

DECEPTION ISLAND, ANTARCTICA, AN EARTH-MARS ANALOGUE. A. Molina^{1,2}, M. A. de Pablo², and M. Ramos³, ¹Centro de Astrobiología. CSIC-INTA. 28850 Madrid, Spain (a.molina@csic.es) ²Unidad de Geología. Universidad de Alcalá. 28871 Madrid, Spain (miguelangel.depablo@uah.es). ³Departamento de Física y Matemáticas. Universidad de Alcalá. 28871 Madrid, Spain (miguel.ramos@uah.es)

Introduction: Deception Island (62°57'S, 60°37'W) is a 12 kilometers in diameter active volcano with a maximum peak of 539 m (Pond Mount), which is located at the South Shetland Archipelago, eastern side of the Antarctic Peninsula. This stratovolcano, one of the few and more active volcanoes in the Antarctic region, is characterized by a horseshoe-shaped morphology in plan due to the existence of an inner caldera (flooded by the sea, forming an inner bay called Port Foster). This volcano is relatively young (< 780 Ka) [1] and the last eruption had been registered in the 1970 [2]. For that reason, we can find well preserved volcanic-related features, as eruption craters, pyroclastic deposits and basaltic lava flows, moreover an intense geothermal activity at selected sites. Climate regime is characterized by short summer and the alternation of freezing and thawing periods, with abundant snow precipitation during the rest of the seasons and strong and cold winds all the year around. The annual mean air temperatures range is, at sea level, between -3.9 °C and -1.6 °C.

We found that all those characteristics, together with the presence of other landforms (such as glacial, slope or structural) on the island convert it on an exceptional site to study Mars analogies [3]. Moreover, the presence of submarine volcanic cones, mounds, hydrothermal vents, and fumaroles also have high astrobiological interest [4]. This island was, in fact, the testing site for the GTS/REMS/MSL instrument [5], today operating on the Martian surface.

Principal analogies:

General landforms. The most common volcanic landforms in the island are lava flows and eruption craters, but its general landscape is formed by mound, hills, and small plateaus (Fig. 1 A).

Volcanic materials. Rock compositions vary from basaltic to dacitic, and show a wide variation range. They could be founded in lava flows (Fig. 1 B) or ash loose deposits, like pyroclasts and cinders. Differences in composition but also in latter alteration, derives in black, reddish, brown and yellowish pyroclasts presence.

Tectonics. Deception is also seismically very active, and faults and tectonic conditioned other features (such as other water-related features) are widespread distributed in the island. For example, one of the most remarkable tectonic features, a completely straight

coast at the eastern side of the island called Costa Recta Beach (Fig. 1 C), was interpreted to be related to a submarine fault scarp [6].

Ice-related features. Due to the climatic conditions, the presence of glaciers on the island is very common, mainly forming ice-caps on the summits but also forming glacier tongues flowing down slope until the sea. An interesting characteristic is that some of those glaciers are covered by pyroclastic materials, hiding the ice beneath the surface (Fig. 1 D), what could be the case of the possible glaciers described on Mars (e.g. [7] [8]). Caused by the different volcanic events on the island, there is a layering (ice and ash-fall deposits) on those glaciers (Fig. 1 D), similar to the layering on the Martian ice deposits [9].

On the other hand, permafrost, such as on Mars, is also well distributed beneath the island surface (except on thermal hotspots), with its structure in its upper part controlled by weather and snow at the short time period and by the ash-fall deposits at the long time period, and the high geothermal activity of the active volcano in the lower part [10].

Water-ice-related features. Some of these water-ice-related features, owing to the similarity to the materials and processes, are comparable to Mars ones. The melting process of both glaciers and permafrost during the warm season mobilizes relevant amounts of liquid water in short time lapses, what lead to the formation of fast floods and mud-flows-like events. Those carve gullies (Fig. 1 E), sapping canals and wide flatbed valleys. Small grained materials (pyroclasts) have been locally remobilized and later sedimented forming beaches, bed streams, alluvial and coluvial fans. All those water-ice-related features show similarities to the analog morphologies described on Mars surface. There are broadly present in the island preglacial features as solifluction lobes and thermokarst, as well the effect of frost wedging in rocks,

Slope features. The irregular landscape made possible the presence of a wide variety of slope features related to both, erosion and sedimentation: slumps, landslides, or rolling boulders, among others (Fig. 1 F).

