Meteorites, supervolcanoes, human evolution: Advancing accessory mineral petrochronology across Earth Science disciplines

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Accessory minerals carry invaluable information about their crystallization environments and the processes operating during crystal growth. Continuously evolving analytical protocols allow integrating high-precision ID-TIMS U-Pb geochronology with a range of analytical techniques to extract trace element and isotope geochemical data from the same crystals placing the geochemical information into a precise temporal framework. While most of these studies focus on zircon, other accessory minerals contain complementary geochemical information and in favorable cases can be dated with comparable precision and accuracy. Such integrated "*petrochronology*" studies have contributed significantly to the understanding of intrusive complexes [1], the evolution of silicic magma reservoirs [2], and the formation of porphyry copper deposits [3].

With this contribution, I intend to summarize current analytical directions and present selected applications that employ accessory mineral petrochronology to tackle a variety of problems across Earth Science disciplines. These applications range from (i) using a large zircon (±titanite) petrochronology data set to compare the evolution of supervolcanic magma reservoirs across tectonic settings, (ii) improving the temporal calibration of human evolution in the East African Rift, and (iii) constraining the thermal evolution of the mesosiderite parent body and the initial abundance of ^{92}Nb in the solar system by combining U-Pb and Nb-Zr chronometry [4].

This overview of recent applications documents the versatility of accessory mineral petrochronology and the valuable information that can be extracted from these minerals using a combination of modern analytical tools.

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