

Formation and Accumulation of Subtle Oil Pools in the Dongying Depression, Bohai Bay Basin, China

Li, Sumei¹, Xionqi Pang¹, Keyu Liu², Zhenxue Jiang¹, Guiqiang Qiu³, Yongjin Gao³ (1) China University of Petroleum, Beijing, China (2) CSIRO Petroleum, Bentley, WA, Australia (3) Shengli Oilfield, SINOPEC, Dongying, Shandong, China

Subtle traps or subtle oil pools have become an important exploration play in the Dongying Depression, Bohai Bay Basin, east China. Despite of the recent success in exploration, the formation mechanisms of subtle traps are still not well understood. The majority of the subtle traps in the Dongying Depression are developed in the Es3 member of the Paleogene Shahejie Formation with the traps being primarily of lenticular basin floor turbidite sands encompassed in mudstones. Oils in the subtle traps were previously thought to have migrated directly from the surrounding source rocks of the same formation (Es3). Detailed geochemical investigation of 47 oils and 50 rocks from the depression indicates that oils from the subtle traps cannot be correlated with the surrounding Es3 source rocks, which are characterized by high Pr/Ph (>1), low Gammacerane/C30hopane, representing a fresh water lacustrine setting. In contrast the oils are featured by low Pr/Ph (<1) and high Gammacerane content, showing a genetic affinity with the underlying Es4 source rocks, which have low Pr/Ph and high Gammacerane content, indicating a brackish lacustrine setting.

Oils in the Es3 subtle traps are likely derived from mixed sources with the contribution from the Es4 source rocks dominated. Therefore unconventional oil migration and accumulation mechanisms need to be invoked to pool the oils from the Es4 source rocks through a thick (>100 m) Es3 source rocks with no apparent structural or stratigraphic pathways. This finding may have significant implications to future exploration and the remaining resource evaluation in the Dongying Depression.