# Two Days Workshop On
# Geodynamic Genesis of Indo-Burma Range – A Conundrum in Earth Science

## (GeoIBR'22)

**6th & 7th JUNE**


**Organized by-**
**Geo Sciences & Technology Division**
**North East Institute of Science and Technology**
**Council of Scientific & Industrial Research**
**Jorhat, Assam, India, 785006**


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# *Preface*

North East Institute of Science and Technology, Jorhat, Assam, a constituent establishment of the Council of Scientific and Industrial Research (CSIR), New Delhi, has been engaged in multidisciplinary research and development work relevant to the country in general and the North Eastern Region in particular. The institute's vision and mission are to empowering excellence in basic and applied research for developing technologies with sustainable development to improve the quality of life in North-East India. Among the major multidisciplinary divisions in the institute, Geosciences and Technology Division is actively working on the active Geodynamics and Tectonics of the northeastern region. The mandate of the division (GSTD) is to estimate seismic hazard of the North East India with a vision to understand scrupulously the geodynamics of this region and its vicinity, pursue Earth science towards hazard mitigation and to thrive for innovative idea/technology to make the region earthquake disaster free.

The Northeast India region is one of the world's most seismically active zones, consisting of two arcs, the Himalayan arc to the north and the Indo-Burmese arc to the east. The Indo-Burmese Range (IBR) is formed by the oblique subduction of the Indian plate beneath the Burmese sliver plate. It has more seismic potential, with strong uplift and exhumation rates. One of the most pressing issues is the tectonics, seismicity, and evolution of the Indo Burma Range. There are strong debates regarding the current state of subduction, the pattern of subduction (oblique or normal), causes of intraslab earthquakes, complex geodynamics and tectonics as well as the rapid exhumation rates, which are the present day conundrums in earth system science and needs an immediate response therefore.

The current workshop aims to synergize thought-provoking ideas, innovative methodologies, logical theories, solutions, and trainings to better understand the current geodynamics and hazard scenario of this complex Indo Burma Range.

# *About GeoIBR'22*

A two days workshop on "Geodynamic Genesis of Indo-Burma Range – A Conundrum in Earth Science (GeoIBR'22)" was organized at Dr. J N Baruah Auditorium, CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat, Assam from 6th June to 7th June, 2022. GeoIBR'22 intends to provide research-based training to undergraduate, postgraduate, research scholars and faculties from various colleges and institutes affiliated with UGC/AICTE/State/Central /Private Universities across the country. The programme as a whole provided a platform for closer interaction between eminent scientists and participants in order to bring together thought-provoking ideas, innovative methodologies, solutions, and trainings to better understand the current geodynamics and hazard scenario of the complex Indo Burma Range. The programme was funded by Science and Engineering Research Board (SERB), India, through an Early Career Research Award (ECRA) as part of its scheme and scope in Scientific Social Responsibility. It is a matter of pride that more than 660 participants from India and abroad have registered and attended the event. This particular workshop was held in a Hybrid mode, both Physical and Virtual. Among the 660 applicants, about 60 candidates were selected to physically attend the workshop at CSIR-NEIST and the rests were attended through virtual mode. All the lectures were streamed live on MS-Teams and archived on YouTube, which can be accessed at any time. The workshop was inaugurated by Dr. G. Narahari Sastry, Hon'ble Director, CSIR-NEIST, Jorhat. In his inaugural address, Dr. Sastry underlined the institute mandate and particularly addressed the way, Geo Sciences and Technology Division (GSTD) is progressive towards vision. Later in the programme, Chief Guests Prof. Sunil K. Singh, Director, CSIR-NIO provided insightful and innovative lectures about Indo-Burman range drives the sediment budget of the Andaman Sea.

This successful event was graced by some stalwarts of the Indian Geoscientific community like, Dr V. M Tiwari, Director, CSIR-NGRI, Hyderabad; Prof. Sunil Kumar Singh, Director, CSIR-NIO, Goa; Prof. Sagarika Mukhopadhyay, IIT Roorkee; Dr Kalachand Sain, Director, WIHG, Dehradun; Prof. J R Kayal, Ex-Dy DG (Head, Geophysics), GSI; and Dr Vineet K Gahalaut, Chief Scientist, CSIR-NGRI, Hyderabad. These eminent scientists of international repute have conducted the technical sessions on the new and progressive researches on the contemporary geodynamics of IBR region and interacted with the participants to fill the gap of

understanding the complex seismicity, evolution and deformation of IBR region. A total of four technical sessions, one key-note lecture and a dedicated training session was performed as part of the schedule of this flagship event.

