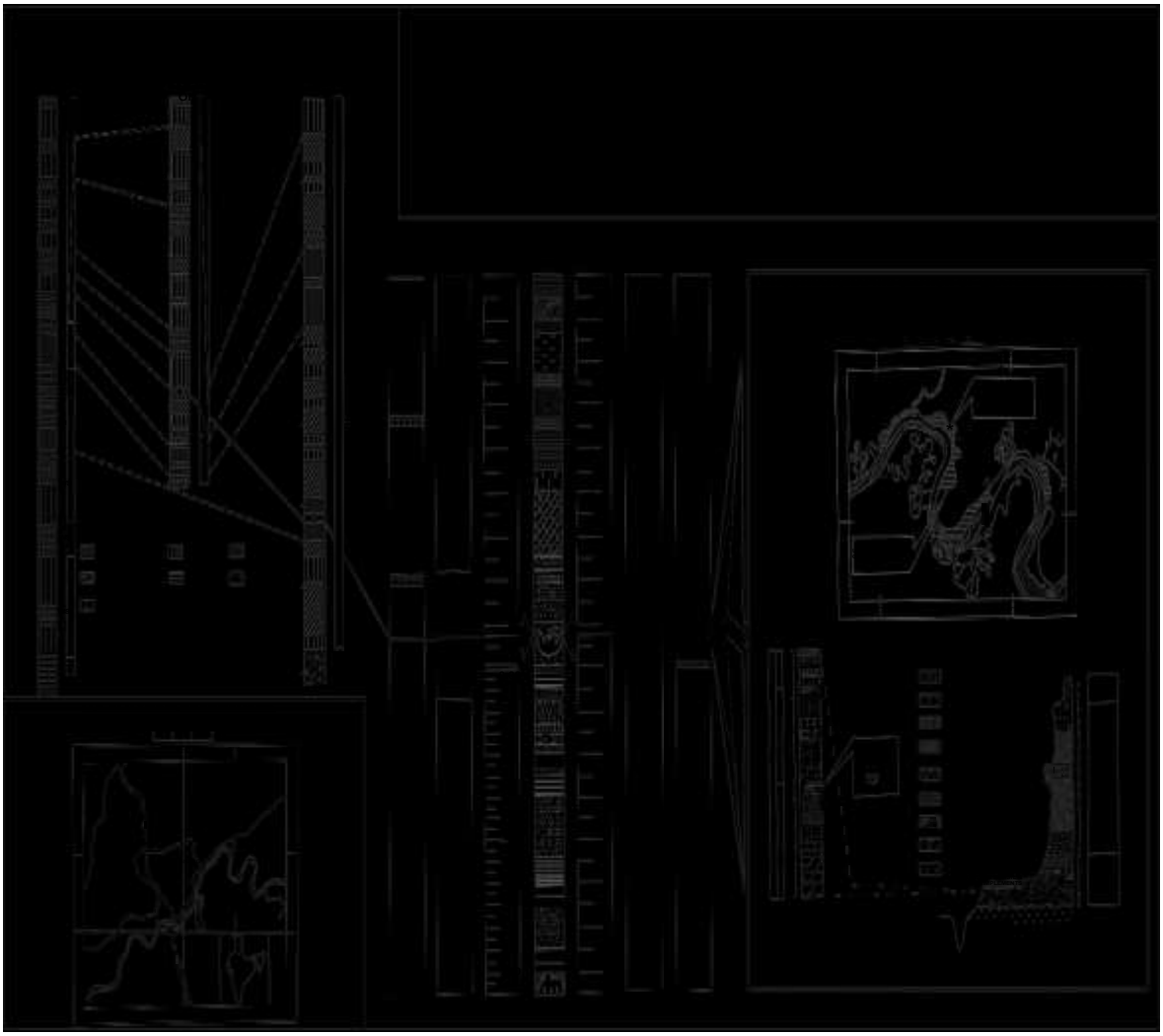
Hominid Locality LuochuanChina:-

In China the study of human origins and evolution, now known as palaeoanthropology, began with the discovery of a worn and fossilized hominid molar tooth at Zhoukoudian, 48 kmsouthwest of Beijing, by the Austrian geologist Otto Zdansky in 1923. Subsequent work at the cave deposit between 1927 and 1937 by European, North American, and Chinese scholars, including Johan Anderson, recovered a large number of hominid fossils and associated cultural remainsWu,M.(1980,1983,1987),Wu,R.(1988),Wu,R et.al (1982,1983,1987),Wu,X&Poirier(1995),Wu,Xet. al(1966),Wu,X.&WL;1985, Wu,X. & Zhang, Z (1985) Weidenreich, F, (1936) Weidenreich, F, (1937b). Up until 1995, information on Middle Pleistocene China was restricted by the minimal amount of publication in languages other than Chinese, the research opportunities and interests of western palaeoanthropologists and the limited travel opportunities available to the Chinese scientific community. Thissituation as dramaticallychanged in 1995 withthe publication of Wuand Poirier's Human evolution in China.(Wu,X & Poirier 1995), it has provided for the first time the detailed morphological, metrical descriptions and associated quaternary sediments of all of the major Chinese Pleistocene hominids in a single volume. Author availing the opportunity of availability of Chinese literature and data of Homonid localitieshas studied and correlated the Quaternary sequence ofHathnora of Narmada India with Luochuan Quaternary sequence of Chinataking all salient and diagnostic elements andparameterson unified Quaternary platformfor correlation for the first time.

