Infinite Diversity

INQUA CONGRESS 2023-INDIA

गिरयस्ते पर्वता हिमवन्तोऽरण्यं ते पृथिवि स्योनमस्तु ।

बभ्रुं कृष्णां रोहिणीं विश्वरूपां ध्रुवां भूमिं पृथिवीमिन्द्रगुप्ताम् ।

अजीतेऽहतो अक्षतोऽध्यष्ठां पृथिवीमहम्

O *Prithvi* (Earth in Sanskrit), auspicious be thy woodlands, auspicious be thy hills and snow-clad mountains. Unslain, unwounded, unsubdued, I have set foot upon the Earth, on earth brown, black, ruddy and every-coloured, on the firm earth that Indra guards against danger.

Artharaveda 12,1,11

Theme

New paradigms of Quaternary for global well-being and sustainability

Venue: Indira Gandhi Pratishthan, Lucknow
Date: 20-26 February, 2023

Invitation by

Birbal Sahni Institute of Palaeosciences

Wadia Institute of Himalayan Geology

National Institute of Oceanography

सत्यमेव जयते
Department of Science and Technology (DST)
DST

सत्यमेव जयते
Ministry of Earth Sciences
Government of India

Overview

India takes great pride and pleasure in inviting INQUA-2023 to the Subcontinent.

The Indian Subcontinent offers exciting geology for Quaternary scientists of every discipline. The region is a Geologists' paradise, with varying sized lakes of nearly all types; a long and varied coastline; exuberant rivers and confluences; large river basins and youthful landforms; extensive deltas and fans; hot and cold deserts; hot springs and waterfalls; hills touching the skies and seemingly bottomless valleys. This region exclusively hosts the Indian Summer Monsoon which modulates global climate due to its large heat contribution to the upper troposphere. Further, the Northern parts receive precipitation from a completely contrasting system of Westerlies feeding the Himalayan glaciers. It is a place where varied impacts of climatic and geodynamic changes are visible both in their amplitude and magnitude, and with unparallel human dimensions. Its ancient civilization and culture reflect its rare geological riches in the entire span of Quaternary Period and also back in time. Intelligent use of Earth resources by early cultures is evident everywhere, be it water harvesting or efficient use of resources and fine traditions of art. This ancient land is steeped in culture and tradition which blends together with the environment while exhibiting vibrant colours, celebrating numerous festivals and exhilarating cuisine. We offer a study in contrast with facets that to a discerning observer would range from metaphysical to physical. Every State and Union Territory of our country offers you something splendid in the field of Quaternary Sciences.

The congress will be held in the city of Lucknow, the capital of Uttar Pradesh, the most populous country subdivision in the world. This city is known for its charm and imperialistic magnificence, which is glorified and eulogized through the ages by writers, poets and historians alike. Apart from this, Lucknow displays a rich heritage of education, fine & performing arts, culture, languages, monuments, cuisine, handicrafts and a lot more.

Besides the details of our invitation, this document presents a glimpse of the Quaternary sites of our country to entice the International fraternity. We hope to welcome you to India to explore its Quaternary geosciences via its historical and cultural marvels and in the process become a partner in our journey to global well-being and sustainability.

The choice is yours and the honour and pleasure of hosting you will be ours!

Contents

Messages

प्रो. अजय के. सूद
अध्यक्ष
Prof. Ajay K. Sood
President

भारतीय राष्ट्रीय विज्ञान अकादमी
बहादुर शाह ज़फर मार्ग, नई दिल्ली-110002
INDIAN NATIONAL SCIENCE ACADEMY
Bahadur Shah Zafar Marg, New Delhi-110002

No.Pr/INSA/2019
27 March 2019

Prof. Allan Ashworth,
President
INQUA
Allan.ashworth@ndsu.ed

Dear Professor Ashworth,

The Indian National Science Academy, the Adhering Member of IUGS-INQUA will be pleased to extend a cordial invitation to the INQUA Commission to hold the 2023 Session of INQUA in India. We are well equipped to host such an event, both materially and academically. India has a rich geological heritage showcasing various aspects of the Quaternary Period with the IUGS approved Meghalayan Stage occupying the youngest space in the global stratigraphic column. With next INQUA convention in India, Quaternary scientists, from all over the world will be able to perceive, understand and physically touch the grounds on which many concepts of Quaternary science are formally based. Members of the Indian National Committee for INQUA and many Indian scientists from the academia and government have been actively participating in on-going activities of this organization with one of its member serving the commission as a Vice President . It will be refreshing if you allow us to submit a bid for organizing this Congress at some suitable venue in India.

With best regards

(A K. Sood)

❑ टेलीफ़ोन / Tel. : +91-11-2323 5865 (Dir), 2323 5153, 2322 1931 - 2322 1950 ❑ (ई. पी. ए. बी. एक्स./EPABX)
❑ फैक्स / Fax : +91-11-2323 1095, 23235648 ❑ ई-मेल / Email : president@insa.nic.in, esoffice@insa.nic.in
विज्ञान वर्ष प्रोफ़ेसर, भौतिकी विभाग, भारतीय विज्ञान संस्थान, बेंगलुरू - 560 012 भारत
Year of Science Professor, Department of Physics, Indian Institute of Science, Bengaluru-560 012, India
❑ टेलीफ़ोन/ Tel. : +91-80-23602238, 22932964 ❑ फैक्स / Fax : +91-80-23602602
❑ ई-मेल / E-mail : asood@physics.iisc.ernet.in, asood1951@gmail.com

सत्यमेव जयते
प्रो. आशुतोष शर्मा
Prof. Ashutosh Sharma

स्वच्छ भारत
एक कदम स्वच्छता की ओर

सचिव
भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
विज्ञान और प्रौद्योगिकी विभाग
Secretary
Government of India
Ministry of Science and Technology
Department of Science and Technology

22nd February, 2019

It gives me an immense pleasure to learn that Quaternary researchers in India are getting together to bid for organizing the 21st Congress of the International Union for Quaternary Research (INQUA) 2023 that aims to provide a platform for world Quaternary researchers and also apprise them of work potentials in this field of research in the Indian sub-continent. Considered deliberations at the International level is likely to bring about meaningful solutions, strategic future planning and execution of the present day problems directly or indirectly related to climate change and its consequences affecting the agriculture based economy World over, particularly our country.

I hope that the common platform like this would surely promote the scientific community to have fruitful exchange of knowledge and ideas that can be efficiently followed upon for the betterment of society along with the uncertainties of climate change. I am sure the outcome of this event will certainly provide a viable and concrete solutions to specific problems related to climate changes and anthropogenic activities. Lastly, the event is expected to bring recognition of Indian researchers and their work on the global platform.

(Ashutosh Sharma)

Technology Bhavan, New Mehrauli Road, New Delhi - 110016
Tel: 00 91 11 26511439 / 26510068 • Fax: 00 91 11 26863847 • E-mail: dstsec@nic.in • website: www.dst.gov.in

सत्यमेव जयते

डॉ. एम. राजीवन
DR. M. RAJEEVAN

सचिव
भारत सरकार
पृथ्वी विज्ञान मंत्रालय
पृथ्वी भवन, लोदी रोड, नई दिल्ली-110 003
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
PRITHVI BHAVAN, LODHI ROAD, NEW DELHI-110003

MESSAGE

It gives me great pleasure to know that the Quaternary community of India has come together to invite International Union for Quaternary Research (INQUA) 2023, to India. This will be a great scientific event that will motivate and inspire a large community of Quaternary scientists in India and the neighbouring countries. An INQUA in the Indian subcontinent is much needed.

This bid reflects a strong desire of the Indian Quaternary community to share and showcase their work, and learn and interact with the experts in the world. The Quaternary community is large and hence this meeting will permit a large fraction of Quaternary researchers to interact with the best in the world. This will be a step forward in the development of human resource in the developing countries. I am glad to learn that our three premier research Institutes (BSIP, Lucknow; WIHG, Dehradun; and NIO, Goa) have taken the responsibility for this. I am sure they will do their best to make it a memorable and incredible experience.

(M. Rajeevan)

Tel. : +91-11-24629771, 24629772 ❑ Fax : +91-11-24629777 ❑ E-mail : secretary@moes.gov.in

S.N. Rajaguru
(Retd.Professor, Deccan College, Pune)
567, Narayan Peth
"Kamal Sudha" Apartment
Pune 411 030
Phone no. 020 24455753 (R)

Message

I am pleased to notice that the Indian Quaternary Community has come together to invite INQUA to the region. An INQUA in the subcontinent is much needed and will be the first one organized here.

India is amongst the few countries that have formally recognized the role of Quaternary sciences and has a number of Institutes and organizations and Universities where these studies are being taken up in a big and detailed manner. With the varied landforms of the entire subcontinents and technological advancements in the past few decades have brought in several good datasets pertaining to almost all regimes of Quaternary sciences.

I will like to add that the Indian subcontinent offers tremendous scope for understanding "Human cultures and vagaries of Indian monsoon' almost for the last 1.5 million years.

I wish INQUA-2023 (India) a great success and will look forward to welcoming the international community.

S.N. Rajaguru 20.03.2019

(Dr. S. N. Rajaguru)
F.N.A. Sc.
Life Time Felo of INQUA,
Retired Professor of Geoarchaeology and former Joint Director
Of Deccan College Postgraduate and Research Institute (Now Deemed to be University)

1946

बीरबल साहनी पुराविज्ञान संस्थान
BIRBAL SAHNI INSTITUTE OF PALAEOSCIENCES
(भारत सरकार के विज्ञान और प्रौद्योगिकी विभाग का एक स्वायत्तशासी संस्थान)
(AN AUTONOMOUS INSTITUTION UNDER DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVERNMENT OF INDIA)

प्रो. मुकुंद शर्मा
वैज्ञानिक - 'जी' एवं निदेशक (अतिरिक्त प्रभार)
Prof. Mukund Sharma
Scientist - 'G' with Additional Charge of Director

53 विश्वविद्यालय मार्ग,
लखनऊ - 226007, भारत
53 University Road,
Lucknow - 226007, India

MESSAGE

On behalf of the Quaternary research fraternity of India, we at Birbal Sahni Institute of Palaeosciences, Lucknow alongwith Wadia Institute of Himalayan Geology, Dehradun and National Institute of Oceanography, Goa are feeling proud to bid for the organisation of 21st Congress of the International union for Quaternary research (INQUA) 2023, in its first visit to the subcontinent.

The Indian subcontinent is unique in its location, orogeny and climate, the interplay of which is evident in its geomorphology and ecology. Its distinct and diverse landforms, population, culture, languages, fauna, flora etc., all along the 3650 kilometre distance from north to south and 2900 kilometre from east to west lead to it being named the only subcontinent of the Earth. Our researchers cover nearly all Quaternary fields in this geographical region.

I am sure that the deliberations and field trips during INQUA-2023, will spellbound the global Quaternary community leading to a greater understanding of the suite of surface processes, environment, climate change, natural disasters etc.

I wish INQUA-2023 (India) a great success and welcome the International community to Lucknow.

(Mukund Sharma)

दूरभाष/Phone :+91-522-2740470, 2740439
फैक्स/Fax : +91-522-2740485
ई–मेल/E-mail : director@bsip.res.in, directorbsip@gmail.com
वेबसाइट/Website : www.bsip.res.in

वाडिया हिमालय भूविज्ञान संस्थान
(भारत सरकार के विज्ञान एवं प्रौद्योगिकी विभाग का एक स्वायत्तशासी संस्थान)
33, जनरल महादेव सिंह मार्ग, देहरादून-248001 (उत्तराखण्ड)
WADIA INSTITUTE OF HIMALAYAN GEOLOGY
(An Autonomous Institution of Deptt. of Science & Technology, Govt. of India)
33, General Mahadeo Singh Road,
DEHRADUN-248001 (Uttarakhand)

डॉ. कालाचाँद साँइ, एफ.एन.ए.एससी.
निदेशक
Dr. Kalachand Sain, FNASc
Director

Message

International Union for Quaternary Research (INQUA) is a global platform strengthening the Quaternary Sciences. I am delighted to support Indian efforts in bidding for the INQUA-2023.

India offers a full spectrum of Quaternary landscape including the Himalaya, its rivers and glaciers, the Thar Desert, cold desert of Ladakh, the Gangetic foreland, the delta, mangroves and a long coast lines. Besides these, the western part of the country has wealth of archaeo-history in form of the Indus Valley civilization in the plains of the lost river Saraswati.

