LASER ABLATION MAPPING OF SIDEROPHILE ELEMENTS IN THE LATE ARCHAEAN REIVILO IMPACT SPHERULE LAYER, SOUTH AFRICA.

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Introduction: Layers of spherules formed during late Archaean to early Proterozoic impacts have been recognised in the coeval Hamersley Basin of western Australia and the Griqualand West basin of South Africa [1]. Three spherule layers in the Hamersley Basin (the Jeerinah, Paraburdoo and Dales Gorge layers) can be correlated with equivalents (Monteville, Reivilo and Kuruman) in the Griqualand West Basin [2]. The Paraburdoo-Reivilo layer is remarkable in that it contains an extremely high (up to 40%) extraterrestrial component (ETC), represented by platinum-group element (PGE) contents, similar to some early Archaean spherule layers [3,4] from Barberton. The high ETC present in the layer allows in-situ trace element mapping of the distribution of the extraterrestrial components within and around impact spherules in order to constrain the processes by which they formed and the manner by which projectile material became incorporated.

Methods: Individual spherules (or clusters of spherules) and surrounding matrix from the Reivilo layer were mapped by time resolved laser ablation ICP-MS using a 12 micron laser beam and similar procedures to those described by [5]. The isotopes used for analysis were ^{24}Mg, ^{27}Al, ^{29}Si, ^{34}S, ^{39}K, ^{44}Ca, ^{47}Ti, ^{51}V, ^{52}Cr, ^{55}Mn, ^{57}Fe, ^{59}Co, ^{61}Ni, ^{65}Cu, ^{66}Zn, ^{75}As, ^{95}Mo, ^{99}Ru, ^{103}Rh, ^{106}Pd, ^{107}Ag, ^{121}Sb, ^{125}Te, ^{140}Ce, ^{185}Re, ^{189}Os, ^{193}Ir, ^{195}Pt, ^{197}Au and ^{209}Bi. NIST610 was used as a reference standard and for repeat analyses to monitor drift over the analytical run.

Results: Element maps produced to date suggest that Os, Ir, Ru, Rh, and Pt, Ni and Co are confined to the interiors of spherules but also that some spherules are free of siderophiles. The PGE occur most notably as microparticles (nuggets?) that occur close to spherule rims and not evenly through the spherule. Palladium and Au are present at low concentrations and concentrated in the matrix between spherules. Some spherules have been infilled or partially replaced by sulfides (millerite, pyrite, chalcopyrite). These have elevated Ni, Cu, and Co contents, but the sulfides are free of PGE and PGE peaks elsewhere never coincide with elevated S. Other elements, such as Mg, Mn, and Fe, are depleted in the spherules and concentrated in the matrix.

Discussion: The presence of spherules with high temperature PGE nuggets and also siderophile-free spherules is significant. If these findings are confirmed by further work, it suggests the spherules formed from a mix of projectile-rich and projectile-free impact melts, not a homogenized cloud of rock vapor. [1].

References: [1] Simonson B., et al. 2009. *Precambrian Research* 169: 100-111. [2] Hassler S.W., et al. 2011. *Geology* 39: 307-310. [3] Simonson B., et al. 2009. *Precambrian Research* 175: 51-76. [4] Kyte F., et al. 1992. *GCA* 56: 1365-1372. [5] Ulrich T., et al. 2009. *Can. Mineral.* 47: 1001-1012.