Luochuansequence:-

The Luochauan is considered to be standard and type sequence of Quaternary deposits of China. A Zhisehng et. al. (1989).The Chenjiawo and Congwanling hominoid sequence have compared with the sequence of Luochuan and Narmada for the purpose of building the lithostratigraphy and magneto-stratigraphy and ultimately assigning the age to hominid fossils. The Luochuan Sequence is multiple sequence of red clay, silty loose, loess and paleosole constituting differential litho units of variable thickness. The red clay with loess constitute the base of these deposits whereas the two sub-litho units of silty loess (L9& L15)are located W in the sequence at depth of 60 and 80 m inter bedded within paleosole and loess units. There are fourteen (14) sub-litho units of loess litho bedded with paleosole at an averagedepth of 0-75m; besidesthree weatheredpaleosole ws-1to ws-3 between90 to 120m. The paleosole units though form thinner horizons as compared to loess sediments but their frequency of occurrence and cumulative thickness constitute the major part of Luochuan deposits.These deposits are associated with fairly good amount of calc- matrix and depict multiple cyclicsequences.Though the thickness ofvarious sub-litho units decreases towardstopand average total thickness of these deposits is about 130 m These deposits are of riverine in origin as evident by the study of litho-logs after An Zhisheng (1989).

Platenohe:-



Tableno.1: Stratigraphy of Quaternary Deposit of Narmada

Age	Jasrullahganj-HardaSection	thmore-Hoshangabad Section		balpur-NarsinghpurSection	Lithology	Environmentofsediment ation	Geomorphismsurface(River-terraces)&Land-formselementsHoshangabad-HathanicSection
Recent	Jan was a/In dra/ Kol aro	Y o u n g e	Ja n w as sf or		Reworked sediment viz boulders,cobbles,pebbles of quartzite gneisss basalt, jasper,agate,sand stone,laterite chert, with coarse to	channeland floodplaine nvironment (flood plainpointbarsandbara	NarmadaterraceTo pointbar,sandbarchannelbar

	fAmbaformation	rallu vium(Youngerfloodplaindeposit)	mation	FluvialSedimentof present domain ofNarmada	finesand	ndchannel bar facies)channelandfloodplainenvironment (flood plainfacies ofpalaeodomain)channelandfloodplainenvironment (floodplainfaciesofpalaeodomain ofNarmada)channelandfloodplainenvironment(flood plain facies ofPalaeodomain ofNarmada)	,riverbraids
	Demawar Formation		Hosangabad Formation	Upperfluvialdeposit ofNarmada	predominently well roundedboulders,cobbles,pebblesofquartizitegneiss,basalt,sandstone,agate,chert,chalcedony,laterite in the matrix ofcorse fine sand silt & clay predominentlyboulders,cobbles,pebblesofgneiss,basalt, sandstone, agate, chert,chalcedony, laterite in thematrix of corseoffinesandsiltclayandsandpredominently boulders, cobbles,pebbles ofquartizitegneiss,basalt,sandstone,agate,chert,chalcedony,zeolite with clay silt andsubordinate amount of sand **disconformity**		Narmadatarrace(NT1)Hasangabadsurface (15m)
	Shivpur Formation	Older Allu	Shahganj Formation	Middlefluvialdeposit ofNarmada			Narmadatarrace(NT2) Shaganjjsurface(16m)

		vium					
	Nasrullaganj Formation		Sohagpur Formation	Lowerfluvialdepositof Narmada			Narmadatarrace(NT 3Sohagpur surface(15 m)
middle pleisto-cene	Bouldercongloneerate	Bouldercongloneerate	Hatnoraformation	Bouldercongloneerate	predominentlysub rounded to rounded boulderscobbles,pebbles of quartizite ,gneiss,limestone, sandstone,basalt,agate, chert,tightly cemented sandandsilt **disconformity**	channelandfloodplainenvironment(floodplainfacies of palaeo domainofNarmada	Rock cut terraces relict platforms andbences(5m)

Pleistocene	Boulder Bid/Glacial/Fluvio-glacial deposit	Boulder bed (glac-io fluviol)	Glacial/fluv-io glacial	Boulderbed/Glacial/fluvioglacial/deposit	Predominentlysub-angulartosub-rounded boulders,co-bbles,pebblesofquartzitesgneiss,basalt,sandstone,withverycoarsetoveryfinesand,siltandclay. **Unconformity**	Glacial/Fluviogla cialenviron m-ent(sediments of Glacial/Fluviogla cialfacies)	Valley fillsedimentsdepositedbyglacial/fluvio-glacialactivities

Table:2 QuaternaryStratigraphyoftheNarmadaValley(Jabalpur- Nusrullaganj-HardaSection)

ChronoStratigraphy	Megneto Stratigraphy	Morp-	LithoStrat-	SoilStratigraphy			Tephra Stratigraph	Biostratigraphy		Paleoclimate
				Soil T	DegreeofOxidation	DegreeofCalcification		FaunalAssemblage	Pollen Assemblage	
Holocene 13KaBp	NotDone		RamnagarFormation	I	Nil	Nil	…….	…….	……	Present Cl.
		NTOT0Depositional	AmberFormation Indra/Kolar Formation	II	Nil	Low	……	UpperAssemblage	….	
		NT1TlE	HoshangabadFormation	III	…..	…..	…	…..	….	Warm an dSe
Upper Pleistocene 128KaBp	[redacted]	NT2-AT2Deposition	Shahganj Formation	IV	Low	Intense	NAB-III volcanic	Upper Assemblage		Warm an dSe
		NT2-B	Demaur Formation	V	Moderate	Moderate	NAB-IIvolcanicAsh		GraminaeCompositae Chenopodiaceae	

