DISTRIBUTION AND FORMATION OF CRYSTALLINE GRAY HEMATITE IN EASTERN VALLES MARINERIS. C. M. Weitz[1], M. Lane[1], E. Noe Dobrea[1], L. Roach[2], and A. Knudson[1]. [1]Planetary Science Institute, 1700 E. Fort Lowell, Suite 106, Tucson, AZ 85719 (weitz@psi.edu); [2]Frontier Technology, 100 Cummings Center, Suite 450G, Beverly, MA 01915..

Introduction: We have mapped out the distribution of gray hematite in Capri Chasma, identified geologic units associated with the hematite, and proposed modes of formation for the hematite. Gray, crystalline hematite (as opposed to fine-grained red hematite or nanophase hematite [*1*]) was identified by the Thermal Emission Spectrometer (TES) initially at three main locales on Mars: Meridiani Planum, Aram Chaos, and Valles Marineris [*2,3*]. Additional hematite-rich units have been found in Aureum and Iani Chaos [4,5].

Observations at the MER Opportunity landing site indicated that the source of the orbital hematite signature seen by TES was millimeter-size spherules containing hematite that were concentrated along the upper cms of the soil as a lag deposit [6]. The hematite-rich spherules are postulated to have formed by secondary alteration of the sulfate-rich outcrop as water permeated through the rocks and produced concretions [7]. Unlike Meridiani, Aram Chaos, Iani Chaos, and Aureum Chaos where the hematite units are confined to a specific layer or fairly continuous unit [*e.g.*, 3, 8], the gray hematite in Valles Marineris is more patchy in distribution and scattered in separate troughs [3, 9].

Our previous analyses of gray hematite in Ophir and Candor Chasmata determined that hematite strongly correlates to relatively dark debris units that are either superimposed on or adjacent to light-toned rocks [10]. The most likely explanation for hematite signatures in Ophir and Candor Chasmata are similar concentrations of hematite-rich grains like those found at the Opportunity landing site. Infiltration of water, perhaps by a rising water table or percolation inward from lakes within the canyons, could have produced hematite-rich grains postulated to be concretions like those identified at the Opportunity landing site.

Hematite-rich units in Iani and Aureum Chaos correspond to the presence of a light-toned layered unit that contains polyhydrated sulfates [4,5]. Ferric oxides correlate to dark superficial material in East Candor [11]. In West Candor, gray hematite occurs on and at the base of sulfate-rich scarps [12]. Previous work at Capri Chasma suggested that hematite formed in situ on crater floors and in chaotic terrain [13].

Observations: We have produced hematite abundance maps from TES data for eastern Valles Marineris (Figure 1) . These hematite maps were then registered to mosaics of THEMIS and CTX images for this region. From these coregistered data sets, we can explore the morphology and mineralogy of the geologic units that correspond to these high abundances of gray hematite. Many of the regions with high (10-20%) hematite abundance have been observed by HiRISE and CRISM so we are analyzing these locations in detail.

Mineralogical maps of eastern Valles Marineris (Figure 1) were derived from CRISM data and used to aid in the identification of units and their compositions that are associated with gray hematite. The two main minerals identified with the interior layered deposit (Capri Mensa) are kieserite and polyhydrated sulfate (PHS), with the PHS stratigraphically above the kieserite [14]. In general, we find that the high abundances of gray hematite occur in low-lying regions near kieserite outcrops. The area with the highest abundance of hematite is situated on smooth plains a few kms away from kieserite outcrops. Another location with gray hematite occurs along the floor of an impact crater (Figure 2). Kieserite is exposed along the walls of the crater while the hematite is found along the bases of the walls.

Discussion: The gray hematite is closely associated with light-toned units composed of kieserite but does not occur within these units. Instead, the hematite appears to erode from kieserite outcrops and then moves downslope where it collects along low-lying regions. These observations match those found at Meridiani Planum and elsewhere in Valles Marineris where hematite grains weather out from nearby sulfate exposures and then concentrate in a lag deposit. The hematite and monohydrated sulfate in Capri may have formed by diagenetic alteration of a sulfate-rich sedimentary deposit [14].

