Feldspar trace element proxies for whole-rock compositions of plutonic igneous rocks

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We present a comprehensive LA-ICPMS major and trace element dataset for plagioclase and alkali feldspar from classic S-, I-, I-adakitic and A-type granite-diorite from New Zealand, Australia and the USA. The dataset reveals that individual feldspar grains carry unique chemical fingerprints that strongly reflect the whole-rock composition of their parent igneous rock, thus providing a means of characterising the granite type and suite that feldspar grains from sandstones, or very small rock samples, were derived from. Discrimination plots, such as Sr versus CaO for plagioclase, and Rb versus Sr for alkali feldspar, provide a relatively robust method for distinguishing granite type, and provide insight into magma generation (i.e. source-related) and evolutionary processes (i.e. fractional crystallization). In-situ trace element fingerprinting of feldspar grains for determining sandstone provenance is a novel, world-first, utilization of the major framework mineral in plutonic igneous rocks. This technique has the potential to be developed into an inexpensive and effective tool for determining the provenance of detrital feldspar grains in sedimentary basins. Application of this method is also shown to be a valuable tool for determining the character of cm-sized seafloor dredge samples that comprise too few grains to represent a whole-rock sample. Geochemical variation within feldspar grains from individual plutons may also provide insight into the formation and evolution of the continental crust.