Middle Pleistocene700			NT2-C	Shivpur Formation	VI	High	Moderate	.....	LowerAssemblage		
	Matuyama		NT3-A	NusrullahganjFormation	VII	VeryHigh	Low	.....			
			NT3-B	Sohagpur Formation	VIII	Intense	Nil	..	NotReported	.....	Warmand Humid
LowerPleistocene			.....	Hathmora Formaion(BoulderConglomerate)	.....Fluvio-glacial/deposit.....			NB-I	.....		
.....				(BoulderBed)	Glacial/Fluvio-glacial/deposit						

Table:3

ComparisonofStratigraphiccoloumnsofNarmadaByVariousWorkersWithReferencetoJabalpur-Nasrullaganj-Harda

Riverbank Sections	Theobold (1860)Base	Deterraetal (1939)Base-	Khatri(1961) Base-	Biswasetal (1981)Base	Biswasetal (1989)Base	Khanetal (1992)Morpho-	Tiwarletal(1996) Base-Lithostrati-
	Erosional	Stoneagecult ure	culture	faunalasseam	faunalassemblage	Stratigraphy	graphysoil-stratigraphy
	Unconformity			blageoxidation	oxidation	Climatic	Morphostratigraphy
					finingupward	consideration	Magnetostrati-
					sequence		graphyFaunalassemblage
	UpperGroup	UpperGroup	LateUpper	NarmadaUpper	Jhalon/Devakachhar	(1)JanwasaFormation	
	Pliocene	UpperPleistocene	Pleistocene	MiddleFormation	FormationLate	Indra/KolarFormation	
				UpperPleistocene	PleistocenetoUpper	Amba/AmberFormation	
					MiddlePleistocene	(2)HoshangabadFormation	
	LowerGroup	LowerGroup		NarmadaLower	Narsingpur	(3)Shahganj/Demawar/	
	Pliocene	MiddlePleistocene	MiddlePleistocene	MiddleFormation	FormationMiddle	ShivpurFormation	
				UpperPleistocene	Pleistocene		
	L	UpperGroup	LateUpper			Nusrullganj	B
	O P	UpperPleistocene	Pleistocene			Formation	A
	W L					UpperPleistacene	P N
	E I						U L E
	R O						P E T

	C						P I A
	G E						E S
	R N	LowerGroup					R T F
	O E	MiddlePleistocene					O O
	U						C R
	P		MiddlePleistocene			HathnoraFormation	E M
						MiddlePleistocene	N A
							E T
			LowerPleistocene			Glacial/Flurioglacial	I
						(BouldedBed)	O
							N

Chenjiawo Sequence:-

The Chenjiawo (34.15.N, 115.00 E) is located in a small tributary of Xiehu. Though the stream is of subsequent nature,but contribute appreciable sediment load fromhigherreachesandhaveentrenchedthequaternaryblanketofBaheri ver,thetrunkstreamXiehudrains north easterly across the Central China. The Chenjiawao deposits consist of inter bedded complex sequence of palaeosole, loess, silty loess with sand and rock gravels at the base. It comprises of nineteen (19) sub-units of palaeosole, twelve (12) sub-units of loess, two (2) sub-units of silty loess with one (1) sub-unit of sand with sand gravel at the base. Thetotal thickness of thesedeposits is 50 m. The sediments are fairlycalcified depict cyclic sedimentation and upward fining sequence typical of basin deposits. An Zhisheng (1989).The Mandiable Hominid of Chenjiawo was found in palaeosole (S6) at the depth of 38 m. assumingaroughly, uniformaccumulationrateofsoilloesscoupletswithinBrunhesportion ofthesection, thedateofLantian mandiable at Chenjiawois estimatedto be 0.65myr. This is in line of Ma et al. An Zhinsheng (1989). The Chenjiawo deposits besides Lantian Hominid consist of other final assemblage and are of middle Pleistocene age.

Congwanling Sequence:-

In China early human fossil were found either at various horizons of loess or in fluvial deposits of river basin. The fluvial deposit represents the former valley floor of river system and sediment of old flood plain facies which are often covered under loess of different ages. The Congwangliang(34 °11’ 15” N-109 ° 30’ 00”) is situated in main Bahe river valley north east of Lantian in Shaanxi province of Central China. The Homo erectus is recovered from loess deposit (9th layer of loess sequence) which is situated near Gongwangling village. The Gongwangling (Lantian) cranial fragments were discovered east of Lantian, in 1964 by a team from the Institute of Vertebrate Paleontology and Paleoanthropology, Beijing(Wu and Poirier, 1995; Wu et al., 1966).The first hominidfossil to be found was an isolated maxillary molar and several months later this was followed by large cranial vault fragments. A large quantity of mammalian faunal material was also recovered from the site. A dominance of tropical and subtropical species has suggested a warmer climate Gu, & Jablonski, (1989); Qi, (1989). An et al., (1990); An and Ho, 1989; Wu et al., (1989) have described the variousartifacts from the Gongwangling site as being primarily cores with five flakes and four scrapers.

