Hydrocarbon Mobility Prediction for lacustrine shale oil plays

WANG, FEIYU[1], WEIPING FENG[1] AND ZHIYONG HE[2]

[1]China University of Petroleum, Beijing,102249)
[2] Zetaware Inc., Sugar Land, TX. 77479 USA

Lacustrine shale oil plays or tight oil systems have become the important exploration and development target in China, a great amount residual hydrocarbon exist in the mature organic matter rich lacustrine shale plays, For a shale play to work, it has to have enough original oil in-place volumes and producible, The occurrence and mobility of residual hydrocarbon are key to assessment of shale oil plays.

Residual hydrocarbon can be splited into two parts, free oil and adsorbed oil, the former occur in the organic matter rich source rocks intervals and interbedded various scale tight reservoir layers within the shale plays, the latter are mainly located in organic matters in the shale plays. The amount of adsorbed oil for lacustrine shale range from 80 mg/gTOC to 100 mg/gTOC, which will be decreased with maturation increase.The most of adsorbed oil in a shale play are immobile and hard to produce. The free oil appear when residual oil is higher than the adsorbed oil threshold. the more free oil amount correspond to the higher mobility for shale oil. Viscosity is very important to hydrocarbon mobility, but less predictable quantitatively, As maturity or transformation ratio increases, GOR increases four orders of magnitude and viscosity decreases three orders of magnitude in the oil window,.The kinetic model of GOR,API and viscosity have been established for the organic rich lacustrine source rock, If maturity or transformation ratio of source rocks can be measured ith much greater precision, the viscosity and hydrocarbon mobility will be predicted in reasonable resolution. Vitrinite reflectance data are often problematic for lacustrine shale play when used for the maturity or thermal calibration,a better approach is calibrated with the residual HI of high TOC source rocks. Higher maturity means lower viscosity, maturity map will provide the hydrocarbon mobility trending in the area.

Case studies from the Hataoyan Formation of Biyang basin and Upper Triassic Chang 7 Shale in Ordos basin have been shown the approaches of hydrocarbon mobility prediction in the lake basins. these case studies indicate that the best oil production seems to be from late oil window with vitrinite reflectance equivalent of 0.9 to 1.2 (%Ro).

Neoproterozoic terranes in the NE China and its tectonic implications

FENG WANG, WENLIANG XU*, FUHONG GAO, JIE TANG, AND WENLI HAO

College of Earth Sciences, Jilin University, Changchun 130061, (jlu-wangfeng@sohu.com, * xuwl@jlu.edu.cn)

NE China is located in the eastern section of the Central Asian Orogenic Belt (CAOB), in a region that consists of a collage of several microcontinental massifs (including, from northwest to southest, the Erguna, Xing'an, Songnen-Zhangguangcai Range, Jiamusi, and Khanka massifs). It has been a controversial issue whether did the Precambrian terranes occur within these microcontinents of NE China, although the geochronolical data of the detrital zircons from the Paleozoic strata in NE China display a lot of the information the Precambrian ages. Additionally, the tectonic attribution of these microcontinents is also an unsolved issue.

The Neoproterozoic magmatisms, corresponding to the breakup of the Rodinia supercontinent, have been widely identified in the Erguna Massif [1]. By comparison, no igneous rocks of this age have been identified in the Xing'an, Songnen–Zhangguangcai Range, and Khanka massifs. However, the LA-ICP-MS detrital zricon U-Pb dating for Dongfengshan and Tadong groups indicate that a suite of Neoproterozoic terranes is present along the eastern margin of the Songnen–Zhangguangcai Range Massif (~821–752 Ma, ~752–560 Ma, and ~750–516 Ma)[2]. And Neoproterozoic magmatic zircons (0.75–0.92 Ga) are the most common zircons identified in the Dongfengshan and Tadong groups, suggesting that a Neoproterozoic magmatic event occurred within the Songnen-Zhangguangcai Range Massif. The detrital zircons with similar ages (0.76–0.97 Ga, our unpublished data) have been also identified in the Huangsong Group along the western margin of the Khanka Massif. Additionally, increasing evidence suggests that Neoproterozoic magmatic zircons are present in Paleozoic sedimentary rocks in the Xing'an Massif [3].

The above findings suggest that the Precambrian terranes did occur within the Erguna, Xing'an, Songnen-Zhangguangcai Range, and Khanka massifs, and that these microcontinents have an affinity to the Siberia craton. This research was financially supported by the National Science Foundation of China (Grant 41272075 and 41072038).

[1] Tang *et al*. (2013) *Precambrian Research* **224**, 597–611. [2] Wang *et al*. (2013) *Gondwana Research,* in press. [3] Han *et al*. (2011) *Tectonophysics* **511**, 109–124.

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