Trace element and δ^7Li geochemistry of Tonga arc submarine basalts

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The intra-oceanic Tonga-Kermadec arc is considered to represent the simplest endmember of arc systems. The highly depleted nature of the mantle wedge beneath the Tonga arc means that it is sensitive to the distinct inputs from the subducting slab, while the sediment input is limited but well characterised [1]. The sparce number of aerial volcanoes along the arc is accompanied by more numerous submarine volcanic centres. We present trace element and δ^7Li data from submarine samples, collected on the NoToVE cruise (2004), from the northern most portion of the arc, and also samples from the back arc spreading region of the Fonualei rifts.

The arc lavas are characterised by sub-chondritic Zr/Hf ratios (27.8-36.7) that reflect mantle wedge depletion. Modelling indicates the mantle source has been depleted by 2-3% from a MORB mantle source. However, arc samples show no systematic variation along strike of the arc, indicating all samples are derived from a similarly depleted source. Given that the rate of extension in the back arc increases from 8 to 16 cm yr^{-1} from S to N of the Lau basin [2] our data clearly demonstrate that wedge depletion is not controled by the rate of back arc extension.

Zr/Hf is correlated positively with the La/Yb ratio in both arc and back-arc lavas, that results from mixing between depleted mantle wedge and subducted sediment, and implying a greater contribution from sediment in the back-arc lavas (0.7%) compared with the arc (0.3%). Moreover samples from the back arc region only require an input from a sediment melt component whereas those from the arc require both a sediment and fluid input. Li isotope variations for this sample suite indicate that the fluid component from the slab is rich in ^{7}Li, as arc samples have heavier δ^7Li (up to 6.4‰) than samples from the back arc(3.0-4.8‰). This observation implies that subducted sediment melts are released into the wedge from the slab, forming the source of back arc magmas, and the subsequent addition of fluids from the slab to this hybridised mantle induces melting above the arc.

[1] Turner *et al.* (1997) *GCA* **61**, 4855-4884. [2] Bevis *et al.* (1995) *Nature* **374**, 249-251.

Timing of brittle deformation in the Deokpori - Gakdong thrust zone, South Korea

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The Deokpori (Gakdong) Thrust is an important structure for the Mesozoic tectonic evolution of Korea. Although the Deokpori Thrust has been interpreted as an Early Triassic intercontinental transform fault or Middle Jurassic intracontinental thrust, there has been no study on the kinematics and absolute age of the thrusting. This study is the first to attempt to directly date geologically young fault movements in the Deokpori (Gakdong) Thrust on the basis of neocrystallization of clay minerals recently applied in other orogens [1]. In the eastern Yeongwol area, the NNE-striking Deokpori Thrust occurs as at least 100 m-wide fault zone between the overlyng Ordovician marble and the underlying Middle Jurassic siliciclastics. The fault core (about 3 m wide) consists of foliated cataclasite, ultracataclasite and foliated gouge. Three samples were taken from the foliated gouge layer (20 to 30 cm thick) of the fault core for this study. One host rock shale was also sampled in the footwall about 40 m away from the fault core.

K-Ar dates of illite separates from fault rock samples, and grain sizes < 0.1 to 6-10 micron yield values ranging from 55.4±1.1 to 75.8±1.5 Ma (n=15). All dated sample fractions were extensively characterized by XRD, SEM and TEM. The host rock samples yield ages of 93.8±2.6 and 95.6±2.0 Ma respectively.

The internal consistency of the age results from K-Ar dating of fault gouges from both surface samples, as well as their consistency with constraints from field relationships and existing geochronological data demonstrate the potential of this method for providing new data to constraint absolute timing of brittle deformation in the Deokpori (Gakdong) Thrust of South Korea.

[1] Zwingmann, H. & Mancktelow, N. 2004. Timing of Alpine fault gouges. *EPSL*, **223**, 415-425.