The Gongwanglinghominidskeletal materialswerefirstdescribedindetailby(Woo,1965). A detailed English language discussion of Gongwangling can be found in Beijing (Wu and Poirier, 1995). The human fossils (PA 1051-6) include a complete frontal, large part of the parietals, most of the right temporal, part of the left and right nasals, and a large section of the right maxilla with associated second and third molars, and part of the left maxilla.. Features suggestive of Homo erectus are most apparent in the frontal bone which is broad, receding and have a robust supraorbital torus. There is marked postorbital constriction and no sulcus between the torus and frontal squama. Cranial vault bonesare also relativelythickenedcertainlycomparedwithHomoerectusfromZhoukoudian,Intermsofgeol ogical age andsequence of early man in China in chronological order is: Gongwangling Homo erectus-

YuanmouHomoerectus-BeijingHomoerectus(orChenjiawoHomoerectus-Hexian Homo erectus)-Dali Man (and Dingchun Man). It is evident that the Gongwangling Lantian Man is the earliest Quaternary human fossil so far found in China. (Plate No HE_9)

Conclusion:-

The skull cap of Narmada man *Homo erectus* Narmadanesis was found in near village Hathnora (22 ° 52" N; 77 ° 52" E) district Sehore, M.P., India in fossiliferous boulder conglomerate. It is recovered in stratigrphic column of Quaternary deposits at the depth of 83 m in of Narmada valley, where estimated total thickness of deposits is about (325 m).This blanket of sediments consist of three domains viz glacial, fluvio-glacial and fluvial, which were deposited in distinct environment during Pleistocene to Holocene time (Khan & Sonakia 1992).

The Skull Cap is completely fossilized undistorted, renal vault nearly complete except few left Supra-orbital and sutures which are nicely preserved. The various morphological features and robust form of skull and excessive thickness of the bones indicate that it belongs to adult male individual (Sonakia, 1984). The discovery of Skull Cap of *Homo erectus* in fossiliferous boulder conglomerate in association of other mammalian fossil is recorded at the depth of 83 m; is estimated to about 1.38 m.y.r. (+) in age and can be considered as the oldest *Homo erectus* in Asia.

The estimation is based on study of fossils assemblage, association of as beds, palaeo soles, tephra bed in boulder conglomerate; palaeo environments, lithostratigraphic and biostratigraphic position of boulder conglomerate, depth of occurrence of skull cap (83 m.) and rate of accumulation of sediment in basin and elevation of fossil yielding horizon (330 m above m.s.l.), association of tephra beds, palaeo-sole, palaeo-environments, glacial and interglacial activities, in Central India during Quaternary time

.The occurrence of tephra beds upstream of Hathnora close to upper gritty sandstone unit of fossiliferous boulder conglomerate and upper fluvial deposits indicate extrusive volcanic activity during and after deposition of this marker horizon. The study of grain morphology of glass matrix and associated minerals of ash bed reveals the Aeolian nature of ash bed material; which was brought in the form of volcanic dust from the distant source and appears to have been settled down across the basin during sedimentation in Quaternary time.

The estimated age of Narmada is based on these parameters is about 1.38 m.y.r. (+), which is greater than Homo erectus of Chenjiawo 0.65 m.y. and Gongwangling man of China 1.15 m.y. Ho Chuan Kun (1988), which occurs at the shallower depth of 38 and 26 m respectively in stratigraphic column of unified Quaternary platform as compared to Narmada man.

The study of morphometric parameters of skull cap of Narmada man and palaeo-environmental setting of Hominid locality, indicate that it belongs to an adult male individual and lived in dry cold and seasonally humid climate in Narmada Valley during upper segment of lower to middle Pleistocene time.)

Bibliography:-

1.Anon.(1983)DiscoveryoffossilizedHumanskullinNarmadavalleyAlluvium Hoshangabad area, M.P., Geol. surv. India, C.R News Vol.4 No.2.
2.An, Z, Gao, W, Zhu, Y, Kan,X, Wang, J, Sun, J, & Wei, M, (1990).MagnetostratigraphicdatesofLantianHomoerectus.ActaAnthropologica Sinica 9:1–7. (In Chinese with English abstract,)
3.An,Z,&Ho,CK,(1989):NewMagnetostratigraphicdatesofLantianHomoerectus. Quaternary Research 32:213–221.
4.Badam,G.L.(1979)PleistoceneformsofIndia,DeccanCollege,Pune.
5.Biswas and Dassarma, D.C. (1981): New species of stegodon from Narmada valley, Prof. Field Conference on Neogene- Quaternary boundary in India (IGCP). Calcutta.
6.Cheng, G.L; Li, S.L; Lin J.L; 1978a. A research on the ages of the strata of "Lantian Man" collected papers of Paleoanthropology. Science press Beijing pp 151-157
7.Cheng, G.L; Lin, Li, S.L; Liang, Q.Z; 1978 b. A preliminary paleomagnetic survey of Nihewan Bed Sci. Geol. Sin. 7 247-252
8.Dassarma,D.C(1979):SomeobservationontheQuaternaryandmammal assemblages of India. Geol. Surv. India, Misc.Publ.no.45 pp 279-287.
9.DaiE(1966)thepaleolithsfondatLantianmanlocalityofGonwanglingandits vicinity. Vertibrata PalAsiatica 10 30-34
10.De Terra and DE Chadian: (1936) OBSERVATION ON THE UPPER Siwalik formationandlater Pleistocene depositsinIndia Procd.Amer. Phil. Scie.v76, no6 pp 719-722.

