Dear Antarctic Science,

The Antarctic Science bursary was generously donated to us to enable a thorough analysis of the granitic rocks of the Lassiter Coast Intrusive Suite (LCIS) on the Antarctic Peninsula, allowing the fundamental processes controlling the generation of continental crust on continental margins to be investigated.

This project aimed to address both regional and global issues, at both event and process scale. On a regional level, the ~13600 km^2 Cretaceous LCIS is one of the most extensive crustal growth events along the entire margin of the Gondwanan supercontinent. On a global scale, previous age data indicated emplacement occurred during peaks of continental and oceanic magmatism around the Pacific, with associated peaks of crustal growth, world temperature, sea level rise, and hydrocarbon generation.

On the scale of fundamental global processes we aimed to utilise the LCIS and the Antarctic Science bursary to investigate the processes controlling the growth of the continental crust. Previous work has shown that the continental crust develops through peaks in intrusive, granitic magmatism. Similarly, peaks in granitic magmatism are shown to be contemporaneous with crustal deformation events. However, the significance and processes by which crustal deformation events (such as the Palmer Land Orogeny) trigger and control the magmatism involved in continental crustal growth are poorly constrained and debated.

As proposed in our submission, the Antarctic Science bursary enabled the collection of isotopic data on zircon crystals (a highly resilient magmatic phase in granitic rocks) from the LCIS by which we were able to determine the petrogenesis of the suite. Combined with other data collected during the study we were then able to integrate the isotopic chemistry with bulk rock chemistry, geochronology, mineral and magnetic fabric data and structural field data collected during our mapping of the region.

Our new field and magnetic fabric data has shown that the suite was indeed entirely emplaced during a period of regional compression in a direction perpendicular to the continental margin (i.e. compression generated in the direction of subduction). This disputes previous work indicating a more complex tectonic history. Combining the chronology, isotopic chemistry and fabric data has shown that the emplacement occurred in pulses of magmatism, and that these pulses are associated with peaks in deformation. By developing a new modelling technique to analyse the geochemical data we have shown a relationship between the periods of deformation and the processes by which the magmas generating the continental crust have differentiated – key processes in generating the distinctive granitic composition of continents. We have also been able to interrogate the processes involved in stable isotope differentiation in granitic rocks.

Through these processes we have been able to achieve our aims of determining the processes involved in the generation of this voluminous magmatic event – one of the most significant along the Gondwanan margin. We have also been able to identify and interrogate the processes involved in the generation of continental crust by granitic magmatism during periods of intense crustal deformation.

The first paper in this study was published this year on the timing of the magmatism (Riley et al., 2018. GSA Bulletin). I am currently drafting two papers on the chemistry of the LCIS and the relationship between tectonic deformation and the magmatism. We will also be publishing a revised map of the region. The publication process was slowed by delays in publishing our preceding study, but we expect publication of all our results by mid-2019.

We grateful for the financial assistance provided by Antarctic Science, enabling us to produce such a complete dataset by which an ambitious and detailed interrogation of these complicated processes could be successfully executed.

Thank you for your assistance,

Alex Burton-Johnson