July, 2021

GEODE

Monthly e-Newsletter Vol. 01, No. 07

University Department of Geology, Ranchi University, Ranchi. Estd:1962

Career Prospects in Geology

Geology is more of a multi disciplinary science and not a fundamental science, Since the subject applies the principles of physics, chemistry, biology mathematics and computer science / Artificial intelligence to study the various spectrum of the earth. The study combines both the field and laboratory-based investigations to retrieve the geological information's of the target area all the geological concepts need to be tasted in the laboratories and should be able to explain the natural geological phenomenon. Geology happens to be concerned with origin and operation of the earth its typical features and various events which has taken place in the Geological past. Geology uses rocks and their disposition to understand the formation of the earth its evolution through time and space and various processes operating on the earth. Since the Geological past.

If you desire to pursue your knowledge to prospect of working on a wide-ranging earth-related issues from resource management to environmental protection to the exciting field of mineral and oil exploration then Geology is the wise choice of career for you.

Career in Geology is an exciting and interesting option as there is plethora of job opportunities in geology all over India and in the entire world

After completion of graduation students can either aspire for various job options or can get involved in higher studies in various job-opportunities are available for students in various government and private companies in different industries- Oil Industry research Area, Mineral industry, mining industries, Meteorology, Oceanography, mineral industry, mining industries, Meteorology, Oceanography, Geoscience education and research, Field Studies. Opportunities in Geology range from studying and predicting man-made (anthropogenic) and natural disasters to exploring mineral resources not only on the earth but other planetary bodies like Moon, Mars and Jupiter as well as the extra-terrestrial bodies like meteorites, comets and Asteroids.

Apart from the fruitful scope of jobs through union civil services, Provincial Civil Services, there are many organisations which provide employments to geologists:

Geological Survey of India (GSI)
Central Groundwater Board (CGWB)
Directorate of Geology and Mining (DGM)
Indian Bureau of Mines (IBM)
Defence Research and Development Organisation (DRDO)
Indian Space Research Organisation (ISRO)
National Geophysical Research Institute (NGRI)
Wadia Institute of Himalayan Geology (WIHG)
Bhabha Atomic Research Centre (BARC)
Oil and Natural Gas Commission (ONGC)
National Hydropower Corporation (NHC)
National Thermal Power Corporation (NTPC)
Minerals and Metals Trading Corporation(MMTC)
State Mining Corporation Limited (SMCL)
Tata Iron and Steel Company (TISCO)
Natonal Mineral and Development Corporation (NMDC)
National Aluminium Company (NAL)
Hindustan Aluminium Company (HAL)
Hindustan Copper Limited (HCL)
Bharat Petroleum Corporation Limited (BPCL)
Tehri Hydro Development Corporation (THDC)
Gas Authority India Limited (GAIL)

The field of Geology and related services is poised to grow phenomenonly in next few years.

--- *Chief Editors' Desk*

Civilization exists by geological consent, subject to change without notice.
- Will Durant

- **NEWS AND NOTES**
  - **On 28th June, 2021 : e- Lecture was organised by the Department of Geology , RU.**
  - On 28 th June 2021 e-Lecture was organized by the Department of Geology in collaboration with Geological Society of India to celebrate the India's 75th years of Independence .

    Speaker: Dr. Shivranjan Kr. Bharti, Superintending Geologist, FTC Kuju, GSI , SUJ, Eastern Region
  - **The theme of the E- Lectures are :**

    1 : Brief Introduction abut Activities of GSI : Role of GSI Training Institute.

    2. Early Permian Glaciation Events and its signatures in the Dhudhinala Section, Hazaribagh, Jharkhand
  - Total No of Participants = 142 (including GSI R.U Research Scholars, Students of 2019-21,& 2020-2022)

Recruitment Process of Contractual Assistant Professors (Memo No. RU/CVS/4055/2021) in four subjects :

- Geo-informatics,
- Gemology, Mineral Exploration,
- Global Sustainability and
- Climate Change

- Started walk-in-Interview. Scheduled at ILS on 28-06-2021 (10:30 am onwards, Interview got postponed due to some unavoidable reasons.
- Nine (09) Certificate courses (6 months) started under Vocational stream of Ranchi University from Session 2021-2022. Admission form available on R. U. Website (Last date of application 30.06.2021). More than 125 applicants are willing to take admission in the courses out of prescribed course wise total of 150 seats. Satisfying to note that there has been huge response of students drawn from IITs, BIT Mesra apart from out own university students.
- Our present Head of the Deparment,
- **Dr. Bijay Singh** , University Department of Geology, Ranchi University, Ranchi, Jharkhand has completed his two years tenure.

Scanning Electron Microscope (SEM)

Ore Microscope

GLOBAL

Unknown human ancestor unearthed in Israel. It had large teeth but no chin.

Mysterious human may have been the ancestor of Neanderthals.(Image credit: Tel Aviv University)

A previously unknown group of ancient humans discovered in Israel may have coexisted alongside modern humans and Neanderthals, interbreeding with both groups and sharing knowledge and tools with them as well, new studies find.

The new fossils were unearthed in 2010 near the city of Ramla in central Israel, after quarrying in the mining area of the Nesher cement plant revealed what is now known as the Nesher Ramla prehistoric site. After digging down about 26 feet (8 meters), the researchers found stone tools and human bones, as well as large quantities of animal bones, including the remains of horses, deer and extinct cattle known as aurochs.

It took scientists a better part of a decade to figure out what they had. "People think it's simple to quickly analyze fossils, but it takes a lot of time," Israel Hershkovitz, a paleoanthropologist at Tel Aviv University and lead author of one of the two studies on the discovery, told Live Science. "Once you find the fossils, you have to clean them and reconstruct them and then collect comparable material around the world to properly understand them."

After all that work, the researchers identified the Nesher Ramla bones as belonging to a new type of Homo, or member of the human family tree, previously unknown to science. They dated the fossils and found them to be about 120,000 to 140,000 years old.

