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# U–Th mapping with nondestructive synchrotron X–ray fluorescence tomography and $^4$He/$^3$He thermochronology in apatite

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We show modeling and data demonstrating insights from nondestructive 3-D mapping of U and Th in apatite for $^4$He/$^3$He thermochronology. Our recently developed technique allows micron-scale characterization of parent nuclide distribution and inclusions in the same sample aliquots used for thermochronometric analysis [1]. This technique is particularly powerful for $^4$He/$^3$He thermochronology, which is more sensitive to thermal perturbations—and also more sensitive to zonation, inclusions, and grain geometry—than (U–Th)/He dating. We demonstrate the power of the technique and explore the implications for $^4$He/$^3$He thermochronology using a sample from the Transantarctic Mountains, and also consider the practical limits and potential alternatives to our time-consuming synchrotron mapping technique.

[1] Sousa et al., Geochronology, https://doi.org/10.5194/gchron-2024-8, in review, 2024.