This particular workshop was managed very successfully, which witnessed the participation of researchers from all the corners of the country, along with international participation. The participants who have participated physically at CSIR-NEIST are provided all types of facilities in free of cost, which ranges the food for all times and accommodation along with local transport. This is one of the major success and achievements of the event, for which the efforts from national and industrial/academic partners are always appreciable. This two days flagship event was proudly sponsored by the national official sponsor, Science and Engineering Research Board (SERB, through ECRA), the Industrial sponsors in the field of Geosciences like Chevron Geomet and Aimil Ind. Ltd and the academic sponsor- The Kaziranga University, Jorhat. The best part of this workshop was the positive remarks and comments by the participants, which indeed reflected their feelings in successful understanding the theme, ideas and complex geodynamics of IBR, alongside the able management and proceedings of the event in a smooth manner by the hard work and efforts of the organizing committee.

In a nutshell, this event, GeoIBR'22 has turned out to be a very informative, socio-realistic, knowledgeable and successful workshop. This has successfully achieved the goals for the theme, and drawn the genesis of geodynamics of the complex IBR and catered the need of the hour to fulfil the gap of understanding for evolution, seismicity and contemporary tectonics of this complex region.

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JORHAT-785006, ASSAM, INDIA

Dr. G Narahari Sastry
FNA,FASc,FNASc,FRSC
DIRECTOR

Warm Greetings from CSIR-NEIST, Jorhat!

One of the pleasurable duties of a scientific organization is to provide a platform for young scientists and students to engage with renowned personalities in the field and CSIR-NEIST has been in the forefront of several such activities, since its inception. I congratulate Geo Sciences and Technology Division of the CSIR-North East Institute of Science and Technology, Jorhat, for taking the initiative to organise a two-day workshop on "Geodynamic Genesis of the Indo-Burma Range – A Conundrum in Earth Science (GeoIBR'22)" on the 6th and 7th of June 2022. I believe that conducting a workshop and training programme like GeoIBR'22 is a wonderful way to enhance the morale of not only the students but also the researchers and faculty and make the aware of problems, opportunities and challenges in the field of geodynamics.

I am delighted to note that eminent scientists across the country has accepted to take part as speakers and delegates in the conference. The online mode of attending the workshop which has become very popular in recent times, has facilitated the participation of about 650 participants across the country virtually, while 60 participants are expected to participate physically, and also a good number of CSIR-NEIST members are expected to join. I consider it as a great honour to welcome all the faculties, researchers, academicians and students for their active participation in the GeoIBR'22. I'd like to thank and appreciate each keynote speaker for accepting our invitation and I am sure that their dissemination of scientific knowledge certainly inspire the country's young minds to engage in innovative scientific research.

The current effort is first of its kind workshop by CSIR-NEIST on Indo Burma Range to address the conundrum of present seismicity, evolution and tectonics, which has been a longstanding debate in the field of geodynamics. The programme as a whole is expected to provide a platform for closer interaction among the participants and is expected to trigger thought-provoking ideas, innovative methodologies, solutions, and trainings to better understand the current geodynamics and hazard scenario of the complex Indo Burma Range.

I congratulate the convener, Dr. Debasis D Mohanty, and Dr. Manoj Kumar Phukan, Head GSTD, chief advisers and the local organising committee and the entire team for their efforts and planning in organizing this event.

I wish the congress all the success.

