

LOWER MAJA VALLIS: J. W. Rice, S. M. Archibald, and R. A. De Hon, Department of Geosciences, Northeast Louisiana University, Monroe LA 71209.

The Eastern Lunae Planum Outflow Complex (1,2,3) extends from chaotic terrain of Juventae Chasma (-2° ; 62°) northward along the Lunae Planum--Xanthe Terra contact (Fig. 1). Eleven hundred kilometers to the north it turns eastward across Xanthe Terra and onto Chryse Planum. This outflow complex is divided into three distinct systems: the Upper Maja System (2), the incised channels of the Maja, Vedra, Maumee and Bahram Valles, and the unconfined flow of Lower Maja across Chryse Planitia. The erosional and depositional features of the Eastern Lunae Planum Outflow Complex suggest that it was formed over a short period of time by catastrophic flooding--analogous to the channeled scablands of Eastern Washington (4).

The southern reaches of the Upper Maja Vallis are composed of deeply incised anastomosing channels. Northward, the flow exhibits erosional scours, probable depositional bars, and streamlined residual uplands as it spreads laterally (2). Shallow, rimless depressions in this region (9° ; 58.5°) may be analogous to terrestrial thermokarst alases (3). Small patches of chaotic terrain (Ister Chaos, 12° ; 53.5°) along the eastern edge of the broad trough acted as secondary sources of water. Bedforms in the confined flow of the canyon section include longitudinal grooves, cataracts, erosional scours and possible pendant bars (2). In the Chryse section, numerous small anastomosing channels cut the surface of a broad, low cone of alluvial material at the mouth of Maja canyon. Further east, multiple channels dissect ridges in the plains-forming material of Chryse basin.

The initial outflow surged northward along the eastern edge of Lunae Planum and impounded on the plains surface (1) until the flood crested the Xanthe Terra highlands to the east and spilled eastward toward Chryse. At the eastern edge of Xanthe Terra (18° ; 54°), the flood waters ponded behind a high standing ridge of rugged terrain. This Xanthe catchment basin filled until a diversion channel directed the flow southward and eastward around the barrier. Continued influx into the Xanthe catchment was greater than the outflow in the diversion channel, and the water level eventually crested the barrier ridge to spill on to the Chryse surface. A gorge was rapidly cut through the ridge; the lake was drained; and the diversion channel was abandoned. An alluvial cone was built at the mouth of the gorge (18° ; 53.5°) as the confined flow spread laterally. Waning flow across the fan cut numerous small distributary channels. Flow from the canyon spread across the western edge of Chryse to be come ponded behind the wrinkle ridges (2). The Maja fan continued to develop as a fan-delta. Again, once the lake level crested the ridges, it continued to spread eastward across the plains surface.

Water on the Lunae Planum surface was not completely drained. This upper lake continued to exist after the canyon section was incised across Xanthe Terra. Smooth plains-forming materials on the floors of some craters represent lacustrine deposition within flooded craters. Benches along the Xanthe Terra contact (16° ; 55.8°) may represent wave cut terraces along the shoreline, and secondary channeling of the Maja fan may represent episodic flow through the canyon. Therefore, the upper lake was drained by episodic release to Maja Vallis and by encroachment of Bahram Vallis by headward erosion across northern Lunae Planum.

This scenario suggests that the outflow and catastrophic flooding, as with most consequent stream systems, was temporarily impounded at several localities along its course. The flow duration was extended by intermediate storage and release from catchment areas and by influx from secondary sources in chaotic terrains along the middle reaches of the outflow channel.

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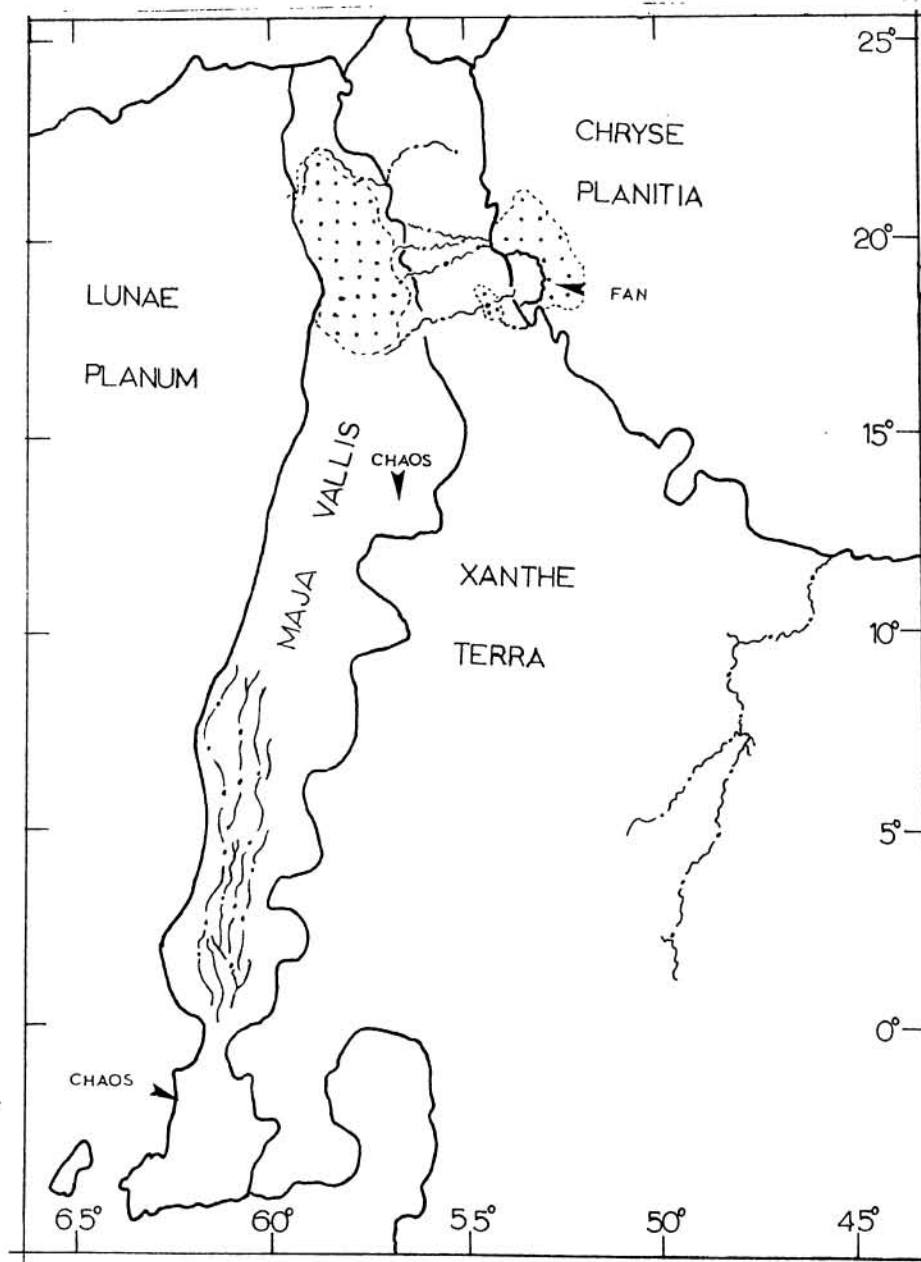


Figure 1. Sketch map of Maja Vallis. Large ephemeral lakes are shown by stippled pattern; major channels by dash and dot line symbol.