

A POSSIBLE DIKE SYSTEM ON ATLANTIS BASIN REGION, SIRENUM TERRAE, MARS. M. A. de Pablo* and A. Márquez. Área de Geología. Dpto. de Matemáticas y Física Aplicadas y Ciencias de la Naturaleza. Escuela Superior de Ciencias Experimentales y Tecnología. Universidad Rey Juan Carlos. 28933 Móstoles, Madrid. Spain. (* madepablo@escet.urjc.es)

Introduction: the MOC/MGS images has shown new features of the martian surface, between them there are possible dikes [1]. Due to these images the large radial fracture systems to Tharsis like Sirenum, Memnonia, or Thaumasia have been related to dikes action [2], and new places where different types of dikes have been located [1] [3]. In this work some features interpretable like dikes are located near to Atlantis Basin, through the employment of the *Mars Odyssey* THEMIS images.

Atlantis basin region: the study area is located in the surroundings of the Atlantis basin [4], centered in 35°S 177°W, in Sirenum Terrae, Mars, in a Middle Noachian volcanic plains [5] [6]. This basin, is an ancient impact crater modified by different erosive, sedimentary, tectonic and volcanic processes [4], with a chaotic area (Atlantis Chaos). In the southwest and east edges two possible volcanic relief [5] [4]. At the North and South of the basin there are the two graben systems of Memnonian and Sirenum Fossae, respectively, are located.

During the Late Noachian period this basin was included into the ancient Eridania Lake [7], the Ma'adim Vallis water source. Before constituting an independent lake of smaller dimensions [8].

Methodology: the present study has been mainly accomplished through the analysis of the *Mars Odyssey* THEMIS images, MOC images and MOLA altimetry data of the *Mars Global Surveyor*.

Description: into the chaotic terrain of Atlantis Chaos, some linear structures are observed, mainly in the 'mesas' that constitute the chaotic terrain. These linear structures show several main directions: SW-NE, SSE-NNW and SE-NE. Occasionally, similar linear structures are observed in the depressed zones located between several 'mesas' of this chaotic area. Locally networks of these linear structures with multiples directions, have been observed.

The linear structures are mainly located in the South area of the chaotic terrain in areas with a more eroded surface than the flat tables.

In addition, similar structures with the same trend have been observed at the North of the studied basin, in the proximities of the Memnonian Fossae fractures. They are not found associated with a chaotic terrain, but with a volcanic plain formed during the middle Noachian [5] [6].

A possible dike system: the observed structures, into the chaotic terrain of Atlantis Chaos, as well as in the surrounding area to the Atlantis basin, could be interpreted as an ancient dikes system. The observed morphologies are similar to the described for dikes in other regions of Mars [1]. With the accomplished local observations, it could be not established a clear origin for these structures, being able to be igneous dikes or hydrothermal dikes. In both cases they could be related to the volcanic activity that gave cause for the existing volcanic edifices in the zone.

The dikes found into the basin could be interpreted as remaining of the igneous activity produced in the interior of impact basins, such it has been described for other places of Mars [9]. The existence of mud-flow deposits around Atlantis Chaos and between its tables, and of possible collapse areas in the South edge of the chaotic terrain would be interpreted as thermal reactivation of these dikes. That interpretation would be supported by the presence of very few impact craters on the volcanic structures of the East margin of the basin.

Dikes and groundwater: if a dike related origin is supposed for these linear structures, then the presence of these dikes would partially explain the formation of the chaotic terrain of Atlantis chaos. In the previous models on chaotic terrains formation existence of a thermal source is required, either for the permafrost fusion [10] [11] or for the decomposition of the subsoil clathrate [12]. In the first model, the permafrost fusion and the chaotic terrain formation also would be produced by the tectonic activity. Although they are not relevant fractures crossing the chaotic terrain of Atlantis Chaos, some lineations can be observed. Therefore this possible origin for the chaotic terrain can not be totally discarded. In any case, the formation of the chaotic terrain was demanding the presence of an important quantity of groundwater.

On the other hand, the presence in the Atlantis chaos surroundings of some mud-flow deposits and subsidence areas could indicate that these possible dikes have been thermally actives at least in one case, producing the permafrost fusion. Both cases indicate the groundwater existence.

Conclusions: into the chaotic terrain located in Atlantis basin appear linear structures that could be interpreted as igneous or hydrothermal dikes. Several

morphological features of this basin would support this interpretation. These dikes could indicate the existence of a possible thermal source in the interior of the basin, what would support the astrobiological interest of the Atlantis basin already emphasized in the bibliography [13].

Acknowledgements: this work was supported by CAM and FSE grants.

