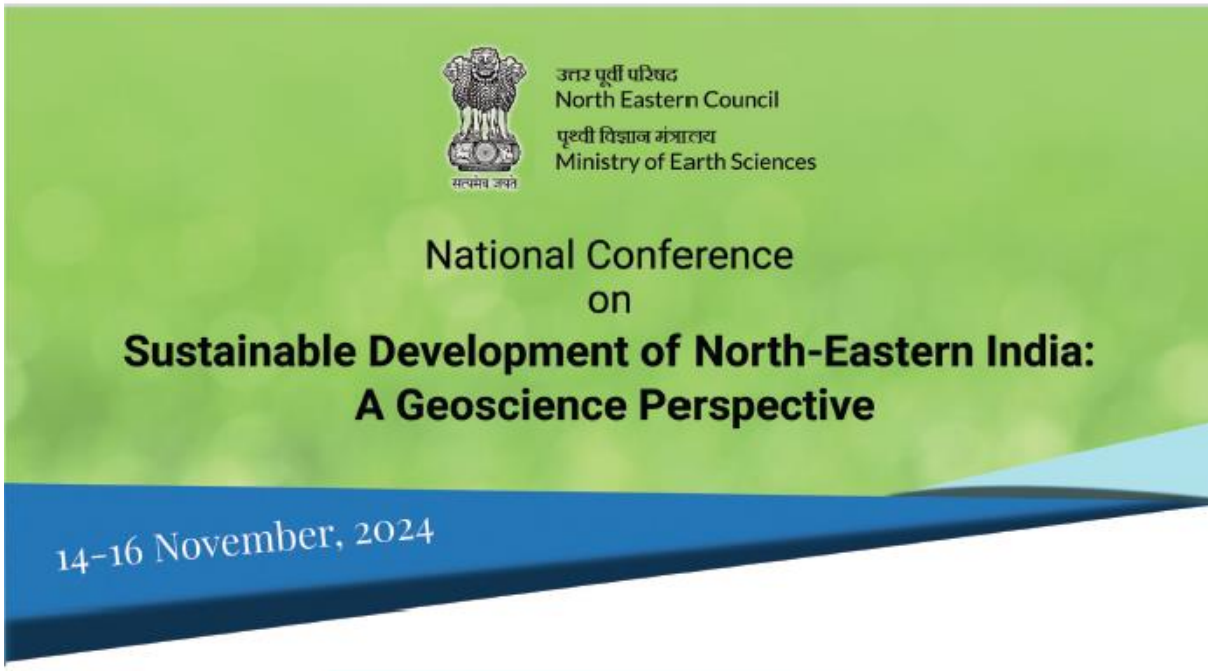
REPORT



Abstract Volume

Organised by

North Eastern Council, Shillong
Ministry of Earth Sciences, New Delhi
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North Eastern Space Application Centre, Meghalaya
Geological Survey of India, Kolkata
Atomic Minerals Directorate, DAE, Hyderabad
CSIR-North East Institute of Science and Technology, Jorhat
Department of Geology, North-Eastern Hill University, Shillong

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CONFERENCE PROGRAMME SCHEDULE

National conference on

Sustainable Development of North-Eastern India: A Geoscience Perspective

November, 14-16, 2024

Patrons

Prof. P. S. Shukla, Vice Chancellor, NEHU
Dr. M. Ravichandran, Secretary, Ministry of Earth Sciences
Shri Angshuman Dey, Secretary, NEC
Padma Shri Dr. Shailesh Nayak, Director, NIAS and President, KMCT
Shri Asit Saha, Director General, Geological Survey of India

Organizing Committee

Convener: Prof. Naresh Chandra Pant, KMCT
Co-conveners:
Prof. Devesh Walia, Dean, SHES, NEHU
Shri Purna Chandra Dash, Additional DG, GSI-NER

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Shri E V R Parthasaradhi, Secretary, KMCT
Prof. Devesh Walia, NEHU
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Dr. K. K. Sharma, NESAC
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Dr. Devsamridhi Arora

Committee for Lodging

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Sukanya Sarmah (7086116454)
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Inaugural Programme of
National Conference
On
"Sustainable Development of North-Eastern India: A Geoscience Perspective"
(14th November 2024 from 17:00 onwards)

The National Conference on "Sustainable Development of North-Eastern India: A Geoscience Perspective" which was held from November 14-16, 2024, started off with an inaugural ceremony on November 14 at 17:00, hosted at the NEHU Guest House, Guwahati where in 150+ participants attended the National Conference. The program jointly organized by the North Eastern Council, Shillong, Ministry of Earth Sciences, Government of India, North Eastern Space Applications Centre, Meghalaya, Geological Survey of India, Atomic Minerals Directorate, CSIR-North East Institute of Science and Technology, and the Department of Geology, North – Eastern Hill University, Shillong. The conference aims to bring together experts to explore the role of geoscience in advancing sustainable development across the North-East, India. Lighting of the lamp by the dignitaries marked the beginning of the ceremony, followed by a soulful rendition of Saraswati Vandana.

Welcome address was delivered by Prof. Devesh Walia (Co-Convener), Dean of School of Human and Environmental Sciences, NEHU, where he emphasized the crucial role of geoscience in achieving sustainable development goals in the region. He highlighted that understanding the subsurface of the Earth is vital for addressing national and regional issues effectively. Prof. Walia underscored the need for strategic focus on geoscience to drive both emotional and national motivations for development, aligning with 13 sustainable development goals relevant to the North-East. He noted that the government's emphasis on these goals can pave the way for more impactful and comprehensive development initiatives.

