Melt related textures in a new, spinel-bearing, monomict ureilite – Ramlat as Sahmah 517

Å. V. Rosén[1], J. Pape[1], B. A. Hofmann[1,2], E. Gnos[3] & M. Guillong[4] [1]Institute of Geological Sciences, University of Bern, Baltzerstrasse 1+3, 3012 Bern, Switzerland. Email: ake.rosen@geo.unibe.ch, [2]Natural History Museum Bern, Switzerland, [3]Natural History Museum of Geneva, Switzerland [4]Insitute of Geochemistry & Petrology, ETH Zurich, Switzerland

Introduction: A single 15 gram stone was found in February 2015 while searching the desert plain during a meteorite search campaign in Al Wusta, Oman. The stone has well-preserved fusion crust and appears complete. RaS 517 is a monomict ureilite of the augite-bearing variety consisting mainly of olivine, augite and low-Ca pyroxene with augite present as inclusions in low-Ca pyroxene and as anhedral grains in the matrix. Silicates display no indications of strong shock. Olivine has characteristic reduced rims and carbon phases consist mainly of graphite with minor diamond. Conspicuous features include large (1.7 mm) skeletal grains of chromium-rich spinel and thin fringes of silica- and aluminum rich glass around spinel and matrix silicate grains. Spinel-associated glass encloses micron-sized euhedral spinel grains and a fine-grained mixture of submicron-sized spinel with pyroxene interstitial to surrounding silicates. Glass surrounding augite in the matrix hosts enstatite-rich pyroxene which apparently grew around partly consumed augite grains as micron-sized, dendritic aggregates. Ca-rich pyroxene has crystallized on reduced olivine rims in contact with glass.

Geochemistry: The sample was investigated using various analytical methods including electron microprobe analysis, Raman spectroscopy and laser ablation ICP-MS. Olivine cores have Fo_{77} with average Fe/Mn=46 and Cr_2O_3=0.36 wt%. Pyroxene compositions are, for augite Fs_{12}, Wo_{34} and for low-Ca pyroxene Fs_{19}, Wo_4. Spinel displays compositional zonation with rare grain patches less rich in Cr_2O_3 and MgO. Glass compositions are highly variable with measured compositional ranges of SiO_2 71-84, Al_2O_3 9-18, FeO 0.2-1.5, Na_2O 1-5, CaO 0.1-1.1, K_2O 0.5-1 wt%. Lithophile trace elements patterns in the main carrier augite are similar to those of Group B bulk ureilites in [1] and show no signs of extensive terrestrial contamination.

Discussion: RaS 517 shows several textural similarities with the well-studied sample LEW 88774 [2] as described in [3] although, main silicate compositions are different. Similarly to what has been described from silica- and aluminum-rich glasses in LEW 88774, NWA 776 [3] and Asuka 881931 [4], glass in RaS 517 shows negative correlation of SiO_2 against Al_2O_3, CaO and Na_2O. Previous suggestions of aluminum-rich melt having been present before ureilite mantle disruption ([4], [5]) are supported by glass composition, compositional zonation and secondary calcium-rich pyroxene, inferred to have crystallized rapidly on reduced olivine rims in contact with glass. Additional geochemical data and further discussion of implications for sample petrogenesis will be presented.

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References:

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