

A Geologic Framework for Mineralization in the Western Brooks Range, Alaska

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Abstract

The Brooks Range is a 950-km-long north-vergent fold and thrust belt, which was formed during Mesozoic convergence of the continental Arctic Alaska terrane and the oceanic Angayucham terrane and was further shortened and uplifted in Tertiary time. The Arctic Alaska terrane consists of parautochthonous rocks and the Endicott Mountains and De Long Mountains subterrane. The Endicott Mountains allochthon of the western Brooks Range is the setting for many sulfide and barite occurrences, such as the supergiant Red Dog zinc-lead mine. Mineralization is sediment hosted and most commonly is present in black shale and carbonate turbidites of the Mississippian Kuna Formation. The reconstructed Kuna basin is a 200 by +600 km feature that represents the culmination of a remarkable chain of events that includes three fluvial-deltaic and two or more orogenic cycles, Middle Devonian to Mississippian episodes of extension and igneous activity, and the emergence of a seaward Lower Proterozoic landmass that may have constituted a barrier to marine circulation. Mississippian extension and related horst-and-graben architecture in the western Brooks Range is manifested in part by strong facies variability between coeval units of allochthons and structural plates. Shallow marine to possibly nonmarine arkose, platform to shelf carbonate, slope-to-basin shale, chert and carbonate turbidites, and submarine volcanic rocks are all represented in Mississippian time. The structural setting of Mississippian sedimentation, volcanism, and mineralization in the Kuna basin may be comparable to documented Devonian-Mississippian extensional sags or half-grabens in the subsurface north of the Brooks Range. Climate, terrestrial ecosystems, multiple fluvial-deltaic aquifers, and structural architecture affected the liberation, movement, and redeposition of metals in ways that are incompletely understood.

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