THE GEOLOGY OF ATLANTIS BASIN, MARS, AND ITS ASTROBIOLOGICAL INTEREST. M.A. de Pablo[1,]*, A.G. Fairén[2] and A. Márquez[1]. [1]Área de Geología. Dpto. de Matemáticas y Física Aplicadas y Ciencias de la Naturaleza. ESCET. Universidad Rey Juan Carlos. 28933 Móstoles, Madrid. Spain., [2]Centro de Biología Molecular. CSIC-Universidad Autónoma de Madrid. 28049 Cantoblanco, Madrid. Spain. (*madepablo@escet.urjc.es).

Introduction: the Atlantis Basin, formed into an eroded impact crater in the southern hemisphere of Mars, is one of the regions where ancient lakes existed on Mars. The geological study of these basins drives to a better knowledge of history of the ancient water evolution of the water on the planet. On the other hand, the places where ancient lakes existed are of enhanced astrobiological interest. In the case of the Atlantis Basin, the existence of some geological features as ancient volcanic edifices, colapse areas, sedimentary deposits of an ancient lake, possible dike systems and recent gullies, seem to indicate the long-term presence of a thermal source and a water reservoir stable enaough to sustain biological processes.

Atlantis Basin: The Atlantis Basin (Fig. 1), so named in previous works [1] [2], is located in the southern hemisphere of Mars, in the Phaethontis quadrangle, Sirenum Terrae region, Mars, centred in the geographic coordinates 177ºW, 35ºS. Pioneering global analyses in the region did not indicate the existence of a paleolake [3], but later some authors have postulated the possibility that this area was an ancient paleolake basin [4]. Subsequent geomorphologic works [1] [2] described the area as an ancient lake basin, that, according to recent studies, was part of a wide lake (Eridania Lake) covering ~3,000,000 km^2, which was the source region of Ma'adim Vallis [5]. Its outlet, through Gusev crater, has been explorated by NASA's MER *Spirit*, which landed on Mars in early 2004.

Geology: On the basis of our studies on topographic (MOLA) and image data (Viking, MOC and THEMIS), we propose the origin of the basin to be related to an ancient (Early Noachian) impact crater [2]. This impact crater was formed in an ancient volcanic plain [6] [7] and it was subsequently modified by: (1) volcanic processes which originated a volcanic massif in its southern edge (Fig. 1-a), an area related to a NW-SE trending fissural-type volcanic structure (Fig. 1-b) in the northeast margin of the basin [1] [3] [6] and some neighbouring small volcanic edifices; (2) tectonic processes forming a ridge system with general N-S trending, especially visible in the west margin of the basin (Fig. 1-c); (3) erosive processes reflected as excavated zones (Fig. 1-d), both in the inner and the outer margins of the basin; and (4), sedimentary deposits (Fig. 1-e) covering parts of the basin's floor [1] [2].

The subsequent evolution of Atlantis Basin is closely related to the evolution of Eridania Lake. The desiccation of Eridania Lake, probably during the Late Noachian [5], might have predated the existence of a series of reduced and interconnected lakes in the area, in which Atlantis might have been included. In this work we propose the name *Atlantis Lake* for the lake formed inside this basin and originated in the decrease of the water level of the Eridania Lake. Water probably flowed in the area from the South, initially draining to Southwest, but later forming an endorreic basin until its complete desiccation. In relation with this evolutionary sequence, the presence of 'mesas' in the basin edges (Fig. 1-f) have been interpreted as sedimentary materials deposited in the floor of the ancient Eridania Lake, and subsequently eroded. This interpretation, together with the presence of relatively recent collapse areas (Fig. 1-g) and mud-flow deposits (Fig. 1-h) around the Atlantis Chaos terrain, indicate the existence of liquid water in the recent past. The appearance of linear structures in the interior of Atlantis basin has been interpreted as indicative of possible ancient dike systems [8], whose new activation would explain the existence of the subsidence zones and the mud-flow deposits by the fusion of the permafrost. Equally, the presence of gullies (Fig. 1-i) in several closed basins near to Atlantis Basin (as Gorgonum Chaos [9]), makes feasible the existence of recent liquid water under the surface [10] [11] [12] [13].

Astrobiological interest: The intense volcanic and tectonic activities, and the presence of possible dikes in the area, as well as the relation of Atlantis with the former wide Eridania Lake, the gullies, and the sedimentary deposits, all highlight the astrobiological interest of Atlantis. A heat source related to tectonovolcanic activity and flowing and ponded water are both hypothesized to have been present in the basin in different periods of the Martian history, perhaps until recent times (Late Amazonian). In addition, the subsurface of Atlantis might include near-surface caves, subsurface fissures, microcracks, intergrain pore spaces, subterranean shallow and deep sealed voids, and aquifers, where microorganisms could be thriving today, protected against extreme temperature fluctuations or desiccation, UV radiation and cosmic rays [14]. So, the sediments in Atlantis basin may be considered as a prime candidate site for future drilling, sampling and analysis, searching for

extinct (fossilized) and extant putative Martian life forms.