The Nesher Ramla bones share features with Neanderthals, especially in the teeth and jaws, but these mystery humans had skulls more closely resembling those of more archaic human lineages, the scientists noted. And this new type of Homo is very unlike modern humans, possessing a completely different skull structure, no chin and very large teeth.

After comparing the Nesher Ramla Homo bones with other fossils previously found in Israel that have baffled scientists for years — such as 160,000-year-old bones from Tabun cave, 250,000-year-old remains from Zuttiyeh cave and 400,000-year-old specimens from Qesem cave — the team "realized they all belonged to the same group," Hershkovitz said. "They were a very large population in the region from at least about 400,000 years ago to about 100,000 years ago."

Hebrew University of Jerusalem archaeologist Yossi Zaidner and his colleagues found stone tools linked with the Nesher Ramla bones, such as points that could later be hafted onto shafts to form spears or arrows. The specific way of crafting these artifacts was previously seen only among modern humans and Neanderthals.

These new findings suggest that two different groups of humans lived side by side in the Middle East for more than 100,000 years between about 100,000 and 200,000 years ago — the Nesher Ramla people, who lived in the region starting about 400,000 years ago, and modern humans, who arrived there about 200,000 years ago.

They likely not only shared knowledge and tools but also interbred — fossils previously unearthed in Skhul and Qafzeh caves in northern Israel that date to between 80,000 and 120,000 years ago may represent groups of intermixed modern-human and Nesher Ramla lineage, the scientists noted.

When the scientists compared these fossils with others around the world, they found that the nearest match came from the Sima de los Huesos, or "Pit of Bones," an underground cave in the Atapuerca Mountains in northern Spain, Hershkovitz said. The nature of the bones there are hotly contested, potentially sharing similarities with modern humans, Neanderthals and the mysterious extinct human group known as the Denisovans.

(Image credit: Tel Aviv University)

Hershkovitz and his colleagues were not able to recover DNA from these fossils. "The problem in Israel is that we live in a hot country," Hershkovitz said. DNA can break down because of heat, "so we never manage to extract DNA from bones older than 15,000 years. We gave it a try, but we knew from the very beginning that our chances were basically nil."

Although these newfound fossils lack DNA, they may help solve a mystery in human evolution: How did modern-human DNA enter the gene pool of Neanderthals long before the groups met? Previous research suggested modern humans, or Homo sapiens, and European Neanderthals mated more than 200,000 years ago, long before archaeological evidence suggested modern humans first entered Europe about 45,000 years ago. Now, Hershkovitz and his colleagues suggest hybrids of modern humans and the Nesher Ramla group may have introduced modern-human DNA into European Neanderthals.

In fact, the researchers suggested that the Nesher Ramla humans may be the ancestors of Neanderthals. "Most researchers believe that Neanderthals started, developed and eventually finished in Europe. Here, we say that maybe Neanderthals were not European — that maybe there's a strong component from the Near East within the Neanderthal population of Europe," Hershkovitz said. "Nesher Ramla may have been the core population from which Europe was recolonized by Neanderthals between glacial periods."

Source: Live Science (Charles Q. Choi)

New geochemical study confirms cause of end-Permian mass extinction event

The most severe mass extinction event in the past 540 million years eliminated more than 90 percent of Earth's marine species and 75 percent of terrestrial species. Although scientists had previously hypothesized that the end-Permian mass extinction, which took place 251 million years ago, was triggered by voluminous volcanic eruptions in a region of what is now Siberia, they were not able to explain the mechanism by which the eruptions resulted in the extinction of so many different species, both in the oceans and on land.

Associate professor Laura Wasylenki of Northern Arizona University's School of Earth and Sustainability and Department of Chemistry and Biochemistry is co-author on a new paper in Nature Communications entitled, "Nickel isotopes link Siberian Traps aerosol particles to the end-Permian mass extinction," in collaboration with Chinese, Canadian and Swiss scientists. The paper presents the results of nickel isotope analyses performed in Wasylenki's lab on Late Permian sedimentary rocks collected in Arctic Canada. The samples have the lightest nickel isotope ratios ever measured in sedimentary rocks, and the only plausible explanation is that the nickel was sourced from the volcanic terrain, very likely carried by aerosol particles and deposited in the ocean, where it dramatically changed the chemistry of seawater and severely disrupted the marine ecosystem.

"The study results provide strong evidence that nickel-rich particles were aerosolized and dispersed widely, both through the atmosphere and into the ocean," Wasylenki said. "Nickel is an essential trace metal for many organisms, but an increase in nickel abundance would have driven an unusual surge in productivity of methanogens, microorganisms that produce methane gas. Increased methane would have been tremendously harmful to all oxygen-dependent life."

"Our data provide a direct link between global dispersion of Ni-rich aerosols, ocean chemistry changes and the mass extinction event," Wasylenki said. "The data also demonstrate that environmental degradation likely began well before the extinction event -- perhaps starting as early as 300,000 years before then. Prior to this study, the connection between Siberian Traps flood basalt volcanism, marine anoxia and mass extinction was rather vague, but now we have evidence of a specific kill mechanism. This finding demonstrates the power of nickel isotope analyses, which are relatively new, to solve long-standing problems in the geosciences."

Wasylenki, who joined NAU in 2018, was formerly an igneous petrologist and then a specialist in calcite crystal growth and biomineralization. She now focuses on the use of metal stable isotope geochemistry to address geological, environmental and biological questions. Many of her recent and current projects have investigated metal isotope effects at solid-fluid interfaces, in particular during metal adsorption to oxyhydroxide mineral particles. This work has implications for ancient and modern geochemical cycles and environmental metal transport. Wasylenki's lab group, named Systematic Experimental Study and Analysis of Metals in the Environment (SESAME Lab), focuses on two main research themes, the cycling of transition metals in modern and ancient oceans and the environmental transport of toxic heavy metals.

