MAGMATIC FE-NI-CU-(PGE) SULPHIDE DEPOSITS IN MAFIC AND ULTRAMAFIC IGNEOUS ROCKS

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Magmatic Fe-Ni-Cu-(PGE) sulphide deposits occur throughout geologic time. The host rocks are normally the most magnesian cumulate (most channelized) rocks (dunite, peridotite, gabbro) in the sequence and are interpreted to be derived from the most magnesian (hottest) magmas in the sequence. Those at most Archean and some Proterozoic deposits are derived from more magnesian magmas (komatiite) and are extrusive, whereas those at most Phanerozoic and some Proterozoic deposits are derived from less magnesian magmas (komatiitic basalt, ferropicrite, and picrite) and are intrusive. These evolutionary changes probably reflect fundamental and irreversible changes in the thermal structure of the Earth's mantle and crust. The host units commonly exhibit geological, stratigraphic, geochemical, and/or isotopic evidence of crustal contamination and in most cases S appears to have been derived from crustal rocks via thermo-mechanical erosion and/or devolatilization. The compositions of the ores and the degrees of contamination and/or chalcophile element depletion in the host rocks vary depending on the compositions of the magma and the contaminant, the partitioning behavior of the various elements at the prevailing temperature, pressure, fS2, and fO2, and the relative masses of silicate magma and sulphide melt (R factor) in the system. Ores associated with intrusive rocks are commonly differentiated into Cu-PGE-rich and Cu-PGE-poor facies, probably reflecting a combination of fractional crystallization of MSS and or sulphide liquid immiscibility during slow cooling, whereas those associated with volcanic rocks are commonly less differentiated, reflecting a more rapid cooling history. Most deposits have been modified by subsequent hydrothermal alteration, deformation, and/or metamorphism.