DELTAIC, SEBKHA AND AEOLIAN SEDIMENTATION IN JUVENTAE CHASMA AND THEIR STRATIGRAPHIC RELATIONSHIPS (MARS). Gian Gabriele Ori[1], Goro Komatsu[1], Andrea Pacifici[1], Ernst Hauber [2], Klaus Gwinner [2], Gerhard Neukum[3], and the HRSC CoInvestigator Team [1]International Research School of Planetary Sciences, Università d'Annunzio,Viale Pindaro 42, 65127 Pescara, Italy. (ggori@irsps.unich.it), [2] Institute of Planetary Research, DLR, Rutherfordstr. 2, 12489 Berlin, Germany., [3] Institut für Geologische Wissenschaften Freie Universität Berlin, Malteserstr. 74100, Bldg. D, 12249 Berlin, Germany

Introduction: Sedimentary basins on Mars have been identified in the past and several of them are lacustrine in origin. These basins are associated with sedimentary bodies that are interpreted as the product of fluvial, deltaic, and wave dynamics. However, the observations so far have been based on morphological data and analysis. The High Resolution Stereo Camera [1] has remarkable stereo capabilities and it allows three-dimensional analysis of Martian outcrops in cliffs and slopes in a way similar to the study of large terrestrial outcrops [2] or seismic lines. The aim of this paper is to describe the facies and strata patterns of two large outcrops corresponding to Interior Layered Deposits (ILDs) in Juventae Chasma. In this chasma there are two major hills of ILDs: the northern hill deposits are interpreted as deltaic deposits and the southern deposits are interpreted as sebkha evaporitic deposits with intervening aeolian deposits.

Large-scale delta: The large cliffs forming the slope of the hill show the internal stratification exhumed by erosion, allowing a detailed analysis of the stratigraphy and facies (Figs. 1). The internal stratal geometry is dominated by an overall stratification inclining southwards. Inclined strata may be observed in both sides (east and west) of the hill and they comprise almost the entire body. Unconformities and sequences occur within this outcrop, but the general geometry is a thick set of strata inclined with angles ranging from 15 to 25 degrees (the angles have been estimated as in the usual terrestrial fieldwork by viewing the stratification in three dimensions). Due to the strong erosional processes the top of the hill has been removed. However, at places, it is possible to see the inclined beds to become horizontal at their upper termination. Moreover, when observable, the base of the inclined strata becomes flat and horizontal. Therefore, even if the bulk of the hill consists of the inclined strata they appear to become horizontal at their termini.

The observed geometry is very well known in terrestrial deltaic deposits where a three-fold stratal pattern is produced by the progradation of deltaic bodies: (i) the horizontal upper strata are the topset facies representing fluvial and delta plain deposition that supplied detritus for the construction of the delta and the horizontal strata mark the level of water inside the basin, (ii) the inclined strata are the foreset package that represents the slope of the delta, and they connect the shoreline (topset) with the basin floor, (iii) the horizontal strata in the lower part are the most distal part of the delta accumulated on the basin floor and they represent the bottomset facies. At places the bottomset strata may be replaced by downlap geometry.

Sebkha and aeolian facies: The general stratal pattern of the outcrops of the southern hill (Figs. 2) resemble classic transgression – regression cycle. From the geometry, the high-albedo strata are the proximal deposits in contrast to the low-albedo deposits that represent the distal facies. The proximal (marginal) facies are probably evaporitic material as suggested by their albedo and the spectral data [3]. The darker material probably represents a more clastic lithology that may consist of clay to coarse-grained silt. The general horizontal stratification pattern without major discontinuities, the absence of sedimentary structures linked to high-energy currents is indicative of low-energy deposition from suspension. This scenario is in good agreement with the interpretation of evaporitic marginal facies passing (northwards) into basinal clastic facies deposited in a body of standing low-energy water.

The east slope of the hill shows again the previous facies and mostly the evaporitic deposits. However, the outcrop is dominated by a unit consisting of cross-bedded material [4]. The unit averages a thickness of about 200 metres but it seems that at places it can become thicker. However, the changes in thickness are due to relives of the top because the bottom of the unit remains approximately at the same elevation. Internally the unit show strata inclined in several directions with apparent angle (it is impossible to measure the true attitude) of 20–30 degrees. These cross-strata are organized in sets 20 to 50 metres thick. However, at the base of the unit a single cross-bedded set attains a thickness in excess of 100 metres. Whereas the base of the unit is near horizontal the upper boundary is irregular, but due to the quality of the image it is possible to do detailed observations only in particular locations. In these instances, the top of the unit is gently curved and the overlaying strata drape these smooth irregularities. Large-scale cross bedding is produce in several subacqueous environments but the facies and geological setting of these ILDs suggest these deposits have been accumulated by wind processes as large-scale aeolian dunes. This situation is common on Earth where sebkha environments are strictly connected to aeolian dunes.

