

# Geology and Hydrocarbon Potential of Neoproterozoic–Cambrian Basins in Asia

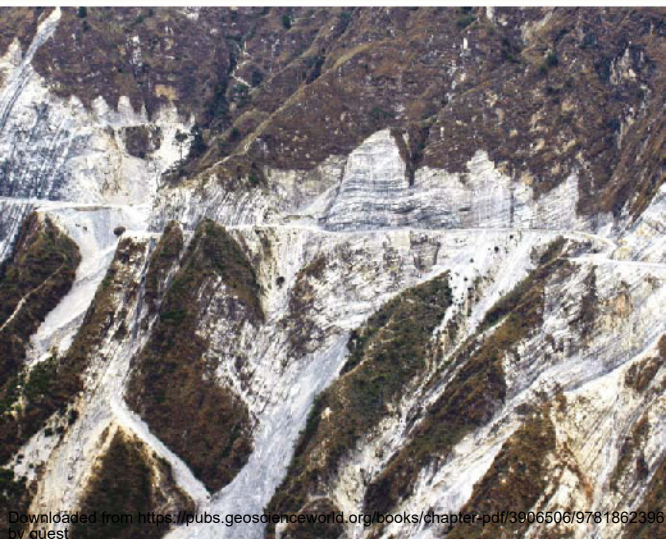
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# Geology and Hydrocarbon Potential of Neoproterozoic–Cambrian Basins in Asia

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# Geology and Hydrocarbon Potential of Neoproterozoic–Cambrian Basins in Asia

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## Preface

Over the past few years hydrocarbon exploration research focus has shifted to the relatively poorly documented Neoproterozoic petroleum systems of the world. The Maghreb Petroleum Research Group (MPRG), Department of Earth Sciences, University College London (UCL) has undertaken a series of research projects to understand the generation and entrapment of hydrocarbons in this unique geological time interval, dominated by several episodes of global glaciations and post-glacial transgressions, coupled with basin development, rift and thrust tectonics on a more regional scale. In addition, a number of geological field trips were conducted to study the Neoproterozoic sequences in North Africa (Libya, Morocco and Mauritania) and India (Rajasthan, Madhya Pradesh and Jammu & Kashmir).

In November 2006, an International conference was held at the Geological Society of London, Burlington House and the conference proceedings were published in 2009 in Geological Society Special Publication 326, entitled 'Global Neoproterozoic Petroleum Systems: the emerging potential in North Africa'.

The second international conference of the series was held at the University of Jammu (India) in February 2008 with a focus on the Neoproterozoic petroleum systems of Asia, including India, Pakistan, Oman, China and Siberia. The conference was organized by the conveners G. M. Bhat (Jammu University), Jonathan Craig and Andrea Cozzi (eni Milan and eni India respectively), Juergen Thurow and Bindra Thusu (MPRG, UCL), Moin Raza Khan (Pakistan Petroleum Limited (PPL)), Zuwena Al-Rawahi (Petroleum Development of Oman) and Madan Lal (Oil and Natural Gas Corporation Limited (ONGC), New Delhi) with support from eni India; Energy & Geoscience Institute (EGI), University of Utah; ONGC; Ministry of Earth Sciences, Government of India; University of Jammu; Department of Geology and Mining, J&K State; and J&K Council for Science and Technology. The conference was endorsed by the Prime Minister of India, Dr Manmohan Singh, and the then Chief Minister of Jammu and Kashmir State, Mr Ghulam Nabi Azad.

The current volume contains a selection of the papers presented at the Jammu conference, in addition to new research data on the geology and hydrocarbon potential of the Neoproterozoic–Cambrian basins of Asia. It contains fifteen articles of which nine are directly related to the petroleum systems and include reviews along with new data and interpretations. These include four from India, two

from Pakistan and one each from Oman, China and Siberia. The remaining articles are related to various aspects of Neoproterozoic geology, tectonics, balanced cross-sections of the NW Himalaya; salt tectonics, microfossils (acritarchs) in Oman; and the palaeobiology of the Vindhyan succession in central India. The introductory chapter is an overview and synthesis of the data presented in the articles of the volume related to the petroleum systems and data on aspects of source rock, hydrocarbon generation, migration and entrapment, types of seals and reservoirs in the context of tectonic plates, super-basins and sub-basins and their sedimentation patterns, tectonic settings and structural styles. The plates, super-basins and sub-basins that have been included in this synthesis include Siberian Platform, Indian Platform (in India, Chhattisgarh (Bhima-, Kurnool- and Cuddapah basins), Vindhyan (Ganga-, Chambal-, and Son valleys and trap concealed Vindhyan); Bikaner-Nagaur Basin (Rajasthan); in Pakistan, Indus Basin, Upper Indus Basin (Salt Range/Potwar)); Oman Basin and South Oman Salt Basin; and NW Tarim Basin (North China). The volume has been supplemented with new data gathered recently for a better synthesis on the petroleum systems especially those in India and Pakistan.

