MOLA TOPOGRAPHIC DATA ANALYSIS OF THE ATLANTIS PALEOLAKE BASIN, SIRENUM TERRAE, MARS. *M. A. de Pablo*. Área de Geología. Departamento de Matemática y Física Aplicadas y Ciencias de la Naturaleza. Escuela Superior de Ciencias Experimentales y Tecnología. Universidad Rey Juan Carlos. 28933 Móstoles, Madrid. Spain. (depablo@geo.ucm.es).

Introduction: In the region of Sirenum Terrae, at the Southeast of the martian Tharsis region, and at the South of Ma'adim Vallis there is a region in the one which are found several chaotic terrains as Gorgonum or Atlantis. In the basin where is found Gorgonum Chaos, the first images of the MOC sensor, aboard of the Mars Global Surveyor mission, showed the numerous gullies presence in the slopes of impact craters, fractures or chaotic terrains. These gullies were interpreted as the result of the groundwater presence in this basin [1]. Afterwards it was described, employing the high resolution Viking images, one other depressed region, at the East of the previously mentioned basin, in the one which is found the Atlantis Chaos, as a possible paleolake basin [2]. Thereinafter, and employing Viking images and MOLA/MGS topographic data it was described in the region of Sirenum Terrae, mainly between the Eridania y Phaethontis martian quadrants, a series of mutually communicated basins that they could operate as a great lake [3]. Both basins, Gorgonum and Atlantis, are included within this great lake. In that work also were described as these lakes constituted the source area of the water that configured the Ma'adim Vallis channel, whose estuary is one of the possible landing points of the future robotic missions to Mars.

Continuing with these previous studies, here is presented a local analysis of the topographic characteristics of one of these paleolake basins: Atlantis, the one which *de Pablo & Druet* (2002) informally designated like Atlantis Basin because these basin contains in its interior to Atlantis Chaos, and whose criterion it will be continued employing here.

Materials and Metodology: For the development of this work have been employed the topographic maps developed by the Washington University with the great resolution topographic profiles accomplished by the Mars Orbiter Laser Altimeter (MOLA) sensor of the Mars Global Surveyor (MGS) mission. From all the available maps it has been employed the maps with a resolucion of 64 pixel by degree. With these materials, and employing computer programs specially developed for the altimetric data treatment, it has been accomplished some hypsometric maps, shaded relief maps and topographic profiles of the studied area.

Location: The Atlantis basin is found in the Phaethontis martian quadrant, centered in the coordinates 35ºS,177ºW, (35ºS,183ºE) in the Southern hemisphere of Mars, between the fracture systems of Sirenum Fossae and Memnonian Fossae, and to the South of Ma'adim Vallis and Gusev Crater.

Topographic analysis: The hypsometric map of the zone (Fig. 1) show in its center to the Atlantis basin, that it can be described as a closed basin with a quasicircular shape, only with some close gaps in its South and Southwest rims, where it is communicated with other next basins. The general slope of its interior sides is low, though locally it has edges with pending more pronounced, especially in the Northeast edge. In the interior of the basin, the chaotic area of Atlantis has a reflex in the topography, topographically restricted under the -100 meters altitude level. The approximate maximum level of this basin is near of 300 meters of altitude since the martian datum. This implies that the maximum depth of this isolated basin, it is arround 800 meters.

One of the topographic profiles accomplished in the zone, with NW-SE direction (Fig. 2), shown like the internal slope of the basin is softer in its South side than in the North, where it is closed by a most important relief. The profile of the basin is relatively soft, unless in the most deep area, where is found the chaotic area of Atlantis Chaos.

The shaded relief map (Fig. 3) permits to observe in a more specifies way the quasicircular shape of the basin, that seems to cut the North - South linear structures, and that they have been interpreted as compression landforms (ridges) [2]. Though in the previous cartography of the zone [2] have been described this type of structures at the South of the basin too, these last do not have a great reflex in the topography, at least at the scale of this map.

Other feature observed in this map is the existence of a regional fracture of the Sirenum Fossae system, interrupted in the point occupied by a relief that constitutes the Southwest limit of the Atlantis basin. That relief there was described in different ways as an ancient massive volcanic construct [4] or as a part of the old martian highly deformed terrain [5]. Its direction does not continue the direction of the Sirenum Fossae fracture system, and it is oblique to this. At the Northeast edge of the basin there is a linear structure de-

scribed as a volcanic building of fissural character [4, 2]. In this map is observed like this linear structure seems to have continuity outside of the limits of the basin.