The fact that the Quaternary Science is relevant to the understanding of modern and past climate, earthquakes, floods vis-à-vis evolution of human civilization, the Government of India is supporting the core of all the initiatives leading to better understanding of these processes. The Birbal Sahni Institute of Palaeosciences, Wadia Institute of Himalayan Geology, National Institute of Oceanography, and Physical Research Laboratory are premiere organizations, besides several universities that are centres of excellence in Quaternary Sciences in India. We host a large Quaternary community that works both at national and international levels.

India is hosting a major Earth Science event "International Geological Congress" in 2020 (IGC-2020) and we shall be pleased to welcome the world Quaternary Community to India to organize the INQUA-2023. I extend my best wishes to Indian contingent in succeeding the bid during INQUA-2019 at Dublin.

(Kalachand Sain)

Date: 29.03.2019
Place: Dehradun

Tel (Off) : +91 135 2525101 Tel (Direct) : +91 135 2649442 Fax : +91 135 2625212
Web : www.wihg.res.in E-mail : director@wihg.res.in / dir.off@wihg.res.in

सी एस आई आर - राष्ट्रीय समुद्र विज्ञान संस्थान
(वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद)
दोना पौला 403 004 गोवा, भारत
CSIR - National Institute of Oceanography
(Council of Scientific & Industrial Research)
Dona Paula 403 004 Goa, India

प्रोफेसर सुनील कुमार सिंह
निदेशक

Prof. Sunil Kumar Singh
Director

8 April 2019

It is indeed a great pleasure that Indian Quaternary research fraternity joins together to bid for organizing the 21st Congress of the International Union for Quaternary Research (INQUA) 2023. This meeting would be the first one organized here and indeed is very much needed to showcase the Quaternary research which holds the key for the multi-facet problem of climate change. The Indian landscapes *viz.*, the most dynamic mountain chain -the Himalaya, lofty heights of Tethyan and Trans Himalaya traversing through some of the world highest passes, glaciers which are considered as Asia's water towers, rivers like Ganga, Indus, Brahmaputra, abode of biggest mangrove deltas the Sunderbans, of longest coastline in the world, the Thar desert and one of its kind the Great Rann of Kachchh, hominoid remains and the illustrious remains of great Indus Valley Civilizations, are the proud possession and a Quaternary treasure trove of our country and the International fraternity will surely admire it.

I am very much apodictic that deliberations in the global Quaternary community will lead to a better understanding of the suite of surface processes, environment, climate change, natural disasters. The meeting will be very fruitful in providing the solutions, strategic future planning and management of all issues directly or indirectly related to climate change. The event is expected to bring recognition to Indian Quaternary sciences and pave its corridors to the global platform.

I wish INQUA-2023 (India) a great success and welcome the International community to India.

SKSingh 08/04/2019

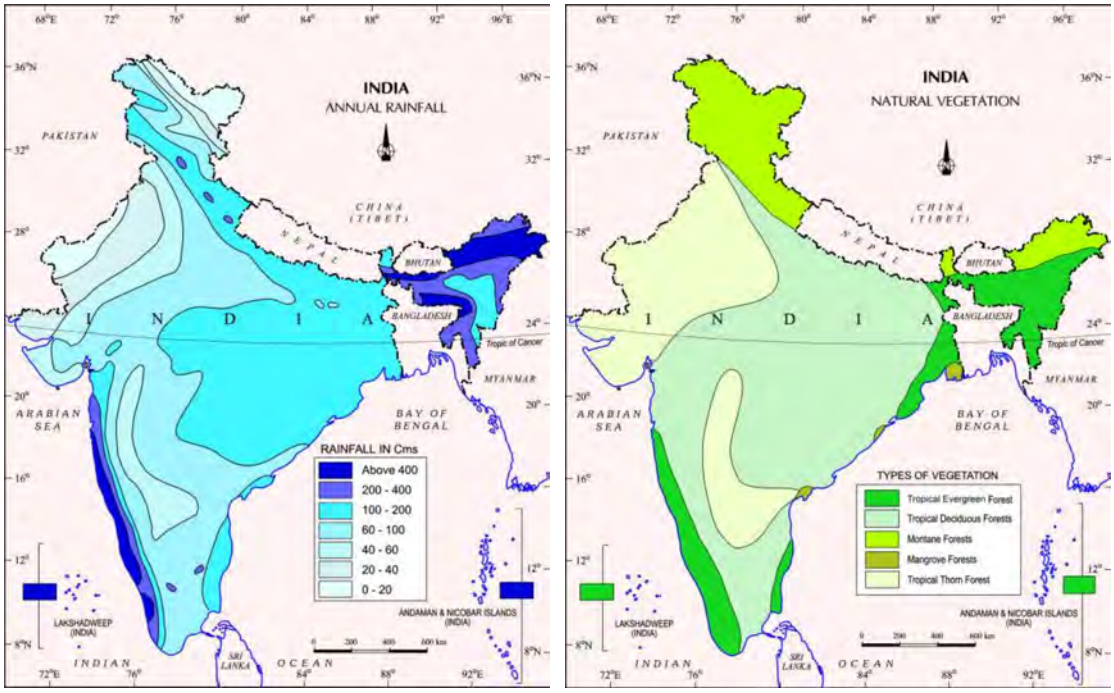
(Sunil Kumar Singh)

India's Bid

India is land of rich heritage with great geological, biological and cultural diversity. One of the world's three oldest civilizations, the Indian region is a collage of many geological terrains including a mosaic of faiths, traditions, and languages. A country with nearly 1.3 billion people, India is the largest democracy in the world today.

The Indian region spread over an area of 3.2 million km^2 is divisible into several distinct natural regions. Some of these are:

1. Himalaya Mountains
2. Indus-Ganga-Brahmaputra Plains
3. Indian Peninsula
4. Arid West
5. Shoreline and Islands

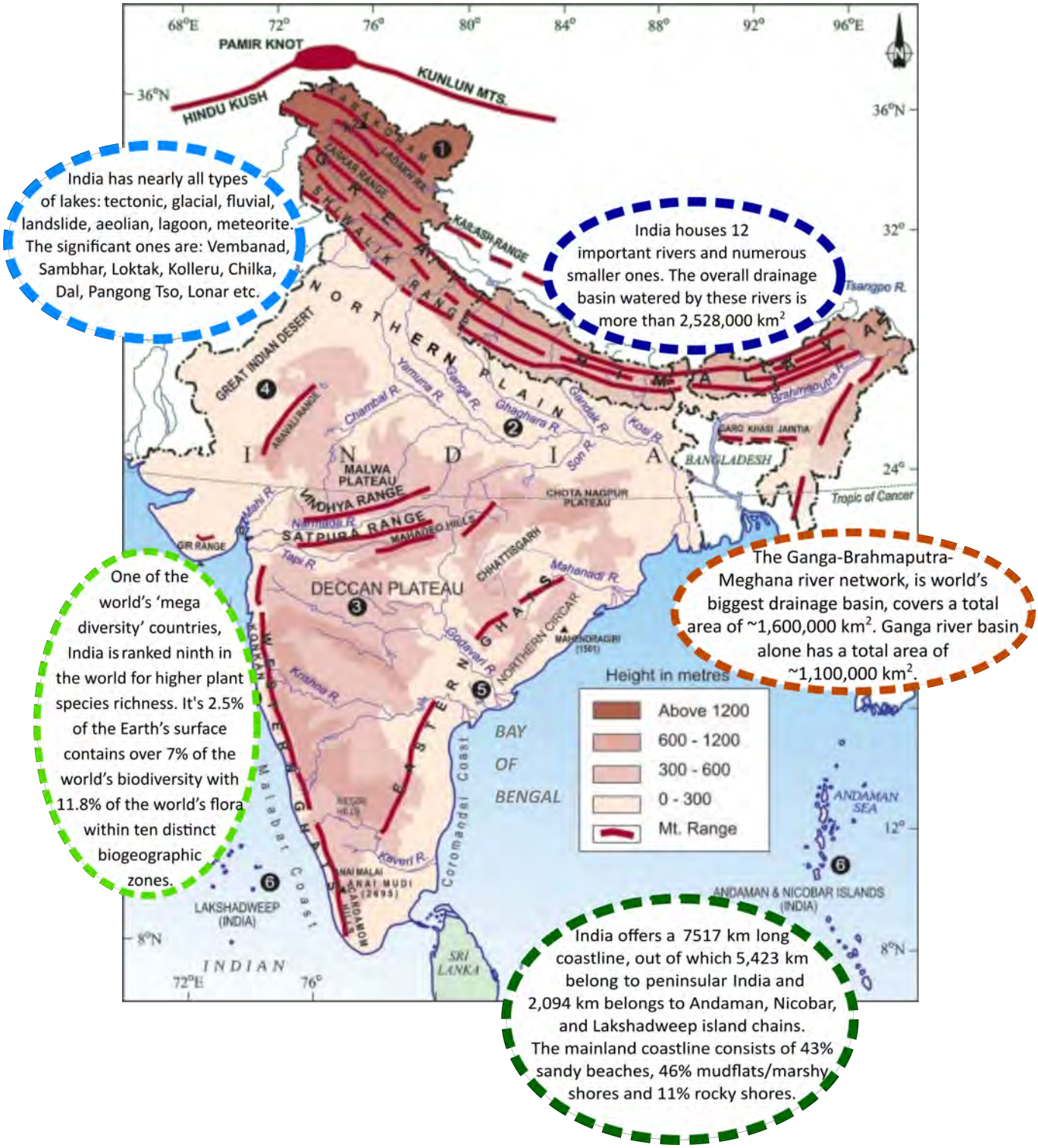


The Indian monsoon is the unique climatic system in the world and constituting one of Earth's most dynamic expressions of ocean-atmosphere interactions. Although monsoons dominate the Indian landscape, due to the large variation in altitude (0 to >8000 m) India has all the major climates of the world, ranging from hot tropical in the south to temperate and alpine in the north. As a result, India has some of the world's most biodiverse regions.

The variations in the monsoon strength during the Quaternary on different timescales have largely determined the geomorphic history of the Indian sub-continent. In the last 4-5 decades, the Quaternary studies in India have mainly dealt with the continental and offshore palaeoclimate records, and attempts have been made to reconstruct the variations in the monsoon-induced rainfall, fluvial runoff, and related aggradation and erosion. Due to the recent Anthropogenic climate change and

its diverse impact of many facets of the subcontinent, one of the primary focus of our research is maintenance of global well-being and sustainable development.

Quaternary studies have also focused on the advances and retreat of glaciers in Himalaya and the Karakoram, the dune building activity and drainage reorganization in the Thar Desert, neo-tectonic activity in the Himalaya Mountains, the foreland basin and the Peninsular region, eustatic changes along the coast, and hazard monitoring.



The Salient Features

- The 2500-km long Himalayan Ranges have over 15000 glaciers. Late Quaternary is characterized by various degrees of asynchronous glacial behaviour. At least five glacial events have been identified in Western Himalaya since LGM.

- Prevalence of C_3 species-dominated moist semi-evergreen forest in East Himalaya until the Last Glacial Maxima (LGM).

- The Early Holocene (~9.5 ka) in the Higher Himalaya was characterized by incision of the valley fills induced by high fluvial discharge associated with intensified monsoon as recorded in the Alaknanda Valley.

- Tree-ring width chronologies longer than 1000 years have been produced in the Himalaya reconstructing humidity conditions. Chronologies of >500 year long from the peninsular region confer information regarding temperature variations.

- Large floods on the Himalayan rivers during the Holocene have generally occurred during early Holocene Climatic Optimum and the Medieval Climate Anomaly. In general, most extreme floods on the these rivers are a result of failure of landslide and glacially dammed lakes.

- The presence of Mega lake systems in the Trans and Tethyan Himalaya during the Late Quaternary.

- Ionic load of Indus water largely from the silicate rocks, while the other smaller rivers show a mix of contribution from silicate and carbonate sources.

- Millennial–orbital scale variations in the Indian summer monsoon and monsoon variability driven directly related to Northern Hemisphere summer insolation is indicated by speleothem oxygen isotope record from Uttarakhand.

∗ Lake records across the Indian subcontinent show an intensified monsoon between 9 and 5 ka, corresponding with the globally recorded warm and wet Holocene Climate Optimum. A general trend in aridity is recorded throughout India after about 4 ka also support these findings.

