CONICAL FEATURES AND BASIN-FILLING DEPOSITS IN ISIDIS PLANITIA, MARS. G. Komatsu[1], M. Cardinale[1], D. A. Vaz[2], J. J. Wray[3], [1]International Research School of Planetary Sciences, Università d'Annunzio, Viale Pindaro 42, 65127 Pescara, Italy (goro@irsps.unich.it), [2]Centre for Geophysics, University of Coimbra, Av. Dr. Dias da Silva, 3000-134 Coimbra, Portugal, [3]Department of Astronomy, Cornell University, Ithaca, NY 14853, USA.

Introduction: The Isidis basin floor is characterized by the presence of massive, basin-filling deposits of Hesperian-Amazonian age [1] and associated, often aligned conical features (**Fig. 1**). The basin-filling deposits embay mesas that represent eroded basin-rim materials. The cones are <1 km in diameter and often have summit craters. The estimated number of the cones is nearly 50,000 within the High Resolution Stereo Camera (HRSC) image coverage of the basin reaching nearly 60% [2]. There are several interpretations for the cones [3], which include pseudocraters (e.g., [4]), volcanic cones (e.g., [5]), peri-glacial features (e.g., [6]), and mud volcanoes (e.g., [7][8][9]). There currently lacks strong support for one hypothesis over others, but any satisfactory explanation must be consistent with the cone morphology, distribution patterns, and the relation among basin-filling deposits and the basement structural fabric.

We report here preliminary results of our investigations of cone distribution, their relation to basin topography, and spectral properties.

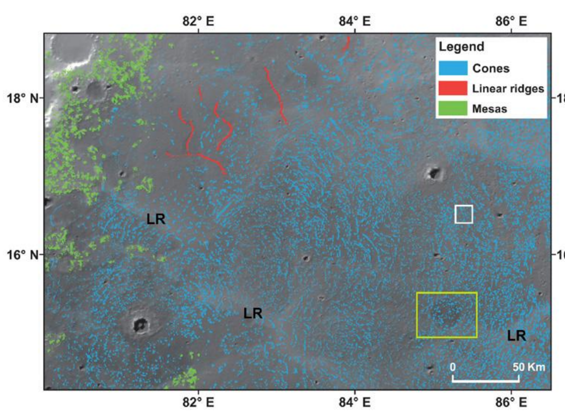

Fig. 1. Distribution of conical features in the northwestern Isidis basin. Locations of Figs. 2a (yellow box) and 3a, b (white box) are indicated. LRs refer to low elongated ridges. The base map is from [10]. The background is MOLA topography.

Cones and the AIi unit: The distribution of the cones seems to be limited to the basin-filling deposits of Early Amazonian age (AIi unit; [1]), implying their genetic relation [10]. At the moment, there is no clear observational evidence clarifying the timing of events: 1) cones formed concurrently with the AIi unit; or 2) cones formed sometime after the AIi unit. The situation 1) implies that the cones directly resulted from the processes forming the AIi unit, but the situation 2) implies that the cone formation was linked to the AIi materials but not necessarily related to the event of the AIi emplacement.

The topography in the AIi unit and its relation to the cone distribution need careful examination, and we examined the relations on the northwestern part of the Isidis basin where cones, linear ridges, and mesas embayed by the AIi unit are observed ([10], **Fig. 1**). Cones in the region often occur in curvilinear alignment but others are more randomly positioned. Low elongated ridges about 10 km wide and up to tens of meters high are widely observed on the basin floor (**Fig. 1**), and they are possibly tectonic features indicating a deformation event of the Isidis basin (e.g., [11]). They do not seem to show any obvious relationship with the cone distribution. A dozen or so shallow (less than 100 m deep) circular depressions up to 35 km wide occur on the basin floor (some occur in the area of **Fig. 1**). They may be buried impact craters and/or sag features. Their peripheral boundaries normally show semi-continuous moats, which could represent sag-induced fractures (**Fig. 2a**). Cones are observed occurring along these moats, some overriding the moats and others clearly cut by the moats (**Fig. 2b**). But for most cones, their occurrence does not seem to be affected by the presence of the circular depression features (**Fig. 2a**).

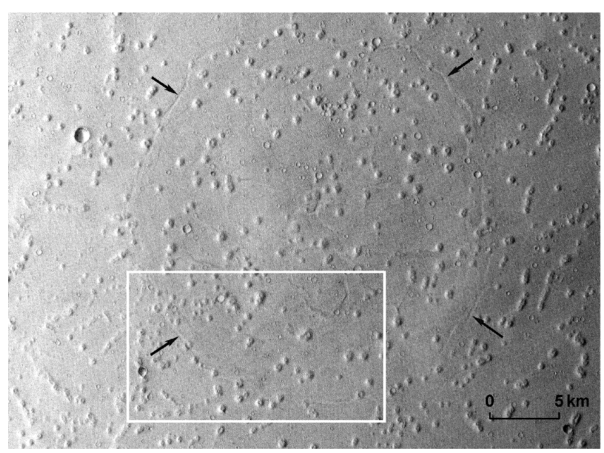

Fig. 2a. Shallow circular depression and conical features. Black arrows indicate moats explained in the text. HRSC image (h5072_0000). Location of Fig. 2b (white box) is indicated.

