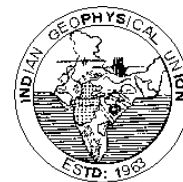


## NEWS AND VIEWS AT A GLANCE



### Forthcoming Conferences/Seminars/Symposia

#### 3<sup>rd</sup> WATER RESEARCH CONFERENCE

Date	11–14 January 2015
Location	Shenzhen, China
Website	<a href="http://www.waterresearchconference.com">http://www.waterresearchconference.com</a>

#### RNA SILENCING IN PLANTS

Date	17–22 February 2015
Location	Keystone, United States
Website	<a href="http://www.keystonesymposia.org/index.cfm?e=Web.Meeting.Summary&amp;meetingid=1363&amp;subTab=summary">http://www.keystonesymposia.org/index.cfm?e=Web.Meeting.Summary&amp;meetingid=1363&amp;subTab=summary</a>

#### Fifth International Conference on Meteorology and Climatology of the Mediterranean

Date	2–4 March 2015
Location	Istanbul, Turkey
Website	<a href="http://www.tethys.cat">http://www.tethys.cat</a>

#### SAVE THE PLANET - WASTE MANAGEMENT, RECYCLING, ENVIRONMENT

Date	11–13 March 2015
Location	Sofia, Bulgaria
Website	<a href="http://viaexpo.com/en/pages/waste-management-recycling-exhibition">http://viaexpo.com/en/pages/waste-management-recycling-exhibition</a>

#### Hydroeco2015 - 5<sup>th</sup> international multidisciplinary conference on hydrology and ecology

Date	13–16 April 2015
Location	Vienna, Austria
Website	<a href="http://web.natur.cuni.cz/hydroeco2015/">http://web.natur.cuni.cz/hydroeco2015/</a>

#### International Conference on Civil and Environmental Engineering (ICOCEE – Cappadocia 2015)

Date	20–23 May 2015
location	Nevsehir, Turkey
Website	<a href="http://www.icocee.org/">http://www.icocee.org/</a>

#### ICES Symposium on Marine Ecosystem Acoustics

Date	25–28 May 2015
Location	Nantes, France
Website	<a href="http://someacoustics.sciencesconf.org/">http://someacoustics.sciencesconf.org/</a>

Carbon Capture, Utilization & Storage: Defining the Frontiers 2015	
Date	31 May – 5 June 2015
Location	Easton, United States
Website	<a href="http://www.grc.org/programs.aspx?id=16854">http://www.grc.org/programs.aspx?id=16854</a>
10 <sup>th</sup> International Conference on Ecosystems and Sustainable Development	
Date	3–5 June 2015
Location	València, Spain
Website	<a href="http://www.wessex.ac.uk/15-conferences/ecosud-2015/page-8.html">http://www.wessex.ac.uk/15-conferences/ecosud-2015/page-8.html</a>
XXVI General Assembly of the International Union of Geodesy and Geophysics (IUGG)	
Date	22 June – 2 July 2015
Location	Prague 4, Czech Republic
Website	<a href="http://www.iugg2015prague.com/">http://www.iugg2015prague.com/</a>
4 <sup>th</sup> International Conference on Management of Natural Resources, Sustainable Development and Ecological Hazards	
Date	1–3 July 2015
Location	Opatija, Croatia
Website	<a href="http://www.wessex.ac.uk/15-conferences/ravage-of-the-planet-iv/page-7.html">http://www.wessex.ac.uk/15-conferences/ravage-of-the-planet-iv/page-7.html</a>

## Awards, Honours and Recognitions:

Dr. Jitendra Singh, Hon'ble Minister of State for Ministry of Science & Technology (Independent Charge), Ministry of Earth Sciences (Independent Charge), PMO, Personnel Public Grievances & Pensions, Department of Atomic Energy, and Department of Space has presented Ministry of Earth sciences Annual National Awards on 27<sup>th</sup> July, 2014. The Awardees are:

- Life Time Excellence Award in Earth System Science: *Prof. Vinod Kumar Gaur, Distinguished Scientist, Bengaluru.*
- National Award for Ocean Science & Technology: *Prof. T. Balasubramanian, Center of Advanced Study in Marine Biology, Annamalai University.*
- National Award for Atmospheric Science & Technology: *Prof. Bhupendra Nath*

*Goswami, Director, Indian Institute of Tropical Meteorology, Pune.*

- National Award for Geoscience & Technology: *Dr. Rishi Narain Singh, INSA Senior Scientist, CSIR-NGRI, Hyderabad.*
- National Award for Polar Science & Cryosphere: *Dr. Anil Vishnupant Kulkarni, Distinguished Visiting Scientist, Divecha Centre for Climate Change, IISc, Bengaluru.*
- Young Researcher/ Achiever Award:
  - Dr. Vijaykumar S Nair, Scientist, Space Physics Lab, Vikram Sarabhai Space Centre, Thiruvananthapuram.*
  - Dr. Rambichar Singh Yadav, Assistant Professor, Dept of Geophysics, Kurukshetra University, Kurukshetra.*

1. **Dr.Sekharan Nair, scientist, Space Physics Laboratory, VSSC, ISRO, Thiruvananthapuram**, has been selected for the prestigious **Zeldovich Award-2014**, instituted by the Committee On Space Research (COSPAR) and the Russian Academy of Sciences, for his significant contributions to the study of couplings in the middle atmosphere. The award carries a medal, certificate and citation. The Zeldovich Medal is given to young scientists under 35 years who have demonstrated excellence and achievement in their field of study. Dr. Nair is the first Indian scientist selected for the award.

2. The Indian Science Congress Association young scientist award has been presented to

<b>Earth System Sciences</b>	<b>Rimjhim Bhatnagar Singh</b> Space Applications Centre, ISRO Ahmedabad - 15
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3. **Prof.Ramesh P. Singh**, Chapman University, USA and member of editorial board of Journal of IGU has been elected as President of Natural Hazards Focus Group of American Geophysical Union (AGU), for two years starting from 1<sup>st</sup> January, 2015.

## Science News

In this issue some recent research findings and innovative developments by communities that are useful in better understanding of various earth processes and practices useful to the society are detailed. Even though they are diverse in nature, the details included in the individual News items are of importance to researchers, pursuing research in different branches of earth system and those interested in serving the society voluntarily.

