THE SOUTHERN ARGENTINEAN PATAGONIA AS A TERRESTRIAL ANALOG FOR MARS.

A Pacifici, IRSPS - Università d'Annunzio, Pescara, Italy. Pacifici@irsps.unich.it.

Introduction: The constant research for Terrestrial sites showing geological and geomorphological analogies with respect to the Martian surface allow to study more in depth geological processes analogue to those which potentially shaped the Martian landscape. To this purpose, this work point-out to some geological and geomorphological analogies occurring between the Santa Cruz area (southern Argentinean Patagonia) and the Martian landscape. This work bases on geomorphological analysis carried out on Terrestrial and Martian remote-sensing images.

The southern Argentinean Patagonia Landscape: During its Cenozoic geological history, a mix of volcanic, glacial, periglacial and eolian processes shaped the Argentinean Patagonia landscape. The basaltic volcanism emplaced lava flows and lava plateaus in a cold, dry, ice-rich environment; the Patagonian Ice Field covered the area several times throughout the Quaternary, leading to an ice-driven weathering of volcanites and allowing the emplacement of periglacial deposits alternating with volcanic rocks. The strong winds that characterized the region mobilized and mixed glacial sands and volcanic ashes; the dry climate and the basaltic composition of rocks favored the formation of salts deposits having similar compositions to those recently observed on Mars. Such geological processes are similar to those hypothesized to have shaped the surface of Mars for larger part of its geological evolution.

Martian analogs: The investigated geomorphological features of the Argentinean Patagonia (fig. 1) and their Martian analogues consist mainly of lava plateaus, rock glaciers and periglacially modified terrains, fan-deltas, mega-ripples, gullies, and wind streaks.

Patagonian Cenozoic volcanites consist of basalts similar in composition to the Martian rocks. They appear as tabular lava flows tens of meters thick, palagonitic pyroclastic breccias, pillows lavas [1], and columnar basalts [2]. Topmost portions of lava plateaus appear densely dotted by pseudo-circular depressions, which generally are teens of meters large. These are termed “bajos sin salida” which means depressions laking of way out, and are generally interpreted as formed by periglacial processes [3]. Often they are infilled by water, which could evaporates leading to saline and iper-saline pondings.

Periglacial debris aprons occur along volcanic scarps. Such debris aprons appear as fossil features, since they are strongly re-eroded by younger geomorphic processes. Rippled surfaces characterizing Patagonian fossil aprons seem to result from solifluction processes and testimony the effective role of ice in shaping this area. Similar lobate debris aprons occur on Mars [4-7].

At the end of the glacial time, large amounts of loose, poorly sorted material (till) were rapidly remobilized and re-distributed by meltwater [8]: geomorphic features shaped in this setting show several similarities to some of the water-related Martian features, such fan-deltas [9] (fig. 2). Mega-ripples tens of meters large have been observed on top of Santa Cruz River valley terraces, which could represent interesting analogs for similar Martian features [10].

Martian gullies appear to be among the most recent structures of the planet [11]. They characterize several scarps, valley flanks, and crater walls. Several ice-related model have been proposed in order to explain their origin. Since the Patagonian landscape is characterized by similar morphologies, it could be possible to infer information about the geological processes originating their Martian analogues.

Strong winds of the Argentinean Patagonia blow constantly westward, forming several wind streaks similar to their Martian analogues, which could provide information about main directions of Martian winds and the capability of the atmosphere to mobilize surficial dust and sand.

Conclusions: Remote sensing analyses suggest that the Argentinean Patagonia could be considered an attractive area in order to study geological processes similar to those that operated on Mars. Furthermore, it could be considered an interesting region to test rovers and equipments for next missions to Mars, and to train astronauts for human expeditions.

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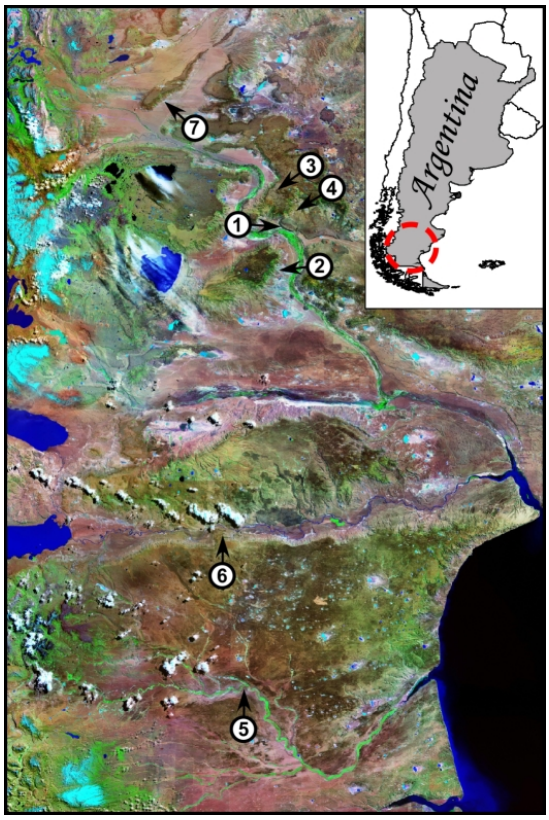

Fig. 1. Landsat image of the Santa Cruz area. Numbers locate investigated morphologies:

1) Stratified lava
2) Fossil debris apron
3) "bajos sin salida"
4) Gullies
5) Fan-deltas
6) Mega-ripples
7) Wind streaks

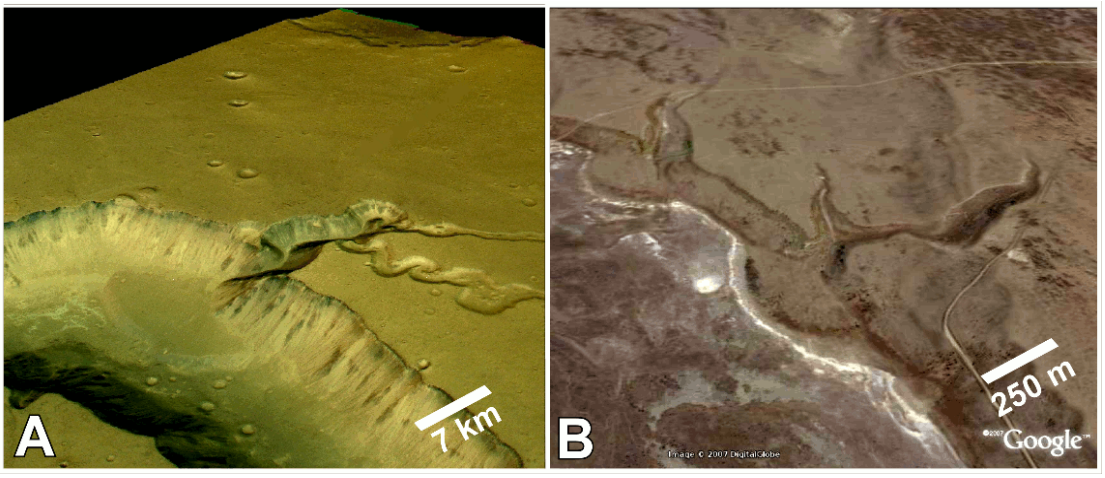

Fig. 2. A) Fan-delta in Shalbatana Vallis, Mars [9]. B) Fan-deltas in Rio Coig Valley (location 5 in Fig. 1)