G Narahari Sastry

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**Dr. Manoj Kumar Phukan**
Head, Geoscience & Technology Division,
CSIR-North East Institute of Science & Technology
Jorhat - 6

## Message from the Head of the Department, GSTD, CSIR-NEIST

The workshop "Geodynamic Genesis of Indo-Burma Range – A Conundrum in Earth Science" organized by Geoscience & Technology Division of CSIR-NEIST aims to address some key questions of one of the tectonically most challenging areas in the world. I feel privileged and very happy to be a part of the organizing committee of this workshop. I extend my sincere gratitude to the esteemed resource persons who have agreed to deliver the keynote lectures in the technical sessions of the workshop. I am also extremely thankful to all the participants of the workshop who have physically come from different parts of India to be a part of the program. Our sincere thanks go to the large number of on-line participants too, whose overwhelming responses have highly motivated us in organizing the workshop. On behalf of the organizing committee, I acknowledge our sincere gratitude to the chief advisors, and different divisions & sections of CSIR-NEIST that contributed in organizing the event. Finally, my sincere acknowledgement goes to Prof. G N Sastry, Director, CSIR-NEIST for all his advises, encouragement and supports in conducting the workshop.

(Manoj Kr. Phukan)

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**Dr. Debasis D Mohanty**
Scientist, Geoscience & Technology Division,
CSIR-North East Institute of Science & Technology
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## Message from the Convener

It is my duty and great pleasure to share the proceedings of a two-day workshop on the "Geodynamic Genesis of the Indo-Burma Range – A Conundrum in Earth Science (GeoIBR'22)" held on 6th and 7th June, 2022. This workshop is in accomplishment of the Diamond Jubilee year of CSIR-North East Institute of Science and Technology. As the convener of this workshop, I sincerely extend my gratitude and regards to Dr. G Narahari Sastry, Director, CSIR-NEIST for supporting this idea and encouraging to organize this event. I am indeed thankful to him for extending his supports in every aspects of this program, to make it a highly successive event.

This workshop is supported and funded by the Science and Engineering Research Board (SERB), DST, India as part of the Early Career Research Award (ECRA). On this special occasion, we are proud to announce that, we are fortunate enough to have Prof Sunil K Singh (Director, CSIR-NIO) as the Chief Guest, Dr. Virendra M Tiwari (Director, CSIR-NGRI) as Chief Guest, Prof. J R Kayal as Chief Advisor, Prof. Kalachand Sain (Director, WIHG) as Distinguished Guest, Prof. S Mukhopadhyay (Professor, IIT Roorkee) as the Guest of Honour, and Dr. Vineet K Gahalaut (Chief Scientist, CSIR-NGRI) as the Guest of Honour.

The Indo Burma Range is highly complicated in terms of seismicity, evolution, and tectonics. The current workshop intends to bring together provocative thoughts, innovative techniques, solutions, and trainings in order to properly understand the current geodynamics and hazard scenario of this complex Indo-Burma Range. It is a matter of pride that more than 650 participants from India and abroad have registered for the event. This particular workshop was held in a Hybrid mode, both Physical and Virtual. Among the 650 applicants, about 60 candidates got selected for physical participation and attended this workshop at CSIR-NEIST.

As the convener of this workshop, I would like to extend my sincere gratitude to Dr G Narahari Sastry, Director, CSIR-NEIST, for his continuous support and motivation. My sincere thanks is due to Dr. Manoj Kumar Phukan, Head, Geosciences Division. I am thankful to Dr Bijit K Choudhury and Dr Chinmoy Rajkonwar for their immense help in conducting this event. In this continuation, I am thankful to each and every members from Geosciences and Technology Division, for their support. I would like to thank all the chief advisors, local advisors, local organizing committee, editorial Committee, technical program committee, student volunteers and the staff members of the CSIR-NEIST for their dedicated support. I feel fortunate to have my four abled and hardworking students, along with all the research scholars from the Department of Geosciences, who have stood as the pillar of success for this event. My thanks is also to our proud sponsors; Kaziranga University, Aimil Limited, and Chrisvin Geomet Services Private Limited.

Finally, I thank all of the volunteers and individuals who have contributed directly or indirectly to the workshop. This workshop would not have been possible without their cooperation and full support. Special thanks to all of my students for their hard work to ensure the success of GeoIBR'22.

