Characteristics and genetic Mechanisms of saline lacustrine Hydrocarbon in north Dongpu Depression, Bohai Bay Basin, Eastern China

DONG LIU[1]*, SUMEI LI[1], XIANGFEI CHEN[1]

[1] China University of Petroleum (Beijing), Beijing, China
(*correspondence: 156246118@qq.com)

The Dongpu Depression is the most typical Tertiary saline lake depression in the Bohai Bay Basin, eastern China. Proven reserves exceed 600 million tons so far. The geological framework of the Dongpu Depression (with multiphase hydrocarbons coexist) is quite different from others in the Bohai Bay Basin, which exerts a strong impact on hydrocarbon generation, accumulation and distribution. We conduct a comprehensive geological and geochemical investigation of saline lacustrine oils to shed light on petroleum formation mechanisms. The saline lacustrine oils are characterized by a significant preponderance of phytane over pristane (Pr/Ph<0.6) . They also have a preponderance of nC$_{37}$, nC$_{38}$ over the adjacent *n*-alkanes, higher abundance of β-carotane and gammacerane, and ascending distribution of homohopane, all of which are typical features of saline lacustrine oils. A two-stage, or inclined linear shape of compound-specific carbon isotopic distribution pattern was observed in the oils. This suggests different organic matter input and a different paleo-environment when the source rocks were deposited. Abundant NSO compounds were detected in the immature oils based on FT-ICR MS, implying a close genetic relationship between the NSO macro-moleculars and the immature oils. Thermochemical sulfate reduction (TSR) was initially detected in partial deep oils, which suggests that TSR had a certain degree of impact on deep oils caused by gypsum-salt rocks, which created an excellent plugged zone for deep oils. Five main factors were identified, which have significantly controlled the formation and distribution of hydrocarbons in the depression: (1)Saline lacustrine source rocks (Es$_3$~Es$_4$ interval) with a good petroleum potential; (2)Multiple hydrocarbon kitchens controlling the distribution of the hydrocarbons; (3)Four sets of gypsum-salt rocks, which acted as excellent regional cap rocks or sealing glands providing good petroleum preservation conditions; (4)Widely developed antithetic faults, which acted as both migration pathways and traps entrapping hydrocarbons; (5)Massive gypsum-salt rocks which had an obvious impact on the hydrocarbon evolution process and on the threshold of liquid hydrocarbons generation.