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| Student | Patrick Boyd |
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| Title | Intra-grain common Pb correction and detrital apatite U-Pb dating via LA-ICPMS depth profiling |
| Adviser | Daniel Stockli |
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Apatite is a common accessory phase in igneous and sedimentary rocks. While apatite is widely employed as a low-temperature thermochronometric tool, it has been increasingly utilized to constrain moderate temperature cooling histories by U-Pb dating. Apatite U-Pb is characterized by a thermal sensitivity window of 375-550Â°C. This unique temperature window recorded by the apatite U-Pb system makes it a powerful tool able to illuminate mid-crustal tectono-thermal processes. However, as apatite tends to have only modest amounts of U and Th (1-10s of ppm) the significant amount of non-radiogenic â□□commonâ□□ Pb incorporated during its formation presents a major hurdle for U-Pb dating. In bedrock samples common Pb in apatite can be corrected for by the measurement of Pb in a cogenetic mineral phase that does not incorporate U, or through determination of the common Pb composition from multiple analyses in Tera-Wasserburg space. While these methods for common Pb correction in apatite can work for igneous samples, they cannot be applied to detrital apatite in sedimentary rocks with variable common Pb compositions. The obstacle of common Pb in apatite has hindered the application of detrital apatite U-Pb dating in provenance studies or U-Pb thermochronometry of (meta-) sedimentary rocks, despite the fact that it would be a valuable tool in such studies. This study presents a new method for the in situ correction of common Pb in apatite through the utilization of LA-ICP-MS depth profiling. Due to the intra-grain U variability in apatite, a mixing line for a single grain can be generated in Tera-Wasserburg Concordia space. This method allows for the correction of common Pb in detrital apatite, making it feasible to conduct detrital apatite U-Pb dating in provenance and source-to-sink studies.