Guest of Honour, Dr. Dheeraj Pande, Director of Atomic Minerals Directorate (AMD), in his address emphasized that the environmental challenges of North-Eastern India, emphasizing the fragile ecosystem, tectonic activity, and rich biodiversity. He highlighted the Department of Atomic Energy's commitment to sustainable development, including the generation of 8,000 megawatts of clean energy and advancements in healthcare. Dr. Pande mentioned the Shillong Centre for Exploration, established in 1976, and emphasized AMD's historical contributions since 1949, urging collaboration with private agencies to accelerate exploration in regions like Assam, Arunachal, and Sikkim.

The Chief Guest, Dr. P. L. N Raju, Special Secretary, Assam, in his address highlighted the significance of space and geospatial technology in sustainable development. He explained how remote sensing, originating from NASA's 1972 satellite launch, has advanced to provide detailed data for disaster prediction, forest monitoring, and erosion control. Technologies like drones and LiDAR aid in border surveillance, relief delivery, and infrastructure planning. Dr. P. L. N Raju also discussed India's progress, including ISRO's privatization and the rise of over 300 space-tech startups, emphasizing the importance of continuously updating technology to address environmental challenges and improve resource management.

In his President's Address, Shri. E. V. R Parthasaradhi, Secretary, Krishnanunni Memorial Charitable Trust (KMCT), outlined the organization's commitment to sustainable development in North-Eastern India. He highlighted the KMCT Dao Map initiative, aimed at boosting village economies and creating employment by utilizing local resources to their fullest potential. Shri. Parthasaradhi emphasized the importance of education, mentioning KMCT's efforts to provide online lectures and conduct programs at school and graduate levels. He also spoke about extending sustainable development projects in villages, ensuring resources are used effectively, with a primary focus on benefiting local communities.

Dr. Rasik Ravindra, Former Director of National Centre for Polar and Ocean Research (NCPOR), expressed gratitude to the dignitaries, speakers, and participants for their valuable contributions. He thanked the organizing institutions for their support and acknowledged the efforts of the organizing committee and staff. Dr. Ravindra concluded by hoping that the conference would lead to impactful advancements for sustainable development in North-Eastern India.

Following the event, a cultural program was held, offering a vibrant display of the rich traditions and diverse cultural heritage of the region. The program featured performances that highlighted the music, dance, and artistic expressions unique to North-Eastern India, providing an engaging and memorable experience for all attendees.

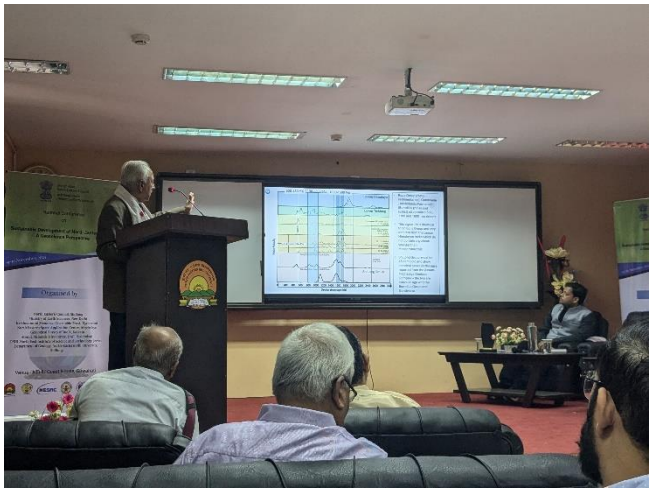
Photo Gallery Inaugural Programme

Release of Abstract Volume by Dignitaries

Geo-exhibition by Geological Survey of India and North-Eastern Space Application Centre, Shillong which brought the attention of the participants and got an opportunity to learn from the experts and see the various rocks, fossils, ore minerals, rocket modals, PSLV's etc.

15th November 2024

DAY1:



The **First technical session** of **"Sustainable Development of North-Eastern India: A Geoscience Perspective"** covering the theme **""***Tectonic and Geodynamic Evolution of NER*" was held in the forenoon of 15th November, 2024. The session was chaired by **Prof. Neptune Srimal** and co – chaired **by Dr. Ashima Saikia and Dr. Ravi Ranjan Kumar** and Rapporteur Ms. Labli Das whereby the keynote was delivered by Prof. Neptune Srimal on the topic: "*A New Tectonic model for Arunachal Pradesh* where this model links Arunachal Pradesh's geology with the Shillong and Meghalaya complexes rather than the Himalayas".

The first speaker of Session 1 was **Dr. J V Rama Rao** whose title of presentation was "*Connecting Eastern Ghat Mobile Belt with Chhotanagapur Gneissic Complex Shillong Meghalaya Gneissic Complex Through Geotectonic Platforms of North West Bangladesh: A Combined Gravity Analysis of Indo-Bangla Region"* where the gravity data reveal a link between the Eastern Ghats Mobile Belt (EGMB), Chhotanagpur, Granite Gneissic Complex (CGGC), and Shillong Meghalaya Gneissic Complex (SMGC), indicating possible continental margin features and connections to East Antarctica.

