Reconstructing fluvio-deltaic depositional systems on Mars: an approach using Martian orbital and Terrestrial analogue data. G. G. Ori[1 2] and F. Cannarsa[1], [1]IRSPS, Universita' d'Annunzio, Viale Pindaro 42, 65127 Pescara, Italy, ggori@irsps.unich.it, cannarsa@irsps.unich.it, [2] Ibn Battuta Centre, Unversite Cady Ayyad, Marrakech, Morocco

Introduction: Fluvial systems (not including outflow channels) are now well recognised on the surface of Mars. They exhibit both erosional and depositional reaches and cover large portion of the planets. Deltaic systems, as well, are widely observed on the planet. The presence of fluvio-deltaic systems is the evidence for a complex hydrological surface system with the occurrence of large bodies of standing water. It is remarkable that these fluvial systems have been depositional. Channel systems in the erosional realm have been observed on Mars since the Viking mission, but recently exhumed (inverted) channels have been observed. This means that fluvial systems constructed themselves in a floodplain and that alluvial plain probably existed.

Types of fluvio-deltaic systems: Erosional fluvial systems (network and isolated channels) are almost ubiquitous on Mars and they often are associated with deltaic features. These deltaic bodies are actually fan-deltas because directly connected to the erosional reaches of their feeding rivers [1]. These fan deltas can be very simple and form single or a few stacked bodies of Gilbert-type deltas [2]. In other cases (e.g. Eberswalde, Sabrina) they show a more complex deltaic plain and probably the delta front was subdivided in several mouth bars.

In a number of instances erosional rivers debouch in plains without any deltaic evidences. By analogy with several drylands, including Sahara, they probably passed into a dry plain via terminal fans, that is the distributary channel systems in low-gradient slopes that dry out downstream due to water evaporation and percolation [3].

The occurrence of exhumed (inverted) channels suggests the presence of more complex river – flood plain systems producing real alluvial plains [4]. These alluvial plain rivers must terminate with complex deltaic bodies resembling fluvial - or wave- dominated terrestrial deltas when debouching in bodies of standing waters. In case of inland basins they may terminate in systems resembling the terrestrial inland deltas.

Terrestrial analogies: Unfortunately, the sedimentological record of exposed depositional systems is largely incomplete. This is due to the strong wind erosion that these features underwent through the long Martian history [5]. In Sahara, large rivers and deltas formed during humid periods and they formed large fluvio-deltaic systems. However, during dry periods eolian activity removed almost completely the entire volume of fine (sand grade to mudstone) leaving only negative erosional morphologies, lags, and gravel deposits (Fig. 1). The only evidence in Sahara and adjacent arid and semi-arid areas (Arabia peninsula, Spain, etc.) of large alluvial plains and deltas are a few scattered exhumed channels both straight and meandering. This was also probably the fate of the fine-grained deposits of the rivers and delta systems on Mars.

A clear hint of this mechanism is shown in the deltaic plain of Eberswalde. Here there are evident meander belts. Meanders to be formed need cohesive muddy banks. Therefore, the presence of point bar bodies indicate that the deltaic plain was covered by a blanket of mud and fine-grained deposits at least as thick as the depth of meandering channels.

Summing up: erosional river systems are connected with fan deltas, alluvial plain systems probably where connected with more complex deltaic bodies, large part of the sedimentary record has been removed, Sahara and drylands may be used as proxies in deciphering the nature of the Martian fluvio-deltaic system.

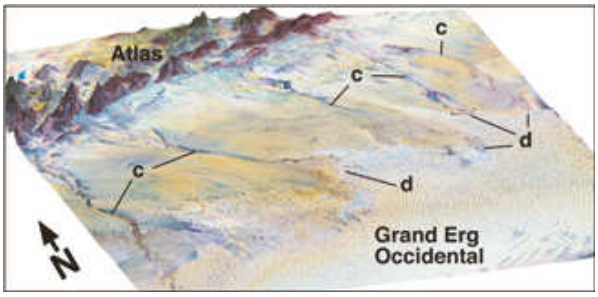

Fig. 1 Oblique view of the Atlasic Hamada with the palaeovalleys (c) flowing from the Atlas Mountains to the Grand Erg Occidental. Oued Namous is to the left. The palaeochannels are clearly visible and their distributary channel systems have their termini at the border of the erg. (d).

References: [1] Kraal E.R. et al. (2008) *Nature 451* (7181), 973-976. [2] Ori G.G. and Roveri M. (1987) *Sedimentology 34* (5), 845-859. [3] Ori G. G et al. (2007) *Sedimentary Processes, Environments and Basins*, Spec. Publ. Num. 38 IAS Editor(s): Nichols G. et al. DOI: 10.1002/9781444304411. [4] Holm D.A. (1960) *Science 132* (3437), 1369–1379. [5] Newsom et al. (2010) *Icarus, 205* (2010) 64–72.