### **\*CRUSTAL DEFORMATION USED TO ESTIMATE EARTHQUAKE RECURRENCE IN APENNINES**

Seismic hazard assessments require knowledge of the amount of strain accumulated and released

along faults. This information can be obtained through measures of crustal deformation and from estimates of strain released by past earthquakes. Over time, the strain released by earthquakes should mirror the tectonic deformation. **(Source:Ernie Balcerak;Eos, Transactions American Geophysical Union;Vol. 95, Issue 20, page 172, 20 May 2014).**

***(Editor's Note:** This study assumes importance in view of significant crustal deformation in parts of Himalayas. It is good to learn a dedicated seismological institute, located in Ghaziabad would carry out detailed studies in Himalayas, in co-ordination with other research institutes. The data generated will be synthesised with already available information, to acquire knowledge of the amount of strain accumulated and released along faults, in space and time.The experiences from Apennines could be useful, to our seismologists).*

### **\*Scientists Focus on Land Subsidence Impacts on Coastal and Delta Cities**

Some coastal and delta cities around the world are sinking but not necessarily due only to sea level rise and impacts from extreme weather events. Land subsidence that is caused by anthropogenic processes—including the extraction of groundwater, oil, and gas and the drainage of soils—is a significant concern for Jakarta, Indonesia; Manila, Philippines; New Orleans, La.; and many other coastal and delta cities, according to scientists at a 28 April, 2014 briefing held at the European Geo-sciences Union's General Assembly in Vienna, Austria. Although much attention has been paid to sea level rise, the problem of subsidence also is very serious but is "a bit hidden," said Gilles Erkens, a researcher with Deltares Research Institute and Utrecht University, in the Netherlands. "Often, if you have increased flooding as a result of subsidence, it is attributed to sea level rise, but it is in addition to absolute sea level rise," he explained. Subsidence in some areas can be 6–100 millimetres per year, which in some cases can be far greater than sea level rise, Erkens said, noting that anthropogenic causes of subsidence are usually of a much higher magnitude than

natural causes. Subsidence can increase flood risk, damage buildings and infrastructure, and disrupt water management, he said. Erkens added that the coping strategies for anthropogenic and natural subsidence from geological processes differ. “You can do something about anthropogenically caused land subsidence, but there is nothing we can do about naturally caused subsidence.”

In an interview with Eos, Erkens said, “If the land goes down and the sea goes up at the same time, the people on the land only see the sea coming up. It looks like the sea comes up, but you are going down yourself. We are in a situation in the world now that both are happening in most cities. The land is going down and the sea is going up. The sea [level rise] is a global problem: It has to do with climate change and warming and expansion of sea water. The land going down is a local problem of that city, and the solution is in that city specifically. It should be found there.” Erkens said that Deltares conducted a subsidence assessment for some megacities— including Jakarta; New Orleans; Tokyo, Japan; and Dhaka, Bangladesh—and found that most of those cities “are on their way to solving subsidence.” However, he said, they are stuck on particular questions such as how much subsidence is occurring, what is causing it, what its impacts are, who is responsible, and what solutions should be implemented. He said that although solutions may differ from place to place, mitigation efforts to deal with anthropogenically caused subsidence can include restricting groundwater extraction, recharging aquifers naturally or artificially, developing alternative water supplies other than groundwater, managing flood waters better, exchanging information and best practices among cities, and improving governance and decision making. “Someone should really deal with this problem at the government level,” Erkens said, noting that often there is no one in a government position who can adequately address subsidence issues affecting a locale.

### ***Venice Subsidence***

At the briefing, Pietro Teatini, a researcher with the Department of Civil, Environmental and

Architectural Engineering at the University of Padua, Italy, also underscored that subsidence often does not receive as much attention as sea level rise. “Coastal cities are spots spread all over the world, and sea level rise is a global problem, more or less,” he said, adding that subsidence occurs only at some of those spots. “But of course, in these small spots, land subsidence is much larger than sea level rise.” Teatini focused on the issue of subsidence in Venice, Italy, which he noted prohibited the pumping of subsurface groundwater in the 1970s. He said that generally Venice “is more or less stable if [we] look at a sufficiently long time period” and that natural subsidence is only on the order of 1 millimetre per year. However, he added that in some localized areas of the city, human activities are causing subsidence of up to 4–5 millimetres per year. He said that this subsidence could be the result of building restoration work, canal dredging, and waves induced by boat and ship traffic. He said that the heterogeneous nature of the city’s subsoil— with some portions of the city built on sandy soil and other sections atop clay or other types of soil— “contributes significantly to this different pattern of movement” in the city. (Source: Eos, Vol. 95, No. 19, page 159, 13 May 2014)

*(Editor’s Note: This topic is very important as we are witnessing clear subsidence in coastal segment of A.P. State. The subsidence in K-G basin, due to oil extraction has created ripples in the coastal belt. The magnitude of it might go up once shale gas extraction of tight Raghavapuram shales commence, using high pressure fracking technique. Keeping this in view an editorial was published in JIGU along with an Opinion on shale gas extraction. A detailed sub section is also included on shale gas extraction, in this issue’s editorial. We need to be pragmatic and take all precautions to avoid subsidence related problems, in our coastal belt where oil extraction has created subsidence).*

### **\*Yellowstone geysers influenced by internal processes**

The intervals between geyser eruptions depend on a delicate balance of underground factors,

such as heat and water supply, as well as on their interactions with surrounding geysers. Some geysers are highly predictable, their intervals between eruptions (IBEs) varying only slightly. The predictability of these geysers offers Earth scientists a unique opportunity to investigate what may influence their eruptive activity and to apply that information to rare and unpredictable types of eruptions, such as those from volcanoes (**Source:**Wendel, J. (2014), *Yellowstone geysers influenced by internal processes*, *Eos Trans. AGU*, 95(21), 180.)

**(Editor's Note:** Yellowstone National Park is home to some 10,000 thermal features, over 500 hundred of which are geysers. In fact, Yellowstone contains the majority of the world's geysers. Within Yellowstone's thermal features can be seen the product of millions of years of geology at work. Much of Yellowstone sits inside an ancient volcanic caldera (the exploded crater of a volcano). The last major caldera forming eruption occurred 600,000 years ago. For hundreds of thousands of years following that, subsequent lava flows slowly filled in most of the caldera. Even now, in some places, nearly molten rock resides as little as 2-5 miles below the surface. Heat from the volcanic activity makes its presence known by heating ground water and creating the thermal features we now see. The four basic types of thermal features present in the Park are geysers, hot springs, fumaroles, and mudpots. Yellowstone geysers occupy a unique place in earth science research. The area is considered as a natural laboratory and helps researchers to understand dynamics of shallow hot chambers, responsible for release of hot fluids, rich of chemicals. The significant seismic imaging study carried out by Indian origin seismologist Dr.H.M.Iyer, while working as a senior seismologist(during 1980s and early 90s) at USGS, Menlopark, CA, USA is considered by many as an excellent imaging study using seismic tomography.)

#### **\*TREES, MORE THAN SHRUBS, PROTECT AGAINST SOIL EROSION**

Soil erosion and saltation—the transport of ground particles by wind—are significant producers of dust and can damage crops or lead

to nutrient-poor soil in semiarid regions. These regions are particularly vulnerable to climate warming and increased human activity, which can exacerbate erosion and induce dust bowl-like conditions. Previous research and observations have shown that vegetation such as shrubs and trees can reduce soil erosion, but existing models do not account for variations in wind direction or strength( **Source:**Wendel, J. (2014), *Trees, more than shrubs, protect against soil erosion*, *Eos Trans. AGU*, 95(21), 180.)