The second speaker was **Mr. Ranuj Kumar Das** whose title of presentation was "*Petrography and Geochemistry of Late Paleocene Lakadong Limestone, East Khasi Hills, Meghalaya, India: Implications for Depositional Environment And Paleoclimatic Influences".* This study on the Lakadong Limestone in Meghalaya highlights shallow marine depositional environment with low salinity and oxic conditions and geochemical proxies point to a passive continental margin during the Paleocene- Eocene time.

The third speaker was **Ms. Debeena Nongmaithem** whose title of presentation was "*Petrography and Diagenesis of Late Cretaceous Mahadek Formation in Parts of the Southern Shillong Plateau, Meghalaya"*. Analysis of Late Cretaceous Mahadek sandstones from the

Shillong Plateau reveals arkosic to feldspathic wacke composition, with evidence of early and late-stage diagenesis.

The session continues with the key note talk by **Dr. Dheeraj Pande**, Director AMD on the topic "*Strategic Minerals"; A study on the Uranium Resource potential of Meghalaya, Northeast India: Challenges and Future Prospects.* Dheeraj Pande's study highlights the uranium potential of the Mahadek Basin in Meghalaya, India's largest sandstone-type uranium deposit. Major deposits are in Wahkyn-Wahkut and Domiasiat, with potential for further discoveries along a 180 km belt. Uranium in these areas, derived from uranium-rich basement rocks, is found in paleo-channels within porous sandstones. Despite challenges like terrain and thick sediment cover, favourable geology suggests prospects for new medium-sized uranium deposits that could boost India's uranium resources significantly.

Next speaker was Mr. Md. Sunny Hussain whose title of presentation was "*New age and metamorphic constraints on the Zimithang Thrust, western Arunachal Himalaya, NE India: Implications for the pahumation of the Upper Greater Himalayan Sequence".* This study on the Zimithang Thrust (ZT) in the western Arunachal Himalaya uses field data, zircon U-Pb dating, and P-T modelling to reveal distinct metamorphic conditions between the footwall and hanging wall. Findings suggest Zimithang Thrust activation around 22 Ma, with evidence of deformation-assisted northward melt migration, providing insights into Himalayan tectonics.

Next speaker was **Mrs. Rashmi Rekha Naik** whose title of presentation was: *"Petrogenesis of Shillong Felsic Metavolcanics (SFM), Shillong Basin, Meghalaya, Northeast India".* This study on the Shillong Felsic Metavolcanics (SFM) focuses on their petrogenesis and tectonic setting. The SFM, part of the Shillong Basin, includes volcanic flows, scoria, pyroclast, and ignimbrite, with high silica and potash content. Geochemical data suggest a subduction-related back-arc setting for their formation. The SFM shows calc-alkaline trends, enriched LREE, and a negative Eu anomaly, pointing to fractional crystallization and mantle-crust interaction during the generation of felsic volcanics in a Proterozoic tectonic environment.

The next presentation was given by **Dr. Kevilhoutuo Theunuo** whose title of presentation was *"Mineralogy and Geochemistry of multi-phase mafic magmatism in Shillong basin, Meghalaya: Imprints of global tectonic events in Northeastern India".* This study investigates the mafic rocks of the Shillong Basin, Meghalaya, which occur as volcanic, metabasics, and dykes/sills. Geochemical analysis reveals three phases of magmatism: Type I (MORB setting, linked to the amalgamation of the supercontinent Rodinia), Type II (rift setting, with crustal contamination, associated with Rodinia breakup), and Type III (within-plate setting, related to Kerguelen Plume magmatism during the Cretaceous).

Next speaker was **Mrs. Rashmi Rekha Naik** whose title of presentation was: *"Geochemical variation of Sylhet Traps from Mawsynram-Balat and Ryngud-Laitiam Sections, Meghalaya, North-East India"* where this study analyzes the geochemistry and petrography of Sylhet Traps in Northeast India, focusing on the Mawsynram-Balat and Ryngud-Laitiam sections. The Mawsynram-Balat section shows more lithospheric contamination, while the Ryngud-Laitiam section exhibits higher mantle plume characteristics. The differences in petrological and geochemical features indicate varying degrees of contamination and fractionation in these volcanic rocks.

Next speaker was **Mr. Tribujjal Prakash** whose title of presentation was: "*Diorites emplaced in a post-collisional rift setting in the Mikir Massif (Assam- Meghalaya Gneissic Complex, Northeast India): Implications for the evolution of Assam-Meghalaya Gneissic Complex during the Pan-African orogeny*". This study focuses on diorites from the Borjuri Pluton in the Mikir Massif, Assam-Meghalaya Gneissic Complex, Northeast India. The diorites are metaluminous, enriched in LREE, and show crustal origin with partial melting of mafic components. Geochemical data and tectonic diagrams indicate post-collisional rift magmatism during the Pan-African orogeny. The emplacement of these diorites in a post-collisional setting offers insights into the evolution of the Gneissic Complex during the Pan-African orogeny.

Next speaker was **Ms. Deepshikha Borah** whose title of presentation was:" *Petrogenesis of High-Magnesium Andesites from the Proterozoic Shillong Basin (Assam-Meghalaya Gneissic Complex, North-east India): Implications for the Columbia Supercontinent Reconstruction".* This study investigates high-magnesium andesites (HMAs) from the Shillong Basin, revealing they are calc-alkaline magmas formed in a subduction setting. Geochemical data suggests they originated from partial melting of a depleted mantle, influenced by subducted sediments. The

findings connect the Shillong Basin to the Mahakoshal Mobile Belt, forming part of a key suture zone in the Greater Indian Landmass.

