Core Archive and Analysis Facility

Indian Institute of Technology Kanpur

Supported by
Science of Shallow Sub-surface (SSS) Programme
Department of Science and Technology
Government of India, New Delhi

Preamble and Background

The **Core Archive and Analysis Facility** at **IIT Kanpur** has been set up as a part of the **Science of Shallow Sub-surface (SSS)** programme supported by the Department of Science and Technology, Government of India. The SSS programme intends to promote research in the area of **Earth and Environmental Science** through funding of projects. The SSS programme recognizes that major floodplain and delta areas of the country should be studied on a priority basis. Accordingly, four major corridors have been selected for this program. They include Ganga corridor, Cauvery corridor, Brahmaputra corridor and Gujarat corridor.

The main objectives of the Core Archive and Analysis Facility at IIT Kanpur are to archive the drill cores, preserve and log them and to make them available for further studies to the researchers across the country. The primary focus is to develop a data-base for the shallow subsurface zone of the Ganga plains. Major applications of such a data base include:

- Evaluation of natural resources viz. water, food, fuel, and minerals.
- Response of river system to long-term climate changes.
- Infrastructure development e.g. roads, tunnels, dams, industries.
- Location of waste disposal sites – municipal, industrial, mining, nuclear.
- Groundwater and soil contamination.
- Ground response to natural hazards.
- Archaeology.
- Lithosphere-biosphere interaction.

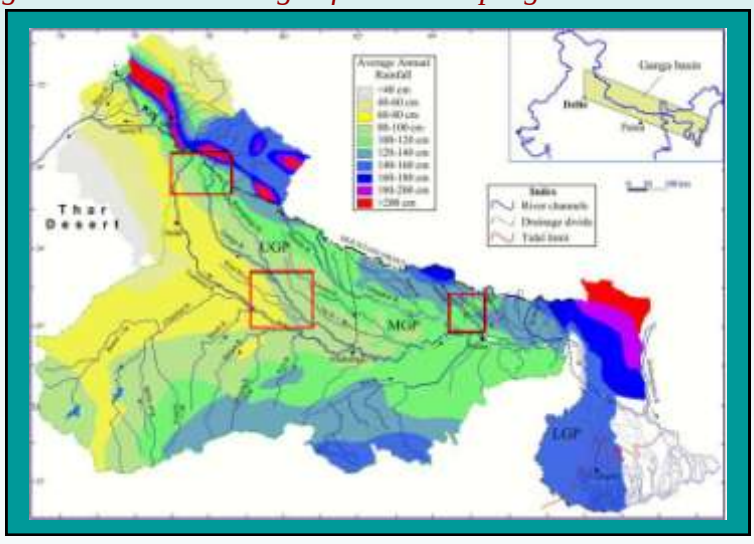
The Ganga Plains, one of the key corridors of the SSS programme, constitute one of the world's most extensive alluvial tracts and are home to hundreds of millions of people, mostly dependent on agriculture. The Ganga plains are of great significance from an academic standpoint, as they hold important clues regarding the tectonic and climatic factors that govern the interaction between the Himalayan Orogen and the Foreland. Understanding the landforms of the Ganga Plains - their origin, development and dynamic imprints - is therefore of critical significance to plan effectively for sustainable development of the region and to track changes in the alluvial landscape on different time scales, for example, decadal, century, millennial and higher order time scales of 10^4 – 10^5 years.

The general non-availability of sub-surface geological data and drill cores has been a serious impediment on advancing our understanding of the history of alluvial plain sedimentation. The projects funded under the SSS programme have provided a major impetus to fill these gaps. Keeping in view the considerable geomorphic diversity across the Ganga plains, particularly from the Himalayan mountain front to the cratonic margin and also in an W-E transect, alluvial stratigraphic development in the Ganga plains is being studied in three important windows.

- *Mountain Exits of the Ganga River*
- *Ganga-Yamuna interfluves in western Ganga plains*
- *Gandak mega fan in the eastern Ganga plains.*

The specific research objectives for the Ganga corridor as envisaged for the SSS programme are:

- *To understand the evolutionary history of the mountain exits of the Ganga river system.*
- *To understand the stratigraphic framework and stratal architecture in the wide interfluve of the Ganga and Yamuna rivers.*
- *To understand the surface processes, sub-surface properties and their dynamics in an extensively used floodplain.*
- *To generate proxies for understanding the response of the Ganga river system to long-term climate change.*



Facilities

CORE ARCHIVE

The main core archive has been built with an area of 32.5 m^2 and is currently housing about 600 meters of cores at room temperature. As and when more cores arrive, the storage capacity can be increased by additional stacks .

COLD ROOM (Blue Star, BSL-52)

New cores are being archived in a cold room which has two components. The larger part has a dimension of 9'-8" x 9'-8" x 8' and maintains a temperature of +5 °C. A smaller and independent part with a dimension of 5'-10" x 9'-8" x 8'-10.25" maintains a temperature of -18 °C . **Stainless steel racks** are used to keep the cores inside the cold room .

CORE ANALYSIS LAB

- **Drill core scanner** (GF Instruments, DCS-1) which is used for continuous measurement of gamma-ray activity (energy range to 3MeV), concentrations of K, U, Th and magnetic susceptibility (sensitivity 1x 10^{-5} SI units) of drill cores.
- **Core splitter** (Newton) uses a motorized blade to split the cores into two halves to facilitate logging and sampling.
- **Core logging** facility is provided with proper lighting arrangements with an enlarger and all necessary accessories for sedimentological description.

