Post-Conference Excursions

25-27th February, 2016

3rd Asian NECLIME Meeting

Birbal Sahni Institute of Palaeobotany Lucknow, INDIA

Climate and sedimentation in the Indo Gangetic plain during Late Quaternary

Experts

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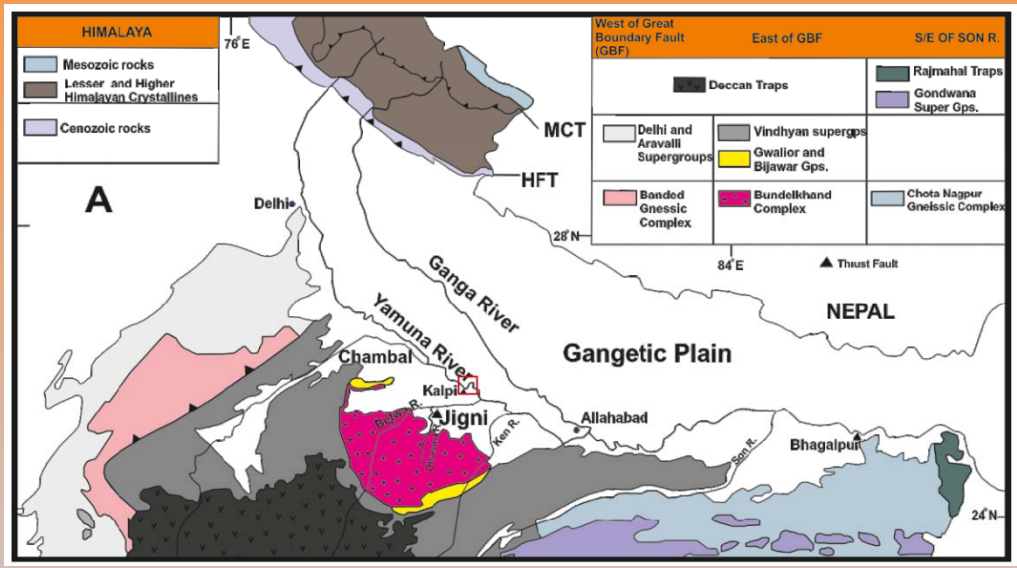
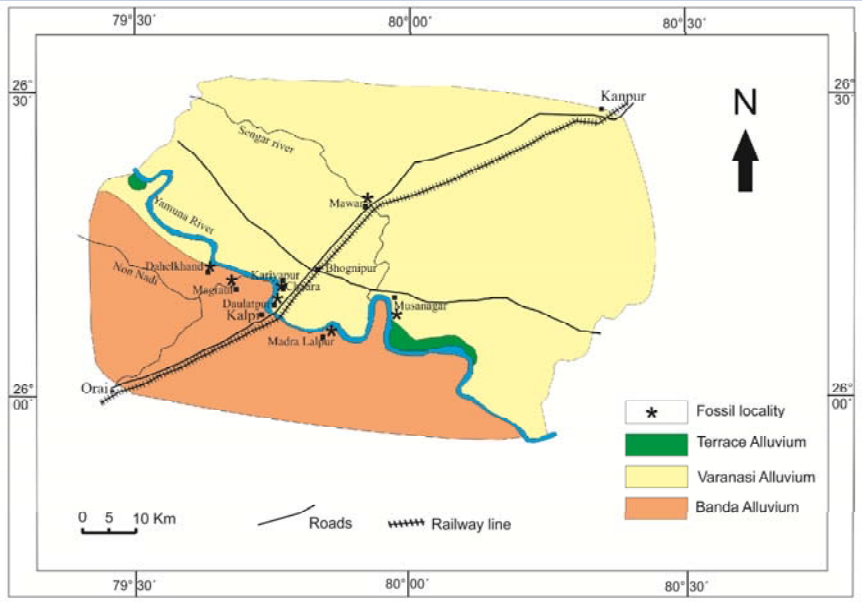
City Tour-25th February, 2016

The charming city of Lucknow is the Capital of Uttar Pradesh, one of the 29 States (Provinces) of India. The imperialistic splendour and magnificence of the Nawabi era has been glorified and eulogized down the ages by writers, poets and historians alike, but has to be seen to be believed. This city tour will take you to the Chatar Manzil, Baradari, Residency, Imambara, Bhul-bhuliya, Picture Gallery, Chota Imambara, Dilkhusha, Ambedkar Udyan. Situated in the northern part of the country, the city displays a rich heritage of education, culture, languages, monuments, cuisine, embroidery, muslins and other light fabric, gold and silver jewellery and a lot more.

