

## LITHOLOGICAL MAPPING OF VESTA USING DETAILED DISTRIBUTION OF PYROXENE COMPOSITIONS IN HOWARDITIC BRECCIAS

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**Introduction:** The howardites and other polymict breccias have distribution patterns of pyroxene composition that are equivalent to spectral variation on the Vestan surface. If the IR-spectral signature of a mixture of pyroxene compositions, that has some average composition, can be distinguished from the signature of a discrete pyroxene of the same composition[1-2], then the observed *composition distribution patterns (CDP)* in the howardites may be matched with spectral variations on the surface of Vesta observed by the Dawn spacecraft.

**H.E.D. Pyroxene:** The range of pyroxene compositions in the howardites is well known[3], but the CDP within that range in individual breccias is weakly constrained[4]. Pyroxene compositions reflect abundant diogenitic orthopyroxene ( $En_{80+}Wo_{0-3}$ ), and eucritic pigeonite ( $En_{50-30}Wo_{5-15}$ ), and other components[5]. Lithologies from peridotite to basalt and beyond are recognized as clasts in the HED suite. Mixing models, using diogenite and eucrite end members of various sorts are used to approximate the geochemical variations within the breccias, but such models often imply that chosen end members are the only significant components even though discrete components with intermediate compositions are present[6]. Observed patterns (CDP) in pyroxene composition space may be uniform, uni-, or multi-modal. Bimodal patterns (eucrite-diogenite) are common but not ubiquitous. Several howarditic breccias (Frankfort, Pavlovka, Hughes 005) have pyroxene distribution patterns that contain abundant intermediate compositions but have very minor diogenite and eucrite contents. Howardites sample source regions on Vesta with differing pyroxene distribution patterns and the patterns measured need to be matched to spectral compositional data to be returned from Vesta by the Dawn mission in 2011. The mineralogical variations from sample to sample presumably reflect both location and temporal differences on Vesta.

**Vestan Pyroxene:** Near to mid-IR spectroscopy of the Vestan surface is dominated by the pyroxene group and increasingly shows compositional variations typical of howardite pyroxene with lesser contributions of diogenitic and eucritic material<sup>1</sup>. The dichotomy between the southern crater province of Vesta (diogenite enriched lowland) and the presumably older surfaces of northern howarditic-eucritic uplands province of Vesta is reflected in the distribution of pyroxene compositions. The individual howardites may therefore be paired with specific regions on Vesta. Howardites without Vestan matches may reflect Vestoid samples. The modal CDP of howardite breccias are being remapped to constrain the relative abundance of different pyroxene compositions within each breccia sample.

**Summary:** Patterns of pyroxene distribution in howardites reflect the provenance of their source regions on Vesta (or vestoids) and need to be documented in detail for comparison with the anticipated spectral mapping by Dawn.

**References:** 1. Donaldson Hanna, K.L. and A.L. Sprague, *Met & Planet. Sci* 2009. **44**, 1755 2. Moskovitz, N., et al., *Icarus*, 2010. 3. Duke, M.B. and L.T. Silver, *Geochim Cosmochim Acta*, 1967. **31**, 1637 4. Prinz, M., et al., *Proc. Lunar Planetary Sci Conf*, 1980. **11<sup>th</sup>**, 1055 5. Delaney, J.S., in *Lunar and Planetary Science*. 1981, LPI. 14. 6. McSween, H., et al., *Space Science Rev.*, 2010.