HYDRIC EVOLUTION OF TWO DELTAS IN THE ISMENIUS CAVUS SYSTEM, MARS. J. Suárez[1], D. Guerrero[2], N. Soler[3], D. Rámirez[4], C. Escobar[5], I. Nocua[6] and J. Gómez[7], [1]National University of Colombia (jaesuarezva@unal.edu.co, Calle 45 Sur #72r-49, Bogotá, Colombia), [2]University of Brasilia (daaguerrerogu@unal.edu.co), [3,4,5,6,7]National University of Colombia.

Introduction: The northernmost latitudes of Mars have always served as evidence for its aqueous past, multiple geologic forms such as valley networks, paleolakes and outburst flows points in this direction. Of special significance is the Borealis Basin, a massive depression that covers the north pole and that has been hypothesized of having contained an ocean [1]. Several fluvial systems spans across the limit between Borealis and higher lands, but delta features may be the most interesting and clarifying of them. A total of 52 deltas have been recorded in Mars [2], in this work we analyze two of these features, both associated with paleolakes in the Ismenius Lacus quadrangle.

The two deltas are close to each other and are related to paleloakes formed in ancient craters, we have named them Upper Delta and Lower Delta, their coordinates are 18.11ºN, 34.31ºE and 17.52ºN, 33.93ºE respectively. The region is heavily cratered and is dated as late Noachian, 3.88 Ga - 3.92 Ga [3], but a complex evolution over time was identified. Ismenius Cavus is the main feature of the region, it is a massive paleolake where the two deltas system drains [4]. The two deltas were first identified by Cabro and Grin [5] and initial interpretations were made by Ori et al. [6].

Data: The most actualized HiRISE and HRSC data provided an opportunity to better interpret this complex system, we make a hydrologic and geomorphologic analysis in three scales, using multispectral images and DEMS´s from THEMIS, Viking, MOLA, HRSC and HiRISE.

Results: *Hydrologic analysis*. On a regional scale it is possible to identify three kinds of regimes: valley networks, outburst flows and glacial features. The valley networks seem to be the oldest of the three, with a maximum age of Mid Noachian, according to the youngest units they cut [7]; outburst flows were formed after the valley networks, as determined by crosscutting relationships; at last, glacial features seems to have occurred in a wide range of time, but are especially predominant after the cease of outburst flows.

At a detailed scale the hydric systems are heavily controlled by medium size craters, which forms a series of interconnected paleloakes **(Figure 1)**, each one with valley networks and outburst flows associated to them. Of special interest is the appearance of two fanlike features, which due to their morphometric and stratigraphic properties seem to be deltaic deposits.

Geomorphologic analysis. The main transforming agents of the region are water and ice, which have been active at different moments in the region geologic history. Ismenius Cavus surroundings are dominated by outburst channels, specially Mammer Valles, a major feature that contains Ismenius Cavus. Nine paleolakes related to craters drains towards this basin, including the two where the studied deltas developed, these two crater make part of an open basin that stars several kilometers upwards the main lake chain, implying a vigorous and extended hydric activity.

The Upper Delta is fed by several valley networks and no outburst flow, then it can be inferred that the Upper Delta formed at a fluvial regime. We identified three main pulses, two of them have an elongated shape, with a length- wide ratio of 1.6, this configuration resembles a river dominated delta [8], which indicates that the dominant system was the incoming flow from the upper side of the basin. The Lower Delta is formed inside Ismenius Cavus, in contrast with the Upper Delta, this one is directly associated with a 10 km fretted channel, this one is composed of three pulses, all resembling a Gilbert-type delta [9]. Both delta structures are covered by glacial debris and recent sublimation pits.

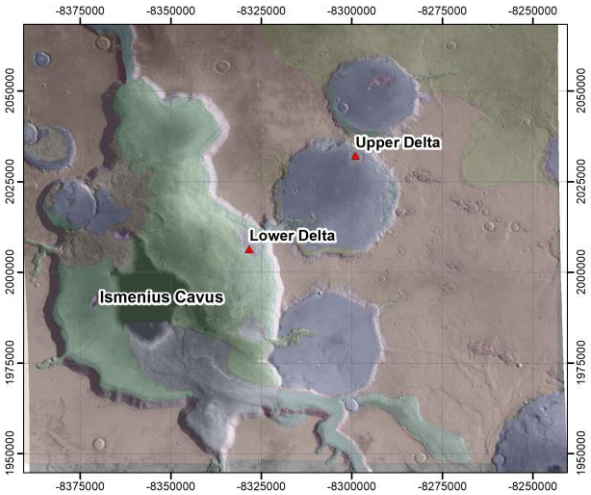

Figure 1: Geomorphologic map of Ismenius Cavus and its surroundings, The Upper and Lower deltas are highlighted.

Discussion: The geologic and hydric history of the zone can be divided in three well defined periods. A first one dates from the Late Noachian, this period is

characterized by the formation of valley network and sedimentary basins in prior crater impacts, including the Upper Delta; all the hydric systems are directed to the north, which implies that water was flowing towards the Borealis Basin, probably even before Mammer Valles was formed. A second period, close to the Noachian-Hesperian transition is dominated by the presence of outburst flows, a large number of fretted channels are superimposed to the earlier valley networks, this activity was intense and widespread in the region, molding large areas and showing and ongoing deterioration in the superficial water activity, the Lower Delta seems to date from this stage. A last stage corresponds to a period from the Middle Hesperian to the present, these features relates mainly to glacial activity and some aeolian features, hydric activity is completely absent and superficial transformation in form of U valleys and sublimation pits dominates the latest history of this system.

Conclusion: Deltaic features are key to identify and characterize the hydric systems of ancient Mars, this work has shown that Ismenius Cavus and its surrounding have undergone different types of hydric regimes, starting with valley networks, then fretted channels and finally being dominated by glacier activity. A well-defined geomorphologic evolution also illustrates the transition from a water rich Mars to the current frozen desert we observe.

Acknowledgments: We thanks the institutions in charge of processing and delivering the data used in this work: The USGS, the planetary data system (PDS) and the University of Arizona.

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