∗ Records based on drill cores from the Ganga Valley reveal a general weakening of Indian monsoon during the transition period from late MIS-5 to 4 and renewed fluvial activity in the post-LGM period followed by incision as well as southward migration of the Ganga River after 6 ka.

∗ Palaeo-ethnobotanical finds from Chalcolithic site reveal advanced agricultural practices in Upper Ganga Plain; domestication of plants, early farming and ecosystem dynamics during Holocene/ Anthropocene and 7 ka old rice chronologies of archaeological significance.

∗ Studies of palaeosols in the Ganga-Yamuna interfluve reveal three major phases of humid conditions spanning 90-80 ka, 50-30 ka and 10 ka with intervening drier phases.

∗ In the Thar Desert, the Indian monsoon maxima during MIS-4 is represented by aeolian sand deposition (75 and 55 ka) due to strengthened monsoonal winds. Aeolian activity and dune building in the Thar Desert during early Holocene continued until 6.8 ka, at ~5 ka and ~3.5 ka coinciding with drier periods.

∗ Records of palaeofloods from Peninsular India suggest that exceptionally high floods occurred during Medieval Warming Period and post-1950 CE, whereas the Little Ice Age (LIA) was characterized by lower magnitude floods.

∗ Multiple studies also indicate distinct flood clusters during the times of major shifts in the monsoon climate in western and southern Indian rivers.

∗ The vertical uplift rates along the major active faults range from 0.8 to 2.8 mm/yr in the Kachchh region, western India.

∗ West Coast has experienced marginally higher sea stand during 6 ka to 3 ka period.

∗ A high-resolution speleothem oxygen isotope record from Mawmluh Cave, located over the Meghalaya Plateau in Northeast India, has provided evidence of an abrupt decline in monsoon rainfall at 4.2 ka. This distinct event was the prime candidate to formally ratify the post 4.2 ka period as the Meghalayan Age.

∗ The Indian region is rich in Acheulian, Middle Palaeolithic, Microlithic, Neolithic and Chalcolithic sites. Cosmogenic nuclide dating of Acheulian artefacts from southern Peninsular India indicate that during the Early Pleistocene (ca 1.5 Ma), India was already occupied by hominins fully conversant with an Acheulian technology. Further, the early Middle Palaeolithic culture in India has now been firmly dated to around 385–172 ka.

∗ Fossil mangrove deposits show that Holocene sea rose from below -12.8 to 1.2 m above present level between 8 and 6 ka and between 5 and 4 ka.

∗ The sea transgressed in East Coast of India intruding ~15–25 km inland until 5–6 ka, afterwards deltas prograded continuously with intermittent short periods of rise and fall in RSL during late-Holocene. In last two centuries, overall subsidence of ~1.3–2.2 cm/yr is observed in Sundarbans, Bengal Basin leading to a ~2.3 cm/yr estimated rise in relative sea level.

∗ The geological evidence of the 1008 CE tsunami in West Coast and earthquakes (Mw >8) in the historical past.

∗ Modern strength of oxygen minima zone around ~1 Ma in denitrification and productivity records from the eastern Arabian Sea since late Miocene.

∗ Planktic foraminiferal assemblage and isotopic records from eastern Arabian Sea reveal a major reorganization in the south Asian/ Indian monsoon circulation attributed to the strengthening of Walker and Hadley circulation.

∗ Inter-hemispheric progression of deglaciation during ~130 ka by heat and moisture transfer from Southern to Northern Hemisphere in Bay of Bengal.

∗ Long-term impact of environmental changes on human health and subsistence have been revealed by sedimentary DNA analysis. Comparison of modern genome studies and those of Harappan / Indus Valley Civilization constructs the population changes in people of south Asia.

India offers

India provides a full rainbow of Quaternary-climate-tectonic-surface processes ranging from colossal mountains, the third pole region, the rain shadow zone, foreland & shield regions; grand river systems, cold and hot deserts, to a long coast line. The network of river systems of India have been a witness to numerous social, agricultural and anthropological events from pre-history to modern.

This unique sub-continent is characterized by a distinct altitude gradient, several climate & vegetation zones each with their own geologic set-ups. The dispersal of it's faunal and floral entities are unique in themselves. It is a cradle of civilization and has a long recorded history. Everyone of which offers a variety of archives to study different landforms, processes, neotectonics, climate-human interaction, resource management and sustainable development.

The Mighty Himalaya

The Himalayan system is a complex and thrust and fold mountain chain. It comprises of the Trans-Himalaya (north of Indus Suture zone (ISZ); the suture zone; the Tethyan Himalaya and the Higher Himalaya, the lesser Himalaya and the Siwalik ranges showing an average relief of ~6 kms.

The Himalaya provides an excellent laboratory to understand: (i) thrust and fold belt tectonics; (ii) mountain-climate interactions; (iii) Glaciers and glacial landscapes; (iv) palaeoglacial deposits and krast landscapes; (v) river systems; (vi) glacial lakes and meadows with diverse herbaceous ground vegetation; (vii) dendro-climatology and many more. This region offers troves of valuable data on natural hazards, like extreme floods, landslides and earthquakes.

Vast palaeolake deposits, e.g. Lamayuru, Spituk-Gupuk (Jammu and Kashmir); Kioto, Atargu (Himachal Pradesh) and several lakes in Uttarakhand Himalaya have been used increasingly in recent years to infer past fluctuations in climate. Processes governing the origin and nature of chemical and clastic sediments within lakes provide a record of past climatic fluctuations and weathering processes in the source region and imply strongly on climate forcing factors. Further, sediments of intermontane basin of Karewa (Jammu and Kashmir) provided academic treasures of many human civilizations and habitations.

The entire region of Ladakh and Kashmir Himalaya is in the rain shadow of the SW Monsoon and has an arid to hyper arid climate and dry steppe vegetation. The region is drained by the Indus River and its tributaries having glaciers in their headwaters. The river banks are flanked by fill and bedrock terraces, large fans, sand ramps, palaeolakes sequences. There are evidences of past occurrences of

extreme floods as well. The terraces, palaeolake and sand ramp sequences in the region are dated and systematically studied that provide clues towards landscape response to climate variability and suture zone tectonics.

Besides this, the periglacial regions preserve evidence of past glacial advances in form series of well dated moraines. Himalaya houses some of the world's highest passes-Khardung La (La=mountain pass) at an altitude of 5,359 m connects the Indus river valley to the Shyok river valley. The others being Chang La, Tang La, Zozi La, Fotu La, Pensi ILa, Kumjum La, Nathu La etc., joining the different valleys in the Himalayan regions

The Ladakh Himalaya is also known for occurrence of several brackish lakes (e.g. Pangong Tso, Tso kar, Tso Moriri) with unique brackish and fresh water ecosystem. Pangong Tso (Tso=lake), is at an altitude of 4257 m occupying a long-submerged valley of ~200 km and exhibits several palaeolake strands and prograding lake delta. They appear as elongated terrace-like ridges of a few decimetres' height, suggesting gradual shrinkage in lake level since its time of formation. It is a lake with swamp and salt deposits around, perfect breeding ground for the rare black neck crane.

The southern front of Himalaya is influenced by full spectrum of Indian summer monsoon and the rivers draining the region cut all the structural discontinuities orthogonally. These rivers originate from the active mountain belts and cross several thrust sheets characterized by different uplift rates. This leads to different shapes of river long profiles and significant spatial variability in-channel slope. These rivers receive water from different sources namely glaciers, rainfall and groundwater marked by spatio-temporal variability. Sediment supply is also quite variable and sediments are generated from different litho-tectonic units of the Himalaya. Spatio-temporal variability in erosion processes is governed by relief, lithology, rainfall gradient, landuse-landcover and glacial contributions. Therefore, the region presents a multifaceted interface between the climate-thrust tectonic and landscape evolution. There are chronologically well constrained records of widespread valley aggradation and river incision that are modulated by climate change over the past 100 ka. The studies have also tested various models of neotectonic evolution of collisional mountains.

The Himalayan rivers provide subsistence to agricultural economy of 1/5th of the global population. The occurrences of large floods, GLOFs, LLOFs and landslides and earthquakes serve severe jolt to growth of human kind and the region provides an excellent laboratory to understand these

natural disasters.

Sikkim Himalaya decadal to centennial scale records a prominent abrupt negative ISM shift during the termination of the Younger Dryas between ~11.7 and 11.4 ka. While, ISM was stable between ~11 and 6 ka, and declined prominently between 6 and 3 ka. The shifting drainage patterns in Itanagar region along Himalayan faults record the changing patterns of neotectonics.

Himalaya has provided a wealth of Dendrochronology and Dendroclimatology data. Distinct and precisely datable growth rings are found in several of the conifers growing over Himalayan region and hence dendrochronological studies are progressing well. The Himalayan pencil Juniper (*Juniperus polycarpos*) has been found to be the longest living tree in India extending >2 ka and still growing healthy. The tree ring series from semi-arid to arid regions contain strong signatures of variability in precipitation.

The Indian Foreland Basin:
Indus-Ganga-Saraswati basins & Brahmaputra Plains

The frontal part of Himalayan thrust fold belt makes a flexural asymmetrical basin called as the Indus-Ganga Brahmaputra peripheral Foreland basin. This basin is bounded in the north by a rising mountain (Himalaya) and deformed foreland deposits and in south lies a subdued fore bulge. The west is bound by Delhi Aravalli Ridge and east by Rajmahal hills.

The Ganga is the axial river of the Indo-Gangetic basin and joined by a number of major Himalayan tributaries including the Yamuna, Ramganga, Ghaghra, Gandak, Kosi, and Tista before draining into the Bay of Bengal.

The mighty Brahmaputra also meets the Ganga and forms a major deltaic depocenter in the Bengal Basin. The Brahmaputra River flows for 1,800 miles through Tibet, India, and Bangladesh. The stratigraphy of eastern part of this basin exhibits an interplay of sea level changes and sediment supply from Himalaya over the past 125 ka.

The vast alluvial tract of this foreland exhibits a varied geomorphology comprising classic Megafans, incised river valleys in western & central plains and large interfluve areas. Its vertical stratigraphy archives >100 ka history of climate and foreland tectonics interplay.

The sequence in drilled core in central Ganga plain suggests tight coupling amongst climate variability, monsoon front migration, orography of Himalaya over the past 100 ka. Whereas, the stratigraphic sections lying in the vicinity of peripheral bulge indicated a propagation 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 between >100 ka and 35 ka BP. These sections show preservation of large vertebrate fauna including Elephas Namadicus, Equus, Bos, Sus, crocodile, turtle.

The great Brahmaputra Valley, covering an area of 3000 km^2 cradles one of largest braided rivers in the world. It is one of the richest biodiversity zones consisting of a unique combination of tropical

evergreen, deciduous forests, mixed deciduous forest, riverine grasslands, bamboo orchards, and numerous wetland ecosystems. In this high rainfall prone area, changes in vegetational succession under climatic shifts is a subject of concern. The Majuli Island is one of the largest tropical river islands in the world and is located in Assam at an elevation ranging from 60 to 85 m above mean sea level.

The Brahmputra Basin, contains significant portions of Himalayan and Indo-Burmese biodiversity hotspots and is globally known for Mawsynram (the wettest place on Earth) and the living root bridges made by morphing aerial roots. This region of the world is considered by botanists and geographers as one of the nuclear areas of early plant domestication.

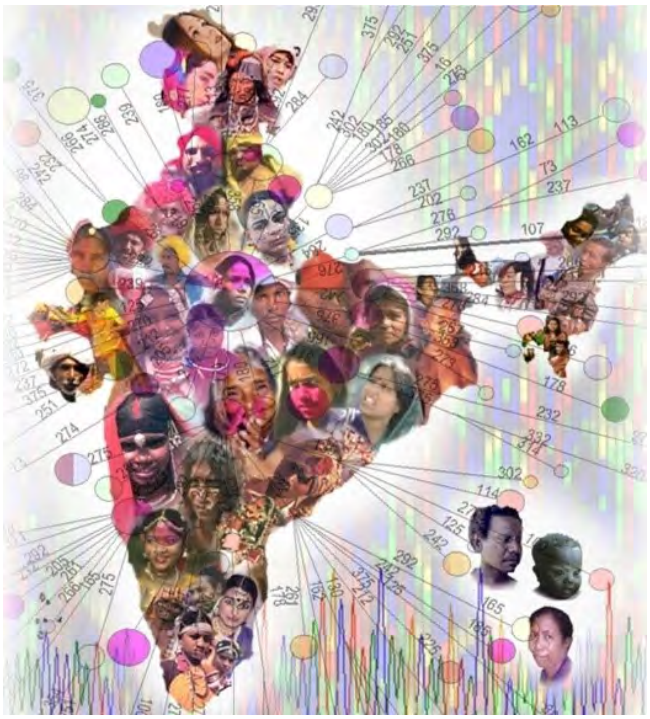
The Indian foreland basin is also one of the most densely populated landmasses characterized by diverse-human cultures having different ancestral origins. The recent archaeological researches from the region are challenging pre-existing conceptual understanding about the origin and divergence of human populations from the continent of Africa. Early Middle Palaeolithic culture in India around 385–172 ka reframes Out of Africa models.

