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Gas-hydrates, A Major Energy Resource of India for the Next Generation

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ABSTRACT
Gas-hydrates are crystalline form of 99% methane and 1% water. They have attracted the attention of geo-scientific community due to their abundant occurrences in the outer continental margins and permafrost regions, and huge energy potential as a viable major energy resource of future. The bathymetry, seafloor temperature, total organic carbon content, sediment-thickness, rate of sedimentation, geothermal gradient imply that shallow sediments of Indian margin are good hosts for gas-hydrates. The methane within gas-hydrates has been prognosticated to be more than 1500 times of India's current natural gas reserve. If we produce only 10% from this gigantic treasure, it can meet India's overwhelming energy requirement for about 100 years. Thus, it was felt necessary to map the prospective zones of gas-hydrates and evaluate their resource potential to boost the exploitation program. We have prepared the theoretical map of gas-hydrates stability thickness along the Indian margin, at the base of which is observed an anomalous seismic reflector, known as the bottom simulating reflector or BSR on seismic section in the presence of gas-hydrates. Through analysis and scrutinizing of multi-channel seismic (MCS) data, we have detected the BSRs in the Krishna-Godavari (KG), Mahanadi and Andaman regions respectively. Gas-hydrates in these regions have later been recovered by drilling and coring under the Expedition-01 of Indian National Gas-Hydrates Program. This has motivated our efforts to develop methods for the delineation, characterization and assessment of gas-hydrates. By computing seismic attributes like reflection strength, blanking, attenuation and instantaneous frequency, we have demonstrated that these attributes can be used for qualifying and characterizing a gas-hydrate reservoir. We have developed several approaches based on seismic travel time tomography, full-waveform inversion, amplitude versus offset modelling, impedance inversion, each coupled with rock-physics modeling, and applied them to seismic data for delineation and quantitative assessment of gas-hydrates in KG, Andaman and Mahanadi basins. We have also acquired high resolution MCS and wide-angle ocean bottom seismic (OBS) data by specially designing an experiment using the state-of-the-art acquisition system in unexplored areas, and delineated new prospective zones of gas-hydrates in the Mahanadi and KG offshore. Recent success in test production of methane gas from gas-hydrates through carbon dioxide replacement method in the permafrost of Alaska (USA) and by depressurization method in the Nankai Trough off Japan has increased tremendous interests in the national gas hydrates programs of India and many other countries like South Korea, China, Taiwan, New Zealand, Australia, Canada, Germany etc. It is expected that the gas-hydrates will be produced commercially by 2020.

INTRODUCTION

The growing demand of carbon emission-free energy and depletion of fossil fuels necessitate looking for an alternate source for sustainable development of energy-starving countries like India. The extremely large volume (1-120 x 10^{15} m^3) of methane trapped within global reserve (Boswell and Collett, 2011) as gas-hydrates seem to be a viable major energy resource of future. Gas-hydrates are crystalline substances consisting of 99% methane and 1% water, and are formed in the outer continental margins and permafrost regions at high pressure and moderately low temperature when methane concentration exceeds the solubility limit (Sloan, 1998). At standard temperature and pressure 1 volume of gas-hydrates

