RIPPLE MIGRATION ON ACTIVE DUNES IN NILI PATERA (MARS). S. Silvestro[1], L. K Fenton[2], D. A. Vaz[3], N. Bridges[4] and G. G. Ori[1,5] [1]International Research School of Planetary Sciences, Viale Pindaro 42, Pescara, Italy, [2]SETI Institute, NASA Ames Research Center, CA, USA, [3]Centre for Geophysics, University of Coimbra, Portugal, [4]Applied Physics Laboratory, Laurel, MD, USA, [5]Ibn Battuta Centre, Universitè Cadi Ayyad, Marrakech, Morocco.

Introduction: Recent studies have documented active sand movement Mars. These includes the deflation of several dome-like dunes in the North Polar Erg [1] and in Meridiani Planum [2], and the identification of sand avalanche scars on dark dune slip faces in the Proctor [3] and in the Rabe crater ergs [4]. In contrast, up until this study, definitive evidence of bedform migration was limit to a single observation by the Spirit rover at Gusev crater (~2 cm in 5 martian sols) [5].

Images from the HiRISE camera on the Mars Reconnaissance Orbiter (MRO) have revealed that, as on Earth, wind ripples are common on dune surfaces [6]. In this work we focused our attention on these features and in other subtle changes observed in the shape of several crescentic dunes in Nili Patera (8.6°N; 67°E) in a time span of less than four terrestrial months (between the 30 of June and the 13 October 2007.

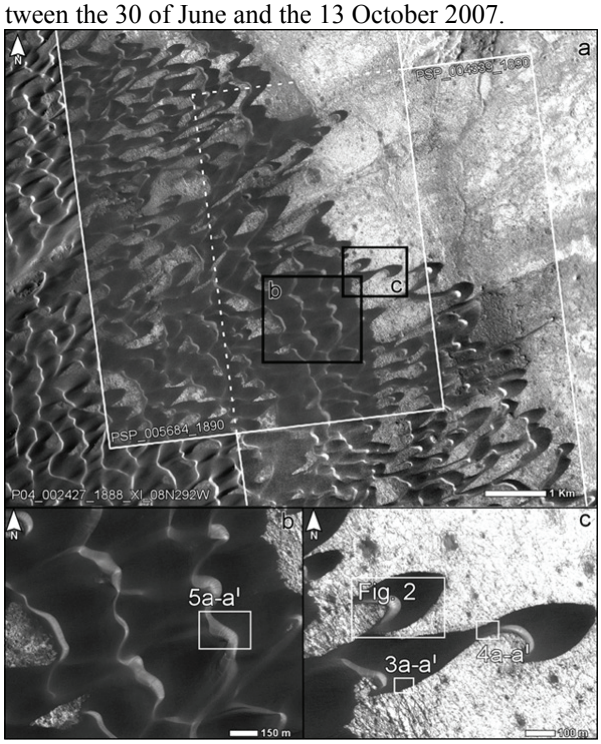

Fig. 1. Location map of the study area

Methods: Two overlapping HiRISE images (PSP_004339_1890 and PSP_005684_1890) were processed and co-registered with the CTX P04_002427_1888_XL_08N292W (Fig. 1) into a Geographic Information System (GIS) environment. The HiRISE have been acquired the 30 June and 13 October 2007 at Ls=267.5° (late autumn) and Ls= 330.0° (winter), respectively. A semiautomatic algorithm for ripple identification was used to extract ripple crests and to search for changing ripple patterns [7, 8, 9] (Fig. 2).

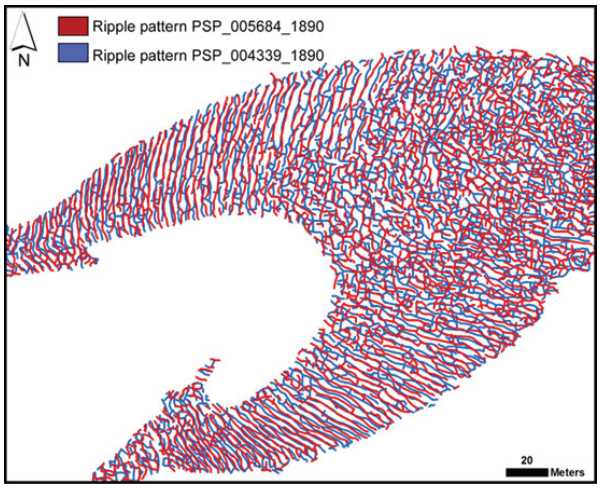

Fig.2. Examples of ripple patterns extracted by using the semiautomatic algorithm

Results: the results of our mapping suggest that widespread ripple migration occurred in the study area (Fig. 2). In particular, such movement is best evidenced in displacement of the Y junctions at the ripple crest terminations (Fig. 3a - a^I). Ripple crests are outlined in yellow and major modifications in blue. Assuming that the displacement of the ripple crests would be less than one crest wavelength, we calculated a migration of ~2 m toward the WSW.