This was followed by another presentation on "*Implications for magma evolution based on mineralogy and geochemistry of syenites and nepheline syenites from the Jasra Alkaline Complex of Mikir Hills, Northeast India"* by **Haobam Ananbala Devi**, which examines syenite and nepheline syenite from the Jasra Alkaline Complex, Shillong Plateau. The research explores magma evolution and mineralization potential of REE and Nb. Geochemical data suggest an OIB-type magmatic source, with syenites showing hypidiomorphic texture and nepheline syenites exhibiting perthitic texture.

The **Second technical session** covering the theme **"*Geomorphology and Remote Sensing*"** was held in the afternoon of 15th November, 2024. with as chair and as co- chairs and Rapporteur. The session was chaired by **Dr. S.P. Aggarwal** and co – chaired by **Prof. Vimal Singh and Dr. Atul Kumar Singh** and Rapporteur Ms. Yarenbela.

The session started with the Keynote speaker Dr. P.L.N.Raju with a talk on the topic, " *Harnessing Resource Mapping and Database solution by ASSAC for Sustainable Growth in Assam*". He stated that ASSAC was established in 1988 as ARSAC, ASTEC, STCCD and later established as an independent centre in 2021. He talked about how NESAC and ASSAC worked together to conduct study on the loss of forest cover, mapping of wetlands, mapping flood prone areas, selecting site suitability for schools and colleges; vulnerable crime area mapping (using mobile apps) for Police Departments and assessment of Hill Cutting in the Khanapara- Jorabat area of Meghalaya state. He stated the importance and convenience of drone-based assessments in identifying the flood prone areas, damage assessments, geotagging of existing sports complexes and playgrounds and Mapping of tea gardens. All of these studies contributed in further planning and development activities in the state of Assam. Lastly, he expressed the contribution of ASSAC towards the development of Assam which included sustainable cities and communities, clean water and sanitation, flood management, climate action by Mapping environmental vulnerabilities and sustainable developmental goals.

The next speaker was Dr. Rasik Ravindra whose title of presentation was "*using Aeromagnetic data as a tool to interpret structural lineaments, whose case study was done in Meghalaya*". He expressed that the state of Meghalaya was tectonically very active and had different magnetic properties which were reflected in the Total Intensity Maps provided by the aerogeophysical surveys conducted by NGRI during 1977. These studies were done by combining geophysical data, geological data, geological maps and geochemical data. He addressed how the interpretation of both aeromagnetic and gravity data brings out the subsurface features and general trend of surface. He stated that the ground magnetic survey also delineated a litho-contact between the Pre-Cambrian and the Tertiaries. He concluded by saying that the ground gravity surveys and ground magnetic surveys corroborated with the aeromagnetic maps.

The next speaker was Mr. Girindra Bora on the topic "*Tectonic geomorphology of the Mishmi thrust front in and around Dibru-Saikhowa-Sadiya area*." He stated that an attempt was made to understand the geomorphological features of the Brahmaputra River system. His study area was the frontal part of Mishmi Fold Thrust Belt. He expressed that earthquake led to geomorphological changes in the area. He also stated that the spatio-temporal scenario revealed the basement tectonics and fault systems strongly influenced the river courses in the area. He talked about the courses of rivers, Lohit and Dibang and gave a short note on the Siang and Dibang fractures. He concluded by expressing that effective flood and erosion management should rely on tectonic geomorphology of the area.

The next speaker was Ms. S Phalneihat Haokip. She talked on the topic *"Landscape evolution and tectonic influences of Tuila River watershed, Churachandpur district, Manipur*." She stated that her study was done through morphometric analysis. She talked about the morphometric parameters and morphotectonic parameters and the integration of both to comprehend the evolution of the landscape. She expressed that her study was done using Digital Elevation Model (DEM), GIS techniques and SRTM. She stated that the study area was at the mature stage of geomorphic development and denudation and that it was in a transitional stage and mature stage of erosion. She concluded by addressing that Tuila Watershed showed a landscape influenced by both erosion and tectonic activities.

16th November 2024

DAY 2:

The **Third technical session** of **"Sustainable Development of North-Eastern India: A Geoscience Perspective"** covering the theme *"Mineral resource potential of North Eastern Region"* was held in the forenoon of 16th November, 2024. The session was chaired by **Dr. Rasik Ravindra** and co – chaired by **Dr. Sudesh K. Wadhawan** and **Shri Purna Chandra Dash** and Rapporteurs **Mr. Manas Mohapatra** and **Mr. Devottham Dutta** and whereby the keynote talk was delivered by Dr. Sudesh K. Wadhawan on the topic *"Geoheritage Potential and Sustainable Geotourism in the North Eastern States of India"*. He highlighted that geoheritage refers to unique geological features worthy of preservation, including rare sedimentary structures, volcanic features, and meteorite impact sites. Such sites, assessed based on their rarity, scientific value, and integrity, play a critical role in education and tourism. Dr. Wadhawan also emphasized the importance of Global Heritage Stone Resources, citing South India's laterite as a potential GHSR, and referenced efforts like K. Krishnanunni's 2004 workshop in Shillong to promote geotourism in the region.