The observed human diversity on the sub-continent is attributed to amicable and adequate shelters with conducive climatic/ environmental conditions that offered life to variety of human populations from the Late Pleistocene to today's environment.

India is home to about a fifth of present-day humanity and among the first geographic regions to be peopled by modern humans after their African exodus.

The existence of modern human in India has been reported since the Early Palaeolithic followed by several wave human migration in to the sub-continent.

These gave rise to various ethnic groups of South Asia, comprising of tribes, castes, and populations identifying themselves by different religions, being largely endogamous and hence revealing complex, multilayer genetic differentiation. From such a complex structure, several questions have stood out in order to understand the peopling of India.



The Indian Peninsula

This triangular peninsula, surrounded by Arabian Sea on the west, Bay of Bengal on the east and Indian Ocean on the south, region of relative tectonic stability, riverine landscape and deposits have provided longer records of the past.

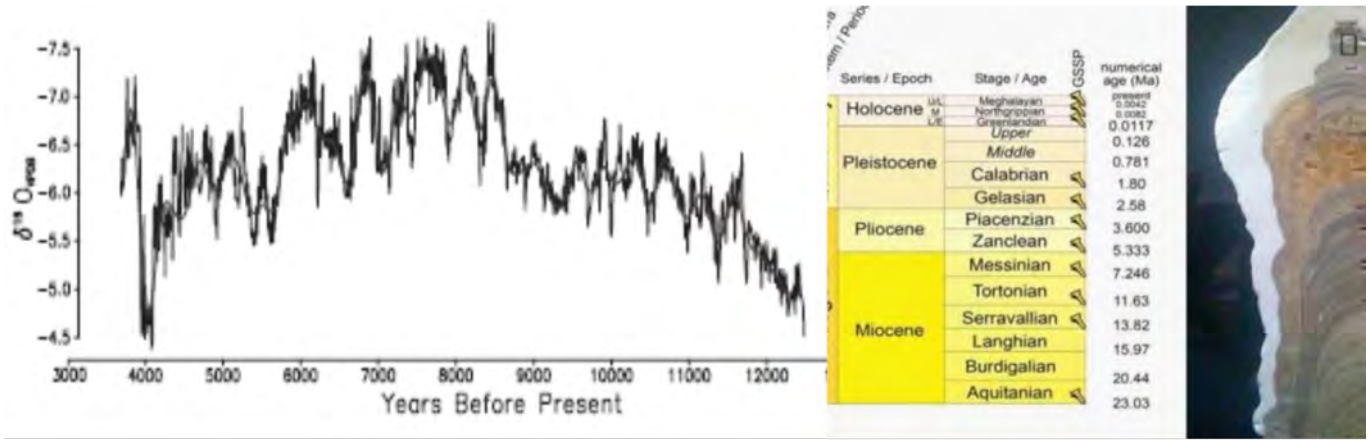
The central Narmada Valley of the Peninsular India is known for rich and diverse natural resources in terms of both flora and fauna. Vindhyan Supergroup sections along this Valley contain caves famous for having relics of human culture in the form of artistic expressions of Palaeolithic and later times. The Quaternary sediments here preserve a great wealth of contemporary palaeontological records particularly a diverse assemblage of mammalian fossils, archaeological archives and volcanic ash beds.

Rock/Cave art and paintings, e.g. Bhimbetka (UNESCO world heritage site), Madhya Pradesh and Mirzapur, Uttar Pradesh, etc. have encouraged a number of researchers to study people–landscape interaction as depicted in its cave paintings. The records of mammalian existence, including that of man, cultural tools and paintings in caves make the rift valleys in the Son-Narmada-Tapti lineament, an ultimate arena to study human evolution in an integrated perspective with changing climate since Pleistocene time.

The oldest known human fossil of middle Pleistocene age recovered from Hathnora in central Narmada Valley is significant from the viewpoint of the origin of early Homo in South Asia and is ascribed to Homo erectus, archaic H. sapiens, or H. heidelbergensis by different investigators. Its maximum age is estimated to be >236 ka but not older than the early middle Pleistocene. The alluvial archives of the central Narmada Valley are also well known for their middle Palaeolithic and Acheulian tools.

Further, the Latest Stage in Earth's history is the Meghalayan Age. Its Global Boundary Stratotype Section and Point (GSSP) is Mawmluh cave in Meghalaya, northeast India Mawmluh cave is one of the longest and deepest caves in India, and conditions here were suitable for preserving

chemical signs of the transition in ages. The Meghalayan, the youngest stage, runs from 4.2 ka to present. The Meghalayan Age is unique among the many intervals of the geologic timescale in that its beginning coincides with a global cultural event produced by a global climatic event. The Strato type speleothem section is housed in the Museum of BSIP, Lucknow.



Earth's only hyper-velocity impact crater on basaltic rock ringed by fascinating temples, the Lonar crater was formed fifty-two thousand years ago, by a 2 million ton meteor which impacted at an estimated speed of 90,000 km/h. It gouged a hole that was 1.8 km wide and 150 m deep. Lonar Lake has prompted scientists to attempt answers to questions like: Why is the lake alkaline and saline at the same time? Why does it support micro-organisms rarely found elsewhere on Earth? Why do compasses fail to work in certain parts of the crater? And what lurks at the bottom?

The hot and wet coastal plain gradually rising in elevation to the high hills and mountain topography of the Western Ghats in Kerala receives strong south-west monsoon. There are several lakes placed in the eastern highland (Pookode and Vagamon) and in the western low land area (Vellayani). These lakes are enclosed fresh water basins with no distinct outlet. Some of these lakes like the Ashtamudi and Vembanad are affected due to the urbanization and elevation in population, practice of domestic waste disposal, industrial discharge, enormous use of agrochemicals, and enhance of antibiotics in aquaculture.

The Core Monsoon Zone of Central India is very sensitive to the variations in Indian Summer Monsoon precipitation, is the key region for the identification of weak or intense monsoon periods, referred to break and active spells, respectively. The vegetation-based palaeoclimatic studies shows the change in climate and its effect on the vegetation dynamics during the last 12.7 Ka.

The Deccan produced some of the most significant dynasties in Indian History like the Cholas (3rd century BCE to 12th century CE), Chalukyas (6th to 12th centuries), Rashtrakutas (753–982), Hoysalas (10th to 14th centuries), Kakatiya (1083 to 1323 CE) and Vijayanagara Empire (1336–1646).

The Arid West

The Thar Desert

Sand dunes cover extensive area of the Thar Desert which lies between the Aravalli Hills in the east and the Nara River in the west. The northern limit of the Thar is along the Indo-Gangetic plains and its southern limits along the north Gujarat plains. Thar desert is known for parabolic dunes and playas with height ranging from 2 m to 50 m or more. Low sand streaks and sandy hummocks are also numerous.

Strong aeolian activity is a characteristic of the latest 200-300 ka period and is marked by several episodes of greater aridity, strong wind regime and sand dynamism followed by periods of stability implying climate amelioration and some pedogenesis. The preceding mid and early Quaternary periods are marked by alluvio-colluvial and sheetwash aggradations with pronounced, well-evolved calcretes. For much of the Quaternary period, the Thar region had a semiarid climate and the current desertic conditions are recent.

The Great Rann of Kachchh

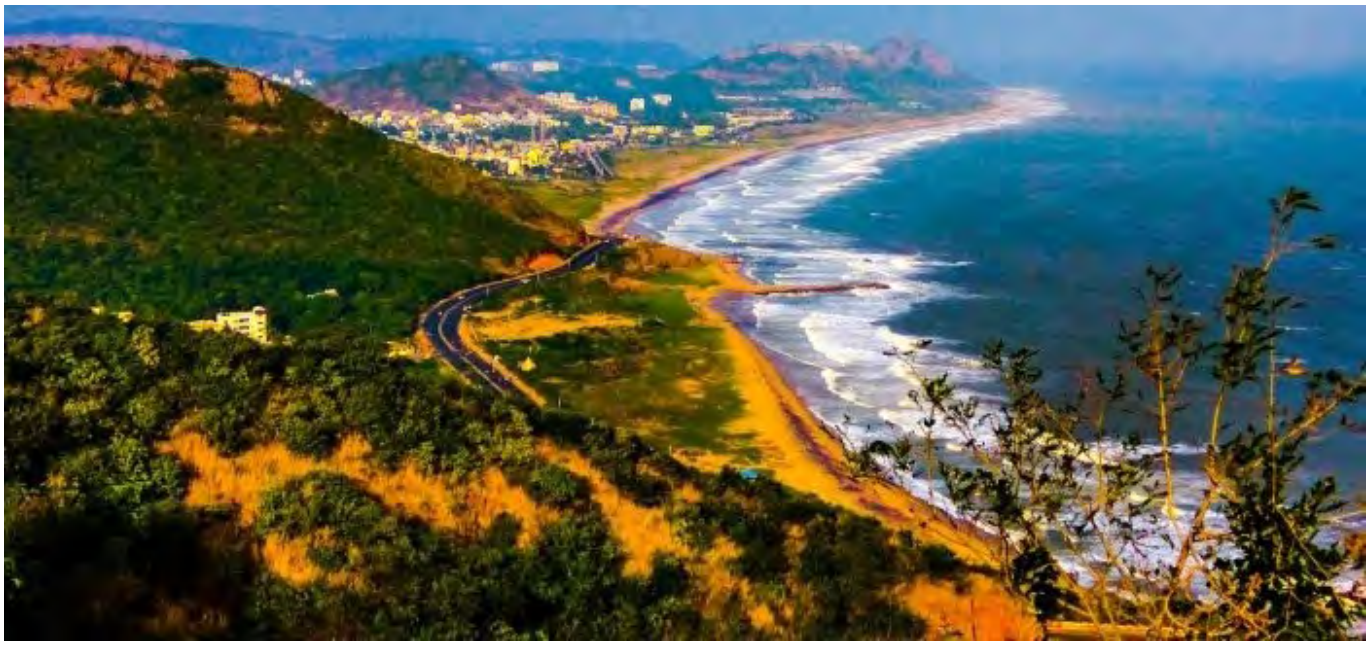
A unique geomorphic entity of the Indian sub-continent, the Rann is a mysterious and fascinating landscape generated during the last 10,000 years, due to an interplay of sea-level changes and tectonic uplift. This salt marsh is among the largest in the world that came to existence between past ~500 to 2000 years before present.

The present view of the Rann appears like desertic, monotonous, salt encrusted flat terrain which is almost devoid of exposures with former islands rising above it like hills. It attracts common man and geoscientists due to its unique annual inundation cycle that keeps it underwater for more than half of the year and completely dried (with salt crust on its surface) during summer months.

The Rann is a natural laboratory for understanding modern biotic response to temperature, salinity, nutrient changes, etc. during its annual cycles. During winters, this area annually attracts large population of migratory birds and become one of the largest nesting sites for species like Flamingos. Similarly, low lying regions also host a few varieties of fishes which tolerates the wide scale changes that their preferred niche conditions and eventually die with hyper-saline conditions.

The Great Rann of Kachchh (GRK) hosts a significant amount of archaeological sites of Bronze age Harappan people. One of the largest archaeological town of Harappan times 'Dholavira' is situated on Khadir island of the GRK Basin. GRK provided marine waterways / tradeways to Harappans for a long time. Artifacts include terracotta pottery, beads, gold and copper ornaments, seals, fish hooks, animal figurines, tools, urns, and some imported vessels that indicate trade links with lands as far away as Mesopotamia along with 10 large stone inscriptions, carved in Indus Valley script, perhaps the world's *earliest* signboard.

