WSAIF

Wadia-Sophisticated Analytical Instrument Facilities

WADIA INSTITUTE OF HIMALAYAN GEOLOGY

(An Autonomous Institute of Department of Science and Technology, Govt. of India)

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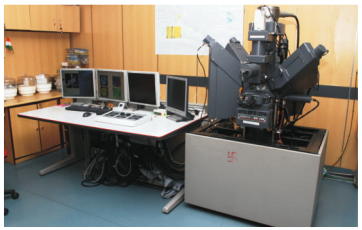
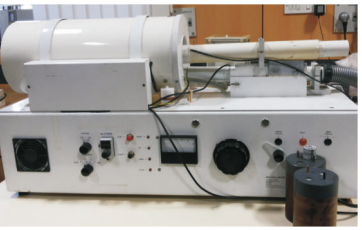
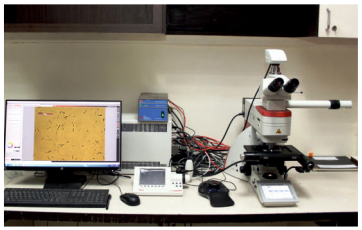
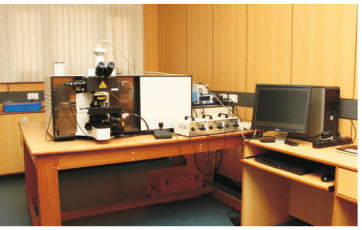
Uttrarakhand (India)









PROFILE

Wadia Sophisticated Analytical Instrument Facilities (WSAIF) is a core research division of the Wadia Institute of Himalayan Geology (WIHG) that provides professional and world-class analytical services.

The state-of-the-art sophisticated analytical laboratories strongly substantiate the field data for understanding the geodynamic evolution of the Himalaya, geological surface processes such as landslides, avalanches, cloud bursts and extreme events, and to characterize and mitigate natural geohazards. Additionally, the sub-surface processes such as earthquakes, crustal hetero-geneities, elastic strain and convergent rate, crustal and mantle interaction are probed by profound geophysical instrumentation and modern analytical techniques. Besides adding significance to the knowledge base, the Institute also provides geoscience support to other government agencies and stakeholders. WSAIF also caters to the analytical facilities of various universities, IIT's, IISER, and other state and central government organizations.

Scanning Electron Microscope (SEM) using Energy dispersive X-Rays (EDX)

Provides High spatial resolution images to study the finer details of tiny objects (like mineral grain and fossils etc.) and in-situ chemical composition. The instrument has the capability to magnify specimens up to 10, 00,000 times. The Secondary Electron Images better visualize small objects and their surface topography. While Back Scatter Electron images offer compositional and phase contrast images.

X-Ray Fluorescence (XRF) Spectrometer

Provides Quantitative analyses for chemical compositions of Major/Trace elements, using pressed pellets made up of rock powder.

Elements, routinely determined as weight % oxide in geological matrices, are SiO_2, TiO_2 , Al_2O_3 , Fe_2O_3 (total), MnO, MgO, CaO, Na_2O, K_2O, and P_2O_5 Trace elements such as Ba, Sc, V, Cr, Co, Ni, Cu, Zn, Ga, Pb, Th, Rb, U, Sr, Y, Zr and Nb are measured routinely.

Quadrapole-Inductively Coupled Plasma Mass Spectrometer (Q-ICPMS)

Provides Quantitative analyses for chemical compositions of REEs/Trace elements in parts per billion (ppb) level using processed powdered samples (Rocks, Soils, Sediments etc. ~2 g; 200 Mesh size).

The technique is being used for elemental analysis of rocks, ores, minerals, water, environmental samples at ppb level.

