Dar Al Gani 896: A unique picritic achondrite

Conference or Workshop Item

DAR AL GANI 896: A UNIQUE PICRITIC ACHONDRITE.
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DaG 896 is the provisional name assigned to a dark, 50% fusion crusted, stony fragment of 22.6 g found in the Dar al Gani region of the Libyan Sahara (~27°08'N – 16°05'E) in November 2000.

Mineralogy: DaG 896 is hypocrystalline with porphyritic texture (porphyritic index ~70). Abundant fine-grained (avg. grain-size 100 μm), skeletal forsterite crystals (avg. Fo_{82}) are set in a groundmass consisting mainly of rhyolitic glass plus quench microlites of pigeonite (En_{54} Wo_9). Minor mineral constituents include enstatite (En_{83} Wo_2), augite ($En_{37}Wo_{30}$) and traces of chromite, troilite, Fe-Ni metal and phosphates. Veinlets up to 15 μm thick of secondary carbonates are most likely due to terrestrial weathering. Mineral mode (vol. %) is forsterite 69, glass 17, clinopyroxene (pigeonite >> augite) 8, enstatite 4, carbonates 1, others 1. Strong undulose extinction and planar fracturing in olivine and mm-thick interconnecting veinlets indicate moderate shock S4, after [1]. Fe/Mn a.p.f.u. ratios for olivine and pyroxenes (35 and 18, respectively) are chondritic [2]. No achondrite with the above texture and mineral composition is documented in literature [e.g., 2]. Similar textures and mineral compositions are in turn observed in some igneous inclusions in ordinary chondrites [e.g. 3].

Bulk chemistry: XRF and ICP-MS major and trace element concentrations indicate an high-Mg (mg# 79.2) picritic *IUGS* composition (SiO_2 = 47.62, Na_2O = 0.16, K_2O = 0.24, MgO = 30.3 wt %) with a chondritic [Mn/Mg] = 7.5 $*10^{-3}$ ratio. The overall composition is similar to H-chondrites [4] (e.g., Mg/Si = 0.83, Al/Si = 0.073, Ti/Si = 0.006) except for a strong depletion in siderophile and chalcophile elements (e.g., Fe/Si = 0.50, Fe/Ni = 254 and S/Si = 0.009). A close major element compositional match is found with the harzburgitic igneous inclusion in the Y-794046 H5 chondrite [5], [6] and [7] and the komatiite-like lithic fragment in the Eva H4 chondrite [3]. Anomalously high concentrations of Cs, Rb, Sr and Pb suggest some terrestrial contamination.

Oxygen isotopes: Mean data from two replicates are $\delta^{17}O$ = 2.55, $\delta^{18}O$ = 3.50 and $\Delta^{17}O$ = 0.726 ± 0.007 ‰. The $\Delta^{17}O$ value is typical for equilibrated H-chondrites [8], although the $\delta^{18}O$ ratio is slightly offset to the light side for this grouping.

Conclusions: i) DaG 896 is a unique picritic achondrite; some igneous inclusions in ordinary chondrites are the closest existing analogs. ii) DaG 896 formed through rapid cooling of a high-temperature melt likely representing the silicate fraction of H-chondritic source material, which underwent severe heating, melting and metal plus sulfide loss.

References: [1] Stöffler D. et al. (1991) *GCA, 55,* 3845-3867. [2] Papike J. J., ed. (1998) *Rev. Mineral., 36.* [3] Ruzicka et al. (1998) *GCA* 62, 1419-1442. [4] Jarosewich E. (1990) *Meteoritics 25,* 323-337. [5] Nakamura N. et al. (1994) *Proc. NIPR Symp. Antarct. Meteorites, 7,* 125-143. [6] Sack R. O. et al. (1994) *JGR, 99, E12,* 26029-26044. [7] Mittlefehldt D. W. et al. (1995) *Proc. NIPR Symp. Antarct. Meteorites, 8,* 251-271. [8] Clayton R. N. et al. (1991) *GCA, 55,* 2317-2337.