GEOLOGICAL MAP OF AEOLIS FLUVIAL SEDIMENTARY BASIN, MARS. I. Di Pietro[1], G. G. Ori[1,2], M. Pondrelli[1], and F. Salese[1], [1]International Research School of Planetary Sciences, Dipartimento di Ingegneria e Geologia, Università d'Annunzio, Viale Pindaro 42, 65127 Pescara, Italy (ilaria.dipietro@irsps.unich.it), [2]Ibn Battuta Centre, Universite' Cadi Ayyad, Marrakech, Morocco (ggori@irsps.unich.it).

Introduction: The Aeolis Dorsa area (151°E 3°S; is a broad depression located along the dichotomy and confined to higher standing Aeolis and Zephyria Plana. The detection of a dense cluster of sinuous ridges (Fig. 1), recently interpreted as exhumed (also mentioned as inverted in the literature) fluvial channels [1,2], led to consider this area as one of the most interesting on Mars to constrain the presence of liquid water and the related depositional processes and climatic implications. The longest channel (Aeolis Serpens) can be traced SE-NW through alternate rounded positive and negative segments along its lenght (~500 km). Aeolis Dorsa basin deposits are stacked within the two most western lobes of Medusae Fossae Formation [1], an extensive light-toned and friable layered unit.

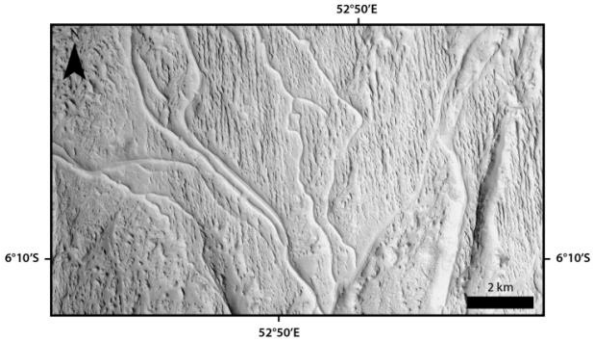

Figure 1- Well-preserved exhumed (inverted) channels and small N-S yardangs are also visible. CTX image n° P08_004336_1742.

Data: For this study, we mainly used Context Camera images (CTX; [3]) and High Resolution Imaging Science Experiment images (HiRISE,[4]) were also explored to get further high-resolution geomorphic information and details about mutual stratigraphic relationships. Mars Orbiter Laser Altimeter digital terrain model (MOLA DTM) at ~463m/pixel resolution [5] provided topographic data.

Results:. In order to understand the geometries, processes and evolution of the sedimentary deposits along the global dichotomy boundary, our project is to produce a detailed geological map delineating the spatial arrangement of the various unit types and their characteristics, stratigraphic relations and finally genetic interpretations. Here, we present a preliminary map of this work, representing the Aeolis Dorsa region. The geological mapping emphasized the presence and distribution of a large river system in the study area during the late Hesperian. River network has been reconstructed through both exhumed (inverted) fluvial and alluvial channels as differential aeolian erosion has removed fine sediments and exposed remnants of more resistant and coarser channels as sinuous ridges or meanderbelts (Fig. 2).

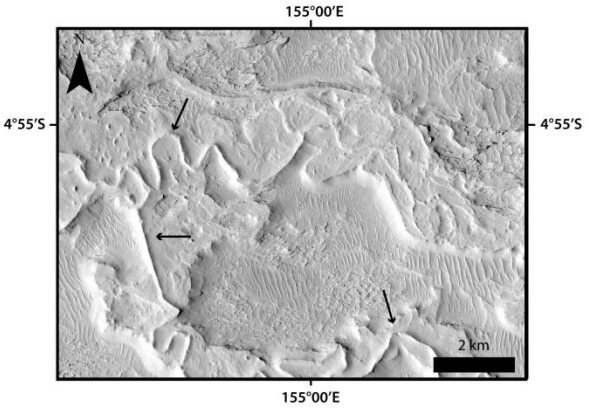

Figure 2- Exhumed meanderbelts. Black arrows mark an individual exhumed-inverted meandering channel. HiRISE image n° ESP_020673_1750.