Source: Northern Arizona University

The "Great Dying" – Rapid Warming Contributed to Abrupt Collapse of Forest-Mire Ecosystems

Rapid Warming and Monsoonal Intensification Contributed to the Abrupt Collapse of Forest-Mire (Glossopteris) Ecosystems in the High Southern Latitudes

The Paleozoic era culminated 251.9 million years ago in the most severe mass extinction recorded in the geologic record. Known as the "great dying," this event saw the loss of up to 96% of all marine species and around 70% of terrestrial species, including plants and insects.

The consensus view of scientists is that volcanic activity at the end of the Permian period, associated with the Siberian Traps Large Igneous Province, emitted massive quantities of greenhouse gases into the atmosphere over a short time interval. This caused a spike in global temperatures and a cascade of other deleterious environmental effects.

Outcrop photos are taken T.D. Frank and are from Frazer Beach, New South Wales, Australia. The end Permian extinction and disappearance of Glossopteris flora occurs at the top of the coal (black layer). Credit: T.D. Frank

An international team of researchers from the United States, Sweden, and Australia studied sedimentary deposits in eastern Australia, which span the extinction event and provide a record of changing conditions along a coastal margin that was located in the high latitudes of the southern hemisphere. Here, the extinction event is evident as the abrupt disappearance of Glossopteris forest-mire ecosystems that had flourished in the region for millions of years. Data collected from eight sites in New South Wales and Queensland, Australia were combined with the results of climate models to assess the nature and pace of climate change before, during, and after the extinction event.

Glossopteris leaves. Credit: Photo by co-author Chris Mays

Results show that Glossopteris forest-mire ecosystems thrived through the final stages of the Permian period, a time when the climate in the region was gradually warming and becoming increasingly seasonal.

The collapse of these lush environments was abrupt, coinciding with a rapid spike in temperatures recorded throughout the region.

The post-extinction climate was 10–14°C warmer, and landscapes were no longer persistently wet, but results point to overall higher but more seasonal precipitation consistent with an intensification of a monsoonal climate regime in the high southern latitudes.

Because many areas of the globe experienced abrupt aridification in the wake of the "great dying," results suggest that high-southern latitudes may have served as important refugia for moisture-loving terrestrial groups.

Outcrop photos are taken T.D. Frank and are from Frazer Beach, New South Wales, Australia. The end Permian extinction and disappearance of Glossopteris flora occurs at the top of the coal (black layer). Credit: T.D. Frank

The rate of present-day global warming rivals that experienced during the "great dying," but its signature varies regionally, with some areas of the planet experiencing rapid change while other areas remain relatively unaffected. The future effects of climate change on ecosystems will likely be severe. Thus, understanding global patterns of environmental change at the end of the Paleozoic can provide important insights as we navigate rapid climate change today.

Source : Geological Society of America

Drone-based surveys of mineral deposits

The rising demand for raw materials, such as rare earth elements and lithium, makes the exploration and extraction of mineral deposits critical. Identification of Earth's hidden treasures is becoming increasingly difficult, owing to the continued depletion of easily accessible deposits and the social stigma surrounding mining activities. Efficient methods that minimise invasive and costly drilling are key for the discovery of potentially profitable mineral resources. However, a gap in observation scales remains. Traditional ground-based surveys (such as rock and soil sampling), although detailed, can only cover some 15–30 kilometres per day, and large-scale mapping via helicopter, plane and satellite fails to provide sufficient resolution to efficiently map small-scale (<1 km2) geological features.

Credit: Photo courtesy of Richard Gloaguen, Helmholtz Institute Freiberg for Resource Technology, Germany.

Drones present the perfect trade-off between coverage and scale of observation, and are essential when ground access is impossible, dangerous or logistically costly. Drones can carry lightweight sensors that, for example, capture changes in the Earth's magnetic field as well as a continuous spectrum of reflected sunlight in the visible and near-infrared regions (hyperspectral imaging). Subtle variations in the measured properties can be used to determine the abundance and composition of key minerals at Earth's surface. For example, specific spectral absorption features and magnetic anomalies could indicate the presence of iron alteration related to mineralisation. The hyperspectral and magnetic data collected by the drones can be used alongside high-resolution true-colour cameras or laser-scanning sensors to place mineral deposits into a 3D geographical context. Therefore, economic mineral deposits can be identified down to depths of several hundred meters.

Drones are becoming important tools for mineral exploration by contributing to the safe, efficient and sustainable provision of the high-tech metals that are required by modern society. For example, drone-based hyperspectral imaging has been used to rapidly map rare-earth-element-rich minerals in Namibia. In addition, in Greenland, drone-based magnetic surveys were deployed to identify sub-surface ore potential at a fraction of the cost of traditional surveys. Drones have the potential to provide non-invasive and eco-friendly platforms from which the environmental impact of exploration and mining activities (such as soil erosion, acid mine drainage and vegetation stress) can be assessed.

Source: Nature Reviews Earth & Environment

NATIONAL

A meteorite fall in Assam holds clues to Earth's formation

Researchers from IIT Kharagpur studied the shocked meteorite that had struck Kamargaon village of Assam. (Photo: Representative/Getty)

The Earth's surface is composed of three layers -- the crust, mantle and core. While we know about crust (the outermost layer) formation and composition, very little is known about the mantle and the core, which are located below the crust. Researchers have now analysed a meteorite that could hold clues about the composition of the mantle and offer insights into how Earth was formed.

A team of students and researchers from the Indian Institute of Technology (IIT) Kharagpur have analysed a shocked meteorite — one that has gone through high-pressure and high-temperature conditions due to an impact event — to conclude that it has a similar chemical composition as found in Earth's lower mantle. The meteorite, which belonged to the asteroid belt located between Mars and Jupiter, fell near a village in Assam in 2015.

The researchers' findings were published in Geophysical Research Letters. The findings state that Earth's mantle was formed from a similar material that constitutes the Assam meteorite, which is mostly made up of a substance known as Olivine. Olivine is a rock-forming mineral found in dark-coloured igneous rocks and has a very high crystallisation temperature compared to other minerals. It is considered an important mineral in Earth's mantle.