**(Editor's Note:** This study assumes importance, as we are witnessing considerable damage due to dust storms from Rajasthan. With increasing drier and warmer weather conditions, dust storms even originating in southern semi arid tracts are converting large tracts of fertile lands in to fallow. Farmers, already suffering due to lack of sufficient rain waters are unable to face this additional negative effect, forcing them to migrate to urban centres, making number of villages abandoned ghost hamlets. The situation presently witnessed in Kadiri and surroundings of Anantapur and parts of adjacent Chittoor districts of A.P stand out as precarious. Majority of trees have perished along with tanks. Shrubs that can survive arid climate remain. It is time a proper study is taken up to address the socio economic impact of soil erosion and come out with an apt strategy to save the suffering millions in drought prone tracts of our country.)

#### **\*Mixing to Monsoons: Air-Sea Interactions in the Bay of Bengal**

More than 1 billion people depend on rainfall from the South Asian monsoon for their livelihoods. Summertime monsoonal precipitation is highly variable on intra seasonal time scales, with alternating “active” and “break” periods. These intra-seasonal oscillations in large-scale atmospheric convection and winds are closely tied to 1°C–2°C variations of sea surface temperature in the Bay of Bengal. Despite their importance, ocean- atmosphere coupled models have low skill in predicting intra-seasonal oscillations due to poorly constrained surface fluxes and inadequate representation of advection and mixing. A major

challenge to improved monsoonal forecasting is a dynamical understanding of oceanic and atmospheric interplay across a wide range of spatiotemporal scales. To improve understanding of the circulation, upper ocean dynamics, and air-sea interactions in the Bay of Bengal, the United States, India, and Sri Lanka recently embarked on an international collaborative research program. This 5-year (2013–2017) initiative brings together major resources and scientists from more than 20 research institutes and universities. The program's overarching goal is improved prediction of the South Asian monsoon, particularly on intra-seasonal time scales. The major objectives are to understand and quantify dynamical processes and boundary transports that control freshwater and salt-water exchanges between the Bay of Bengal and the Arabian Sea, to observe small- to large-scale atmospheric phenomena that modulate air-sea exchanges and upper ocean heat content, and to examine oceanic responses to buoyancy and wind stress forcing using observations and high-resolution air-sea coupled models. Bay of Bengal dynamics are marked by seasonal wind and current reversals and shifts in precipitation. In summer, south-westerly winds carry moisture-laden air and bring rainfall to much of eastern and central India, Bangladesh, and the eastern Bay of Bengal. Terrestrial precipitation is discharged into the northern part of the bay via the Ganges- Brahmaputra- Meghna, Irrawaddy, and other major river systems. In winter, north-easterly winds carry dry air from the Asian continent over the bay, promoting evaporation and cooling surface waters, while accumulating moisture and causing rainfall over southern India and Sri Lanka. Large freshwater contributions influence the structure of the upper layers of the Bay of Bengal, resulting in a fresh, shallow, mixed layer overlying a highly stratified pycnocline. These shallow mixed layers respond quickly to surface forcing and are likely to influence monsoonal intra-seasonal oscillation dynamics. The formation of shallow, salt-stratified layers must depend on lateral and vertical processes because river water must be moved horizontally from the boundaries and spread across the interior of the bay. Researchers therefore expect that the study of the three-dimensional (3-D) dynamics that control stratification and circulation in the basin

will lead to improved understanding of monsoonal intra-seasonal oscillation variability. (Source: Eos, Vol. 95, No. 30, 29 July 2014).

**(Editor's Note:** This initiative will be of immense help to our country, as any information pertaining to intra seasonal weather/ monsoon fluctuations/ patterns would definitely help the experts in releasing weather bulletins of enhanced quality to help the agriculture sector. Lack of needed prior information on intra seasonal changes in the monsoon pattern has been affecting us year after year. The study hopefully would strengthen the agrometeorological initiatives, the apt inputs needed in the coming times as monsoon variability has taken a new dimension, with significant changes at local level, making area specific decisions paramount for our agriculture sector to survive and grow. An editorial section has been included in Oct, 2014 issue on some aspects of monsoon variability and Agro-Meteorology).

#### **\*Environmental Concerns:**

#### **\*Geoengineering—Ethical and Developmental aspects (Pros and cons)**

In couple of articles ( JIGU and IJEE, 2013) I urged the Geoengineering experts to be more rational in constructing multi-storeyed mega structures in seismically vulnerable North East India, as such structures could cause considerable destruction and destabilization of the environment. My objection for such structures on Hill slopes and river banks was based on reality, as unconsolidated sediments and thick saturated Alluvial soils, respectively, destabilize due to erosion and seismic wave amplification related phenomena. However, I am not against geoengineering in total, as it may be useful in addressing specific problems. Let us look in to recent debate on this.

#### **Scientists Debate Geoengineering at European Geosciences Union Meeting**

Recent reports by the Intergovernmental Panel on Climate Change (IPCC) and others have presented forecasts of a warmer world and cautioned that some forms of geoengineering might be necessary

to deal with climate change in an emergency situation. A debate about geoengineering and the climate, held at the European Geosciences Union (EGU) General Assembly on 1 May, 2014, explored whether any geoengineering techniques should be considered; if so, which might be acceptable; and what circumstances could necessitate their use. Also discussed was whether potential unintended repercussions from geoengineering could be worse than the problem. During the debate and in a 13 April, 2014 IPCC report, differentiation was made between two general but distinct types of technologies that are referred to as geoengineering. Carbon dioxide (CO<sub>2</sub>) removal includes afforestation, the coupling of biomass energy with carbon capture and storage, and iron fertilization in the oceans to enhance the uptake of CO<sub>2</sub>. None of these currently can be deployed quickly on a large scale. The other type of geoengineering, solar radiation management (SRM), includes techniques such as injecting particles or aerosol precursors into the upper atmosphere. Although SRMs may be more quickly deployed, they may substantially change the global hydrological cycle or have other potentially problematic impacts. Among the debaters at the EGU meeting, Ken Caldeira, senior scientist with the Department of Global Ecology at the Carnegie Institution in Stanford, Calif., focused on the distinction between different geoengineering approaches. “If we could either plant forests or remove CO<sub>2</sub> from the atmosphere and stuff it underground—and it was cheap and local environmental impacts were acceptable—then I’d think we would want to go ahead and employ it today,” he said. He noted that the main issues are cost and local environmental risks. However, Caldeira said that ocean fertilization is among the worst approaches to carbon removal, in part because it involves trespassing on a global commons and converting natural systems into human-managed systems.

