SUPER-ERUPTIONS ON IO. A CLASSIFICATION BASED IN EARTH'S ANALOGUES. D. Tovar[1] and J.J Sánchez[1]. [1]Universidad Nacional de Colombia – Department of Geosciences , Carrera 45 No 26-85 – Building 224, Bogota D.C., Colombia (dftovarr@unal.edu.co)

Introduction: The term super-eruption was recently introduced in scientific vocabulary by Rampino & Self in 1992 and refers to the ejection of magma with a volume greater than 450 km^3 for effusive eruptions and 1000 km^3 for explosive eruptions [1]. Based in this values, many super-eruptions has been classified on Earth; some examples are the well-known eruptions of Toba 74.000 years ago, Yellowstone, Siberian Traps in the Permian, Deccan traps and others. Despite the term super-eruption has been used exclusively for events on Earth, we suggest apply this term to eruption on Io, the most volcanic body in the Solar System. The Geological Map of Io [2] shows the different units recognized on the surface of Io including deposits produced by volcanic eruptions such as plain units (65.8% of surface), lava flows fields (28.5%) and diffuse deposits (~18%). Approximately 17% of Io's surface is covered by plume deposits that over a period of 5 years of continuous volcanic activity (time that Galileo made observations at Io) reach a thickness of 3 cm; nonetheless we used the value of 10µm thick (minimum thickness of deposits to be visible by instruments) [3] to calculate the minimum volume required to classify a super-eruption on Io. Considering only the values of surface area covered by deposits and don't consider the composition and geographical distribution of these in order to obtain real values of the minimum volume for super-eruptions on Io, we consider the data provided by Galileo mission and instruments on board such Near Infrared Mapping Instrument (NIMS) and Solid State Imaging SSI.

Methodology: We estimate the rate of volume variability for giant eruptions on Earth defined as

$$i_{vvol} = -\log(V_{SEE}/ V_E) \qquad (1)$$

where i_{vvol} = volumetric rate variability, V_{SEE} = minimum volume of a super-eruptions on Earth. V_E = volume of Earth. It was obtained that i_{vvol} = 9.035. This is the minimum value that should have deposits on Earth to associate a super-eruption. To Io not exist a value from which a deposit can be considered as generated by a super-eruption. However, we can estimate the minimum volume of a stock to be detected, which is calculated as:

$$V_{minIo} = 10\mu m \times (\text{area of smaller eruption}) \qquad (2)$$

$$i_{vvol} = -\log(V_{minIo} / V_{Io}) \qquad (3)$$

$$i_{vvol} = -\log(V_{maxIo} / V_{Io}) \qquad (4)$$

where 10µm is the thickness mentioned before, V_{minIo} = minimum volume of deposits calculated on Io, V_{maxIo} = maximum volume of deposits calculated on Io and V_{Io} = total volume of the moon Io.
Considering the volume values calculated in this work, a value of 1 x 10^{-4} km^3 proves to be conveniently associated with a super - eruption. The value for the index of variability for this value is 14.40 so this will be the minimum value associated with a super-eruption. Any other container that has a value below of 14.40 is considered a super - eruption.

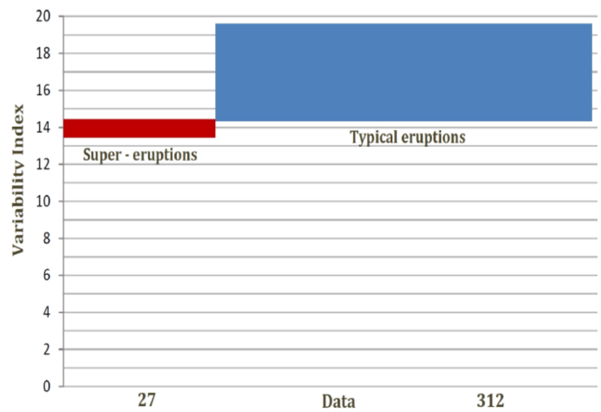

Fig1. Classification of super-eruptions on Io. The vertical axis is the variability index and the horizontal axis is the population data. Of the 339 data, only 27 were classified as super-eruptions on Io. These data correspond to diffuse deposits

References: Miller C., and Wark D. (2008) *Elements* Vol 4, issue 1, 11-16 [1]. Williams, D.A., Keszthelyi, L.P., Crown, D.A., Yff, J.A., Jaeger, W.L., Schenk, P.M., Geissler, P.E., and Becker, T.L. (2011) USGS Scientific Investigations Map 3168, scale 1:15,000,000, 25 p. [2]. Geissler P.E., McEwen A., Phillips C., et al (2004) *Icarus* 169, 29-64 [3].

