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Editorial: Advances in exploration and exploitation of deep and ultra-deep shale oil and gas

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Editorial on the Research Topic
Advances in exploration and exploitation of deep and ultra-deep shale oil and gas

The Central Himalaya (Nepal) occupies about 800 km in the entire 2,400 km long Himalayan range, which is divided into four tectonostratigraphic zones from south to north: the Sub-Himalaya (Siwalik), Lesser Himalaya (LH), Higher Himalaya (HH), and Tibetan-Tethys Himalaya (TH). Gansser and (Neupane et al., 2020) have described the entire Himalayan region including verities of geological structures (e.g., anticline, syncline, fault, etc.) that may be one of the reasons for the accumulation of oil and gas. The Lesser Himalayan Eocene–Miocene sequence in far western Nepal (Dailekh) contains various hydrocarbon deposits. (Dhital, 2015) divided the exposed oil and gas region in Dailekh district western Nepal into the following: the Paleoproterozoic Nabhistan Formation (Phyllite), Paleoproterozoic Dubidanda Formation (Quartzite), Surkhet group, Gondwana group, Upper Lakharpata group, and Lower Lakharpata group. In the major geological structures, such as Ranimatta Thrust (RT), Mahabharat Thrust (MT), and Nabi Khola Anticline, oil and gas migrated upward. It is exposed on the ground around the Padukasthan, Nabhisthan, and Sristhan areas.

(Neupane et al., 2020; Dhital, 2015) further reclassified the Surkhet Group (Paleocene–Early Eocene) into Suntar Formations, Swat, and Melpani (Dhital, 2015), which is believed to have a potential reservoir for shale gas, as it is rich in organic matter. The lower unit (Melpani Formation) is composed of quartz arenites or quartzose sandstones, with intercalation of shale bed, whereas the overlying Swat Formation contains fissile marine shales containing gastropods and bivalves, the Paleocene-Eocene depositional age firstly confirmed by (Sakai, 1983). The Suntar Formation (upper unit), conformably overlies the fossiliferous bed of the Swat Formation and is composed of siliceous sandstones, variegated shales, sandstones with occasional marls beds, and conglomeratic sandstones.

Zhongxiong et al. presented data from the Swat Formation (−50 m thick) of the Surkhet group, a main source rock, including an organic matter as I-II type, TOC content ranging from 0.7% to 2.24%, and Ro value ranging from 1.83% to 2.07%, which indicate that organic matter was in the evolution stage of condensate to wet gas. The Suntar Formation and Meipani Formation of the Surkhet group are supposed to be the main

reservoir rocks. Subedi et al. and (Neupane et al., 2020) described a pore type and porosity of the sandstone of the Suntar Formation; the pore type is intergranular with intragranular dissolved pores and an average porosity of 9.2% whereas for the Melpani Formation, asphalt fillings were observed in the sandstone with a porosity ranging from 7% to 10%.

Zou et al. (2015) mentioned hydrocarbons and their components crude oil and natural gas are usually deposited in the sedimentary rock of deep formations. Numerous methods can be applied for the exploration and exploitation of oil and gas resources in deep formations. (Wenrui et al., 2013) focused on the basic elements of hydrocarbon exploration which were the assemblages of source, reservoir, caprock, trap, migration, and preservation. (Guo et al., 2020) reviewed the numerous oil-gas fields and reserves especially in deep and ultra-deep zones (i.e., 6,000 to 2000 m) in the world. Zhongxiong et al. showed a result based on the recent Seismic exploration data; the oil and gas source of the central Himalaya region was 4,250 m deep.

Numerous methods are used for drilling out petroleum resources. (Mitchell, 1992) and Lyons and Plisgaexplained two kinds of widely used drilling methods (i.e., percussion drilling and rotary drilling) between them and suggested a rotary drilling method is the most widely used method. Ma et al. discussed more advanced techniques to apply to drill more complex wells, such as directional wells, horizontal wells, extended reach wells, and multi-lateral wells. Recently, vertical drilling, directional drilling, and horizontal drilling methods have been developed for unconventional petroleum resources; Liu et al. explained shale oil and gas, (Zou et al, 2015). explored tight oil and gas, and (Verma and Sirvaiya, 2016) have considered coal-bed methane Based on the theoretical research and technologies, it has been recommended that more attention be paid to hydrocarbon resources in deep and ultra-deep zones in exploration in the central Himalayas.

Zhang et al. (2018) and Yongqing et al. described landform features of the thrust belt on the northern margin of the Qilian Mountains in northwestern China, which are similar to the thrust nappe structure with high and steep fractures, and the strong anisotropy of field velocity of the Dailekh gas and oil field in the Central Himalaya. Distribution of oil and gas is higher in western than eastern Nepal. In central Nepal, Muktinath gas seepage originated from Tethyan Himalaya Jurassic shale beds and in Kathmandu Valley. In eastern Nepal, Jwala Mai gas seepage also originated due to the tectonic activity of MBT, similar to western Nepal. The study of oil and gas in central Himalaya is less studied; however, a series of oil and gas seeps are recorded in different localities (i.e., Dailekh oil and gas seeps, Muktinath gas seeps, and Jwala Mai gas seepage). Hiller, 1988, and Jadoon, 1999. documented several reservoirs and their potential for exploration in adjoining regions (i.e., Bangladesh, Pakistan, and India), which may be of benefit to study and may advance the exploration and exploitation of oil and gas in Central Himalayan deep and ultra-deep shale oil and gas.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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