[EJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG57]Dynamics in mobile belts

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The dynamic behaviours of mobile belts are expressed across a wide range of time scales, from the seismic and volcanic events that impact society during our lifetimes, to orogeny and the formation of large-scale fault systems which can take place over millions of years. Deformation occurs on length scales from microscopic fracture and flow to macroscopic deformation to plate-scale tectonics. To gain a physical understanding of the dynamics of mobile belts, we must determine the relationships between deformation and the driving stresses due to plate motion and other causes, which are connected through the rheological properties of the materials. To understand the full physical system, an integration of geophysics, geomorphology, and geology is necessary, as is the integration of observational, theoretical and experimental approaches. In addition, because rheological properties are greatly affected by fluids in the crust and fluid chemical reactions, petrological and geochemical approaches are also important. After the 2011 great Tohoku-oki earthquake, large-scale changes in seismic activity and regional scale crustal deformation were observed, making present-day Japan a unique natural laboratory for the study of the dynamics of mobile belts. This session welcomes presentations from different disciplines, such as seismology, geodesy, tectonic geomorphology, structural geology, petrology, and geofluids, as well as interdisciplinary studies, that relate to the dynamic behaviour of mobile belts.

[SCG57-P15]Uplift and denudation history of the South Fossa Magna region revealed by 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. In this region, multiple blocks, which are four at maximum (Kushigatayama, Misaka, Tanzawa, Izu), collided and formed crustal structures after the middle Miocene[1, 2]. When these blocks collided are estimated by sediments between each block and the Japan arc, whereas what influences given emerge as the deformation of the Japan arc to which the Izu-Bonin arc are collided. However, these questions remain unresolved.

Today geodetic techniques, such as GPS observation, make progress to better understand the uplift rates quantitatively, but the technique is restricted to measure crustal motions of short timescale (less than a few decades). Then, we used low-temperature thermochronometric methods to estimate uplift-denudation histories of geological time scale. Thermochronology is a discipline to determine the timing and temperature of past thermal events on basis of radiometric ages, which may be reset by past heating[3]. This method has been applied to various geological phenomena.

In this study, we performed apatite fission track (AFT) thermochronometric methods to resolve the uplift and denudation history of the Japan Arc side that mainly suffers tectonically from the collision in the South Fossa Magna region. The AFT was used because of its lower closure temperature (˜ 100 °C) than other thermochronometries such as U-Pb and zircon fission track methods[4].

The AFT age for Okuchichibu area is 14.7 ± 4.7 Ma, the ages for Kanto Mountains are 1.0±0.4 Ma, 8.7 ± 2.0 Ma, and 6.3 ± 1.1 Ma, and the age for Minobu area is 3.6 ± 2.5 Ma. These granitic blocks were formed in the middle Miocene. In the Okuchichibu area, the AFT age is almost same to the age of rock formation (i.e., 10.5 ± 1.5 Ma, based on the K-Ar method for hornblende[5]). In the Kanto Mountains and Minobu area, the AFT age is younger than the age of rock formation (i.e., the Kanto Mountains: 10.5 ± 0.4 Ma, based on the K-Ar method for biotite[6]). Assuming a general geothermal gradient of 40 ℃/km, the average denudation rate for the Okuchichibu area is 0.23 ± 0.07 mm/yr, the rates for Kanto Mountains are 3.6 ± 1.4 mm/yr, 0.36 ± 0.08 mm/yr, and 0.49 ± 0.09 mm/yr, and the rate for Minobu area is 1.6 ± 1.1 mm/yr. The denudation rates for Tanzawa granites are ˜ 2 mm/yr at 3.3 - 2.0 Ma, and ˜ 0.8 mm/yr at 2.0 - 0 Ma[7]. The rates of Tsuburai granites range from 0.16 to 0.21 mm/yr after 16.4 Ma, as calculated from the previously reported AFT ages[8]. Therefore, the denudation rates of Kanto Mountains and Minobu area are faster than those of Okuchichibu area and Tsuburai granites, and almost same to that of Tanzawa granites. These results may reflect the tectonic effects of the collisions, such as doming or thrusting.

The subjects for a future study are as follows: 1) improvements for thermochronometric mapping by increasing the number of counting tracks and starting analysis for other sampling localities/areas, 2) more reliable thermal history inversion analysis by considering a cooling process using track length distributions, 3) revealing crustal movements at even shallower levels by the apatite (U-Th)/He method.

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