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Title: GEOLOGY OF PALEOZOIC VOLCANOGENIC MASSIVE SULFIDE (VMS) DEPOSITS OF THE NORTHERN CANADIAN CORDILLERA

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Abstract: Paleozoic rocks of the northern Canadian Cordillera (north of 60o latitude) host ~35 million tonnes of volcanogenic massive sulfide (VMS) within the North American Miogeocline and pericratonic Yukon-Tanana terrane (YTT). Northern Cordilleran deposits range in composition from bimodal-felsic (Kuroko-type), felsic-siliciclastic (Bathurst-type), mafic (Cyprus-type), to mafic-siliciclastic (Besshi-type). The oldest deposits are ~365 Ma and include the felsic-siliciclastic Marg deposit within the Selwyn Basin, the bimodal-felsic MM and Wolf deposits of the Cassiar terrane, and the mafic-siliciclastic Fyre Lake deposit in the YTT in the Finlayson Lake district (FLD). Circa 360 Ma deposits include the bimodal-felsic Kudz Ze Kayah and GP4F deposits in the YTT of the FLD. This district also hosts the high grade and silver-rich, Mississippian (~347 Ma), felsic-siliciclastic Wolverine deposit. The youngest deposit is the mafic Ice deposit hosted by Permian (~274 Ma) rocks of the Slide Mountain terrane in the FLD.

The Devonian-Mississippian deposits of the northern Cordillera formed in response to back-arc rifting of the Yukon-Tanana arc from the North American craton. Far field stresses induced extension and associated volcanic activity within miogeoclinal strata forming the late Devonian (~365 Ma) Marg, MM, and Wolf deposits; these deposits were also broadly coincident with sedimentary exhalative (SEDEX) deposits in the miogeocline, and VMS deposits in the Delta and Bonnifield districts in Alaska. Coincident arc rifting within the outboard YTT resulted in the formation of the Fyre Lake deposit and subsequent continental back-arc rifting resulted in formation of the Kudz Ze Kayah and GP4F VMS deposits at ~360 Ma. Following 360 Ma there were no further VMS deposits formed within the North American Miogeocline. Continued back-arc rifting within the YTT, however, led to the formation of the Wolverine deposit at 347 Ma. There was a lull in hydrothermal activity from Early Mississippian to Permian times as continued back-arc spreading resulted in the formation of the Slide Mountain ocean, a back-arc basin between the fringing YTT arcs and North American craton. The final pulse of Paleozoic exhalative activity occurred in the Permian (~274 Ma) with the formation of the mafic Ice deposit within the Slide Mountain ocean.

All the VMS deposits of the Northern Cordillera formed within extensional geodynamic settings (back-arc rifts, arc rifts) and are associated with high temperature felsic (A-type,

peralkaline) and/or mafic (MORB, boninites) magmatism. Furthermore, most deposits are associated with local (and global) ocean anoxia. It was this combination of extensional activity (fluid conduits), elevated heat flow (driver of the hydrothermal systems), and anoxia (enhanced preservation and/or source of reduced sulphur) that led to this significant pulse of syngenetic (VMS and SEDEX) mineralization within the northern Cordillera in the mid-Paleozoic.