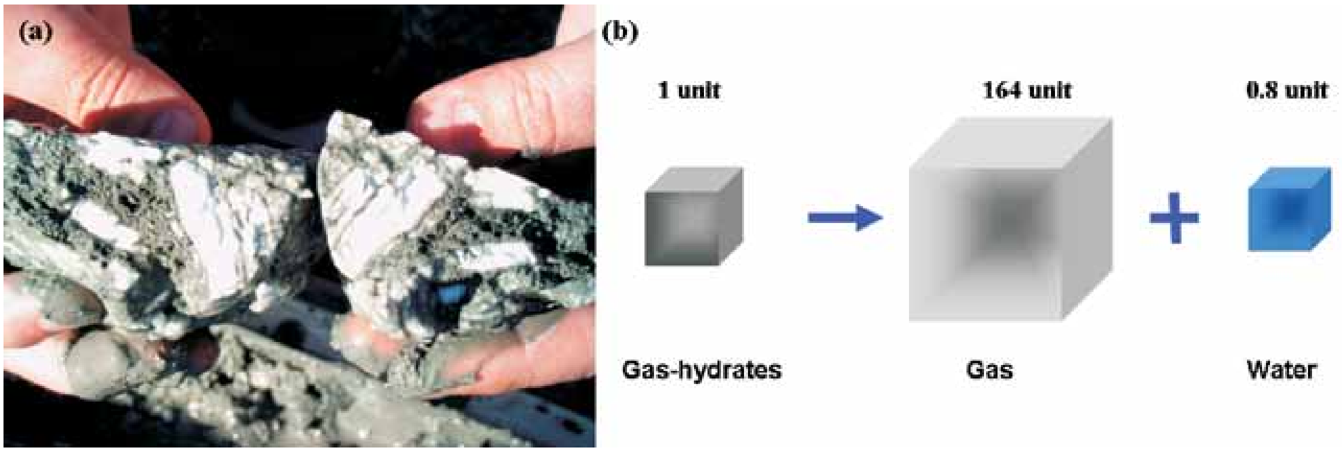

Figure 1. (a) Gas hydrate-bearing sediments, (b) One unit of gas hydrates is equivalent to 164 units of gas and 0.8 unit of water at STP

is dissociated into 164 volume of methane and 0.8 volume of water (Fig.1). The energy potential of gas-hydrates is so huge that even 15% production from global reserve can meet the world's energy requirement for about two hundred years (Makogon et al., 2007). Since methane is the cleanest of all hydrocarbon fuels, its use will cause less pollution to the atmosphere. Thus, it is desirable to identify the most prospective zones of gas-hydrates and evaluate their resource potential before the techniques for commercial production of gas from gas-hydrates are fully developed.

Globally, gas-hydrates have been identified from geophysical, geochemical and geological surveys, and by drilling and coring (Boswell and Saeki, 2010; Ruppel, 2011). Geophysically, gas-hydrates can be found out by identifying an anomalous seismic reflector, known as the bottom simulating reflector or BSR, on a seismic section (Fig.2). The BSR is the main proxy for identifying gas-hydrates from seismic data, and is often associated with the base of gas-hydrates stability zone. Many countries in the Asia-Pacific region such as India (Collett et al., 2008), Korea (Park et al., 2008), China (Zhang et al., 2007) and Japan (Tsuji et al., 2009) have launched successful deepwater gas-hydrate drilling expeditions, and established presence of gas-hydrates in respective regions. After having identified signatures of gas-hydrates off SW Taiwan by various geo-scientific investigations (Liu et al., 2006), Taiwan has initiated for an IODP level drilling program. Deep-water hydrate drilling operation in Malayasia has also been launched (Hadley et al., 2008). The status of gas-hydrates research and development in the Asia-Pacific region is available in a recent review article by Matsumoto et al. (2011).

STATUS OF GAS-HYDRATES RESEARCH IN INDIA

The Ministry of Petroleum & Natural Gas and the Ministry of Earth Sciences have formulated the national programs. The Directorate General of Hydrocarbons, Oil and Natural Gas Corporation Limited, Oil India Limited, Gas Authority of India Limited, National Geophysical Research Institute, National Institute of Oceanography, National Chemical Laboratory, National Institute of Ocean Technology, Indian Institute of Technology at Kharagpur, Kanpur and Chennai, Indian School of Mines at Dhanbad are actively working for the identification and quantification of gas-hydrates along the Indian shelf followed by technology development for safe production.

In India, gas-hydrates were first recognized by an ONGC personnel (Chopra, 1985) in the Andaman region. The bathymetry, seafloor temperature, total organic carbon (TOC) content, sedimentary thickness, rate of sedimentation, geothermal gradient indicate that shallow sediments along the Indian shelf are good hosts for gas-hydrates (Sain and Gupta, 2008; Sain and Ojha, 2008). A total volume of ~1900 trillion cubic meter of methane gas, stored in the form of gas-hydrates, has been prognosticated (Collett et al., 2008) within the vast exclusive economic zone (EEZ) of India. This volume of gas is greater than