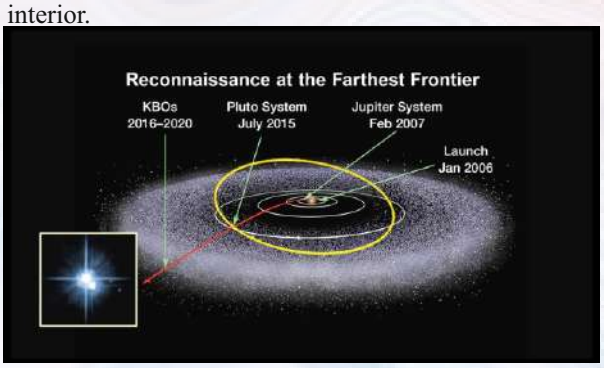
"This is the first time that researchers have found compositions in a meteorite that is found when Olivine is melted at high temperatures and pressures, confirming that the chemical found in the mantle is also present in the asteroid belt," Dr Sujoy Ghosh told IndiaToday.in.

A METEORITE FROM THE ASTEROID BELT

Researchers from IIT Kharagpur studied the shocked meteorite that had struck Kamargaon village of Assam on November 13, 2015.

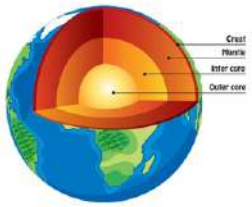
The meteorite was classified as an L6 chondrite. "It provided our team with samples of naturally occurring high-pressure minerals like those believed to make up the Earth's deep mantle," Ghosh added.

Researchers used a high-resolution electron microscope to image and scan the meteorite and conduct a set of complex analyses on a nanometer scale to find evidence of the complex chemical reaction that forms the Earth's mantle. Researchers found that Olivine breaks down into Bridgmanite and Magnesiowustite in the Earth's lower mantle, which is one of the most important reactions that largely control the properties in the Earth's interior.



The Kuiper Belt is a disc-shaped region is populated with hundreds of thousands of icy bodies larger than 100 km (62 miles) across and an estimated trillion or more comets. (Photo: Nasa)

This particular kind of meteorite is found in the asteroid belt — formed by accumulation of solid particles during the formation of planets — located between the orbits of Jupiter and Mars. These materials are at times pulled out from the belt due to collision and gravitational forces. "These meteorites have survived high-pressure and high-temperature events during their formation and fall on Earth due to the planet's gravitational pull," Ghosh added.



Earth's mantle extends from 660 kilometers. (Photo: Getty)

UNDERSTANDING EARTH'S MANTLE

The mantle is the second layer of Earth that begins at nearly 660 kilometers under the surface and extends up to 2,700 kilometers. With the centre of Earth around 6,360 kilometer from the surface, the only way to study material from such immense depths is through volcanic eruptions and magma samples.

The meteorite found in Kamargaon experienced the kind of pressure found in Earth's mantle -- around 24 Giga Pascal, which is 2,50,000 times more than the atmospheric pressure that we experience on the surface. The layer also sees temperatures ranging up to 2,500 degrees Celsius. The samples found in the meteorite are similar to those observed on plate tectonics and could prove useful in studying earthquakes and volcanic activities.

'Meghalayan Age' announced as official new chapter in Earth's history

The Meghalayan Age encompasses the period in Earth's history from 4,200 years ago to present day (Getty Images)

The past 4,200 years have been officially classified as a new chapter in Earth's history – the Meghalayan Age.

Beginning with a global drought that had devastating consequences for ancient civilisations from Egypt to China, the new age is the most recent section of a longer period known as the Holocene Epoch, which reflects everything that has happened over the past 11,700 years.

The Meghalayan is unique because it is the first interval in Earth's geological history that has coincided with a major cultural event, as agricultural societies struggled to recover from the shift in climate.

In a meeting held in June, the International Commission on Stratigraphy (ICS) announced the new division in time, which will now appear on all official charts depicting Earth's geological past.Geologists use the International Chronostratigraphic Chart to show the divisions in the planet's 4.6 billion-year history, each of which is marked by major events like the break-up of continents or climate change.

Every age is characterised by its global impact and a notable change in rocks and sediments.

The concept of the Meghalayan was first proposed seven years ago due to specific chemical signatures found in stalactites and stalagmites.

A stalagmite found in the north eastern Indian state of Meghalaya has provided the best evidence of this, so far and therefore gave its name to the new age.

Two other new phases within the Holocene – the Greenlandian and Northgrippian stages – were also identified based on ice cores sampled in Greenland, and together with the stalagmite they have been placed in protected archives for further study.

However, some researchers have objected to the Meghalaya's creation, especially as there are ongoing discussions about the definition of a new geological period based on human activity – the "Anthropocene".

Stalagmite from India showing the beginning of the Meghalayan Age (IUGS)

Scientists like Professor Mark Maslin from University College London, who have been involved in the Anthropocene debate, have voiced their concerns about the abrupt imposition of this new age.

"After the original paper and going through various committees, they've suddenly announced [the Meghalayan] and stuck it on the diagram," he told the BBC.

"It's official, we're in a new age; who knew?"

"We have lots of new definitions that perhaps now contradict the Anthropocene Working Group and go against what most scientists perceive to be the most important change on Earth in the last 10,000 years."

"We have lots of new definitions that perhaps now contradict the Anthropocene Working Group and go against what most scientists perceive to be the most important change on Earth in the last 10,000 years."

While the concept of an Anthropocene has been popularised in environmental circles as a symbol of the harm humans are causing to the planet, it too is a source of controversy. Many scientists have argued that while the name is eye-catching, it lacks the geological evidence to back it up.