The internal rim of the basin, especially in their Northeast, South and North sides, presents relatively deep rilled morphologys, the same as in external margin of the Southwest, where are observed that kind of landforms.

A punctual observations is the presence of a small relief in the center that it seems to be the central peak of an ancient impact crater in the interior of the Atlantis basin and that is found surrounded by chaotic area.

Interpretations: With the accomplished observations of the hypsometric and shaded relief maps, and the topographic profiles, it is possible accomplished some interpretations about the origin and evolution of the Atlantis basin.

The quasicircular shape of the Atlantis basin, the same shape of the immediately souther basin, would be due to the origin of the basin like a consequence of an impact, what would clear the doubts about the origin raised in the bibliography [2]. On the other hand, the sudden interruption of the ridge structures of the North margin of the basin seems to support the interpretation of the impact like the origin of the here studied basin. The gaps existence in the South and Southwest rims of the basin would be the result of the water flow during the long time period during the one which was operating the great lake proposed for this region [3].

The relief of the South rim of the basin, this is located superposed to a regional fracture that crosses the zone, with an E-W approximately direction. This is compatible with the existing interpretation of this relief as a massive volcanic [4]. However, this massive volcanic does not continue the direction of the regional fracture, and it is oblique to this. This would be a consecuence of that the volcano is located in the intersection zone of the regional fracture with some of the concentric fractures to the possible impact crater that formed the Altantis basin, such it has been interpreted previously.

The existence of volcanism in the zone is supported by the presence of a volcanic construct, fissural in character [4], in the Northeast rim of the basin, and whose prolongacion of the fracture seems be followed even in the East foreign area of the basin, as was observed in the accomplished shaded relief map (Fig. 3).

The rilles existence into the internal margin of the basin indicates that when the great lake, that the Atlantis basin was a small part, of the region was decreasing its level under 1100 meters of altitude [3], in the Atlantis basin was formed a lake of more reduced dimensions, in the one which the ruon-off surfaces in its hillsides was eroding the previous lacustrine sediments, what supports the previous interpretations of the evolution of the basin [2]. The rilled and eroded zones in the South and Southwest rims of the basin would be explained by the incoming water in the basin, from the South, and the outflowing water from the basin by the Southwest rim, eroding the previous lacustrine sediments. This seems to be opposed to the previous interpretations on the empty of the lake across the North edge [2]. Furthermore, the topographic profiles and the hypsometric map permits to determine that though the initial lake had a maximum level of 1100 meters over the martian datum, would be very dificult that this is overflowed in the North zone of the Atlantis Basin, since were existing 300 meters of relief yet.

Finally, the soft internal slope of the Atlantis basin, observed in the topographic profiles, permits to suppose that if it has been originated like an impact crater, the subsequent sedimentary landfills were very important, especially in the South margin of the basin, what is corresponded with the zone of water and sediments contribution, such it has been interpreted previously. This great quantity of sediments in the interior of the basin would support the previous interpretations [2] on the training of the chaotic terrain, Atlantis Chaos, by the reactivation of the volcanism producing the fusion of the ice originating from the water of this ancient lake.

Conclusions: The observations and interpretations of the MOLA topographic data of the region of Atlantis basin, Mars, permit conclude that: a) the origin of the basin seems be found in an ancient impact crater; b) the volcanism of the region is located in fractures of local and regional type, as well as in their intersection zones; and c) the basin was a part of a great lake that when it was emptied partially generate a lake of reduced dimensions that were fed from the South and were emptied by the Southwest.

This basin would be a future missions objective for the martian exploration due to the existence of a lacustrine system, firstly of large dimensions, and thereinafter more confined, in the one which it could be found a thermal source located in the volcanic constructs in different fractures, something which can be astrobiologycally interesting.

References: [1] Malin, M.C. & Edgett, K.S. 2000. Evidence for recent groundwater seepage and surface runoff on Mars. *Science*, 288: 2330-2335. [2] de Pablo, M.A. & Druet, M. 2002. Description, origin and evolution of a basin in Sirenum Terrae, Mars, including Atlantis Chaos: a preliminar study. *LPSC XXXIII*

