EGU21-7050
https://doi.org/10.5194/egusphere-egu21-7050
EGU General Assembly 2021

UAV high-resolution magnetic mapping of the Chenaillet ophiolite, in the Alps

Pauline Le Maire[1], Denis Thieblemont[1], Marc Munschy[2], Guillaume Martelet[1], and Geoffroy Mohn[3]

[1]BRGM-French Geological Survey – Orléans, France (p.lemaire@brgm.fr)
[2]Institut Terre et Environnement de Strasbourg, UMR7063 (Université de Strasbourg, CNRS, ENGEES), France
[3]Laboratoire GEC, CY Cergy-Paris Université, France

Continent-Ocean Transitions (COT) and ultra-slow spreading ridges, floored by wide area of exhumed serpentinized mantle, bear strong amplitude magnetic lineations. However, whether these anomalies are linked to inversions of the direction of the magnetization (therefore characterized as isochrones of seafloor spreading) or to structural and lithological contrasts remains an open question. Generally, marine magnetic data acquired at sea surface along profiles, are too low resolution to image the intensity variations of the magnetic field at a kilometric scale. Performing a dense deep tow magnetic survey at a present-day COT or ultra-slow spreading system would be better to determine the sources of the magnetic signal but remains expensive. To go ahead, a valuable alternative to address these questions is to record the magnetic signal on ophiolite representing remnants of COT and oceanic systems sampled in orogenic system. We worked on the Chenaillet Ophiolite (French Alps), which represents a fossil COT or ultra-slow spreading system integrated to the Alpine orogeny. This ophiolite escaped high-pressure metamorphism and has only been weakly deformed during Alpine orogeny, preserving its pre-orogenic structure.

We performed an UAV magnetic survey using fluxgate magnetometers in complex conditions due to the altitude (> 1800 m), the strong topography variations and the weather conditions (negative temperatures, snow). Despite these difficulties, which highlight the viability of UAV for geophysical measurements, a survey of 20 square kilometers with 219 km of profiling was completed 100 m above ground level. Flight line spacing is 100 m above the ophiolitic basement and 200 m above the sedimentary units. Another magnetic UAV survey was flown with another UAV to map a small area 10 m above ground level. Magnetic anomaly maps were computed after standard processing (e.g., calibration/compensation, temporal variation and regional magnetic field corrections, levelling).

Our first results evidence well-defined magnetic anomalies clearly linked to serpentinite. This shows that the magnetic signal is of sufficient resolution to contribute to a revision of the cartography of the massif combining geological observations and magnetic data.

In addition, the magnetic susceptibility was measured on 60 outcrops, to support interpretation.

In this presentation, we focus on the magnetic acquisition campaigns, processing and 2D/3D interpretations by forward modelling and data inversion. Lastly, two items are discussed: 1) contribution of magnetic UAV surveys for geological mapping; and 2) implication of the results on the Chenaillet massif to discuss the contribution of magnetic mapping to the understanding of the TOC or ultra-slow spreading system.