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Plastic Deformation of Olivine-rich Diogenites and Implications for Mantle Processes on the HED Parent Body

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Thought to represent ejecta material from the mantle of the differentiated asteroid, Vesta [1], olivine-rich diogenites can provide insight into primary planetary processes. We present the results of Electron Backscattered Diffraction (EBSD) on three olivinerich diogenites of differing olivine content. All three samples yield well-defined LPOs. Comparison with recorded LPOs from terrestrial mantle rocks [2] unexpectedly indicates the occurrence of plastic deformation in all three diogenite samples, none of which are indicative of deformation by compaction or cumulate processes. These results impel us to consider a process where plastic deformation is the main LPO-forming mechanism of these diogenite samples on their parent body. Based upon known Vestan parameters [3], independent numerical modeling renders feasible large-scale downwellings in the upper mantle of Vesta during the first 100 Ma after CAI formation.

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