A SOURCE REGION FOR MARTIAN METEORITE ALH 84001: EOS CHASMA, MARS. V. E. Hamilton. Hawai'i Institute of Geophysics and Planetology, Univ. of Hawai'i, Honolulu, HI 96822. E-mail: hamilton@higp.hawaii.edu.

Introduction: A global search of infrared data collected by the Mars Global Surveyor Thermal Emission Spectrometer (MGS TES) revealed only one spatially significant exposure, in Eos Chasma (Valles Marineris), of orthopyroxene-rich materials matching the spectral signature of ALH 84001 [1]. Here I evaluate spectral, thermophysical, and geomorphic evidence for this location as the ejection site of ALH 84001.

Spectral Observations: Up to ~45% of the ALH 84001-like surface materials in Eos Chasma consist of ortho-pyroxene (OPX), with the remainder consisting of basaltic minerals [2]. Using a range of compositions between Mg_{70-90}, [2] verified the results of [1] and modeled the composition of the OPX as Mg_{70-77}, consistent with ALH 84001.

Thermophysical Observations: TES thermal inertias of the OPX-rich material are in the range of ~230 – 720 J m^{-2} K^{-1} $s^{-1/2}$, consistent with a wide range of particle sizes from coarse particulates (~375 µm) to rocky material and/or bedrock [1].

Geomorphological Observations: The OPX-rich materials are a lobate deposit that superposes Eos Chasma floor materials. There are several lobes, with an inferred direction of flow onto the central chasm floor radial to the southern wall. The edges and upper surfaces of the deposit do not resemble those of typical mass wasting deposits observed elsewhere in the Valles Marineris. Lobate ejecta deposits provide a better morphologic analogue to the Eos Chasma deposits [2]. The remnants of a probable impact crater, ~20 km diameter & now partially collapsed, appear to be located on the southern rim.

Eos Chasma: ALH 84001 Ejection Site? Based on the combined compositional, thermophysical, and geomorphic observations, I propose that the OPX-rich deposits observed in Eos Chasma are a lobate ejecta deposit related to the ejection of the ALH 84001 meteorite. Martian meteorites may have been ejected from craters as small as ~1.5 – 3 km in diameter [3, 4]. Examination of the OPX-rich materials using THEMIS and MOC visible images reveals no craters this large. Thus, it is unlikely that the lobate materials were spread across the floor and subsequently impacted to eject ALH 84001. Another possibility is that an impact event producing the lobate deposit simultaneously ejected ALH 84001. In either case, the OPX-rich materials likely were located within the wall rock prior to their dispersal across the valley floor. Such a location is consistent with the formation of an ancient orthopyroxenite like ALH 84001. All Martian meteorites are estimated to have been ejected from Mars in the last 20 My, thus the low number of sizable craters on the Eos Chasma deposit is consistent with its relatively recent emplacement as an ejecta blanket. The complex shock history of ALH 84001 has been invoked to suggest that it must have been moved from its location of origin to a shallower depth prior to ejection; earlier impact events in this region may have disturbed the local stratigraphy such that the recent impact proposed here was able to eject ALH 84001 and disperse all or part of the source deposit and local basaltic rocks across the valley floor, physically mixing and exposing them.

References: [1] Hamilton, V. E. et al. 2003, *Meteoritics & Planetary Science*, 38:871-885. [2] Hamilton, V. E. 2004, *Eos Trans. AGU*, 85:P11A-0959. [3] Head, J. N. et al. 2002, *Science*, 298:1752-1756. [4] Beck, P. et al. 2005, *LPSC 36*, Abstract #1333.