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Field campaigns to analyse spectral characterisation of various volcanic material in NIR range; preparation for EnVision and VERITAS

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One of the main objectives of the ESA EnVision and NASA VERITAS missions is to understand the evolution of Venus by characterizing the composition and origin of its major geological terrains. The best Venus' dataset comes from the VIRTIS instrument on-board Venus Express, which used a near-infrared sensor [1,2,3], because the dense CO_2 atmosphere of Venus only allows observations in narrow spectral windows around 1μm. It mapped the Venusian surface through atmospheric windows at 1.02, 1.10 and 1.18μm [4,5]. Although VIRTIS was not designed for this task, it provided new insights into Venus' evolution and history, such as the discovery of recent volcanic activity [6]. The Venus Emissivity Mapper (VEM) [8] will observe the surface of Venus through a broader wavelength range with five atmospheric windows including six bands. These will allow the spectral characteristics of the Venusian surface, as well as the type of lava and likely alteration processes. To prepare for these missions and deepen our understanding of the emissivity spectral characterisation of various volcanic rocks, we plan several field campaigns using in-situ measurements that emulate VEM and bring samples back for emissivity measurements at the Planetary Spectroscopy Laboratory of DLR-Berlin.

Vulcano in southern Italy: Field work in this area was planned as part of the Vulcano summer school [9] in 2022. Tectonically-controlled magmatic activity is the source of lava for Aeolian Islands and their alignment [10]. Vulcano rocks display diverse compositions from basalt to rhyolite, making this site an attractive analogue to Venus. The island also shows a strong fumarolic activity with very high temperatures. Our main goal was to characterize the spectra from the fresh and old volcanic rocks with different compositions using the spectral range of the VenSpec-M and VEM. See [11] for more information on this campaign.

Iceland: Reykjanes peninsula in Iceland with its very recent eruptions from the Fagradalsfjall volcano, is a prime analogue to Venus. The extended presence of recently erupted lava fields (2021, 2022, and 2023), with various textures (from aa to pahoehoe), as well as the local presence of fumaroles within the lava fields, constitute a prime analogue site. In August 2023, DLR and JPL plan an airborne radar data collection campaign over the Reykjanes peninsula accompanied by a field work. Our goal is to collect in situ spectral measurements and relevant samples for characterisation in the Venus Emissivity chamber of the PSL at DLR-Berlin. See [12] for more information and the prepared remote sensing project.

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