

## **Diagenesis and Reservoir Quality of Lacustrine Deep-Water Gravity Flow Sandstones of the Shahejie Formation (43.7-38.2 Ma) in the Dongying Sag, Jiyang Depression, Eastern China**

**Tian Yang<sup>1</sup>, Yingchang Cao<sup>1</sup>, Henrik Friis<sup>2</sup>, and Yanzhong Wang<sup>1</sup>**

<sup>1</sup>School of Geoscience, China university of petroleum(East China), Qingdao, China.

<sup>2</sup>Aarhus University, Aarhus, Denmark.

### **ABSTRACT**

The lacustrine deep-water gravity-flow sandstone reservoirs in the middle of the third member of the Shahejie Formation (43.7-38.2 Ma) are the main exploration targets for hydrocarbons in the Dongying Sag, Jiyang Depression, Eastern China. The impact of diagenesis on reservoir quality of these sandstones has been constrained by a variety of methods, including core and thin section observation, XRD, SEM, CL, XRF, fluorescence, electron microprobe, fluid inclusion and isotope analyses. Petrographically, the sandstones are mainly lithic arkose (Q43F33L24) and have reservoirs with average porosity and permeability values of 17.1 % and 38.1 mD, respectively. In addition to the primary intergranular pore, secondary pore has originated from feldspar dissolution, and the pore throat radius ranges from 0.01 to 40 μm. The dissolution of feldspar and transformation of smectite to illite may be the source of silica for the first phase of quartz overgrowth, while illitization of kaolinite may be responsible for the second phase of quartz overgrowth. Calcite cement in sandstones may have been sourced from Ca<sup>2+</sup> and bicarbonate in adjacent mudstones. The precipitation of ferroan calcite and ankerite in the sandstone are sourced from the dissolution of calcite and dolomite, feldspar, and the transformation of smectite to illite both in sandstones and mudstones. Dissolution of feldspar has little impact on the reservoir quality, while compaction and carbonate cementation are the main factors which reduce the reservoir quality significantly. Oil charge may have retarded the carbonate cementation, generated overpressure which will retard compaction of reservoirs, and thus preserving the porosity. Reservoirs with the first period of oil charge are observed with a small amount of ferroan calcite and ankerite, at the same time, change the wettability from water-wet to oil-wet, which will promote the second period of oil charge. The central of sandstones (more than 0.6 m in the thickness) which have two periods of oil charge are the most promising for high-quality reservoirs. This work provides a new interpretation to the formation mechanism of high quality lacustrine deep-water gravity flow sandstones reservoirs with multi-period of oil charge.