

**GOVERNMENT OF INDIA  
MINISTRY OF EARTH SCIENCES**

**MINUTES OF THE MEETING HELD ON 14<sup>th</sup> DECEMBER 2010 AT SCOPE CONVENTION CENTRE,  
NEW DELHI TO DISCUSS PROPOSAL FOR DEEP DRILLING IN KOYNA REGION.**

A meeting was held on 14<sup>th</sup> December, 2010 at SCOPE Convention Centre, New Delhi to discuss the proposal regarding deep drilling in Koyna to investigate the continued seismicity in the area.

List of participants is annexed.

Dr. Shailesh Nayak, Secretary, MoES welcomed the participants of the meeting and expressed happiness that almost all invitees had shown keen interest to attend this important discussion meeting related to the proposed Koyna Deep Bore Hole programme. He mentioned that MoES is in the process of reorganizing the seismology related activities of India Meteorological Department (IMD) and EREC including, monitoring of earthquakes, microzonation and earthquake precursors, etc. It is planned to separate all these activities and create a National Centre for Seismology (NCS). He then briefly explained the importance of this new programme and said that it is intended to be an important national programme of MoES that may run for the next 10-15 years. He pointed out that it is a unique opportunity for India to take a global lead on an important scientific issue with several countries following it.

Keeping this in mind, a proposal was prepared by Prof. H. K. Gupta and submitted to International Continental Deep Drilling Programme (ICDP). The preliminary reactions of ICDP are very positive. The main reason to approach ICDP is non availability of appropriate technology in the country to go for deep drilling in hard rock area as well as installing the instruments at that depth. The drilling experiment, however, remains to be a national programme. He also mentioned that a MoU is expected to be signed by the Ministry with ICDP shortly. This will be followed by an International workshop to be held at NGRI/Koyna during March 21-25, 2011 to deliberate upon the relevant issues.

This meeting has been convened to have consultations for initiating this national programme with participation of all relevant organizations including, government agencies, academic institutions and universalities, etc.

Dr. Harsh Gupta, Panikkar Professor, made a detailed presentation on the scientific merits, background and status of the proposed Koyna Deep Bore Hole programme. He explained that Koyna was a unique site for undertaking deep drilling since it is a small isolated region of shallow seismicity where it would be possible to drill through an earthquake fault zone to monitor comprehensive geophysical observations of physical and chemical parameters in the "near-field zone", typically before and after an earthquake. On the status of the programme Dr. Gupta mentioned that the International Continental Drilling Program (ICDP), Potsdam in Germany, had been approached and that they have in principle accepted to participate in the

proposed program. Prof. Gupta also briefly introduced the ICDP and mentioned that it was started in 1996. At present, there are 19 countries participating in this initiative including, USA, China, Japan and Taiwan, etc. The ICDP has so far completed about 21 projects. He further informed that an international workshop with about 40-50 participants both national and international has been planned in Hyderabad during 21-25 March 2011, including a 3 day field trip to Koyna. This workshop is expected to provide the much needed inputs and advice from experts related to both the drilling program and the subsequent research studies. Finally a complete proposal will have to be submitted to ICDP by January 2012.

Dr. Y.J. Bhaskar Rao, Director, NGRI pledged the support of his organization in taking up this program and mentioned that apart from the earthquake related studies, the drill cores obtained down to a depth of 6 or 7 km would form an extremely valuable data set for lab investigations for the first time in an ancient cratonic shield region.

Dr. P.G. Rao, Director, NEIST (CSIR) suggested that in addition to earthquake seismology, the deep drilling investigations would be useful to assess the hazards to the upcoming and planned hydropower projects in the country, particularly in the NE India region, as it has a very huge hydroelectric power potential. We should take this initiative forward in the national interest, he added.

Dr. P. Pande, DDG, GSI mentioned that the proposal for signing of a MoU with ICDP came earlier to the Ministry of Mines and as we mentioned, it is quite a challenging task. We will get an opportunity for coring of samples at different depths. The initiative would be significant from mineral point of view as well. He further informed that GSI is associated with coring of mineral for quite some time and a core library is being established at Nagpur. This facility can be used for cores to be collected during the drilling. Dr Pande extended full support of GSI to go for deep drilling in Koyna region.

Prof. B. R. Arora while complementing the effort of MoES mentioned that it's a visionary mission and a great exercise for confidence building as well. The deep drilling investigations would help in providing insight into existence of "low velocity" zones in the top few kilometers of the crust besides other tectonic issues, hydrocarbon exploration in the Mesozoic sediments underlying Deccan Traps, geothermal hot springs, etc. Therefore, we should whole heartedly support this programme.

Dr. P. C. Nawani, Director, NIRM stressed the need to carry out in-situ stress measurements and caliper logging, etc. in the proposed deep borehole, and expressed their willingness to participate in such measurements and the programme.

Shri D.K. Sinha, AMD suggested undertaking radon surveys during drilling as also geological logging below the Deccan Traps that would be useful for uranium exploration. AMD would be happy to extend technical knowhow as it has some experience in drilling shallow hole in Latur.

Dr. Sukanta Roy, Scientist, NGRI stressed the deep drilling investigations at Koyna would provide a “once-in-a-lifetime” opportunity to not only study the genesis of earthquakes in an intra-plate setting and their trigger mechanisms, but also provide an unique opportunity to calibrate the geological and geophysical models through direct measurements to 6-7 km of the continental crust.

Dr. N. Purnachandra Rao, Scientist F, NGRI, mentioned that their ongoing multidisciplinary research program in the Koyna-Warna region funded by MoES has provided several important inputs related to the hypocentral depths and fault plane parameters required for planning the programme. He emphasized that the recent deployment of a network of 97 seismic stations by NGRI has provided scope for a clear understanding of the region through several accurate studies in the near future, particularly using the ambient seismic noise correlation technique.