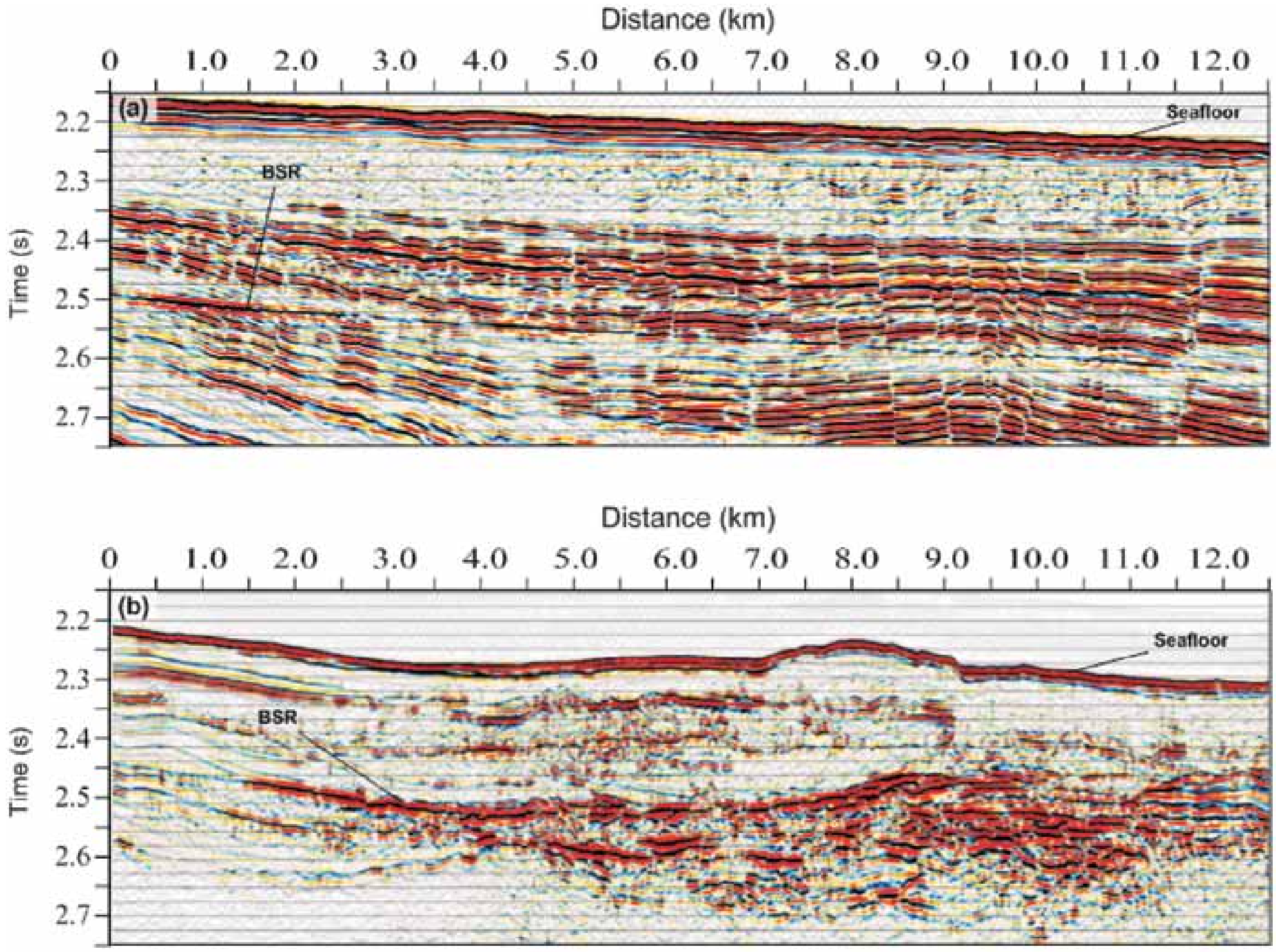

Figure 2. Specimen seismic sections in (a) Mahanadi and (b) KG basins showing prominent BSRs (marker for gas hydrates) (from Sain and Gupta, 2012))

1500 times of India's current natural gas reserve. If we produce only 10% from this huge deposit, we can overcome India's burgeoning energy requirement for about one hundred years.

The gas-hydrates stability thickness map was first prepared using the-then available seafloor temperature, geothermal gradient and bathymetry data. We have recently modified the map (Fig.3) by incorporating new data generated later on (Sain et al., 2011). Since the BSR is often associated with the base of gas-hydrates stability zone, this map helps for identifying BSRs and hence gas-hydrates using seismic data.