Source: Independent (Josh Gabbatis)

India Bets on Geothermal Energy, Green Hydrogen for a Carbon Neutral Ladakh

India is on a hunt for viable alternatives to replace its aging coal fleet and reduce its dependence on oil and gas. As the search extends beyond conventional renewables of solar, wind and power, the massive energy potential of the Himalayas has once again come into sharp focus. Following the rapid development of hydropower potential across the Himalayas, efforts are now increasingly directed at tapping the region's solar, wind and geothermal energy potential.

Ladakh, India's newest Union Territory, has emerged as perhaps the most important cauldron for India's new energy aspirations in the Himalayas. With an aim to make the Union Territory carbon neutral, Ladakh's administration and the central government of India are assessing the potential for geothermal power. Additionally, efforts are also underway to tap into Ladakh's capacity to produce green hydrogen – which is produced from renewable sources of power like solar and wind.

Representative photo: The high-altitude lake of Tso Moriri in Ladakh. Photo: raahulsingh/Flickr, CC BY 2.0

Eyeing carbon neutrality

Ladakh's renewables push appears to be in line with Prime Minister Narendra Modi's carbon-neutral vision for the Union Territory, which he has repeatedly stated.

The first signs of actual movement in this direction came at a conference last year in November, when Ladakh's Lieutenant Governor, RK Mathur, told global investors and energy stakeholders about the region's capability to become "a hydrogen-driven" Union Territory and alluded to the development of decentralised hydrogen power capacity in Ladakh. "Decentralised availability" refers to a model where power is produced close to where it will be consumed via multiple small-scale power production units. In the context of Ladakh, it means power production units will be located close to hamlets rather than connect all hamlets via one grid.

Later, Mathur told both the ministries of renewable energy and power that green hydrogen is "the best alternative to make Ladakh carbon neutral" and forwarded the possibility of "replacing diesel with green hydrogen energy for electricity, heating and transportation purposes".

Green hydrogen is produced using renewable energy and electrolysis to split water. It is different from grey hydrogen, which is produced from methane and releases greenhouse gas, and brown hydrogen, which uses coal.

"There is a clear inclination towards decarbonising Ladakh," said Tirtha Biswas, the programme lead at the Council on Energy, Environment and Water. "Ladakh has a good renewable potential of almost 40GW and hydrogen has a role to play," he added.

The green hydrogen vision

Hydrogen is now well and truly on the radar in India's energy pursuit. Finance minister Nirmala Sitharaman made this much clear as she announced the National Hydrogen Energy Mission during her budget speech in February this year.

For the Centre, hydrogen-fuel is crucial for a low-carbon transition in industrial sectors. Specifically, the plan focuses on producing hydrogen from renewable sources like solar and wind power.

For Ladakh, the hydrogen fuel's growing momentum offers a clear opportunity. At present, Ladakh has a 200 KW green hydrogen pilot project at the Sonam Norboo Memorial Hospital in Leh. According to Mathur, the pilot's success would count as a "big achievement" in meeting the electricity demand, with potential for the model to be "scaled up for use by the Army and tourists".

Biswas explains that the hospital project uses fuel cell technology to produce heat and electricity. Fuel cells convert the chemical energy in hydrogen into electricity. Here, the green hydrogen is produced using solar power. Biswas notes that given how Ladakh has good solar and wind energy potential, green hydrogen is a viable option.

"High altitude valleys have strong solar irradiance and these valleys also have a good wind profile… this combination [of both solar and wind potential] is also very interesting because they complement each other," Biswas said. In a day, solar power generation potential is about 4-5 hours and it peaks in the afternoon. So, in the off-peak hours, reliance can be placed on wind power. Effectively, this combination provides for a stable source of renewable power.

Although officials are keen, green hydrogen can be invariably land intensive given India's propensity for large solar and wind farms.

Uderstanding impacts

Ulka Kelkar, the climate programme director at the World Resources Institute in India, pointed out that while creating large-scale energy infrastructure, we also need to respect the ecological uniqueness of landscapes like Ladakh. "It would be ideal to come up with hybrid approaches that generate modern electricity services while also protecting local biodiversity and livelihoods that depend on natural resources," she said.

Water is another constraint because "you need water to produce hydrogen," Biswas said. "So we need to understand the hydrological impact of hydrogen production in a high altitude area in the winters," he added.

What the national mission must do to give green hydrogen the push it needs – both in Ladakh and India as a whole – is financial assistance via means like viability gap funding, Biswas points out. Viability gap funding is usually provided by the government for privately run infrastructure projects to make them economically feasible.

Geothermal power in Ladakh

Aside from green hydrogen, officials in Ladakh are also looking to develop geothermal power – which is electricity generated from heat sources, including steam, hot water, magma and hot dry rock, within the earth's crust.

At the energy conference in November, Mathur put Ladakh's geothermal energy potential at 300MW.

"Ladakh is probably the best place in India for generating geothermal power because subsurface temperatures are very high," said Anirbid Sircar, professor and dean of research and development at the Pandit Deendayal Petroleum University in Gujarat.

In February this year, an MoU was signed by the administration of the Union Territory of Ladakh to establish the first ever geothermal field development project in India at Puga in Ladakh – a step hailed by Mathur as "a promising initiative towards innovative and sustainable development" of Ladakh.

In Phase 1 of the project, the power generation aim is 1MW, which will be supplied to the public free of charge, according to the press release announcing the project. In Phase 2, a "deeper and lateral exploration of [the] geothermal reservoir" has been planned via the drilling of wells and the setting up of a higher capacity demo plant in Ladakh. And commercial operations have been planned for phase 3.

"The project [at Puga] is still at a very nascent stage and no systematic exploration and exploitation has been done yet," said Sircar. Comparatively, Gujarat has "already exploited geothermal power by digging shallow wells that generate about 20KW of electricity [which is used for captive consumption]," he added.

View of Puga valley with shallow-boreholes discharging hot fluids. Rocks of ophiolite suite (Sumdo Formation) in the background.

