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Natural enhancement and mobility of oil reservoirs by supercritical CO₂ and implication for vertical multi-trap CO₂ geological storage

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Abstract

The accumulation and production of both deep mantle-derived CO₂ and light oil were discovered in the Huangqiao reservoir, which is located in the Subei Basin, East China. The Huangqiao reservoir shows that both CO₂ and oil are entrapped in and produced from vertical multi-traps. The effects of deep CO₂ on the accumulation and production of oil under natural conditions and the implications for CO₂ geological storage are investigated in detail. The fluid inclusions in quartz or calcite veins from the Silurian Fentou Formation (S_{2-3f}), Permian Longtan Formation (P_{2l}) and Triassic Qinglong Formation (T_{1q}) have homogenization temperatures (Ths) that display peak ranges of 180°C–190°C, 170°C–180°C and 150°C–160°C, respectively. The Ths are higher than the formation temperatures. The calcite veins have light carbon and oxygen isotope compositions and have high ⁸⁷Sr/⁸⁶Sr ratios and positive Eu anomalies. These characteristics reveal the activities of deep CO₂-rich hydrothermal fluids in the basin strata. The feldspar in the S_{2-3f} and P_{2l} sandstone reservoirs underwent significant dissolution because of the presence of CO₂-rich fluids,

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