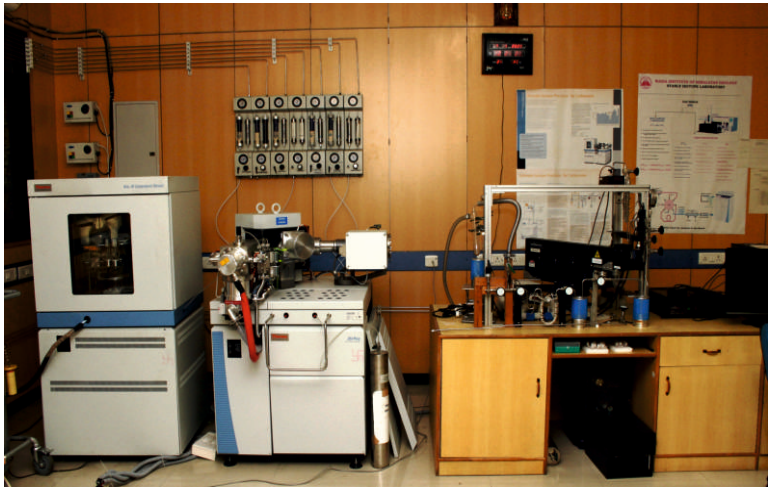
Water Chemistry Lab: Ion-Chromatograph & Auto Titrator, Bacteriological Analysis

This is state-of-the-art laboratory and fully dedicated to snow and water chemistry for environmental studies, chemical weathering of rocks, and water quality in natural water (Snow/Ice/Geothermal/Riverine/ Groundwater). The lab is equipped with the following instruments.

1. Ion chromatograph (ICS-5000, dual-mode), Thermofisher Scientific for the analysis of major ions in water.
2. Ultrapure Water Purification System (Millipore).
3. Laser water Isotope Analyzer for stable isotopes of hydrogen and oxygen in natural waters.
4. Portable Water Analysis Kit for physical parameters such as temperature, pH, Conductivity, TDS and DO (HACCH) make.
5. Autotitrator (Metrohm).

Stable Isotope Lab
Isotope Ratio Mass Spectrometer (IRMS)

Determines Isotope ratios, mainly $\delta^{13}C$, $\delta^{18}O$, δD & ^{17}O- in natural waters, $\delta^{13}C$, $\delta^{18}O$ in mineral, sediments and fossils (Foraminifera, Gastropods and Speleotherms etc.)



Laser Ablation-Multi Collector- Inductively Coupled Plasma Mass Spectrometer (LA-MC-ICPMS)

Laser Ablation Mode, mainly dedicated to determine accurate measurement of U-Pb/-Th radiometric dating of Zircons Apatite, Monazite separated from rocks and sediments.

Solution mode has capabilities to determine the isotopic ratio measurements from elements (Lithium to Uranium). It accurately measures the significant isotopic ratio $^{87}Sr/^{86}Sr$, $^{43}Nd/^{144}Nd$, and $\delta^{7}Li$.


Utility of tree rings in
ACKNOWLEDGEMENT

Thermo Luminescence (TL) & Optically Stimulated Luminescence (OSL) Lab

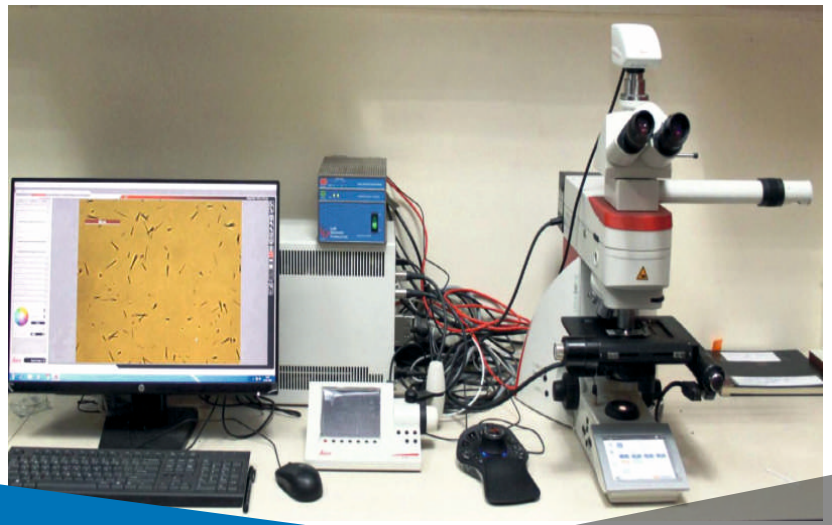
Fully dedicated for dating of Late Quarternary (age ranges from 0 to 150 000 years) samples, mainly used for