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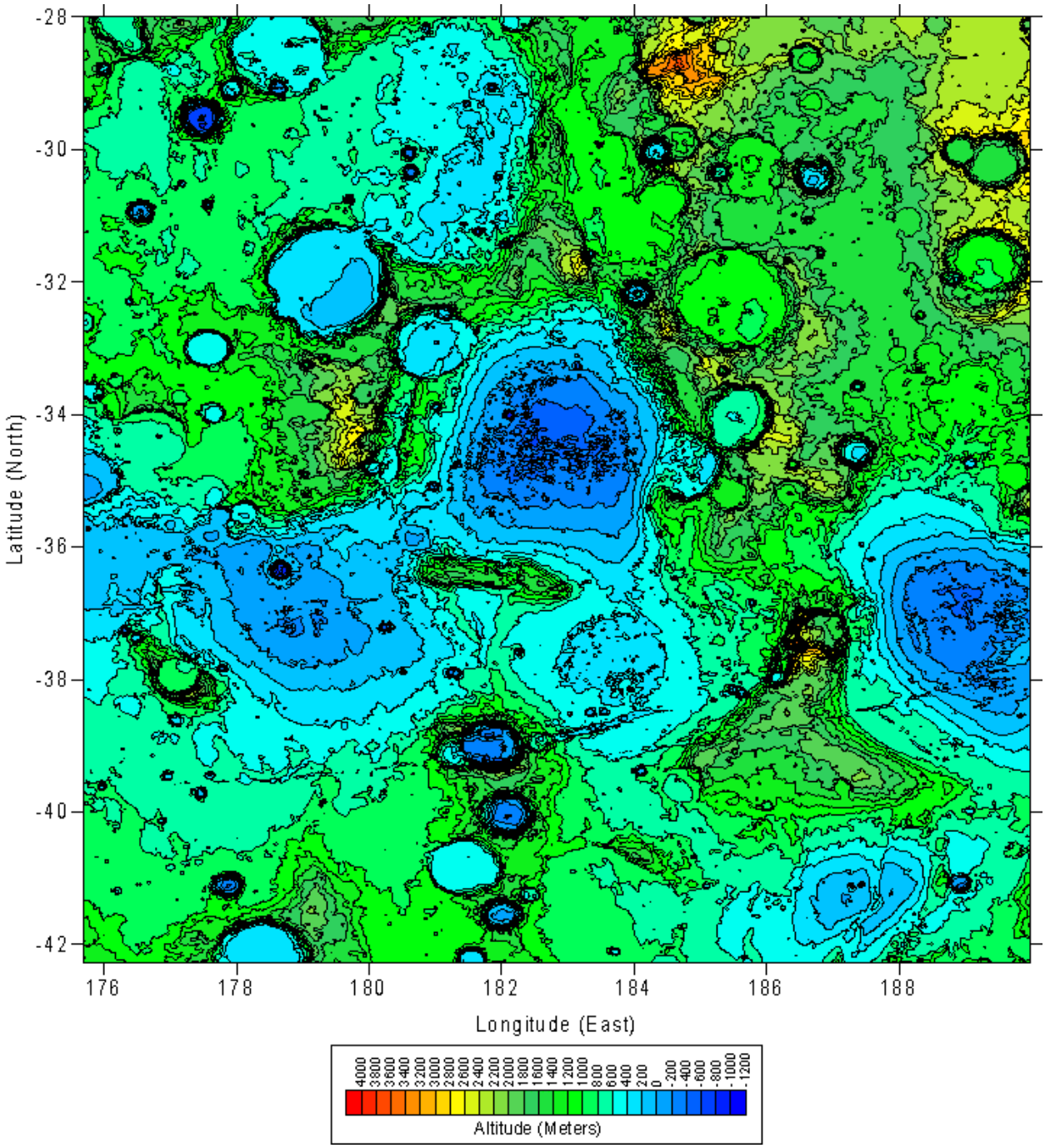

Fig. 1: hypsometric map of the Atlantis basin area (center), Sirenum Terrae, Mars, a paleolake basin (elaborated with MOLA/MGS topographic data).

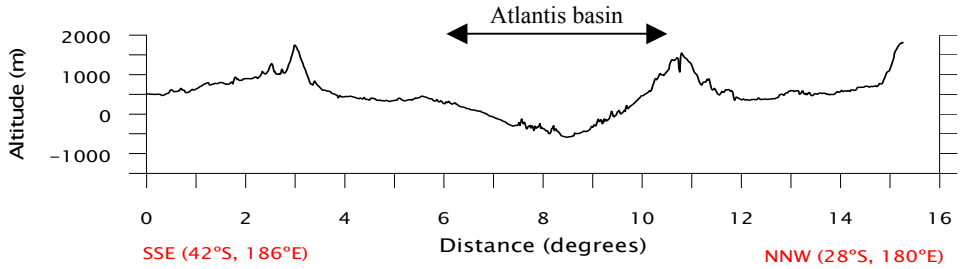

Fig. 2: topographic profile of the Atlantis basin were is reveled the assimetry between their South and North rims, originated by a differential sedimentation ratio.