Dr. B. K. Rastogi, Director General, Institute for Seismology Research, Gujarat referred to the work, initiated in Koyna about 40 years back and mentioned that various models have been developed by NGRI Scientists and it would be really interesting to learn more scientific aspects, especially, checking up of hypotheses and the behavior of rock mass at different depths. ISR would be happy to be associated with the programme.

Dr. I. D. Gupta, Director, CWPRS, Pune mentioned that the Institute was associated with the Koyna Reservoir since its construction, and also with other water reservoir projects in the country. CWPRS would be happy and willing to contribute to issues such as the stability / seismic safety of Koyna Dam, and mentioned that the deep drilling investigations would help in design of dams in the stable continental region from the seismic point of view.

Dr. N. R. Karmakar, University of Pune mentioned that the drill hole will provide some insight into the nature of the fluids as well as help to identify the precursor to Deccan volcanism, if any. Heat capacity would also be an important aspect, he added. Dr. Karmakar extended full support for the experiment.

Dr. N. J. Pawar, Vice Chancellor, Shivaji University mentioned that though geology is not a main subject in the University, the Professors in the Department of Physics and Electronics are very enthusiastic about the new challenges related to the physics of the earth including, hydro-geological studies. Apart from that the University would be happy to extend all facilities and support for organizing meetings etc. as it is very close to the Koyna site. Dr. Pawar appreciated the programme.

Dr. K. C. Tiwari of M. S. University of Baroda highlighted a few important aspects which are possible to take up under the proposed programme. These include geometry of faults, causative factor of continued shifting of earthquakes, reconstruction of stratigraphy, paleo-land surveys and study of discontinuities. He also added that since M. S. University of Baroda has some experience of drilling, they would be happy to extend possible support for supervising the drilling.

Dr. Rasik Ravidra, Director, NCAOR appreciated the efforts of Ministry and mentioned that the proposed experiment would help in ascertaining the type of material which lies below 6 km. He suggested that it would be very important to consider variations in the 36 to 40 different lava flows associated with the Deccan traps and to address the question of whether there are Mesozoic sediments below the traps. Since NCAOR is actively engaged in geosciences related studies, association with this experiment would further help in advancement of research.

Dr. N. K. Verma, GM-Basin Manager, ONGC mentioned that ONGC is equally excited about the proposed experiment. Apart from understanding earthquake and impact on large water bodies, the experiment may help in ascertaining the availability of Mesozoic sediments below the Deccan traps. He also mentioned that ONGC has been engaged in drilling deep wells in different areas in the country; but for different purpose and ONGC would be happy to provide data sets to the geoscientific community for their use. Dr. Verma further mentioned that ONGC can definitely contribute in this national initiative as they have got a wide experience in drilling projects across the country. He also briefly mentioned about the surveys undertaken by ONGC in different parts of the country. ONGC is planning to conduct a training course on passive tomography during January 12-14 2011 at Greater NOIDA. Participation from MoES and other relevant institutions is welcome, he added.

Dr T. K. Biswal, IIT (B) expressed their willingness to contribute to core logging, isotope geology, structural geology, rock-water interactions, etc.

Shri Dattatrayam, IMD while supporting the deep drilling investigations, stressed on the importance of looking at the seismograms in greater detail.

Dr. B.K. Bansal mentioned that Bio-geophysics was an important area that needs to be covered. The proposal was supported by NCAOR, ONGC and others.

The newly recruited scientists and Research Associates at MoES shared their views and interests with respect to the forthcoming program.

### **Summing-up and Actionables**

- The heads / representatives from different national and state departments unanimously hailed the proposed Koyna Deep Bore Hole programme, pledged their full support to the programme, and provided their inputs and suggestions.
- Prior to the International Workshop planned in March 2011, a preparatory meeting may be convened to concretize various scientific ideas and finalize the scientific presentations by Indian experts during the Workshop.
- It was agreed that all the participating organizations would provide their inputs in the form of short write up of up to 500 words each, outlining their program / activity of interest by 31 December 2010.

- Dr Shailesh Nayak, Secretary, MoES thanked everybody for providing valuable support and suggestions. Dr. Harsh Gupta thanked MoES for taking lead in this programme, and emphasized the need to create expertise in certain areas through training, visits to sites currently being drilled by ICDP. There is a need to concretize various scientific ideas before the International Workshop.

Dr. B. K. Bansal proposed a formal vote of thanks.

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**LIST OF PARTICIPANTS**

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3. Dr. P.G.Rao, Director, North East Institute of Science & Technology, Jorhat
4. Dr. P.C.Nawani, National Institute of Rock Mechanics, Champion Reefs P.O., Kolar Gold Fields-563 117, Karnataka.
5. Dr. Ishwar Datt Gupta, Director, Central Water and Power Research Station, Khadakwasla, Pune-411024.
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10. Dr Sukanta Roy, National Geophysical Research Institute, Uppal Road, Hyderabad-500007.
11. Dr.B.K.Rastogi, Director-General, Institute for Seismology Research, Raison, near Petroleum University, Gandhinagar-382009.
12. Dr. D.K.Sinha, Scientific Officer–G, Planning & Management Services, Atomic Minerals Directorate for Exploration and Research (AMDER), AMD / DAE, AMD Complex, Begumpet, Hyderabad-500 016.
13. Prof. B.R. Arora, Emeritus Scientist and Former Director, WIHG, 33-General Mahadev Singh Road, Dehradun-248001.
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26. Ms. Rashmi Pradhan, Research Associate, Ministry of Earth Sciences, New Delhi
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