He cautioned that while SRM approaches may have some prospect of reducing the amount of climate change, they introduce new climate risks, new governance problems, and other environmental and social risks. “The bigger concern is: what are the unexpected things that would happen socio-

politically in terms of would that cause people to emit more CO<sub>2</sub> and not work as hard on mitigation, or would it generate international conflict, or these kinds of things,” he said. Caldeira said that he favours researching CO<sub>2</sub> removal techniques. “I would probably oppose deploying them as long as we are still building devices such as smokestacks and tailpipes,” he said, even if SRM were shown to work perfectly with minimal environmental impacts. “If it’s enough of an emergency to deploy the solar geoengineering system, it’s enough of an emergency to stop deploying devices—power plants, automobiles—that make the problem worse.” He said SRM approaches might be deployed in dire situations. “To me, it has to be something like if there were massive famines with hundreds of millions of people dying and the global political system was too screwed up to deal with it through more reasonable ways of doing it. If, by emulating a volcano, we could save hundreds of millions of lives, I think I could be in favour of it at that time.” Krishna Kumar Kanikicharla, coordinating lead author for the IPCC Working Group I, warned that SRM approaches could affect the severity of monsoons in Asia, which in turn could affect billions of people. He added that while he is not in favour of completely abandoning all approaches to geoengineering, he is concerned that some techniques—including SRM—could tempt policy makers. “There is a general tendency for the policy makers to take things easy when you show them some way out in a short term,” he said, stating that the first priority should be to reduce emissions. “We should wait until we see that the emissions are stabilized in the atmosphere” before we think about advancing emergency button scenarios such as SRM, he said. Mark Lawrence, a scientific director at the Institute for Advanced Sustainability Studies in Potsdam, Germany, raised the issue of time scales. “If you take an assessment of the current state of knowledge for all of the proposed techniques to remove CO<sub>2</sub> from the atmosphere—at least the ones that I am aware of—you have to account for very long time scales, generally in decades,” before you would have a significant impact from these techniques, he said. “We can’t count on proposed CO<sub>2</sub> removal measures to notably

supplement mitigation measures anytime in the near future.” Lawrence said that although SRM techniques “could act much more quickly to cool the planet, actually on the time scale of a year,” it could take decades for the techniques to be implemented properly. SRM techniques “harbour very large uncertainties about their effectiveness, about the varying regional distribution effects on temperature and precipitation, and about a palate of potential side effects,” he said. “So even though it might be possible in a decade to develop and implement the technical capability to modify the Earth’s radiation budget on a global scale, it would take decades to be able to do so in a knowledgeable and justified manner” in terms of physical consequences, technical implications, and the challenges of international governance that would need to be addressed. Lawrence also urged the geoscience community to not lose sight of “a vast range of societal issues” that are associated with geo- engineering, including ethical concerns associated with research. He raised the question of “moral hazard,” which he defined as the risk that even giving the impression that a Plan B is being worked on could end up reducing the motivation for implementing mitigation measures to reduce CO<sub>2</sub> emissions. However, he said, the moral hazard issue, might depend on social attitudes in different regions. The debate followed the 13 April release of IPCC’s Working Group III report on mitigation of climate change, which stated, “*A risk management strategy for climate change will require integrating responses in mitigation with different time horizons, adaptation to an array of climate impacts, and even possible emergency responses such as ‘geoengineering’ in the face of extreme climate impacts.*” The report continued, “*In the face of potential extreme impacts, the ability to quickly offset warming could help limit some of the most extreme climate impacts although deploying these geoengineering systems could create many other risks. One of the central challenges in developing a risk management strategy is to have it adaptive to new information and different governing institutions.*”

**(Source:—RANDY SHOWSTACK, Staff Writer, EOS Transactions, May, 2014)**

**(Editor’s Note:** *Any intervention that can destabilise environment should be avoided, by all means, even if such interventions could lead to short term development. It is essential that all the stake holders join together and take apt measures to bring out a sustainable development (even of small scale in small steps) that in the long run can be of use to the environment and the society. Unfortunately, all the steps taken at ground level totally ignore the negative impact the technological interventions make to destabilise the ecological balance.*)

### **\*MINERAL MAGIC? COMMON MINERAL CAPABLE OF MAKING AND BREAKING BONDS**

Reactions among minerals and organic compounds in hydrothermal environments are critical components of Earth’s deep carbon cycle, they provide energy for the deep biosphere, and may have implications for the origins of life. However, very little is known about how minerals influence organic reactions. A team of researchers from Arizona State University have demonstrated how a common mineral acts as catalysts for specific hydrothermal organic reactions -- negating the need for toxic solvents or expensive reagents.

The essential ingredients controlling chemical reactions of organic compounds in hydrothermal systems are the organic molecules, hot pressurized water, and minerals, but a mechanistic understanding of how minerals influence hydrothermal organic reactivity has been virtually nonexistent.

The ASU team set out to understand how different minerals affect hydrothermal organic reactions and found that a common sulfide mineral (ZnS, or Sphalerite) cleanly catalyzes a fundamental chemical reaction -- the making and breaking of a C-H bond. Their findings are published in the July 28 issue of the *Proceedings of the National Academy of Sciences*. “Typically you wouldn’t expect water and an organic hydrocarbon to react. If you place an alkane in water and add some mineral it’s probably just going to sit there and do nothing,” explains first author Shipp. “But at high temperature and pressure, water behaves



more like an organic solvent, the thermodynamics of reactions change, and suddenly reactions that are impossible on the bench-top start becoming possible. And it's all using naturally occurring components at conditions that can be found in past and present hydrothermal systems."

This research provides information about exactly how the sphalerite mineral surface affects the breaking and making of the C-H bond. Sphalerite is present in marine hydrothermal systems i.e., black smokers, and has been the focus of recent origins-of-life investigations.

Hydrothermal organic reactions affect the formation, degradation, and composition of petroleum, and provide energy and carbon sources for microbial communities in deep sedimentary systems. The results have implications for the carbon cycle, astrobiology, prebiotic organic chemistry, and perhaps even more importantly for Green Chemistry (a philosophy that encourages the design of products and processes that minimize the use and generation of hazardous substances). (Source: Science Daily, July, 2014)

*(Editor's Note: The findings are useful in understanding the basics of chemical reactions at deeper depths and how common elements can change at high pressure and temperature. Once these compositional changes that can occur at a particular depth are synthesized with geological/geochemical and geophysical findings we can better interpret data generated through surface and sub surface probing techniques. This in turn, as stated by the authors can explain various natural processes that continuously occur at different sub surface depths and explain better the geodynamic processes ).*

#### **\*What drives migration of riverbed sand dunes?**

Depending on grain size, river sediments fall into two main groups: wash load (grains that never fall out of suspension) and bed load (sediment that rests on the riverbed). Bed load sediment,

similarly, can be either resting on the riverbed or temporarily in suspension, at which point it is known as suspended load. The sand dunes that carpet the beds of some rivers are made primarily from bed-load, which migrates by bouncing along the bottom, or suspended load, which moves by getting picked up and carried downstream, affects the shape and size of the dune. In turn, the size, shape, formation, erosion, and migration of riverbed sand dunes influence the river's speed, the amount of turbulent mixing, and the migration of the river channel. Measuring the role of suspended and bed load sediments in dune migration have traditionally been limited by the lack of a way to measure the concentrations of both types of sediment simultaneously. A new experimental apparatus known as an acoustic concentration and velocity profiler (ACVP) solves this problem.

