

## “Inca City” DDS Test Region in Mars: New Comparisons by MRO Data

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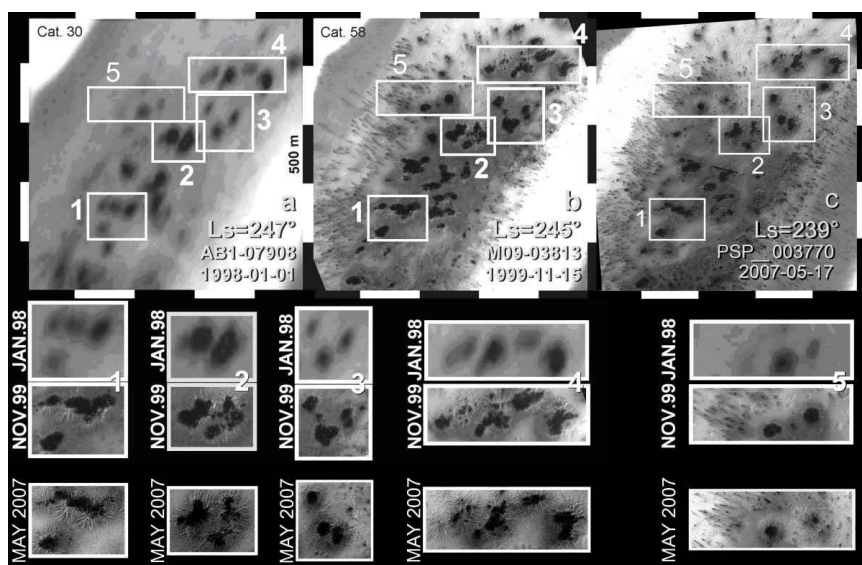
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**Introduction:** Even in 1997, on the first Mars Global Surveyor (MGS MOC) images acquired in springtime on the southern frosted polar dune fields, interesting dark spots were discovered in the cassette structures of Inca City region [1]. In the first images only the dark spots were present but later, on the MGS images with higher resolution another phenomenon was found parallel with the dark spots: the spider phenomenon. Part of the investigators considered that the spiders and the dark spots are different phases in the development of the same phenomenon [2]. Since that time a great number of spiders are studied in detail on the MGS images [3, 4]. Ness and Orme suggested that spiders may be related to biological objects [4].

On the new Mars Reconnaissance Orbiter (MRO) HiRISE images long term and very high resolution comparisons became possible [5, 6].

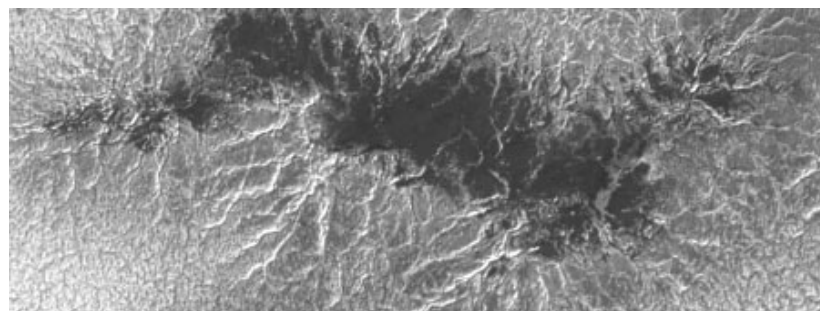
We began to study the dark splotches, which we named Dark Dune Spots (DDS) in 2000 and the first results were presented at the 32<sup>th</sup> Lunar and Planetary Science Conference (LPSC) [7]. In these studies the idea arose that DDSs are the products of simple biological objects, MSOs (Mars Surface Organisms). The detailed description of the DDS-MSO hypothesis was given in 2003 [8].

On the high resolution images of the Inca City region the detailed sequence of the changes of the DDSs have been demonstrated at the 33<sup>th</sup> LPSC [9].



**Fig. 1.** In the cassette II in the Inca City Region [8, 9] we can observe annual changes of the appearance of the DDSs in some enlarged sections of their framed region. Image (a) has 16 m resolution, (b) 4 meter resolution by MGS, and (c) 0.25 m resolution by MRO. It can be well observed that on the marked areas the DDSs appear in the vicinity of spiders.

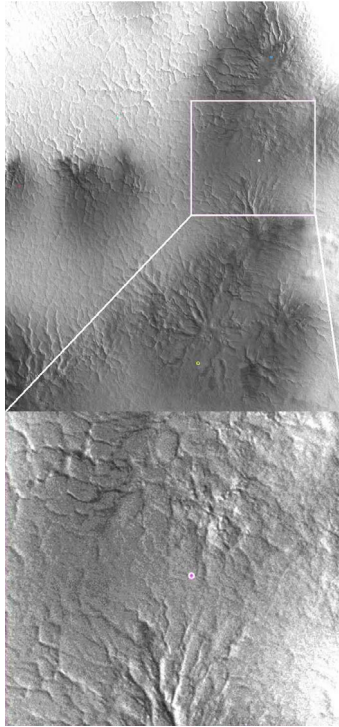
**Fig. 2.** On the 500x175 m frame of the HiRISE PSP\_003770 (1 of Fig. 1) image the DDSs appear on the flat areas between the arms of the spiders, but do not correspond to the most furrowed terrain.



