

Title:

Unique Mineralogy of Oil Shale from the Piceance Basin, Colorado

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Several outcrop samples of Piceance Basin oil shale were examined for mineralogic content and associations using X-ray powder diffraction analyses (XRD), scanning electron microscope analyses (SEM), and thin section analyses using petrographic, cathodoluminescence, and fluorescence microscopy. The samples analyzed consist of kerogen-rich materials that are representative of the Mahogany zone of the Green River Formation.

The bulk mineralogy of the samples varies from that of regular shale containing significant quantities of clay minerals (such as smectite and illite) to carbonate marl (composed of calcite and dolomite/ankerite). The oil shale samples are finely laminated with prominent mineral segregation between the various layers of inorganic and organic materials. When the layers are composed of clay minerals, the clays are found to be oriented with the microbedding and readily expand and contract with changes in water activity. Organic content (kerogen and bitumen) in the samples examined varied from absent to as high as ~40 wt% and is present as either distinct bedded layers, or as minute fragments of organic material distributed within the inorganic matrix. Sulfides are quite prevalent and associated with the organics, presumably due to the naturally reducing conditions.

Other interesting minerals observed in these oil shale samples include significant quantities of the mineral dawsonite [NaAl(CO₃)(OH)₂], analcime (especially as nodules and clasts that appear to spread apart bedding), and nahcolite. Buddingtonite, (analogous to an ammonium version of K-feldspar) is also present and indicates an authigenic origin forming simultaneously with the maturation of the organic materials.

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