References: [1] Mège, D. (1999). *V Mars Conference*, Abstract #6207. [2] Wilson, L., and Head, J.W. (2001) *JGR*, 107, 10.1029. [3] Jaeger, W.L. et al. (2003) *XXXIV LPSC*, Abstract #2045. [4] de Pablo, M.A. and Druet, M. (2002) *XXXIII LPSC*, abstract

#1032. [5] Scott, D.H. and Tanaka, K.L. (1986) *USGS. Misc. Inv. Ser. Map I-1802-A*. [6] Greeley, R., and Guest, J.E. (1987) *USGS. Misc. Inv. Ser. Map I-1802-B*. [7] Irwin, R.P. III, et al. (2002) *Science*, 297, 2209-2212. [8] de Pablo, M.A. (2003) *VI Mars Conference*, abstract #3037. [9] Albin, E.F. (2001) *XXXII LPSC*, abstract #1972. [10] Hartmann, W.K. (1993) *Wadsworth Pub.*, Belmont. 510 pp. [11] Komatsu, G. et al. (2000) *XXXI LPSC*, abstract #1434. [12] Oyawa, Y., et al. (2003) *V Mars Conference*, Abstract #3095. [13] de Pablo, M.A. and Fairén, A.G. (2003) *Proceedings of the 3rd European Exo/Astrobiological Workshop*. 126-127.

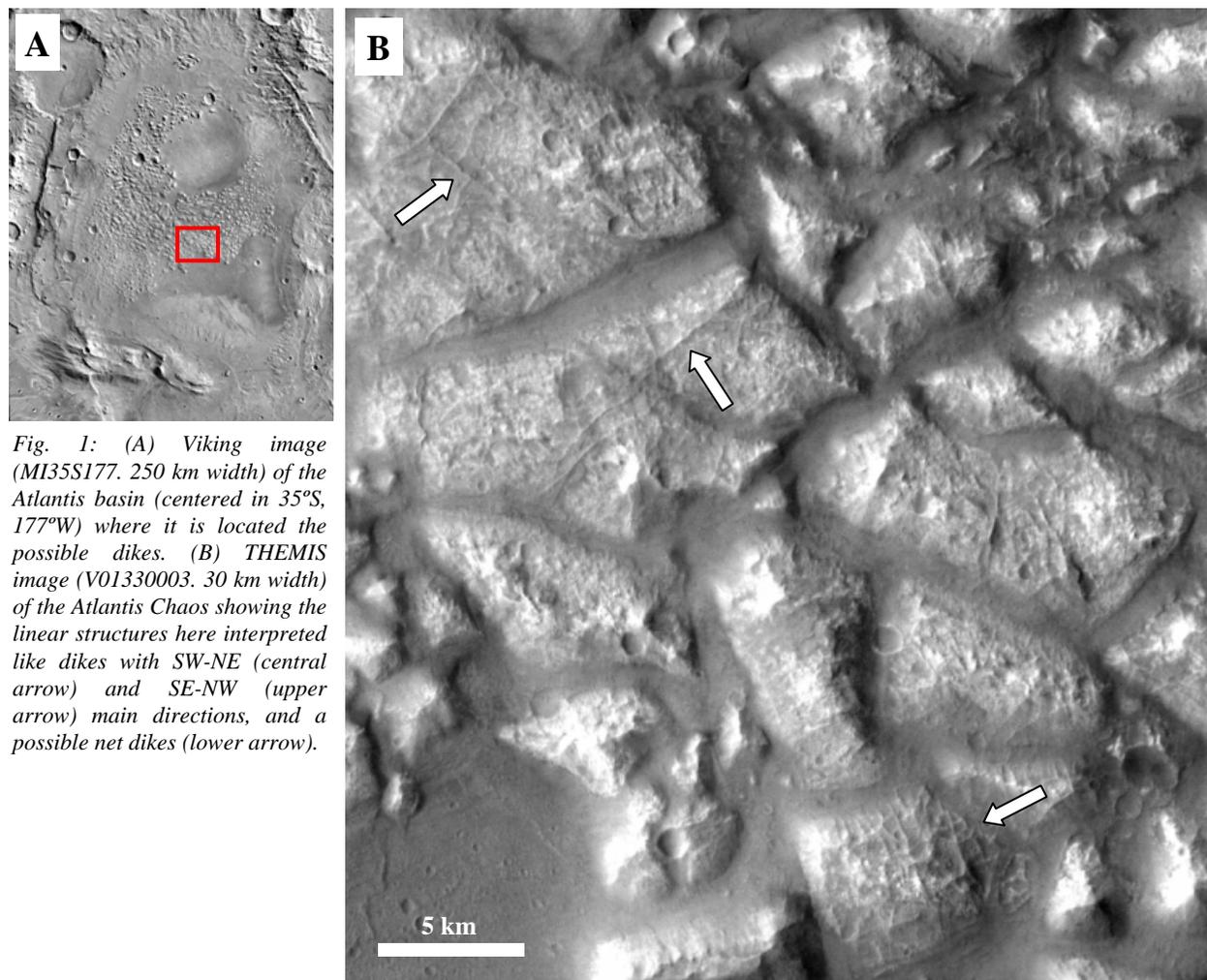


Fig. 1: (A) Viking image (MI35S177, 250 km width) of the Atlantis basin (centered in 35°S, 177°W) where it is located the possible dikes. (B) THEMIS image (V01330003, 30 km width) of the Atlantis Chaos showing the linear structures here interpreted like dikes with SW-NE (central arrow) and SE-NW (upper arrow) main directions, and a possible net dikes (lower arrow).