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Geologic analysis of knob fields and sedimentary deposits in Ariadnes Colles, Terra Sirenum, Mars

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Abstract

Ariadnes Colles is a basin located in the southern highlands (173° E; 35° S) which displays varied geological features such as knob fields, water-related materials, and other landforms suggesting that Ariadnes may have hosted a lake during the Noachian Epoch. Here we present the preliminary results of a geomorphological, stratigraphical and mineralogical analysis of the region, which will provide better constraints on its geological history.

1. Introduction

A group of topographic depressions in the southern highlands of Mars, between Terra Cimmeria and Terra Sirenum shows very intriguing geomorphologic and tectonic features including isolated knob fields on their floor [1] (Fig. 1). Morphologic studies suggest that these depressions could have been filled with water during one or more episodes, forming the so called Eridania Lake and/or minor isolated paleolakes during the Noachian Epoch [6]. These lakes would have overflowed to carve Ma'adim Vaills [7], which is located to the north of the basins (Fig. 1). The presence of several water-related features [6-8] such as channels, inverted channels, fans, as well as aqueous minerals (phyllosilicates [2] and chlorides [9]) confirms the important role of water in the geological evolution of the region.

In this study, we focus on the Ariadnes Colles basin, which display some of the best preserved landforms in the region. We produce a geomorphological, stratigraphical and mineralogical analysis of the basin on order to retrace its geological history. Our first results are presented below.

2. Data and methods

For geomorphology and stratigraphy, HRSC, CTX, THEMIS and HiRISE images and derived topography have been combined into a Geographic Information System (GIS). We also analysed CRISM and OMEGA hyperspectral cubes to determine the mineralogical composition of the observed materials and units.

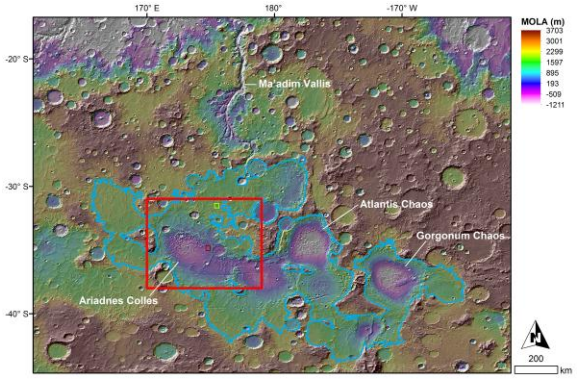

Figure 1 Location of the Eridania Lake, and its proposed coastline (blue line [6]) reported on a MOLA topographic map. The red square shows our study area. Dark red and green smaller squares show the location of Fig. 3

3. Geologic mapping results

We produced a geomorphologic map of Ariadnes Colles (Fig. 2). We defined 8 geological units in the study area. The Hesperian ridged (Hr) and Noachian cratered plains (Npl), both described by Greeley and Guest [5] are covering most of the lowlands and highlands, respectively. Impact crater ejecta and crater smooth floors have been defined as another two different units. Several lobate and fluidized ejecta blankets have been found in the area, as well as some possible pedestal craters. The Electris formation [3-4] is located at the rims of the basins, where the contact with the Npl unit is unclear. The chaotic terrains and knobs unit is located mainly on the floor of the Ariadnes depression and of the basin to the southeast. Some isolated minor fields and knobs are also distributed along the Hr unit. We also

observed two geological units of different thermal and albedo properties (Fig. 3). The first one, the geological unit 1, has high IR reflectance and low albedo. Its surface is smooth and it is in contact with the knob field unit in Ariadnes. The second unit has a low IR reflectance and high albedo. Some localized outcrops of this unit are situated to the north and to the east of the study area, and might be evaporitic deposits considering their texture and their location in some depressions surrounded by channels. The ones to the east of the area have been identified as chlorides bearing material [9].

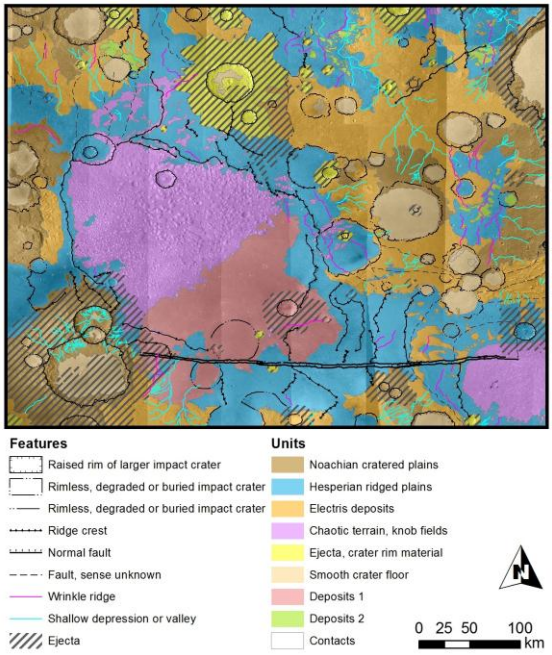

Figure 2 Geologic map of our study area displayed over a mosaic of HRSC images (location in Fig. 1).

The area also displays several tectonic features including the Sirenum Fossae, and faults, ridges and wrinkle ridges are distributed broadly. Most valley networks are incised into the Npl unit.

4. Conclusions and future work

Ariadnes Colles is unique since it displays the best-preserved records of the Eridania Lake. We identified different geological units which suggest a complex geological history. The stratigraphical relationships, the age and the possible origin of the geological units will be discussed at the conference.

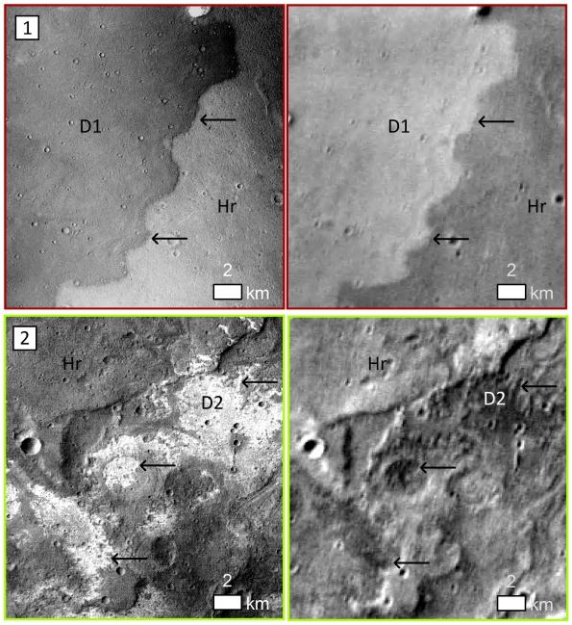

Figure 3 Close look of representative areas for the geological units 1 and 2 (location on Fig. 1). Representative contacts between units are signed by arrows. THEMIS day infrared (Right) and visible images (Left, Geological unit 1 CTX P08_004177_1455_xi_34s185w and 2 HRSC h0024_0000).

Acknowledgements

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