Zircon saturation and the growth of the Cathedral Peak pluton, CA

J.E.P. MATZEL[1,2] J.S. MILLER[3] R. MUNDIL[1] AND S.R. PATERSON[4]

[1] Berkeley Geochronology Center; jmatzel@bgc.org; rmundil@bgc.org
[2] University of California, Berkeley
[3] San Jose State University; jsmiller@email.sjsu.edu
[4] University of Southern California; paterson@usc.edu

The spatial and temporal evolution of a pluton is a key constraint in conceptual models that explain the processes responsible for compositional diversity in a pluton and the degree to which plutons preseve information about their source region vs. internal magma chamber processes. ID-TIMS, U-Pb geochronology of single or incrementally leached zircons offers the best resolution of available techniques and allows reconstruction of the intrusive history of plutons. Zircon solubility provides further constraints for understanding the assembly and evolution of these systems.

We obtained U-Pb zircon analyses from three samples across the granodioritic Cathedral Peak pluton (CTP) within the Tuolumne Intrusive Suite, Sierra Nevada. A sample from the western margin yields a concordant and statistically significant cluster of $^{206}Pb/^{238}U$ dates (n=5) at 87.3±0.2 Ma, and one resolvably older zircon at 88.6 Ma. On the eastern margin, nine analyses are dispersed along concordia from 86.2 Ma to 87.0 Ma with one older zircon at 92.4 Ma. A central CTP sample has 7 analyses between 85.7 Ma and 86.5 Ma and three analyses at 88.1 Ma, 91.2 Ma, and 94.1 Ma. We interpret these results as zircon crystallization over the 1.6 Myr time period represented by the spread of ages between 85.7 Ma and 87.3 Ma. The resolvably older analyses are likely zircon crystals entrained from older parts of the magmatic system. Zircon recycling is most abundant near the center of the body.

Zircon saturation temperature (Tzr) offers important insight into the thermal history of the CTP. Whole rock analyses of CTP granodiorite yield an average Tzr of 755°C, and similar results were obtained with the Ti-in-zircon thermometer [1]. The sample with a tight age cluster (western margin) likely reflects a region where cooling through the Tzr was rapid. Conversely, the high degree of dispersion of analyses in the central and eastern samples may reflect a prolonged interval of crystallization and/or transient thermal oscillations about the Tzr. The low Tzr of the CTP magmas indicate that entrainment of zircon from older parts of the magmatic system occurred late in the history of the CTP when the system was in a melt-present, but high-crystallinity state.

References

[1] Watson E.B., Wark D.A., and Thomas J.B. (2006) *CMP* doi 10.1007/s00410-006-0068-5.