

Hydrocarbon generation characteristics of alkaline lacustrine source rocks: The lower Permian in the northwestern Junggar Basin, NW China

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High-quality alkaline lacustrine source rocks are an important type of lacustrine source rocks. So far, typical cases are mainly found in the Eocene with low to middle maturity [1-3]. Thus, their hydrocarbon generation characteristics remain enigmatic, as one of the most critical issues in lacustrine petroleum geology and geochemistry.

Here we report a new discovery of ancient alkaline lacustrine source rocks in the lower Permian Fengcheng Formation of the northwestern Junggar Basin, NW China. Typical evidence includes the identification of alkaline minerals, plentiful microbes, highly mineralized (alkaline) formation brines and geochemical indicators. In particular, the Fengcheng source rocks have reached high to over maturity, providing an invaluable case to investigate the evolution of hydrocarbon generation of alkaline lacustrine source rocks.

The Fengcheng Formation has typical characteristics of high-quality source rocks, e.g., middle to high organic matter abundance, type II-I kerogen, and moderate-high maturity. These are similar to conventional high-quality lacustrine source rocks. However, it exhibits some particular characteristics that are different from conventional lacustrine high-quality source rocks, such as continued hydrocarbon generation, multi-phase generation peaks, long oil-generation window, high conversion efficiency, light oils, and high oil to gas ratio. These particularities might be related to the unique bioprecursors of microbes and cyanobacteria as well as the mineralogy of alkaline minerals. Organic-inorganic interactions in source rocks result in the unique hydrocarbon generation characteristics, which would be further discussed in-depth.

[1] Horsfield *et al.* (1994) *Org. Geochem* **22**, 415-440. [2] Carroll & Bohacs (2001) *AAPG Bulletin* **85**, 1033-1053. [3] Feng *et al.* (2013) *Energy & Fuels* **27**, 7314-7323.