Controls on magmatic Au-PGE mineralisation in the Skaergaard Intrusion, East Greenland

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The Platinova Reef of the Skaergaard Intrusion in East Greenland comprises a resource of 203 million tonnes @ 0.88 g/t Au, 1.33 g/t Pd and 0.11 g/t Pt [1]. The Skaergaard Intrusion was formed from a single batch of magma that crystallized in its entirety as a closed system [2]. Unlike all other examples of significant magmatic PGE and Ni-Cu-PGE mineralization, the Skaergaard rocks exhibit no evidence of contamination by S-bearing crustal rocks, the major factor responsible for driving magmas to sulphide saturation and ore genesis [3]. Although the Skaergaard rocks and mineralized zones have extremely low S contents, the mineralization is believed to be the product of late stage sulphide saturation of the magma. Factors that drove the magma to sulphide saturation include: (1) prolonged build up of S and Cu in the residual melt of the fractionating magma; (2) crystallization of magnetite which resulted in a decrease in FeO and in the conversion of SO^{-4} to S^{-2} (3) saturation in Cu sulphides as a result of fractionation; and (4) cooling of the magma [4]. High quality PGE, Au, Cu, S, Se data and other geochemical data for samples from a detailed stratigraphic section through the Skaergaard intrusion are used to model these elements throughout its crystallization history, estimate their concentrations in the Skaergaard parental magma, and to establish the timing of sulphide saturation and the causes of PGE-Au mineralization.

The Skaergaard magma first became sulphide saturated ~300m below the Platinova Reef. However, sulphide saturation was initially limited to the border zone between the magma and the crystallization front. The remaining magma in the chamber did not become completely sulphide saturated until after the formation of the Platinova Reef at which time there was a significant increase in the amount of Cu-rich sulphides segregating from the magma.

[1] www.platinaresources.com.au/projects/skaergaard/ [2] Andersen et al. (1998) Econ Geol 93, 488-509. [3] Keays & Lightfoot (2010) Miner Deposita 45. 241-257. [4] Keays & Tegner (2016) Jour Petrol, doi: 10.1093/petrology/egv075.