A textural map of Europa´s chaotic terrains reveals patterns that could be related to their formation history

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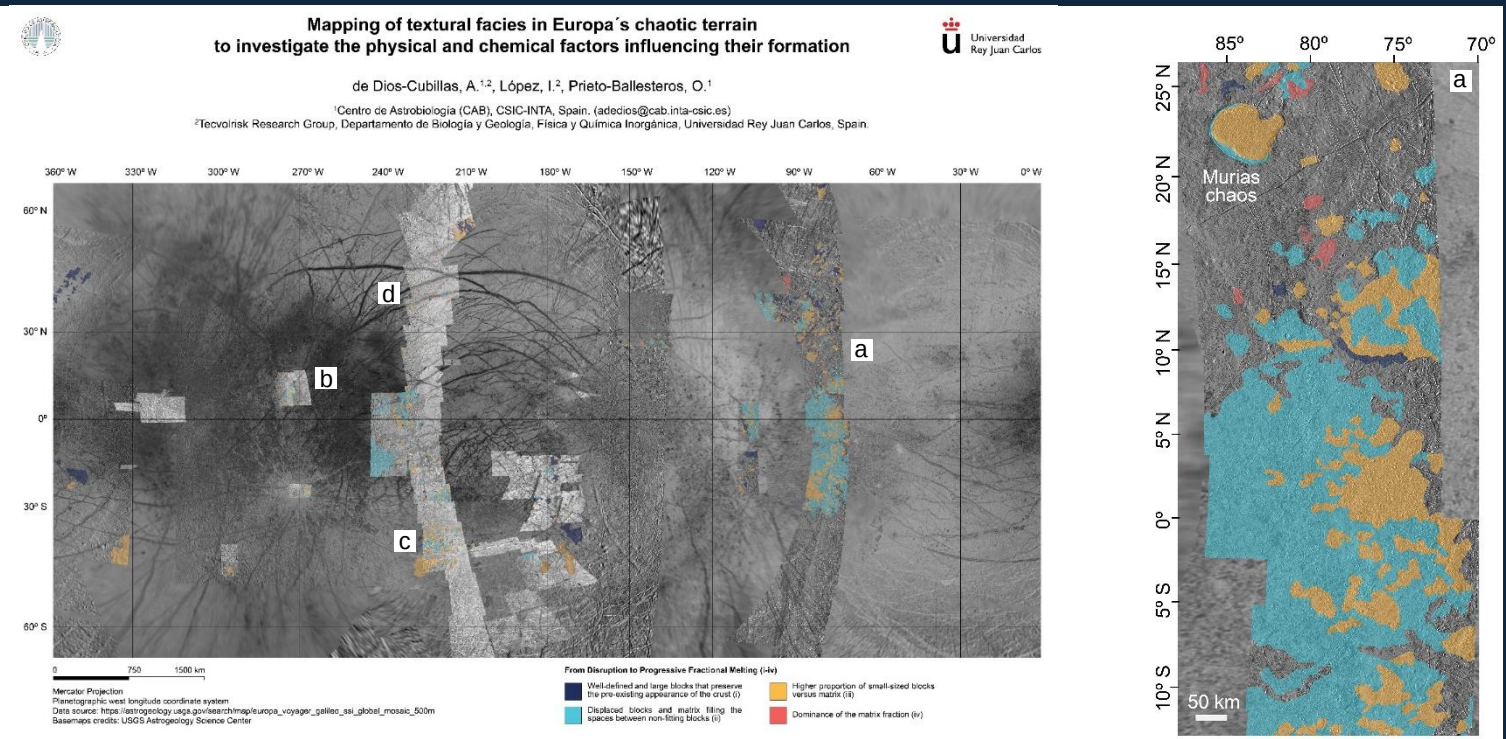

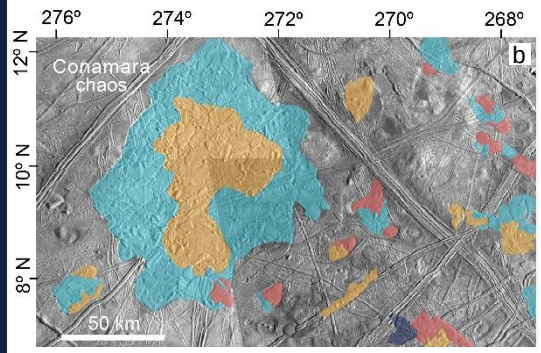

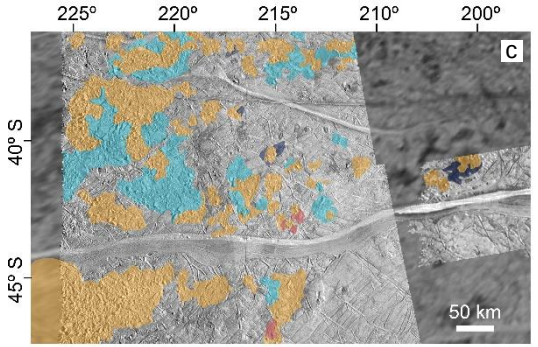

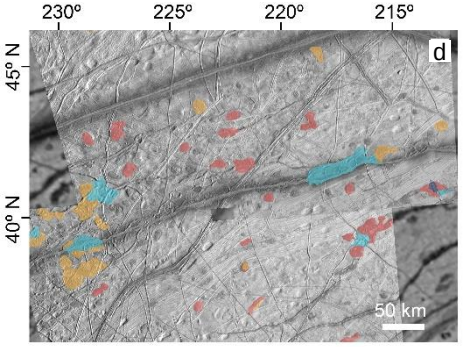

Chaotic terrains are the youngest geological features on Europa, and are recognised as reddish-coloured areas compositionally enriched in salts, where the original crustal appearance is poorly preserved due to fragmentation into blocks or has faded due to fractional melting. Their formation remains a subject of active debate and is currently attributed to processes such as local melting, diapirism, cryomagmatism, or impact cratering. In order to shed light on it, we searched for patterns by mapping their textural features.

We identified four texture facies types, arranged along a gradient from greater disruption to higher degrees of fractional melting: **(i) fragmentation without block displacement**, **(ii) fragmentation with block shifting and fractional melting but the pre-existing appearance is still preserved**, **(iii) fragmentation and fractional melting is such that only small blocks and matrix are distinguished, with the proportion of blocks is higher**, and **(iv) low block-to-matrix ratio**.

The textural facies map reveals an asymmetry in the size, number of facies (mono- or multifacies), distribution, and degree in the disruption-fractional melting of chaos units. We identified that larger, multifacies chaos with moderate degrees of disruption and fractional melting are concentrated around the equator, whereas smaller, more fractionally melted chaos are widely distributed. These observations suggested that tidal and internal heating alone cannot fully explain the formation of chaotic terrains. Instead, greater fractional melting at smaller scale would imply localised cryomagmatic processes. Moreover, mineralogical and structural heterogeneities within the ice crust could have influenced the internal processes associated with their formation.

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