MAPPING EUROPA AT THE REGIONAL SCALE: INSIGHTS ON THE RESURFACING HISTORY OF CONAMARA CHAOS AND MOYTURA REGIO. E. J. Leonard[1], D. A. Senske[1], and D. A. Patthoff[2]
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Introduction: Evaluating the potential habitability of Europa requires an understanding of the geology that drives the interaction between the surface and the deeper interior of the body. To this end, we have constructed a global geologic map at the scale of 1:15M [1]. To provide greater insight into the broad global stratigraphic relations, we are currently mosaicking and mapping, with a consistent set of units, the surface imaged at 100-250 m/pixel (~10% of the total surface area) placed in the global-scale context. In this paper, we discuss and compare preliminary results from regional scale mapping (1:500,000) of Moytura Regio and Conamara Chaos and report implications for deformation history of each region.

At the global scale, the Conamara Chaos region consists primarily of Low Relative Brightness Chaos and Regional Plains [1]. Moytura Regio, however, is dominated by Moytura Chaos material (a unique unit of chaos), consisting of large (>30 km) rounded blocks of pre-existing terrain at the global scale [1]. At the regional scale, our initial observations of the two regions reveal significant differences in the morphology of the outcropping materials that go to make up each occurrence of chaos terrain (Figs. 1-3). The morphology of the chaos in the Conamara Chaos region is platy—dominated by large blocks/slabs (>1 km wide) of pre-existing material and finer-scale intervening matrix material—whereas the Moytura Regio chaos contains, fewer recognizable blocks of preexisting terrain.

Methods: At the regional scale, we first identify unit classifications—Plains, Bands, Chaos, mantling deposits and crater materials (Fig. 1)—for Conamara Chaos (Fig. 2) and Moytura Regio (Fig. 3). The stratigraphic relationships in these regions generally follow that found in the global map, older regional plains and younger outcrops of chaos [1]. To gain greater insight in the how chaos is formed, in this work, we are specifically interested in comparing the chaos morphologies and the lineament orientations between the two regions.

From our regional mapping, it is apparent, that there are distinct differences in the abundance, size, and distribution of elements making up the two areas of chaos. We map individual areas of chaos focusing on blocks—outcrops of pre-existing terrain—down to the ~1 km scale. We then calculate the size-distribution and aerial percentage of blocks within each chaos region. As part of our analysis, we identify the long-axis orientation of the chaos blocks and determine the distribution to assess potential relations relative to fracture or flow patterns within the chaos regions [e.g., 2]. In addition, quantification of block angularity is expected to provide insight into the degree of degradation [3] of the chaos blocks.

Preliminary Results and Future Work: Our initial results show that for the Conamara Chaos region, chaos blocks comprise up to ~20% of the area within the chaos terrains while in Moytura Region, the chaos blocks make up only ~10% of the area within the chaos mapped. This could indicate that there was a higher level of deformation in Moytura Regio associated with chaos formation, causing less blocks to remain. Quantifying block angularity could provide insight into the degree to which the blocks have been processed or eroded.

The size-distribution of chaos blocks in Conamara Chaos appears to follow a power law whereas in Moytura Regio the distribution seems irregular (Fig. 4). The different size-distributions could relate to differing controls on initial fracturing during chaos formation. We are still investigating the implications of this observation and aim to quantify the size-distribution curves.

The distribution in long-axis orientation of the chaos blocks in Conamara Chaos peaks near 40° and 130° with a minimum at ~90° (Fig. 4). This orientation preference could be due to the pre-existing tectonic fabric—as seen in the similar orientation of the surrounding bands—or relatedly, the overall shape of the chaos terrain (Fig. 2). In comparison, for Moytura Regio, there does not appear to be any correspondence between the orientation of the blocks and the adjacent geologic units.

We also will analyze the orientation of lineaments in each region. Previous work [4] has suggested a cyclical pattern of emplacement of ridges and bands in Conamara Chaos. Our work will expand on this analysis and evaluate the orientation of lineaments in each region through time (as determined by cross-cutting relationships). This analysis should allow insight into the dominant stress mechanisms in each region.

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References: [1] Leonard et al. (2020), USGS. [2] Spaun et al. (1999), GRL, 25(23), pp. 4277–80. [3] Wadell, H. (1932). Geology, 40(5), 443-51. [4] Senske, D. A. (2016). LPSC, (Vol. 47, p. 1365).