(Debasis D Mohanty)

# Talk Abstracts of Keynote Speakers

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| **Day 1 (6th June)** |
| **Inauguration Ceremony** |
| **Key Note Lecture-**<br>**Key Resource Person: Prof. Sunil K Singh, Director, CSIR-NIO, Goa Talk Title:** Indo-Burman range drives the sediment budget of the Andaman Sea |
| **1st Technical Session-**<br>**Key Resource Person: Prof. J R Kayal, Ex-Dy. Director, GSI**<br>**Talk of the workshop:** Geodynamics of the IBR: An Appraisal |
| **2nd Technical Session-**<br>**Key Resource Person: Dr. Kalachand Sain, Director, WIHG**<br>**Talk title:** Geo-hazards in the Himalaya and AI-based Early Warnings: Earthquakes, Landslides and Avalanches |
| **Day 2 (7th June)** |
| **3rd Technical Session-**<br>**Key Resource Person: Prof. S Mukhopadhyay, Professor, IIT Roorkee**<br>**Talk title:** Geodynamic Evolution of the Indo Burma Ranges – Present Day Geophysical Signature. |
| **4th Technical Session-**<br>**Key Resource Person: Dr. V K Gahalaut, Chief Scientist, CSIR-NGRI**<br>**Talk title:** Tectonics of Indo-Burmese arc |
| **5th Session (Training):**<br>1. Demonstration on Ground Penetrating Radar (GPR).<br>2. Demonstration of broadband seismometer – installation and data processing.<br>3. Demonstration of gravity meter and survey. |
| **Closing Ceremony** |

# Indo-Burman range drives the sediment budget of the Andaman Sea

**Sunil Kumar Singh** FNA, FASc, FNASc

Director, CSIR-National Institute of Oceanography, Dona Paula, Goa

## Abstract:

The Andaman Sea receives about 550 MT of sediments annually through the Irrawaddy and the Salween Rivers. The Irrawaddy is the major river originating in the Northern Myanmar with a catchment area of 4.1 × 105 km2 and debouching into the Andaman. The Chindwin is its major tributary which joins it in downstream Mandalay. The Salween River originates in the Tibetan Plateau and drains an area of ~2.7 × 105 km2 in the Yunnan Province of China, the Kayan and the Mon States of Myanmar before debouching into the Andaman Sea. The smaller rivers, the Kaladan, Naf, Lemro, Mayu flowing through the western slope of the Indo–Burman ranges along the Arakan coast supply sediments to the western shelf of Myanmar. The Irrawaddy River flows through the Gangdese batholith, metamorphic rocks and ophiolites, the volcanics from a Cretaceous arc, sediments produced during the collision and the Mogok Metamorphic Belt containing schists, gneisses, marble, migmatites, and calc-alkaline plutonics. Many of the rivers along the Arakan coast and the western tributaries of the Irrawaddy such as the Chindwin River drain the Indo–Burman range comprising the Neogene and Paleogene sedimentary rocks, ophiolites, serpentinites, metamorphic rocks of Triassic to Cretaceous age and the Cretaceous-Cenozoic forearc flysch. Sr-Nd isotope composition along with major element compositions of the sediments from the Irrawaddy river and the Myanmar Shelf are used to identify their sources over the Andaman Shelf region. Major elemental compositions of these sediments constrain mafic lithology containing ophiolites, ultrabasic rocks and andesites over the Indo–Burman range as the dominant source of these sediments. Non-radiogenic Sr isotope ratios along with radiogenic Nd isotope composition confirm the Indo-Burman range as dominant control on the sedimentary budget of the Andaman Sea. Intensely focused precipitation over the higher relief of the western slopes of the Indo-Burman range causes higher erosion over this mountainous region, supplying enormous amount of sediments through the Kaladan and the Irrawaddy rivers to the Western Myanmar Shelf. Such intense erosion of the Indo-Burman range enhances its uplift due to isostatic rebound contributing significantly to its dynamic evolution.

# Geodynamics of the IBR: An Appraisal

**J R Kayal**

Ex-Dy. Director General (Head, Geophysics), GSI, Kolkata;
Presently: Adjunct Professor, NIT Agartala

## Abstract

The ~1100 km long, 150 km wide and ~1000 m high Indo Burma Ranges (IBR) run almost in north-south direction, convex westward, joins the E-W Himalayan arc to the north forming the Eastern Himalayan Syntaxis (EHS) zone. It is generally accepted that the sea-floor spreading along the Carls Berg Ridge pushed the Indian plate towards north-northeast during the Cenozoic, and the IBR, or the Burmese arc was formed as a result of subduction of the Indian plate under the *Burma platelet* (e.g. Mitchell, 1981, Geol. Soc. London; Nandy 2001, abc pub., India).