11.De Terra, H. and Paterson (1939): studies on the Ice age in India and associated human culture. Carn. Inst. Washington.
12.Falcon,H.(1859):DescriptiveCatalogue,fossilremainsVertebratefromSiwalikhills Narbudda Perim Island etc. In the museum of Asiatic Society of Bengal, Calcutta.
13.Gupta, S.K. (1974): Geology and sedimentation of parts of Narmada Basin, Sehore and Hoshangabad districts, M.P., Geol. Surv. India, Progress Report.
14.Gu Y, and Jablonski N (1989) A reassessment of Megamacaca lantianesi of Gangwangling Shaanxi Province. Acta Anthropological Sinica 8: 343-346
15.Hoojier, D.A. (1963): Preliminary identification of some of the fossil mammals from Narmadavalley,India.AppendixinSenandGhoshRivasta DIscience Pleistocene 18)1-4),P29
16.Khan, A.A. (1984): Geological and Geomorphological studies around Tapti-Vagher confluencedistrictJalgaon,Maharashtra.Geol,Surv.IndiaRec.V.113pt6pp99-109.
17.Khan, A.A. & Banerjee, S.N. (1984): Geology and Geomorphological studies in the parts of Narmada Basin, Sehore district of M.P. Un Pub. Report. Geol. Surv. India.
18.Khan, A.A., and Rahate, D.N. (1990-91 & 1991-92): Geological and Geomorphological studies in parts of Narmada Basin) parts Hoshangabad and Narsingpur district, M.P. Geol. Surv. Of India Unpublished Progress Report.
19.Khan A.A and A. Sonakia (1992): Quaternary deposits of Narmada with special reference to the Hominid Fossils, Jour. Geol. Soci. Of India Vol. 39 No2, pp 147-154
20.Khan, A.A, Rahate, D.N. (1991): Volcanic Ash fromQuaternary deposits of Narmada Valley Central India. Proceed, of 78th session of Indian Sci. Cong. Association. (Abstract) pt. III pp 28-29
21.Rahate. D.N.Khan A.A and BANERJEE, S.N. (1985): Geomorphological and geological studies of Quaternary sediments in collaboration with project CRUMANSONATA in parts of Narmada valley, Sehore, Hoshangabad and Dewas districts, M.P. progress repost (Unpublished) Geo. Surv. Ind.
22.Khan, A. A; Rahate; D.N, Fahim, M; & Banerjee, S.N.(1991) :Evaluation of Quaternary terrace of lower Narmada valley , Districts Sehore and Hoshangabad, Madhya Pradesh
23.Khan; A.A. (1991): Geological studies of Harda – Barwaha basin in parts of Dewas, Sehore, Hoshangabad and Khandwa districts with the Aid of Satellite imagery and Remote Sensing Techniques, Geol. Surv.Ind, Rec. Vol; 126 pt-6
24.Khan, A.A; D.N, Fahim, M. and Banarjee, S.N. (1992): Evaluation of Geology and Geomorphology in Central Narmada Valley (Districts Sehore and Hoshangabad, Madhya Pradesh) Scientific Publishers, Jodhpur.
25.Khatri, A.P (1966): Pleistocene mammalian fossils of the Narmada river valley and their horizons Asian Perspective 9.pp113-133
26.N.L. Yadova andKhan , A.A. (1995): evaluation of Geology and structure of Eastern Harda- Barwah Basin, Madhya Pradesh using Remote Sensing Techniques with Field Checks. Jour.Ind.Soci. Remote Sensing (Photonirvachak)
27.Khan, A.A. (1990): Geomorphology of Narmada Valley Of Jabalpur_ Handia Section Unpublished G.S.I Note.
28.Khan,A.A.&Vatsa,U.S.(1987-88):GeoenvironmentalAppraisalofthe areaaround
29 Khan.A.A (.2018) Quaternary deposits of Narmada valley in relation to Geomorphology and Neotectonic of the area with special reference to Hominid occurrence D.sc. Unpublished thesis submitted to Barkatullaha University Bhopal, M.P. India.
29.JabalpurCity,MadhyaPradeshG.S.I...Rec.Vol122pt-pp163-64.
30.Khatri, A.P. (1980). The Pleistocene mammalian fosse of Narmada river Valley and their horizons. Asian perspective, v.-9pp 113-133.
31.Ma,H.X;QianF;Li,P;Ju,S.Q(1978)PaleomagneticdatingofLatianMan. Vertebr.PalAsiatic a16, 238-243 (in Chinese)
32.Lydekker. R. (1880): Siwalik and Narmada Equidae, Pal.Ind. Ser. X, v I (5), pp 162-292.
33.Lydekker. R. (1882): Siwalik and Narmada Proboscides Pal. Ind.Ser.X.v).3(2) pp 63-92.
34.Lydekker, R.(1984): Siwalik and Narmada Bundont studies. Pal.Ind.Ser.X.v.pp 35-104.
35.PIligrim,G.E.(1905):Elephasantiques(namadicus)inGodavaryAlluvium,Rec. GSI. V. 32 pt I p 215.
36.Princep. J. (1932): Note on Jabalpur fossil bones. Jour.Asiatic Society Bengal, Calcutta, volume 1v.I, pp 456-458.
37.Princep. J (1832): Note on fossil bones discovered near Jabalpur. Jour. Asiatic Soc. Bengal. Volume 2 pp 583-588
38.Qi G (1989) Quaternary mammalian faunas and environment of fossil humans innorth China. In R Wu, X Wu and S Zhang (eds.): Early humankind in China. Beijing: Science Press, pp. 276-337.
39.Roy,A.K.(1971):GeologyandgroundwaterresourcesofNarmadaValleyBull.Geol. Surv. Ind. Ser. B. No.3.

