Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19771

Zircon unit-cell parameters: Potential proxy for indicating the variable thermal sensitivity of uranium-rich zircon (U-Th)/He system

YAN MA, JIANZHANG PANG AND DEWEN ZHENG

Institute of Geology, China Earthquake Administration

Presenting Author: mayan82634@hotmail.com

Noble gas-based thermochronometers, providing cooling ages of minerals based on the interplay between the kinetics of daughter accumulation and kinetics of its diffusion in the radioisotopic systems, represent the most widely used and applicable method of constraining the thermal, tectonic, and geomorphic evolution of the crust and surface of the Earth. However, it is also found that for some minerals, diffusive daughter loss depends not only on the temperature but also on the degree of radiation damage. Zircon (U-Th)/He decay has been proposed as a low-temperature thermochronometer with a closure temperature of ~170–190°C. While, zircon has a tolerance for actinides and lanthanides in their crystal structures at the time of crystallization, so it would have a level of α-recoil damage high enough to lead to its metamictization, which would exert a strong effect on the helium diffusivity that generates young (U-Th)/He ages. In this study, we propose that the unit-cell parameter of zircon crystal might be the potential proxy to characterize the degree of radiation damage in zircon and thus the temperature sensitivity (T_c and *PRZ*) of zircon-He system. Marked changes occurred in the trends of XRD intensity, unit-cell parameters, and macroscopic swelling with the effective uranium concentration (*e*U) in a series of uranium-rich zircon samples. Further work from atomic scales to bulk diffusion experiments is ongoing, and our aim is to establish the grain-dependent thermal sensitivity parameters for the uranium-rich zircon-He system for thermal history research.