IN THE PURSUIT OF REGOLITHIC HOWARDITES.

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Introduction: The HED (Howardite, Eucrite and Diogenite) meteorite clan likely originate from the asteroid 4-Vesta [1]. Howardites (polymict breccias of eucritic and diogenitic material) are believed to originate from the vestan surface, and many contain regolith-like features (impact and/or melt clasts, fragmental breccia clasts, carbonaceous chondrite fragments), which may relate to regolith-formation processes. Noble gas analysis can help determine true regolithic nature, as Solar Wind (SW) is implanted into grains at the upper-surfaces of solar system bodies lacking an atmosphere or magnetic field. Howardites from Vesta's true regolith would thus show evidence for SW components.

Thus far, we have identified 5 regolithic howardites: LEW 85313; MET 00423; PRA 04401; SCO 06040 and EET 87513; based on our noble gas analyses, with the latter 3 showing some evidence for a planetary(+SW) component, likely related to CM-like material present in the assemblage [2-5]. However, we did not find a good correlation between SW content and other petrologic regolithic features. Nor did we find an obvious correlation between SW and high siderophile element contents (Ni > 300 µg/g), or an Al_2O_3 range of 8-9 wt% and eucrite/diogenite (E/D) ratio of 2:1 as suggested by [6] to be further regolith indicators. Here, we report our latest noble gas data for two howardites GRO 95535, GRO 95602 and a polymict eucrite EET 87518 in continuing research aimed at better understanding the vestan regolith.

Results: Noble gas analysis was performed on an MAP 215-50 noble gas mass spectrometer using furnace step-heating. Our results, shown in Table 1, are compared with SW- (LEW 85313) and planetary-dominated (PRA 04401 ~60% CM) howardites [2]. EET 87518 is dominated by cosmogenic components. By comparison, both howardites show strong evidence for SW, with total $^{20}Ne/^{22}Ne$ ~8.7-8.8 (SW: $^{20}Ne/^{22}Ne$ 13.78 [7]), and identical release patterns to our other CM-poor SW-rich samples. This suggests that these samples are from the vestan regolith. As they have lower Ni contents than suggested by [6], this further illustrates that these parameters may show some bias [2].

Table 1: Latest howardite and polymict eucrite noble gas results compared with typical SW-rich and planetary dominated howardites [2].

	EET 87518	GRO 95535	GRO 95602	LEW 85313	PRA 04401
^{22}Ne (10^{-8})	5.6(1)	52.1(1.0)	6.1(1)	36.7(8)	6.6(3)
$^{20}Ne/^{22}Ne$	0.84(0)	8.74(4)	8.79(4)	9.68(4)	3.22(4)
$^{21}Ne/^{22}Ne$	0.851(12)	0.295(4)	0.238(4)	0.157(1)	0.670(6)
$^{20}Ne_t$ (10^{-8})	0.22(16)	441(21)	52(3)	347(22)	16.9(11)
Ni	81.9	98.6	193	804	4720
Al_2O_3	11.3	7.6	8.5	9.2	4.3
E/D	7.3/1	1.3/1	1.8/1	2.3/1	1.8/1

Ne concentrations in cc/g, Ni in µg/g, Al_2O_3 in wt%, errors in parentheses. t = trapped.

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