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BREAKING UP A CONTINENT: TIMING AND SOURCES OF GRANITOID MAGMATISM IN THE OSLO RIFT, NORWAY

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Investigating the processes associated with granitoid magma production and crystallization is essential to advancing our understanding of continental crustal growth. While continental and oceanic arcs have traditionally been considered active sites of juvenile crustal growth, granitoid magmatism during continental rifting is also an important mechanism through which continental crust can be generated. Yet in continental rifting environments, the petrogenesis of granitoid rock suites remains enigmatic within the context of their role in juvenile crustal growth. The Oslo Rift (OR) in southeastern Norway exposes the architecture of a continental rifts' magmatic plumbing system. It represents a failed rift, the central region of which is dominated by two batholiths: the Finnemarka (125 km^2) and the Drammen (650 km^2). Through the application of crystal chemical and isotopic stratigraphy, focusing on on the following minor and accessory phases: zircon ($ZrSiO_4$), titanite ($CaTiSiO_5$) and apatite ($Ca_5(PO_4)_3(F,Cl,OH)$), the petrogenetic history of these granites will be investigated within the context of rift evolution, and crustal growth.

Apatite and titanite data from both batholiths exhibit high REE abundances, with ∑REE in titanite up to 44,842 ppm and ∑REE in apatite up to 35,519 ppm. High ratios of La/Sm and La/Ce (~4-15 and ~0.42-0.70ppm, respectively) are consistent with apatite crystallization in a highly-oxidized environment, with several LREE vs HREE discrimination plots indicative of apatites from mafic I type granites (Sha et al., 1999). The ∑REE abundances in titanite range from 29,031 to 43,352 ppm in the cores, and from 33,343 to 43,121 ppm in the rims. Broadly, REE-chondrite normalized patterns display prominent Eu-anomalies, consistent with crystallization in a magmatic environment where plagioclase is crystallizing. However, two titanite crystals exhibit a positive Eu anomaly and clear enrichment in the HREE. This is interpreted as representing alteration from hydrothermal fluids.

Future work will involve isotopic characterization (U-Pb, Hf, O) of the minor phases studied to date. This study therefore offers a unique opportunity to assess the processes, and timescales, associated with granitoid magmatism during continental rifting and associated continental growth.

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