Fig. 4a – a^I shows a significant change of albedo in the two images, highlighted by the red circles. We interpret this albedo variation to be due to the removal of the dark sand that saltates downwind suggesting that these dunes are undergoing major modifications of their shape.

Fig. 5a - a^I shows the variation of the rectilinear streaks over the dune slip face (see Fig. 1 for location). We interpret these features as new grainflow events [10] suggesting consistent dune activity between late autumn and winter.

Discussion: The changes in the position of the Y junctions and in the edges of the study dunes (Figs. 3, 4), indicate that sand transport occurred in the study

area. The ripple migration was likely forced by the same ENE winds affecting the whole dune field suggesting high stress winds blowing between late autumn and winter.

The capability of sand to move on the Martian surface has been discussed by [5] as a factor controlled by the pervasive indurations of the regolith and the frequency of wind events having sufficient energy to saltate sand. Ripple migration at this site suggests that dune surfaces are not heavily crusted or indurated and that saltation events, possibly caused by high-energy atmospheric phenomena like dust storms, are frequent enough to prevent the formation of a thick stabilizing crust.

The occurrence of new grainflow scars on dune slip faces in Nili Patera indicates that not only ripples, but also the whole dunes, are actually migrating.

Collectively, our results, indicate that sustained sand saltation occurred in the study area and that dark dunes in Nili Patera are active in present day atmospheric conditions.

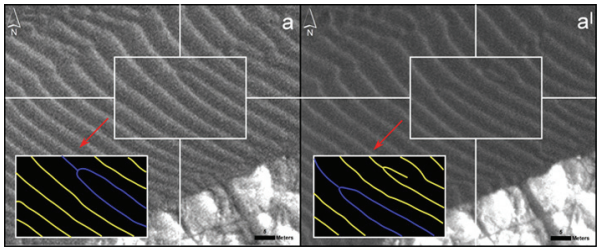

Fig. 3. Modifications of the ripple pattern in the study site. Ripples are outlined in yellow. Major changes in the ripple pattern are outlined in blue. HiRISE PSP_004339_1890; a^I, b^I, c^I) HiRISE PSP_005684_1890

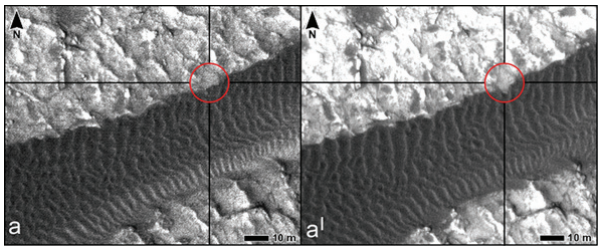

Fig. 4. Dune edges modifications. Major albedo change outlined by the red circles

Future work: a global searching for ripple movement and dune slip face avalanching is planned to better constrain the migration rate of the wind ripples and the geographical distribution of the active dark dunes and seasonal wind pattern on Mars.

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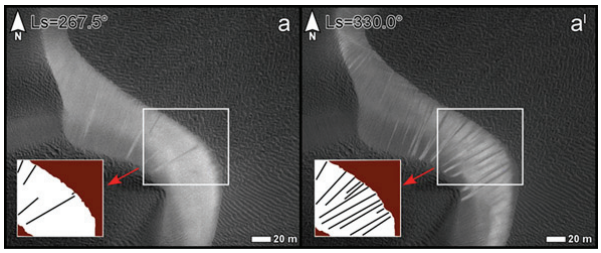

Fig. 5. Modifications occurred over dune slip faces. Several new grainflows (in black) occurred over the dune slip face (in white). Dune stoss side in brown. a) PSP_004339_1890; a^I) PSP_005684_1890.

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