

राष्ट्रीय भूभौतिकीय अनुसंधान संस्थान  
वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्  
समाचार पत्रिका



**CSIR - NGRI** e-newsletter

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**From Director's Desk**



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**Greetings from CSIR-NGRI**

This quarter has been busy as usual. Our scientists have been engaged in carrying out high impact research in different parts of the globe. Our contributions in the areas of ground water exploration and management are particularly noteworthy. Highlights of some of these contributions are reported in the following section. The Koyna drilling project has been making significant progress. A 1.5 km deep borehole was drilled to completion at Koyna, which revealed Deccan trap thickness of 933 m with a granite-gneiss basement.

We were delighted to invite 55 students from different universities of India during the summer months to participate in research with our scientists. They were selected through a very competitive process in which only 55 out of 1100 applicants could pass the benchmark. These students are extremely motivated and I am convinced that many of these students will make their mark professionally. We are also looking forward to recruiting a few high calibre scientists including those in our fourth paradigm center in the near future.

## Some Selected Publications

### **Chronic kidney disease in two coastal districts of Andhra Pradesh, India: role of drinking water**

A number of people of a few coastal regions of Srikakulam district and Chimakurthy mandal (~30 to 40 km away from the coast) in the Prakasham district of Andhra Pradesh, India have been suffering from Chronic kidney disease (CKD). Some medical experts and the local population have apprehensions that the drinking water is the sole reason for this disease in these areas. As the source of drinking water for these two regions is only groundwater, major ions and trace elements were measured on waters from different sources to identify the causative element(s), if any. Comparison of hydrochemical data of both the areas indicates that groundwater in Srikakulam coastal region is less mineralised than that of the Prakasham region, which may be due to geological, hydrological and climatic reasons. The concentrations of various inorganic chemicals such as Cl, F and NO<sub>3</sub> are within the permissible limits and are thus not expected to lead to any deleterious effects on human health, including any effect on the kidneys. Though the concentration of most of the chemical constituents is relatively higher in Chimakurthy area, the renal problems are much more severe in the Uddanam area (Srikakulam dist). Thus, it is doubtful whether drinking water quality has any bearing on CKD and it is unlikely that the inorganic chemicals cause ill health, including CKD, in the study areas. However, as there is a continuing suspicion that the kidney damage in people living in the study areas is due to chemicals in drinking water, it is necessary to investigate for other organic and inorganic chemicals known to be associated with kidney damage.

(Ref: D. V. Reddy and A. Gunasekar<sup>1</sup>, Environ Geochem Health (2013) 35:439–454, DOI 10.1007/s10653-012-9506-7)

<sup>1</sup>WHO Country Office for India, New Delhi 110011, India

### **Subduction related tectonic evolution of the Neoproterozoic eastern Dharwar Craton, southern India: New geochemical and isotopic constraints**

Geochemical, common Pb and Nd isotopic data are analysed for syn-kinematic granitoids, stratigraphically well constrained felsic and mafic volcanic rocks from three major Neoproterozoic greenstone belts of the northern part of Eastern Dharwar Craton (EDC), namely the Sandur, Kushtagi and Hutti belts. This study is aimed at understanding the tectonic processes responsible for the petrogenesis and evolution of the EDC and to verify whether the granitoids and felsic “adakitic” rocks display true slab melt signatures similar to the modern adakites. The proposed petrogenetic mechanism involves multi stage processes in a supra subduction regime involving slab dehydration, formation of hydrous basaltic melts, and re-melting; interaction with the sub-arc basaltic crust at low pressures where amphibole+/-plagioclase is the dominant residual phase. There is a notable systematic decrease in the extent of older crustal involvement from west to east in the EDC. The radiogenic Pb and evolved Nd isotopic signatures, coupled with older Nd depleted mantle model ages suggest the significant role of recycled Mesoproterozoic crust for the evolution of these rocks in the northern part of EDC. The systematic decrease in the extent of older crustal involvement from west to east is in concurrence with the systematic younging of Dharwar Craton from west to east and its east ward subduction. The contrasting variations in terms of the involvement of predominant juvenile crustal additions and that of older recycled crust for the felsic magmatic rocks of EDC, their trace elemental variations can be explained in a subduction tectonic framework.

