A 'hotspot highway' in the S. Pacific

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New deep-sea dredges from the Samoan region provide evidence for three seamounts (Malulu, Papatua [PPT], Waterwitch) and one atoll (Rose) that are not geochemically related to the Samoa hotspot track. We use a plate motion model to show that three non□Samoan hot spots, currently active in the Cook□Austral Islands, are responsible for 10–40 Ma volcanism in the Samoan region. The four 'interloping' volcanoes in the Samoan region exhibit geochemical affinities with the three hot spots. All three hot spots would have left a depleted, viscous, refractory keel that is coupled to the base of the Pacific lithosphere that has been 'rafted' to the Samoan region. Without major modification of the current 'propagating lithospheric cracks' model, it is not clear how such cracks could yield melts from the refractory keel present under the Samoan lithosphere. Instead, a region of buoyantly upwelling mantle, or plume, is suggested to generate the shield stage volcanism in the Samoan region.

Another implication of the Cook-Austral interlopers in the Samoan region is that they may provide the "missing link" to what may be a third long hotspot track in the Pacific, in addition to the Hawaii and Louisville chains. The Hawaii and Louisville hotspots exhibit very different behavior at ~45-50 Ma (the Hawaiian hotspot exhibits a clear "kink", and Louisville exhibits a gradual bend), and it is important to establish a third long-lived hotspot for comparison during this critical time in Pacific tectonics. Plate reconstruction models suggest the Rurutu hotspot track—one of the three hotspots in the Cook-Austral Islands—bends at ~45 Ma and emerges from the Gilbert Islands before trending through Samoa and toward the present-day hot spot location beneath Rurutu. Deep-sea dredging the seamounts in the region predicted to be the ~45 Ma Rurutu "bend" is necessary for evaluating a genetic and temporal link to the Rurutu hotspot.

Quantitative determination and mapping of trace element concentrations in sulfide minerals using LA-ICP-MS

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Quantitative trace-element analysis of sulfide minerals has a number of important applications, including: empirical indication of deposit setting, geo-thermometry and geo-barometry, ore paragenesis studies, indicator mineral surveys, and deportment investigations. However, progress in this field has been hindered by the lack of multi-element sulphide mineral standards for trace-element microbeam techniques and methods for mapping trace element concentration distributions in samples with complex mineralogy.

In this study, element distribution maps have been constructed from time-resolved LA-ICP-MS signal intensity data acquired during multiple, continuous parallel line ablations and lines of edge-to-edge, square spot ablations across selected areas of petrographic sections. The data were deconvoluted, calibrated and digitally combined using in-house software to generate elemental concentrations maps, which provide detailed information on spatial variations of elements within and between sulfide grains and their enclosing minerals.

Determining concentrations in mono-mineralic sampling areas was perfomed using conventional calibration protocols involving external standardization and normalization using an internal standard, performed on a (mass) scan-by-scan basis. External standardization was achieved using a multi-element synthetic pyrrhotite standard that was prepared by reaction in an evacuated quartz tube of elemental iron and sulfur doped with multi-element aqueous standards. This has been shown to be homogeneous (r. s. d. <10%) for the majority of the 30 doped elements. For complex mineralogies, both sulfide and silicate external standards were employed, together with normalization using different internal standard elements and/or concentrations for different minerals, and algorithms that automatically detected the mineral phase being analyzed.

The effect of different laser sampling strategies and algorithms for data smoothing and interpolation, and assignment of colours to element maps will be demonstrated.