A variably enriched mantle wedge and contrasting melt types during arc stages following subduction initiation in the southwest Pacific

ERIN TODD[1], JAMES B. GILL[2] AND JULIAN A. PEARCE[3]

[1]Dept. of Earth and Planetary Sciences, University of California, Santa Cruz, USA (todd.erin@gmail.com)
[2]Dept. of Earth and Planetary Sciences, University of California, Santa Cruz, USA (jgill@pmc.ucsc.edu)
[3]School of Earth, Ocean and Planetary Sciences, Cardiff University, Cardiff, CF10 3YE, UK (PearceJA@cardiff.ac.uk)

Mantle sources at the initiation of Vitiaz arc magmatism in the SW Pacific (≥45Ma) have isotope ratios similar to the mantle currently underlying the Havre Trough and adjacent back-arc basins. The early Vitiaz melt source was not only a mixture of depleted mantle plus small amounts of slab-derived component, but also includes an enriched FOZO component that makes it 'Pacific' in character. This old enriched component anchored SW Pacific arcs untils opening of the Lau Basin. Preferential melting of the enriched component leaves a more depleted residue. The Vitiaz nascent- and proto-arc, preserved in subaerial Eocene to lower-Oligocene rocks in Viti Levu, Fiji and 'Eua, Tonga, are similar in age and magma types to the earliest Izu-Bonin-Mariana (IBM) arc. Like IBM, Yavuna and 'Eua basalts range from boninitic to tholeiitic in composition. 'Eua is LREE-depleted whereas Yavuna ranges from LREE-depleted to LREE-enriched. The early arc was characterized by extreme variations in HFSE and HREE, reflecting large variations in percent melting, extending to very high degree melting necessary to generate low boninitic trace-element concentrations. Early bonintic melts have a more enriched quality (isotopically and in LREE/HREE) than tholeiitic melts. The end of Yavuna arc magmatism coincides with formation of the South Fiji Basin (SFB) (~20-30 Ma). Rocks of the Yavuna Group are unconformably overlain by late Oligocene to early Miocene rocks of the Wainimala Group, so 'second arc' edifices were at least in part deposited on Eocene to early Oligocene arc basement. Yavuna and Wainimala rocks show similar ranges for $^{143}Nd/^{144}Nd$ but variation in $^{176}Hf/^{177}Hf$ defines an array steeper than the Mantle Array in Hf-Nd isotope space. Higher $^{176}Hf/^{177}Hf$ ratios for Wainimala rocks indicate a more depleted source mantle than existed prior to SFB spreading.

Magmatic evolution of lunar highland rocks estimated from trace elements of plagioclase in regolith

S. TOGASHI[1], N.T. KITA[2], A. TOMIYA[1] AND Y. MORISHITA[1]

[1]Geological Survey of Japan, AIST, Tsukuba 305-8567, Japan (*correspondence: s-togashi@aist.go.jp)
[2]Department of Geoscience, University of Wisconsin, Madison 1215 W. Dayton Street, Madison, WI 53706-1692, USA (noriko@geology.wisc.edu)

SIMS analyses of plagioclases and the host magma

The SIMS trace element analyses of plagioclases in lunar regolith are performed in order to estimate compositions of host magmas of FAN and Mg-suite rocks. We reexamined partition coefficients of trace elements between plagioclase and magma by taking account of the compositional dependence. The estimated host magmas of FAN have low Ba (48-115ppm), Sr (90-152ppm), and TiO_2 (0.5 to 1.3%).

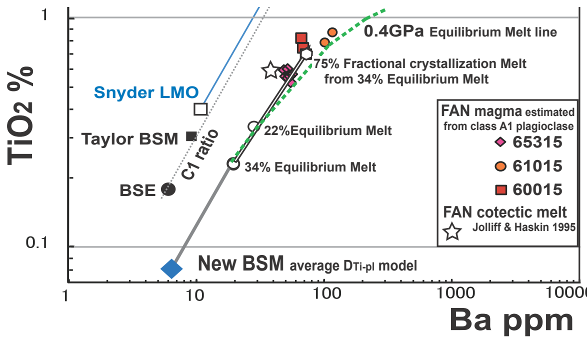

Figure 1: The estimated host magmas of FAN. Snyder LMO [1], Taylor BSM [2], FAN cotectic melt [3]

Model for FAN magma evolution

We developed an igneous evolution model for magmas of FAN and Mg-suite rocks by using phase relations based on MELTS program. We propose a new Bulk Silicate Moon (BSM) model with high Al_2O_3 (6.1%), sub-chondritic Sr/Al and Ti/Ba ratios and chondritic Sr/Ba ratios. High degrees (22-34% or more) of equilibrium melting of the BSM could produce the primary FAN magma under high pressure (0.4-3GPa), whether the BSM is partially or totally molten at the initial stage.

[1] Snyder *et al.* (1992) *GCA* **56**, 3809–3823. [2] Taylor (1982) *Planetary science*. 481p. [3] Jolliff & Haskin (1995) *GCA* **59**, 2345–2374.