(Ref: Ram Mohan, M.; Piercey, Stephen J.; Kamber, Balz S.; et al. Source: PRECAMBRIAN RESEARCH Volume: 227 Special Issue: SIPages: 204-226 DOI: 10.1016/j.precamres.2012.06.012 Published: APR 2013)

### **Crustal Heterogeneity and Seismotectonics of the National Capital Region, Delhi, India**

National Capital Region (NCR), Delhi, India, experienced earthquakes of magnitude 6 and above since historical times. We carried out local P- and S-velocity tomography beneath the NCR to understand the relationship between crustal heterogeneity and seismotectonics in the National Capital Region (NCR), Delhi, India, in a better way. First arrival times of the first P- and S-wave from 275 crustal earthquakes recorded by the Seismic Telemetry Network in and around Delhi of the India Meteorological Department, India, are inverted to obtain crustal P-, S-velocity and  $V(P)/V(S)$  variations in the region. Our tomographic images of the upper crust reflect well the surface geological and tectonic features. The Delhi fold belt is identified as low  $V(P)$ , high  $V(S)$  and low  $V(P)/V(S)$ . The Sohna hot spring region is appearing as low  $V(P)$ , low  $V(S)$  and high  $V(P)/V(S)$  correlating with the possible presence of fluid-filled rocks. The crustal seismicity is distributed in both the high- and low-velocity zones, but most distinctly in the low  $V(P)/V(S)$  region.

Although the present study could delineate the main tectonic features in the NCR, they are a sort of preliminary results with the limited data and further work is required to obtain detailed seismic structures with higher special resolutions through installation of more seismic stations.

(Ref: Gupta, Sandeep, Mohanty, WK ; Prakash, R ; Shukla, AK Source: PURE AND APPLIED GEOPHYSICS Volume: 170 Issue: 4 Pages: 607-616 DOI: 10.1007/s00024-012-0572-7 Published: APR 2013)

### **NEWS FROM THE KOYNA-WARNA REGION**

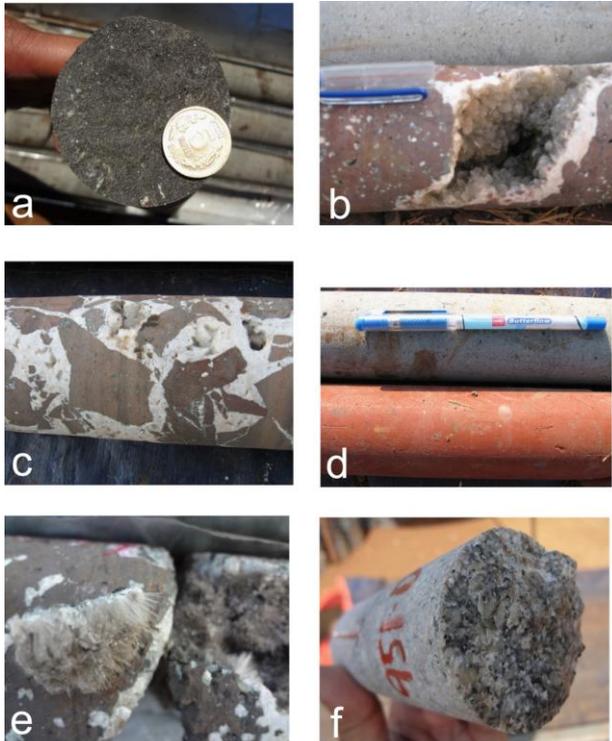
- Drilling near Koyna reveals direct information on thickness of Deccan Traps and nature of underlying basement rocks
- Drilling underway at Udgiri amidst fractured rock, sticky clay, jammed rods and monsoon rains
- Airborne gravity gradiometry and magnetic survey completed; a "first" in India
- MT and Deep electrical resistivity surveys nearing completion
- Brainstorming Workshop at Koyna



**Director with scientists and the drilling crew at Rasati, the site of borehole KBH-**

As a prelude to scientific deep drilling in the Koyna-Warna region, we have launched a preparatory phase of investigations comprising exploratory drilling and acquisition of new geophysical, geological and geothermal datasets to characterize the subsurface structure and tectonics in the region. The studies are funded by the Ministry of Earth Sciences, Government of India to study the mechanism of reservoir triggered earthquakes in intraplate regions.

Drilling was undertaken at two sites, Rasati (near Koyna; borehole KBH-1) and Udgiri (south of Warna; borehole KBH-2), broadly marking the northern and southern limits of the seismic zone. Both boreholes were targeted to go through the Deccan basalt pile and penetrate the underlying basement rocks for the first time in the region.