Seismological evidences suggest a 30-40 km thick dipping seismic zone (or Benioff zone) down to 200 km below the IBR; the dipping structure is conformable with the observed gravity anomaly (Kayal, 1996, Him. Geol.). The Burmese arc connects the Andaman-Sumatra-Java arc to the south, and the Benioff zone deepens down to 300 km below Andaman, 400 km below Sumatra and 660 km below Java islands (Rao and Chary 2005, Curr. Sci.). Further, seismic cross section along the IBR shows that the Benioff zone does not exist beyond 26° N latitude, which implies that the subduction tectonics is taken over by the collision tectonics to the north (Kayal, 2008, Springer). Fault plane solutions indicate that the shallower (<90 km) earthquakes show normal and strike slip faulting, and deeper (>90 km) earthquakes thrust faulting below the IBR (Rao and Kalpana, 2005, GRL). The stress inversion reveals a NNE-SSW compressional stress in the IBR (Baruah et al., 2013, BSSA), which suggests that the subducted Indian lithosphere below the IBR is possibly being dragged to the NNE with the Indian plate movement. Seismic tomography, on the other hand, images the high velocity subducted lithosphere down to 500 km below the IBR (Koulakov, 2011, JGR); the lower part of the subducted plate below 200 km depth is not seismically active. Note that the IBR produced some 10 large earthquakes (Mw $\geq$7.0) and the EHS produced the 1950 great Assam-Tibet earthquake (Mw 8.4) since the 1897 great Shillong earthquake. The intra-plate seismicity in the region, like that in the Assam valley Kopili fault zone, Shillong plateau and Bengal basin, is explained by the tectonic stresses transmitted from the Burmese and Himalayan arcs.

Several geophysical precursor studies, carried out by several authors in the region, are summarised by Kayal (1991, PAGP). In April-August, 2020 an earthquake precursory (?) swarm is observed in Mizoram (IBR). It is, however, argued that based on the observed precursors short-term earthquake prediction with specific *time, space and magnitude* is far from the success till date, It is, however, emphasized that the seismic hazard *microzonation* maps in the region can help us to build an earthquake resilient society like that in Japan, NZ or USA.

# Geo-hazards in the Himalaya and AI-based Early Warnings: Earthquakes, Landslides and Avalanches

**Kalachand Sain** FNA, FASc, FNASc, FTAS, FAPAS, J.C. Bose Fellow, GoI

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## Abstract

The sediment-water transmits from the rivers, snow fields and glaciers system rivers have made the Himalaya as the center stage for human settlement for socio-cultural development and agro-economy. However, 2500 km long NW-NE stretch of Himalaya is prone to Geo-hazards caused by earthquakes, landslides, avalanches, glaciers lake outburst floods (GLOFs), landslide lakes outburst floods (LLOFs), debris flows, flash floods etc. A lot of sub-surface and surface processes such as crustal shortening, complex geodynamics, convergence, tectonics, neo-tectonics, rock deformation, rising, weathering, erosion, climate-induced extreme events, solid/liquid precipitation, developmental activities, etc. are still on. All these have led to the changes in landscapes and geomorphology of the Himalaya, which, in turn, control the damage patterns during a disastrous event. Billions of people living in the Himalaya and adjoining mountainous regions like the Indo-Burmese Arc under the threat or risk of geo-hazards of different magnitudes. Every year, the mountainous region experiences some sort of disasters that incur huge economic loss in terms of death toll and damage to properties and structures. As per PM's 10 points agenda on Disaster Risk Reduction, it is our responsibility to build a disaster-resilient society and climate-adaptable future for sustainability and secured living in the Himalaya and adjoining mountains.

With the dense network of high-resolution data, availability of fast computing system, advancement of modelling approaches combined with application of AI/ML, it is possible to predict the disastrous events that can be caused by earthquakes, landslides and avalanches. All these natural hazards cannot be stopped but their impact to lives and livestock or damage to properties and structures can be reduced by monitoring and early warning against such disasters. The investment on this monitoring and development of operational Integrated warning system (IWS) would be much more cost-effective than the cost we have to pay for the rehabilitation, restructuring and loss of lives. Once the IWS is operational at a basin, it can be easily developed and deployed to other areas of concern. Several aspects of Geo-hazards and their plausible mitigation will be discussed.