The Indian shoreline:
Beaches, Deltas, Islands and Mangroves



India flaunts a more than 7500 km long coastline fringing the peninsula. The Indian coastline falls in humid (having two monsoons), semi-arid and arid climate with rocky, muddy and sandy segments.

The coastal wetlands sustain millions of people and are more vulnerable to the effects of rise in Relative Sea Level and changes in marine ecosystems. The sediment depositional environments vary from fluvial, fluvio-marine to purely marine depending upon the geomorphology and distance from the shoreline.

The deltaic dynamism is largely influenced by monsoon driven active channels, tectonic nature of the basin, sea level changes, relief of the drainage basin and climate. The temporal and spatial change in these deltaic variables brings about profound alterations in the geomorphology either through erosion or accretion processes.

Land subsidence in modern coastal or deltaic plains is a common and is susceptible to sea invasion. The rate of sediment deposition and texture in the coastal wetlands largely varies from time to time and depends on the direction and energy of the rivers/streams which feed them, coupled with the magnitude of wave action. 43% of 1030-km long Andhra Pradesh coastline is under very high risk if the sea level rises by 0.6 m resulting in an estimated loss of ~1.2 million people residing within an elevation of 2.0 m.

The East Coast is characterized by gentle slope gradient of ~1–2 m above mean sea level covering more than 4–6 km from the present shoreline. About 2–3 km of coastal zone is shallow, ranging from 0.4 to 1 m amsl, and is at a very high risk of inundation even if a slight rise in sea level occurs in future either because of climate or geomorphological changes.

Due to variations in ecological conditions, the magnitude of impact on mangroves varies from place to place depending upon hydrostatic changes. The apparent rise in relative sea level in several pockets along the East Coast of India is attributed to vertical displacement of the unconsolidated sediments rather than a net increase in global sea level rise. The average rate of sea level rise in India is 1.34 mm/yr. The southern part of the East Coast was severely impacted by December 2004 Tsunami due to the wide coastal plains.

Deltas are the most productive landforms along the river topography and are incredibly important to the human geography of a region being most densely populated areas in the world. In Indian subcontinent, most of the major rivers, such as Ganga and Brahmaputra, Kaveri, Krishna, Godavari and Mahanadi flow eastwards and empty into the Bay of Bengal via deltas. The Ganga-Brahmaputra Delta is the largest delta in the world. The Sunderbans, comprising of four UNESCO World Heritage Sites, covers the southernmost part of this delta.

Mangroves play an important role in understanding the extent, magnitude and duration of sea level changes either induced by climate or geomorphology of the area. Mangrove diversity is highest in the East Coast (91.6% of the total mangroves) favoured by the numerous rivers feeding the estuaries/lagoons. Shallow protected intertidal zones of bay islands such as Lakshadweep and Andaman constitute 16% of the total mangroves.

On the basis of fossil mangrove deposits, it is seen that Holocene sea rose from below -12.8 to 1.2 m above present level between 8 to 6 ka and later between 5 to 4 ka. Records from contemporary East Coast of India show that the sea transgressed until 5-6 ka encroaching land (~15–25 km), and since then the delta prograded continuously but with intermittent short periods of rise and fall in relative sea level during late-Holocene. The amelioration of climate from strengthened to weakened monsoon has been observed in different parts of Indian peninsula and the central/western part of India since 6 ka.

Sunderbans is the largest mangrove forest in the world, covering an area about 9,600 km^2 in India. This area is known to serve as a marine habitat for sea turtles, saltwater crocodiles and other reptiles. The overall subsidence of ~1.3-2.2 cm/yr is observed in Sundarbans, because of which an estimated rise in relative sea level is 2.3 cm/yr versus the global estimates of subsidence rates and a rise in sea level are 3.4 mm/yr and 1.7 to 3 mm/yr, respectively.

Bhittarkanika is the second largest mangrove ecosystem of India, next to Sundarbans mangroves.

It covers an area of 650 km^2 and harbours one of India's largest populations of saltwater crocodiles *Crocodylus porosus*.

Subarnarekha mangroves, Mahanadi, Godavari and Krishna deltas, Pichavaram and Cauvery estuaries are deltaic mangrove forest situated at the mouth of major rivers carrying freshwater facing Bay of Bengal. Cochin estuary, Coondapur/Malpe area, Zuary estuary, Bombay mangrove creeks, Gulf of Kutch and Bhavnagar estuary, are coastal mangrove habitats in the intertidal zones along with mouths of minor rivers or minor estuaries and back waters facing Arabian Sea.

Chilka Lagoon is the largest brackish water lagoon in Asia and stretches over an area of 1100 km. It is a paradise for birding, biodiversity hotspot and largest habitat of Irrawaddy Dolphins.

Andaman and Nicobar Islands is an island archipelago, with diverse and encompass unique habitats and complex ecosystems. An area of 513.70 km^2 along the West Coast of South Andaman Island is notified as a tribal reserve for the Jarawa people. To the south west of South Andaman Island is North Sentinel Island with an area of 59. 67 km^2 and is inhabited by the Sentinalese people. An area of 885 km^2 includes the Nicobar Biosphere Reserve and all these parks are within the tribal area. These parks are unique, very diverse and are important biodiversity hot spots, besides being the last

remaining 12 pristine areas in the archipelago. Some of these national parks needs to be recognized as world Heritage sites and some should come under the Ramsar Wetlands. The Lakshadweep Islands have a vast expanse of the blue sea with precious heritage of ecology and environment.

Indian coral reefs cover total area of 5,790 km^2 and are mainly distributed in the Andaman & Nicobar and Lakshadweep Islands. The Andaman and Nicobar Islands have fringing reefs around many islands, and a long barrier reef about 329 km on the West Coast. Three major reef types are in India are Atoll, Fringing and Barrier. Within these habitats some of the most diverse, extensive and least disturbed reefs exist.

Other Interesting sites

Critical Zone Observatories

In the time of Anthropocene, characterized by a dramatic increase in anthropogenic pressure, global changes are questioning the capacity of the planet Earth to sustain the development of human societies in the long term. In the past two decades, this concern has fostered world wise efforts to develop integrated studies of the 'Critical Zone'.

In India, the first CZO was established in 2003 in the Kabini River Basin and two more are being established in the Himalayan region and Ganga Basin.

Astrogeological sites

Ladakh in the North, Lonar in Central and Kutchh in Western India, have diverse, pristine, extreme environments which are considered analogues for other planetary environments. These three regions have potential for astrobiology study.

In Ladakh, hot springs, high altitude glacial passes, sand dunes, saline lakes, and permafrost mounds are seen in abundance. The landscape of the place resembles that of Lunar and Martian topography.

Evaporation of saline waters in the Kachchh leaves thin salt crust (few centimetres to tens of centimetres at places) spread over several hundreds of kilometres. This region offer unique opportunities to study the extremophile micro and macro-organisms under rapidly changing environments and prove the best analogues for the planetary studies.

The meteorite lake, Lonar is considered to have potential as astrobiological analogues of Martian surface. Shocked altered basalt and shocked soil from Lonar Crater can be used as analogues for similar materials found by rovers in Martian meteorite melt veins.

Apart from these we have:

- 37 World Heritage sites (UNESCO)
- 26 Ramsar sites (UNESCO)
- 3686 Archeological Survey of India's Protected Monuments
- 34 National Geological Monuments of India
- 18 Biosphere Reserves
- Numerous National Parks
- Hundreds of Hill stations

India is rich in the educational institutes/organizations/universities dedicated to scientific research and teaching:

- 9 Indian Institutes of Technology (IIT)
- 7 Indian Institutes of Science Education and Research (IISER)
- 49 Central Universities
- 367 State Universities
- 282 Private Universities
- 123 Deemed to be Universities
- 94 Institutions of National Importance
- 500+ Autonomous Research Institutes
- 38 Research Laboratories Under CSIR

Thus,
India has an excellent package of Quaternary Science, Sedimentary exposures, interesting field sites and manpower for the Global Quaternary Fraternity to have an enriching experience.

Session Themes

The scope of the INQUA-2023 Congress will range across all areas of Quaternary research. Suggestions for sessions are welcome within the areas covered by INQUA's commission: Atmospheric Sciences; Biogeosciences; Climate: Past, Present and Future; Instrumentation and Data Systems; Geomorphology; Geochemistry; Hydrological Sciences; Natural Hazards; Ocean Sciences; Seismology; Soil System Sciences; Solar-terrestrial Sciences, etc. will be dealt within the indicative areas of interest alphabetically below.

Anthropocene; Applied Quaternary; Amino acid dating; Archaeology; Chronology; Chronostratigraphy; Climate change; Chironomid analysis; Cosmogenic nuclides; Data-handling and analysis; Diatom analysis; Environmental change; Fire-history; Fluvial systems; Geoarchaeology; Geogenic contaminations; Geoheritage; Geohydrology; Geomorphology; Geotechnical and engineering geology; Glacial process; Glacial stratigraphy; Glacial-interglacial records; Glaciations; Human evolution; Island biogeography; Isotope analyses and dating; Karst geomorphology; Lake sediments; Macrofossils; Magnetostratigraphy; Mapping; Marine sediments; Mathematical Geology; Medical and Forensic; Megafauna; New methods and Technology; Orbital forcing; Palaeoclimate; Palaeoecology; Palaeofloods; Palaeogenetics; Palaeohydrology; Palaeoseismicity; Paleoceanography; Peat; Periglaciation; Planetary geomorphology; Polar research; Pollen analysis; Quantification of Processes; Radiocarbon-dating; Regional stratigraphy and correlation; Sea-level change; Sesimicity and Hazards; Sustainability; Taphonomy; Tephrochronology; Testate amoebae

Additional ideas and suggestions are requested with welcome.

Proposal

It is proposed to hold the INQUA during 20-26 February 2023 with the opening ceremony scheduled on 20 February. The scientific sessions will take place for 7 days from 20 February after inaugural session. The delegates will have the opportunity to select from a range of short tours on local Quaternary geology. All organizations affiliated to INQUA will be invited to participate and contribute to the development of the scientific program.

The Congress will be supported by the Indian National Science Academy, the Department of Science and Technology and the Ministry of Earth Sciences of Government of India.

Organisers

The event will be organized jointly by three leading institutes, Birbal Sahni Institute of Palaeosciences, Wadia Institute of Himalayan Geology and National Institute of Oceanography. All these institutes have made substantive contributions to Indian Quaternary researches and the society in a wide range of areas ranging from geomorphology, neotectonics, palaeoclimate, palaeontology and infrastructural projects. Presently we have over 500 Quaternary geoscientists working on various areas.

Birbal Sahni Institute of Palaeosciences
(An Autonomous Institute under Department of Science & Technology, Government of India)
1946

http://www.bsip.res.in

Birbal Sahni Institute of Palaeosciences (erstwhile Birbal Sahni Institute of Palaeobotany), located at Lucknow, Uttar Pradesh was established in the year 1946, was an outcome of vision of Prof. Birbal Sahni. It is an autonomous Institute under the Department of Science & Technology, Government of India, New Delhi. It is dedicated to both fundamental and applied aspects of plant fossil research. This world-renowned centre of excellence has been pursuing researches on Archaean to recent sequences. An integrated and multidisciplinary approach is practiced in BSIP to make Palaeosciences more relevant in the 21st Century.

An integration of plant and earth sciences in the pursuit of palaeobotanical researches is the primary aim of this organization. Researches, on various applied and fundamental aspects, supported by state-of-the-art instrumentation, computational technology, well-equipped laboratories with qualified experts give a true meaning to this Fusion-Science. Various research projects through National and International collaborations researches are operational to achieve the desired goals of developing palaeobotany in all its botanical and geological aspects; to constantly update data for interaction with allied disciplines; to co-ordinate with other palaeobotanical and geological research centres in

the areas of mutual interest, such as diversification of early life, exploration of fossil fuels, vegetational dynamics, climatic modelling, conservation of forests and also to disseminate palaeobotanical knowledge in universities, educational institutions and other organisations. BSIP has more than 30 scientists working on various aspects of Quaternary.

Wadia Institute of Himalayan Geology (WIHG)

वाडिया हिमालय भूविज्ञान संस्थान

An Autonomous Institute of Department of Science and Technology, Ministry of Science and Technology, Government of India

http://www.wihg.res.in

Wadia Institute of Himalayan Geology, Dehradun is an autonomous research institute of the Department of Science and Technology, Ministry of Science and Technology, Govt. of India.