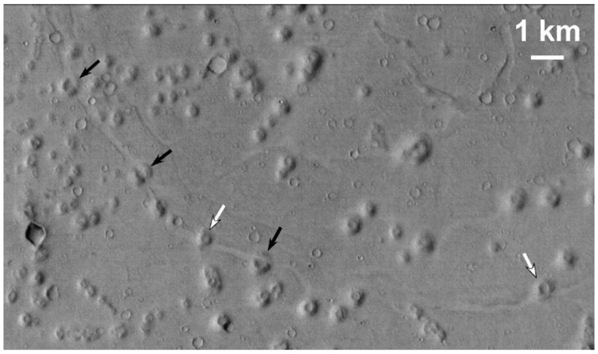

Fig. 2b. The close-up of Fig. 2a showing the moats and the cones. Black arrows indicate cones clearly cut or modified by the moats. White arrows cones with no visible evidence of modification.

CRISM data analysis: We have analyzed one CRISM observation in the Isidis basin to date, which does not show a distinctive mineralogy for the cones. They are spectrally very similar to the adjacent plains (AIi unit), implying similar mineralogies or possibly a thin uniform dust cover across the terrain. The cones do have relatively strong 3 µm absorptions attributed to H_2O, and are surrounded by rings of light-toned material (debris?) with relatively weak 3 µm absorptions (**Fig. 3a, b**). One possible explanation of these absorptions is that they are due to water adsorbed on surface grains. The variation in band strength may reflect the states of materials (e.g., grain sizes) [12] of the cones and of their immediate surroundings. Indeed, the broad rings with weak 3 µm bands appear dark in THEMIS nighttime IR images, likely indicating a low thermal inertia and relatively small grain size (e.g., [13]). We will examine additional CRISM observations in the Isidis basin to see if these spectral trends are widespread.

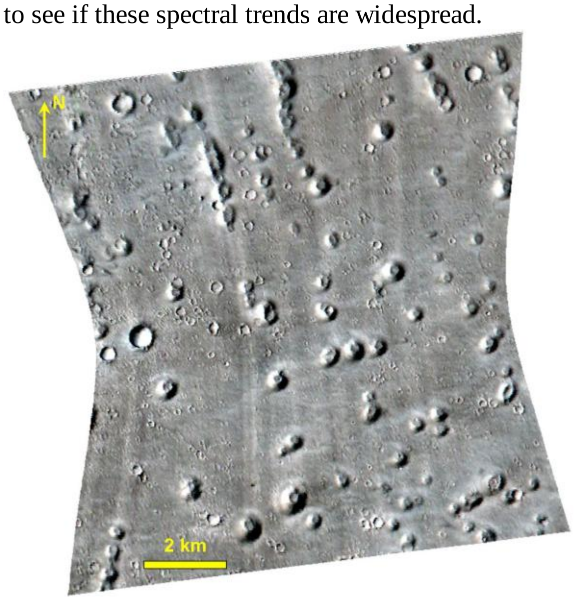

Fig. 3a. CRISM FRT0000A3C3 composite color image of conical features. See Fig. 1 for location.

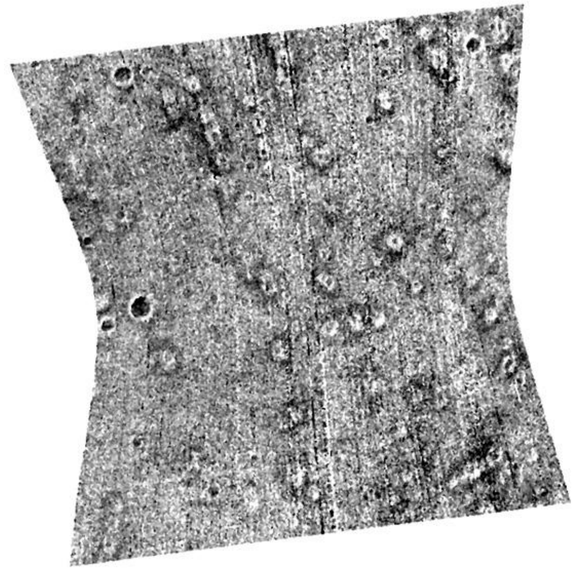

Fig. 3b. CRISM map of 3 µm band depth (BD3000 parameter from [14]), attributed to H_2O. The same area as Fig. 3a.

Discussion: Our preliminary observations indicate that the formation of the conical features in the Isidis basin is linked with the emplacement of the basin-filling AIi unit, possibly with their formational timings close to each other. The presumed tectonic events such as the formation of the low elongated ridges and the localized subsidence related to the shallow circular depressions appear either to have occurred concurrently or to have postdated the cone formation. The determination of the origin of the conical features must account for this sequence of events.

References: [1] Tanaka K. L. et al. (2005) U.S.G.S., *Map 2888*. [2] Hielscher F. J. et al. (2010) *LPS XXXXI*, Abstract #2394. [3] Scott D. H. et al. (1995) U.S.G.S., *Map I-2461*. [4] Frey H. and Jarosewich M. (1982) *JGR, 87*, 9867–9878. [5] Bridges J. C. et al. (2003) *JGR, 108*, E1, 5001. [6] Grizzaffi P. and Schultz P. H. (1989) *Icarus*, *77*, 358–381. [7] Davis P. A. and Tanaka K. L. (1995) *LPS XXVI*, 321–322. [8] Ori G. G. et al. (2000) *LPS XXXI*, Abstract #1550. [9] Keszthelyi L. P. et al. (2010) *Icarus*, *205*, 211–229. [10] Komatsu G. et al. (2011) *PSS*, doi:10.1016/j.pss.2010.07.002. [11] Ritzer J. A. and Hauck S. A., II (2009) *Icarus, 201*, 528–539. [12] Milliken R. E. and Mustard J. F. (2007) *Icarus*, *189*, 574–588. [13] Mellon M. T. et al. (2008) in *The Martian Surface*, ed. J. Bell, pp. 399–427. [14] Pelkey S. M. et al. (2007) *JGR*, *112*, E08S14.