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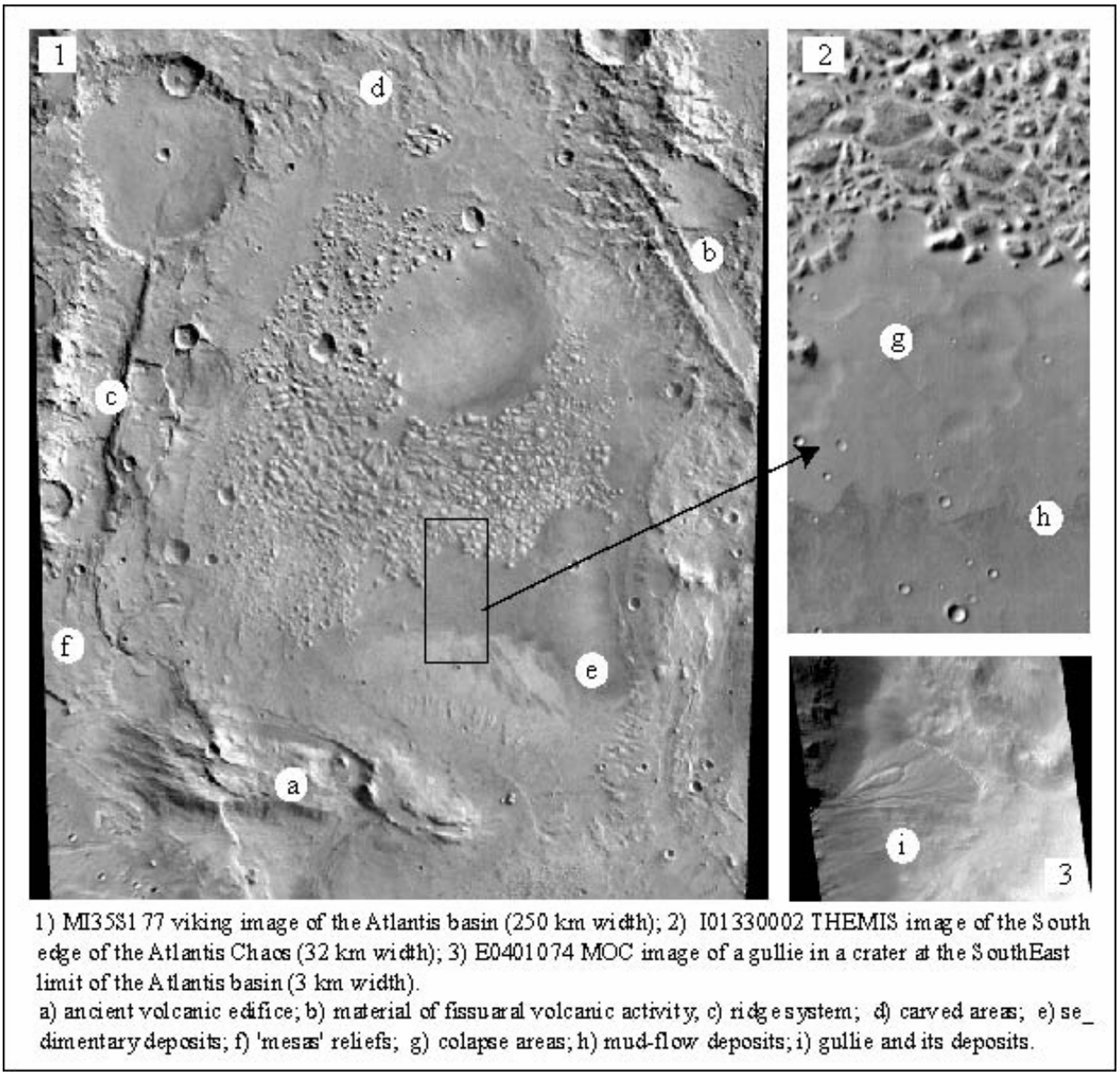

1) MI35S177 viking image of the Atlantis basin (250 km width); 2) I01330002 THEMIS image of the South edge of the Atlantis Chaos (32 km width); 3) E0401074 MOC image of a gullie in a crater at the SouthEast limit of the Atlantis basin (3 km width).
a) ancient volcanic edifice; b) material of fissuaral volcanic activity, c) ridge system; d) carved areas; e) sedimentary deposits; f) 'mesas' reliefs; g) colapse areas; h) mud-flow deposits; i) gullie and its deposits.