Using an ACVP, which combines acoustic backscatter and acoustic Doppler sensors, Naqshband *et al.* studied the roles of different types of river sediments on dune formation and migration. With this instrument, the researchers found that bouncing bed load outpaces suspended load as the dominant mechanism for sand dune migration on the river's bottom. (Source: Naqshband *et al.* Journal of Geophysical Research: Earth Surface, doi: 10.1002/2013JF003043, 2014)

*(Editor's Note: This study is very useful in understanding the sand dune dynamics of perennial rivers like Ganga, Yamuna, Godavari and Krishna. This in turn helps in taking up any developmental activities across these rivers, without destabilizing riverbed dunes and basic river dynamics. In the absence of such an information we will be inviting disasters, as witnessed in Uttarakhand)*

#### **\*At what depths do magma-water eruptions breach the surface?**

When magma ascends upward in the Earth's crust, it can react violently with groundwater, leading to underground explosions or even full-fledged eruptions. If they breach the surface, these phreato-magmatic eruptions leave debris

that falls concentrically around the crater or cone. Previously, researchers have sought to determine the depth within the vent from which the eruption originated by looking at the types of ejected rocks and their original positions beneath the volcanoes, but *Valentine et al.* found that these two factors are not necessarily directly related. Rather, the authors sought to establish an empirical relationship between the depth of an explosion and whether the explosion ejects material by looking at past data from underground chemical and nuclear explosions.

The authors then applied this empirical relationship to phreato-magmatic explosions, which depend on factors such as the volume of magma, and found similar relationships. Specifically, for a given amount of energy, explosions below certain depths in the vent will be contained underground. Further, there is a shallower depth that will optimize an eruption where material is ejected. Determining these depths for different energies within a volcano will help scientists better quantify volcanic hazards.

Although explosions may occur down to 2 kilometers below the Earth's surface, the authors note that most are only eruptive above 200 meters underground. In addition, they found that the eruptions that deposit the most tephra occur above 100 meters. The authors note that these findings will help improve analysis of geological features of phreato-magmatic eruptions. **(Source:** Valentine et al; *Geophysical Research Letters*, doi: 10.1002/ 2014GL060096, 2014) —JW —COLIN SCHULTZ, Writer; and JOANNA WENDEL),

*(Editor's Note: This study clearly demonstrates that magma dynamics is variant from place to place. But, the final eruption, usually originates from shallow depths and as such a constant monitoring of volcano's surroundings helps us to pin point phreato-magmatic explosions, which trigger eruptions. The information helps in better management of volcanic eruption related disasters)*

### **\*Too late for course corrections on Global warming-IPCC**

The latest fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC) predicts a bleak future for the world, and especially South Asia. Hinting that it may already be too late for significant course correction on global warming, the report cautions, "Regardless of action taken now to reduce emissions, the climate will change until around the middle of this century."

Urgent damage control and risk mitigation are the need of the hour, the report notes.

"In the longer term, in all except the low-emission scenario, global warming at the end of the 21st century is likely to be at least 1.5 degree Celsius," it says, adding that in higher emission scenarios warming is likely to be 2 degree Celsius. However, the report warns that if emissions are not reduced significantly globally, average global temperatures could rise by 2.6 to 4.8 degree Celsius. With all these scenarios, the danger of increasing poverty, decreased food production, destruction of infrastructure, rise in vector-borne diseases and heat-related deaths are going to increase.

The situation for India could be especially precarious, the report notes. "In the Indo-Gangetic plains which produce 90 million tonnes of wheat a year (about 14-15 per cent of global production), projections indicate a substantial fall in yields unless there is a shift to different crop varieties and management practices," it says.

Further, it adds that the incidence of many diseases, such as dengue and Japanese Encephalitis, increase at higher temperatures. In the last few years the incidence of these vector borne diseases has increased in India, so much so, that the Government has been forced to undertake mitigation efforts on a priority. "The Asia region, as a whole, experienced the most weather and climate-related disasters in the world between

2000 and 2008, and suffered the second-highest proportion (almost 30 per cent) of total global economic losses," the IPCC report says (**Source:** CMS-ENVIS).

*(Editor's Note: What is stated above is already known, in one form or the other to all the concerned. Unfortunately, due to various limitations and our incapability in controlling over use of non renewable energy resources have created cobwebs. To wriggle out we need to destroy the cobwebs in toto and not satisfied with trimming them. Until we take revolutionary changes in our energy usage and radically change agriculture sector by compulsorily introducing mechanised farming and water saving irrigation practices our initiatives to enhance realistic GDP growth would not see the day. Our statistically built, with error ridden sampling data, growth rate projections and achieved results are basically cosmetic. Until we delink IT sector impact and stock market controlled statistics we will not be seeing the reality existing at ground level. Let us not live in a utopian world. We need to take measures, even if those measures bleed one and all a bit. It is time we make every one realise that our economy is not sound and sustainable development needs sacrifices).*

#### **\*Climate change to cut South Asia's growth**

Climate change will cut South Asia's growth almost 9 per cent by the end of the century unless world governments try harder to counter global warming, the Asian Development Bank (ADB) warned. The region is home to a fifth of the world's population and is already vulnerable to climate extremes: seasonal floods, cyclones and droughts that ravage vast swathes of agricultural land and displace hundreds of thousands of people every year. The costs of countering climate change in South Asia will also increase over time and will be prohibitively high in the long term, the ADB's "Assessing the Costs of Climate Change and Adaptation in South Asia" report said.

South Asian countries will see more frequent severe weather, damaging property, infrastructure, agriculture and human health, the ADB said.

Between 1990 and 2008, more than 750 million people in South Asia were affected by at least one natural disaster, resulting in almost 230,000 deaths, it said. Coastal areas of Bangladesh, India, the Maldives, and Sri Lanka will see sea level rises that are likely to displace people and adversely affect the tourism and fisheries sectors. The cost of shielding the region against climate change could be lowered if the world's governments significantly cut greenhouse gas emissions and, if the rise in global temperatures was kept below 2.5 degrees Celsius, that cost could be nearly halved to about \$40.6 billion, or 0.48 per cent of GDP, it said. South Asia also needs to introduce flood- and saline-resistant crop varieties, better coastal zone management, and improved disease surveillance, protection of groundwater and greater use of recycled water.

India, one of the world's largest agrarian economies, is badly at risk, the report said, and may see GDP losses of up to 8.7 per cent by 2100.

"Agriculture provides employment and livelihood opportunities to most of India's rural population and changes in temperature and rainfall, and an increase in floods and droughts linked to climate change, would have a devastating impact on people's food security, incomes, and lives," ADB Vice-President Bindu Lohani said in a statement. (**Source:** CMS-ENVIS)

*(Editor's Note: All of us witnessed in 2014 the significant negative impact due to extreme weather events. We could survive to a reasonable extent due to already available food stocks, in spite of failure of Kharif season, in many segments of our country. While drought affected our food production the unprecedented floods in J & K and parts of North India have added fuel to the fire. It is evident that we have to get prepared to face such monsoon aberrations in the years to come. Experts are concerned that any repetition of failure of earlier part of monsoon or extended presence of El Nino like conditions can devastate our economy. We are at the mercy of Nature. And we need to develop resilience, taking stock of various ground realities, to overcome setbacks)*

### **\*Another Drop in Stratospheric Water Vapour**

In 2000 a sudden severe drop in stratospheric water vapour levels interrupted the supposed long-term increase of this greenhouse gas, an important contributor to global warming and climate variability. Satellite sensors observed a recovery in the following years, hidden behind a large variability. More recently, during 2011 and 2012, measurements revealed another severe drop in stratospheric water vapour concentrations. Similar abrupt changes have likely occurred previously but were not observed because of the lack of adequate satellite measurements before the 1990s. In addition, future changes may remain unobserved, with present-day limb-sounding satellites well beyond their design lifetimes and no new missions planned to continue the observation record.