# Geodynamic Evolution of the Indo Burma Ranges – Present Day Geophysical Signature

**Sagarika Mukhopadhyay**

Senior Professor (HAG), Department of Earth Sciences, IIT Roorkee 247667

## Abstract

The Indo Burma Ranges (IBR) developed due to the eastward subduction of the Indian plate below the west Burma microplate. It is a part of a very complex regional tectonic evolution. It is surrounded by the Burma microplate to the east, the Bengal Basin-Shillong Plateau–Mikir Hills, to the west, the Brahmaputra river basin to its northwest, the Assam Syntaxis that connects it to the Eastern Himalayas to its northeast, and the Bay of Bengal including Andaman-Nicobar Island chain to its south. It is seismically very active and falls within Zone V of the seismic hazard zonation map of India. There is a very well-defined Benioff zone with seismicity extending up to about 150 km. There are several opinions about the present-day nature of plate motion below the IBR. Some researchers claim that active subduction is going on at present. Some claim that there is oblique subduction. Still, others claim that active subduction has stopped and at present, the remnant of the subducted plate is being dragged northwards. The researchers in my laboratory are engaged in imaging the subsurface structure of NE India and its surroundings using various methods of analysis of earthquake data including travel time tomography, surface wave tomography, and receiver function analysis. The results clearly indicate that the Indian lithosphere is underthrusted below the Eastern Himalayas. The subducted part of the Indian plate below the IBR is also clearly visible in the tomographic images. One interesting finding is that the Indian plate is buckled up and the crest of the buckled-up portion lies below the Shillong plateau – Mikir hills region. We interpret this as the manifestation of the plate being in a vice-like grip between two compressive regimes, viz. the Eastern Himalayas towards its north and the IBR towards its east. The complex interaction of the Indian plate with the Eurasian plate towards its north and the Burma microplate towards its east has created a unique tectonic regime in NE India and its surroundings that needs a more detailed and collaborative research initiative.

# Tectonics of Indo-Burmese arc

**Vineet K. Gahalaut** FNA, FASc

Chief Scientist, CSIR-National Geophysical Research Institute, Hyderabad

## Abstract:

Earthquakes in the NE India are as diverse as the region itself. They occur in response to the India-Eurasia and India-Sunda interaction in the north and in the east, respectively. The region exhibit interplate, intraplate, intraslab and intrawedge earthquakes. It is also the region which has produced the largest continental earthquake of the Himalayan arc. Earthquakes in the Indo-Burmese arc (the IndoBurmese wedge and Sagaing fault) occur in response to the partitioning of the India-Sunda motion along these two distinct boundaries. Under the accretionary wedge of the Indo-Burmese arc, majority of the earthquakes occur in the depth range of 30-60 km and define an eastward gently dipping seismicity trend surface that coincides with the Indian slab and are termed as intraslab earthquakes which occur on steep plane within the Indian plate. There have been recent studies which suggest that the shallower part of the wedge (below Bangladesh, Tripura and Cachar region may host a large megathrust earthquake on the plate interface. Although the earthquakes within the wedge are rare, recently there was an earthquake close to the Mizoram Myanmar border which occurred at shallow depth (<20 km) and appears to be within the wedge. In the Sagaing fault region, earthquakes occur through dextral strike slip motion along the north-south oriented plane and the stress state is consistent with the plate motion across the Sagaing fault. Beside reviewing seismicity, I plan to discuss the GPS measurements of crustal deformation and their constraints on the tectonics of the region.