Next speaker was **Dr. Anand Singh Rawat** presented on the topic *"Mineral Resource Potential of Arunachal Pradesh with Special Reference to Strategic Minerals"*. He discussed the geology of Arunachal Pradesh, which encompasses three mountain systems, and introduced the exploration of strategic minerals, including graphite and vanadium. Notably, 45% of India's

graphite reserves are located in Arunachal Pradesh, with key deposits such as the Laa-Lamdak Graphite Block, Bopi Graphite, and Taliha Graphite. Dr. Rawat also highlighted the essential role of strategic and critical minerals in industries like electronics, defense, and green technologies, which are vital for economic development and national security. He also outlined the efforts of the State Department of Geology and Mining to encourage exploration activities in collaboration with the GSI and private agencies to maximize the state's resource potential.

Next speaker **Prof. SK. Md. Equeenuddin**, who presented on the topic *"Occurrence of Rare Earth Elements in Coal Mine Discharge: A Case Study from the Makum Coalfield, Assam"*.He introduced the significance of rare earth elements (REEs) and their presence in coal and acid mine drainage. He highlighted that while the total REE concentration in coal is lower than the global average, mine water and leachate show significantly higher REE levels. The study observed MREE enriched patterns in both coal and acid mine drainage, indicating promising potential for extraction. However, Prof. Equeenuddin emphasized that this was a preliminary investigation, and further detailed research is required in this area.

Next speaker, **Mr. Sanjay Singh**, who presented on the topic *"Critical Mineral Potential of the Proterozoic Metalliferous Carbonaceous Rocks of Arunachal Pradesh"*. He highlighted the STM map, which shows the range of vanadium. He mentioned that while the deposit is 200 meters thick, drilling could not proceed due to land issues. Additionally, he showcased granite veins within carbonaceous phyllite and speculated the presence of algal mats in these rocks. Following this, Mr. Sanjay Singh also presented on "REE Mineralisation in Proterozoic Metasediments of the Khetabari Formation in Arunachal Lesser Himalayas". He discussed EPMA and XRD studies and highlighted drilling operations that identified a 50-meter mineralised zone through core sampling. Additionally, he compared chemical data from the Lodoso prospect with other REE deposits worldwide.

Next presentation was given by **Dr. Ashima Saikia** on the topic *"Petrogenesis of Pyroxenites from Jasara Alkaline Complex of Mikir Hills, Northeast India: Implication for the Role of Pyroxenite in REE Transfer to Carbonatites"*. She introduced the Assam Meghalaya Gneissic Complex and described the Jasara Alkaline Complex, which has an hourglass shape trending NE-SW. The petrographic analysis revealed major minerals like clinopyroxene and minor ones like feldspar, while REE carrier minerals include perovskite, apatite, and calcite. She further explained the mineral chemical characteristics and geochemical evidence distinguishing these pyroxenites as natural and different from mantle-derived pyroxenites. She also highlighted

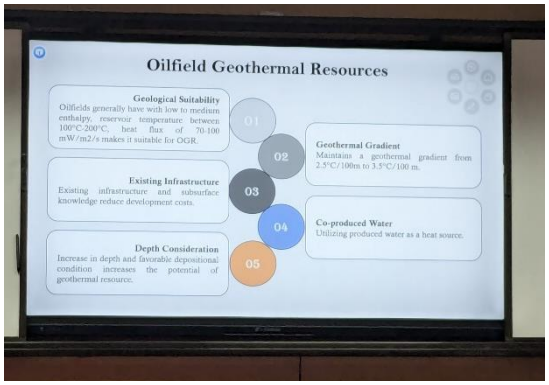
carbonatite metasomatism, as evidenced by corona structures, and discussed the formation of pyroxenites through carbonatite magma via antiskarn reactions.

Next presentation was given by **Prof. Sarajit Sen Sharma** presented an engaging talk on the *"Distribution and mobilization of rare earth elements (REE) during the weathering of Precambrian quartzite in the Shillong Plateau"*. He highlighted how silicate rock weathering contributes to carbon sequestration and REE transport, with a focus on the unique geological and climatic conditions of the region. He explained that the weathering process in the Shillong quartzite may have been ongoing for the past 3-4 million years.

The **Fourth technical session** of **"Sustainable Development of North-Eastern India: A Geoscience Perspective"** covering the theme *"Natural resource development of North Eastern Region*" was held in the forenoon of 16th November, 2024. The session was chaired by **Dr. Joyesh Bagchi** and co – chaired by **Prof. Sarajit Sensarma** and **Dr. Meghali Baruah** and Rapporteur Ms. Labli Das where the key note was delivered by **Dr. S.P. Aggarwal**, Director, North Eastern Space Application Centre (NESAC) whose topic was on *"Space Technology Interventions for Sustainable Development*". This presentation emphasizes space technology's role in achieving SDGs, particularly in India's North Eastern Region (NER). Applications include precision farming, water management, urban planning, and climate monitoring. NESAC initiatives like Bhuvan and NeSDR support regional development. Challenges include capacity-building and grassroots implementation, requiring investments and partnerships.

The first presentation was given by **Dr. Shikhar Kumar** on the topic "*Assessing the Potential of Rainwater Harvesting at North-Eastern Hill University (NEHU), Shillong, Meghalaya: A Comprehensive Study on Sustainable Water Resource Management"*. This study highlights the significant rainfall patterns recorded at NEHU, Shillong, from March to June 2024, totalling 2715.345 liters. It underscores the importance of rainwater harvesting for sustainable water management in regions with heavy rainfall. Rising temperatures, humidity variations, and monsoon onset were documented, emphasizing rainwater collection as a resilient solution to water security and environmental sustainability.

