

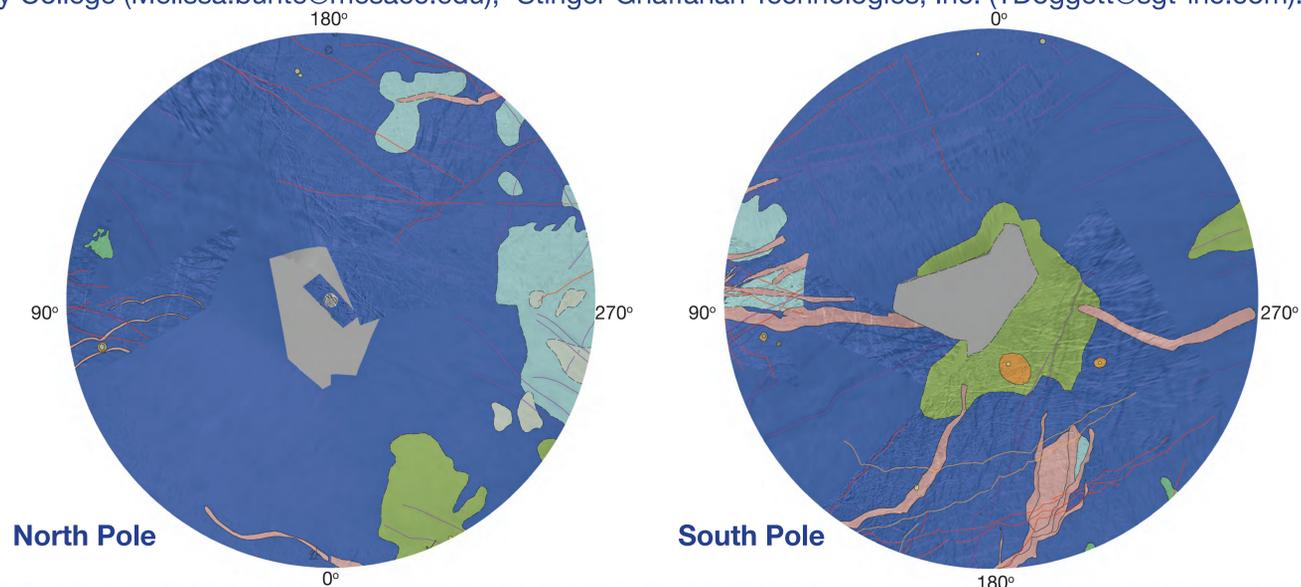
Updating the Global Geologic Map of Europa

E. J. Leonard¹, D. A. Patthoff², D. A. Senske³, G. C. Collins⁴, M. K. Bunte⁵, T. Doggett⁶

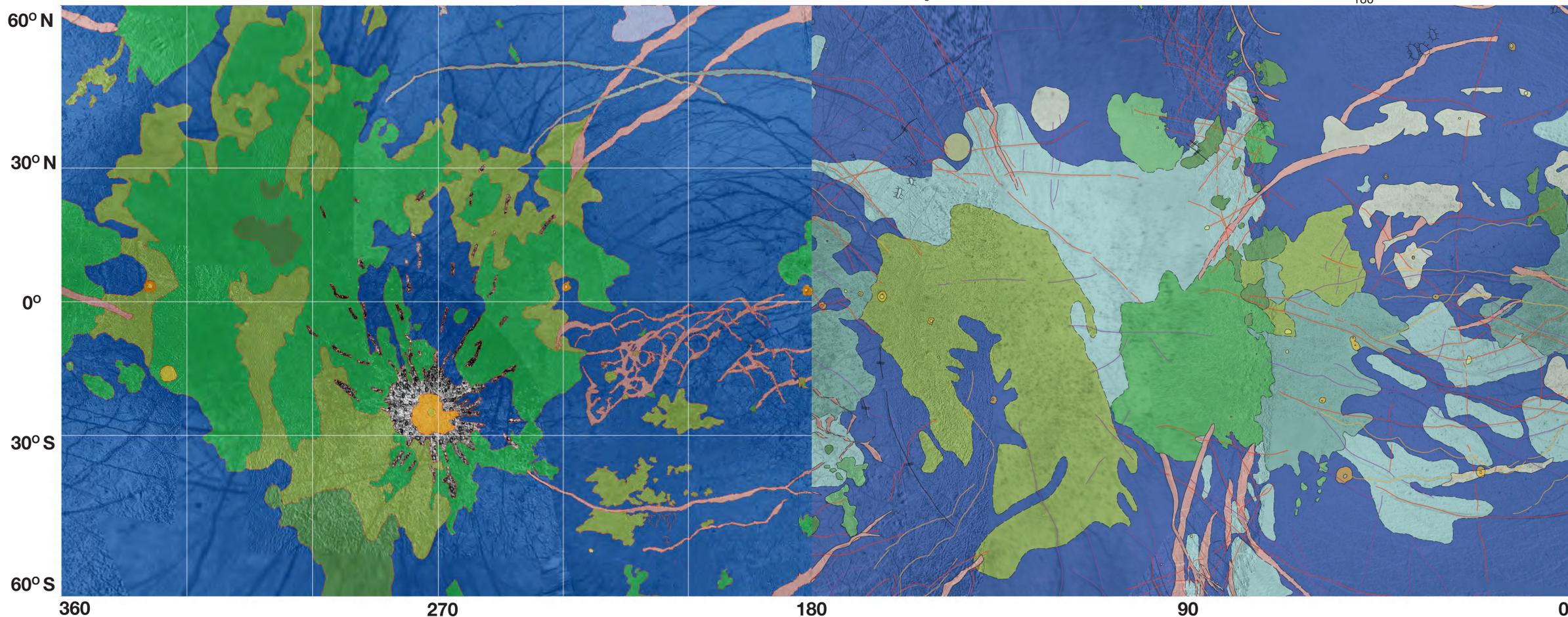
¹University of California, Los Angeles, (erinleonard@ucla.edu) ²Planetary Science Institute (apatthoff@psi.edu), ³Jet Propulsion Laboratory, California Institute of Technology (David.a.senske@jpl.nasa.gov), ⁴Wheaton College (gcollins@wheatoncollege.edu), ⁵Mesa Community College (Melissa.bunte@mesacc.edu), ⁶Stinger Ghaffarian Technologies, Inc. (TDoggett@sgt-inc.com).