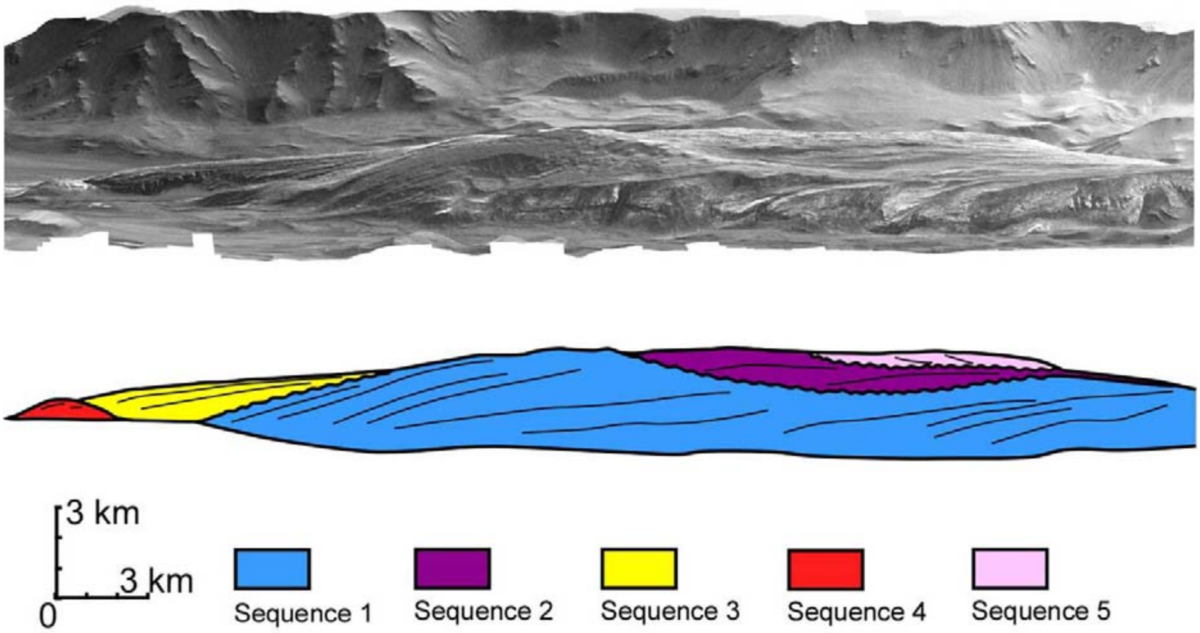

Fig. 1. The eastern slope of the northern ILD showing large-scale cross-bedded strata produced by deltaic progradation. The different sequences are the product of stages in the deltaic evolution. A general lowering of the water level is marked by the decrease in the elevation of the topset beds in sequences 1, 3, and 4.

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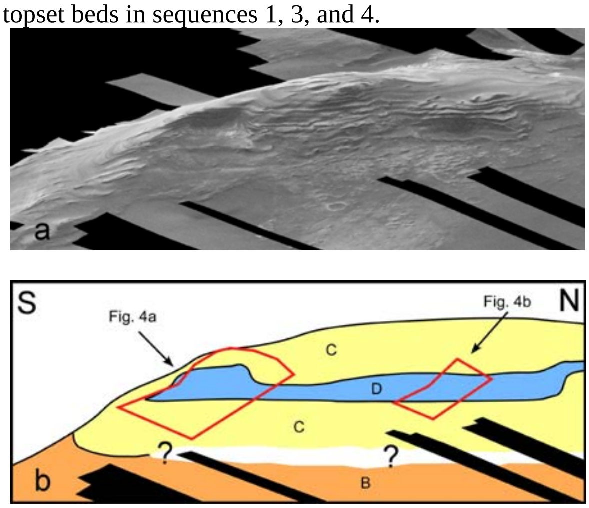

Fig. 2. The eastern slope of the southern ILD. B: poorly exposed outcrop of evaporitic deposits, C: well-bedded evaporitic deposits, D: large cross bedding.