- the most recent sun bleaching (application in sediment dating)
- the most recent thermal event (application in archaeology, baking by lava flows, fusion crust of meteorites)
- crystallization event (application in travertine's in caves)

Fission Track Dating

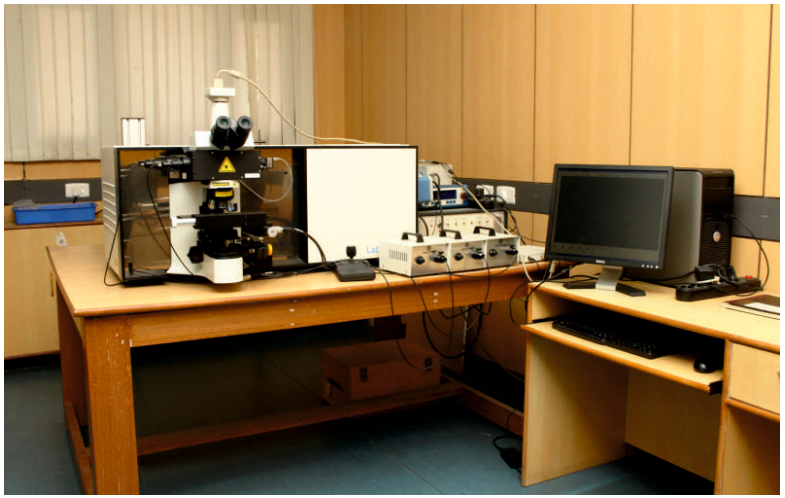
Apatite fission track dating is widely used for reconstruction of low temperature (<300°C) thermal histories in upper crustal rocks.

This technique provides constraints on denudation, landscape evolution and tectonic history of different geological terrains such as the orogenic belts, rifted margins and more stable areas.



Mineral Separation Lab

Mineral Separation Lab is a world-class facility for the separation of various minerals from rock/sand samples. Lab follows the international standard procedures like rock crushing and powdering, gravity separation using Wilfely Table, heavy-liquid separation, magnetic separation using Magnetic Barrier Separation, and picking of grains under stereo zoom microscope for geochronology and thermochronological research. The lab is providing services to various institutes/universities throughout India.



Fluid Inclusion and Raman Spectroscopy Lab

Provides physical characterization and genetic information of volatiles (Liquid, Gas, and Solid-Salt) trapped in the thin rock wafers and grains.

Raman Spectrometry is used for determining the incipient mineral phases and structural deformity, arrested in the mineral. Laser Raman has capabilities to retrieve various information from minute solid, liquid and gas phases available within the geological entities.

Total Organic Carbon (TOC) Lab

The primary function of the Total Organic Carbon Analyzer TOC-LCPH (Make: Shimadzu, Japan) with an Auto Sampler (ASI) and semi-automatic Solid Sample Module (SSM-5000A) is to measure the concentrations of Total Carbon (TC), Inorganic Carbon (IC), and Total Organic Carbon (TOC) in solid and liquid samples. These concentrations are extensively utilized in geological sciences, environmental sciences, agricultural sciences, etc.

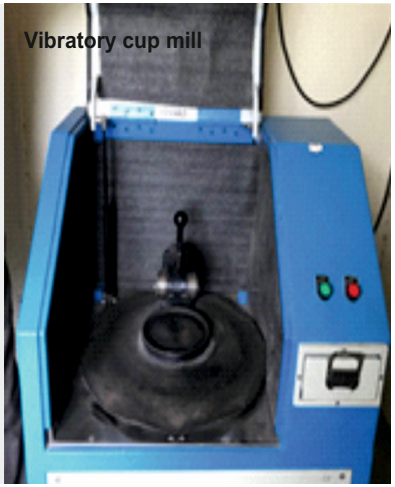
Paleomagnetic Lab

The MMVFTB (E)/Peterson Instruments, Germany and Magnetic measurements, UK are used to study the palaeomagnetic and magnetic properties of geological Samples.