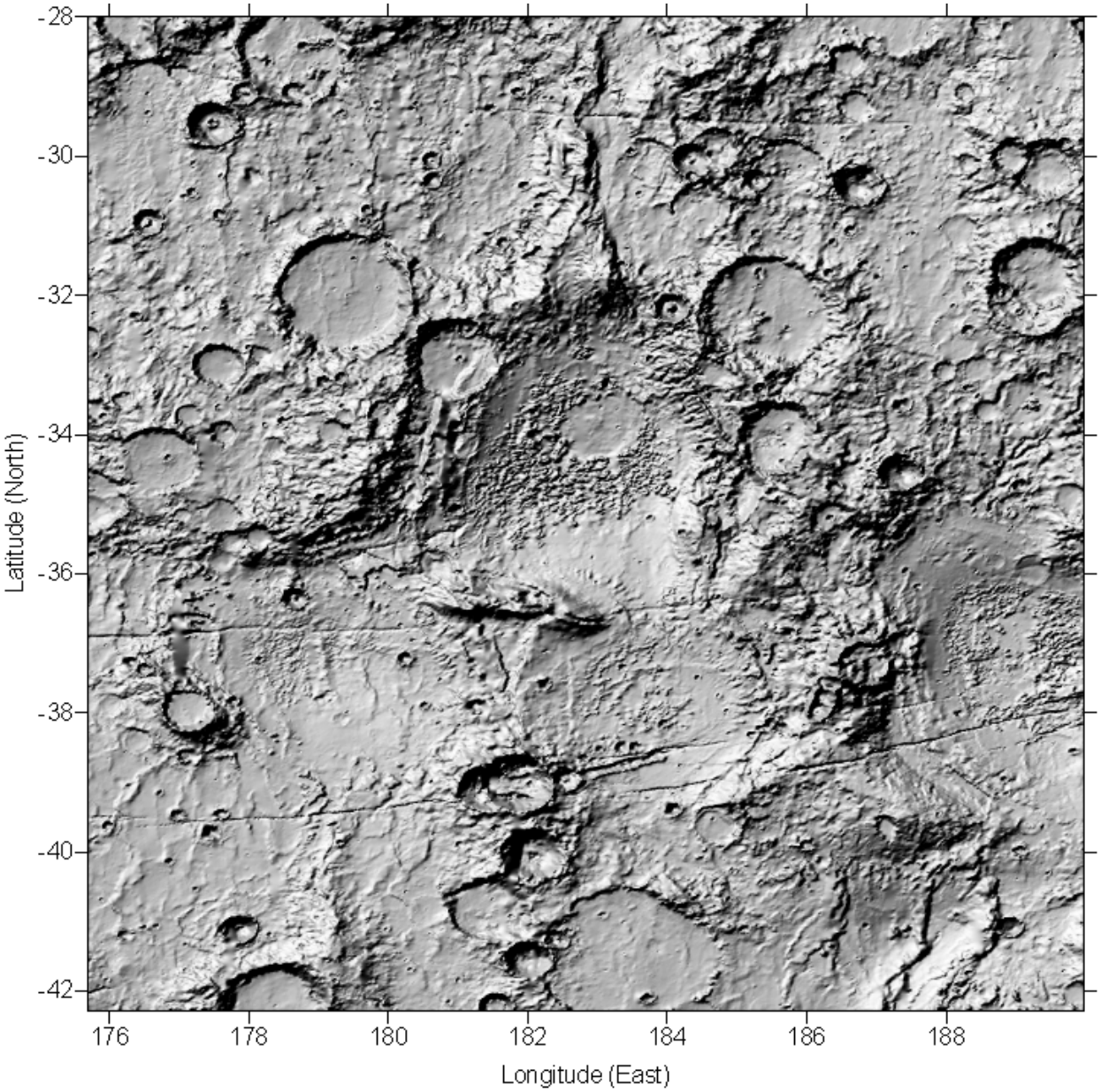

Fig. 3: shaded relief map of the Atlantis paleolake basin area where it is possible to determine the quasi-circular morphology of the basin, and the relationship of this with the compressive structures, the fractures and the volcanic constructs described in the basin, and that permit to establish an origin and an evolution for the basin.