*A scanned photograph of a view of the Puga hot-springs in Ladakh. Source: Geothermal Atlas of India 199*1

But, Sircar pointed out, Ladakh is a much better place for geothermal power than Gujarat and places like Puga are "very promising" because of natural geological conditions.

"The Puga hot spring area, located at the junction of the Indian and Tibetan plates along the Indus Suture Zone, has the greatest potential for the near-term development of geothermal energy in the Indian subcontinent," a November 2013 paper noted. It added that the area "exhibits vigorous geothermal activity in the form of hot springs, mud pools, sulphur and borax deposits… It is estimated that more than 5,000 MWh of geothermal energy is available at Puga, which could be used for heating, for greenhouse cultivation and, eventually, to generate electricity.

"Puga is "unique even when we consider the whole country, not just Ladakh", said Ghulam Bhat, a professor at the Department of Geology, University of Jammu, and one of the authors of the 2013 paper.

The area was also surveyed by the Geological Survey of India (GSI) in the 1970s. "They [GSI] drilled boreholes and the maximum depth they reached was 284 m and the temperature here was 260°C. From what has been studied until now, this is the hottest spot in the whole of India. And this makes it very favourable for the generation of electricity," Bhat added.

In fact, a 1991 Geothermal Atlas of India prepared by the then Indian government had identified Puga as having high geothermal potential.

Assessing environmental impacts of geothermal energy

But before going ahead with such geothermal energy exploration and exploitation projects, environmental impact assessment studies are the need of the hour.

"There is no environmental impact assessment policy in India as far as geothermal energy is concerned," Sircar said. Environmental studies similar to the ones currently in place for oil and gas exploration need to be in place for geothermal power because "the stress and strain on the land has to be understood," he added.

"I am not in favour of directly drilling holes and going ahead with [Geothermal] projects, " Professor Bhat said. "This is an exotic area with a lot of rare and endangered wildlife. Drilling and exploration [without thorough assessments] can cause habitat destruction and a lot of disturbance to wildlife. Also, the region is virtually free of devastation."

The high levels of seismicity of the region adds to the need for detailed studies of the associated risks. The seismic risks of geothermal exploration have been known for some time now and several earthquakes around the world in recent years have been linked to geothermal energy projects. One such earthquake, of magnitude 5.4, hit South Korea's Pohang city, which is home to an experimental geothermal plant, in November 2017 and caused widespread destruction. More recently, a geothermal project in northeastern France was halted late last year following concerns surrounding earthquake risks.

According to Bhat, there is little evidence of such seismic risks in Ladakh. "Ladakh is not very seismically active. The region does not have a history of major earthquakes in the past 100 years or so. Earthquakes here are usually between magnitudes of 3-5 (on the Ritcher scale)," Bhat explains. He, however, adds that given how geothermal power in Ladakh is still at a very nascent stage, more research is needed to understand potential risks, including seismic ones.

The Indonesia example

"Indonesia started working on geothermal power in 1980. Today, we have 2,200 MW of [installed geothermal] capacity," said Riki Ibrahim, president director, Geo Dipa Energi, an Indonesian geothermal energy company. This makes Indonesia the second largest in the world in terms of geothermal capacity after the United States.

Indonesia is located in the Ring of Fire, a volcanic belt. And it is owing to such volcanic geology that it is routinely said that the country has 40% of world geothermal capacity.

Ibrahim explained that Indonesia uses geothermal power for heating, drying and electricity production. "I hope India also invests in producing geothermal power," he added, noting that the power is "environmentally friendly" compared to thermal power, which entails significantly higher greenhouse gas emissions.

He also added that the power production process is not land intensive. "For 1 MW, you need 0.2 hectares. But if you see solar photovoltaic, it needs 1 hectare for 1 MW," he pointed out.

As for what specific measures Indonesia has taken to ensure there are no adverse impacts from drilling and explorations activities, Ibrahim pointed out that the geothermal sector has regulations similar to the oil and gas sector when it comes to drilling activities. "But geothermal is less risky because there are no flammable elements… it's only hot water and steam," he added.

CarbonCopy sent emails to the MNRE and the Ladakh administration officials requesting for an interview about India's plans for geothermal power, how they're taking shape in Ladakh and ensuing ecological impacts. This copy will be updated if and when responses are received.

While Ladakh's prospects to become carbon neutral are bright, it's imperative the government errs on the side of caution. There are many lessons to be learnt from the mistakes made with hydropower – inadequate risk assessments being at the top of that list. A rushed, target-based top-down approach would only magnify these risks. The energy generation potential of the Himalayas will be critical in ramping up energy access, especially in underserved mountainous regions of the country. For this however, India's government must keep an ear to the ground.

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Source: Science The Wire

Geologists find dinosaur fossils

A team of the Geological Survey of India (GSI) including a geologist from Odisha, Dr Linashree Dalabehera, has made a breakthrough that proves the presence of giant species of dinosaurs about 100 million years ago in India.

The team of women researchers comprising Bashisha Iangrai and Dr Linashree Dalabehera, both senior geologists, under the supervision of Superintending Geologist Dr Debahuti Mukherjee has discovered Titanosaurus bones in the South West Khasi Hills of Meghalaya. During a recent Field Season Programme (FSP) by the GSI's Palaeontology Division from North-East Regional Office, the senior geologists identified vertebrate fossil bone fragments of sauropod dinosaurs dating back to about 100 million years from the lower part of the Mahadek Formation of Maastrichtian age from Mawphuli and Dirang villages near Ranikor in the South West Khasi Hills district, Meghalaya, a Facebook post by the GSI had informed it in May this year.Hailing from Bhuban in Dhenkanal district, Dr Linashree Dalabehera is the youngest daughter of Ishwar Behera, a retired engineer, and Tulasirani Behera, a poetess.

After completing matriculation from the Bhuban Government Girls' High School in 1995, Linashree pursued her intermediate at the Baji Rout Memorial College. She cleared her graduation and post-graduation in Geology from the Dharanidhar College in Keonjhar and the Utkal University in Bhubaneswar, respectively.

