

Uplift and denudation history of the South Fossa Magna region using low-temperature thermochronometric methods

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The South Fossa Magna region is located at the junction of the Japan and Izu-Bonin arcs. Up to four crustal blocks of the Izu-Bonin arc, i.e., Kushigatayama, Misaka, Tanzawa, and Izu, collided this region and formed its crustal structures since the middle Miocene (1, 2). The timings of the collision events have been estimated by deposition ages of sediments between each block and the Japan arc. However, these questions remain unresolved.

In this study, we performed apatite fission track (AFT) and apatite (U-Th)/He (AHe) thermochronometric methods and U-Pb dating method to resolve the uplift and denudation history of the South Fossa Magna region.

The AFT ages are estimated to be 14.7 ± 4.7 Ma in the Okuchichibu area (c.f., hornblende K-Ar age: 10.5 ± 1.5 Ma (3)), 3.0 ± 0.5 Ma, 9.2 ± 2.2 Ma, and 7.6 ± 0.9 Ma in the Kano Mountains (c.f., biotite K-Ar age: i.e., 10.5 ± 0.4 Ma (4)), 3.6 ± 2.5 Ma in the Minobu area (c.f., biotite K-Ar age: 5.4 ± 0.3 Ma (5)). Also, the AFT ages are inferred at 37.0 ± 5.9 Ma in Mt. Tsukuba (c.f., Rb-Sr whole rock isochron age: 61.6 ± 4.3 Ma (6)), and 44.9 ± 4.1 Ma in the Sori granitoid in Gumma Prefecture (c.f., biotite K-Ar age: 92.6 ± 0.6 Ma (7)). The rocks which have younger AFT ages than the formation ages may reflect the uplift and denudation events since the rock formation. However, exhumation rates of the Tanzawa mountain, the closest mountain to the Izu block, did not increase before and after the collision of the Izu block (8), which may imply that the collision of the Izu block did not cause the uplift and denudation events significantly.

We also obtained the new AHe ages and U-Pb ages. The AHe ages for Okuchichibu area, Kanto mountains and Minobu area are about 3 Ma. Furthermore, according to the results of the inverse thermal analysis using the apatite FT lengths data, the granites in Okuchichibu area and the southern part of Kanto mountains cooled rapidly since about 3 Ma, and the granites in Minobu area and northern part of Kanto mountains cooled rapidly since about 1 Ma. The results of AHe ages were consistent with the results of inverse analysis. Based only on these ages, the rapid cooling ages of 3 Ma and 1 Ma are comparable to the collision ages of the Tanzawa block and the Izu block, respectively.

References

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Keywords: low-temperature thermochronology, South Fossa Magna, apatite fission track