**Core samples from borehole KBH-1 showing (a) massive basalt, (b) vesicular and amygdaloidal basalt, (c) flow-top breccia, (d) red bole bed and overlying massive basalt, (e) vugs filled with zeolite, and (f) basement granite-gneiss.**

Unlike KBH-1, drilling in borehole KBH-2 has been slow due to complete water loss and the frequent occurrence of thick clay zones and/or fractured horizons at multiple depths that are prone to caving. The borehole reached a depth of 956 m in mid-March 2013 and was yet to go beyond the Deccan basalt pile. Multiple fishing operations in the borehole are underway. Further drilling is expected to commence soon after clearing the borehole.

A two-day brainstorming workshop was organized during March 19-20, 2013 at Koyna. Geologists from several universities/institutes and earth science departments in the country and representing major areas of expertise including structure, geochemistry, geochronology, hydrology, palaeomagnetism, thermal and mechanical properties were invited to the Workshop.

Scientific drilling through the Deccan Traps near Koyna has revealed a 933 m – thick pile of basaltic flows, which is underlain directly by granitic basement rocks. The Koyna Bore Hole – 1 (KBH-1) reached a final depth of 1522 m on March 17, 2013 after drilling round-the-clock for three months, except for a few stoppages to conduct downhole geophysical logging. This is the deepest borehole so far in this part of the Western Ghats region, and the first one to penetrate the basaltic pile. The thickness of the Deccan Traps, revealed by drilling, is consistent with the inference made earlier from the conspicuous absence of earthquakes in the top ~1 km in the area. The flood basalt pile comprises multiple lava flows of varying thicknesses; each flow consists typically of a massive lower part and vesicular / amygdaloidal middle-upper part, occasionally flow top breccia and inter-trappean sediments. A number of sheared and/or crushed zones were observed in cores both from the basalt pile as well as the granitic basement.



**Secretary, MoES and Director, NGRI along with other geologists have a look at the core samples.**

A visit to the scenic Rasati borehole site and display of cores from the borehole KBH-1 was the highlight of the first day. A brainstorming on potential geologic investigations on core samples to better constrain earthquake mechanisms in general and reservoir triggered seismicity in particular was organized on the second day.



**Group photograph of participants to the Brainstorming Workshop at Koyna**

Airborne gravity gradiometry (AGG) and magnetic surveys at low-altitude have been carried out along 5012 line km over the Koyna-Warna region. A low-noise, fixed-wing aircraft with capability for flying at low altitude centred around 100 m above the ground level was used for the survey. This marks the maiden AGG survey in India.



**Field photograph of MT survey in the Koyna area.**

Other geophysical surveys including broadband magnetotellurics at 65 stations, deep resistivity soundings and CSAMT have been completed in the region to image the subsurface resistivity structure at both local and regional scales. The MT survey adopted a rolling array pattern and operation of remote-reference sets during the survey to achieve high signal-to-noise ratio in spite of the rugged terrain.



**The fixed-wing aircraft ready to fly for airborne gravity gradiometry and magnetic survey**

Drilling is planned at additional sites to facilitate imaging of fault zones and characterization of the in-situ stress, thermal and hydrogeological regime in the basement rock. Information obtained from these studies, together with subsurface imaging using seismic, gravity, magnetic and electrical datasets will guide the planning for scientific deep drilling to be undertaken during the next phase.

## Awards and Honours



Dr.Parthasarathy, Chief Scientist has been appointed as an Editorial Member of the International Journal MAPAN- published by Springer wef July 2013."MAPAN"-Journal Metrology Society of India is a quarterly publication exclusively devoted to Metrology (Scientific, Industrial or Legal) and fulfills an important need of Metrologists and particularly of quality practitioners by publishing exclusive articles on scientific, industrial and legal metrology. This journal has an impact factor of 0.276 for the year 2012.

## Important Events

### National Technology Day



The Technology Day lecture was delivered by Dr.Mylswamy Annadurai, the Project Director of Chandrayaan-1&2, Indian Satellite Missions to the Moon on Technological challenges of realizing space science missions with special emphasis on Indian Space Science Missions. This talk has covered the technological challenges of realizing space science missions with special emphasis on Indian Space Science Missions.