Initially named as the Institute of Himalayan Geology, it was renamed as the Wadia Institute of Himalayan Geology in memory of its founder, the late Prof. D.N. Wadia, in appreciation to his contributions to the geology of the Himalayas. During the last quarter century the Institute has grown into a centre of excellence in Himalayan Geology and is recognised as a National Laboratory of international repute with well-equipped laboratories and other infrastructural facilities for undertaking advanced level of research in the country.

In the early years of the Institute, the major thrust of the research activity was directed towards remote areas with difficult mountainous terrains and severe working conditions, as well as where the geological framework and geological knowledge were lacking. In the beginning the Arunachal Himalaya, Higher Himalaya of Kumaun and Lahaul-Spiti and Indus-suture of Ladakh and Karakoram were taken as priority areas for geological research. Now the thrust of the research has been focused on some specialized areas of national as well as international relevance in both the western and eastern Himalayas.

http://www.nio.org

National Institute of Oceanography (NIO) with its headquarters at Dona Paula, Goa, and regional centres at Kochi, Mumbai and Visakhapatnam, is one of the 37 constituent laboratories of the Council of Scientific and Industrial Research (CSIR), New Delhi.

CSIR-NIO was established on 1 January 1966 following the International Indian Ocean Expedition in the 1960s. The institute has since grown into a multi-disciplinary oceanographic research institute of international repute. The principal focus of research has been on observing and understanding special oceanographic characteristics of the Indian Ocean. The results have been reported in more than 5000 research articles so far.

The institute has a sanctioned strength of 200 scientists and 100 technical support staff. The major research areas include the four traditional branches of oceanography - biological, chemical, geological/geophysical, and physical as well as ocean engineering, marine instrumentation and marine archaeology.

Scientific Programme

The detailed scientific program of the proposed INQUA will follow the standard format of the IUGS and an International Scientific Committee would oversee the program.

Plenary/Invited Lectures	Plenary talks by stalwarts of different fields of Quaternary Sciences
Keynote	Each session will start with a keynote of 30 minutes
Thematic oral presentations	10+5 minutes
Topical sessions	Morning and afternoon each day

Invited Lectures

There will be inter-disciplinary special symposia where eminent Quaternary scientists will be invited to deliver talks on themes like:

- Quaternary Sciences – how far have we come
- Monsoons: Past, Present and Future
- Changes in Ocean circulation due to climate change
- Large River Dispersal Systems
- The Third Pole and its Climatic Implications
- Water-Unmaking of a Crisis
- Himalaya: Tectonics, Topography and Hazards
- Extreme Hydrological Events
- Sesimicity and Hazards
- Mathematical Geology
- Quantification of Processes
- New methods and Technology
- Anthropocene

Topical Sessions - Some Suggestions

- Neo-tectonics and Climate
- Tectonic Geomorphology and Earth Surface Processes
- Interfacing Biotechnology with Agricultural Geology
- Geomicrobiology and Biogeochemistry in Life under Extremes
- Human Transformation of Earth Systems and Sustainability

- Forensic Sciences in Quaternary
- Environmental Geochemistry
- Quaternary Geoscience Education
- Geohydrology in Irrigated Regions
- Geoparks and Geo-Tourism
- Data Archival and Knowledge Systems
- Studies of the Critical Zone in the Tropics
- Extreme Events and their Import on Earth Processes
- Soils of the Earth and their Management for Sustainability
- Numerical Simulations: Challenges and Opportunities
- Tectonics and Seismic Hazard in the Himalayan Region
- Aquifer Mapping and Ground Water Management

Proposed Schedule

<table>
<tr><th></th><th></th><th>19-Feb</th><th>20-Feb</th><th>21-Feb</th><th>22-Feb</th><th>23-Feb</th><th>24-Feb</th><th>25-Feb</th><th>26-Feb</th><th></th></tr>
<tr><td>-9:00</td><td></td><td></td><td>Registration</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>9:00-11:00</td><td rowspan="9">Pre-Conference Field Excursion</td><td rowspan="3">Return from Field</td><td>Inauguration</td><td>Topical Session</td><td>Topical Session</td><td rowspan="9">Mid-conference field work</td><td>Topical Session</td><td>Topical Session</td><td>Topical Session</td><td rowspan="9">Post-Conference Field Excursion</td></tr>
<tr><td>11:00-13:00</td><td colspan="3">Plenary / Public Sessions / Business Meetings / Expo</td><td colspan="3">Plenary / Public Sessions / Business Meetings / Expo</td></tr>
<tr><td>13:00-14:00</td><td colspan="3">Lunch</td><td colspan="3">Lunch</td></tr>
<tr><td>14:00-16:00</td><td rowspan="6">Registration and Ice-breaking session</td><td>Topical Session</td><td>Topical Session</td><td>Topical Session</td><td>Topical Session</td><td>Topical Session</td><td rowspan="2">Valedictory Session and Closing ceremony</td></tr>
<tr><td>16:00-18:00</td><td>Topical Session</td><td>Topical Session</td><td>Topical Session</td><td>Topical Session</td><td>Topical Session</td></tr>
<tr><td>18:00-20:00</td><td colspan="3">Cultural Programs / Group Interactions</td><td colspan="2">Cultural Programs / Group Interactions</td><td rowspan="2">Leave for Field</td></tr>
<tr><td>20:00-</td><td>Welcome Dinner</td><td colspan="2">Local Tours / Social Activities / Shopping</td><td></td><td>Conference Dinner</td></tr>
</table>

Total topical sessions that can be accommodated in varied topics and disciplines of Quaternary are 120-150. General body meetings and business meetings may also be conducted.

Professional Conference Organisers will provide the following services:

- Secretariat Services
- Oral sessions organisation & Poster Sessions display
- Onsite Secretariat

- Online Website creation and maintenance
- Online Registration
- Online Abstract Submission
- Online Visa Assistance
- Online Payment for Registration, Accommodation and Field excursions
- Designing and Printing
- Signage/Branding
- Cultural Programme
- Local Transportation
- Assistances in revenue generation and outreach activities

Registration and Budget

A fee of 20 €will charged for each Abstract submission.

A Full Registration which will include a Congress bag, abstract volumes and local maps, working lunches, morning and afternoon tea/coffee and snacks, invitation to the opening ceremony and get-togethers during the Conference. Daily transportation will also be provided from the hotels to the convention centre. The Registration Fee will have a two-tier format with regular and late + onsite registration.

Registration Fee for the accompanying participants (spouse & non-professionals) will be €500-600 and will include Congress material, lunches, tea/coffee and snacks, local sightseeing and cultural evenings of classical music.

	Regular Fee (€) Deadline 30th Oct, 2022	Late Fee (€) After 30th Oct, 2022
Full Delegate	650	750
Student Delegate	450	500
Full Delegate – Least developed country	450	500
Student Delegate – Least developed country	250	300

INQUA Capitation

All Abstract submission fees, will be paid to INQUA as capitation fee.

Exposition

An International exposition will be organized during the Congress within the premises. The exposition will showcase all the current advancement in Quaternary Sciences along with state-of-the-art technology. A large space will be available at special discounted rates.

Community Programs

The Indian community will be involved during the INQUA 2023, with certain outreach programs for school and college students and other welfare organizations. Given the established links of the national TV channels, Vigyan Prasar, and the EDUSAT (satellite for education) direct webcasting of plenary and public lectures carried out for a larger outreach.

Sponsorship and Support

Sponsorship and support are expected from major government departments and other sources. Being organized by the institutions of Department of Science and Technology, Ministry of Earth Sciences and Council of Scientific & Industrial Research the event will be underwritten by the Government of India. Additional support will accrue from the private companies and Oil Industry.

Estimated Cost of Participation

Region	Airfare to Delhi Economy Class	Registration Professional /Student	Stay in 3-5-star hotel for 7 days	Total Min to Max
Europe	900	650 / 450	350 to 1500	1700 to 3050
USA and Canada	1300	650 / 450	350 to 1500	2100 to 3450
Asia / Australia	300 to 1000	650 / 450 to 450 / 250	350 to 1500	900 to 3150
Africa / South and Central America	500 to 2000	450/ 250	350 to 1500	1100 to 3950

All costs are given in €.

Financial support will be given to students and scientists. The support is planned as following:

A. General Student Grant

This grant will provide scholarship covering Registration, travel, boarding, meals, etc. to school and undergraduate students coming from SAARC and BIMSTEC countries.

B. Early-career scientists and Postgraduate student Fellowship

Early-career scientists and postgraduate students who are citizens and residents of countries designated by the World Bank as "low" or "lower-middle" income per capita will be considered for this grant. Registration, travel, boarding, and meals will be covered.

C. Registration Fee waivers

Registration Fee of meritorious researchers will be waived off.

Hostel/Guest houses

Students and young scientists (from groups A-C) will be offered free or cheap accommodation (10-15 €/day) in Hostels and guest houses close to the venue on first come first serve basis.

The number of students/scientists to be supported will be decided later.

National Committees

Patrons

President, Indian National Science Academy, New Delhi
Vice-President, Indian National Science Academy, New Delhi
Secretary, Department of Science and Technology, New Delhi
Secretary, Ministry of Earth Sciences, New Delhi
Prof. S.N. Rajaguru, Life Time Fellow of INQUA, Pune

Mentors

Director, Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow
Director, Wadia Institute of Himalayan Geology (WIHG), Dehradun
Director, National Institute of Oceanography (NIO), Goa
Director, National Centre for Polar and Ocean Research (NCPOR), Goa
Director, National Centre for Earth Science Studies (NCESS), Thiruvananthapuram
Director, National Geophysical Research Institute (NGRI), Hyderabad
Director General, Institute of Seismological Research (ISR), Gandhinagar

Scientific Committee

Dr. Binita Phartiyal, BSIP, Lucknow
Dr. Pradeep Srivastava, WIHG, Dehradun
Prof. Vishwas Kale, Pune University, Pune
Prof. L.S. Chamyal, M S University, Vadodara
Dr. Anjum Farooqui, BSIP, Lucknow
Prof. Anindya Sarkar, Indian Institute of Technology, Kharagpur
Dr. N. Juyal, Physical Research Laboratory, Ahmedabad
Dr. Anupama Krishnamurthy, French Institute of Pondicherry, Puducherry
Dr. B.S. Kotlia, Kumaon University, Nainital
Prof. Hema Achyuthan, Anna University, Chennai
Prof. A.D. Singh, Banaras Hindu University, Varanasi
Prof. Rajeev Sinha, Indian Institute of Technology, Kanpur
Prof. U.K. Shukla, Banaras Hindu University, Varanasi
Dr. Amal Kar, Central Arid Zone Research Institute, Jodhpur
Prof. Sunil Kumar De, North-Eastern Hill University, Shillong
Dr. Sushama G. Deo, Deccan College, Pune
Prof. Vikrant Jain, Indian Institute of Technology - Gandhinagar
Dr. Snigdha Ghatak, Geological Survey of India, New Delhi
Prof. Satish Sangode, Savitribai Phule Pune University, Pune
Dr. Rajeev Saraswat, National Institute of Oceanography, Goa
Dr. Vineet K. Gehlot, National Centre for Seismology, New Delhi

Prof. M. Sekhar, Indian Institute of Science, Bangalore
Dr. Subir Bera, University of Calcutta, Kolkata

Field Excursions

Dr. Anupam Sharma, BSIP, Lucknow
Prof. D. M. Maurya, The M.S. University of Baroda, Vadodara
Prof. Dr. Nilesh Bhatt, The M.S. University of Baroda, Vadodara
Dr. Rajesh Agnihotri, BSIP, Lucknow
Dr. Thamban Meloth, NCPOR, Goa
Prof. Dhruv Sen Singh, University of Lucknow, Lucknow
Prof. Prasanta Sanyal, Indian Institute of Science Education and Research, Kolkata
Prof. Manoj Jaiswal, Indian Institute of Science Education and Research, Kolkata
Dr. Saikat Sengupta, Indian Institute of Tropical Meteorology, Pune
Dr. Santosh K. Shah, BSIP, Lucknow
Prof. Kotha Mahender, Indian Institute of Technology, Bombay
Prof. Sugatha Hazra, Jadavpur University, Kolkata
Prof. Rajeev Patnaik, Panjab University, Chandigarh
Dr. Parth Chauhan, Indian Institute of Science Education and Research, Mohali