She started her career as a geologist after receiving her doctorate degree from the IIT Kharagpur. Her husband Subrat Kumar Das, a resident of Hanumanpada in Talcher, is also a researcher in physics.

Jharkhand

BCCL to promote silk cultivation over underground mines in Jharkhand by planting Arjun and Assan trees

Representational Image.

RANCHI: In a first-of-its-kind initiative taken by Bharat Coking Coal Limited (BCCL), Arjun and Assan trees will be planted over the underground mines in Dhanbad, under the mine reclamation project so that silk cultivation could be done on those trees once they grow.

The objective, according to BCCL officials, is to provide self-employment to the people living in the region under the CSR fund. Notably, Arjun and Assan trees are the most suitable trees for rearing cocoons and are also found in abundance in some of the tribal districts like West Singhbum, East Singhbhum and Khunti.

Sericulture has also been a traditional practice among the tribals in Jharkhand. They further added that the initiative has been taken as a pilot project which will be extended further looking at the impact of this scheme in the days to come.

Mine reclamation is the process of restoring land that has been mined to a natural or economically usable state under which plantation of trees is done in the mining area once it gets completed.

"Mostly reclamation is done over the overburden dump (OB dump) but this time, a suggestion was made to do plantation of Arjun and Assan trees paving way for tassar cultivation after they grow up. Work order for plantation has already been placed to the forest department and they will be doing plantation of more than 33000 trees in this coming monsoon," said Environment Head of the Department Kumar Ranjeev.

Presently it is being done under mine reclamation project and tassar cultivation will be done through the CSR project when the trees grow up, he added.

Initially, OB dump was considered for this project it was not found suitable for the project then it was decided to do plantation in the 20-hectare area in Putki-Balihari through the forest department following which an attempt will be made for tassar cultivation.

Kumar further added that "It is a four year project under which preparation is done in the first one year while plantation is done in the second year and monitoring of plants is done in the next two years."

Preparation has already been done and plantation of trees is to be done this year, he added.

According to Kumar, as per the work order forest department will also have to replace the plant if any of them dries up.

"Primarily, the objective is to improve greenery in the mining area but we also focus on sustainable development and engage more and more locals in self-employment," said the HOD Environment.

Once it gets successful, they will expand it to other areas also, he added.

"In addition to that, we have also developed several ecological parks in mining areas. So far, four such parks are functional, while two are being developed. Whereas in the next five years nine more ecological parks will be developed in the mining areas," said the HOD.

Earlier, suitable plants were planted by the forest department till 2010-11, but later Forest Research Institute (FRI) was engaged to guide BCCL on the plantation of suitable trees in the region, and ecological restoration was done with local species of grass, shrub and trees over 294 hectares of land in Dhanbad over OB dump, he added.

Source : New Indian Express

Coal India to start producing CBM from Jharkhand block

Central Mine Planning and Design Institute, CIL's consultancy arm, has been involved as the principal implementing agency for the CBM development in its leasehold areas. Around 80% of the CBM bearing areas come under the coal monolith.

Coal India (CIL) will start producing coal bed methane (CBM) from its lease hold area under Bharat Coking Coal (BCCL) in Jharkhand. This is the first time the coal miner is producing gas from coal seams, as part of its diversification plans to produce clean energy from coal. CBM extraction will prevent releasing gas into atmosphere while mining coal.The company has already issued a Letter of Acceptance to a CBM developer, selected through a global bidding process, this month.

CIL will be the third company after Great Eastern Energy Corporation (GEECL) and Essar Oil and Gas Exploration and Production (EOGEPL) to extract CBM from the coal belts of eastern India.

Until 2015, CIL was only allowed to extract coal from its lease hold area. But the ministry of petroleum and natural gas has allowed the coal miner to extract CBM without alienating lease rights, with a rider to involve only a central or state PSU for exploitation of CBM and that the majority stake be held by CIL.

Central Mine Planning and Design Institute, CIL's consultancy arm, has been involved as the principal implementing agency for the CBM development in its leasehold areas. Around 80% of the CBM bearing areas come under the coal monolith.

A CIL executive said the Jharia CBM Block-I will likely come up at an investment of Rs 1,880 crore as per the project feasibility report. While BCCL will be investing 20% of the total capital required, the developer will invest the rest. CIL did not disclose the name of the developer citing non-disclosure norms, though it said an Indian developer has been awarded the work.

The Jharkhand CBM block-1 has a resource base of over 26 billion cubic metres (BCM) spread over an area of 27 sq km. Average production capacity has been pegged at 1.3 million metric standard cubic metres per day once the commercial operation kick-starts from 2026. The life span of this methane extraction project has been estimated to be over 25 years, the executive said.

The PSU miner has also floated two global tenders this month to look for developers for two more CBM projects having a combined resource potential of 2.7 BCM. A block at Ranigunj under Eastern Coalfields in West Bengal has 2.2 BCM resource while Sohagpur CBM Block under South Eastern Coalfields in Chhattisgarh has 500 million cubic metres resource of methane.

The CBM produced may be used for city gas distribution or distributed through the GAIL gas pipeline, being commissioned under Urja Ganga project, to potential gas users.

Source : Financial Express (FE Bureau |)

Discarded mines to be converted to pisciculture zones in West Singhbhum

West Singhbhum region is known as a mineral rich district and mining is a thriving industry in several areas. However, there are 26 discarded mines in the district where ores had been exhausted and they have been lying idle.

However, the district administration has drawn up a novel plan to utilize these discarded mines for fish rearing or pisciculture thereby opening up earning avenues for people. The Fisheries Department has already started preparations and initially cage farming, a process of fish rearing, will be launched in 26 discarded mine pits in Jagannathpur, Jhinkpani and haat Gamharia Blocks of the district.

The Jharkhand government as a part of its pilot project had initially launched cage fish farming in Ranchi and Ramgarh. This form of fish farming has also been launched at Pansuva Dam in Chakradharpur Sub Division and plans are afoot to start the process in entire West Singhbhum district.

