RADAR IMAGERY OF THE CHRYSE–XANTHE REGION, MARS. J. K. Harmon, Harmon Space Science, 1902 Cacique St., San Juan, PR 00911, jharmon897@gmail.com.

Introduction: Earth-based radar imagery of Mars has been used to map regions of enhanced small-scale (sub-meter) surface roughness based on the brightness of the depolarized echo component. Although most bright depolarization features are associated with lava flows in the major volcanic provinces [1,2], some apparently non-volcanic bright features were also seen in early (pre-upgrade) Arecibo imagery of the Chryse–Xanthe region [3]. Here I present updated imaging results for Chryse–Xanthe and environs based on observations made with the upgraded Arecibo radar during the 2005 and 2012 Mars oppositions. I describe four specific subregions where bright depolarization features appear to be signatures of aqueous deposition/modification or other effects peculiar to the unique Chryse–Xanthe channel region.

Maja-Lunae Complex: The most prominent of the Chryse–Xanthe features is a large bright patch centered near 300°E, 15°N (feature A in Fig. 1). This "Maja–Lunae Basin" feature, which includes previously mapped Maja Valles floodplain as well as an extended portion of eastern Lunae Planum to the west, apparently shows where rocky sediments have been deposited by floods and/or debris flows debouching from the south. The southern source flows include Maja Valles itself (B) as well as a previously unrecognized "West Branch" (C) that appears to have arisen from catenae west of Juventae Chasma. Portions of Maja–Lunae Basin and the West Branch show up in THEMIS IR images, and some associated lobate flow fronts appear as relief features in CTX images. It is now apparent from both radar and spacecraft imagery that the floods and flood deposits in this region are more extensive than was previously thought.

SW Chryse and VL-1: Northeast of Maja–Lunae Basin is another radar-bright region (Fig. 2) covering a large area of southwest Chryse Planitia. This feature, which is separated from the Maja–Lunae feature by the radar-dark Xanthe Montes (D), appears to be largely attributable to rocky debris debouched from the various narrow Maja-system drainage channels cutting through the Montes. The brightest part of the SW-Chryse feature constitutes a large arc wrapping around the north and west sides of the dark-halo crater Santa Fe (E). The southern part of the arc (F) appears to be largely debris from Maja, Vedra, and Maumee Valles, while the northern swath (G) may be dominated by flood deposits from Bahram Valles. There is some support for this from THEMIS IR imagery. The new evidence for the importance of Bahram Valles effluent is particularly interesting, especially as the affected region seems to include the VL-1 lander site (H).

Central Chryse and Bright Craters: Central and northern Chryse shows moderate depolarized brightness attributable to rocky outwash from the various southern and western channels draining into the basin, although the deposits are probably sparser than those in the brighter Maja outwash region of southwest Chryse. Superimposed on the general background brightness of the region are numerous bright and dark features associated with impact craters. The dark features are mostly associated with "dark-halo craters" such as those seen in Mars' volcanic regions [2] as well as the Moon, Venus, and Mercury. The bright features are associated with "bright-ejecta craters" of a kind that we have not found elsewhere on Mars outside of the Chryse–Xanthe channel region. The most prominent of these bright craters can be seen in Fig. 3; these include the named craters Lismore (J), Grindavik (K), and Sefadu (L). The ejecta blankets of these craters appear very bright in THEMIS nighttime infrared images and dark in the daytime IR images, which, with the radar brightness, implies rocky ejecta. The fact that all such bright-halo craters are located in outflow channel floors or outwash plains suggests that aqueous effects were conducive to the production of rocky impact ejecta, although it is also possible that Chryse has unique crustal properties.

Xanthe Plateau Features: The Xanthe Terra region south of Chryse shows three main radar-bright regions (Fig. 4), all of which are located on plateaus bordering chasma, chaos, or channel features. The first of these includes the north edge (M) of the plateau between Simud and Shalbatana Valles and the island plateau (N) immediately to its north. The second region includes the plateaus surrounding Orson Welles Crater and chaos (P) and the Aromatum Chaos/Ravi Valles complex (R). The third region lies on the plateau surrounding Ganges Chasma (S) and includes Aurorae Planum (T) south of the chasma. Some possible explanations for the Xanthe radar-bright features include: debris deposition by overbank flooding; surface roughening by subsurface aqueous eruptions, possibly associated with incipient chaos formation; and dielectric enhancement through aqueous induration or alteration.

References: [1] Harmon J. K. et al. (1999) *JGR, 104,* 14065–14089. [2] Harmon J. K. et al. (2012) *Icarus, 220,* 990–1030. [3] Harmon J. K. (1997) *JGR, 102,* 4081–4095.

