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A rare sekaninaite occurrence in the Nenana Coal Basin, Alaska Range, Alaska

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Abstract

Coal-seam fires are not uncommon and occur in coal deposits of all ages. Coal-seam fires have been noted in Alaska, but this paper is the first to describe the mineralogy and petrology of a coal-seam fire in the Mystic Creek coal basin in the remote eastern part of the Nenana Coal Basin, Alaska Range. The coal is Miocene and part of the Healy Creek Formation of the Usibelli Group. The coal-fire products were studied optically and analyzed using XRF, XRD, and electron microprobe. The host rock is a silty sandstone consisting mainly of quartz, feldspar, and minor hematite and clay. The coal-seam fire fused and melted the country rock producing a metasediment-clinker and paralava. Sekaninaite (Fe-cordierite), plagioclase, and fayalite are the main minerals that formed along with titanomagnetite, mullite, augite, and an unidentified Al-Fe-Ti oxide mineral. Petrographic analysis shows there are at least three distinct lithologies in the paralava at thin section scale: a vesicular, holocrystalline sekaninaite-plagioclase ± olivine bearing area; holocrystalline areas dominated by plagioclase and quartz ± minor sekaninaite; glassy bodies; and a bulbous, lenticular body of coarse-grained sekaninaite and lesser olivine. The paralava is an andesite with rhyolitic residual glass. Oxidation and fusion of the sediment was the first phase of pyrometamorphism, where the sediment becomes brown-red and sekaninaite begins to form. The metasediment melts forming vesicles in a black glass; sekaninaite formation is well underway. The melt separates from the host and coalesces to form the paralava. As the paralava cools, fayalite and sekaninaite precipitate, accompanied by plagioclase, quartz, titanomagnetite, and an Al-Fe-Ti oxide. Proximity to the surface allowed quenching of the remaining liquid to rhyolitic glass. Numerical modeling was employed to calculate the liquidus temperature (1140 to 1200 °C) and understand the crystallization pathway to the rhyolitic glass. In all models, sekaninaite precipitation is the most important mineral leading to the rhyolitic glass.

Keywords: Sekaninaite, Nenana Coal Basin, Alaska Range