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Single Crystal Paleointensity Analyses of Olivine-Diogenites: Implications for a Past Vestan Magnetic Field

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Pioneering studies of meteorites and recent investigations have presented paleomagnetic data suggesting some parent bodies had dynamos. With this background, meteorites of the Howardite-Eucrite-Diogenite (HED) group of anchondrites, linked to the differentiated asteroid 4 Vesta, represent promising targets for magnetic investigation. Prior studies of HED meteorites have yielded contrasting results. Cisowski [1] reported low paleofields (1-5 μT) from two unbrecciated eucrites, whereas Morden [2] reported paleointensities of up to 37 μT from Thellier analyses of the brecciated Millbillillie eucrite; the latter were interpreted as indicative of a past dynamo. The age of the Millbillillie magnetization might be approximately 3.55 Ga [3] when the meteorite was heated by impact. Fu and Weiss [4-5] have recently reported a study of fusion crust of the Millibillie eucrite, supporting the conclusion that the meteorite preserves an ancient magnetization, but with very low (2-3 μT) paleointensity values.

Here we discuss results from Northwest Africa (NWA) 5480, which is a olivine-diogenite (or harzburgite), 57 vol% olivine and 42 vol% orthopyroxene. Olivine is found in bands that have been interpreted as magmatic flow within the Vestan mantle [6-7]. We use single crystal paleointensity analyses [8]. Olivine grains 1-2 mm in size were separated for analyses. We specifically exclude grains with large visible inclusions as these may be multidomain magnetic minerals which relax on relatively short timescales. Magnetic hysteresis measurements suggest that olivine hosts single to pseudo-single domain magnetic inclusions suitable for paleointensity analyses. Thermal demagnetization reveals removal of several scattered magnetizations at low unblocking temperatures, followed by stable decay at higher temperatures. Thellier-Coe paleointensity data suggest a field of approximately 36 μT. These preliminary data, if confirmed, imply a Vestan dynamo because alternative primary magnetic sources would have imparted much weaker fields. Consistency tests are needed to further address potential magnetic contamination during meteorite collection. In addition, definition of the nature and composition of the magnetic inclusion carriers is needed. These studies are in progress, as are single crystal paleointensity analyses of other HED meteorites. References [1] Cisowski, S.M. (1991) *Earth Planet Sci. Lett.*, 107, 173-181. [2] Morden, S.J. (1992) *Meteoritics* 27, 560-567. [3] Yamaguchi, A. et al. (1994) *Meteoritics* 29, 237-245. [4] Fu, R. and Weiss B.P. (2011) EPSC, Abstract 1646. [5] Fu, R. and Weiss B.P. (2011) AGU abstract P21E-08. [6] Irving, A.J. et al. (2009), LPSC Abstract 2466. [7] Tkalcec, B.J. (2010), LPSC Abstract 5191. [8] Tarduno J. A. et al. (2006) *Rev. Geophys.*, 44, RG1002.