Field Excursion 26th February 2016

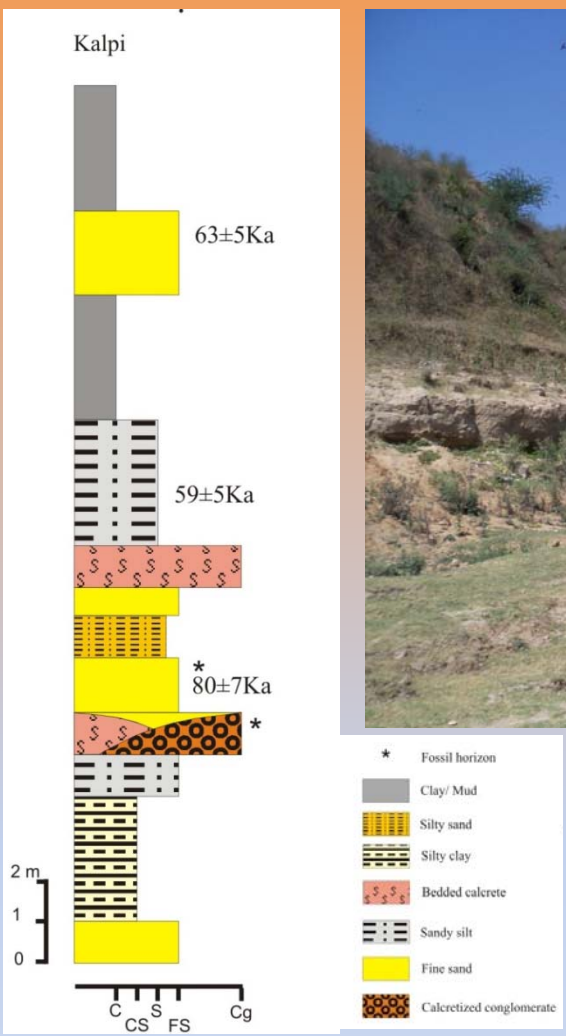


The Indo-Gangetic plain developed by two major river systems (Indus and Ganga) in the Himalayan foreland, represents one of the largest alluvial plains in the world. A number of lakes and ponds were formed in the Ganga plain due to disruption of fluvial channels around 9-8 ka responding to the tectonic activity and base-level changes (Singh, 1996, 2001).



The field field excursion is planned along the river Yamuna in the Kalpi region. The incised river and ravined nature of the region provides good 20-30 m thick exposures that archive Late Pleistocene evolution of southern Ganga plain in terms of peripheral bulge tectonics and climate change (~40ka humid climate with strong monsoon Tewari et al., 2002).

Kalpi section



21 m thick section of alternate beds of sand and silt. Bedded calcrete and conglomerate showing overlapping relationship.

Many **vertebrate fossils** including bones, tooth, scutes etc. were recovered from the study area like Daulatpur, Mangraul, Mohana and Kalpi. These vertebrate fossils were mainly recovered from Banda Alluvium. These fossils were further cleaned and processed in the laboratory followed up by the identification procedures. Fossils like **Bovid Vertebrae and calcaneum, chipped Crocodilia tooth, Cervid horn**, were identified so far.

Cervid Antler from Kalpi

*** Scale: Square represents 1 x 1 cm**

Daulatpur section

The two sections (i) Daulatpur (ii) Musanagar exhibit the basal pedogenic soil horizon followed by a craton sourced cross bedded gravelly channel bar unit. This unit yielded fossils of large mammals like *Elephas Namadicus, Bos, Sus,* crocodile, turtle. Studies on several such sections indicated a propogation of large craton derived gravelly fans towards the central part of the foreland. The fans predated the ravine formation and the arrival of the axial river Yamuna in the region. The luminescence dating of these sections suggests all happening between >100 ka and 35 ka BP.