The Next speaker was **Mr. Monmohan Gogoi** whose title of presentation was:" *Geothermal- A Source of Non-Conventional Energy Resources: Prospect Examination in Oilfields of Upper Assam"*.This study explores the geothermal energy prospects in Upper Assam's oilfields, which exhibit medium to low enthalpy energy sources (70–150°C). Utilizing abandoned or high water-cut oil wells for geothermal energy is highlighted as a cost-effective and sustainable approach. The suggested binary systems, like Rankine or Kalina cycles, use low-boiling-point secondary fluids for energy extraction. Leveraging existing petroleum infrastructure and geological knowledge offers a promising avenue for zero-emission, sustainable energy generation in the region.



The Next speaker was **Prof. Vimal Singh** whose title of presentation was: *"Understanding Urban Critical Zone in the era of Development".* The presentation focuses on urbanization's impact on natural critical zones, leading to the emergence of urban critical zones. Rapid urban development in India, aiming for developed nation status by 2047, alters natural processes and stresses ecosystems, often disregarding landscape considerations and carrying capacities. This oversight contributes to urban floods and ecosystem service deficits. Special emphasis is placed on the Northeast, where balancing socio-economic development with environmental conservation is essential. Understanding landscape processes and carrying capacities is critical for sustainable urban planning in the region.

The next title of presentation was *"Development of a Unified Portal for Infrastructure and Resources in the North Eastern States of India"* presented by **Shri E.V. R. Parthasaradhi**. The presentation proposed a unified portal to address gaps in state-specific, district-level data for the North Eastern states. This platform will provide comprehensive information on resources, infrastructure, demographics, education, healthcare, natural disasters, and economic opportunities. By leveraging GIS tools, advanced databases, and user-friendly interfaces, the portal aims to support informed decision-making and regional development. Additionally, it will enhance accessibility for non-technical users, promoting economic growth and better resource management in the region.

The **Fifth technical session** of **"Sustainable Development of North-Eastern India: A Geoscience Perspective"** covering the theme "*Disaster Preparedness*" was held in the afternoon of 16th November, 2024. The session was chaired by **Dr. Saibal Ghosh, DDG, GSI** and co – chaired by **Dr. Prerona Das** and **Dr. Chaitra Dhar Taye** and Rapporteur Ms. Phalneihat Haokip where the key note talk was delivered by **Dr. Sudesh Kumar Wadhawan**, on the topic *"Human–Mountain Landscape Interactions in Itanagar Urban Environment, NE Himalaya, Arunachal Pradesh, India – Implications for Disaster Risk Reduction in Quaternary - Neogene Deposits"*. He highlighted that rapid urbanization in Itanagar, driven by a growing population, has led to deforestation, land excavation, inadequate waste disposal, and construction of infrastructure, which exacerbates vulnerability to various hazards. He also mentioned that the city lies within a high seismic zone (Seismic Zone IV), affected by frequent neotectonic activities and intersecting tectonic lineaments, making the region susceptible to earthquakes and mass-wasting events. He proposed strategies for disaster risk reduction, including smart urban planning, remediation measures, and enhancing community resilience to ensure safe and sustainable development in Itanagar, particularly in the Quaternary and Neogene sedimentary deposit.

The next speaker **Dr. Manasi Debnath**, presented on the topic *"Glacial Lake dynamics in the Lachung Basin, North Sikkim, Eastern Himalaya"*. She introduced the study of glacial lake area variability in the Lachung Basin, North Sikkim, driven by the Indian Summer Monsoon (ISM) and North-East Monsoon. She highlighted that over the past 35 years (1988-2023), the number of lakes increased from 49 to 99, and the total lake area expanded by 45.21%, showing significant growth during 1988-1991 and 2014-2023. She also noted that fluctuations in lake area occurred over four periods, with little expansion observed between 1991-2001, potentially due to lake disappearance or area reduction. She stressed that the study contributes to understanding climate variability and lake dynamics, offering insights for disaster preparedness, particularly for Glacial Lake Outburst Floods (GLOF) in the Upper Tista Basin of Sikkim.

The next speaker **Dr. Ravindra Pratap Singh**, presented on *"Prediction Modelling for Reanalysed Morphoclimatic Extremes of Sikkim Himalayas"*. The Sikkim Himalayas, characterized by rapid tectonic deformations and diverse landscapes with major geological features such as OST and MCT thrusts. The study integrates morphometric indicators (elevation, slope steepness, landform classification) with climate data (temperature and precipitation) to predict geohazards in the Tista River watershed, focusing on flood risks and

discharge patterns. The analysis reveals that the eastern and central parts of Sikkim are highly vulnerable to geohazards, with extreme temperature fluctuations and increased precipitation contributing to higher risks of landslides, avalanches, and other geological hazards. Extreme temperature trends and intense precipitation events exacerbate slope instability and snowmelt, further increasing the likelihood of geohazards such as landslides and floods. The study proposes a predictive model combining morphometric indicators and climate data to assess geohazard risks, offering a valuable tool for improving risk assessments, disaster preparedness, and mitigation strategies in the region.

