

MARS STRUCTURAL AND STRATIGRAPHIC MAPPING ALONG THE COPRATES RISE. R. Stephen Saunders, LPI, rssaunders@earthlink.net

Introduction: This geologic mapping project supports a topical study of structures in east Thaumasia associated with the Coprates rise. The study examines cuesta-like features on the east flank of the Coprates rise first identified by Saunders et al. [1]. Mapping combines detailed local stratigraphy, structural geology and topography. Hogbacks and cuestas indicate erosion of tilted rock units. The extent of the erosion will be determined in the course of the mapping. The region of interest lies along the eastern margin of Thaumasia bounded by latitudes -15 and -35 and longitudes 50 to 70 W (Figure 1).

Three MTM geologic quadrangles are being compiled for publication by the USGS (-20057, -25057, -30057). All existing data sources are used including THEMIS, MOC, CTX, HiRISE, MOLA and gravity, as well as higher level data available through the PDS data nodes at ASU, UA and Washington University. The extremely valuable ASU JMARS tools are used for analysis of many of the data sets. ArcGIS software has been obtained and is being learned for the map compilation.

Discussion: Erosional landforms that reveal stratigraphy and structure are common on Earth but less so on Mars. Cuesta landforms occur on the eastern flank of the Coprates rise, at about 60° west on the eastern edge of the Tharsis region [1]. The Coprates rise ridge had been identified previously using Goldstone radar to obtain topographic profiles. At that time this was the only reliable topographic data available. The

erosional landforms were barely resolved in the Viking images.

Wise et al. [2] published a detailed outline of the Tharsis region that included the structural geology. Plescia and Saunders [3] produced a detailed multi-phase tectonic history of the Tharsis region and identified the faulting in eastern Thaumasia as the oldest tectonic activity. More recently, others have produced detailed studies of the regional structure, and noticed and commented on the cuesta and hogback features on the eastern edge. Schultz and Tanaka [4] addressed the structures associated with the Coprates rise. A detailed regional study is by Dohm and Tanaka [5]. Borracinni et al. [6] have studied the regional structure of eastern Thaumasia. The most comprehensive study of the entire western hemisphere is by Anderson et al. [7] There are many other regional studies that help to provide the context for a more detailed examination using recently obtained high resolution data.

The geologic mapping of the three MTMs will illustrate the topical study of the regional structure and stratigraphy from detailed cross sections through the eroded hogbacks and cuestas. Several archived data sets cover the region. MOLA topography is used to determine slopes and stratigraphic column thickness. THEMIS IR images are particularly useful and cover most of the region. Figure 2 shows part of a daytime IR image obtained by THEMIS. The basic resolution of the THEMIS IR images is 100m per pixel. Higher resolution images from HiRISE, THEMIS VIS, CTX, CRISM and MOC are also used, primarily to examine small

features of the erosion to understand the erosion mechanisms and the surface material properties.

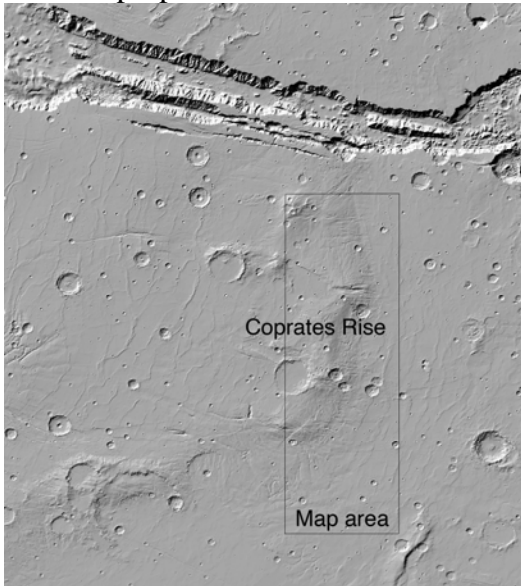


Figure 1 – Eastern Thaumasia and the Coprates rise map area.

The detailed mapping of this area is addressing questions in more detail than the previous regional studies. For example:

- ❖ What is the thickness of the stratigraphic column revealed in the upturned beds?
- ❖ How does this stratigraphic section relate to the material exposed in the wall of Coprates Chasma to the north?
- ❖ What is the nature and timing of the structural features of the area?
- ❖ How much material has been stripped off by erosion in the map area?
- ❖ What are likely processes that produced the erosion?
- ❖ What are the material properties of the eroded section?
- ❖ When did the erosion occur?
- ❖ What was the erosion rate?

Not all of these questions can be answered with available data but multiple hypotheses can be framed and tested to the extent the data allow.

References: [1] Saunders, R. S. (1980), LPSC XI, p. 977-978. [2] Wise, Donald U. et al. (1979) *Icarus*, 38, Issue 3, 456-47. [3] Plescia, J. B. and R. S. Saunders, (1982), *JGR* 87, 9775-9791. [4] Schultz, Richard A. and Kenneth L. Tanaka (1992), LPSC XXIII, 1245-1246. [5] Dohm, James M. and Kenneth L. Tanaka (1999), *Planetary and Space Science*, 47, Issues 3-4, 411-431. [6] Borraccini, F. et al. (2007), *JGR.*, 112, E05005. [7] Anderson, Robert C. (2001), *JGR*, 106, E9, 20563-20586.



Figure 2 – THEMIS daytime IR image of cuestas. Crop of I01975002BTR.