IMPACT-TRIGGERED, CONDUIT-TYPE Ni-Cu MINERALISATION, NORITE BELT, MANIITSOQ STRUCTURE, WEST GREENLAND.
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Introduction: Many of the largest impact structures on Earth host important economic resources, including the giant Ni camp at the base of the melt sheet in the Sudbury impact structure, Canada. The Ni-Cu (PGE) mineralisation in the norite belt near Maniitsoq in West Greenland, discovered the 1960s, has received new interest with the recent proposal of a giant impact structure at Maniitsoq [1] and the suggestion that the norite belt represents impact-triggered, crustally contaminated mantle melts [2].

The norite belt: The norite belt is a c. 75 km long, curvilinear field of numerous, unshattered norite–diorite plugs and inclined sills that occur in the eastern, heavily shattered and hydrothermally altered part of the Maniitsoq impact structure [1, 2]. The intrusions commonly have proto-orbicular texture indicative of rapid cooling of superheated magma, and have wide, hybrid contact zones with the host orthogneisses. They are unshocked but in part heavily hydrothermally altered. The norites have mantle-like, strongly suprachondritic Ru/Ir, Rh/Ir, Pt/Ir and Pd/Ir ratios similar to high-Mg basalts [2].

Ni-Cu mineralisation: More than 50 pyrrhotite-pentlandite-chalcopyrite-pyrite-mineralised localities with uniform characteristics are known [3]. The Ni tenor is uniformly high, averaging 6–9% Ni recalculated to 100% sulphide. The whole-rock Ni content varies from 1–2 wt% over several to many metres, with additional 0.1–0.6% Cu, 0.01–0.07% Co, up to 0.2 ppm Pt and Pd, and up to 0.3 ppm Au. The sulphide minerals form interconnected, semi-massive networks with inclusion-bearing, breccia-like textures characterised by rounded, centimetre-sized and larger lumps of the host rock. These textures closely resemble those found in established magmatic, conduit-type Ni deposits around the World. At Sudbury, the metals were supposedly present in the upper-crustal rocks that sourced the melt sheet. At Maniitsoq, the PGE-metal spectra quoted above and high Cr and Ni contents in some intrusions suggest that the metals stem from the mantle melts and were exsolved as immiscible sulphide melts during the magma ascent due to variable crustal contamination.

Conclusions: There are two different types of impact-related, magmatic Ni-Cu (PGE) deposits: the upper-crustal Sudbury type exsolved from the impact melt sheet, and the lower-crustal Maniitsoq type exsolved from contaminated mantle melts.