The next presentation is given by, **Mr. Naorem William Singh**, on the topic *"Geospatial Technique-Based Landslides Susceptibility Mapping Using the Analytical Hierarchy Process (AHP) in Parts of Arunachal Pradesh, India"*. He introduced the study on landslide susceptibility mapping in the upper reaches of West Siang District, Arunachal Pradesh, focusing on delineating the risk using a multi-criteria decision analysis (MCDA) approach. He explained that the study integrated eight geo-environmental factors (lithology, landforms, structures/lineaments, soil texture, drainage, land use/landcover, slope, and aspects), and the Analytical Hierarchy Process (AHP) was used to assign relative weights to each factor. He noted that the landslide susceptibility map was developed on a GIS platform, categorizing susceptibility into five classes: very low, low, moderate, high, and very high. He concluded that the study is valuable for planners and decision-makers in landslide hazard management and provides a foundation for further research on landslides in mountainous regions.

The next presenter, **Ms. Tingky Haokip** presented on the topic *"Preliminary Geotechnical Investigation of Imphal City, Manipur, NE-India"*. She introduced the study by highlighting Imphal's growing earthquake vulnerability due to urban development, with the city situated above thick alluvial deposits in the Indo-Burma Subduction Zone, a region with high seismicity. She explained that over the last 100 years, the area experienced 388 earthquakes with magnitudes >2.5 and 73 earthquakes with magnitudes >6.0, emphasizing the need for geotechnical analysis. She presented** the analysis of geotechnical parameters based on 120 borehole data sets from 24 sites, revealing the soil as silty clay with intermediate to high plasticity (IS-1498-1970). She also highlighted that the seismic site classification of the study area, categorizing it into class-

D (stiff soil), class-E (soft clay), and class-F (liquefiable soils), using the NEHRP (2003) criteria and standard penetration resistance data.

In addition to the oral presentations, a total of 42 poster presentations covering the theme *"Mineral resource potential of North Eastern Region; Clean Energy and Data Management for Sustainable Development; Geomorphology and Disaster Preparedness; Tectonic and geodynamic evolution of NER"*.

Panel Discussion

The concluding session of the National Conference on **"Sustainable Development of North-Eastern India: A Geoscience Perspective"** featured a thought-provoking panel discussions. Experts and participants deliberated on the intricate relationship between development and environmental sustainability, particularly in the context of the region's unique geoscientific challenges and opportunities.

The discussion began with participants raising concerns about increasing landslide susceptibility due to inevitable development activities. They sought insights into tackling these hazards while pursuing sustainable growth.

Shri Asit Saha, Director General, Geological Survey of India, emphasized that reversing the environmental damage caused by past development efforts requires concerted actions centered on sustainable practices. He highlighted the critical role of geology as a foundational discipline for addressing environmental challenges. Stressing the importance of problem-solving at a fundamental level, Shri Saha advocated for revisiting and updating the basics of geological education to better equip future geoscientists to meet contemporary challenges.

Prof. Devesh Walia, Dean, School of Human and Environmental Sciences, NEHU, underscored the pivotal role of geologists in addressing sustainability issues. He asserted that sustainable development must adhere to proper protocols to ensure responsibilities toward both nature and society are fulfilled. Prof. Walia noted that geoscience plays a crucial role across diverse fields, providing solutions to complex environmental and developmental challenges.

Ms. Labli Das, Research Scholar, Department of Geology, NEHU, highlighted the significant contributions of women in fostering sustainable development in Northeast India. She shared examples from different parts of the country where women's empowerment through entrepreneurship and access to geoscience tools has catalysed development. Her remarks

brought attention to the need for facilitating greater participation of women in geoscience-related activities, emphasizing their role as critical stakeholders in sustainable development.

Shri P.C. Dash, Additional Director General, Geological Survey of India, NER, addressed the importance of integrating environmental factors into development planning. He pointed out that Geoheritage sites, which hold both scientific and cultural value, must be preserved as part of sustainable development initiatives. Shri Dash further emphasized balancing scientific advancements with social outcomes to achieve long-term sustainability in the region.

Dr. Manasi Debnath, Assistant Professor, Nagaland University, praised local communities in the Northeast for their commendable environmental initiatives, often undertaken without governmental support. She highlighted the tourism potential of the region, noting that the locals' concern for their environment is a model worth replicating. Dr. Debnath also emphasized the importance of preserving the cryosphere, which plays a crucial role in maintaining regional and global climatic stability.

Dr. Sudesh Kumar Wadhawan, Former Director General, Geological Survey of India, reflected on the dynamic nature of geology as a discipline. He celebrated the rich geological diversity of India and noted that geoscience applications are no longer limited to mineral exploration but extend to various facets of sustainable development. Dr. Wadhawan also emphasized how advancements in data availability and accessibility, driven by organizations like the GSI, have enhanced perspectives and knowledge, enabling better planning and decision-making.

The panel discussion offered a comprehensive exploration of the challenges and opportunities associated with sustainable development in Northeast India. Experts agreed that while development is essential, it must be approached with caution to minimize environmental risks. They stressed the importance of adopting a holistic perspective that integrates geoscience knowledge with social, environmental, and community considerations. Balancing scientific innovation with social impacts was recognized as critical for achieving long-term sustainability. Ultimately, the discussion highlighted the need for inclusive development strategies that harmonize progress with environmental stewardship.