Conclusions: To sum up, we consider Deception Island as a proper site to study some geologic and geomorphologic features and processes that occurred on Mars. As is described here we can find several composition, climate and morphology similarities,

from some areas of Mars and Deception Island, including other aspects with astrobiological interest. Furthermore, the relative well access to the area, with both Spanish and Argentinean Antarctic Stations located near the shore of the inner bay, make possible to develop analog studies that would help to unravel the nature of the past geological history of the planet Mars.

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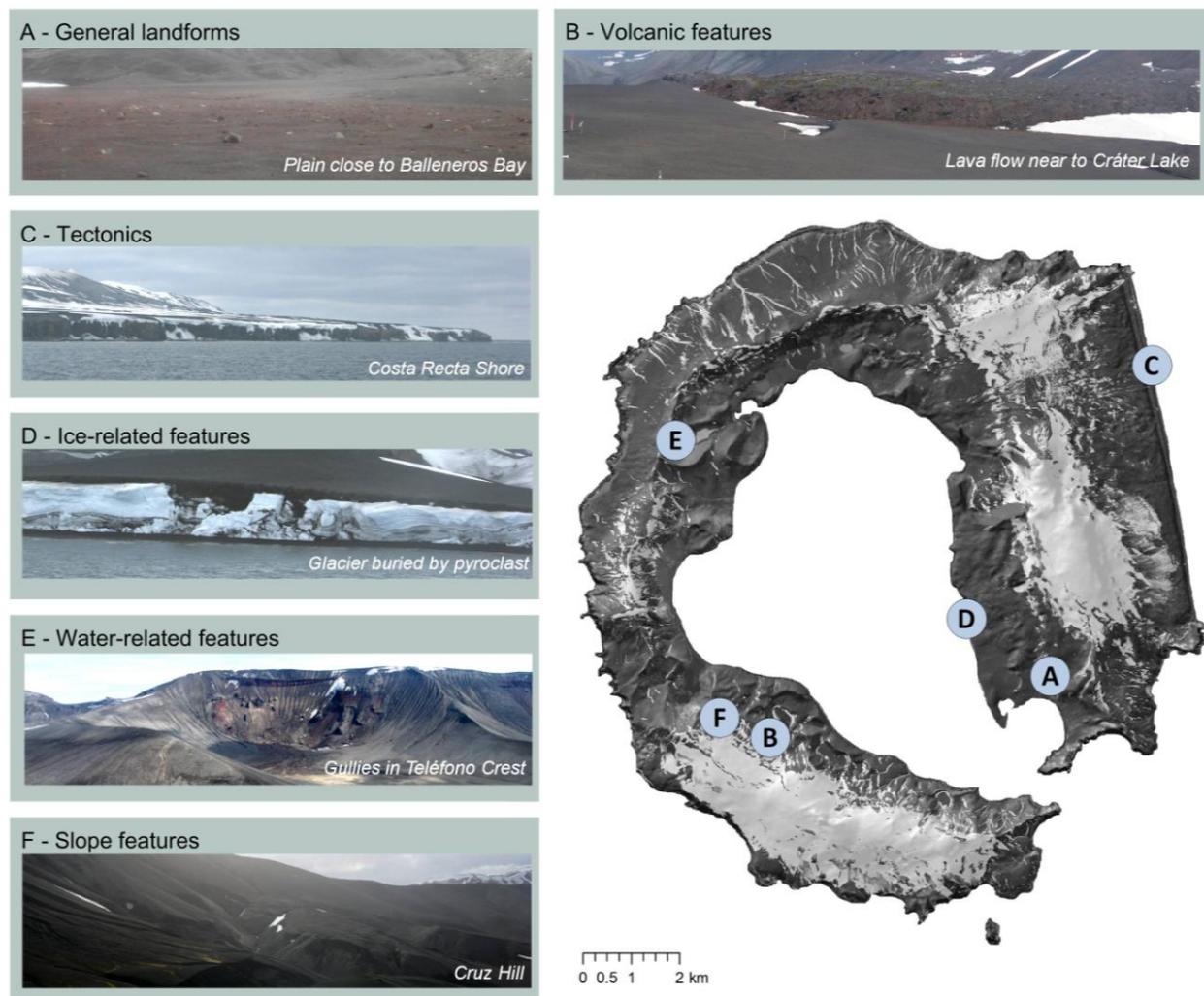


Fig. 1: Down-right, Satellite image of Deception Island (Antarctica). There are labeled (A to F) the location of the examples of analogies cited in the abstract, matching with some views pictures showed in the left-upper boxes.