Musanagar Section

15 m thick section composed of conglomerate, clay, sand and gritty sand.

Vertebrate fossils from Musanagar section

Hemibos sp.

Boselaphus sp.

Bos sp.

Invertebrate fossils from Musanagar section

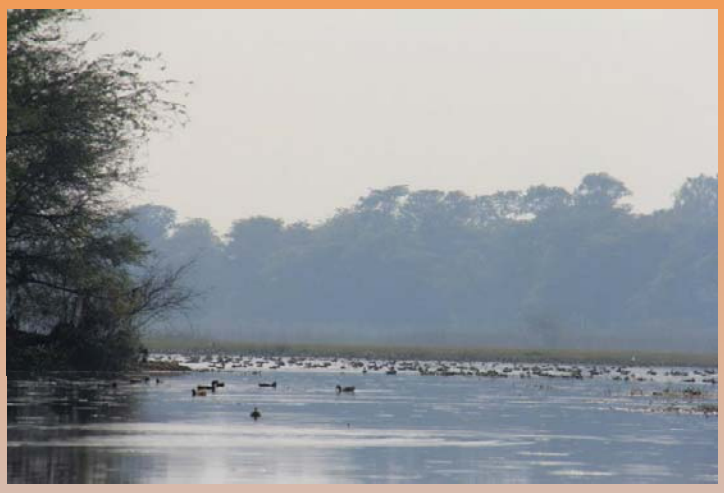
Unio sp.

Chara sp.

Field Excursion 27th February 2016

Nawabganj Bird Sanctuary, in Unnao district on the Kanpur-Lucknow highway in Uttar Pradesh, India consistis of a lake and the surrounding environment. It is one of the many wetlands of Northern India.

The field site- the Nawabganj Lake (Latitude 26.611932 and Longitude 80.655791) is situated in the central part of Indo-Gangetic plain. The abandoned channel segments are characterized by alkaline soils, lakes and ponds etc.



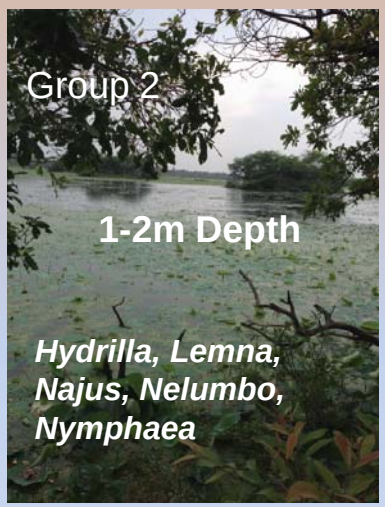
The sanctuary provides protection for 250 species of migratory birds mostly from CIS (or formerly USSR) countries, but the numbers have been dwindling since the 1990s, most having relocated to newer areas in Himachal and Rajasthan. About more than 250 migratory birds flock this area every year from northern higher latitudes and remain here from November to March. The sanctuary also houses a deer park, watchtowers and boats.

The climate here is extreme winters and summers with annual winter temperature dipping to ~7ºC and summer temperatures rising up to ~45 ºC. Most of the rainfall is during South West Monsoon followed by winter monsoon for a short duration. As a result, the study area falls under high seasonality zone and the vegetation is dry deciduous to moist deciduous type.

