PGE CHEMISTRY AND SYSTEMATICS OF SOME ARCHEAN SPHERULE LAYERS IN THE BARBERTON MOUNTAIN LAND.

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The oldest known impact ejecta layers on Earth are represented by Archean spherule layers in the Barberton Greenstone Belt (BGB, South Africa) and the Pilbara craton (West Australia) [e.g., 1,2]. Primary geochemical characteristics preserved in the spherule layers may provide insights regarding the impact processes, target material and the extraterrestrial projectiles involved. Comprehensive studies of petrographic, mineralogical, and geochemical characteristics from a set of newly drilled Archean spherule layer material in drill core CT3 from the northeastern part of the BGB are being carried out. Our research on CT3 spherule bed intersections from the 3.26 Ga Fig Tree Group places a special focus on the identification and localization of phases potentially hosting an extraterrestrial PGE signature. This investigation is based on the recent discovery of sub-µm sized PGE micro-nuggets in a concurrent project on spherule layers in ICDP drill core BARB5 from the BGB [4].

Using low voltage SEM-EDS analysis (6 kV), we [4] identified accumulations of sub-µm sized PGE phases in direct association with Ni-Cr spinel. PGE phases in the matrix between internally broken Ni-Cr spinel grains contain varying amounts of sulfur and arsenic, likely due to secondary overprint, whereas primary PGMs within Ni-Cr spinel are metal-dominated (directly derived from the projectile or the result of condensation from a vapor plume?). We identified Ni-Cr spinel clusters as local neighborhoods of PGE enrichment – proving that local ultrahigh (> bulk chondritic values) PGE enrichments are due to scavenging of PGE by Ni-Cr spinel. In CT3 17 spherule layer intercalations have been identified over a stratigraphic interval of 150 m. Using the CT3 core material, we aim to address the - in our opinion - most relevant questions raised by our investigation of spherule layers in these Archean rocks: (1) Are the observations from the current BARB5 project representative also for other spherule layer intersections with respect to the composition of PGE micro-nuggets and the occurrence of such nuggets within and between Ni-Cr-spinels? (2) Are PGE micro-nuggets primary meteoritic phases of the impacting body or the product of impact melting or condensation from the vapor plume, or have they been affected by postimpact secondary processes?

Further petrographic and textural analyses, as well as quantitative analysis at the sub-microscale by SEM, EMPA, and TEM of PGE phases and host material, are being carried out and results will be reported at the meeting, to better understand the impact spherule formation and emplacement processes.

Refs: [1] Lowe D. R. et al. (2003) *Astrobiology*, 3, 7-47. [2] Lowe D. R. et al. (1989) *Science*, 245, 959-962. [3] Johnson B. C. and Melosh H. J. (2014) *Icarus,* 228, 347-363. [4] Mohr-Westheide et al. (2015), Geology 43, 299-302.