Introduction: Reflectance spectroscopy suggests that the asteroid 4 Vesta is the principal source of the HED meteorites [1]. In theory then, oxygen isotope analysis of the HEDs should provide important constraints on the formation and evolution of Vesta. However, a number of issues need to be resolved before this goal can be fully achieved.

Vesta’s intrinsic isotopic variation: Almost all HED meteorites fall in a narrow range of $\Delta^{17}O$ values [2,3,4], the recent study of [4] giving a mean value of $-0.242 \pm 0.016$ (2σ), consistent with a global melting event that homogenized Vesta [3]. One anomalous eucrite, NWA 011 [5], falls far outside this range and is clearly from a separate body. However, five others are closer in their $\Delta^{17}O$ values to the mean value and their status is more ambiguous: Pasamonte, NWA 1240, Ibitira, Asuka 881394, and PCA 91007 [4]. PCA 82502 is another probable example. If Vesta was homogenized isotopically then these anomalous eucrites are not from Vesta. In contrast, anomalous eucrites can be viewed as evidence that Vesta is isotopically heterogeneous [2].

Overlapping groups: Mesosiderites show similar isotopic variation to the HEDs and may also be derived from 4 Vesta [6]. It has recently been proposed that HEDs, mesosiderites and other related groups are all derived from a larger disrupted body [7]. While this possibility is contradicted by some geochemical evidence [8] it is clear that the relationship between HEDs and other groups with similar isotopic compositions is poorly understood.

Impact processes: HEDs generally show evidence of intense brecciation and may contain identifiable non-HED clasts [9]. The extent to which such extraneous material contributes to the isotopic heterogeneity of Vesta has yet to be fully evaluated.

Terrestrial weathering: Over 93% of HED samples are finds. Although various acid leaching techniques can be used, terrestrial contamination effects cannot be completely eliminated.

Conclusions: The discovery of eucrites with anomalous oxygen isotopic compositions [2-4] can be interpreted in favor of multiple parent bodies [4], a heterogeneous Vesta [2] or a combination of both. These possibilities cannot be resolved solely on the basis of oxygen isotopes, but require evidence from a range of geochemical and remote sensing sources. A more thorough evaluation of the isotopic heterogeneities introduced by impact and weathering processes is also of fundamental importance.