Figure 1 : Preliminary legend for the Conamara Chaos and Moytura Regio regional maps

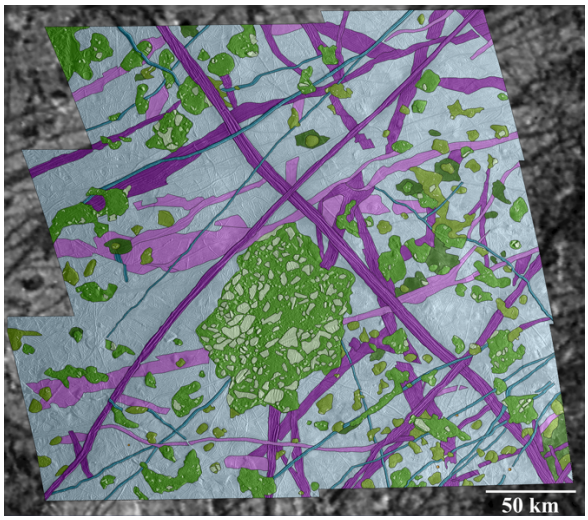

Figure 2: Regional geologic map of the Conamara Chaos region. The images that were mapped were taken by Galileo during the E6 flyby and have a resolution of ~200 m/pixel.

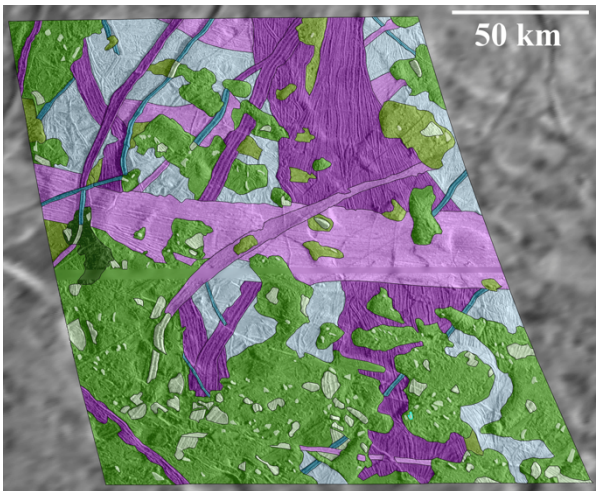

Figure 3: Regional geologic map of Moytura Regio. The image that were mapped were taken by the Galileo spacecraft during the E12 flyby and have a resolution of ~185 m/pixel.

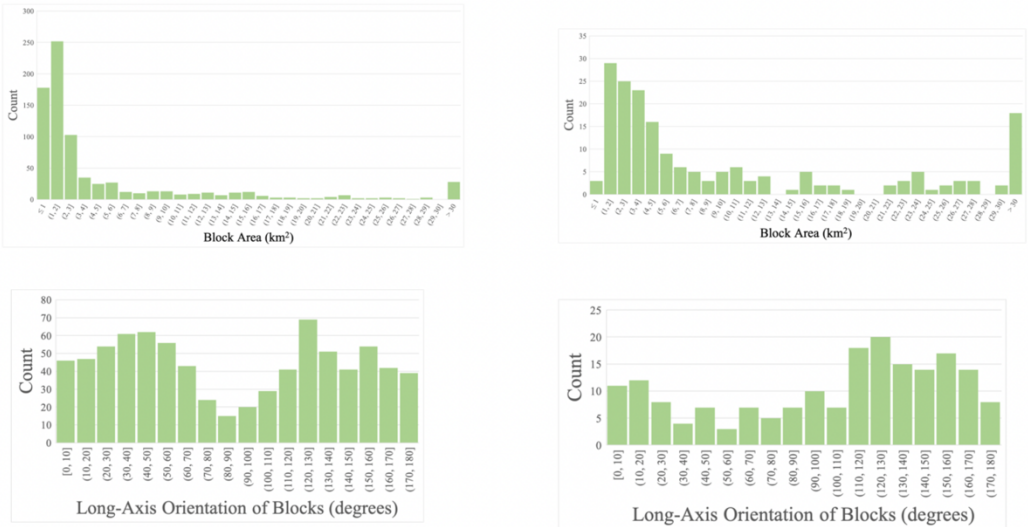

Figure 4: Chaos block size-distribution for the Conamara Chaos region (upper left) and Moytura Regio (upper right); long-axis orientation of chaos blocks in the Conamara Chaos region (bottom left) and Moytura Regio (bottom right).