Summary of our 9 years of study on DDS evolution were presented at the 40<sup>th</sup> LPSC [10].

Our new studies revealed that the spiders and the DDSs can be present in separate locations, and especially at the Inca City region, appear both together in a connected form, as well as separately.

**Observations:** In our investigations a great number of MGS and some new MRO images were used. In Fig. 1 we demonstrate the fantastic increase in resolution of the images from 16 m to 0.25 m.



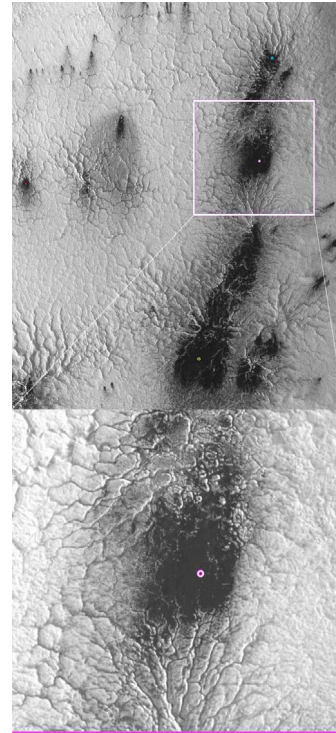
**Fig. 3.** 550x700 m region of Inca City early spring MRO image (ESP\_011557\_0985,  $L_s=190.5^\circ$ , 50 cm/pixel, 13012009), below: 200x200 m enlarged frame without DDS between the two spiders. Sun illuminated from left

It is visible in Fig. 2. that in the marked areas, the DDSs appear in the vicinity of the spiders. In the high-resolution details of MRO images the DDSs mostly appear in the flat areas between the arms of the spiders, but do not necessarily coincide with the centers of the spiders. From a comparison of two MRO images (Fig. 3. and Fig. 4) it can be seen that there are DDSs, which do not coincide with the central position of the spiders.

An early (ESP\_011557\_0985) and a later spring image (PSP\_003770\_0815) has been used for comparison. Equivalent 550x700 m sections of the Inca City region are shown in Fig. 3. and Fig. 4. upper images. In Fig. 3. it can be seen on an early spring image that pale gray terrains mark the sites where the DDSs will develop. In Fig. 3. lower image (enlarged from the upper one) the surface region is visible between the two spiders with no signs of a DDS. In the late spring image of this

area in Fig. 4. the black spots of the developed DDSs are already visible. In Fig. 4. lower image (enlarged from the upper one) the surface region between the two spiders exhibit prominent black dune spots.

In general the DDSs in geographical position closer to the equator manifest to ringed structure and their appearance is different from those in Inca City [11, 12].



**Fig. 4.** 550x700 m region of Inca City late spring MRO image (PSP\_003770\_0815,  $L_s=239.4^\circ$ , 25 cm/pixel, 17052007). Below: 200x200 m enlarged frame with black DDS between the two spiders. Sun illuminated from right

**Conclusion:** Both at, and between the flat areas of spiders the DDSs can cover the surface. According to the DDS-MSO theory [8, 11], the frost sublimated at the DDS by the help of the MSO's activity. And finally the naked dark basaltic sand surface emerges. At the same time, on the areas where there is no DDS, the frost can be seen for a longer time in late spring.

**Acknowledgment:** This work was supported by the ESA ECS-project No. 98076.

**References:** [1] Malin, Edgett (2000) 31<sup>st</sup> LPSC #1052; [2] Picqueux et al., 2003 ; [3] Kieffer (2000) *Int. Conf. on Mars Polar Sci. Explor.* #4095; [4] Ness, Orme (2002) *J.B.I.S.*, 55, 85-109, (2001); [5] Hansen, McEwen (2007) *AGU Press Conf.*; [6] Thomas et al., (2008) 37th COSPAR, Canada, B02-0026-08; [7] Horváth et al. (2001) 32<sup>nd</sup> LPSC #1543; [8] Gánti et al. (2003) *Orig. Life Evol. Biosph.*, 33: 515-557; [9] Horváth et al. (2002) 33<sup>rd</sup> LPSC #1109; [10] Kereszturi et al. (2009) 40<sup>th</sup> LPSC #1618; [11] Szathmáry et al. (2007) in *Planetary Systems and the Origin of Life*, ed. Pudritz et al., Cambridge University Press 241-262; [12] Horváth et al. (2009) *Astrobiology*, 9, 1, 90-103.