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Augmented field Geology and Geophysics for Planetary Analogues

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Planetary surface exploration, either robotic, human, or human-robotic, relies on experiments that can be tested on Earth analogues [e.g. 1, 2]. Training in basic geoscience as well as the use of specialised geophysical equipment proved successful for the NASA Apollo program. The recent ESA astronaut training campaign extension PANGAEA-X [3] allowed to use and test on the volcanic planetary (Mars, Moon) analogue terrains of Lanzarote several geological and geophysical experiments and protocols, as well as their integration.

The Augmented field Geology and Geophysics for Planetary Analogues (AGPA) [4] concept comprises a flexible set of experiments deployed during the ESA PANGEA-X field campaign. Performed activities included Remote Sensing (e.g. drone stereogrammetry, LIDAR) and geophysical (e.g. geo-electrics, active and passive seismics) investigations. The aim of AGPA is to integrate training data collection and analogue field geology procedures with geophysical in-situ and remote sensing methods in order to maximise and augment science return and operational effectiveness, both at data analysis and exploration planning stages.

Aerial and ground-based remote sensing via respectively drones (AGPA-D) and ground-based or mobile LIDAR systems (AGPA-L) provides accurate contextual morphological and geological information as well as the capability of documenting surface activities performed during the survey [3]. Subsurface sounding via either active or passive geophysical methods allows for investigating planetary analogue subsurfaces. Characterisation of buried lava tubes via and geo-electrics (AGPA-G) as well as seismics (AGPA-S) has been performed at various location in Lanzarote during PANGAEA-X [3].

The integrated use of both surface imaging and subsurface geophysics can be synergistic [5], useful for cross-validation and improved geologic interpretation. The approach can be applied on a planetary analogue target, such as lava tubes, or future planetary cases, such as Lunar or Martian landing sites with the need to characterise, map and explore the subsurface, e.g. through lava tubes, collapses and caves.

AGPA supports open sharing of collected data, the first of which from the 2017 campaign are available on public repositories such as Zenodo [6]. Datasets, both raw and processed will be shared in a similar manner to foster cooperation, re-use and reproducibility.

References:

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