A trunk river (or river system) stretched longitudinally and alluvial fans, distributary systems and tributary rivers flowed perpendicularly to the basin axis (Fig. 3).

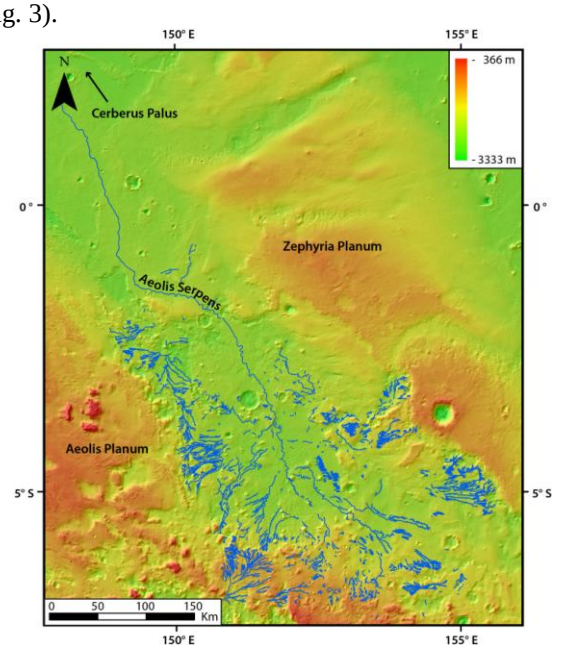

Figure 3 - Extrapolated river network on colorized MOLA topography in Aeolis Dorsa basin region.

Several time (and deposition) gaps have been noticed between observed deposits, so the whole stratigraphic sequence points to several deposition-erosion (Fig. 4) cycles controlled by the amount of available water provided by rain or snowmelt. Different water availabilities and, hence, different regime flows and transported sediment result in a different channel deposits and floodplain deposits proportion and make to distinguish three types of fluvial deposits in Aeolis Dorsa.

So, at least three main wet phases are recognizable, corresponding to three main different fluvial units (F1, F2, F3). In conclusion, Aeolis Dorsa region deposits record a regional climate that differs from the present-day Martian environmental conditions that are totally dry. In those periods, the water supply should had to exceed infiltration and evaporation processes in order to transport sediments. This puts an important clue in the planet's past climatic history and evolution.

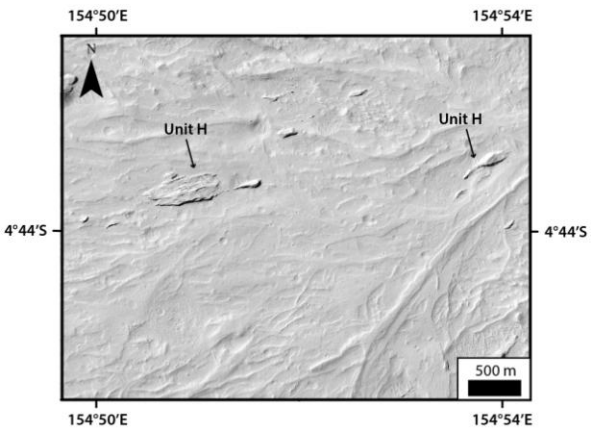

Figure 4 - Post-fluvial deposits remnants (Unit H) lying in low-standing zones between inverted alluvial fan channels (unit F1) and testifying an erosional phase before Unit H emplacement. HiRISE image n° PSP_007975_1755.

References: [1] Burr D. M. et al. (2006) *Icarus, 200, 52.76.* [2] Pain C. F. et al. (2007) *Icarus, 190, 478-491*. [3] Malin M. C. et al. (2007) *JGR, 112, E05S04.* [4] McEwen A. S. et al. (2007) *JGR, 112, E05S02.* [5] Smith D. E. et al. (2001) *JGR, 106(E10), 23689–23722*.