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Features of the transformation of visean quartz sandstones under the influence of water-oil fluids

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Abstract

Research subject. This article analyses specific features of secondary transformations of quartz grains under the influence of water-oil fluids on the example of the Tulsky and Bobrikovsky oil-saturated quartz sandstones of the Demkinskoye oil deposit in the south-east of Tatarstan. Materials and methods. The research was carried out using the methods of optical microscopy, x-ray diffraction and electron paramagnetic resonance (EPR). Results. On the example of the Tulsky and Bo-brikovsky oil-saturated Visean quartz sandstones, we analysed the influence of water-oil fluids on rocks and features of the secondary transformations of quartz grains in the Demkinsky oil field in the southeast of Tatarstan Republic. In the oil-charge stage, the spatial redistribution of silica was realized. Quartz grains dissolved in the sole and middle part of the reservoir, precipitating in the form of chalcedony in the top part of the reservoir. The dissolution of quartz grains was promo-ted by micro defects concentrated on their periphery. The dissolution was triggered by both plastic deformations of minerals at the contacts and an increase in the alkalinity in the pore space up to pH = 9–10. Chalcedony aggregates were formed in the intergranular space of oil-saturated sandstones. Depending on the nucleation point of the siliceous substance and silica concentration in pore fluids, either single spherulitic or agate-type aggregates were formed. According to EPR, the studied chalcedony aggregates have a high content of paramagnetic E’-centres. This was caused by a deficiency of oxygen in the mineral-forming fluid during chalcedony precipitation. Conclusions. Chalcedony precipitation underwent in acidic con-ditions, which led to silica-type metasomatism in the top part of the reservoir followed by substitution of muscovite grains by morphological fibrous chalcedony. Metasomatism affected the grains of both detrital muscovite and muscovite present as inclusions inside quartz grains. This process indicates the manifestation of surface and bulk diffusion of silica, affecting all clastic components.

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Keywords

Fluid lithogenesis, Oil reservoir, Quartz sandstone, Silica cementation, Visean

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