District Fisheries Department Officer Jayant Ranjan said, "We plan to cover the entire district by initiating fish farming so that income avenues open up for local people. We have done the groundwork and sent the survey report along with the proposal to the state government. West Singhbhum has tremendous potential for pisciculture."

Source : The Avenue Mail (News Desk)

Unending despair in India's magical land

Jadugoda means the land of magic. But this town in East Singhbhum district of Jharkhand, where uranium mining operations started in the 1960s, has been facing issues like displacement, poor water quality and fear of radiation, reports DEEPANWITA GITA NIYOGI

The aroma of khichdi, a spicy Indian dish made of rice and lentils, wafted through the air from the open kitchen in the courtyard of a tribal house at Tilaitand village in Jadugoda, about 30 km from Jamshedpur, in the eastern Indian state of Jharkhand. It was in this town where the Uranium Corporation of India Limited, or UCIL in short, started underground mining operations in 1967.

In this peaceful atmosphere punctuated by the sound of pots and pans, and the hurrying footsteps of women, the reporter awaited the arrival of the local guide to take her to Chatikotcha, a few minutes away from Tilaitand. Later sitting on the ledge of his house, the walls of which are painted green and yellow in horizontal stripes, Chatikotcha resident Roshan Hembrom informed that the water in the village is unfit for drinking as well as bathing. "To solve the crisis, the company supplies us water but even then its quality is not that good," he said.

Problems galore

Talking of water, Modi Murmu, a resident of Purihata village near another underground UCIL mine located at Turamdih, said that though his village falls in the radiation zone, the company still does not supply water. Hand pumps yield water but the quality is not at all good Still fortunately it is better compared to some of the other villages. Water quality is a pertinent issue in the entire Jadugoda area, he added.

Murmu is part of the Jharkhand Krantikari Mazdoor Union, a workers' organisation. It was formed to protest against the company's sudden termination of temporary labourers who worked from 2010-2013 on a contract basis. He also admitted the possibility of radiation which has received considerable media coverage.

Jadugoda resident Ashish Birulee, who is a Ho tribal, questions the company's complete refusal to admit the problem of radiation. "If UCIL denies radiation, then why does it supply water to the villagers?" he asks. Birulee, whose grandfather was an employee of UCIL, informed that even his father underwent training in the company. During his apprenticeship my father started having questions. The possibility of radiation crossed his mind, Birulee said.

Tailing ponds and fear of radiation

UCIL has three tailing ponds in Jadugoda used for dumping residual waste and slurry. The village of Chatikotcha is located near such a pond. The company has put up boards warning of trespassing, but the fear of seepage is palpable. "Some of the villages in this area have cases of birth deformities. Maybe more people will suffer in future," Hembrom pointed out.

Birulee, who works for Adivasi Lives Matter which is a platform for upholding tribal voices, said one of the sacred groves belonging to the tribal population in Chatikotcha has partly submerged in the tailing pond. It is locally called jaherthan and is a place of worship for tribals. "We are highly concerned because groves should not be taken for granted. These are sacred places for us." Apart from affecting such a sacred place which evokes faith, the reporter's guide, a local youth, informed that uranium mining has badly hit water sources in the entire area, besides affecting flora and fauna.

According to Birulee, living in Jadugoda is difficult but tribals are attached to their lands. His father Ghanshyam Birulee, who has been fighting against radiation through his organisation called JOAR (Jharkhandi Organisation Against Radiation) formed in 1998, added that tailing ponds have been imposed on the local population. Today, JOAR which has about five-six members, is committed to bringing justice to the residents of Jadugoda. But locals working in UCIL view it with suspicion.

In 2007, a team of three doctors, who were part of the Indian Doctors for Peace and Development, conducted a detailed study in villages lying within 0 to 2.5 km radius of uranium mines and tailing ponds. One of the members, Dr Shakeel ur Rahman based in Patna, said that the number of cases of deformities found in these villages is higher compared to other areas. Health problems like sterility and cancer as well as lower life expectancy were also noted. Rahmani said this was an independent study. "I was with two other doctors and we had hired local investigators and trained them. It took us three to four weeks. The government must conduct a chromosome study. But there is no doubt that several cases of congenital deformities are seen in the affected areas."

Talking about radioactivity, UCIL states in its website that it is based on myth and media speculations. It further says that UCIL is mining low grade uranium, as a result of which the radiation level in and around Jadugoda is much below the limit as prescribed by the Atomic Energy Regulatory Board, an Indian regulatory body.

Geologist and environmentalist Nitish Priyadarshi, based in Jharkhand's capital Ranchi, said radiation occurs in pockets in Jadugoda. According to him, tailing ponds are not covered. Sometimes, locals go near these ponds. "For safety, these must be covered with granite rocks or there should be increased security at the sites. It is true that people living in villages near tailing ponds face health problems even though medically it has not been proved that it is due to radiation," he added. Priyadarshi pointed out that radiation causes large heads, genetic deformities and untimely deaths, all common in Jadugoda. In a report by Priyadarshi on the effects of mining on environment in Jharkhand, the researcher also says that the Subarnarekha river flowing through Jamshedpur is in a highly polluted state due to waste entering the water body from Jadugoda.

Coal is still a major source of energy and accounts for around 70 percent of India's electricity generation. The country's present share of atomic energy in electricity generation stands at about three percent, but it is committed to increase its capacity. The World Nuclear Association says that 10 percent of global electricity is generated from uranium in nuclear reactors. While the US has some 100 reactors supplying 20 percent of electricity, France gets over 70 percent of electricity from uranium.

The author has done this story as part of my Pulitzer Center project on Adivasis and the crisis they are facing for a long time. She has reported the story from Jadugoda in Jharkhand where there is uranium mining by UCIL since 1960s.This story was produced in partnership with the Pulitzer Center on Crisis Reporting.

Source : Tehelka (Deepanwita Gita Niyogi)