The Ferrar Continental Flood Basalt: a ~1.6 Ma long duration evidenced by high-precision $^{40}Ar/^{39}Ar$ ages.

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One of the most impassioned topics in large igneous province (LIP) research is how prolonged the duration of these large scale magmatic events are. Durations of LIP magmatism have considerable impact on models of associated reconstructions of climate variability or tectonic events. Four high-precision $^{40}Ar/^{39}Ar$ plagioclase plateau ages for the Tasmanian dolerites (Ferrar) indicate ~1.6 ± 0.4 Ma of resolvable, continuous magmatic activity; 184.3 ± 0.2 to 182.7 ± 0.5 Ma (2σ). The $^{40}Ar/^{39}Ar$ results provide evidence of distinctly older intrusions and a more prolonged duration than the observed 182.4 – 182.9 Ma age range and duration indicated by the main zircon record [1], with only one multi-zircon age of 183.9 ± 0.3 Ma on the Dufek intrusion supporting older ages. Increasingly so, high-percision geochronology is illustrating that most continental flood basalts U/Pb zircon and $^{40}Ar/^{39}Ar$ plagioclase ages indicate similar duration timescales. Furthermore, modern day techniques/instrumentation have nearly removed analytical discrepancies between different chronometers. Therefore, can a geologic feature account for the difference in duration estimates measured for the Tasmanian dolerites?

Coupling geochemical data to the Tasmanian dolerite age data indicates a silica and incompatible element evolution of the Ferrar magmatic system through time. The older generation of intrusions (Zr: 92 ppm, SiO_2: 53.67%) are seemingly less enriched in incompatible elements and silica than the youngest youngest generation (Zr: 147 ppm, SiO_2: 56.5%). For this geochemical evolution to occur, a putative magma chamber source must be closed to allow fractional crystallization to dominate the system. Lacking replineshment of primary melts, the chamber will differentiate to more incompatible/silica-rich compositions saturating zircon only at evolved magmatic stages. Here, we suggest that plagioclase dates the full duration of magmatic Ferrar LIP activity of ca. 1.6 Myrs whilst zircon ages might be naturally biased and restricted to post- Zr saturation stage.

[1] Burgess et al. (2015), *EPSL* **415**, 90-99.