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Drones for Remote and Autonomous Multi-sensor Mapping in Mineral Exploration

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Uncrewed aerial vehicles (UAVs), also known as drones, have become an important branch of development in the field of innovative exploration technology. Short turnaround times, the highly adaptable nature of drone platforms, and the growing variety of sensors that can be deployed are driving increased interest in implementing drone-based mapping into mineral exploration workflows. Drone-based adaptation of technologies previously applied in airborne or ground-based campaigns now enables rapid mapping of geologic targets in unprecedented detail. The ability to objectively map topography and surface mineral composition using imaging sensors (including RGB, multi- and hyperspectral cameras) and subsurface physical properties using geophysical sensors such as magnetics and radiometrics has shown to add impressive value to conventional mapping workflows. Regulatory and technical barriers, however, often force a difficult trade-off between sensor payload and flight time on drone-based surveys. In an applicational field, where short turnaround times are key and targets of interest are remote and difficult to access, this often results in the use of light-weight sensors and single-sensor acquisitions.

In this contribution, we demonstrate the challenges and opportunities provided by multi-modal drone-based data in the framework of mineral exploration. In several case studies, we showcase the added value of integrating surface (spectral imaging) and subsurface (geophysical) data for better target characterization. We finally give an outlook on autonomous and multi-drone data acquisition for a targeted and more efficient characterization.