By analyzing available multi-channel seismic (MCS) data, the BSRs have been identified in the Krishna-Godavari (KG), Mahanadi and Andaman regions in the Bay of Bengal (Sain and Gupta, 2008; Sain and Ojha, 2008). The drilling and coring by expedition-01 (Collett et al., 2008) under Indian National Gas Hydrates Program (NGHP) have validated the ground truth in Miocene to Pleistocene/recent sediments where gas-hydrates were predicted from surface seismic data in the Bay of Bengal. The KG, Mahanadi and Andaman basins are considered as the most prospective basins in India. This has boosted to advance further research for the detection, delineation and evaluation of gas-hydrates followed by a strong initiative for production in an environmental-safe manner. Though gas-hydrates have not been recovered at one hole in Kerala-Konkan basin by the expedition-01, the geo-scientific investigations along with parameters like the sediment thickness, rate of sedimentation and TOC indicate prospects of gas-hydrates in the Saurashtra, Kerala-Konkan, Kerala-

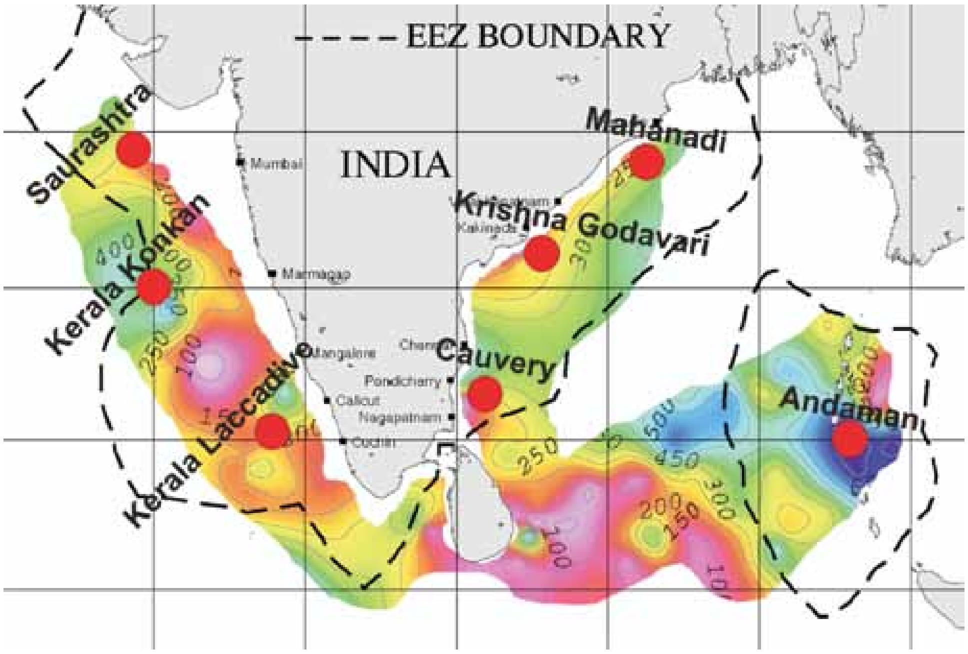

Figure 3. The most prospective zones (Krishna-Godavari, Mahanadi and Andaman) and less-explored but potential zones (Kerala-Konkan, Saurashtra, Kerala-Laccadive and Cauvery) of gas hydrates are superimposed on the gas-hydrates stability thickness (GHST) map along the Indian shelf with the EEZ (dashed line) boundary (modified after Sain et al., 2011). Lightest pink represents the minimum (0) and darkest blue represents the maximum (700) GHST in m below sea floor (mbsf)

Laccadive and Cauvery basins (Veerayya et al., 1998; Rastogi et al., 1999; Ramana et al., 2006; Sain and Gupta, 2008). These less explored basins need to be taken up for detailed investigation of gas-hydrates. All these zones are superimposed on the gas-hydrates stability thickness map (Fig.3) to get a bird's eye view of potential basins along the Indian margin.

