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Diagenetic evolution of the sandstone member of Kosd Formation (Central Hungary)

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The Kosd Formation (KF) crops out in small spots in the Bükk Mountains, the Left Side Blocks of Danube and the Buda Hills. The studied formation was encountered in a borehole, drilled in 2000s by MOL Plc. The well is located in the northern part of mid Hungary, at the central of the Hungarian Paleogene Basin. The KF unconformable overlies the Mesozoic basement and is built up by two parts, the lower one contains terrigenous, while the upper one consists of shallow marine, lagoonal sediments. According to Gidai (1978) the main indicator fossil is the Isthmolithus recurvus, which one indicates the NP19 zone, the Lower Priabonian age. The psammitic and pseffitic rocks of KF are hydrocarbon reservoir rocks in some cases and are usually compartmentalized (Radovics et al. 2017).
The sandstone member of KF was cut by a drill core and was sampled for petrography and fluid inclusion (FI) analyses to reconstruct the diagenetic history.
The framework is built up by quartz (80–97%), feldspar (0–1%) and rock fragments (3–20%). The grains are angular to sub-rounded and show low- to medium-sphericity. The size of the grains are between the coarse silt and medium sand, but locally coarse-grained. The samples are poorly- to moderately-sorted and contain less than 10% of calcareous matrix. The sandstones are classified as quartzarenites and sublitharenites (Dott, 1963; McBride, 1964). The arenites are rich in differentially preserved fossils. The grains are predominantly cemented by calcite, furthermore quartz overgrowth, pyrite and dolomite replacement or kaolinite can be observed. The sandstones have hybrid porosity, where the moldic and oversized pore textures are dominant. However, at microscale the samples show strong heterogeneity in the spatial distribution of pores.
Fluid inclusion petrography and microthermometry were performed on FI found in centimetre sized grown-up calcite crystals at an oversized pore and in dust rims of quartz overgrowths. The FI assemblages are primary and contain two phase, liquid dominant aqueous inclusions. The range of homogenization temperatures (Th) is between 130–137 °C (n=84) and 118–129 °C (n=56), respectively. Moreover, the range of final ice melting temperature (TmICE) in calcite is between -2.8—3.0 °C (n=89). Nevertheless, the determination of TmICE at quartz overgrowths was not possible, due to the deficiency of vapour phase during ice melting.
Based on the preliminary petrographic and FI microthermometry study the following diagenetic events can be identified. Early diagenesis is represented by cementation (of framboidal pyrite and calcite) and weak mechanical compaction. On the other hand, the later diagenetic phases involved cementation (of late pyrite and carbonates, quartz overgrowth, kaolinite), pressure solution (chemical compaction), carbonate and pyrite replacement, grain dissolution and pyrite oxidation processes.
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