Combining analytical approaches to decipher geological problems: An example using the Morefield (Virginia, USA) monazite age standard using SIMS + LA-ICP-MS + EMPA

ELIZABETH CATLOS, NATHAN MILLER[1]

[1] The University of Texas at Austin, Dept. of Geological Sciences, Austin, TX , 78712-1722

Monazite [(Ce, Th)PO_4] from a pegmatite in the Morefield Mine of the eastern Piedmont of central Virginia is used as an age standard but has unusually high and variable amounts of common Pb. Common Pb has led to problems for dating applications, interpretations regarding the significance of its age, and how it relates to nearby granite intrusions and faults. We analyzed a single large monazite grain from the pegmatite using electron microprobe analysis (n=64), laser ablation-inductively coupled plasma mass spectrometry (n=58), and secondary ion mass spectrometry (n=59). The combination of approaches reveals that the amount of ^{204}Pb in the mineral, a proxy for common Pb, linearly correlates with Ba (r2=0.88). Common Pb in the Amelia monazite is likely related to the presence of a Ba-bearing phase as the result of alteration. SIMS ^{232}Th-^{208}Pb dating from grain regions where ^{208}Pb comprises >99% of Pb isotopes yields two sets of ages: 263.5±3.0 Ma (±1s) and 234.1±3.3 Ma. Regionally, the ages are similar to the youngest Appalachian pegmatite bodies emplaced during the terminal (Alleghanian) Laurentia-Africa collision. The younger monazite age coincides with Triassic normal and/or sinistral faulting linked to the development and deformation of local rift basins. The combination of analytical approaches was ideal in ascertaining the regional significance of the monazite ages from the pegmatite, and Ba and fluid-induced alteration can be considered when working with monazites that contain unusually high amounts of common Pb.