KEEP SILENCE
VISITORS
SIGNATURE

Thin Section Preparation & Crushing/ Powdering Facility

Provides thin sections petrography slides for structural geological, EPMA mineral chemistry, fluid inclusion studies as well as mineral slides for Raman Spectrometry, geochronological and thermochronological applications. It also provides service for powdering of samples for XRF and ICPMS studies.

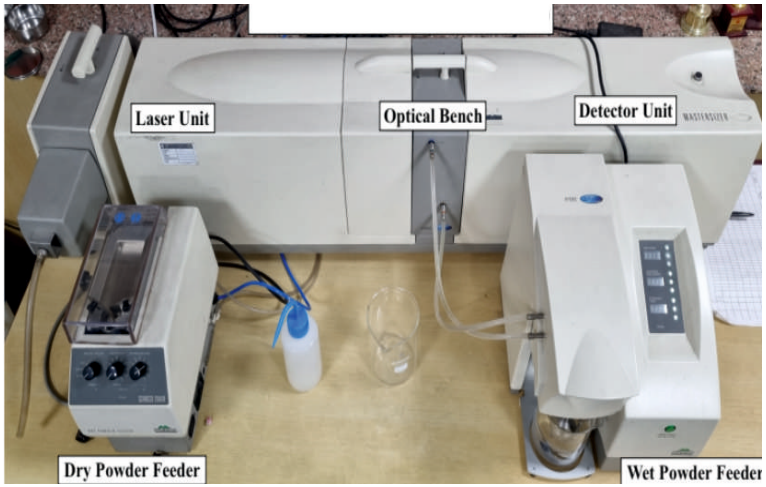


Sedimentology Lab

Laser Particle size analyzer & Vibratory sieve shaker

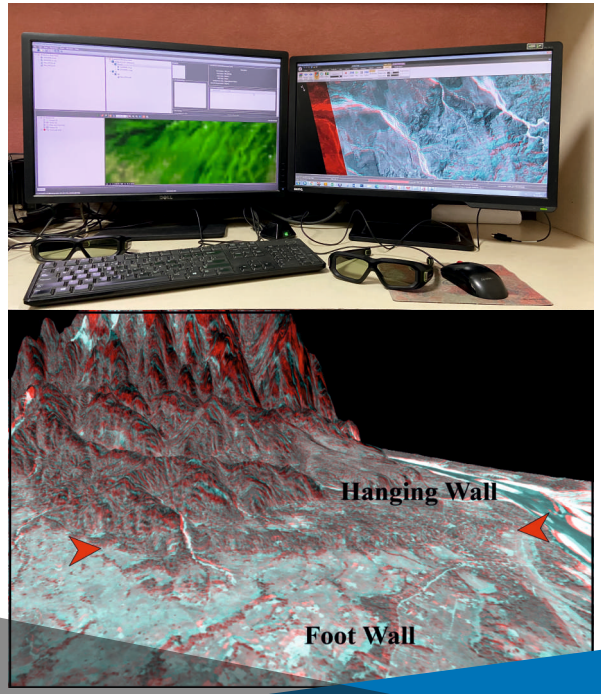
Used for analyses of sediments (0.100 to 1000.000 µm) for their size distribution sieving of sediment & Preparation of clay slide.

Laser diffraction particle size analyzers are used to measure the sizes of particles in a material by measuring the angle of light scattered by the particles as they pass through a laser beam.



Geotechnical Lab

This lab is used to measure the strength characteristics of rocks and soils needed for the infrastructure development and mitigation of mass movement activities in the Himalaya.