Some Case Studies of Nawabganj, Unnao District

Surface sediment samples : Diatoms, pollen/spores, thecamoebians

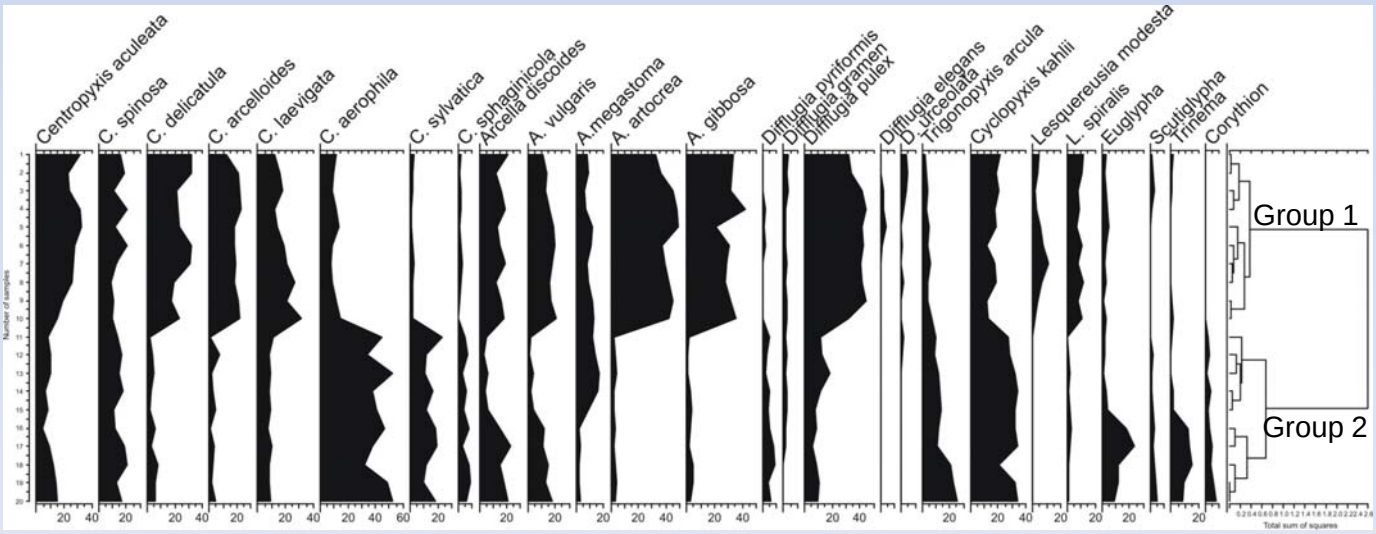
Very low pollen assemblage, high diversity of thecamoebians and diatoms



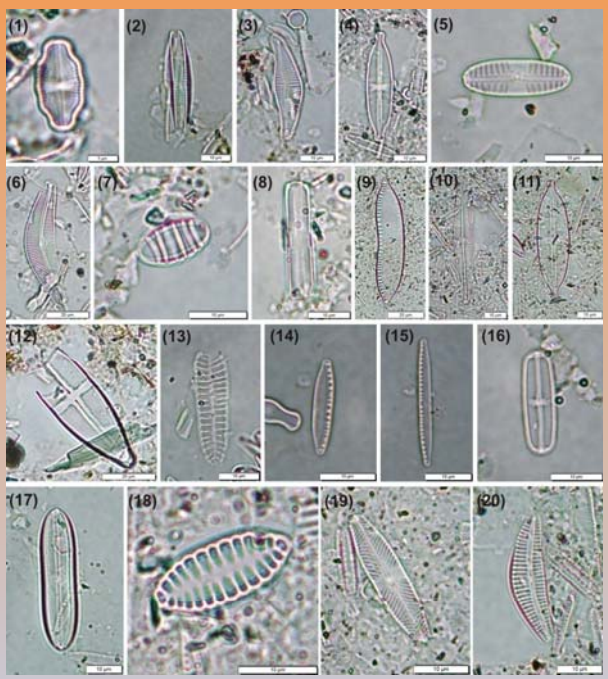
The water depth in the lake varies from 50 cm in the peripheral area to more than a meter in the deepest part. In between the lake are the vegetated highlands, some of which are made artificially for the protection of migratory birds. The common aquatic weeds present in the Nawabganj lake are *Ceratophyllum, Chara, Eichhornia, Hydrilla, Lemna, Najus, Nelumbo, Nymphaea, Pistia, Polygonum, Potamogeton, Sagittaria, Spirodella, Vallisneria*, *Wolffia etc.*

Marginal weeds are *Typha, Brachiaria, Scirpus* etc. The sediment profile beneath the lake and surrounding areas show calcium–rich duricrust (50-100cm thick layer) commonly known as Calcrete at 1-2m depth. The Calcrete is formed as a result of climatic fluctuations in arid and semi-arid regions. The lake originated by the abandoned river channel (Sai River) in the Gangetic plain during Holocene.