Dr.Annadurai gave an engaging and animated account of the various space programmes and challenges with an emphasis on how innovation and creativity were involved in each step. He mentioned that the Space and celestial objects were the subjects of myth and folklore until the second half of the last century when the spirit of science and technology brought them, virtually, down to earth. When the developed nations took giant steps to explore the space and the celestial objects, India, as a developing nation, did not remain a silent spectator. Indian Space science programme took convincing steps in this direction which Chandrayan 1 showcased. ISRO aims to go further with another moon mission and an orbiter mission to Mars and also has more ambitious plans.

Dr. G.Parthasarathy, Chief Scientist, introduced the speaker to the gathering while Dr S.K.Ghosh, chief scientist proposed vote of thanks.

### Earth Day Celebrations

CSIR-NGRI celebrated the Earth Day- 2013 in collaboration with the Society of Earth Scientists (SES).The 5<sup>th</sup> Foundation Day lecture was held on 17<sup>th</sup> April, 2013.

The function was presided over by Prof Mrinal K. Sen, Director, CSIR-NGRI while SES Foundation Day Lecture was delivered by Dr T.R.K. Chetty, Emeritus Scientist and President, International Association of Gondwana Research. Dr V.P. Dimri, CSIR Distinguished Scientist released the SES News Letter.



Release of SES News letter by Dr V.P. Dimri, Distinguished Scientist



**Prof Mrinal K. Sen felicitating the speaker Dr T.R.K. Chetty**

In his talk, Dr T.R.K. Chetty explained about the initiation of diamond search in India by using age old method of stream sediment sampling technique at NGRI under UNDP program and discovered diamond bearing Kimberlite (pipe-7) in Ananthapur district near Wajrakarur. Prior to this talk, students of NGRI high school and Agabe International School Boduppal, Hyderabad, spoke on various topics related to Earth and the environment viz., the resource potential of the earth, depletion of O-zone layer and global warming etc. Around 50 students from different schools attended the function.



**School children listening to the Foundation day Lecture**

Dr.Kusumita Arora, Principal Scientist CSIR-NGRI conducted the event and also proposed the vote of thanks. Dr K. Veera Swamy gave a presentation on the activities of Society of Earth Scientists and also coordinated the event. Dr.Chetty was felicitated by Prof.Mrinal Sen, Director, NGRI.

## **Indo-Norwegian collaborative project**

The Indo-Norwegian Project meeting was held on 24th May 2013 at CSIR-NGRI. Prof Mrinal Sen, Director NGRI, Prof. V.P Dimri, CSIR-Distinguished Scientist and Project Advisor, project participants from NGRI, Mr. Håvard Hugås, Counsellor, Energy and Climate Change, Royal Norwegian Embassy, and Dr. Vivek Kumar, Senior Advisor, Energy and Climate Change, Royal Norwegian Embassy were present in



the meeting. Cand. real. Idar Akervoll and Dr. Per Bergmo, scientists from SINTEF, and Shib S Ganguly, PhD student from CSIR-NGRI, joined the conference through Video Conferencing facility.

## **Presentation by Experts of CGG Technologies**

A team of experts from CGG Technologies made presentations at NGRI on the theme Technology for Innovations in Geology and Geophysics. Various topics such as Seismic Reservoir characterisation, Airborne Electromagnetic survey by TBD, Broad band seismic survey were covered during the presentations. Dr. Rakesh Walia, Dr. Ranjit Shaw, Dr. Hampson Russell, Dr. Hemant Dixit were among the speakers. Prof Mrinal K Sen, Director NGRI presided over the entire meeting.

## **Collaboration of NGRI with CSIRO, Australia**

Mr. Law, Commonwealth Scientific and Industrial Research Organisation, (CSIRO), Australia visited CSIR-NGRI on 14<sup>th</sup> June, 2013 and discussed with Prof. Mrinal K Sen, Director NGRI on current issues and priorities for the mining in India and Australia and possible collaboration between CSIRO and NGRI in this direction.

## **Ground water Exploration under World Bank funded project**

CSIR-NGRI and Central Ground Water Board (CGWB), Ministry of water resources, Government of India have been carrying out a project study on Aquifer Mapping (AQUIM) under World Bank funded HP-II project in different representative areas of the country. The main objective of the project is to map various lithological and aquifer zones in study areas up to a depth of 250-300 m using existing and advanced geophysical techniques. One of the study areas is **LOWER VELLAR BASIN** in Cuddalore district of Tamil Nadu located in coastal sediments.

