

MINERALOGICAL PECULIARITIES AND FORMING CONDITIONS OF VEINLET MINERALISATION IN THE PALAEOZOIC SEDIMENTARY SERIES OF CARPATHIAN FORELAND

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The foreland of Ukrainian Carpathians, called L'viv Palaeozoic depression, developed on the southwest margin of the Ukrainian Shield and it is represented by a trough subparallel to the main structures of the Carpathians. The Lower Palaeozoic sedimentary series of this depression are considered lately as perspective for hydrocarbon prospecting. Significant amounts of veinlet katagenetic and hydrothermal mineralisation of various ages within the sedimentary complexes are detected. These veins often contain bitumen and oil filled openings. Quartz and calcite, the main minerals of the veinlets often contain numerous, essentially water or hydrocarbon fluid inclusions. Investigations of these inclusions can give well-grounded information about the conditions of post-sedimentation transformations of rocks, as well as information about the composition and migration behaviour of hydrocarbon-bearing fluid palaeosystems. But the lack of knowledge about mineralogy and formation stages of vein formations in rocks makes interpretation of fluid inclusion data difficult.

Mineralogical peculiarities are investigated and previous paragenetic scheme of the stages of veinlet mineral genesis in the rocks of the region is proposed. During the post-sedimentary history of the trough the following stages formed: 1 – carbonate concretions and septarian calcite veinlets in them with admixtures of crystals of brown siderite or ankerite, dickite, sometimes quartz and pyrite; 2 – calcite and quartz–calcite nests and veinlets, zones of recrystallisation, dolomitisation, silicification of limestones connected with katagenic processes; 3 – post-katagenetic hydrothermal vein formation in fractured zones; 4 – late marcasite–calcite mineralisation in coal beds in surrounding rocks.

The age of the veinlets ranges from Carboniferous for katagenetic formations to post-Carboniferous–pre-Cretaceous for hydrothermal ones.

According to the structural and mineralogical features there are about three stages of vein formation connected both with katagenetic and hydrothermal processes. Distinguishing between katagenetic and hydrothermal veins is difficult. Vein mineralisation in tectonic fractures coincident with definite disjunctive structures is regarded as hydrothermal. Hydrothermal veins consist mainly of calcite with 2–3 generations of the mineral. The veins also contain quartz crystals, and accessory barite, celestite, sphalerite.

Quartz and calcite contain numerous primary coexisting inclusions of water solution and hydrocarbon fluid. This is an evidence for the heterogeneous two-phase state of the mineral forming system. The salt concentration of water solution amounts to 0.9–9.0 wt%, rarely 10–12 wt%. The main dissolved components are NaCl, CaCl₂, Na₂SO₄. The volatile components of hydrocarbon inclusions consist of CH₄ (81–99 vol%), C_nH_{2n+2} (up to 15 vol%) with admixtures of CO₂ and N₂.

As derived from microthermometrical data for oil and water inclusions, the minerals precipitated at 220–140 °C for quartz and 200–110 °C for calcite. A clear lateral zonation was established by inclusion composition. From the north-western to the southeastern part of the depression the organic part of heterogeneous fluids changes from light oils to substantially methane fluid. This information could be used as the basis of oil and gas prospecting.