40.Sonakia, A. (1984) : The skull Cap of Early man and mammalian fauna fromNarmada Valley alluvium, Hoshangabad are, Madhya Pradesh , India Rec .Geol.Surv. V.113 pt-6, pp.159-172
41.Splishbury, G.G. (1844): Notes on Nerbudda fossils, J. Asiat.Soc. Bengal Calcutta,13, pp 765-766
42.Splishbury, G.G. (1883): Account of the bones discovered in beds of the Omar Nadi nearNarsigpuronGodavari in valleyNerbuda.Jour.AsiaticSoc.Bengal,v2,pp 388-395.
43.Rao, Venkata et.al. (1997): Stratigraphy of the Quaternary fluvial sediments and Tephra of Narmada valley Central India. GSI Sp. Publication 46. (1997) pp 65-78
44.Theo bold, W (1860): On Tertiary and alluvium deposits of the Central portion of Narmada Valley. Meom.GSI, VII, pp.279-298.
45.Theobold, W.(1881):TheSiwalikGroup of Sub-Himalayan Region. Rec. Geol.Surv. of India pt.14, pp 66125.
46.Tripathi, C. (1968): The Pleistocene alluvial deposits of Central India .Rec. GSI.v 95 (2).
47.Weidenreich, F, (1943): The skull of Sinanthropus pekinensis: acomparative study ofa primitive hominid skull. Palaeontologica Sinica D10:1–485.Weidenreich, F, 1946. Apes, giants, and man. Chicago: Chicago University Press.
48.WooJ(!965).ThehominidskulloflantianShensiVertibarateapalAsiatic10:1-22
49.Wu, X, Yuan, Z, Han, D, Qi, T, & Lu, Q, (1966): Report of the excavation at Lantian man localityof Gongwanglingin 1965.VertebrataPalAsiatica 10:23–30.(In Chinese with English abstract.)
50.Wu, M. (1980): Human fossils discovered at Xujiayao site in1977.Vertebrata PalAsiatica 18: 227–238. (In Chinese with English abstract.)
51.Wu, R, & Dong, X, (1982): Preliminary study of Homo erectus remains from Hexian, Anhui. Acta Anthropologica Sinica 1:2–13. (In Chinese with English abstract.)
52.Wu, R, & Lin, S, (1983): Peking Man. Scientific American 248:78–86.Wu, R, &Pang, R, 1959. Fossil human skull of early paleoanthropic stage found at Mapa, Shaoquan, and Kwantung Province. VertebrataPalasiatica 3:176–182. (In Chinesewith English abstract.)
53.Wu, M, (1983): Homo erectus from Hexian, Anhui found in 1981. Acta Anthropologica Sinica 2:109–115. (In Chinese with English abstract.)
54.Wu, X, & Wang, L, (1985): Chronologyin Chinese Palaeoanthropology. In Wu, R, & Olsen, JW, (Eds) Palaeoanthropology and Paleolithic archaeology in the People's Republic of China; 29–68. London:Academic Press.
55.Wu, X, & Zhang, Z, (1985): Homo sapiens remain from Late Paleolithic andNeolithic China. In Wu, R, &. Olsen, JW, (Eds) Palaeoanthropology and Paleolithic archaeology in the People's Republic of China; 107–133. London: Academic Press.
56.Wu, R, (1987): A revision of the classification of the Lufeng Great Apes. Acta Anthropologica Sinica 6:265–271. (In Chinese with English abstract.)
57.Wu, R, (1988): The reconstruction of the fossil human skull fromJinniushan, Yinkou, Liaoning Province. Acta Anthropologica Sinica 7:97–101. (In Chinese with English abstract.)
58.Wu R, Wu X, and Zhang S, eds. (1989) early human kind in China. Beijing: Science Press
59.Wu,X,&Poirier,FE,(1995):HumanevolutioninChina.Oxford:Oxford
60.UniversityPress.
61.Wu,R,&Wu,X(1997):China.InSpencer,F,(Ed) HistoryofPhysicalAnthropology an Encyclopedia; 273–282. New York: Garland Wu, R. Wu, X, & Zhang, S, (Eds) 1989. Early humankind in China. Beijing: Science Press.
62.Weidenreich, F, (1936): The mandible of Sinanthropus pekinensis. Acomparative study. Palaeontologica Sinica D7:1–132.Weidenreich, F, 1937a. The dentition of Sinanthropus pekinensis: Acomparative odontography of the hominid.Palaeontologica Sinica New Series D No 1:1–180.
63.Weidenreich, F, (1937b): Reconstruction of the entire skull of an adult female individual of Sinanthropus pekinensis. Nature 140:1010–1011.
64.Yobin Sun & Zhisheng, An (2005) Late Pliocene-Pleistocene Change in mass accumulationratesofeoliandepositsonthecentralChineseloessplateau.Kennedy,
65.K.A.R. Sonakia, A. J. Chiment, K.K. Verma, Is the Narmada Fossil Hominid anIndian Homo erectus, Am. J. Phys. Anthropol. 96 (4) (1991) 475-496.
66.Kennedy, K.A.R Deraniyagala, S.U.. Roertgen, W.J Chiment, J.. Disotell, T Upper Pleistocene fossil Hominids from Sri Lanka, Am. J. Phys. Anthropol. 72 (1987) 441-
67.461.Acharyya, S. K., & Basu, P. K. (1993).Toba ashon the Indian subcon-tinent and its implications for the correlation of Late Pleistocene Al- Copyright © 2012 SciRes. 129 A. R. Sankhyan ET AL.
68.Luvium.QuaternaryResearch,40,10-19.doi:10.1006/qres.1993.1051.
69.Angel, J. L. (1972). A middle Paleolithic temporal bone from Darra-i- Kur, Afghanistan. In L. Dupree (Ed.), Prehistoric research in Af- ghanistan (1959-1966). Transactions of American Philosophical So- ciety, 62, 54-56.