National Conference
on
Sustainable Development of North-Eastern India:
A Geoscience Perspective
Organised by
NESAC

Valedictory Program

The Valedictory Program of the National Conference on "**Sustainable Development of Northeast India: A Geoscience Perspective"** was held in the evening of 16th November, 2024, was a grand and memorable occasion, marking the culmination of thought-provoking discussions and valuable insights shared throughout the event. The program commenced with the auspicious lighting of the ceremonial lamp by the dignitaries, symbolizing enlightenment and the spreading of knowledge.

Following the lighting of the lamp, the audience was immersed in a soulful rendition of the Saraswati Vandana, invoking the blessings of Goddess Saraswati, the deity of wisdom and learning.

Prof. Devesh Walia, Dean, School of Human and Environmental Sciences, NEHU and Co-Convener of the conference, extended a heartfelt welcome to the gathering. In his address, Prof. Walia highlighted the importance of sustainable development in the Northeast region of India, emphasizing its unique geoscientific challenges and opportunities. He remarked that the conference had paved the way for a deeper understanding of the intricate relationship between geoscience and sustainable development, urging collective action for a better future in the region.

The **Chief Guest, Shri Asit Saha, Director General, Geological Survey of India,** stressed the importance of geoscience in sustainable development for Northeast India. He highlighted the region's geological challenges and the need for responsible resource management. Shri Saha stated that we must use our geological knowledge to promote sustainability and disaster resilience, encouraging young researchers to continue contributing to solutions for the region's development. He praised the conference for facilitating collaboration among experts and stakeholders.

Shri E. V. R. Parthasaradhi, Secretary of the Krishnanunni Memorial Charitable Trust, Hyderabad, delivered an inspiring speech, shedding light on the pivotal role of community engagement and the judicious use of natural resources in achieving sustainability. He emphasized the importance of preserving the rich biodiversity and cultural heritage of Northeast India while fostering scientific research. Shri Parthasaradhi noted that efforts must be directed towards inclusive development that empowers local communities while safeguarding the environment.

An award ceremony was followed where awards were presented to the best posters and participants to researchers who showcased innovative and impactful work relevant to sustainable development in Northeast India.

Dr. Rasik Ravindra concluded the program with a Vote of Thanks, expressing gratitude to all the participants, organizers, and dignitaries for their invaluable contributions to the conference's success. Dr. Ravindra underscored the significance of collaborative efforts in addressing the region’s unique geoscientific challenges. He stated that collective knowledge and dedication are essential for developing sustainable strategies that balance development and environmental preservation. He urged all to carry forward the insights gained and to work together for the prosperity and well-being of the region.

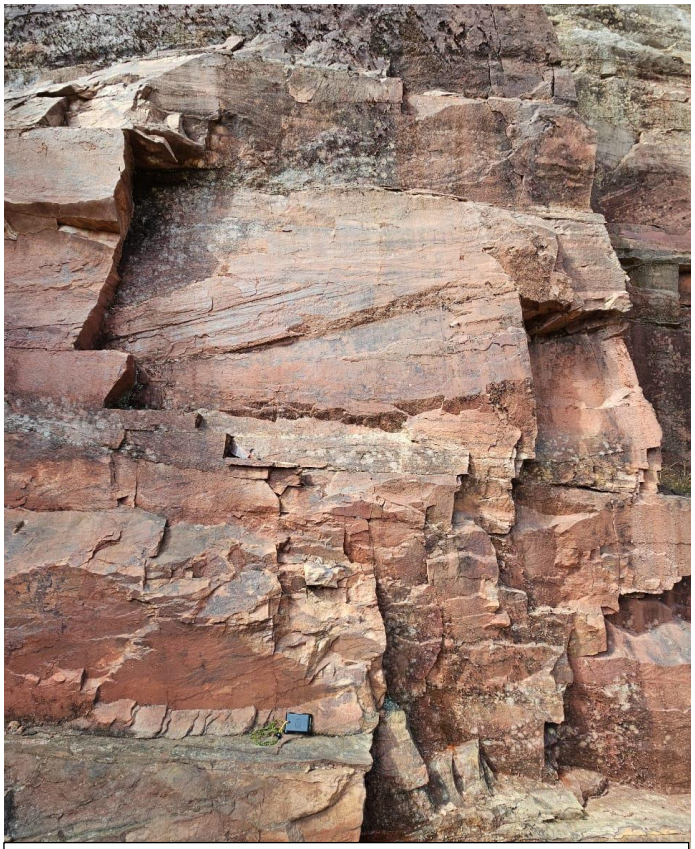
The Valedictory Program concluded with a commitment to continue the discourse on sustainable development, fostering further research and collaborative action for the benefit of Northeast India and beyond.

17th November, 2024

Geological Field Work

The post-conference geological fieldwork was conducted in and around Shillong to provide participants with hands-on exposure to the geological features discussed during the conference. The field study aimed to reinforce theoretical knowledge through direct observation of rock formations, stratigraphic sequences, and structural features in their natural setting.

The fieldwork was carried out in Nongpoh, Mylliem, Mawkdok and Cherrapunji areas, which is well-known for its unique geological feature, e.g., intrusions of Granite in Shillong Group of rocks, contact between Shillong Group and Cretaceous rock formations, limestone quarry and caves. The area provided an ideal natural laboratory to observe stratigraphic contacts, tectonic features, and various structures within the caves.



Quartzites of Shillong Group

Nongpoh Granite showing Porphyritic Texture

Exposure of Mylliem Granite

Fossiliferous Limestone, Arwah Cave

Stalactite, Mawsmai Cave