Facilities

SEDIMENTOLOGY LAB

- Sediment dispersion and mixing unit
- High temperature furnace
- Rotary flask shaker
- Low temperature oven and drier
- Thin section preparation unit
- Clay mineralogy sample preparation setup
- Distillation unit

WET LAB

- **pH/conductivity/ion analyzer** (Eutech Instruments, CyberScan PC 5500)
- **Spectrophotometer** (Systronics 106)
- **Digital flame photometer** (Elico, CL-360 for Na & K)

MICROSCOPY & ENVIRONMENTAL MAGNETISM LAB

- **Stereozoom microscope** (Nikon, SMZ1000)
- **Petrological microscope**
- **Image analysis system** (Leica)
- **Vibrating sample magnetometer** (VSM)- Central facility, located in Advanced Centre for materials Science
- **Magnetic susceptibility meter** (Bartington)

PARTICIPATING INSTITUTIONS

Banaras Hindu University, Varanasi (BHU)

Indian Institute of Technology, Kanpur (IITK)

Lucknow University, Lucknow (LU)

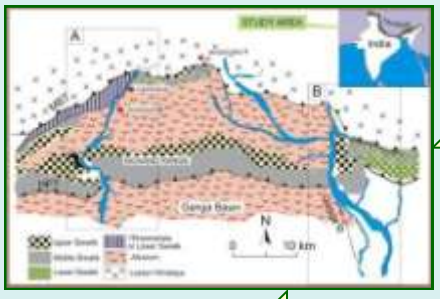
National Bureau of Soil Survey and Landuse Planning, Nagpur (NBSS LUP)

National Geophysical Research Institute, Hyderabad (NGRI)

University of Delhi, Delhi (DU)

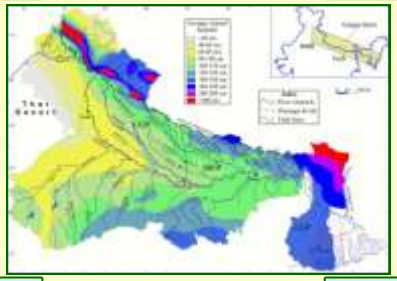
Wadia Institute of Himalayan Geology, Dehradun (WIHG)

LINKED RESEARCH PROJECTS



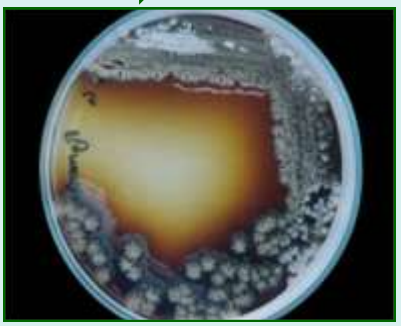
Quaternary Tectono-climatic records of the Ganga basin in the Mountain exits of Himalaya: An Integrated Approach (WIHG, NGRI)

Interfluve stratigraphy, sedimentology and geochemistry of the central and southern Ganga plains.(IITK,NB SSLUP, DU)



Studies on the microbial populations present in the vadose zone in the Kanpur area of the Indo-Gangetic plains. (IITK)

Fluvial dynamics and sub-surface stratigraphy of Gandak megafan. (LU)

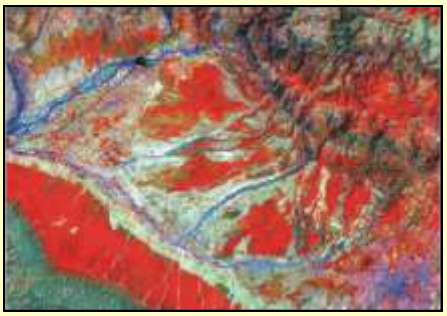


MULTIPLIER EFFECTS
(Collaborations)

River dynamics and hazard assessment in the Himalayan foreland (UKEIRI)

Department of Geography, University of Durham, UK

AIM: To generate a coherent overview of river response to base level change across the Himalayan foreland region, as well as an integrated regional hazard assessment that links upstream river basin conditions and mass movement potential with downstream flooding .



Sub-surface stratigraphy of the Ghaggar plains: linkage of landscape evolution and cultural heritage

Faculty of Earth Science and Engineering, Imperial College, London (UK)

AIM: To generate the sub-surface data on the buried channel belt of the ancient Saraswati through resistivity surveys and sediment coring and to understand the linkage between climate change and river evolution.

Late Quaternary environmental changes in western Haryana plains interpreted through lake deposits.

Department of Archaeology, University of Cambridge.

AIM: To reconstruct high resolution climatic events and to link these to the disappearance of one of the most advanced ancient civilizations in the world- the Harappa civilization.

Reconstruction Of Monsoonal Rainfall From Late Quaternary Ganga and Yamuna Alluvial Plain By Stable Isotope Traces: Implication To Climate Forcing On Vegetation And Response (DST)

Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur

AIM: To analyze stable isotope composition of carbonates and clay minerals for sediment core samples for paleomonsoon reconstruction and for understanding the vegetation and river response to climatic forcing.

Provenance determination and erosional history of the hinterland using Isotopic studies.

Earth Science Division, Physical Research Laboratory, Ahemedabad.

AIM: To analyze the cores for Sr isotope and stable isotopes to understand provenance variability as a function of climatic change to generate proxy records for climate change and provenance variability.

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(URL: http://www.iitk.ac.in/nfca)

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Designed by: Shikha