A Newly Discovered Hematite-Rich Unit in Aureum Chaos: Comparison of Hematite and Associated Units With Those in Aram Chaos. T. D. Glotch[1], D. Rogers[1], and P. R. Christensen[1], [1]Department of Geological Sciences, Arizona State University, Tempe, AZ 85287-6305

Introduction: Results from the MER Rover Opportunity have pointed to an aqueous depositional mechanism for the hematite-rich unit discovered by the Mars Global Surveyor Thermal Emission Spectrometer (MGS-TES) instrument [1, 2]. Though Meridiani Planum is the site of the largest hematite deposit by area, other hematite-rich units have been discovered in Aram Chaos and Ophir and Candor Chasma [3]. The Aram Chaos hematite-rich deposit has been described as both a hydrothermal [4] and a lacustrine envirmonment [5]. The newly discovered hematite-rich deposit in Aureum Chaos shares several similarities with Aram Chaos, including the presence of hematite in a friable layered unit, and the presence of a light-toned caprock. In addition, the Iani and Arsinoes chaotic terrains, although lacking evidence for crystalline hematite, have interior layered deposits similar to those seen in Aram and Aureum Chaos. The presence of these units over a distance of several hundred kilometers in the equatorial latitudes of Mars may point to a preferred global mechanism for hematite formation.

Approach: Several data sets have been used to study the equatorial chaotic regions of Mars. TES data were used to initially locate the hematite deposit in Aureum Chaos and will be used to isolate the surface spectra of the light-toned caprock units and the surrounding layered and chaotic terrains. Thermal inertia and albedo datasets from the TES instrument will also be used to characterize the various units. Odyssey Thermal Emission Imaging System (THEMIS) daytime and night time mosaics have been made over the Aureum, Iani, and Arsinoes chaotic terrains to map the distribution of the light-toned layered materials. In addition, 16 and 32 m/pixel visible image mosaics have been made over selected regions within the chaotic terrains that contain the light-toned caprock material. The mosaics, in combination with Mars Orbital Laser Altimeter (MOLA) data, were used to map the distributions of the Cap-like materials in the equatorial chaotic terrains and ascertain their stratigraphic relationships to the surrounding layered and chaotic units.

Observations: The Aureum Chaos hematite deposit, with an area of ~150-200 km^2, is small by comparison to the Meridiani Planum and Aram Chaos hematite deposits, but falls within the range of the smaller deposits seen in Ophir and Candor Chasma [3,6]. The TES spectra acquired over the hematite-rich unit contain the characteristic 300 and 450 cm^{-1} absorptions of hematite (Figure 1). The estimated maximum hematite abundance is ~10%, similar to the estimated abundances in Meridiani Planum and Aram Chaos [2, 5]. The average elevation of the Aureum Chaos hematite deposit is -3500 m, compared to an average elevation of the hematite deposit in Aram Chaos of -2600 m [4]. The thermal inertia of the hematite-rich unit in Aureum Chaos is 300 (units of $Jm^{-2}s^{-1/2}K^{-1}$ used throughout) similar to the value of 280-315 in the corresponding unit in Aram Chaos [5]. By contrast, the thermal inertia of the nearby caprock unit in Aureum Chaos (Figures 2 and 3) ranges from 330-360, implying that it is a more consolidated or rockier unit than the hematite-rich unit. While the caprock unit in Aureum Chaos has a higher thermal inertia than the hematite-rich unit, and appears to be cliff-forming, the thermal inertia is significantly lower than the Cap Unit in Aram Chaos, which ranges from 400-500. The thermal inertias of the Cap-like materials mapped in Iani and Arsinoes chaos have values similar to those seen in Aram Chaos.

Discussion: The discovery of a small hematite-rich unit in Aureum Chaos adds to the list of regions in which this type of deposit occurs on Mars. The similarities between Aureum and Aram Chaos are not likely to be coincidental, and may point to a preferred formation mechanism for gray crystalline hematite on Mars. Aram and Aureum chaos have several similarities including their likely formation history (catastrophic release of water), presence of interior layered deposits, including a hematite-rich unit, and the presence of a relatively high thermal inertia layer stratigraphically above the hematite unit. Though the Cap Unit in Aram Chaos and similar units in the Aureum, Arsinoes, and Iani chaotic terrains appear to be similar (Figures 3 and 4), there is a difference of ~100-200 thermal inertia units between them. These units likely did not form coincidentally as part of a much larger regional layer, but instead probably formed by similar, but not identical, processes in their respective chaotic terrains.

Future work will attempt to correlate other properties of the Aram Chaos Cap Unit with those of the caprock materials in the other equatorial chaotic terrains. Recovery of TES spectra, and comparison of THEMIS IR and VIS spectral properties may confirm the hypothesis that these units were deposited in similar environments. An elevated abundance (10-15%) of sulfate has been detected in the Aram Chaos Cap Unit [4]. Detection of similar abundances of sulfate or other salts in the caprock materials in the other chaotic terrains may point to a common, evaporative origin of

these deposits, and link them to the deposits seen in Meridiani Planum.