Contacts

Dr. Binita Phartiyal
Birbal Sahni Institute of Palaeosciences
53, University Road, Lucknow, India
Email: binitaphartiyal@gmail.com
Phone: +91 9411856391

Dr. Pradeep Srivastava
Wadia Institute of Himalayan Geology
33 GMS Road, Dehradun, India
Email: pradeep71s@rediffmail.com
Phone: +91 9412058165

Field Trips

Pre and Post Conference Field excursions

List of possible Field excursions

5-8 Days each including To and Fro travel

1. Thar (Rajasthan) -Desert and its evolution
2. The Great Rann of Kachchh (Gujarat)- Salt marshes
3. Dholavira, Lothal, Kalibangan (Gujarat & Rajasthan), the Harappan Archaeological sites of Indus Valley Civilisation
4. Rakhigarhi (Haryana)-Holocene Climate and Harappan Civilization
5. Bhimbetka (Madhya Pradesh), UNESCO World Heritage Site- archaeological site spanning to prehistoric palaeolithic and mesolithic periods, Hathnora (Madhya Pradesh)-Hominid site
6. Mirzapur (Uttar Pradesh)-Rock/Cave art and paintings
7. East Coast of India- Geomorphology, Sea level changes and Neo-tectonics
8. Chilka (Orissa)- Lacustrine ecosystem
9. Sundarban Delta (West Bengal)- The Mangrove Forest
10. Pichavaram (Tamilnadu)–The mangrove ecosystem, sea level changes and climate, Rameshwaram (Tamilnadu)- southernmost tip of India-where three waters meet
11. Western Ghats (Kerala, Tamilnadu)- The bio-diversity hot spot
12. Lonar (Maharashtra)-crater lake, Ajanta-Ellora (Maharashtra)-Ancient historical sites, Western Ghats (Maharashtra) - The bio-diversity hot spot
13. Varanasi and Sarnath (Uttar Pradesh), UNESCO World Heritage Site-ancient historical sites, Chunar Fort, Rohtas Fort
14. Himalayan rivers
15. Mawmluh Cave (Meghalaya) - Karst landscape
16. Himalaya- Glaciers, glacial landscape and geomorphic evolution and climate
17. Satluj Valley (Himachal Pradesh)-Archives of Late Quaternary climate fluctuations
18. Ladakh (J&K)-Cold Arid Desert - Arid Zone Geomorphology, Processes, Sedimentation and Neotectonics along Indus Suture Zone
19. Transact across Himalaya-different tectonic-lithostratigraphy sections of lesser to trans Himalaya showing neo tectonics and active tectonics; Landslides; critical zones
20. Karewa Intermontane Basin (J&K) - Palaeolake deposits

Detail Description of Few excursions

Ancient civilisation and The Rann of Kachchh

Influence of Late Quaternary palaeogeographic effects on cultural evolution

The proposed pre-conference field trip will include visits to various sites in Kachchh that reflect interaction between landscape changes and human occupation patterns and cultural evolution with particular reference to the Harappan civilisation. The field trip will cover sites that showcase evidences of sea level changes and tectonic activity and its relation with archaeological settlements including Dholavira and others. The aim of the field trip will be to demonstrate how sea level changes and seismic events played significant role in Harappan as well as in historic times. Owing to the logistic constraints in remote areas of Kachchh, the number of participants will be limited to 15. The tentative programme of the field trip is as follows:

* Traverse from Bhuj to Kaladungar-Visit to sites of active faulting and palaeotectonic significance around Bhuj, Kaladungar, Banni plain and Great Rann of Kachchh

* Traverse from Bhuj to Lakhpat-Visit to sites around Lakhpat and Kori creek showing large scale geomorphological changes in western Kachchh induced by recurrent seismicity in historical times.

* Traverse around Dholavira-Travel from Bhuj to Dholavira, visit to Harappan archaeological site showcasing Harappan civilisation and its relation to palaeogeographic conditions, sea level changes and seismicity.

* Traverse around Little Rann of Kachchh to see Late Harappan archaeological sites and Late Holocene palaeogeographical changes.

Coastline

Geomorphology, sea level changes, neo-tectonics and bio-diversity hotspots

India boasts of its 7500 km long coastline fringing the Indian peninsula. The Indian coastline falls in humid (with two monsoons), semi-arid and arid climate with rocky, muddy and sandy segments. To see the local structural controls that are manifested by coastal configuration and geomorphology. A vivid fabric of the coastal geomorphology, sea level changes, neotectonic activities, coastal hazards (local as coastal erosion and siltation to regional like Indian Ocean tsunami of 2004); coastal sedimentary archives, beaches (rocky, sandy, shelly) all can be seen.

East coast

Prominent geomorphic segments are Ganga-Brahmaputra estuarine zone of the Sundarbans, sandy beaches of Odisha, rocky coast of Andhra Pradesh and punctuations by the river deltas, backwaters and coastal ridges of Kerala.

The Sundarbans is a vast mangrove forest in the coastal region in and around the delta of the Ganges, Brahmaputra and Meghna rivers at the Bay of Bengal. It was recognised in 1997 as a UNESCO World Heritage Site. Quaternary scientists will get the opportunity to experience active delta building processes, its complex network of tidal waterways, mudflats and small islands of salt-tolerant mangrove forests that presents an excellent example of ongoing ecological processes.

West Coast

Straight long sandy beaches of Karwar (Karnataka-Goa), rocky and sandy coasts of Maharashtra, tidal flats of the Gulf of Khambhat and Gulf of Kachchh in Gujarat along with rocky cliffs and shore platforms of Saurashtra Coast.

Coastal landscape is a net result of an equilibrium attained between a large number of interacting variables over very small (daily) to long (millennial) time periods. The present coastal system is an expression of a dynamic equilibrium established after the major sea level rise since the LGM, i.e. ~110 m rise in 10 ka.

Unravelling the mystery of the Gangetic plain

This field aims to show the geomorphic and sedimentological architecture of Ganga foreland basin starting from uplifted thrust sheets with piggyback basin, mountain front piedmont deposit, and central plain river systems to marginal plain peripheral bulge deposits. Pedogenesis aspects of different areas are emphasized. Some important geo-archaeological sites are also exhibited. It is designed to expose the world community to the contributions made by various study groups on the different aspects of the Himalayan foreland basin.

* Himalayan piggyback Basin, Main Bounadary Thrust (MBT), Himalayan Frontal Thrust (HFT) and topogarphic growth of landscape in Dehradun Area

* Dehradun to Mohand: Middle & Upper Siwalik, Ganga Piedmont and Megafan sequences

* Peripheral bulge sequence, Ravines, archaeological site etc. around Kalpi and Musanagar, Kanpur

* Ganga River cliff sections and archaeological sites around Varanasi

The Cold Desert - Ladakh, Trans Himalaya

Arid Zone Geomorphology, Processes, Sedimentation and Neotectonics along Indus Suture Zone

This excursion is designed to have a glimpse of the landscape of Ladakh Himalaya (lunar topography), showcasing the Arid zone geomorphology, Sedimentary processes, Suture zone tectonics and its influence on landscape, Palaeoclimate in form of (a) slack water deposits, (b) palaeolakes and glacial lakes (c) sand ramps (d) glacial moraines.

Ladakh is a delight for geologists as well as tourists. The entire area is a geoheritage with its lunar/martian topography, barren mountains, highest passes, highest motorable roads, suture zone, batholiths exposures, lakes and palaeolakes and rock art. Several monasteries and gompas are a major attraction and treat to the eyes.

* Thiksey Monastery: A Bird eye view to the geomorphology of the Indus River and Suture Zone and Shey Village sand ramp, Fanglomerate section and fluvio-lacustrine deposit

* Spituk palaeolake section, Shanti Stupa, River terraces on way to Karu, Flood deposits between Stakna and Upshi, Tanglang La, cave deposits, Hemis Monastery: triangular facets and amphitheatre valleys towards the left bank, from the right bank side

* Stok Village: the longest village of India, Indus Gorge and Confluence of Indus and Zanskar, Nimo glacial moraines

* Basgo Village / Nala: fluvial deposits and slope deposits, Saspol Lake section, Lamayuru Palaeolake, Alchi Caves, Zanskar River upstream to Chilling, Phyang Ice Stupa, Ganglass Village, Leh view point

Mid Conference and Local sight-seeing Tours

1. Jajmau-Bithurkalpi Transect in Ganga Plain: Diversity of rivers, Sediments, Landforms, Surface Processes, Human Culture, Palaeopedology and Tectonics

2. Daulatpur, Mangraul, Mohana and Kalpi sections in Ganga Plain: thick exposures that archive Late Pleistocene evolution in terms of peripheral bulge tectonics and climate change

3. Nawabganj Bird Sanctuary: 250+ species of migratory birds flock this area every year from northern higher latitudes and remain here from November-March

4. Hullas khera: Archeological site from 1000 BCE showing civil engineering and human culture

5. Lucknow old city: centre of culture and art of Nawabs in the 18th and 19th centuries

Venue

The Host City - Lucknow

Lucknow, the city of *Adáb* (courtesy), *Tahzeeb* (culture) and *Tazeem* (civility), is the capital of Uttar Pradesh. It is the eleventh most populous city and the twelfth most populous urban agglomeration of India. Lucknow, which is considered to be The Golden City of the East, has still kept its old-world charm absolutely intact, which is an appealing feature for the visitors and tourists. The city has been given various other names too, such as The Constantinople of India, *Shiraz-i-Hind* and the Golden City of the East. Its beautiful sprawling gardens, polite mannerisms, fine-cuisine, music, and *Shayari* (poetry), had found a patronage in the Shia *Nawab*s of the city who loved Persia.

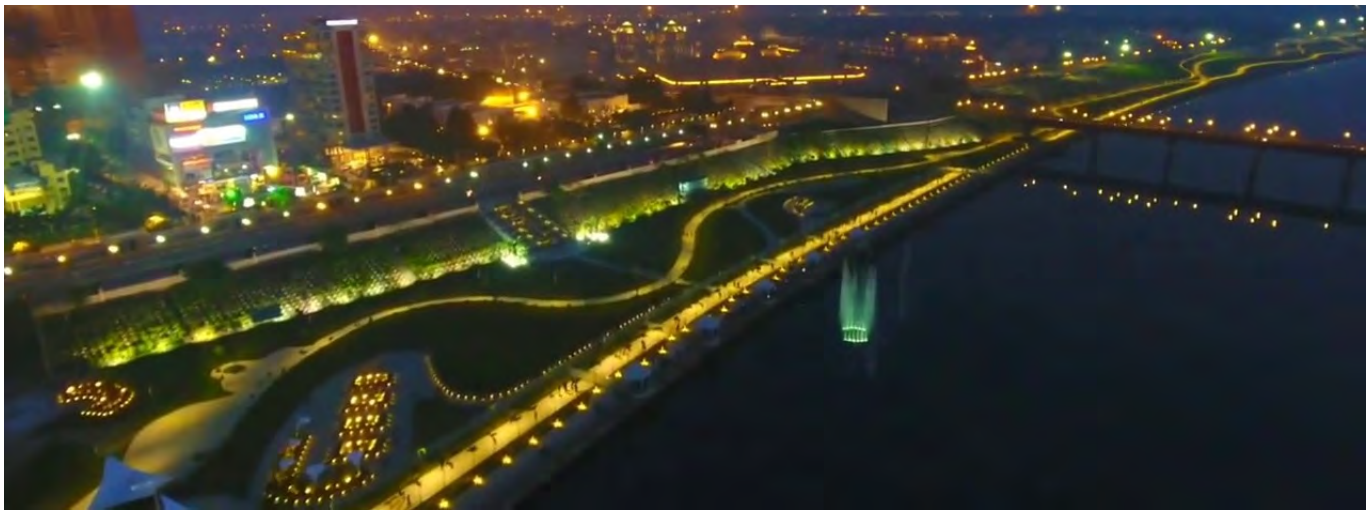
Lucknow has always been known as a multicultural city that flourished as a North Indian cultural and artistic hub, and the seat of power of *Nawab*s in the 18th and 19th centuries. The imperialistic splendour and magnificence of the *Nawabi* era has been glorified and eulogized down the ages by writers, poets and historians alike, but has to be seen to be believed. 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. It continues to be an important centre of governance, administration, education, commerce, aerospace, finance, pharmaceuticals, technology, design, culture, tourism, music and poetry.

