Geophysical Research Abstracts
Vol. 20, EGU2018-16801, 2018
EGU General Assembly 2018

Mapping scoria cones: planetary analogue studies using Drone photogrammetry and Lidar data from Lanzarote

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Scoria or cinder cones are relevant analogies for both the Moon and Mars and beyond. Examples include the Marius Hills complex with its C-shaped irregular cones or the pitted cones in the Nephentesu / Amenthes region of Mars. The geological complexity and possible young age of some of the planetary cones on the Moon and Mars make them suitable candidates for future robotic and manned missions.

The AGPA (Augmented field Geology and Geophysics for Planetary Analogues) field campaign in November 2017 focused on one such scoria cone in the Timanfaya region of Lanzarote. One of the objectives was the measurement of surface geometries and morphologies to better classify and understand geological processes such as hydrovolcanism and phreatomagmatic activity on other planets such as Mars. In addition, detailed and accurate surface (base) maps are required for operations such as site selection, preparation, and base construction, especially when long-term robotic or human presence on the lunar or Martian surface is envisaged. Drone-based photogrammetry and ground-based Lidar data were acquired during the AGPA field campaign.

While photogrammetry requires sufficient lighting conditions and is prone to fail in areas with few distinctive features, requires several viewpoints with a large baseline to compute the 3D geometry and provides generally no scale information Lidar produces dense point clouds from single viewing positions is independent of external light sources but is currently limited to large and heavy devices. The combination of the two methods allows to identify the advantages and disadvantages with respect to their application in Planetary Analogues.

Preliminary photogrammetry and LIDAR results included very dense point clouds and orthomosaics with a varying resolution of 16mm to 120 mm. The database is of sufficiently high resolution to quantify grain size and surface texture variability. It is also used to identify and map cm scale lichen growth. The broad-scale characteristics (height/width/length/slope) are similar to some of the above mentioned pitted cones on Mars.