Petrologic and mineralogical observations from the Ovoid ore body - Voisey's Bay Ni-Cu sulfide deposit, Canada - Implications for the formation of the ore body

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Magmatic Ni-Cu platinum-group elements (PGE) sulfide deposits are commonly hosted in mafic-ultramafic rocks, which formed from mantle derived silicate magmas. To form Ni-Cu-PGE deposits it is necessary for the magma reach early sulfide saturation and become saturated in an immiscible sulfide liquid capable of collecting the PGE and other chalcophile elements. During the crystallization of the sulfide liquid, Fe-rich monosulfide solid-solution (*mss*) crystallizes first and collects Re, Os, Ir, Rh and Ru. As the system cools, Cu-rich intermediate solid-solution (*iss*) crystallizes and collects Ag, Cd and Zn. However Pt, Pd, Au, Bi, As, Te and Sb are incompatible with *mss* and *iss*, and concentrate into a residual liquid. The residual liquid, crystallizes platinum-group minerals (PGM), among the *mss* and *iss*. Finally when the temperature is <650°C, pyrrhotite and pentlandite exsolve from the *mss* and chalcopyrite ± pentlandite exsolve from the *iss*. The Voisey's Bay deposit (1.33Ga) is related to a troctolite-anorthosite ± granite plutonic suite located close to tectonic province boundaries. This deposit was formed at depth (~14km), which results in slow cooling and enough time to exsolve coarse grains of base metal sulfides minerals, and also exsolve PGM. Thus far, Voisey's Bay is the only significant deposit in this geological context. The main objective of this project is to study the massive sulfides from the Ovoid ore body from the Voisey's Bay deposit, in order to document and describe the distribution of PGE and other chalcophile elements distribution among the base metal sulfide minerals. Petrography, whole rock analysis, SEM analysis were carried out. The next step of this project will be carry out LA-ICP-MS analysis and mass balance calculations in order to develop a model of trace elements distribution in the Ovoid. Preliminary results show two different sulfide mineral assemblages: *Fe-rich* comprises pyrrhotite, troilite, pentlandite and ± chalcopyrite. *Cu-rich* comprises cubanite, ± chalcopyrite, ± pentlandite. Magnetite, minor galena and sphalerite occur in both assemblages. Troilite and cubanite exsolve in temperature <200°C which means that the magma is enriched in Fe. Also the whole rock analyzes indicate a magma poor in PGE. The Ovoid cooled slowly so there is enough time to form extensions exsolutions of PGM and Bi-As-Te phases that could be observed in massive sulfides during the SEM analysis.