

GEOCHEMISTRY OF POST-KINEMATIC MAFIC INTRUSIONS AT MANITSOQ, WEST GREENLAND: CONTAMINATED MANTLE MELTS OR IMPACT MELTS?

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Introduction: The ~2.975 Ga Maniitsoq structure in West Greenland may be a Mesoarchaean impact structure [1]. It is centred on a ~200km wide aeromagnetic anomaly and contains a near-circular, >40km wide homogenised granitoid core with a diffused boundary, surrounded by a still wider belt of shattered and brecciated country rock with variably deformed and down-graded quartz PDFs, dykes of fluidised microbreccia, abundant evidence of partial melting, and massive hydrothermal alteration. A 70 km long contemporaneous curvilinear belt of unshocked norite-diorite sills and diorite plugs with proto-orbicular textures, indicative of rapid cooling of superheated melt, occurs east of the core. The norites and diorites are geochemically diverse [2], with zones of sulphide mineralization and the aim of this study has been to test whether any could be downward injections of impact melt below the crater in the manner of offset dykes at Sudbury [3].

Results: Analyses for major elements, trace elements and platinum-group elements (PGE) were performed by ICP and ICP-MS. The norites-diorites display an enormous range of MgO (5.9-23.7wt%) and Cr (120-3600ppm) over a limited range of SiO₂ (47-59wt%). On Harker plots the intrusions fall on a general array, between primitive mantle melts and local gneisses/amphibolites, that is more extensive, dispersed and shows a stronger mantle component than typically found with impact melts [3]. Unmineralized high-Mg norites contain low concentrations of PGE (Ir = 0.03-0.2ppb). Mineralized norites may carry up to 10ppb Ir but sulphide metal tenors are low and high Cu/Pd ratios (10⁴-10⁶) indicate removal of PGE by immiscible sulphides before final emplacement. Norites and diorites typically display strongly suprachondritic Ru/Ir, Rh/Ir, Ru/Rh and Pt/Ir typical of mantle melts. However, one low-Mg diorite (283761) south of the structure core plots off the main compositional array and contains the highest concentration of Ir (0.59ppb), along with chondritic Ru/Ir, Rh/Ir and Ru/Rh ratios.

Discussion: The evidence suggests that most of the 2.975 Ga norite-diorite intrusions are not impact melts but represent contaminated mafic magma, intruding upwards from the mantle below the structure, possibly in response to post-impact decompression. However one intrusion sampled to date may represent impact melt injected downwards from a former overlying melt sheet.

References: [1] Garde, A.A. 2010. *Abstracts and Proceedings of the Geological Society of Norway* 1:57-58. [2] Garde, A.A. 1997. *Geological Survey of Greenland Bulletin* 177:115 pp. [3] Wood, C.R. and Spray J.G. 1998. *MAPS* 33:337-347.