GRANITOID CLAST IN HOWARDITE: DIVERSITY AMONG EVOLVED VESTAN LITHOLOGIES

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Introduction: Howardites contain an array of lithic fragments that suggest other minor lithologies may be present locally on Vesta [1, 2, 3, 4]. The petrogenesis of these fragments evokes models that are consistent with a magma ocean, which could produce residual liquids similar to KREEP lithologies on the Moon, extraction of residual liquids from partial melting of eucrites [5], or impact melts from micrometeorites that have effectively oversampled portions of the eucritic crust to produce Ca-rich and K-rich impact melt spherules [4]. Here we report a recent finding of a clast in the Dominion Range howardite pairing group that contains K-feldspar, and is rich in silica (~30 vol %), otherwise absent in the howardite-eucrite-diogenite (HED) meteorites.

Methods and Results: A granitoid clast from DOM 10100 approximately 4 mm x 4 mm displays subophitic and granulitic textures locally, and consists of plagioclase (An_{86-84}), pyroxene (En_{37-28}; Wo_{2-40}), silica (tridymite?), troilite, ilmenite, FeNi metal (Ni 3-12 wt %), minor phosphate (apatite and merrillite) and K-feldspar. The clast is dominated by plagioclase and silica; however, large (300 μm) pyroxene grains ophitically enclose plagioclase. Troilite, ilmenite, and FeNi metal occur as amoeboid-shaped grains, which do not seem to have any spatial correlation with other phases. Often, but not exclusively associated with plagioclase rims are grains of K-feldspar (Or_{98-99}), up to 60 μm in longest dimension, that contain 0.8-1.5 wt % BaO. The K-feldspar grains do not represent glass with high K_2O concentrations because they are stoichometrically correct. Phosphates occur as irregularly-shaped grains ranging in size from 10-90 μm. The fluorine content of apatite ranges from 3.3 wt % to assumed pure fluoroapatite (3.8 wt %).

Discussion: The granitoid clast is similar to basaltic eucrites with respect to plagioclase and pyroxene compositions; however, it contains too much silica, oxides, sulfides, and FeNi metal to be classified with eucrites [6]. This clast may ultimately be useful in discriminating between the competing hypotheses for evolved melts on Vesta: a fractionated residual melt pocket [4] or a KREEP-like lithology from a magma ocean [3]. Although the assemblage may be a mesostasis pocket, its large size and homogeneity may suggest otherwise. Similar clasts from separate thin sections of the DOM pairing group suggest that this clast is not an unrepresentative sample. We believe we have discovered an evolved granitoid lithology from Vesta, the large size and composition of which make this clast unique among previously described, evolved <1 mm fragments and glasses [e.g. 1,2,3,4].

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