Introduction

Jupiter's icy moon Europa reveals a geologically young and complex surface covered with numerous fractures, ridges, chaos, and other geologically distinct features [1]. A global geologic map of Europa is a challenge due to inconsistent image coverage and the complex geologic features that are often at a scale below the image resolution. However, as a mission to Europa is currently in formulation [2], a global geologic map that incorporates data at all resolutions that can be interpreted at a global scale will facilitate the science investigations through the collection of collaborative and synergistic data. Work is ongoing in completing and updating earlier global geological maps produced by Doggett et al. [1, 3] and Bunte [4, 5] at the scale of 1:15 million.



Europa Global Map



Key

Geologic Units

**units we have modified from Bunte et al. (2015) are listed as: Modified Name/Original Name. Additional or modified Description/Original Description

- **Ridged plains (Pr)**. Distributed over all latitudes, this unit has the greatest geographical distribution of the identified units. The ridged plains are characterized by subparallel to cross-cutting ridges and troughs.
- **Banded Plains (Pb)**. Located primarily near and south of the equator on the anti-Jovian hemisphere, this region of plains is composed of ridges superposed by dark bands.
- **Low Albedo Ridge Material/Lenticulated plains (Pl)**. Low albedo material that surrounds large (>10 km) ridge structures/Pits, domes, and spots are grouped together into this singular unit that generally has a lower albedo relative to other plains units. Most of these features are found in conjunction with the ridged plains unit (see below); however, this separate classification is reserved for regions where the darker spots are more highly concentrated.
- **Band material (b)**. A single band has a relatively constant albedo along its length, but can occur in albedos varying from high to low/Bands are linear to curvilinear zones with a distinct, abrupt albedo change compared to the surrounding region. They commonly completely disrupt the older terrain but are also observed to be crosscut by younger features.
- **Crater material (c)**. Here we distinguish between the site of the impact, crater material, and the debris that falls out from the event. For the largest craters, we map the crater rim, floor, and multi-rings when applicable (i.e. Tyre and Callanish).
- **Crater ejecta (ce)**. Impact events can create deposits of material that surround the impact site. Here we map the largest impacts and identify the surrounding hummocky material which appears in a radial pattern away from the central impact site.
- **Secondary craters (s)**. Crater chains that are associated with a larger primary crater. Identified at the global resolution by high albedo rays emanating from a central crater. This unit is only present around Pwyll.

- **Low Albedo Chaos/General chaos (Ch)**. Typically low albedo regions identified at low resolution (1 km scale) with a mottled texture. Where higher resolution data are available, this unit is found to be associated with disrupted areas of chaos [6].
- **Variagated Albedo Chaos/Undifferentiated chaos (Chu)**. Low albedo, potentially chaos regions that do not fit in any previously mentioned chaos subdivisions.
- **Subdued chaos (Chs)**. Low albedo chaos regions that are generally dominated by smooth material and contain little to none of the rough, knobby or platy texture of other chaos units.
- **Knobby Chaos/Blocky chaos (Chb)**. Regions with a mottled albedo and a rough or knobby texture. Blocky chaos is typically elevated above the surrounding terrain and in some places the low albedo material appears to have embayed into surrounding units
- **Fractured chaos (Chf)**. Low albedo regions made up of a high density of lineaments where the pre-existing plains material is no longer visible. The low albedo material appears to embay the commonly surrounding ridged plains unit.
- **Micro chaos (Chm)**. Small (> ~50 km diameter) low albedo outcrops, potentially merged lenticulae, occurring within the ridged plains unit. Micro chaos does not appear as disrupted as general chaos, though this could be an artifact of image resolution.

- Linear Features**
- **Contact - certain**
- - - **Contact - approximate**
- **Undifferentiated linea**. Long (10s to 100s of km), linear, through going features of either low or high albedo that do not have other discernable characteristics at the global scale or at the available resolution
- **Ridges**. Quasi-linear topographic highs containing one or more crests. Most commonly identified as double ridges, two ridges separated by a trough.
- **Flexus**. Also known as cycloids, these features consist of a series of long arcs connected by sharp cusps.
- **Trough**. Narrow topographic low with material on either side showing no apparent offset.
- **Bounding Scarp**.

References

- [1] Doggett, et al. (2007). 38th LPSC, abstract 2296. [2] Phillips and Pappalardo (2014), EOS AGU 95.20. 165-167. [3] Doggett, et al. (2009). Europa, University of Arizona Press, 137-159. [4] Bunte, M. et al. (2013), 44th LPSC, abstract 2978. [5] Bunte, M. et al., (2015), Global Geologic Map of Europa, submitted to USGS. [6] Lucchitta and Soderblom (1982). Satellites of Jupiter, University of Arizona Press, 521-555.

Acknowledgments

This work is supported by NASA's Europa Clipper Project.