A study on validity identification of marine carbonate source rocks

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Marine carbonate sequences are widely distributed and developed with thick layer in China, which has been an important field of oil and gas exploration. Recently, a series of oil and gas fields has been discovered in marine successions of Chinese sedimentary basins such as Sichuan Basin and Tarim Basin, showing considerable potential of reserves. However, the evaluation of marine carbonate rocks as effective hydrocarbon source rocks remains an unsolved problem because marine carbonate sequences in China underwent more tectonic movements, more complicated histories of thermal evolution and accociatd with lower organic carbon content.

A geochemical investigation was carried out on 146 core and cuttings samples from selected Paleozoic source rocks in the central part of the Sichuan Basin. Before conducting the analyses, all samples were crushed and divided into two subsets. The first subset was pyrolysed using a Rock-Eval 6 instrument to determine the total organic carbon (TOC) content and Rock-Eval pyrolysis parameters, such as the free hydrocarbon fraction (S_1), the fraction released by thermal cracking (S_2), and the pyrolysis temperature (T_{max}) of maximum kerogen cracking measured at the top of the S_2 peak. The second set of powdered samples were conducted by the X-ray diffraction in order to obtain the content of clay minerals and ordinary non-clay minerals.

Rock-Eval pyrolysis data reveal that these samples have relatively high thermal maturity, their organic enrichment decreased due to the generation and expulsion process of hydrocarbon and the original TOC should be recovered as described by Jarvie[1]. The results reveal that the TOC increased with the increase of the content of clay minerals, meaning that the content of clay minerals plays an important role in the organic carbon content and its contribution to hydrocarbon accumulation of marine carbonate source rocks. Moreover, according to the relation between depositional environments and source rock quality, the continental shelf could offer a favorable condition for source rock development.

[1] Jarvie D M. et al. (2007) AAPG Bulletin, 91(4),475-499.