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TITLE: The unusual Samoan hotspot: A "hotspot highway" juxtaposed with a trench *(Invited)*

SESSION TYPE: Oral

SESSION TITLE: V53G. Seamount Trails: Implications for Global Plate and Hotspot Motion, Mantle Flow, and the Geochemical Evolution of Mantle Plumes II

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ABSTRACT BODY: Oceanic hotspots are fed by (relatively) stationary, upwelling mantle plumes that melt beneath mobile tectonic plates. This mechanism results in the generation of a linear chain of volcanoes exhibiting a clear age progression: the islands and seamounts should be increasingly older with increasing distance from the inferred location of the mantle plume. Located in the southwest Pacific, the Cook-Austral volcanic islands and seamounts were long thought to lack a clear age progression, and it has been argued that the Cook-Austral volcanic chain is an example of a hotspot not fed by a mantle plume. However, work by Chauvel et al (1997) showed that the Cook-Austral volcanoes have been generated by three distinct, co-linear mantle plumes spaced by ~1000 km, resulting in 3 overlapping hotspot tracks. Critically, the volcanoes generated by each hotspot exhibit a clear age progression that emerges from its respective plume. Using plate motion models, the reconstructed tracks of the three Cook-Austral hotspots backtrack through the region of the Pacific plate now occupied by the Samoan hotspot between 10 and 40 Ma (Konter et al., 2008). Owing to the unusual number of hotspots (Samoa is the fourth) that have been hosted in the region, we refer to this corridor of the Pacific plate as the "hotspot highway." The Samoan hotspot is burning through and thus crosscutting the trails of the older Cook-Austral hotspots.
Consistent with this hypothesis, Jackson et al. (2010) reported volcanic features from the Cook-Austral hotspots in the Samoan region, including three seamounts and one atoll with geochemical affinities to the Cook-Austral hotspot. The Pacific lithosphere was likely "preconditioned" (metasomatized) by the three Cook-Australs hotspots before the arrival of the Samoan plume into the region, yet geochemical signatures associated with the Cook-Austral hotspot pedigrees are not evident in Samoan shield lavas. However, Samoan rejuvenated lavas exhibit a clear EMI (enriched mantle 1) signature that is not present in Samoan shield lavas (and thus not in the Samoan plume), but the EM1 signature is present in the most recent Cook-Austral hotspot (Rarotonga) to have contributed volcanism to the region of the Pacific plate occupied by Samoa. We suggest that the lithosphere beneath Samoa was underplated with (or impregnated by) material from the Rarotonga plume at ~10 Ma. The shield stage of Samoan volcanism does not sample melts of the lithosphere. However, the region of EM1-impregnated Pacific lithosphere once occupied by the Rarotonga hotspot (which has since been rafted into the Samoan region) is now located just ~100 km from the northern terminus of

the Tonga trench. We suggest that plate flexure resulting from the tectonic regime near the trench has resulted in decompression melting of the metasomatized lithosphere, which yields the EM1-flavored melts observed in Samoan rejuvenated lavas.

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Additional Details

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