During the 1980s and 1990s, researchers observed a long-term increase of water vapour in the lower stratosphere (at altitudes between 16 and 26 km). The measurements, made using balloon-borne cryogenic frost point hygrometers launched from Boulder, Colo. (40°N, 105°W), indicated a rate of increase of about 1% per year, later revised to 0.6% per year. This long-term increase concerned scientists who study climate change because water vapour is one of the most prominent greenhouse gases that effectively absorbs light (terrestrial radiation) at infrared wavelengths. Sensitivity studies with climate models demonstrated that even small changes in lower stratospheric water vapour can lead to notable changes of radiative forcing and the temperature at the surface. The strength of a water vapour feedback mechanism—a warmer climate increases stratospheric water vapour, which causes further warming—was recently estimated at about +0.3 watt per square meter per Kelvin temperature change in the mid-troposphere. In addition, climate models uniformly predict that stratospheric water vapour concentrations will continue to increase in the future. In 2000 a severe drop in stratospheric water vapour levels interrupted the supposed long-term trend, surprising observers. Satellite measurements

showed a recovery in subsequent years, and scientists first considered the drop to be a singular perturbation in the long-term water vapour time series, attributed to an abrupt strengthening of the residual circulation (the slow circulation in the stratosphere transporting air masses from the tropics to higher latitudes), leading to stronger upwelling and lower temperatures in the tropical tropopause region. However, several independent satellite sensors observed a large variability with several highs and lows of water vapour concentrations during the past decade. Just recently, during 2011 and 2012, a strong drop in stratospheric water vapour concentrations similar to the one observed in 2000 was measured, again accompanied by a sudden decrease of tropical tropopause temperatures. Stratospheric water vapour concentrations followed roughly the evolution of the tropical tropopause temperature, and observations show that temperature and water vapour increased again in 2013. It can be expected that similar abrupt changes will also occur in the future and have occurred earlier in time (for example, in 1983–1985), but were not observed because of the lack of satellite measurements of lower stratospheric water vapour of sufficiently good quality before the 1990s. Water vapour in the stratosphere is governed by two major processes. One is the entry through the tropical tropopause, where the lowest temperature (the so-called cold point temperature) determines how much water vapour continues on its upward path into the stratosphere and how much is removed by a freeze-drying process. The other is the oxidation of methane, which is the only important chemical source of water vapour in the stratosphere. The increase in stratospheric water vapour concentrations during the past century cannot fully be explained by changing tropopause temperatures—cold point temperatures decreased while water vapour overall increased—or increasing levels of the greenhouse gas methane. Observed methane increases levelled off in the second half of the 1990s before the gas started to increase again in 2007. The drop in water around 2000 and the following recovery, however, seemed to be consistent with tropopause temperatures going down and rising again.

The recent drop during 2011–2012 was again accompanied by low tropopause temperatures. Scientists believe that the variability of tropopause temperatures is dominated by modulations of the stratospheric residual circulation, with periodicities corresponding to the stratospheric quasi-biennial oscillation and the El Niño– Southern Oscillation. Although this part of the puzzle seems close to being understood, inspection of collected data reveals that not all of the observed variability of lower stratospheric water-vapour in the tropics can be explained by changes in average tropopause temperature (for example, the period 2008–2011). Other zonally asymmetric or localized processes may contribute. Moreover, nobody is currently able to predict the rise and fall of tropopause temperatures and thus the future development of stratospheric water vapour. Satellite limb measurements have been successfully conducted since the early 1990s with, for example, the Halogen Occultation Experiment (HALOE) on board NASA's Upper Air Research Satellite (UARS) providing a long water vapour time series of excellent quality from 1991 to 2005, and the Stratospheric Aerosol and Gas Experiment II (SAGE II) on the Earth Radiation Budget Satellite (ERBS).

The number of satellite limb observations of the stratosphere increased starting in 2001 with the launch of the Swedish-led Odin satellite, which was followed by several other satellites carrying limb- sounding sensors capable of measuring stratospheric water-vapour on a global scale. These include the European Space Agency's Envisat in 2002, the Canadian SCISAT in 2003, and NASA's Aura in 2004. However, Envisat's observations ended unexpectedly in 2012 because of a failure of the satellite. Several limb- sounding missions are currently operating with the required sensitivity and resolution to make profile measurements of stratospheric water vapour. However, all these missions are already far beyond their scheduled lifetimes. Although regular balloon- borne observations at Boulder measurements collected through the Global Climate Observing System

(GCOS) Reference Upper Air Network (GRUAN), and data from ground-based networks such as the Network for the Detection of Atmospheric Composition Change (NDACC; <http://www.ndacc.org>) are contributing to the monitoring of stratospheric water vapour, their geographical coverage and temporal sampling frequencies remain sparse, in particular in the tropics. In the absence of a long-term global observation strategy of the space agencies, there are at present no future space missions scheduled for launch that can provide vertically well resolved measurements of lower stratospheric water vapour on a longer time scale, despite the importance of humidity for the climate system. **(Source:** EOS, Transactions, American Geophysical Union, Volume 95 Number 27, 8 July 2014 Pages 245–252)

*(Editor's Note: Such studies are useful, to face monsoon aberrations due to abrupt changes in the stratosphere. Our Space scientists need to take note of this and gather sufficient data from tropics. It is now confirmed that levels of almost all the greenhouse gases in the atmosphere have increased significantly in the last couple of decades and impact of such an increase is witnessed/ experienced in the form of global warming and acidification of sea waters and abrupt changes in the monsoon pattern with enhancement of extreme weather events like El Nino. In spite of number of warnings nothing substantial has been achieved in cutting greenhouse gas emissions, due to variance in individual countries perceptions. Unless developed countries substantially cut emissions and extend their help in a significant way to developing nations, to restrict emissions, nothing much can be achieved as socio-economic issues are linked with fossil fuel usage. To impress upon one and all the impact due to confluence of negative factors, it is essential to have global network of data centres, including dedicated satellite networks by pooling up resources from a number of countries. The suggestion made by the Prime Minister Sri.NarendraModi to have SAARC satellites to monitor various activities of concern to the environment and economic stability needs to be given due importance).*