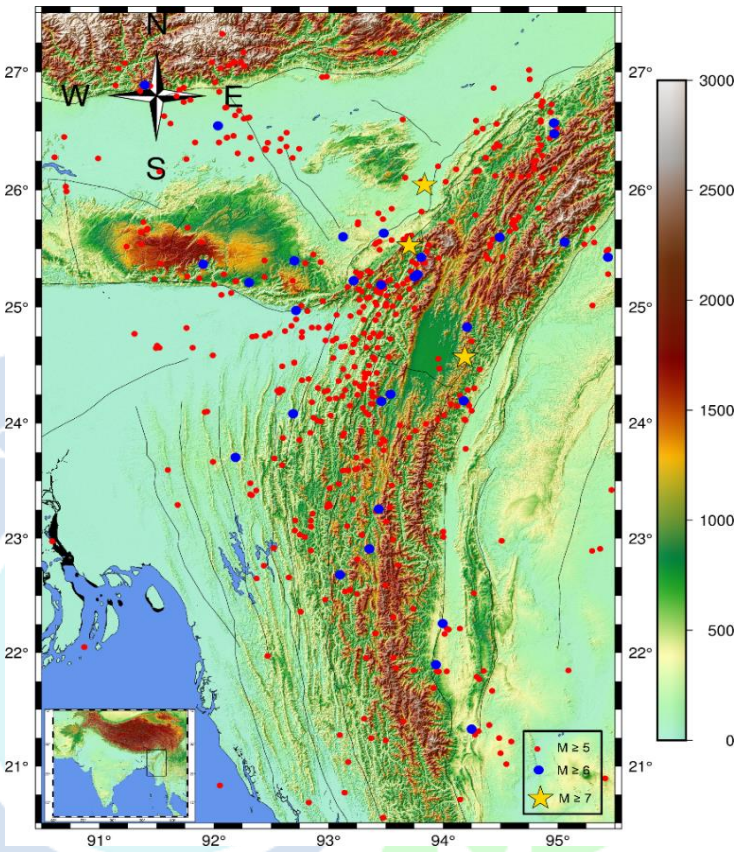
## Geodynamics of Indo- Burma Range

North-East India is one of the most seismically active regions of the world because of the convergence between the three major plates – India, Eurasia, and Sunda forming two convergence zones, i.e., the Himalayas and Indo-Burma Range. In the Indo-Burma subduction zone, Indian plate is obliquely subducted beneath the Sunda plate with a relative velocity of 5cm/yr in between the Indian plate and Eurasian plate, towards a direction of N20E, responsible for the formation of this Sliver plate, the Burma plate. A series of fold and thrust belts formed in the Indo-Burma Range as a result of convergence, trending from NE-SW at the Naga-Patkai range to N-E at the chin hills and NNW-SSE at the Arakan Yoma belt. The 1250 km long IBR arc is bounded by Bengal basin to the west and the central Burma basin to the east. Towards south, the Andaman Nicobar Island is the continuation of IBR and the northern limit is comprised of the eastern Himalayan syntaxis. The complex tectonic nature of IBR makes it important region to study from the seismological and geological point of view.

The origin of IBR can be explained by the high oblique subduction of Bengal crust beneath the Burma plate. The direction of movement of Indian slab is in $N17^0$-$21^0E$ having a rate of motion of 5 cm/yr towards North and 1.6-1.9 cm/yr towards East. The obliquity of plate motion throughout the Indo-Burma range varies progressively from 58° at 20° N latitude to 70° at 22° N latitude to 90° at 24° latitude, beyond which the obliquity exceeds 90°. The slab pull extension tectonics is the driving force for subduction. The dip amount of the subducting slab progressively increases from north to south direction. The major tectonic and subduction events are dated to the Lower Cretaceous to Mid-Miocene age.The IBR can be defined as an accretionary wedge of oceanic materials. The fast accretion of Bengal basin sediments leads to the development of Indo Burma Wedge. The process involves in the growth of Indo-Burma Wedge is N-S dextral shearing, where right lateral shearing in the innermost part and E-W shortening in the outermost part are prominent mechanisms in this region. The Indo Burma Wedge is spreading and drifting westward along the southern edge of the Shillong plateau, comprised of colliding microcontitents, continental Mesozoic – Paleogene flysch sediments and ophiolites. The Kabaw and the Sagaing are two major faults in IBR. The Sagaing fault is a right lateral strike slip fault in the eastern margin of this region and the Kabaw Fault, which runs through the center of the range, acts as a major tectonic boundary between the Indo-Burma Range and the Burmese basin, while the nature of the Indo-Burma plate margin is unclear.