70.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 (pp. 137-170). New York: Springer Press. doi:10.1007/1-4020-5562-5_7
71.Badam, G. L., Ganjoo, R. K., Salahuddin, M., & Rajaguru, S. N. (1986). Evaluationof fossil hominin—The maker of Late Acheulean tools at Hathnora, Madhya Pradesh, India. Current Science, 55, 143-145.
72.Badam, G. L., & Sankhyan, A. R. (2009). Evolutionary trends in Nar- mada fossil fauna. In A. R. Sankhyan (Ed.), Asian perspectives on human evolution (pp. 92-102). New Delhi: Serials Publications.
73.Barik, S. S., Sahani, R., Prasad, B. V. R., Endicott, P. et al.(2008). De-tailed mtDNA genotypes permit a reassessment of the settlement and population structure of the Andaman Islands. American Journal of Physical Anthropology, 136, 19-27. doi:10.1002/ajpa.20773.
74.Bermudez de Castro J. M., Carretero, J. M., Garcıa-Gonzalez R., Rodri- guez-Garcıa, L., Martinon-Torres, M., Rosell, J., Blasco, R., Martın- Frances, L., Modesto, M., & Carbonell, E. (2012). Early pleistocene human humeri from the gran dolina-TD6 site (Sierra de Atapuerca, Spain). American Journal of Physical Anthropology, 147, 604-617. doi:10.1002/ajpa.22020.
75.Cameron, D., Patnaik, R., & Sahni, A. (2004). The phylogenetic sig- nificance of the Middle Pleistocene Narmada hominin cranium from central India. International Journal of Osteoarchaeology, 14, 419- 447. doi:10.1002/oa.725.
76.Carretero, J. M., Haile-Selassie, Y., Rodríguez, R., & Arsuaga, J. L. (2009). A partial distal humerus from the Middle Pleistocene depos- its at Bodo, middle awash, Ethiopia. Anthropological Science, 117, 19-31. doi:10.1537/ase.070413
77.Chandrasekar, A., Kumar, S., Sreenath, J. et al. (2009). Updating phy- logeny of mitochondrial DNA macrohaplogroup M in India: Disper- sal of modern human in South Asian Corridor. PLoS ONE, 4, 1-13. doi:10.1371/journal.pone.0007447
78.Chesner, C. A., Rose, W. I., Drake, A. D. R., & Westgate, J. A. (1991). Eruptive historyofearth'slargestquaternarycaldera(Toba,Indone-sia)clarified.Geology,19, 200-203. doi:10.1130/0091-7613(1991)019<0200:EHOESL>2.3.CO;2
79.Churchill, S. E. (2007). Endocrine models of skeletal robusticity and the origins of gracility.InA.R.Sankhyan,&V.R.Rao(Eds.), Hu-manorigins,genomeandpeople of India (pp. 337-368). New Delhi: Allied Publishers.
80.Ganjoo, R. K., Rajaguru, S. N., & Gupta, A. (1996). On the problem of age and genesis of Bhedaghat waterfalls (Jabalpur), Madhya Pradesh, Journal Geological Society of India, 48, 421-425.
81.Van Heteren, A. H., & Sankhyan, A. R. (2009). Hobbits and pygmies: Trends in evolution. In A. R. Sankhyan (Ed.), Asian perspectives on human evolution (pp. 172-187). New Delhi: Serials Publications.
82.James, H. V. A., & Petraglia, M. D. (2005). Modern human origins and the evolution ofbehaviorinthelaterpleistocenerecordofSouthAsia. CurrentAnthropology,46,3-83.27. doi:10.1086/444365.
84.Kennedy, K. A. R. (2000). God-apes and fossil men: The paleoanthro- pology of South Asia. Michigan: The University of Michigan Press.
85.Kennedy, K. A. R. (2007). The Narmada fossil hominid. In A. R. Sankhyan, & V. R. Rao (Eds.), Human origins, genome and people of India (pp. 188-192). New Delhi: Allied Publishers.
86.Kennedy, K. A. R., & Deraniyagala, S. U. (1989). Fossil remains of 28,000 year old hominids from Sri Lanka. Current Anthropology, 30, 394-399. doi:10.1086/203757
87.Kennedy, K. A. R., Sonakia, A., Chiment, J., & Verma, K. K. (1991). Is the Narmada hominin an Indian Homo erectus? American Journal of Physical Anthropology, 86, 475-496. doi:10.1002/ajpa.1330860404
88.Khan, A.,A & Sonakia, A. (1992). Quaternary deposits of Narmada with special reference to the hominid fossil. Journal of the Geological Society of India, 39,147-154.
89.De Lumley, H., & Sonakia, A. (1985). Contexte stratigraphique et Archéologique de L'Homme de le Narmada, Hathnora, Madhya Pradesh, Inde. L'Anthropologie, 89, 3-12.
90.Lumley, M. A., & Sonakia, A. (1985). Premiere Découverte D'un Homo erectus Sur Le Continent Indien a Hathnora, Dans la Moyenne vallée de la Narmada. L'Anthropologie, 89, 13-61.
91.Mallasse, A. D. (2009). Cranial embryogeny and hominin phylogeny. In A. R. Sankhyan (Ed.), Asian perspectives on human evolution (pp. 103-121). New Delhi: Serials Publications.
92.Oppenheimer, C. (2002). Limited global change due to largest known Quaternary eruption, Toba ~74 Kyr BP. Quaternary Science Review, 21, 1593-1609. doi:10.1016/S0277-3791(01)00154-8
93.Oppenheimer, C. (2003). Ice core and palaeoclimatic evidence for the great volcanic eruption of 1257. International Journal of Clima- tology, 23, 417-426. doi:10.1002/joc.891