References: [1] Squyres, S. W. et al., *Science*, 306, 1709-1714, 2004. [2] Christensen, P. R. et al., *J. Geophys. Res.*, 105, 9623-9642, 2000. [3] Christensen, P. R. et al., *J. Geophys. Res.*, 106, 23873-23886, 2001. [4] Catling, D. C., and J. M. Moore, *Icarus*, 165, 277-300, 2002. [5] Glotch, T. D., and P. R. Christensen, *J. Geophys. Res.*, submitted. [6] Knudson, A. T., and P. R. Christensen, *Eos Trans. AGU, 85(47) Fall Meeting Suppl.* Abstract 9722.

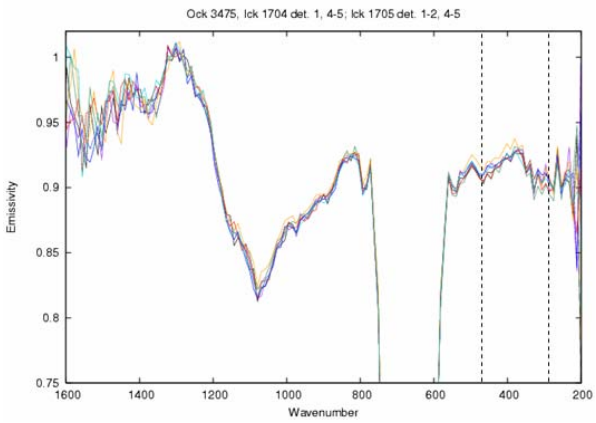

Figure 1. Non-atmospherically corrected TES spectra taken over the Aureum Chaos region. Spectra show clear indications of the characteristic hematite absorption bands at 450 and 300 cm^{-1}.

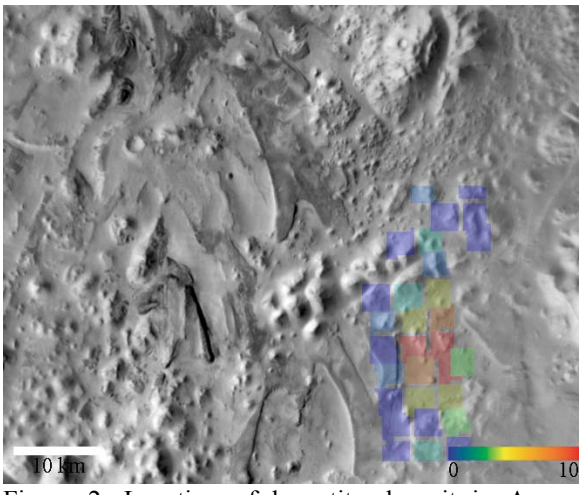

Figure 2. Location of hematite deposit in Aureum Chaos. The hematite lies stratigraphically below a unit similar to the Cap Unit in Aram Chaos.

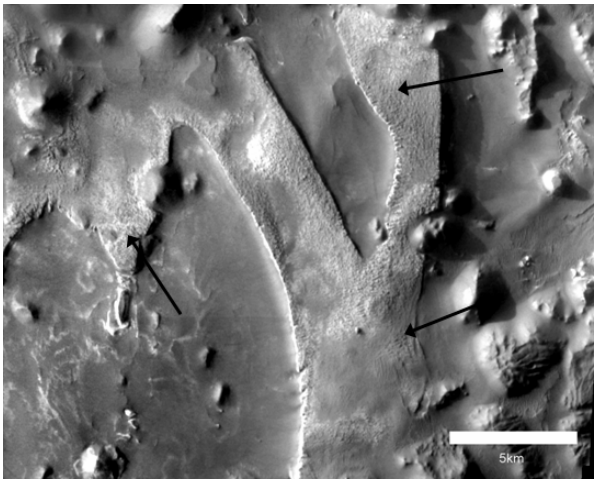

Figure 3. THEMIS Visible mosaic of the light-toned layered material near the crystalline hematite deposit. The light-toned layered material (arrows) bears a striking resemblance to the Cap Unit in Aram Chaos (Figure 4.)

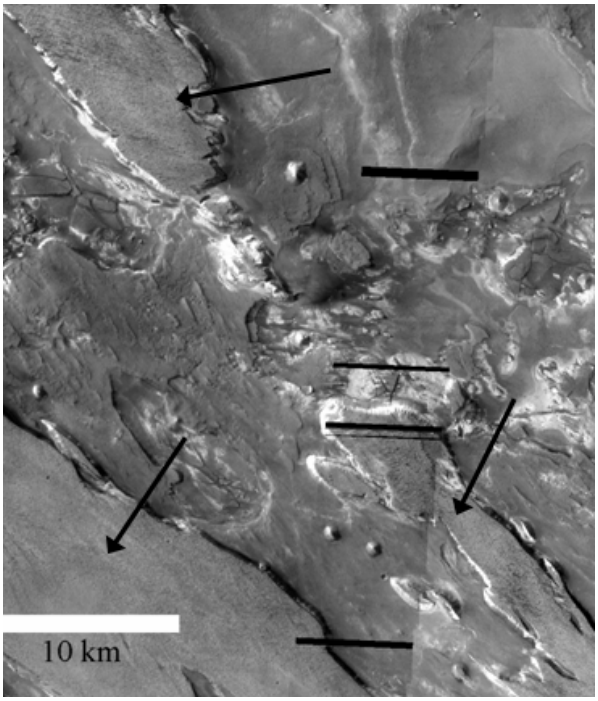

Figure 4. Light-toned Cap Unit (arrows) in Aram Chaos has a higher albedo and thermal inertia than the layered units that lie beneath it. It may be cemented by sulfate salts [5].