Lucknow is host to a large number of research Institutes of the Government of India including the Birbal Sahni Institute of Palaeosciences, Central Drug Research Institute, National Botanical Research Institute, etc. as well as four Universities, Colleges for Fine Arts and Architecture, etc.

The culture of Lucknow has a great feel and is an amalgamation of complete sophistication, warmth, manners, etiquette, courtesy and a fine taste in standard of living. Many cultural traits of the city have become the landmarks of *Tehzeeb*. Lucknow is extremely popular stylish and delicate Indian embroideries like *Chikan* and *Lucknavi Zardozi*.

Lucknow's cuisine, also known as Awadhi cuisine has a unique delicate style. The major highlights are biryanis, kebabs and breads like, *nahari-kulcha*, *roomali roti* and *warqi paratha*.

The city is very well-connected from different parts of the country. The temperature is very pleasant in end-February, ranging between 23-29 ℃during the day, and 10-18 C at night. Early February may witness a few showers but end-February is generally dry, however, freak showers cannot be ruled out.



Air Connectivity

Lucknow is one-hour flight from New Delhi and Delhi Airport is connected by all the major international airlines from all the major airports worldwide. Direct air connections are available in Lucknow to New Delhi, Patna, Kolkata, Mumbai, Bangalore, Ahmedabad, Hyderabad, Chennai, Guwahati, Jaipur, Raipur, Dehradun, Chandigarh and other major cities via Chaudhary Charan Singh International Airport. The airport has been ranked the second best in the world in small airport category. The airport is suitable for all-weather operations and provides parking facilities for up to 14 aircraft. At present, Air India, Air India Express, Jet Air, GoAir, IndiGo, Saudi Airlines, Flydubai, Oman Air and Air Vistara operate domestic and international flights to and from Lucknow. Covering 1,187 acres (480 ha), with Terminal 1 for international flights and Terminal 2 for domestic flights, the airport can handle Boeing 767 to Boeing 747-400 aircraft allowing significant passenger and cargo traffic.

The Conference Centre: Indira Gandhi Pratishthan

Indira Gandhi Pratishthan (IGP), Gomti Nagar, spread over 25 acres, is centrally located and is surrounded by plenty of five-star hotels. It can accommodate 5000 to 10000 delegates conveniently. This is eco-friendly green campus with ample parking space and easy disable access.

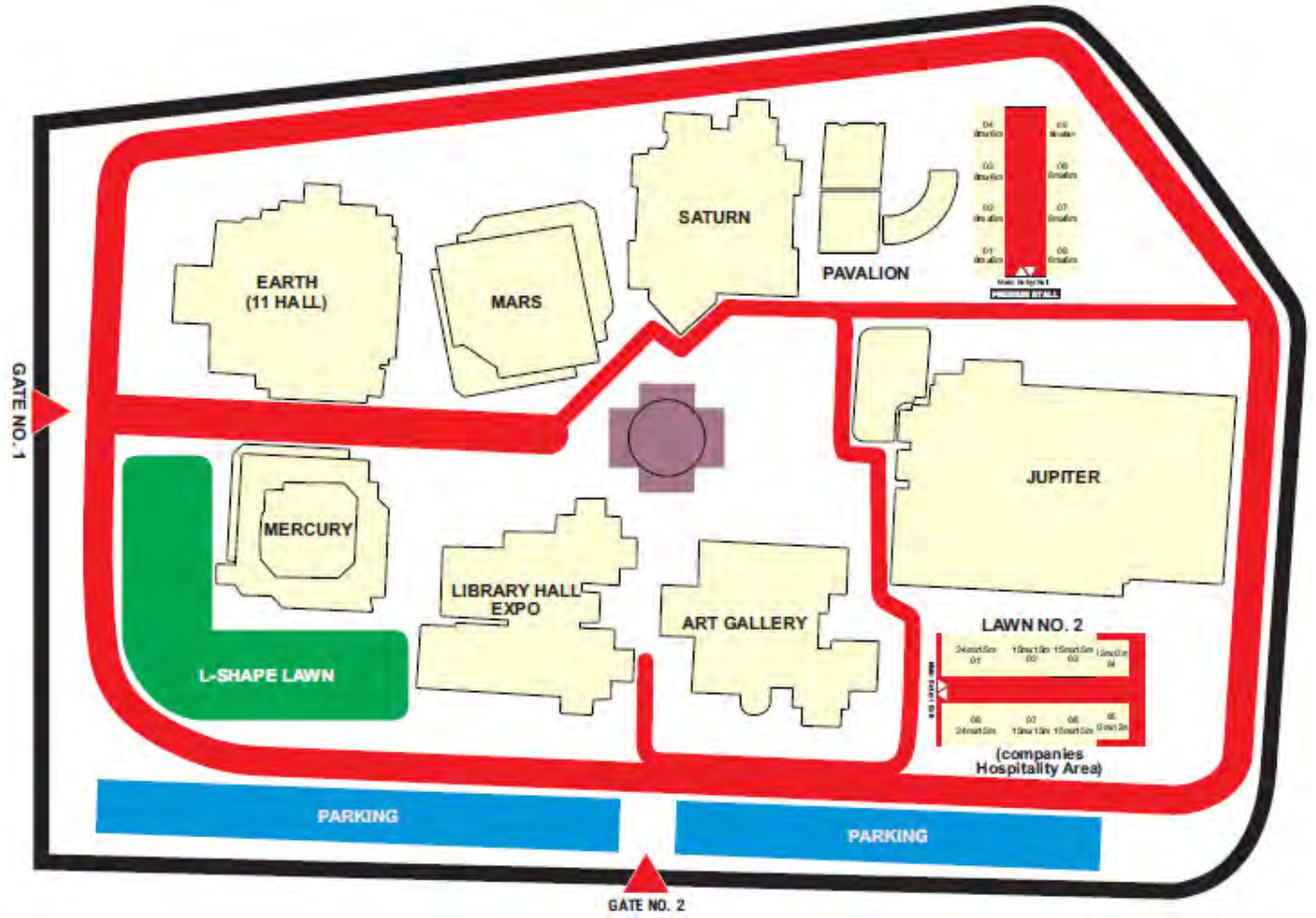
IGP has state-of-the-art auditoriums of 1500, 600, 400, 200 seating capacity and adequate small meeting rooms. The spacious and well-equipped conference halls are named after planets.

With Air-conditioned halls; Uninterrupted power supply; Wi-Fi /Tele/Fax facility; Floor ports/CCTV; Conference rooms; Banquet Hall; Business / VIP lounges; Organisers office; Paved open area; Freight/Passenger Lifts/Escalators; Security; Storage/Housekeeping; LCD Screens/video walls; First aid, etc. IGP, Lucknow caters to all the needs of the participants. With its convention and exhibition halls, executive lounges, cafeterias, parking, and allied facilities available under one roof makes it extremely suitable to hold big events.

Art Gallery:	Lawns/Open areas:
Hall 1: 200-250	Lawn 1 (L-shaped green area): 1000 People
Hall 2: 100-150	Lawn 2 (paved): 4000 people
6 rooms for meeting	Parking space for 1000+ vehicles

Neptune Library:
3 Halls each in the Ground and First Floors with 250 seats each
2 halls in Second Floor

Distance from Airport	Distance from Railway Station
22 kms	11 kms

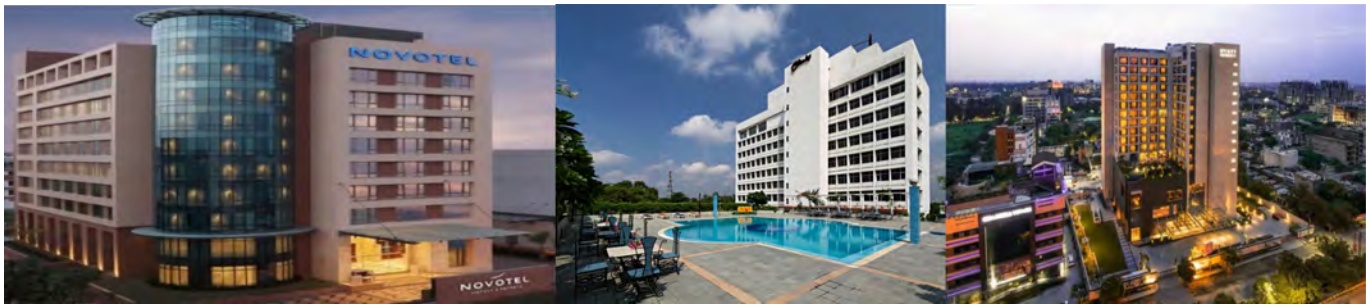


Accommodation

Adjacent to IGP, Lucknow, accommodation facilities are available from Five Star to Budget categories and this place also has an easy connectivity from anywhere in the city.

Hotels in Gomtinagar area (in the vicinity of the IGP):

Hotels		268
	Three Star	150
	Four Star	20
	Five Star	9
	Others	89
Guest Houses		13
Villas, Home stays, Resorts, etc.		47



Few of the prominent ones are:

S. No.	Hotel Name	Star Category	Distance from IGP (km)
1	Renaissance Lucknow	5	5.7
2	Vivanta by Taj - Gomti Nagar	5	5
3	The Piccadilly	5	17.6
4	Clarks Avadh	4	9.3
5	La Place Sarovar Portico	4	8.7
6	The Grand Radiant	4	9.8
7	Lebua Lucknow, Saraca Estate	4	8.3
8	Fairfield by Marriott Lucknow	4	1
9	Sapna Clarks Inn	4	7.3
10	Dayal Paradise	4	5
11	India Awadh	4	8.2
12	Golden Orchid	4	9.4
13	Gen X Casaya Inn	4	4.3
14	The Grand JBR	4	4.4
15	Comfort Inn	4	1.6
16	Lineage	4	3.9
17	Ranjees	4	2.3
18	Arif Castles - Lucknow	4	8.5
19	Savvy Grand	4	1.7
20	Silvete	3	8.5
21	York Inn Boutique	3	10.5
22	The Maple Leaf	3	9.6
23	Nest Inn	3	2
24	I.P. Palace	3	12
25	Gemini Continental	3	9.5

Local Sites

Lucknow, the city of *Nawab*s, is known for its civility, courtly manners and hospitality. Situated on the banks of the Gomti River, Lucknow is famous for its culture, food, heritage and its traditional dance form Kathak. Symbols of its rich historical past are well displayed here through the architectural designs, the handicrafts and the typical Nawabi way of life. A symbol of religious harmony, Lucknow is a hub of literature in Urdu, Hindi and many Hindustani Languages. The local cuisine is well-known for its delicate palette and combined cooking patterns from the Central Asia, the Middle East, and Northern India. The various architectural styles and brilliant monuments make Lucknow a historian's delight.

Tourist attractions

Bara Imambara	Indira Gandhi Planetarium
Chhota Imambara	Dream World Water Park
Hazratganj	Rumi Darwaza
British Residency	Dr. Ambedkar Park
Wajid Ali Shah Zoological Garden	Botanical Garden
Janeswar Mishra Park	Gomti Riverfront

We acknowledge:

Scientific inputs and field illustrations of the outcrops for this document were provided by colleagues from Quaternary group of BSIP and those in various institutions in the countries such as MS University Baroda, Savitribai Phule Pune University, Lucknow University, National Geophysical Research Institute, National Centre for Polar and Ocean Research, Banaras Hindu University, Indian Seismology Institute, Physical Research Laboratory, Ministry of Earth Sciences, Indian Institute of Technologies of Gandhinagar, Kanpur, Kharagpur, Roorkee, etc. Write up for few of the field trips were kindly provided by Dr. Nitesh Khonde, Dr. Pradeep Srivastava and Dr. Nilesh Bhatt. We utilised web sources and the materials provided by the several ministries of Government of India. We thank Prof. A.K. Singhvi, Prof. Vishvas Kale and Dr. Vandana Chaudhri for their inputs. We sincerely thank Dr. Neeraj Rai for cover page design. The final document was compiled, composed and typeset by Dr. Binita Phartiyal and Dr. Trina Bose.

This is an academic document for the bid for hosting an INQUA-2023 and may include several general-izations.

Although, the bid is supported by the several Ministries of Government of India, this is not an official document of the Government of India.

We welcome you to

Joined hands of Namaste is the formal
greeting in India, which implies,
'the spirit in me respects the spirit in you and
the divinity in me bows to the divinity in you.'

Its first use is traced back to the
Indus Valley Civilization ca. 4000 years ago