THE EVOLUTION OF ARES VALLIS. A. Pacifici, G.G. Ori. G. Komatsu and M. Pondrelli. (International Research School of Planetary Sciences, Pescara, Italy. Pacifici@irsps.unich.it)

Introduction: Ares Vallis is one of the greatest outflow channels of Mars, and it has been well investigated in past decades. Several reconstructions of the geological evolution of the channel have been proposed in the past, involving various geological processes, such as catastrophic floods [1][2][3][4], glacial erosion [5][6], and periglacial processes [7][8].
However, the previous ideas were based on the low- to medium-reolution Viking data and did not benefit from the newest high-resolution data sets. New high-resolution images from the HRSC on board on Mars Express along with data from MGS, and Odyssey allow more detailed investigations of Ares Vallis.
To understand in depth the morphologies shaped by outflow channels on Mars, it is better to comprehend the behaviour of water in the Martian environment, the climatic conditions at the periods in which they were formed, and the climatic changes that occurred in the Hesperian age of Mars.

Methodology and results: For the geomorphological andlysis of Ares Vallis, we used 21 HRSC orbit data-sets and more than 300 MOC Narrow Angle and THEMIS VIS images.
We observed and mapped in detail several erosive and depositional features distinctive of catastrophic floods, such as streamlined uplands, erosive terraces, giant bars, pendant bars, and an impressive cataract-like feature (figure 1). Superimposed on the catastrophic floods morphologie, we observe some glacial and periglacial features: they consist of ice-contact structures, thermokarstic depressions, and patterned grounds. We propose geological properties of the mapped units and characteristics of geomorphological processes responsible for their shaping; the cross-cutting relationships occurring among different units and the impact craters densities that are used to constrain the geological evolution of the area.

The geological evolution of Ares Vallis: Our investigations outline that Ares Vallis and its valley arms have been sculpted by several, time-scattered, catastrophic floods, occurring from the early to late Hesperian and originating from Iani Chaos, Aram Chaos and Hydaspis Chaos. Geomorphological evidence suggests that catastrophic floods were more than 500 meters deep, and that they were ice-covered as proposed by [9]. The lengths of time intervening among different floods vary from hundreds to thousand of years. At the end of each catastrophic flood, thick ice masses grounded on the valley floor, forming stagnant dead-ice bodies of considerable sizes. Each catastrophic flood event was followed by a relatively short period of warmer-wetter climatic conditions, possibly triggered by the greenhouse effect generated by water vapor and carbon dioxide released in the atmosphere during the catastrophic flood processes, according to Baker et al. [10]. During these periods, flows of water in equilibrium with the Martian atmosphere formed meandering channels and ice-walled streams and lakes on ice-masses, emplacing ice-contact deposits (figue 2) . Finally, the ice masses were wasted by sublimation, indicating that the atmosphere became again to have dry-cold climatic conditions. The ice bodies where covered by detritus, subsequently led to the formation of patterned terrains, which are associated with high values of emittance in THEMIS IR Night images. This suggests the presence of duricrust or ice cemented soils, and could be considered a possible indicator of the existence of buried ice-bodies at the present day or until a recent past.

