HED METEORITES IN THE LIGHT OF DAWN.

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Dawn spacecraft data support Vesta as the HED parent body [1], allowing the meteorites to be used as ground truth in Dawn's exploration of this asteroid. Here we turn the issue around and examine how Dawn data have changed perceptions and interpretations of HEDs. Multiple lines of evidence indicate that HEDs were extracted from the Rheasilvia basin, so eucrites, diogenites, and howardites cannot be mapped to extant sources on Vesta. The modest mass abundance of howardites suggests that breccias are not volumetrically dominant in the crust, even though Dawn data indicate that the present surface consists of polymict lithologies. Regolith thickness estimates (1-5 km) are considerably less than the nominal crustal thickness of ~20 km. Mapped distributions of H (and OH) concentration [2] may suggest that carbonaceous chondrite clasts in howardites were introduced when the Veneneia basin formed [3]. Areas mapped as basaltic eucrite represent the most ancient exposed surface, are were likely more widespread before the Rheasilvia impact. Cumulate eucrite is relatively uncommon on Vesta, consistent with its scarcity as a component of howardites [4]. Vesta's impact history recorded in $^{40}Ar/^{39}Ar$ ages of eucrites [5] is complex; however, the age of Rheasilvia and even whether or not its Ar age should be recorded is contested [6, 7] and presently unresolved by crater counting. Diogenite is exposed in the most deeply excavated portions of Rheasilvia. The overlapping Rheasilvia and Veneneia basins must have plumbed the upper mantle [8], implying that diogenites are either upper mantle rocks or plutonic samples from the crust-mantle boundary. Gravity data appear to support the existence of diogenite plutons [9]. The olivine abundance in the upper mantle must be less than ~25% (the limit for spectroscopic detection [10]); its scarcity suggests sequestering of olivine in the lower mantle. However, a few possible mantle-derived olivines occur in howardites [11], and isolated olivines occur where the vestan crust is thin. A chondritic model for the HED parent body [12] is consistent with Vesta's geophysical constraints, and differentiation models [13, 14] resolve some geochemical complexities in HED petrogenesis.

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