Two pre-conference workshops: 'Geological Time Scale' by Alan Smith (Cambridge University, UK) and 'Improve Your Image' using borehole-image technology for reservoir characterization in oil exploration by Ajay Sapru, Mark Lawrence and S. L. N. Rao (Baker Hughes, UK) were also organized as part of the conference activity. In addition, a pre-conference fieldtrip to the spectacular Neoproterozoic–Early Cambrian outcrops of the Bikaner-Nagaur Basin (western Rajasthan, India) was organized and conducted by Andrea Cozzi (eni India), and a post-conference trip to the stromatolite-bearing Sirban Formation of Neoproterozoic age at Reasi and Proterozoic gypsum deposits at Assar in Doda District conducted by G.M. Bhat and S.K. Pandita (University of Jammu).

On the sidelines of the conference, a children's education programme 'eni's Energy Efficiency Campaign' was launched and conducted by Jonathan Craig, eni-Milan; Jyotsana Rai, Birbal Sahni Institute of Palaeobotany (BSIP), S. K. Parcha (Wadia Institute of Himalayan Geology (WIHG) and the Jammu University Team. The programme was attended by 150 school children from 75 schools of the three regions, Jammu, Kashmir and Ladakh.

Many individuals helped to make the Jammu conference and the Children's education



programme a success. In particular we thank Professors Amitabh Mattoo and Varun Sahni (former Vice-Chancellors) and Professor M. P. Singh Ishar (Present Vice-Chancellor of Jammu University); Raymond Levey (EGI), Ugo Astuto, Deputy Head of the Italian Mission in India, Umberto Vergine, Luca Bertelli, Luca Savini, Ciro Pagano, Corinna Carbone, Franco Conticini, Andrea Degli Alessandrini and Stefano Santi (eni Milan/India), Mr. Faraj Said (National Oil Corporation of Libya), Bourima Belgaseum (Libyan Petroleum Institute (LPI), Libya), Yousef Abutarruma (Earth Science Society of Libya (ESSL)), Mr. Syed Munsif Raza (PPL), Nick Butterfield (Cambridge University), Nick Christie-Blick (Columbia University), Alan Collins and G. Halverson (Adelaide University), Amed Ghorri (Geological Survey of western Australia), Martin Brasier (Oxford University), Dilip Mukhopadhyay (BSIP), D. K. Pandey, Jokhan Ram and P. K. Bhowmick (ONGC), G. N. Rao (ONGC, Videsh), V. K. Sibal and Malcolm V. Lall (Directorate General of Hydrocarbons (DGH), New Delhi), B. R. Arora (WIHG), K. S. Jamwal, R. L. Kashkari and B. K. Raina (Geological Survey India (GSI)), Ashok Kotha (Ministry of Home), B. K. Bansal (Ministry of Earth Sciences (MoES)), Late V. K. Koul (J&K Council for S&T), Parwaiz Malik and A. M. Mir (Directorate of Geology and Mining), T. R. Sharma, S. K. Shah, G. S. Sambyal, Meenakshi Kilam, Renu Nanda, Malvinder Kour, S. S. Bleoria, S. S. Wazir, Mohd. Shafi Pandit, Sudhanshu Pandey, Anil Goswami, T. Angchuk, Imran Farooq, Jasbir Singh, Poonam Choudhary, Anju Bhasin, Gohar Hafeez Fani; faculty, research scholars and supporting staff of the Department of Geology, University of Jammu especially M. A. Malik, C. S. Sudan, R. K. Ganjoo, Ashok Sahni, S. K. Pandita, P. K. Srivastava, A. S. Jasrotia, Varun Parmar, Yudhbir Singh, Kuldeep Thakur, Sham Singh, Bashir Ahmed

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