94.Patnaik, R., Chauhan, P. R., Rao, M. R., Blackwell, B. A. B., Skinner, A. R., Sahni, A., Chauhan, M. S., & Khan, H. S. (2009). New geochro- nological, paleoclimatological and Paleolithic data from the Narmada Valley hominin locality, Central India. Journal of Human Evolution, 56, 114-133. doi:10.1016/j.jhevol.2008.08.023
95.Pearson, O. M. (2000). Activity, climate and postcranial robusticity: Implications for modern human origins and scenarios of adaptive change. Current Anthropology, 41, 569-605. doi:10.1086/317382
96.Petraglia, M. D., & Alsharekh, A. (2003). The middle paleolithic of Arabia: Implications for modern human origins, behaviouranddis-persals. Research(Online).
97.Petraglia, M. D. (2007). Middle paleolithic assemblages from the In- dian Subcontinent before and after the Toba Super-Eruption. Sci- ence, 317, 114-116. doi:10.1126/science.1141564
98.Rose, W. I., & Chesner, C. A. (1990). Worldwide dispersal of ash and gases from earth's largest known eruption: Toba, Sumatra, 75 Ka. Palaeogeography, Palaeo-Climatology, Palaeoecology, 89, 269-275. doi:10.1016/0031-0182(90)90068-I
99.Sankhyan, A. R. (1997a). Fossil clavicle of a Middle Pleistocene homi- nid from the Central Narmada Valley, India. Journal of Human Evo- lution, 32, 3-16. doi:10.1006/jhev.1996.0117
100.Sankhyan, A. R. (1997b). A new human fossil find from the Central Narmada basin and its chronology. Current Science, 73, 1110-1111.
101.Sankhyan, A. R. (2005). New fossils of Early Stone Age man from Central Narmada Valley. Current Science, 88, 704-707.
102.Sankhyan, A. R. (1999). The place of Narmada hominin in the Jigsaw puzzle of human origins. Gondwana Geological Magazine Special Publication, 4, 335-345.
103.Sankhyan, A. R. (2006). On the status of Indian hominoid and hominid fossils. In R. Ray, & V. Jayaswal (Eds.), Status of Prehistoric Studies in the 21st Century in India, Proceedingsof 15thUISPP Congress, Lisbon,BAR International Series1924(pp.13-23), Oxford: Archaeo Press.
104.Sankhyan, A. R. (2010). Pleistocene Hominins & associated findings from central Narmada Valley bearing on the evolution of man in South Asia. Ph.D. Thesis, Chandigarh: Panjab University.
105.Sankhyan, A. R. &Rao, V. R. (2007). Did ancestors of the Pygmyor Hobbit everlive in Indian heartland? In E. Indriati (Ed.), Recent ad-vances on Southeast Asian paleoanthropologyand archeology (pp. 76-89). Yogyakarta: Gadjah Mada University.
106.Sankhyan, A. R., Dewangan, L. N., Sahoo, R. H., Chakravarty, R., & Chatterjee, R. (2011). Early prehistoric signatures of man in Bastar region, Central India. Current Science, 101, 1146-1149.
107.Sonakia, A. (1984). The skullcap of Early Man and associated mam- malian fauna fromNarmadaValleyAlluvium, Hoshangabadarea,M.P.(India). RecordsGeological Survey of India, 113, 159-172.
108.Tiwari, M. P., & Bhai H. Y. (1997). Quaternary stratigraphy of the Narmada Valley. Geological Survey of India Special Publication, 46, 33-63.
109.Todd, R. Y., & Churchill, S. E. (2006). Archaic and modern human distal humeral morphology.JournalofHumanEvolution,51,603-616.doi:10.1016
110./j.jhevol.2006.07.006.
111.Trinkaus, E. (2007). Appendicular robusticity and the paleobiology of modern human emergence. Proceedings of the National Academy of Sciences of the United States of America, 94, 13367-13373. doi:10.1073/pnas.94.24.13367.