EPITAXIAL GROWTH OF SINGLE-DOMAIN MAGNETITE IN MARTIAN METEORITE ALH84001. J. P. Bradley1, H. Y. McSween Jr.[2] and R. P. Harvey[3]. [1]MVA Inc., Norcross GA 30093 (jbradley@mvainc.com), [2]Dept. of Geological Sciences, Univ. of Tennessee, Knoxville, TN 37996-7216 (mcsween@utk.edu), [3] Dept. of Geological Sciences, Case Western Reserve University, Cleveland, OH 44106-7216 (rph@pop.cwru.edu)

Magnetite in ALH84001 is concentrated within carbonate-bearing fracture zones. Although much of the magnetite appears to have formed by in-situ (thermal?) oxidation of Fe sulfides and possibly other Fe-bearing minerals, it has been proposed that other (single-domain) magnetites were formed at low temperatures (<120° C) as a result of biological activity within the ancient crust of Mars [1]. It has also been suggest that "ovoid and elongated forms" are Martian nanofossils [1]. A subsequent study showed that the single-domain magnetites include platelets and whiskers similar in size and shape to the putative nanofossils [2]. Some whiskers contain axial screw dislocations, suggesting that they formed at much higher temperatures (500-800° C) by vapor phase growth. (Axial screw dislocations have not been reported in biogenic single-domain magnetites.) Recently, new evidence about the growth of magnetite in ALH84001 has emerged from examination of the crystallographic relationships between the nanocrystals and the carbonate substrates upon which they were deposited. Some magnetites are epitaxially intergrown with one another, whereas others are epitaxially intergrown with the carbonates (Fig. 1). Epitaxy is yet another important mechanism of vapor phase growth; it rules out intracellular precipitation of the magnetites by biological processes, provides further evidence of the high-temperature origins of magnetite in ALH84001, and indicates that the carbonates have also been exposed to elevated temperatures. The widely published images of aligned nanofossils in ALH84001 (e.g. [3]) are probably magnetite whiskers with parallel orientations resulting from epitaxial growth on carbonate substrates.

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References. [1] McKay, D. S. et al. (1996) *Science*, 273, 924-930. Bradley, J. P. et al. (1996) *GCA* , 60, 475-481. [3] Kerr, R. A. (1997) Science, 276, 30-31.

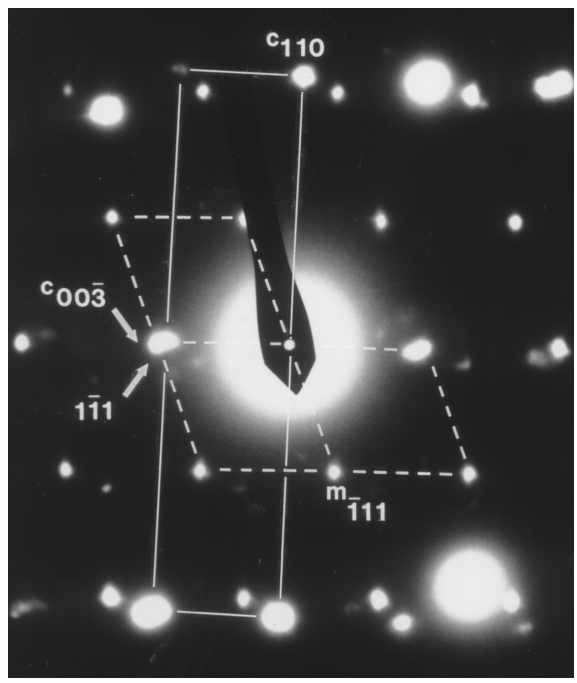

Fig. 1. SAED pattern from single-domain magnetite nanocrystal epitaxially intergrown onto carbonate. Dashed and solid lines shown magnetite [110] and carbonate [110] reciprocal lattice nets respectively. Lower case "m" and "c" indicate carbonate and magnetite reflections. Magnetite (1,-1,1) lattice planes are aligned approximately parallel to carbonate (0,0,-3) planes.