EGU2020-4505
https://doi.org/10.5194/egusphere-egu2020-4505
EGU General Assembly 2020

Contribution of magnetite (U-Th-Sm)/He thermometer to quantify the final exhumation of high-pressure ultramafic rocks : example of the Rocher Blanc ophiolite (western Alps)

Stéphane Schwartz[1], Cécile Gautheron[2], Richard A Ketcham[3], Fabrice Brunet[1], Arnaud Agranier[4], and Marianna Corre[1]

[1]ISTerre, Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, IRD, IFSTTAR, 38041 Grenoble, France
[2]GEOPS, Univ. Paris-Sud, CNRS, Université Paris-Saclay, 91405 Orsay, France
[3]Jackson School of Geosciences, The University of Texas at Austin, Austin, TX, USA
[4]UBO, IUEM, Place Nicolas Copernic, 29820 Plouzané, France

This contribution investigates the use of the (U-Th-Sm)/He dating method to unravel the exhumation history of ultramafic ophiolite rocks. Magnetite-bearing rocks are widely distributed on the Earth's surface and are associated with a large range of geological and geodynamic settings. However, little is known of the crystallization and exhumation history of in case of oceanic accretion to orogenic zones, due to a lack of datable minerals. In the past few years, the (U-Th-Sm)/He method applied on magnetite or spinel appears to be very relevant and promising. However, the applicability of this method to access the thermal history has never been quantitatively investigated, limiting the age interpretation. To highlight the applicability and to access geological information using magnetite (U-Th-Sm)/He method (MgHe), we applied it on a well-known high-pressure low-temperature alpine ophiolite (Rocher Blanc ophiolite, Western Alps) where the P-T-t exhumation history is well constrained. A study of magnetite petrology, mineralogy and geochemistry has allowed us to characterize that magnetite crystallize at T>250°C. MgHe ages that range between apatite and zircon fission track (AFT and ZFT) ages of surrounding rocks in agreement with the known thermal sensitivity of those methods. MgHe data were co-inverted with AFT and ZFT data to determine the most robust thermal history associated with the ophiolite cooling. This first MgHe age inversion is consistent with experimental He diffusion data, opening the use of MgHe as a thermochronometer. This result allows us to refine the thermal history and to precise the geodynamical context associated to the final exhumation of this alpine ophiolite.