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Chromitites from Eikland Mountain, Yukon: A Potential Source for Platinum Placers of SW Canada?

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INTRODUCTION

Discovery of Platinum Group Minerals (PGM) in gold placer deposits of SW Yukon has been repeatedly reported to the Yukon Geological Survey (e.g. Fedortchouk & LeBarge, 2008). However, the source rocks for these PGM remain uncertain.

Recently, Escayola et al. (2012) reported the occurrence of PGE-rich chromitite veins within the Eikland Mountain ultramafic massif (SW Yukon, Canada). Preliminary data on Platinum Group Elements (PGE) distribution indicate these chromitites as the possible source rock for Pt-rich PGM found in nearby placers. However, PGM detected in polished sections were too small (<5µm) to achieve precise quantitative determination by Electron microprobe Analysis (EMPA).

In this work we present quantitative data on PGM concentrates from one sample of dunite with high-grade chromite mineralization. The concentrates were obtained by applying innovative hydroseparation technique (HS) at the HS-11 laboratory of the University of Barcelona, which allowed collection of a good number of PGM grains with a size suitable for mineralogical investigation.

GEOLOGY OF EIKLAND MOUNTAIN

The 40km² ultramafic massif of Eikland Mountain is part of the SW Yukon Ultramafic Complex (Fig. 1). It consists of slightly serpentinized peridotites (60% dunite; 40% harzburgite), with a poorly developed crustal sequence of gabbro. A true diabase sheeted dyke complex is missing, while volcanic and sedimentary rocks are rare.

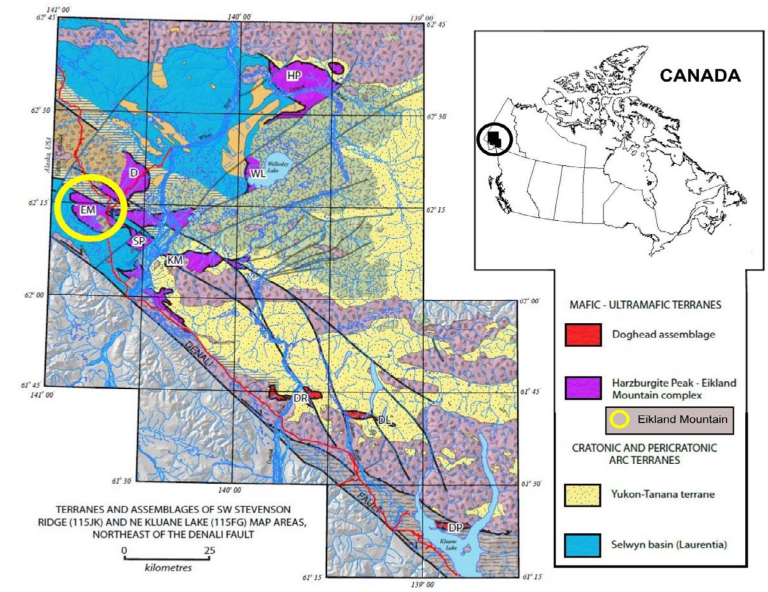

fig 1. Geological overview of the SW Yukon ultramafic complex with the location of the studied area; adapted and modified from Escayola et al. (2012).

The harzburgite shows orthopyroxene banding and deformation features typical for the upper mantle in the vicinity of the Moho Transition Zone. Foliated dunite hosts disseminated euhedral to subhedral chromite grains (up to 5 mm), as well as thin (<15 cm thick) irregular veins of chromitite (Escayola et al., 2012).

CHROMITITES OF EIKLAND MOUNTAIN

Under the microscope, the chromitite shows a massive texture with equilibrium triple junctions among coarse chromite grains, thus indicating post-magmatic annealing and sintering processes at high temperatures. Solid inclusions of calcite, rutile, Na amphibole, albite, and apatite are frequent, along with accessory pentlandite partly altered to awaruite.

The matrix is mainly composed of olivine and minor amounts of magnetite and Ni-sulfide. EMPA analysis of primary chromite yielded a homogeneous composition, with a consistent #Cr (~0.45) and relatively high titanium contents in the range 0.41-0.62 wt% TiO_2 (Escayola et al., 2012).

Total PGE content is as high as 2.4 ppm in massive chromitite, but drops down to 153 ppb in dunite with low grade chromite mineralization. Chondrite normalized patterns are characterized by a positive slope due to PPGE (Rh+Pd+Pt) enrichment relative to IPGE (Os+Ir+Ru) (Escayola et al., 2012).

PGM OF EIKLAND MOUNTAIN

The PGM found in polished sections were not larger than 5 µm and therefore

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could be analyzed only qualitatively. Potarite (PdHg), alloys in the Pt-Fe-Cu-Ni system, sperrylite ($PtAs_2$) and rare irarsite (IrAsS) are the most common PGM. These generally occur within the silicate matrix or are associated with interstitial pentlandite and Fe oxides (Fig. 2). None of the PGM was found included in chromite crystals.