### **\*Second Generation Biofuels**

The Energy Independence and Security Act of USA (EISA, 2007) mandates that the United States must use 21 billion gallons of second generation biofuels per year by 2022, while the National Biofuels Policy of India approved on December 24, 2009 proposes an indicative target of 20% blending of biofuels by 2017. This can be made possible with the sustainable production and use of biofuels from non-food based feedstock which can increase energy independence, reduce greenhouse gas (GHG) emissions, and promote healthier land-use while providing additional jobs and income to both rural American and Indian communities. **The U.S.-India Consortium for Development of Sustainable Advanced Lignocellulosic Biofuel Systems** is a collaborative effort between Indian and U.S. institutions under the **Joint Clean Energy Research and Development Center (JCERDC)** initiated by the Governments of India and the United States to accelerate transition to a low carbon, high-performance and energy-secure economy. The Biofuel Consortium addresses the second generation biofuels R&D priority area of the JCERDC, emphasizing sustainable feedstock cultivation and supply, biochemical conversion technologies for production of second generation biofuels with minimal environmental impact, and analysis of overall sustainability and supply chain of feedstock as well as biofuel. The consortium is jointly led by the **Indian Institute of Chemical Technology (IICT)**, Hyderabad, India and the **University of Florida**, Gainesville, USA. (Source: Connect: September 2014)

*(Editor's Note: It is good to have such collaborations, provided area specific alterations are introduced to make the initiative adoptable to local conditions. It is essential to generate sufficient data, under varying environments to identify bottlenecks and then to remove them. Scientists from both the collaborative organizations should freely exchange ideas and data to make the initiative successful in all respects. While carrying out sustainable feedstock cultivation and supply it is essential to go in to existing scenario and the socio-economic compulsions. Such a strategy is crucial as many a time high technology*

*initiatives are found lacking in ensuring sustainable development due to non-acceptance of proposed change by the local entrepreneurs).*

### **\*Zabo: The art of impounding water**

Kikruma in Nagaland has its own system of water harvesting. Watch a farmer explain this unique method called Zabo, which helps manage water while nurturing the soil and optimizing agriculture. Located at an altitude of 1270 metres, Kikruma, a quaint village nestled in a rainshadowed area of Phek district of Nagaland is a wonder. Centuries ago, the village evolved a self-organizing system to take care of its water, forest and farm management. 'Zabo', which means 'impounding water', is an ingenious method of catching rainwater from running off the mountains. It involves the preservation of forests on the hill tops as they are the catchment for the water. At the next level are the ponds dug out to hold rainwater, which is brought there through small channels. These channels are even dug across 'pucca' roads! They serve as reservoirs with their bottom and sides rammed and compacted so as to reduce seepage. The water is passed through cattle yards and let into the paddy fields located below. This water carries the dung and urine of the animals to the fields below – perfect to meet the nutrition needs of the soil.

These paddy fields are also used to rear fish, yielding about 50-60 kg of fish per hectare as an additional output. The bunds of the ponds also support a huge variety of medicinal plants and herbs. The ponds are constructed in a way that the distribution of water is uniform. Inlet channels are dug to carry water from one pond to the next. Strangely enough, this system unique to Kikruma has not been replicated elsewhere. (Source: Water Portal News, Bangalore)

*(Editor's Note: Waterportal of Bangalore has been doing an yeoman service by bringing in to focus existing scenario in different parts of our country and simultaneously suggesting various aspects of water management, being practiced by both technical and non-technical organizations*

*and individuals. A close study of the Portal's News clearly tells that number of techniques, area specific, are in vogue since considerable time and a close inspection of these techniques could help in developing viable technologies of use to the needy. To make these technologies easily accessible to one and all, all those wedded to the development of our water resources should come forward and help in forming dedicated service centers( all over our country) to address both drinking and irrigation needs. It is time the scientific community extends its support to this initiative).*

## Living Legends-Know Your Peers



### **\*SRI. T.M.MAHADEVAN:**

Sri.T.M.Mahadevan was born on the 15th April 1926 at Ernakulam, Kerala, in an enlightened family. He has imbibed sublime qualities of humility, honesty and dignity of labour right from the childhood. He obtained first rank in the B.Sc(Hons ) of the Presidency college, Madras and received M.Sc. ( by research ) of the Madras university in 1950 for his thesis on the evolution of high grade granulites of Periakulam district of the then Madras state. He was the first to identify the sapphirine-spinel-cordierite symplectites of Ganguvaripatti under the able guidance of Prof.T.N.Muthuswamlyer.

Sri.Mahadevan served the Geological Survey of India from 1949 to 1969 and significantly contributed to our knowledge on the Chota Nagpur Plateau, Southern Peninsular Shield, Bihar Mica Pegmatite Belt and Wynad Gold Belt. The Petrology Laboratory of GSI set up by him at Hyderabad bears testimony to his passion for petrological research. Sri Mahadevan served the Atomic Minerals Division (AMD) of the Department of Atomic Energy from 1969 to 1987. He has adopted a holistic approach, jointly with his colleagues, for exploration strategies for atomic minerals incorporating the principles of geochemical mobility of the elements. This paid significant dividends in the identification of extensive uranium mineralization

in the vast Siwalik formations. This was a landmark achievement.

Sri.Mahadevan, after superannuation from the AMD as its Director, received international recognition in 1994 with the publication of Deep Continental Structure of India: A Review (Memoir 28, Geol.Soc. India). This publication brought him recognition, in the scientific circles, as a versatile scientific writer. Over the years, beyond 70 years of age, he sharpened his capabilities by freely interacting with both the young and senior scientists. He openly acknowledged that he enjoyed learning and sharing his acquired knowledge with others. In this process he honed his tools for deducing geological interpretations from geophysical data. Since 1994 he has become an acknowledged authority on deep continental structure of India. His insatiable urge for the acquisition of knowledge in all sub-disciplines of Earth System Science, from one and all, is exceptionally phenomenal. The mastery he acquired on the Deep Continental Structure of the Indian Sub-continent is amply reflected through publications and edited memoirs. The scientific community owes a deep debt of gratitude to this great personality for the yeoman services he has rendered for the last 25 years, initially as a member of the Editorial Committee, and later on as the Editor of the widely acclaimed DST NEWS LETTER on DEEP CONTINENTAL STUDIES IN INDIA. Sri Mahadevan was actively associated with the PAMC-DCS programme of Department of Science and Technology, in various capacities, for more than two decades and guided many scientists and teachers from research institutes and universities, in molding their research career. Sri.Mahadevan, by virtue of his involvement in deep continental studies, had also the privilege of participating in the post-Latur earthquake renaissance in India that led to the development of a wide network of broadband seismic stations in India. Sri.Mahadevan is revered by his colleagues and friends. In recognition of his yeoman service to the scientific community in particular and the society in general, spanning over six decades, members of the Earth Science Fraternity honoured him in 2007 by releasing an excellent IAGR Memoir (Memoir 10 of International Association for Gondwana Research, Japan).

Sri.Mahadevan is decorated with prestigious national awards, including Decennial award of Indian Geophysical Union, and bestowed with honours from several scientific associations.He inspired generations of scientists of different organisations by his erudition, scholarship, scientific temper and benevolent interactions.

Indian Geophysical Union is indebted to him for his positive support to the organization.He has been providing guidance to the editorial team of Journal of Indian Geophysical Union, since its inception.

