Izu-Bonin arc collision and mountain formation of the South Fossa Magna region: New insights from low-temperature thermochronology

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The South Fossa Magna region is one of the unique regions in the world, being situated at an active arc-arc collision zone. It is thought that up to four crustal blocks of the Izu-Bonin arc have collided with this area since the middle Miocene, resulting in crustal modification of the Honshu arc side (e.g. Amano et al., 1999; Kano, 2002). However, the timing and effect of these blocks are still debatable.
Horizontal deformation such as the rotation of the collided blocks has been studied mainly by paleomagnetism. In this study, in order to reveal the vertical deformation, low-temperature thermochronometry was performed on basement granites. The uplift and denudation history were estimated and compared with the collision events.
Apatite fission track (AFT) ages obtained in this study were significantly younger than the granite formation ages and are consistent within an uncertainty of $\pm 2\sigma$ at all localities. The apatite (U-Th)/ He (AHe) ages were younger or consistent within an error than the AFT ages and previously reporter ages. Using this data inverse thermal history modeling using the HeFTy software (Ketcham, 2005) was carried out. Results indicate that the last cooling started at about 1 Ma in the northern and central parts of the Kofu granites in the Kanto Mountains, and at about 5 Ma in the southern part. Considering only the timing for the onset of the last cooling, these ages are in accord with the collision ages previously reported for the Izu block and the Tanzawa block, respectively.
The average denudation rates in the South Fossa Magna region were estimated from the age and temperature of the onset of the last cooling and these are consistent with average uplift rates over the last 0.1 Ma estimated from the elevation of fluvial terraces (Fujiwara et al., 2005). This suggests that vertical deformation such as uplift of the Honshu arc side has continued at a constant rate from the time of collision of the Izu block to the present.
In summary, our results suggest that collisions between the crustal blocks affected uplift of the mountains. However, considering that cooling rates in the Tanzawa Mountains, which are closest to the Izu block, did not increase due to the collision of the Izu block (Yamada and Tagami, 2008), the collision of the Izu block might not have directly influenced the uplift and denudation of the Tanzawa Mountains. For further discussion on the tectonic history of the crustal blocks, thermal inversion analysis at more localities in the Kanto Mountains and Misaka Mountains, which are located northwest of the Izu block, are required.

References:
1. Amano et al., 1999, *Structural Geology*, **43**, 11-20
2. Kano, 2002, *Bull. Earthq. Res. Inst. Univ. Tokyo*, **77**, 231-248
3. Ketcham, 2005, *Reviews in Mineralogy & Geochemistry*, **58**, 275-314
4. Fujiwara et al., 2005, *Journal of Nuclear Fuel Cycle and Environment*, **11(2)**, 113-124
5. Yamada and Tagami, 2008, *Journal of Geophysical Research*, 10.1029/2007JB005368

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