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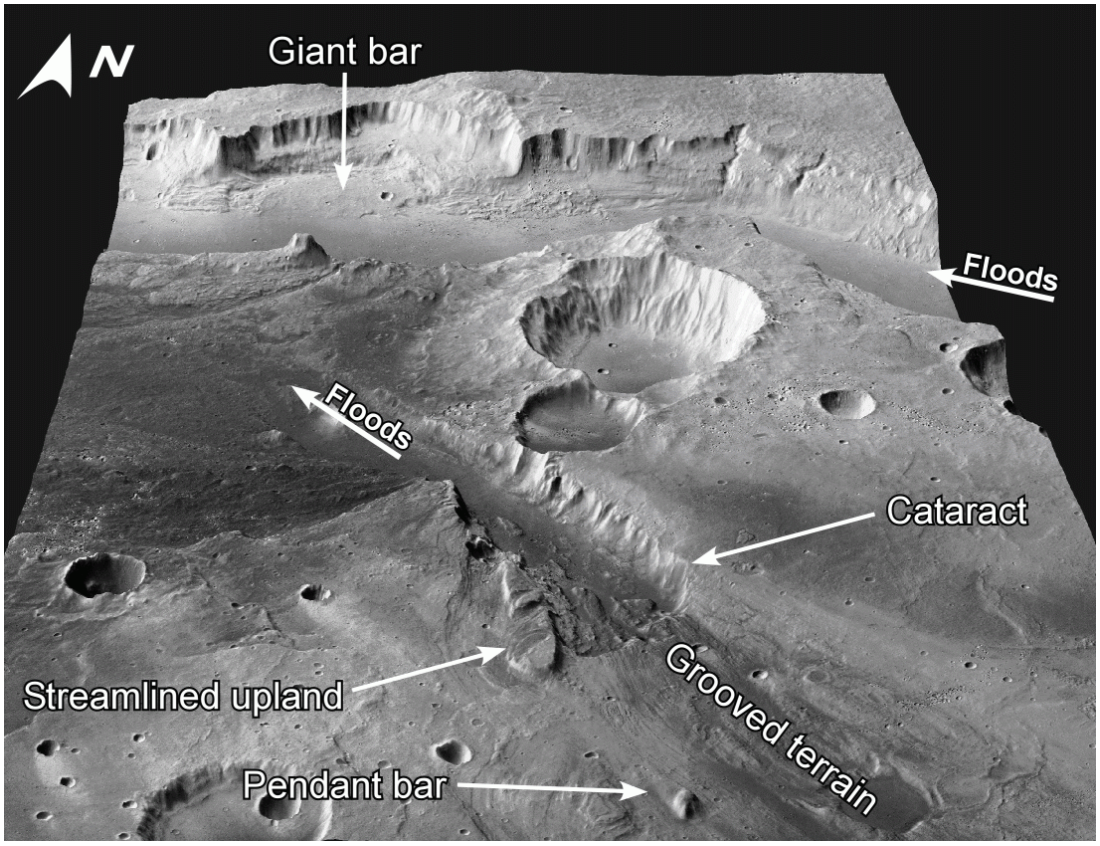

Figure 1. erosive and depositional morphologies shaped by catastrophgic floods sculpting the Ares Vallis. Erosive features consist in Streamlined uplands, grooved terrain and an impressive 500 meter high cataract. Depositional morphologies are giant bars located on alcoves that flank the main flooded valley and pendant bars. HRSC mosaic draped on HRSc stereo derived DTMs mosaic. Vertical exaggeration is 5 time

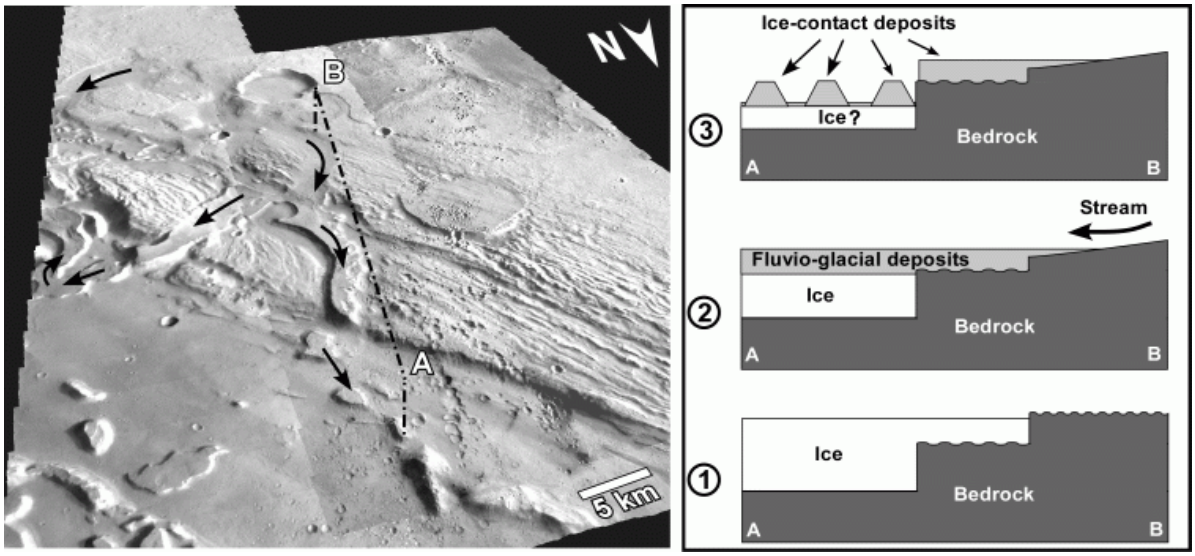

Figure 2 . Ice-contact deposits emplaced on top of terraces scoured by catastrophic floods. The sketch illustrates the proposed geological evolution of these features.