Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.33559

Authigenic quartz and its origin in the sandstone of Pinghu Formation in Hangzhou area, Xihu sag, China

JIAMING WANG[1] AND GUANGHUI YUAN[2]

[1]State Key Laboratory of Deep Oil and Gas, China University of Petroleum (East China)
[2]China University of Petroleum (East China)

High-yield oil and gas flows have been discovered in reservoirs buried deeper than 5000 m in the Hangzhou area of the Xihu Sag. Thin-section observations show that reservoir space is dominated by well-preserved primary intergranular pores. Integrated petrographic analyses indicate that silica cementation crusts developed at the tops and bottoms of thick sandstone bodies play a critical role in the preservation of primary porosity. To constrain the origin of authigenic quartz and its relationship with diagenetic fluids, a systematic study was conducted using optical petrography, cathodoluminescence (CL), fluid inclusion microthermometry, EPMA, LA-ICP-MS, and in situ oxygen isotope analyses. Two generations of quartz overgrowths can be clearly distinguished under CL imaging. The Stage I exhibit dark CL luminescence, are widely distributed, and display relatively large thicknesses, whereas the Stage II show brown CL luminescence, are locally developed, and are relatively thin and therefore not discussed in detail in this study. Thicknesses of Stage I generally range from 30 to 150 μm, with a maximum of up to 240 μm; cumulative thicknesses of multiple overgrowths within a single pore commonly reach 40–310 μm and locally up to 370 μm, indicating an early formation timing. Fluid inclusions hosted in the quartz overgrowths yield homogenization temperatures of 140–170 °C, suggesting precipitation under a high-temperature diagenetic background. Compared with detrital quartz, Stage I quartz overgrowths show distinct compositional characteristics, including enrichment in Al and Li. The $\delta^{18}O$ values of quartz overgrowths range from 10.12 to 16.42‰, and calculated pore-water $\delta^{18}O$ values based on homogenization temperatures range from −9 to +2‰, indicating a significant contribution of meteoric freshwater to pore fluids, with its influence decreasing systematically with increasing burial depth. Integrated petrographic and geochemical evidence suggests that quartz overgrowths most likely formed during an early diagenetic stage under an elevated geothermal background, where deep-seated fault activity enhanced heat flow, accelerated clay mineral transformations in mudstones, and supplied silica for quartz cementation. This early-stage silica cementation at the tops and bottoms of sandstone bodies increased the overall mechanical rigidity of the sand bodies, thereby facilitating the preservation of primary intergranular porosity within the sandstone interiors.