A suite of geophysical approaches has been developed for the detection, delineation and quantification of gas-hydrates, and their applications have been shown with field examples (Sain et al., 2000, 2009, 2010; Satyavani et al., 2003, 2008; Shankar and Sain, 2007; Ojha and Sain, 2008, 2009; Ojha et al., 2010; Ghosh et al., 2010a, b; Sain and Singh, 2011; Sain and Gupta, 2012; Singh and Sain, 2012; Satyavani and Sain, 2013; Shankar et al., 2013; Wang et al., 2013).

Since seismic velocity of pure gas-hydrates is very high compared to the normal oceanic sediments in which they occur, the gas hydrate-bearing sediments exhibit high velocity anomaly that can be used in delineating the zones of gas-hydrates from seismic data (Ojha and Sain, 2009; Singh and Sain, 2012). Quantification of gas-hydrates, which has been recovered in fractured shale in KG basin by Expedition-01, has been a challenge. By employing the effective medium modeling, we have estimated the average saturation of gas-hydrates as 38% from sonic velocity, which varies vertically between 60 to 140 m below sea floor (mbsf) (Fig.4). The results for anisotropic background (due to fractures) match quite well with the pressure core data available at 78 mbsf. If sonic velocity is not available, very accurate seismic velocity can be estimated using the full waveform inversion of seismic data (Sain et al., 2000). By employing the effective medium modeling to such velocity, gas-hydrates can be estimated by rock physics modeling as has been demonstrated by Sain et al. (2010) in the northern Cascadia margin, where gas-hydrates have been quantified as 30% for non-contact and 20% for contact models respectively. As seismic Q varies with the saturation of gas-hydrates and free-gas, we propose that the estimated Q (Sain and Singh, 2011) against the background Q can be used for the qualification and quantification of gas-hydrates and free-gas in a similar manner that has been adopted for the quantification of gas-hydrates using seismic velocity (Ojha and Sain, 2007; 2008). Encouraged by the drilling and coring results of the NGHP Expedition-01, we have collected a large

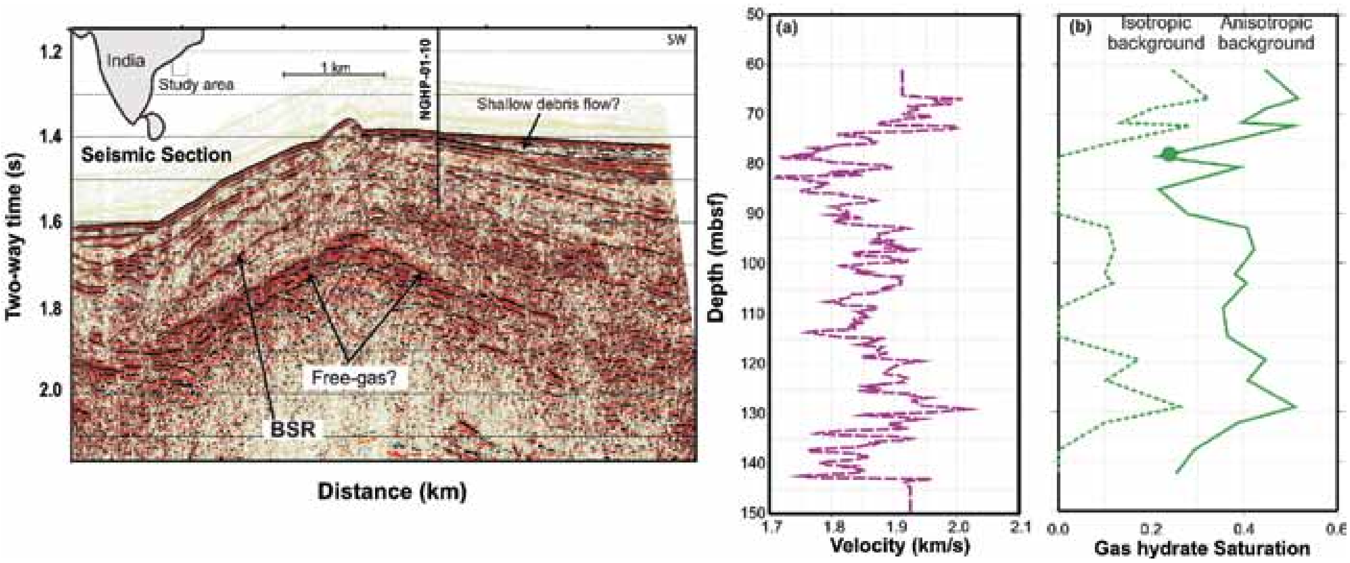

Figure 4. Seismic section in KG basin showing BSR. Gas hydrates have been recovered in fractured shale through drilling at site NGHP-01-10. (a) Sonic velocity used by effective medium modeling for estimating saturation of gas hydrates; (b) saturation of gas hydrates with subsurface depths in m below sea floor (mbsf) for a fractured porosity of 5% in isotropic and anisotropic background respectively. Solid circle shows the estimation from pressure core data (modified after Ghosh et al., 2010a).

