Insights into Pikes Peak Batholith construction using U-Pb ages and Hf isotopes in zircons from Lake George Ring Complex (Colorado, USA)

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The Colorado Front Range (CFR) basement developed at ~1800 Ma and was subsequently intruded by granitic batholiths at ~1700, ~1450, and ~1080 Ma, commonly referred to as, respectively, the Boulder Creek, Silver Plume, and Pikes Peak magmatic events [1]. The Lake George intrusion is an epizonal granitic ring complex thought to be part of seven small alkalic intrusive bodies interpreted by some as late-stage events in the Pikes Peak Batholith [2].

In order to better understand the chronology of emplacement and the nature of the magma sources of the Lake George ring complex, we analyzed zircons from seven lithologies sampled at Lake George and vicinity, and representing the different intrusive phases and general CFR intrusions, for their U-Pb and Hf isotope compositions.

We found zircon U-Pb ages of 1696 ± 5 Ma, 1449 ± 10 Ma, and 1432 ± 7 Ma, consistent with the Boulder Creek and Silver Plume magmatic events. These are accompanied by moderately positive ε_{Hf} values indicating significant involvement of pre-existing crust in their genesis, as opposed to the essentially juvenile ~1800 Ma basement. This is similar to what has been inferred previously from Nd isotopes [1]. The Lake George intrusive center is composed of a syeno-monzonite, which gives a zircon U-Pb age of 1428 ± 8 Ma, and has a Hf isotope composition indistinguishable from that of similarly aged wall-rocks. Ages and ε_{Hf} for the other intrusive lithologies systematically decrease towards the external parts of the Lake George ring complex (+4.9 at 1117 ± 12 Ma, +0.8 at 1087 ± 12 Ma, and -0.6 at 1066 ± 10 Ma). The latter result is for an extensive medium- to coarse-grained granite, known as the typical Pikes Peak Batholith. The present zircon U-Pb and Hf isotope data indicate that the Lake George ring complex represents an early stage in the formation of the Pikes Peak Batholith, consistent with petrological models for its formation and growth first proposed by Barker *et al* [3].

[1] DePaolo *et al* (1981), *Nature* **291**, 193-196. [2] Wobus and Anderson (1978), *J. Res. US Geol. Surv.* **6**, 81-94. [3] Barker *et al* (1975), *Precamb. Res.* **2**, 97-160.