Thecamoebian Community 26 species recorded

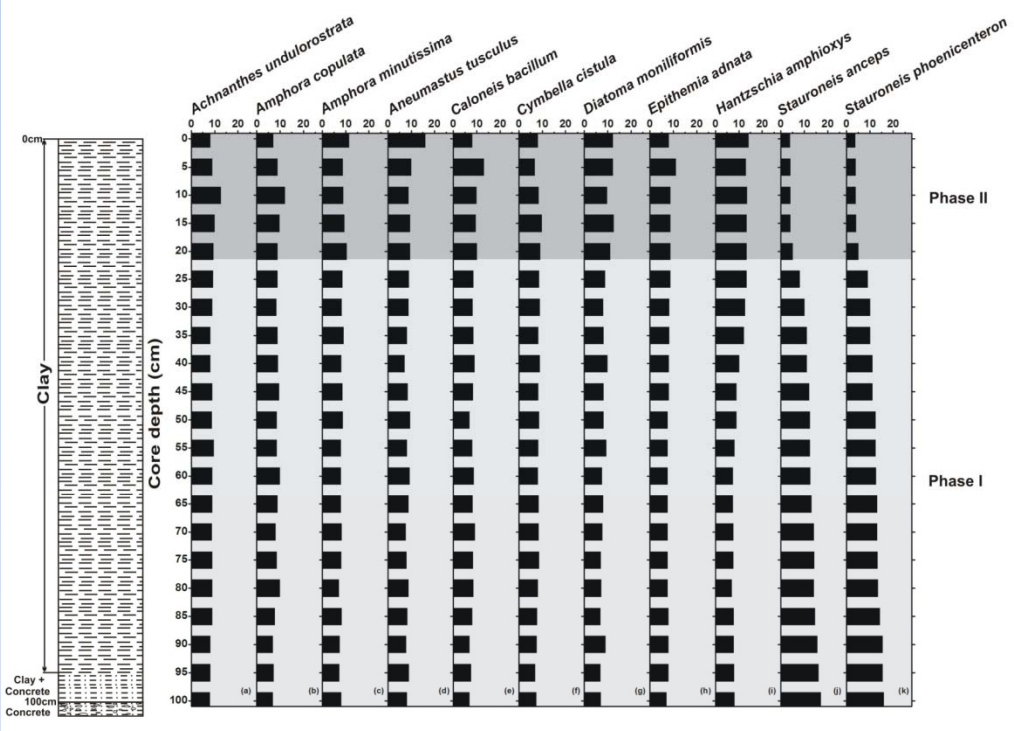


Predominance of freshwater Benthic diatom species from Nawabganj Lake (1 m trench)



1. *Achnanthes undulorostrata* Lowe and Sherwood
2. *Amphora copulata* (Kützing) Schoeman and Archibald
3. *Amphora minutissima* W.Smith
4. *Aneumastus tusculus* (C.G. Ehrenberg) Mann & Stickle (= Navicula tuscula)
5. *Caloneis bacillum* (Grunow) Cleve
6. *Cymbella cistula* (Ehrenberg) Kirchner
7. *Diatoma moniliformis* (Kützing) D.M.Williams
8. *Epithemia adnata* (Kützing) Brébisson
9. *Hantzschia amphioxys* (Ehrenberg) Grunow
10. *Navicula pseudolanceolata* Lange-Bertalot
11. *Stauroneis anceps* (Ehrenberg)
12. *Stauroneis phoenicenteron* (Nitzsch) Ehrenberg
13. *Surirella minuta* Brebisson ex Kützing
14. *Nitzschia fonticola* (Grunow) Grunow
15. *Nitzschia* sp.
16. *Sellaphora* sp.
17. Unidentified sp.
18. *Surirella angusta* Kützing
19. *Sellaphora rexii* Potapova & Ponader
20. *Cymbella affinis* Kützing

Downcore Quantitative abundances of diatoms



- Predominance of Benthic diatom species (complete absence of planktonic diatom species).
- *Hantzschia amphioxys*, a terrestrial species is much greater in the recent past (Phase II).
- Cold water species (*Stauroneis phoenicenteron*) abundances declined from past to present.
- Overall, productivity was greater in the past compared to the recent time period.

Reference: Singh, 1996, 2001; Tewari et al., 2002; GSI collaboration and *internet*