



5th Dr. M.N. BOSE

MEMORIAL LECTURE

**Imaging Sub-volcanic Mesozoic Sediments
and Assessment of Gas-hydrates towards the
Energy Security of India**

Dr. Kalachand Sain

Wadia Institute of Himalayan Geology
Dehradun, India

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More than 50% of global oil is found in Mesozoic sediments. However, a vast tract of India is covered by Deccan Traps or volcanic rocks that have made routine methods incapable

of probing underlying sediments. We have been able to map Mesozoic sediments in Kutch, Saurashtra and Tapti grabens by conventional travelttime tomography (TT) of wide-angle seismic data. We have also imaged Gondwana sediments below Rajmahal Traps in Bengal and Mahanadi basins. All these models lack in structural details in which oil industries show a lot of interests for hydrocarbon explorations. Here, we demonstrate through a synthetic study that the state-of-the-art full waveform tomography (FWT) is a powerful tool for delineating finer details of the subsurface by exploiting traveltimes, amplitudes, frequencies, phases, etc. contained into seismic waveform. The study shows that TT model serves as a good starting model for FWT, which is to be carried out from low frequency and switching over to higher frequency step-by-step to deal with highly non-linear FWT. Having gained this insight, we have applied FWT to wide-angle field seismic data in Kerala-Konkan Offshore, and delineated finer details of subsurface including thin sediments sandwiched between two volcanic rocks. The result matches reasonably with litholog available nearby.

As gas-hydrates, crystalline form of methane and water, are prognosticated as major future energy resources, we have developed several approaches and applied to seismic data for the delineation, characterization and assessment of gas-hydrates in Krishna-Godavari and Mahanadi Offshore. Application of these approaches to field seismic data will be deliberated.

PROFILE

Kalachand Sain received his M.Sc.(Tech) in Applied Geophysics from Indian School of Mines, Dhanbad in 1988 and Ph.D. in Controlled Source Seismology from Osmania University (CSIR-NGRI), Hyderabad. He visited Cambridge University (UK) and Rice University (USA) as a post-doctoral fellow, and USGS in Menlo Park (USA) as a Visiting Scientist.

At present, he is the Director of Wadia Institute of Himalayan Geology at Dehradun. Earlier, he held the position of Chief Scientist (“G”) & Head of Seismic Group with three wings: Deep Seismics, Shallow Seismics and Marine Seismics at CSIR-NGRI.

He is working on seismic attenuation, meta-attribute, travel-time tomography, AVO modeling, 1-D & 2-D full-waveform inversion, impedance inversion, prestack depth migration, rock physics modeling.

His main interests include (i) delineation and assessment of gas-hydrates, (ii) imaging sub-volcanic sediments, and (iii) understanding geotectonics and earthquake processes of Indian provinces including the Himalaya from geophysical data.

He has published 125 research papers in peer-reviewed scientific journals, guided for 5 doctoral theses and 65 M.Sc./M.Sc.(Tech) dissertations.

He has been recognized by a number of awards/fellowships/honours; notable among them are (i) Fellow of National Academy of Sciences, India (2011); Andhra Pradesh Academy of Sciences (2010); Telangana State Academy of Sciences (2016), (ii) Distinguished Alumnus Award (2017) of IIT(ISM); AP Scientist Award (2011); Young Scientist Award (1998) of CSIR; National Mineral Award (2005) by Ministry of Mines; Best Paper Award (2012) published in Gondwana Research (IF=8.23); Best Poster Award (2007) by Int. Con. on Oil & Gas by PETROTECH; Swarnajayanti Project Award (2001) by DST, (iii) Raman Fellowship (2003) by CSIR; BOYSCAST Fellowship (1999) by DST, (iv) Krishnan Gold Medal (1996); Anni Talwani Memorial Prize (2014) & Decennial Award (2016) by IUGG, (v) Prem Bahadur Memorial Lecture (2009) by IGC and Prof. J. Singh Memorial Lecture (2019) by IIT(ISM), Dhanbad, etc.

He was a Bureau Member of International Lithosphere Program under IUGG (2007-2015); Hon. Secretary of Indian Geophysical Union (2014 onward); Member of Indian National Gas Hydrates Program (2000 onward); Alternate delegate of Asia Pacific region to AAPG House of Delegates (2015-2017), and Editorial Board member of ‘Journal of Geological Society of India & First Track Articles’, ‘Open Access Jour. of Geophys. & Remote Sensing’, and Open Access International Journal of Geosciences Research’. He has served as a Guest Editor in 3 special issues on gas-hydrates in ‘Marine & Petroleum Geology’ (2011, 2014, 2019) by Elsevier and as a member of Editorial Board for the 2nd Edition of ‘Encyclopedia for Solid Earth Geophysics’ by Springer.

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