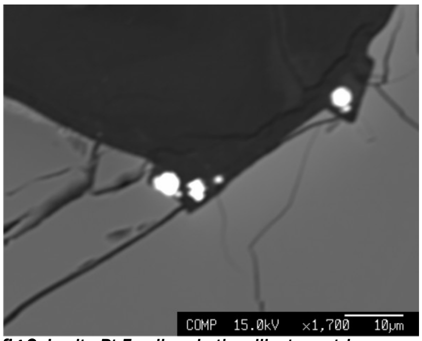

fig 2. In situ Pt Fe alloys in the silicate matrix.

Heavy mineral concentrates were obtained from a 652 g sample of dunite with chromitite mineralization by the use of the HS11-hydroseparator instrument operative at the University of Barcelona (see: Rudashevsky & Rudashevsky, 2001, 2007; Aiglsperger et al., 2011, and http://www.cnt-mc.com, for technical details). This innovative technique led to the discovery of 70 PGM grains up to 40 µm in size, suitable for quantitative analysis by EMPA.

Two populations of PGM were observed: 1) minute grains of potarite (<5µm) attached to pentlandite and/or Fe oxides, and 2) free grains of potarite, Pt-Fe-alloys with isoferroplatinum-type stoichiometry (Pt_3Fe), tulameenite (Pt_2FeCu) and sperrylite (Figs. 3, 4).

EMPA compositions of isoferroplatinum and tulameenite are plotted as atoms % in the Pt-Fe-(Cu+Ni) ternary system (Fig. 5).

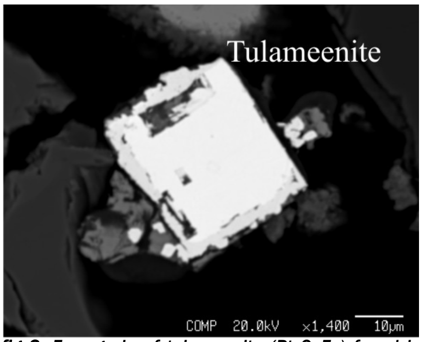

fig 3. Free grain of tulameenite (Pt_2CuFe) found in HS concentrate.

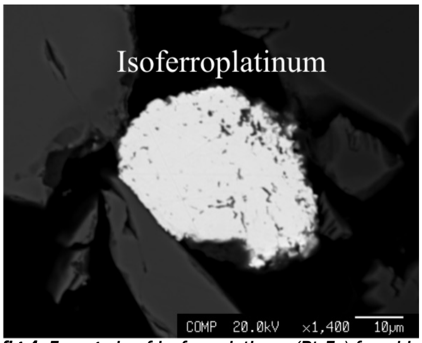

fig 4. Free grain of isoferroplatinum (Pt_3Fe) found in HS concentrate.

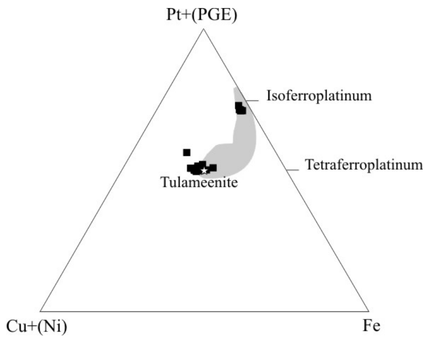

fig 5. Compositions of Pt-Fe-Cu-Ni rich PGM found in HS concentrate. Gray field are Pt alloys from selected Ural-Alaskan chromitites (Garuti et al. 2002).

CONCLUDING REMARKS

Dunite with chromitite mineralization from the Eikland Mountain ultramafic massif (Yukon) has been studied as to their PGE content and mineralogy. Total PGE content of chromitite reaches 2.4 ppm, with a remarkably positive chondrite-normalized pattern due to Pt+Pd enrichment.

The PGE mineralogy reflects the PPGE dominated geochemistry consisting of abundant potarite, alloys in the Pt-Fe-Cu-Ni system, sperrylite and rare irarsite. The PGM found in situ were less than 5 µm in size. In contrast, those found by the use of HS reached up to a size of 40 µm and could be quantitatively analyzed by EMPA. The results of our mineralogical study suggest a relation between PGM in the chromitites of Eikland Mountain and PGM nuggets reported from placers of SW Yukon. Based on the mineralogy and composition of PGM nuggets, Fedortchouk et al. (2010) have proposed the possible contribution of an Alaskan-type source for some placer deposits of Yukon. However, our field observations coupled with PGE geochemical data from the dunite-chromitite assemblage do not support an Alaskan-type affinity for the Eikland Mountain ultramafic massif.

This study is an unambiguous example how innovative HS supports traditional methods to gain valuable insights in heavy mineral research.

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