ABSTRACT FOR THE GENERAL PUBLIC - ENGLISH

Plate tectonics operate on timescales that prevent directly measuring the rates of the tectonic processes. Instead, the tectonic rates can be resolved from the ancient rock record and applied to present-day and future tectonics. The discipline of geochronology utilizes certain minerals within rocks that incorporate radioactive elements with known decay rates for resolving the timing and rates of geological processes. These minerals are known as ‘geochronometers’. White mica is an ideal geochronometer as it incorporates two radioactive elements: ^{40}K and ^{87}Rb. ^{40}K decays to either ^{40}Ca or ^{40}Ar, with the latter being the basis for ^{40}Ar/^{39}Ar geochronology, whereas ^{87}Rb decays to ^{87}Sr allowing for Rb-Sr geochronology. White mica is a common mineral in metamorphic and deformed rocks that record larger-scale plate tectonic processes. These two geochronological systems in white mica can record thermal processes in the temperature range of ~600-400°C. Furthermore, white mica is also readily deformed and if often genetically associated with deformation structures in rocks. Deformation of white mica and fluid interactions with the mineral also can reset the two geochronological systems in temperatures <400°C, allowing for direct dating for tectonic events associated with the deformation. Therefore, white mica has the potential to record a wealth of tectonic processes in middle- to lower-crustal levels. However, the development and understanding of white mica as a geochronometer has been impeded by technological limitations. Recent state-of-the-art technological advancements aim to correct this and now allow for *in-situ* dating of white mica using both ^{40}Ar/^{39}Ar and Rb-Sr geochronological methods. These advancements have the potential to revolutionize white mica geochronology by providing high-spatial resolution for the analysis of single grains that are kept within their structural position. These recent developments have not yet been utilized to their full potential to develop white mica as an ideal geochronometer. This project is designed to stimulate geochronological investigations of white mica to realize its full potential. The project employs state-of-the-art *in-situ* white mica ^{40}Ar/^{39}Ar and Rb-Sr geochronological methods on rocks from two different tectonic settings (the Seve Nappe Complex in the Caledonian Orogen, and the Cycladic Blueschist Unit in the Hellenic Orogen). Specific case-studies are developed to examine the roles of thermal events (i.e., cooling of the rocks), deformation, fluid flow through the rocks, and intrinsic rock parameters (e.g., rheology and bulk chemical composition of the rocks) that can control the geochronological record in white mica. The two methods will be directly compared in all the case-studies to examine how they both respond to these different controls. These case-studies will identify how to approach and utilize the two different methods for examining different tectonic processes. The project represents the first, detailed direct comparison of *in-situ* ^{40}Ar/^{39}Ar and Rb-Sr geochronological methods in white mica. Consequently, the results will provide a critical advancement of white mica as a geochronometer to resolve the rates of tectonic processes, which ultimately govern seismicity, heat-transfer, and mineralization of economic ore deposits.