Paleoseismology and Active Tectonics Laboratory

The laboratory examines the geologically recent motions of the Earth's crust, particularly those produced by earthquakes, with the aim of understanding the physics of earthquake recurrence, the growth of mountains, and the seismic hazard embodied in these processes. The main purpose is to increase understanding of the region's tectonic and seismic behavior, to identify signs of previous earthquakes, their size, their recurrence, and their potential for destruction, as a basis for more reliable forecasting. The lab is equipped with high-end workstations with 3D visualization to critically examine the earthquake induced Landforms.

Seismic Interpretation Laboratory

Seismic is the most suited geophysical tool that provides accurate information on subsurface geological features/ properties from surface measurements. The Seismic Interpretation Laboratory (SIL) is a new initiative by WIHG that aims for the interpretation of high resolution seismic data to understand the subsurface tectonics and geological processes in the NE and NW Himalayas and adjoining regions. The SIL is equipped with high-end workstations, software and visualization facilities that enable researchers and students to critically look into seismic data for the investigation of subsurface complexities in the Himalayan terrain.

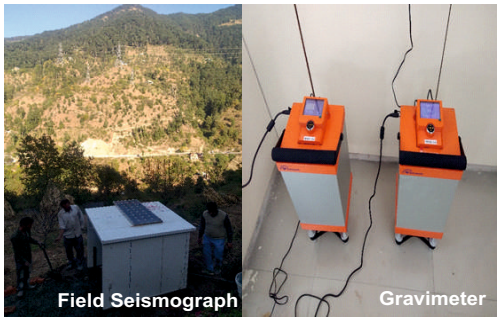
Isotopic Characterization

Isotopic study characterizes different components of the stream flow, it manifests percentage contribution of snow and ice melt in the meltwater. The laser based technique has unique capabilities to capture the isotopic signatures of sensitive components and accurately monitor the source of the moisture.

ONSITE FIELD INSTRUMENTS

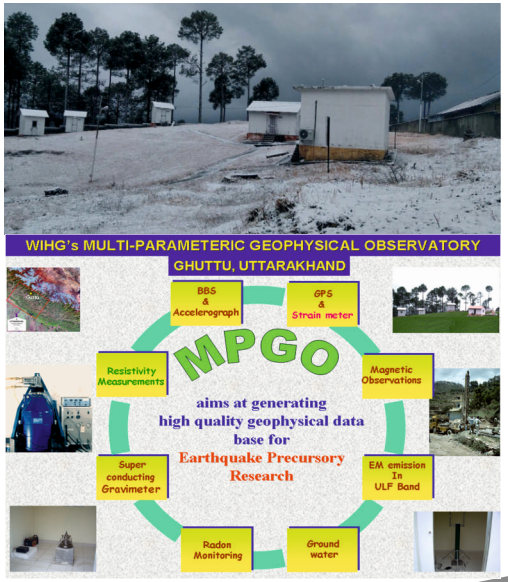
Seismic Network

During the last 4 decades, WIHG spread a network of seismometers over the large part of the Himalaya and characterized the seismicity pattern. Presently, 70 Broadband seismographs and 16 accelerograph stations are operational at Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Ladakh, and Arunachal Pradesh for monitoring seismic activity, seismic source characterization, investigation of sub-surface lithosphere structures, and assessment of seismic hazards.



Multi-Parametric Geophysical Observatory (MPGO)

India's 1st MPGO is stationed at Ghuttu Garwal Himalaya, situated at the south of Main Central Thrust (MCT). Its main objective is to generate high-resolution geophysical time series data for the detection of earthquake precursors to understand the genesis of big earthquakes in the central Himalaya. This observatory hosts Superconducting Gravimeter, Broadband Seismograph, Accelerograph, Overhauser and Fluxgate magnetometer, ULF band induction coil magnetometer, GPS, radon, and water-level recorders. The MPGO records precursory signals resulting from stress-induced changes in density, magnetization, resistivity, seismic wave velocity, fracture propagation, crustal deformation, electromagnetic and radon gas emission as well as fluctuations in hydrological parameters.



