A Gold- and Platinum-Mineralized Layer in Gabbros of
The Kap Edvard Holm Complex: Field, Petrologic, and Geochemical
Relations

JOHN G. ARNASON †,* AND DENNIS K. BIRD
Department of Geological and Environmental Sciences Stanford University,
Stanford, California 94305-2115

Abstract

The Lower Layered Series a cumulates of the Kap Edvard Holm Complex contain a
stratiform layer, 1 to 20 m thick and > 6 km long, that is mineralized with gold and
platinum-group elements (PGEs). The Lower Layered Series a cumulates (>650 m thick)
are dominated by modally layered gabbro with lesser volumes of granular anorthosite and
troctolite that together form 2- to 30-m-thick layers that are most abundant above the
mineralized layer. Minor volumes of poikilitic wehrlite form a few 1- to 2-m-thick layers
throughout the section. Field and petrographic relations as well as cryptic variations in
cumulus mineral compositions indicate that the Lower Layered Series a formed in an
open system magma chamber from repeated magma injections.

Within the mineralized layer, average concentrations over 3 m thickness are 250 ppb
Pt, 40 ppb Pd, and 50 ppb Au, with individual samples containing up to 5 ppm Pt and 6
ppm Au. The concentrations of Ir, Os, Ru, and Rh are uniformly low (<20 ppb).
Stratigraphic zoning of Pt, Pd, and Au is consistent along strike with peak Au
concentrations overlying Pt and Pd peaks. Platinum minerals are primary Pt-Fe alloy,
sperrylite, and moncheite, with secondary Pt sulfide overgrowths. Gold occurs as alloys
with Ag and Cu. These minerals are found in contact with primary and secondary
silicates and oxides and with intercumulus base metal sulfides that consist of the
assemblage bornite + chalcopyrite + digenite.

Deposition of the mineralized layer is associated in space and time with injections of
plagioclase-saturated, primitive magma that mixed with more evolved, resident magma.
These events caused efficient partitioning of Au and PGE into sulfides derived from a
large volume of magma, deposition of these sulfides to form the mineralized layer, and
subsequent deposition of the overlying anorthosite layers. The wehrlite layers, however,
were formed by postcumulus reactions between gabbro cumulates and hydrous,
intercumulus melts, probably derived from the compacting cumulus pile. Subsolidus
reactions between primary minerals and meteoric hydrothermal solutions caused
extensive alteration of the mineralized gabbro, oxidation and desulfurization of Cu-Fe
sulfides and local recrystallization of PGE minerals.