Variation of arc signature in volcanic lavas from the southern Tonga-Lau arc and back-arc system

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In the southern area of the Lau basin, Eastern Lau Spreading Center (ELSC) and Valu Fa Ridge (VFR) form the longest back-arc spreading axis. Recent studies (e.g. [1] [2]) have suggested a model of mantle wedge having the transition at 20.6°S (~70 km from the arc) from hydrous domain in the southern part to less hydrous one in the northern area, which controls the ridge morphology and segmentation in these spreading centers.

Here we present, new major, trace element data and isotopic compositions of lavas dredged from the spreading ridges, ELSC and VFR, and the adjacent submarine arc volcanos of Tofua Arc (20-23°S) to examine the suggested mantle wedge structure in geochemically. We attempt to characterize geochemical affinities within the arc and back-arc system by comparisons of the along-axial variations of ELSC and VFR with the adjacent arc lavas located along slab flow lines. The major element data show that the volcanic rocks are dominantly basaltic, while some of more felsic rocks are found in the arc volcanos. In spidergram, the arc lavas are more depleted in incompatible elements at the north (TA10 and 11) of the transition zone than at the southern arcs. All analyzed volcanic lavas show no significant variation in elemental proxy for mantle fertility (e.g. La/Sm and Nb/Yb). Whereas, they show latitudinal variations in selected trace element ratios, representing subduction component (e.g. Ba/Nb and Ba/Th) for both back-arc axis and volcanic arcs. The increase of LILEs accompanied by more radiogenic $^{206}Pb/^{204}Pb$ for the southern ridge lavas and their systematic along-axis variations indicate increasing arc signature with decreasing distance from the arc. Decreasing of subduction component in the arcs from north to south appears to be related to formation of the hydrous arc-proximal mantle domain in adjacent back-arc spreading ridge.

[1] Dunn and Martinez (2011) *Nature*, **469**(7329), 198-202
[2] Sleeper and Martinez (2014) *J. Geophy. Res. Solid Earth*, **119**, 1678-1700