volume of MCS and ocean bottom seismic (OBS) data in unexplored areas of the KG and Mahanadi basins in 2010 under the sponsorship of the Ministry of Earth Sciences, Govt. of India. The preliminary analysis shows wide-spread occurrences of BSRs (Fig.2), and thus reveals new prospective zones of gas-hydrates in KG and Mahanadi basins (Sain et al., 2012; Sain and Gupta, 2012). We have also procured MCS data in the Andaman region from the Directorate General of Hydrocarbons under NGHP. By employing the indigenous approaches to the MCS data in the most prospective KG, Mahanadi and Andaman basins, we have been pursuing research for (i) characterizing gas-hydrate reservoirs; (ii) delineating the zones of gas-hydrate-bearing sediments; (iii) quantifying the amount of gas-hydrates; and (iv) understanding the petroleum system associated with gas-hydrates with a view to provide best locations for ground truth validation, and subsequent production at later date. After successful production test in Alaska (onland) by US Department of Energy (USDOE); Japan Oil, Gas and Metals National Corporation (JOGMEC); and ConocoPhillips in 2012 by injecting a mixture of carbon dioxide and nitrogen into gas-hydrate reservoirs, and very recently in Aichi Prefecture (Japan offshore) by JOGMEC and National Institute of Advanced Industrial Science and Technology (NIAIST) in Japan in 2013 using depressurization method, huge interests have spread into the national program of India and many other countries for evaluating the resource potential using geo-scientific methods followed by technology development for commercial production of gas-hydrates. It is obvious that production technology depends on regional geology and environment. It is to be noted that study of gas-hydrates is also important from natural hazards point of view (Maslin et al., 2010; Gupta and Sain, 2013).

CONCLUSIONS

To expedite the exploitation program, a systematic strategy consisting of the following steps is the need of the day.

i. Identification of gas-hydrates based on certain proxies such as BSR
ii. Characterization of gas-hydrates reservoirs by computing seismic attributes such as attenuation, reflection strength, instantaneous frequency, blanking and other available geological/geochemical/micro-biological approaches.
iii. Delineating the zones of gas-hydrates and free-gas bearing sediments by seismic velocity anomaly
iv. Quantification of gas-hydrates by employing rock physics modeling to seismic velocity
v. Understanding the genesis (source, migration and accumulation) of gas-hydrates

So far, no exploitation methodology has been proved with economic viability. It is expected that gas trapped below gas-hydrates can be produced first for commercial purposes, and it may take some time to produce gas from gas-hydrates - the major energy resource of the next generation.

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REFERENCES

Boswell, R., Saeki, T., 2010. Motivations for the geophysical investigation of gas hydrates: in Riedel, M., Willoughby, E., Chopra, S., Eds., Geophysical Characterization of Gas Hydrates; Society of Exploration Geophysicists Geophysical Developments Series, v.14, pp:23-32.

Boswell, R., Collett, T.S., 2011. Current perspectives on gas hydrate resources. Energy Environmental Science,v. 4, pp:1206-1215

Chopra N.N., 1985. Gas hydrates - an unconventional trap in the forearc regions of Andaman offshore. ONGC Bulletin, v.22, pp:41–54.

Collett, T.S., Riedel, M., Cochran, J., Boswell, R., Presley, J., Kumar, P., Sathe, A.V., Sethi, A.K., Lall, M., Sibal, V.K., NGHP Expedition 01 Scientists, 2008. NGHP Expedition 01 (2006), Initial Reports, Directorate General of Hydrocarbons, Noida and Ministry of Petroleum & Natural Gas, India. 4 volumes.