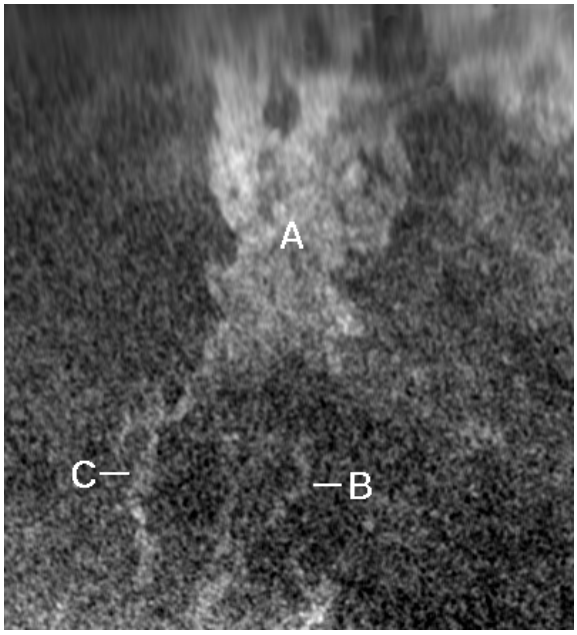

Figure 1. Depolarized radar image of the Maja-Lunae complex from observations on February 23–25, 2012. The labelled features are: (A) Maja–Lunae Basin, (B) Maja Valles, and (C) "West Branch". The image spans 290.6–310.6°E, 0.6°S–21.6°N.

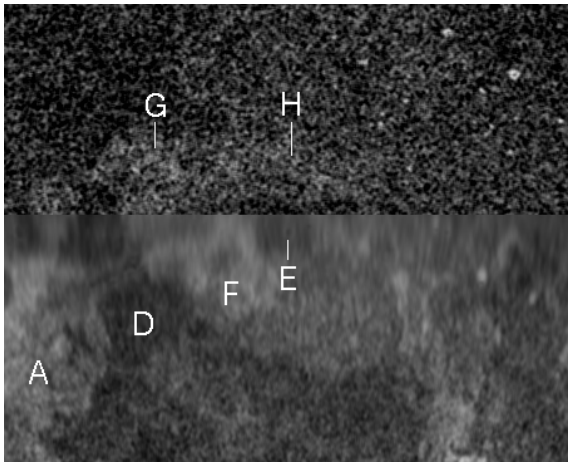

Figure 2. Depolarized radar image of SW Chryse. This is a composite of imagery from November 23, 2005 (upper panel) and February 23–25, 2012 (lower panel). The labelled features are: (D) Xanthe Montes, (E) Santa Fe Crater, (F) southern outwash debris from Maja Valles, (G) northern outwash debris from Bahram Valles, (H) VL-1 lander site. Also shown is the Maja–Lunae Basin feature (A). The image spans 301–324°E, 10–28°N.

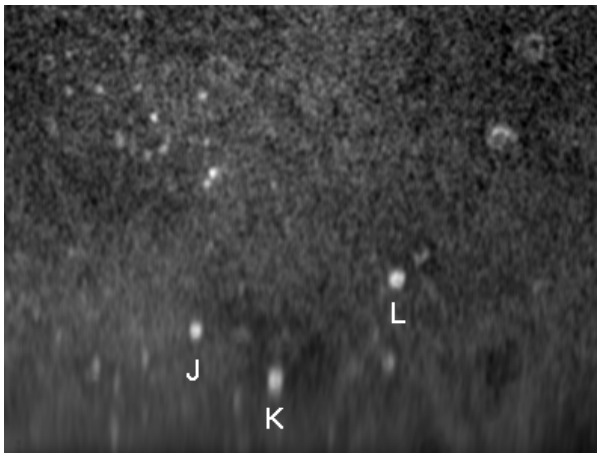

Figure 3. Depolarized radar image of central Chryse from observations on February 23–25, 2012. Labelled bright-ejecta craters are: (J) Lismore, (K) Grindavik, and (L) Sefadu. The dark patch just NE of Grindavik corresponds to the dark-halo crater Calahorra. The dark feature in the SE corner shows where Kipini Crater diverted the surrounding channel outwash. The image spans 312–332°E, 23–40°N.

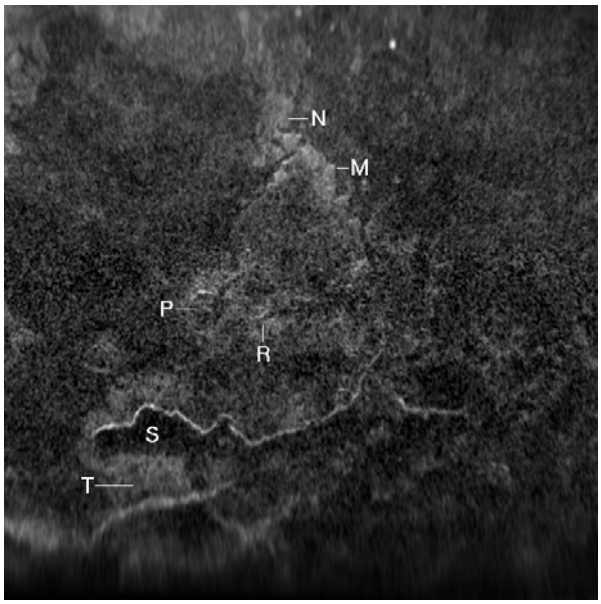

Figure 4. Depolarized radar image of Xanthe Terra. This is a composite of imagery from February 23–25, 2012 (above 3°N) and November 23, 2005 (below 3°N). The labelled features are: (M) north edge of Simid–Shalbatana Plateau, (N) island splitting Shalbatana Valles outlet channels, (P) Orson Welles Crater, (R) Aromatum Chaos/Ravi Valles, (S) Ganges Chasma, (T) Aurorae Planum. The image spans 302–338°E, 18°S–18°N.