Model 5a

DESCRIPTIVE MODEL OF DULUTH Cu-Ni-PGE

By Norman J Page

DESCRIPTION Sporadically distributed massive to disseminated sulfides associated with basal portion of large layered intrusions in rift environments.

GENERAL REFERENCE Weiblen and Morey (1980).

GEOLOGICAL ENVIRONMENT

Rock Types Peridotite, harzburgite, pyroxenite, norite, augite, troctolite, anorthosite. Associated with pyritic shale, anhydrite, or recognizable source of sulfur to contaminate magma.

Textures Cumulus textures, locally diabasic or ophitic textures.

Age Range Precambrian to Tertiary(?).

Depositional Environment Intruded during rifting into metasedimentary (slate, argillite, graywacke) and metavolcanic rocks.

Tectonic Setting(s) Rift environment.

DEPOSIT DESCRIPTION

Mineralogy Pyrhotite + pentlandite + chalcopyrite + cubanite ± PGE minerals ± graphite.

Texture/Structure Disseminated, matrix, and massive sulfides.

Alteration Locally sulfides may show evidence of hydrothermal remobilization.

Ore Controls Zone of active syn-intrusion faulting forming basins, in basal part of intrusion; source of external sulfur; source of silicic material to contaminate magma.

Geochemical Signature Ni/Cu approximately 1/3, Cu, Ni; PGE, Co, Ti; sulfur isotopes show non-magmatic sulfur.

EXAMPLES

Duluth Complex, USMN (Dunka Road deposits)	(Weiblen and Morey, 1980; Bonnichsen, 1972; Ripley, 1981)