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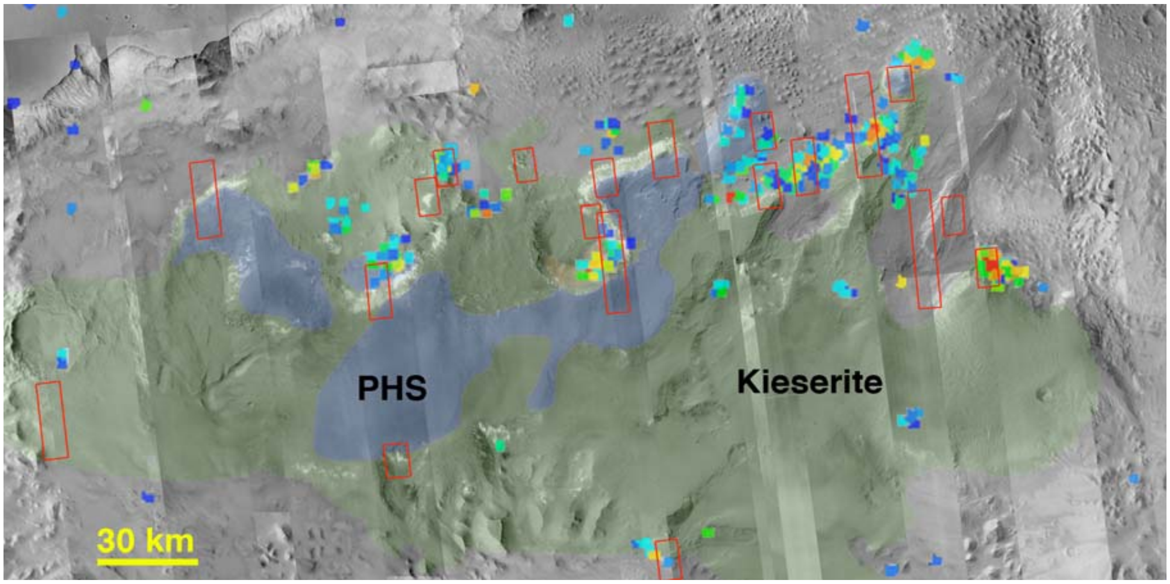
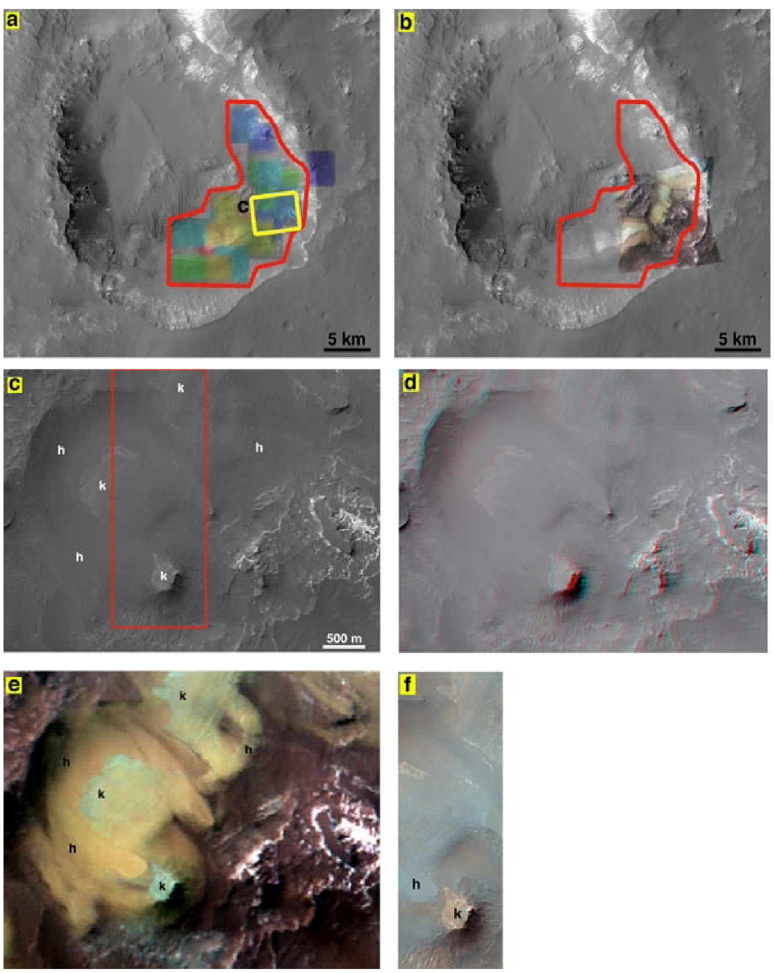


Figure 1. Capri Chasma. The interior layered deposits of Capri Mensa are composed of polyhydrated sulfate (PHS) in blue and monohydrated sulfate (kieserite) in green [14]. Small colored boxes represent TES-derived hematite abundances, with higher abundances shown in warmer colors (i.e., red, yellow). Red rectangles are locations of HiRISE images analyzed in this study.



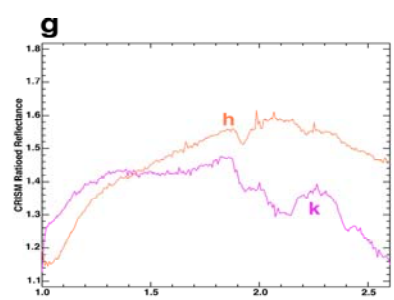


Figure 2. (a) CTX image of a ~30-km diameter crater where gray hematite is detected in TES (colored rectangles). Yellow box shows location of c. (b) Same CTX image with CRISM FRT overlain in color. (c) Portion of a HiRISE image showing areas with hematite (h) and kieserite (k). Red box shows location of f. (d) HiRISE stereo anaglyph of same region shown in c. The hematite occurs along slopes and low elevations but otherwise does not correspond to a particular stratigraphic level. (e) CRISM image in color overlain on HiRISE image. The hematite appears orange and the kieserite appears light green. (f) HiRISE false-color image is also able to distinguish the hematite and kieserite units. (g) CRISM spectra of the hematite (h) and kieserite (k) units.