## Seismicity in the Indo-Burma Region

Earthquakes in the Indo-Burma Range (IBR) are the result of the ongoing subduction process. These earthquakes can be classified mainly into three classes as: a) Earthquake in the plate boundary b) Earthquakes in the Benioff-Zone and c) Earthquakes in the overriding plate. Generally the earthquakes occur in the depth range of 30-60 km under the Indo-Burma wedge. The focal depth of the Indo-Burma arc can be traced up to 150 km. However, the Sagaing fault region produces shallow depth earthquakes of less than 25 km. With increasing depth, the pattern of the Benioff-Zone earthquakes changes from Normal Faulting and strike slip faulting (<90 km depth) to reverse/thrust faulting (>90km depth).




*Seismicity map of Indo Burma Range from 1970 to 2021 with Magnitude ≥ 5*

IBR region has experienced several major earthquakes, some of these are very significant like the 1988 earthquake of magnitude 7.3 which is considered as the largest magnitude earthquake that happened in the IBR boundary in past 50 years, 1897 Shillong Plateau earthquake, 1950 Assam earthquakes among the others. In the Sagaing fault region, the 1912 earthquake of magnitude 8 is counted as the only great earthquake in the history. The general characteristic of typical subduction zones is that, these are dominated by thrust faulting (74% of total focal mechanisms), whereas the strike-slip faulting is the common focal mechanism in the Indo-Burma arc. The P axis azimuth in the Indo-Burmese arc also makes it unique from the other subduction zones. In Indo- Burma arc the P-axis is oriented in the NNE-SSW arc trending direction, rather than the subduction slab downdip east direction, making it somehow a unique feature.

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Ceremonial Lightning of lamp by Dr. G Narahari Sastry, Director, CSIR-NEIST

Opening remarks by Dr. G Narahari Sastry, Director, CSIR-NEIST


Introductory speech by Dr. Debasis D Mohanty, Convener, GeoIBR'22


Felicitation of the Dignitaries

Opening remarks by Prof. Sunil K Singh, Director, CSIR-NIO

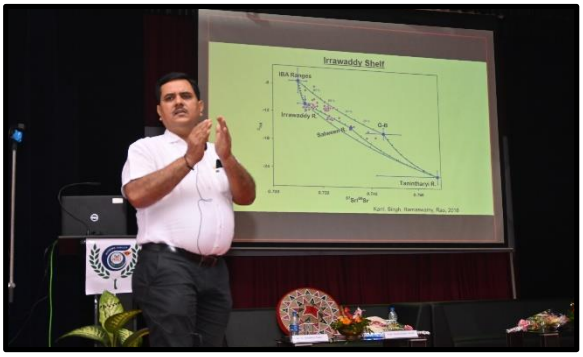
Opening remarks by Prof. S Mukhopadhyay, IIT Roorkee

# Photo Gallery

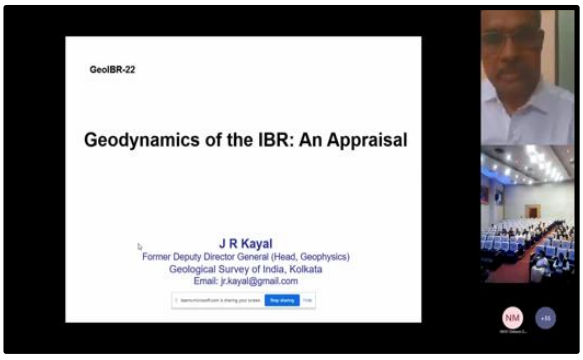

Group Photo of GeoIBR'22 at the Inaugural Session

Opening remarks by Dr. V.M. Tiwari, Director, CSIR-NGRI

Opening remarks by Dr. V.K. Gahalaut, CSIR-NGRI




Keynote Lecture by Prof. Sunil K. Singh, Director, CSIR-NIO




Star talk by Prof. J.R.Kayal, Ex-Dy.Director General, GSI

Hosting the inaugural session by Dr. Bijit Kumar Choudhury

Glimpse of participants attending GeoIBR'22

# Photo Gallery


Group Photo of GeoIBR'22 in the valedictory session


Group Photo of Training Session

Glimpse of participants attending Training Session


Closing remarks by the Convener, Dr. Debasis D Mohanty

Editor
Dr. Debasis D. Mohanty
Dr. Chinmoy Rajkonwar

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