COMPOSITION AND PETROLOGY OF HED POLYMICT BRECCIAS: THE REGOLITH OF (4) VESTA.

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The polymict breccias of the howardite, eucrite and diogenite (HED) clan of meteorites preserve records of regolith processes that occur on Vesta, their putative home world. These breccias – howardites, polymict eucrites and polymict diogenites – are impact-engendered mixtures of diogenites and eucrites. The compositions of polymict breccias can be used to constrain the lithologic diversity of the vestan crust and the excavation depths of these materials [e.g. 1]. We have done petrological and compositional studies of multiple samples of 5 polymict eucrites and 28 howardites to investigate these issues. Older analyses were done on samples of ~0.5 gram mass by INAA; newer analyses on samples of ~5 gram mass by XRF and ICP-MS.

We estimate the percentage of eucritic material (POEM) [2] of polymict breccias by comparing their Al and/or Ca contents to those of average basaltic eucrite and diogenite. Our samples have POEM ranging from 28 to 98; adding two polymict diogenites from [3] extends the range to POEM 10. One hypothesis is that ancient, well-mixed vestan regolith has POEM ~67 and has a higher content of admixed impactor material [1]. Several of our howardites have POEM of 59-74 (Al and/or Ca contents ±10% of POEM 67); about a third have Ni contents >300 µg/g suggesting they contain >2% chondritic material (CM and/or CR; [4]). These may be regolithic howardites [1]. Only one (LEW 85313) contains Ne dominated by a solar wind (SW) component [5]. PCA 02066 is dominated by impact-melt material of polymict parentage and petrologically appears to be a mature regolith breccia, yet it does not contain SW-Ne [5]. GRO 95602 falls within the POEM window, contains SW-Ne [6], yet has a Ni content of 193 µg/g. Its petrologic characteristics suggest it was formed from immature regolith (no polymict breccia clasts; no glass).

Trace element characteristics of the polymict breccias demonstrate the dominance of main-group eucrites as the basaltic component. Mixing diagrams of Zr, Nb, Ba, Hf and Ta with Al show no evidence for a significant contribution from Stannern-trend eucrites. An exception is polymict eucrite LEW 86001 (POEM 92), which is dominated by Stannern-trend basaltic debris. Howardite LAP 04838 (POEM 84) has higher incompatible trace concentrations than other polymict breccias (excluding LEW 86001), and either contains a Stannern-trend basaltic component, or has a significant contributions from evolved eucrites like Nuevo Laredo.

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