

Noble Metals in Organic Matter and Clay-Organic Matrices, Kupferschiefer, Poland

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Abstract

In the Kupferschiefer deposits of Poland, Cu, Ag, Pb, Zn, Fe, noble metals, and other transition elements were concentrated by a process of catalytic oxidation and desulfurization of organic matter. They occur as several well-defined horizons that are zoned from the bottom upward: noble metals (southwest perimeter of orebodies), Cu, Pb, Zn, and pyrite.

The noble metal content in black shale clay-organic matrices reaches 1,900 ppm Au, 1,900 ppm Pd, and 600 ppm Pt. Gold valence determinations suggest that Au occurs in two forms: native microinclusions with 0 valence containing silver, and Ag-free microinclusions with gold valence +1 probably bound to bitumens. The noble metals content in the organic matrix of thucholite reaches 2,528 ppm Au, 5,000 ppm Pd, and 1,770 ppm Pt. Pt is probably bound to tetrapyrrole rings, with Ni and V as vanadyl.

The vertical distribution of metals is controlled by redox interfaces. On the reduced side of the interface, up to 0.5 m thick, the following minerals occur: a continuous Ag-Au series, several Pd arsenides and sulfide-arsenides, Bi sulfides, tennantite, Co-Ni arsenides, castaingite CuMo_2S_5 , thucholite, covellite, and digenite. On the oxidized side of the interface, up to 1 m thick, the following minerals occur: gold of high fineness, hematite, PdBi sobolevskite, clausthalite, native Pb, plumbian gold, native palladium, graphite, and relicts of organic matter. The oxidized portion of the redox interface, containing lower noble metal contents, occupies a much larger area than the reduced counterpart with its higher pay metals values.