Ghosh, R., Sain, K., Ojha, M., 2010a. Effective medium modeling of gas hydrate-filled fractures using sonic log in the Krishna-Godavari basin, eastern Indian offshore. Journal of Geophysical Research, v.115, B06101, pp:1-15.

Ghosh, R., Sain, K., Ojha, M., 2010b. Estimating the amount of gas hydrate using effective medium theory: a case study in the Blake Ridge. Mar. Geophys. Res. v. 31, pp:29-37.

Gupta, H.K., Sain, K., 2013. Gas-hydrates: Natural Hazard. In Bobrowsky, P. (Ed.), Encyclopedia of Natural Hazards, Springer, pp:377-378.

Hadley, C., Peters, D., Vaughan, A., 2008. Gumusut-Kakap project: Geohazard characterisation and impact on field development plans. International Petroleum Technology Conference 12554, pp:15.

Liu, C.S., Schnurle, P., Wang, Y., Chung, S.H., Chen, S.C., Hsiuan, T.H., 2006. Distribution and characters of gas hydrate offshore of southwestern Taiwan. Terrestrial, Atmospheric and Oceanic Sciences, v.17, pp:615-644.

Makogon, Y. F., Holditch, S.A., Makogon, T.Y., 2007. Natural gas hydrates - A potential energy source for the 21st Century. Journal of Petroleum Science & Engineering, v.56, pp:14–31.

Maslin, M., Owen, M., Betts, R., Day, S., Dunkley-Jones, T., Ridgwell, A., 2010. Gas hydrates: past and future geohazard? Phil. Trans. Royal Soc. A, v. 368, pp:2369-2393.

Matsumoto R., Ryu, B.J., Lee, S.R., Lin, S., Wu, S., Sain, K., Pecher, I., Riedel, M., 2011. Occurrence and exploration of gas hydrate in the marginal seas and continental margin of the Asia and Oceania region. Marine & Petroloem Geology, v.28, pp:1751-1767.

Ojha, M., Sain, K., 2008. Appraisal of gas hydrates/free-gas from V_P/V_S ratio in the Makran accretionary prism. Marine & Petroleum Geology, v.25, pp: 637-644.

Ojha, M., Sain, K., 2009. Seismic attributes for identifying gas hydrates and free-gas zones: application to the Makran accretionary prism. Episodes, v.32, pp:264-270.

Ojha, M., Sain, K., Minshull, T.A., 2010. Assessment of gas hydrates saturation in the Makran accretionary prism using the offset dependence of seismic amplitudes. Geophysics, v.75, no. 2, C1-C6.

Park, K.P., Bahk, J.J., et al. 2008. Korean National Program expedition confirms rich gas hydrate deposits in the Ulleung Basin, East Sea. Fire in the Ice, US Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, v.8, pp:6-9.

Ramana, M.V., Ramprasad, T., Desa, M., Sathe, A.V., Sethi, A.K., 2006. Gas hydrate-related proxies inferred from multidisciplinary investigations in the Indian offshore areas. Current Science, v.91, pp:183-189.

Rastogi, A., Deka, B., Budhiraja, I.L., Agarwal, G.C., 1999. Possibility of large deposits of gas-hydrates in deep waters of India, Marine Georesources and Geotechnology, v. 17, pp:49-63.

Ruppel, R., 2011. Methane hydrates and the future of natural gas. MITEI Natural gas Report, Supplementary Paper on Methane Hydrates, v.4. pp: 25.

Sain, K., Minshull, T.A., Singh, S.C., Hobbs, R.W., 2000. Evidence for a thick free-gas layer beneath the bottom-simulating reflector in the Makran accretionary prism. Marine Geology, v.164, pp:3-12.

Sain, K., Gupta, H.K. 2008. Gas hydrates: Indian scenario. Journal of Geological Society of India 72, 299-311.

Sain. K., Ojha, M., 2008. Identification and quantification of gas hydrates: a viable source of energy in the 21st century. Memoir, Geological Society of India, v.68, pp:273-288.

Sain, K., Singh, A.K., Thakur, N.K., Khanna, R.K., 2009. Seismic quality factor observations for gas-hydrate-bearing sediments on western margins of India. Marine Geophysical Researches, v. 30, pp:137-145.

Sain, K., Ghosh, R., Ojha, M., 2010. Rock physics modeling for assessing gas hydrate and free gas: a case study in the Cascadia accretionary prism, Marine Geophysical Researches, v.31, pp:109-119.

