ISMENIUS CAVUS: ANCIENT LAKE DEPOSITS AND CLAY MINERALS SURROUNDED BY AMAZONIAN GLACIERS. N.Mangold[1] , E. Dehouck[2], F. Poulet[3], V. Ansan[1]. and S. Le Mouélic[1], [1]LPGNantes UMR6112 CNRS 44322 Université Nantes, France, [2]StonyBrook University, New York, USA, [3]IAS, Université Paris XI, 91405 Orsay Cedex, France (nicolas.mangold@univ-nantes.fr).

Introduction: Ismenius Cavus is a depression inside the Ismenius Lacus region located close to the Martian dichotomy, north of the Arabia region (Fig. 1) [1]. Geological data on this site (located 33°49'N, 17°10'E, elevation -3450 m, with Exploration zone of 60*70 km) include fluvial and deltaic landforms, clay-bearing sedimentary deposits and glacial landforms. This unique association of landforms of various ages (from Noachian to Amazonian) is of interest for human exploration because this site shares large water resources as ice or clay minerals and fundamental scientific interests for exobiology.

Fluvial landforms: Ismenius Cavus is a basin where six valley networks converge, including two from the east, two from the west, and two from the south, including the 1200 km long Mamers Vallis. One valley at the northern edge is an outlet that joins other troughs. Mamers Vallis may have been connected to the larger drainage basin associated with the Naktong-Scamander valleys to the south [2]. Three of the six valleys entering Ismenius Cavus have depositional fans interpreted as Gilbert-deltas [1,3,4]. Topographic profiles with slope breaks between a flat plain and a 10-15° front slope are typical of Gilbert deltas of fluvial deposits entering a lake. All fans have a flat-lying plain at elevation between -3100 and -3150 m also typical of deltaic deposits. The elevation difference between the delta plains and the deepest basin floor section implies that this lake was 600 m deep, providing a theoretical volume of liquid water of ~550 km^3.

Glacial landforms: Most valley floors, as well as part of the interior rims of Ismenius Cavus, are overlaid by lineated valley fills and lobate debris aprons [5] identified by their lobate shapes, lineations and pitted texture. These lobate landforms are usually thought to result from the viscous flow of ice-bearing material [5,6]. Recent orbital radar data have confirmed the presence of a high proportion of ice (up to 80%) north of the study region [7]. Glacial landforms cover more than one half of the Cavus hillslope as well as most valley floors. We expect ice to be present below a thin layer of debris or/and dust.

Mineralogical detections: Iron-rich smectites were detected in the layered unit by OMEGA [8]. CRISM data display spectra with 1.4, 1.9, and 2.3 μm absorption bands [1]. Possible minerals include Fe/Mg phyllosilicates, such as nontronite or saponite. Phyllosilicates are found in meters-scale thick layers present at elevations between –3400 m and –3600 m (Fig. 1). Layer dips extracted from topography are subhorizontal suggesting that this unit is ~200 m thick. Phyllosilicates are also observed on a series of layers with a V-shape in plan view. These layers have a sub-horizontal dip and correspond to an elevation of –3300 m. The whole layered unit forms a single unit ~300 m thick, and layering is only visible here because this area is currently under erosion. Lastly, the dark material on the Ismenius Cavus floor contains pyroxene, probably in dark sand giving its color to the low albedo area.

Region of interest 1 (Science and resources): Centered 33°42', 17°09'E. The clay-rich deposits extend over ca. 10 km*10 km immediately south of the proposed landing site. Sedimentary deposits are bottomsets of the paleolake, suggesting that clay minerals could be detrital or authigenic. This context (sediments inside deep lakes) is of topmost interest for the search of past life on Mars and past climate evolution. In addition, clay contains abundant interstitial water that could be used for resources at the landing site.

Regions of interest 2 (Science and Resources): Centered 33°46'N, 17°44'E (ROI 2a) and 33°44'N, 16°49'E (ROI 2b). The glacial landforms contain ice deposited during the Amazonian era, therefore enabling retracing the recent climate evolution. They content abundant water ice that can be used as resources for astronauts.

Regions of interest 3 (Science): Centered 33°55'N, 17°30'E (ROI 3a), 33°32'N, 17°30'E (ROI 2b), 33°34'N, 17°04'E (ROI 3c). The three deltaic landforms correspond to the deposits of fluvial valleys. They contain topsets and foresets of clastic sediments enabling to sample material from the Noachian source areas in Arabia Terra and will be complementary to the study of ROI 1 on bottomset deposits to understand duration and extend of the lacustrine activity.

Region of interest 4 (Science): Centered 34°12'N, 16°56'E (ROI 4). The ejecta from a large crater excavating Noachian crust would be of interest for sampling diversity of the crust.

Region of interest 5 (Resources): Dust-bearing areas are numerous on the edge of Ismenius Cavus. These areas should not be a problem on the landing site where themal inertia is intermediar, but dust present in the surroundings could be a third source of water as Arabia Terra dust is supposed to contain as much as 10% of water as observed by Mars Odyssey Neutron Spectrometer [9].

Figure 1: (a) Context topographic map with Ismenius Cavus on the top of Arabia Terra. (b) Geologic map from [1] with the ROI superimposed. Caption to the right. (c) HRSC mosaic with topographic contours. (d) CRISM data (smectite in purple, pyroxene in green) of ROI 1. (e) CTX image of convex, ice-rich lobate aprons (ROI 2a) and flat plain of the deltaic deposit (ROI 3a). LS=Landing site. EZ=Exploration zone.

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