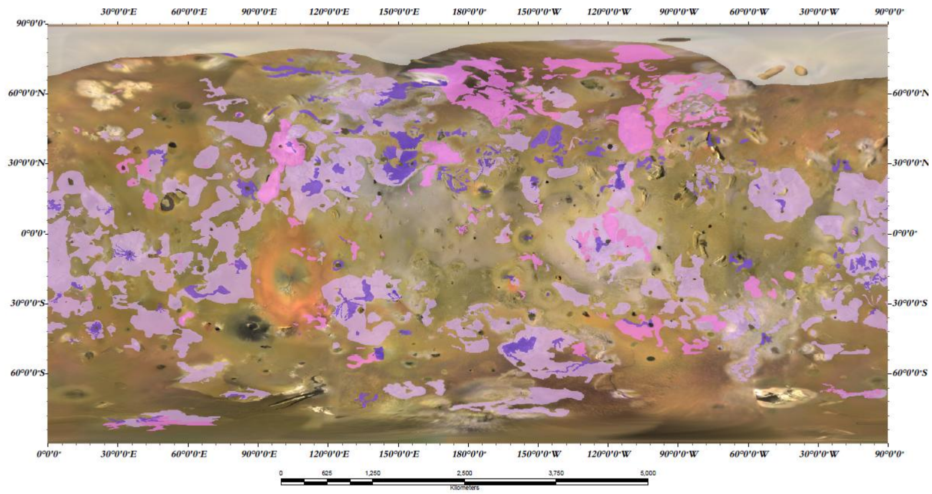

Fig 2. Flow units. This map shows the following units: f_d (dark flow material), f_b (bright flow material), f_u (undivided flow materials). (Modified from D. Williams et al 2011)

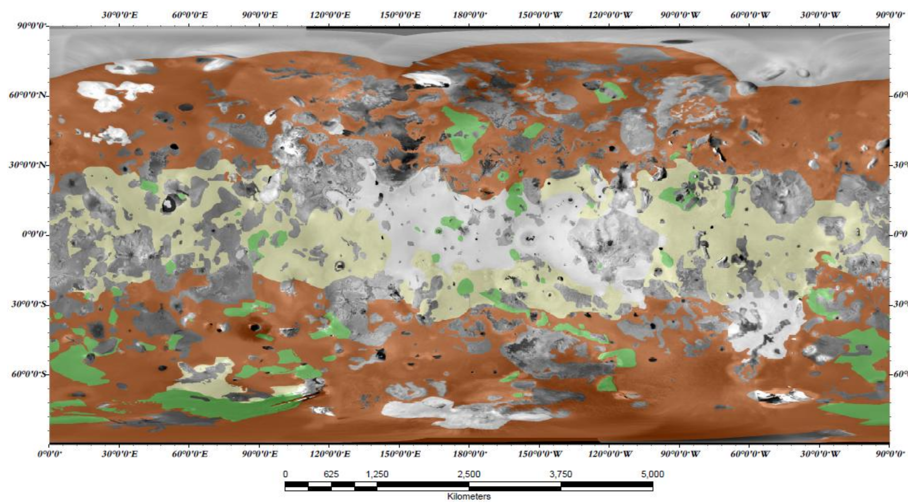

Fig 3. Plain units. This map shows the following units: p_{by} (yellow bright material), p_{bw} (white bright material), p_{rb} (red-brown materials) and p_l (layered material). (Modified from D. Williams et al 2011)

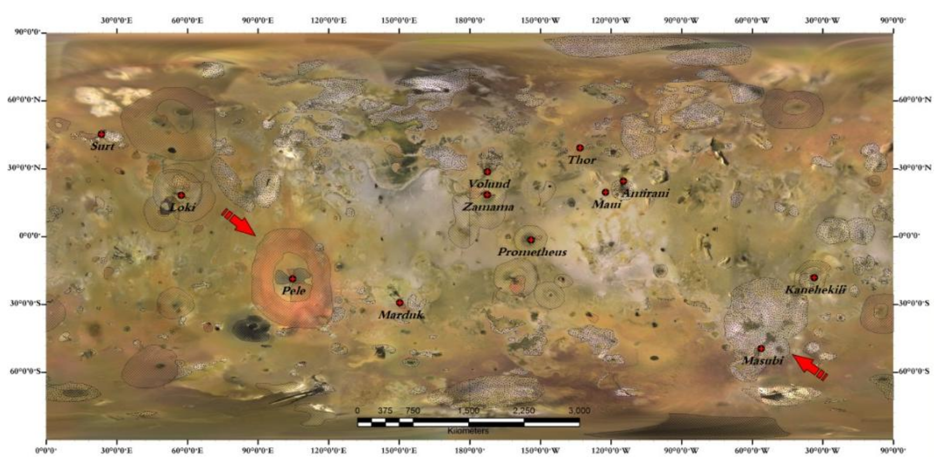

Fig 4. Diffuse deposits on Io. The arrows shows 2 of the 27 deposits associated with super-eruptions.