Geoelectrical studies with Schlumberger array were carried out at 14 locations over the basin area with maximum current electrode spread (AB) of 2000 m deploying RS1 SYSCAL equipment to delineate the

deeper aquifers. The present study could delineate three different stages of the confined aquifer system at depths beyond 300 m. Various thematic and aquifer maps such as depth to confined aquifers, thickness of confined aquifers, longitudinal conductance and transverse resistance were prepared for the basin area. The 2-D resistivity tomography clearly mapped the aquifer salinity influenced by the sea incursion to a depth of 60-80 m near the coast.

### **CSIR-NGRI and WIHG sign MoU for Research Cooperation**

In order to develop ties of cooperation and to advance research in the area of Himalayan Geology and Geodynamics, Prof. Mrinal K. Sen, Director, CSIR- National Geophysical Research Institute, Hyderabad (CSIR-NGRI) and Prof. Anil K. Gupta, Director, Wadia Institute of Himalayan Geology, Dehradun (WIHG) signed a Memorandum of Understanding (MoU) on June 11, 2013 in presence of Prof. Harsh Gupta, Hon. Member of NDMA and Prof. V.P. Dimri, CSIR-Distinguished Scientist. The MoU would facilitate the scientists from two institutions to partner in developing and working on challenging research problems of Himalayan Orogeny and exchange of scientists and students.



**A group photograph after signing MoU**

### **New COFA and AO joined at NGRI**

Shri K. A. Naidu and Shri. BinodDubey have joined at NGRI as Controller of Finance & Accounts and Administrative Officer respectively.

### **Superannuated Staff Members**

Mr.SaiBaba, Lab Assistant

Mr.B. Sattaiah, Lab Assistant

Dr.V. Balaram, Chief Scientist

Mr.V.V. Ramana Murthy, Sr. Tech. Officer (2)

Smt. M. Muralikumari, Sr. Tech. Officer (3)

Dr.P. KoteswaraRao, Chief Scientist

Dr.V. Vijayakumar, PTO

### **Obituary**

Mr.Md.Younus, Sr. Technician (2)

## Distinguished Lectures

Date	Name of the Visitor	Title of the Talk
16 <sup>th</sup> April, 2013	Mr.D. P.Sinha Honorary Lecturer, SEG 2013	Earth Velocity Estimation –Bridge the Gap of Interdependency between Geology and Geophysics
19 <sup>th</sup> April, 2013	Dr. Anthony R. Lowry Utah State University, Utah, USA	GPS, gravity and seismic expression of postseismic transient deformation, slow fault slip and tectonic tremor: Implications for the seismic cycle.
25 <sup>th</sup> April, 2013	Dr.Karl Kwan Senior Interpreter Geotech Limited	Recent case study examples using the VTEM full waveform system.  HLCI of VTEM data Heuristically & laterally constrained inversion.
25 <sup>th</sup> April, 2013	Dr.MarkSams A Rock Physics Expert	Rock Physics for quantitative Interpretation
16 <sup>th</sup> May, 2013	Dr. Sunil Kumar Singh Associate Professor & Chairman, Geosciences Division;Physical Research Laboratory	Impact of the Himalayan Orogeny on the contemporary and paleo-Sedimentary, Geochemical & Isotope Budgets of the Indian Ocean
19 <sup>th</sup> June, 2013	Prof. N. Guddati Murthy, Professor of Civil Engineering, North Carolina State University, U.S.A.	Seismic Imaging and Inversion
20 <sup>th</sup> June, 2013	Dr.Rakesh Walia CGG, INDIA	Broad Band Seismics
27 <sup>th</sup> June, 2013	Dr. Rama R. Bhattacharjee, Senior Assistant Professor, PSG, Institute of Advanced Studies, Coimbatore.	Development of Nano-tracers for identifying Ambient Flows in Boreholes: Nanoparticles Transport in Porous media, their Brownian motion and hydrodynamic interactions".

## IN-House Talks

14 <sup>th</sup> May, 2013	Dr.S.K.Ghosh, Chief Scientis, NGRI	More Reflections on Seismic Amplitude : Reemergence of the Role of Subjectivity, a Recurrent Theme in Physics and Metaphysics
3 <sup>rd</sup> June, 2013	Dr. S.N. Rai, Chief Scientis, NGRI	BhujalShrotonkiKhoj, Samuchit Vikasevam Prabhandhan (in Hindi) Delineation, Sustainable Development and Management of Ground Water Resourcesin CSIR-NGRI Campus

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