Sain, K., Singh, A.K., 2011. Seismic quality factors across a bottom simulating reflector in the Makran accretionary prism, Arabian Sea. Marine & Petroleum Geology, v.28, pp:1838-1843.

Sain, K., Rajesh, V., Satyavani, N., Subbarao, K.V., Subrahmanyam, C., 2011. Gas hydrates stability thickness map along the Indian continental margin. Marine & Petroleum Geology, v.28, pp:1779-1786.

Sain, K., Gupta, H.K. 2012. Gas hydrates in India: Potential and Development. Gondwana Research, v.22, pp:645-657.

Sain, K., Ojha, M., Satyavani, N., Ramadass, G.A., Ramprasad, T., Das, S.K.,Gupta, H.K., 2012. Gas-hydrates in Krishna-Godavari and Mahanadi basins: new data, Jour. of Geol. Soc. of India, v.79, pp:553-556.

Satyavani, N., Thakur, N.K., Shankar, U., Reddi, S.I., Sridhar, A.R., Rao, P.P., Sain, K., Khanna, R., 2003. Indicators of gas hydrates: role of velocity and amplitude. Current Science, v.85, pp:1360-1363.

Satyavani, N., Sain, K., Lall, Malcolm, Kumar, B.J.P., 2008. Seismic attribute study for gas hydrates in the Andaman offshore, India., Mar. Geophys. Res., v.29, pp:167-175.

Satyavani, N., Sain, K. 2013. Seismic insights of a bottom simulating reflector (BSR) in Krishna-Godavari basin, eastern Indian margin. Marine Georesources and Geotechnology, in press, DOI:10.1080/1064119X.2013.797059.

Shankar, U., Sain, K., 2007. Specific character of the bottom simulating reflectors near mud diapirs: Western margin of India. Current Science, v.93, pp:997-1002.

Shankar, U., Gupta, D.K., Bhowmick, D., Sain, K., 2013. Gas hydrate and free-gas saturations using rock physics modeling at site NGHP-01-05 in the Krishna-Godavari basin, eastern Indian margin. Jour. of Petrol. Sci. & Engg., v.106, pp:62-70.

Singh, P.K., Sain, K., 2012. 2-D Velocity structure in Kerala-Konkan basin using travel time inversion of seismic data. Jour. of Geol. Soc. of India, v.79, pp:53-60.

Sloan, E. D., 1998. Clathrate Hydrate of Natural Gases. Marcel Dekker Inc., New York, pp:705.

Tsuji, Y., Fujii, T., Hayashi, M., Kitamura, R., Nakamizu, M., Ohbi, K., Saeki, T., Yamamoto, K., Namikawa, T., Inamori, T., Oikawa, N., Shimizu, S., Kawasaki, M., Nagakubo, S., Matsushima, J., Ochiai, K., Okui, T., 2009. Methane-hydrate Occurrence and Distribution in the Eastern Nankai Trough, Japan: Findings of the Tokai-oki to Kumano-nada Methane-hydrate Drilling Program, In: Collett, T.S., Johnson, A., Knapp, C.,Boswell, R., eds., Natural gas hydrates - Energy resource potential and associated geologic hazards: AAPG Memoir, v. 89, pp:228-249.

Veerayya, M., Karisiddaiah, S.M., Vora, K.H., Wagle, B.G., Almeid, A.V., 1998. Detection of gas-charged sediments and gas hydrate horizons along the western continental margins of India. in: Henriet, J.P., Mienert, J., Eds., Gas Hydrates: Relevance to world margin stability and climate change, Geological Society, London, Special Publication v.137, pp:239-253.

Wang, X., Sain, K., Satyavani, N., Wang, J., Ojha, M., Wu, S., 2013. Gas hydrates saturation using the geostatistical inversion in fractured reservoir in the Krishna-Godavari basin, offshore eastern India. Jour. of Mar. & Petrol Geol., v. 45, pp:224-235.

Zhang, H., Yang, S., Wu, N., Su, X, Holland, M., Schultheiss, P., Rose, K., Butler, H., Humphrey, G., GMGS-1 Science Team, 2007. Successful and surprising results for China's first gas hydrate drilling expedition, US Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, v.7, pp:6-9.

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