Sri.Mahadevan is an eighty eight year old young and vibrant scientist eager to take up academic adventures and responsibilities .No account of Sri. Mahadevan is complete without mention of his artistry over violin.He was a regular auditioned artist of the All India Radio, and his recitals on the violin have been broadcast on the AIR for a period of 32 years from 1967 to 1999.The rich and admirable human qualities of Sri.Mahadevan are in consonance with his scientific accomplishments. We rarely come across another person gifted with so many virtues.Our talented young researchers can be benefited by following him in letter and spirit. They can overcome hurdles by acquiring the art of positive attitude from him. He is a true Legend.



**\*DR.K.NARAYANAN**

Kottilil Narayanan. Born 24 Sep 1929. B SchHons, M Sc and Ph D in geology Presidency College and University of Madras. Oil and Natural Gas Directorate from 1956 August. ONGD became a statutory Commission in 1957 and, later on, got converted into a 'Corporation'.

Narayanan was deputed to Tanzania in 1973 from where he was not released until 1982 but was allowed to retire in April 1980. After the Tanzania UNIDO project was taken over by

the Royal Norwegian Government. Narayanan was employed by NORAD from 1982-1992 for assistance programmes to several developing countries. He was recalled to India and made Chairman of the DGH Council with the specific task of setting up DGH in the image of the Norwegian Petroleum Directorate. He served in this capacity from 1993 to 2000.

The Narayanan Committee set up by Government of India as the 2<sup>nd</sup> Bombay High Enquiry Committee identified that the water flood programme had failed on account of the Miocene carbonate reservoirs being widely and severely fractured. Narayanan was asked to chair the 3<sup>rd</sup> Bombay High Committee with young oil professionals of ONGC as the other members. Studies carried out during this programme showed that very little oil had been produced from the granular porosity until the end of 2010. The SPG Golden Jubilee Award of 2008 was given to him, specifically for the work done by him on the performance of the Bombay High field.

He is known for his commitment to enhance oil recovery from abandoned and under-utilized reservoirs.

Kottilil Narayanan is a life member of APG India which gave him a Life Time Achievement Award in 2002. He is an honorary life Fellow of Indian Geophysical Union. He, as Key note speaker during Millennium Conference of IGU, brought in to light the needed steps to enhance quality of oil exploration and exploitation. He also delivered several keynote addresses, in subsequent IGU annual conventions. He is also an honorary life member of Association of Exploration Geophysicists. In a fifty plus years' career he has published two original papers and one review article, but revolutionized oil industry efforts.

Dr.Narayanan, a charming personality, has received accolades from all those closely associated with him for his positive traits and ready wit.





**\*PROF.C.LEELANANDAM**

Prof. Chervela Leelanandam obtained B. Sc (Hons) degree in 1953 (standing First in First Class) and M. Sc degree in 1954 from the Andhra University, and Ph.D. degree in 1961 from the Osmania University. He obtained another Ph.D. degree from the Department of Mineralogy and Petrology, University of Cambridge (England) in 1965 under the supervision of the world renowned Prof. W. A. Deer, FRS. He was a Commonwealth Research Fellow at the Trinity College (Cambridge) from 1962-65, and Alexander von Humboldt Post-Doctoral Senior Research Fellow at the Geochemistry Institute, Göttingen (West Germany) from 1972-74.

Prof. Leelanandam joined the Geology Department, Osmania University in 1956 at the age of 22, after working for one year in the Chemistry Division of the Department of Atomic Energy, Bombay. He served Osmania University as a Lecturer (1956-65), Reader (1965-76) and Professor (1976-94); He was the Head of the Department (1977-78; 1983-85); Dean, Faculty of Science (1993-94); CSIR Emeritus Scientist (1994-99). In his long teaching career spanning over three and half decades, he carved a niche for himself as a dedicated and motivating lecturer. He has mentored 12 Ph.D. students who have substantially contributed to his academic wealth. Prof. Leelanandam, as the UGC National Lecturer (1985-86), has delivered a series of inspirational lectures on different topics at several universities. He has also delivered the Prof. Jhingran Memorial Lecture (1995), West Memorial Lecture (2005), National Science Day Lecture (2008) and Prof. C. Mahadevan Memorial Lecture (2013).

He participated in field trips in Scotland and Northern Ireland (1963-65) and invigorating International Field Conferences [in Southern Granulite Terrain (1988), Laramie (1988) and Adirondack Mountains (1991) in USA]. His sojourns to Cambridge, Edinburgh, Laramie,

Houston and Stony Brook, during the period 1988-1994, have revitalized his scientific strengths.

From 1956 onwards, Prof. Leelanandam was vigorously conducting, with single-minded devotion, high-quality mineralogical, petrological and geochemical research work on the charnockitic rocks (of Kondapalli), layered and massif anorthosite complexes, chromitites, alkaline rocks, ferrosyenites and ophiolites. The exceptional expertise he gained, both in classical wet chemical methods of analysis of rocks and constituent minerals at Cambridge (1962-65) and sophisticated instrumental techniques (XRF, AAS and EPMA) at Göttingen (1972-74), earned him enviable global reputation. A total of 173 mineral analyses and 82 whole rock (major and REE) analyses were obtained by him for the Kondapalli area (~20 sq. km) alone!

During the period 1960-2014, Prof. Leelanandam has published nearly one hundred original research papers in reputed national and highly prestigious international journals; presented forty papers (or delivered talks) at the seminars and international conferences. His contributions are extensively quoted in reputed reference works. He has edited the immensely popular Memoir No. 15 (of the Geological Society of India) on Alkaline Rocks (1989) and co-edited the evocative Memoir No. 10 (of the International Association of Gondwana Research) on the Indian Continental Crust and Upper Mantle (2007).

Prof. Leelanandam has the unique distinction of discovering three disparately distinct rock complexes: Kondapalli Layered Complex in 1972; Elchuru Alkaline Complex in 1972 (along with his students); and Kandra Ophiolite Complex in 1990. The trinity of these serendipitous discoveries, supported by REE and U-Pb age data have helped him in enunciating the plate tectonic framework of SE India.

He was the Member-Secretary of the INC of the IUGS (1981-85). He was the member of the INC of the IGCP; INC of the IUGS (1986-89); PAC of the

DST (ESS) (1994-2001); Governing Body of the WIHG, Dehra Dun (1997-2000).

Prof. Leelanandam's achievements are deservingly acknowledged by the geo-scientific community. The Geological Society of India has bestowed upon him the M. R. Srinivasa Rao Award (1992), JGSI-Radhakrishna Prize (2009) jointly with Prof. K. Vijaya Kumar, and Bellur Rama Rao Birth Centenary Award (2010). The Asiatic

Society (Kolkata) has honoured him with the Pramatha Nath Bose Memorial Medal (2010) for his significant contributions to the field of geology. Towering all these, the Government of India (Ministry of Mines) has conferred upon Prof. Leelanandam the coveted National Geoscience Award for Excellence-2010 in recognition of his life-time achievements in the field of Geosciences, especially for the advancement of teaching and research in petrological studies in India.

**P.R.Reddy**

