

UAV-borne Hyperspectral Data Across Tailings and Waste at Memi Mine in the Republic of Cyprus

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The EU-funded M4Mining project (www.m4mining.eu; Horizon Europe scheme) promotes sustainable mining practices through integrated remote sensing data from uncrewed aerial vehicles (UAVs) and satellites for regular monitoring of mining-related masses across the entire life of mine chain. The overarching goal is to develop comprehensive remote sensing solutions for active and legacy mine sites, including tailings monitoring.

In this case study, we present the results of hyperspectral imagery (HSI) integrated with geochemical and mineralogical data from a field campaign in April 2024 at the Memi Mine, a legacy pyrite mine in the Republic of Cyprus. Here, there is processed waste and tailings from the production of sulphur concentrate, derived from iron pyrite ore mining at Memi and adjacent mines. HSI data were collected with a Mjolnir VS-620 using Visible to Near- and Shortwave Infrared (VNIR-SWIR) sensors with a combined wavelength range of 400-2500 nm. As part of the M4Mining project development, the drone-based hyperspectral data are displayed as 3D surfaces using co-acquired LiDAR data and integrated into a single full-spectrum hyperspectral mesh. Several control points were identified for ground-truth validation and spectral sampling using a portable field spectrometer.

The reflectance-corrected HSI is being assessed and compared by applying different classification methods for minerals known to occur in areas affected by acid mine drainage and secondary iron-bearing mineral precipitation, as well as for mineral sequestration potential. The geochemical and mineralogical characterisation of the samples is integrated and presented, aiding in the interpretation and validation of the collected HSI data and mineral classifications. Surface patterns of hematite, goethite, and jarosite, with only minor carbonate, are interpreted from the hyperspectral data. XRD results further demonstrate the presence of variably altered minerals that are associated with a VHMS deposit.