GPS and Gravity

GPS is used in understanding the creeping movement of the Earth and crustal deformation, and play an important role to monitor the pattern of elastic strain accumulation in the Himalayan belt. WIHG is monitoring a network of permanent GPS stations in Delhi, Dehradun (WIHG), Ghuttu, Badrinath, Bhatwari, Pithoragarh, Haridwar, Munsiyari, Biharigarh, Nahan, Naddi, and Kothi in NW Himalaya and Panamik and Tangtse in Ladakh Himalaya.

The Gravimeter assists in interpreting the relationship between the topography and gravity anomalies in the Himalayan terrain. The measurements provide an estimate of buoyancy and the mechanical strength of the lithosphere bearing the topographic load.

Magnetotellurics (MT)

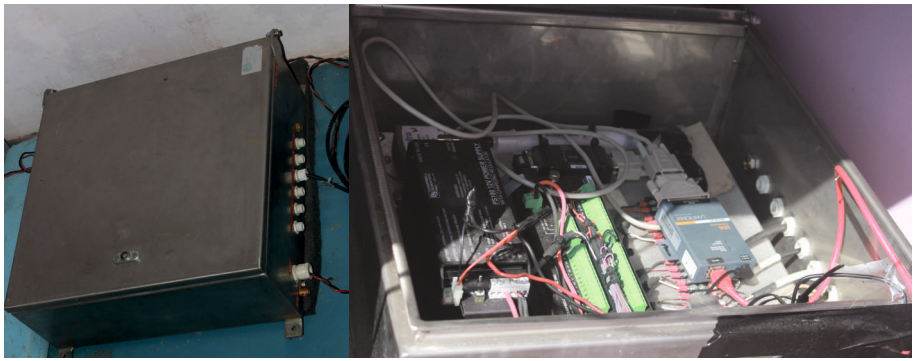
MT investigations employ natural magnetic and electric fields for the interpretation of resistivity structure of the Earth's subsurface. The study helps in delineating the geometry of Main Himalayan Thrust (MHT) and presence of Fluids for understanding the seismogenesis of the Himalaya.

Superconducting Gravimeter (SG)

SG provides temporal variation in gravity with high accuracy to sub microGal at a Sampling Rate of 1 SPS. Continuous measurement of gravity is used for the study of Tidal analysis, Co-seismic changes, Free Earth Oscillation, Mass drifting, etc.

Radon meter

PM-11 detector, installed at MPGO Ghuttu, is a gamma spectrometer that records Radon (Rn222) in soil and groundwater. The data is helpful for pre-seismic observation for understanding the occurrence of an earthquake.



Monitoring of Himalayan Glaciers

WIHG began monitoring of Chhota Shigri Glacier in Lahaul and Spiti through multi-disciplinary and multi-institutional expeditions during 1986-1989, while Dokriani and Chorabari glaciers in Garhwal Himalaya have been monitored for glacier dynamics and hydrological research since 1991 and 2003, respectively. Presently, ten (10) glaciers are being monitored by WIHG and some are developed as flagship research stations for long-term measurement of high-quality research on mass balance, flow dynamics, snout retreat, mountain meteorology, glacial hydrology, sediment transfer, and stable isotopic studies.

Meteorological Observations

A network of Automatic Weather Stations (AWS) has been established at 2500 m above sea level (asl) for acquiring meteorological data continuously throughout the year and a long-term database is being prepared to comprehend the effects of climate change. Some conventional meteorological observatories have also been established as per the norms of India Meteorological Department (IMD).

Hydrological Observations

An accurate measurement and assessment of total glacier melt discharge and its spatio-temporal distribution are of vital importance for planning and management of water resources that include flood forecasting, reservoir operation and design of hydraulic structure. To meet these objectives, temporary gauging sites have been established near the snout of Dokriani, Chorabari, Gangotri and Dunagiri-Bangni glaciers for long term hydrological observations using non- contact Automatic Water Level Recorders.

CONTACT

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