

Cooling and denudation history of the Kiso Range, central Japan, based on thermochronometric methods

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The area in and around the Itoigawa-Shizuoka Tectonic Line (ISTL), central Japan, shows complex tectonics, where the North-east Japan Arc and the Southwest Japan Arc collide with each other and the Izu-Bonin Arc collides with them from the south. There are about 3,000-m-high ranges called the Japan Alps (the Hida Range, Kiso Range and Akaishi Range), which implies this area has been uplifted rapidly. Recent studies have revealed that these three ranges are different from each other in their initiation, uplift mechanism, or so on (Ikeda, 1990; Kaizuka and Chinzei ed., 1995; Machida et al. ed., 2006). These differences seem to reflect the complex tectonic setting of this area. Therefore, revealing landform evolution of these ranges is significant to clarify tectonics of the central Japan area or of the whole of Japan.

Estimate of denudation is important to discuss landform evolution of mountainous areas. The conventional method to estimate denudation rate of Japanese mountains has been mainly derived from sediment volume in a dam (Fujiwara et al., 1999). Availability of this method is constrained by the age of dam on time scale and by drainage area on spatial resolution. Thus, we applied thermochronometric methods which can be applied to still longer time scale and get data on each sampling sites in order to reveal the cooling and denudation history of the Kiso Range and to compare them with those of the Hida Range (Harayama, 1994; Yamada, 1999; Ito and Tanaka, 1999) and Akaishi Range (Yamagiwa et al., 1997) derived from the common method.

The Kiso Range is a fault block mountain being uplifted by faulting of the Inadani Fault Zone which consists of low angle thrust faults with high slip rate, about 6-12 mm/yr in total net slip rate of each fault. The Kiso Range is considered to be the newest in the Japan Alps. The initiation of dividing the Kiso Range and the Inadani Basin is estimated to be about 0.8 Ma because granitic sediment from the Kiso Range started to deposit in the Inadani Basin (Matsushima, 1995). This age roughly corresponds to the initiation of most active faults distributing the Tyubu and Kinki area (Ikeda, 2003) and to the outset of the collision of the Izu block and Honshu Island (Kano, 2002).

On the other hand, the extended area from the ISTL to Mino-Mikawa Plateau seems to have been uplifted gently because the Inadani Basin is at relatively high altitude though it is in the subsidence side of the Inadani Fault Zone and because the Mino-Mikawa Plateau is tilted to the west. This widespread uplift is also supported by the observation derived from leveling in past about 70 years (Danbara, 1971). It implies that the Kiso Range has been uplifted not only by faulting of the Inadani Fault Zone, but also by more widespread uplift activity. In order to constrain landform evolution of the Kiso Range and tectonic development of the area in and around the ISTL, we applied thermochronometric methods to the Kiso Range to reveal mainly: 1) denudation history of the Kiso Range and 2) the relation between denudation rate distribution and the Inadani Fault Zone.

We collected rock samples from the Kisokoma Granodiorite which distributes from the west base to around peak of the Kiso Range. Samples were collected from about 300-m-high site to more than 2000-m-high site with getting across the Kiso Range from west to east. It is because we aimed to observe the relation between denudation rate distribution and the Inadani Fault Zone in the east side. The cooling history of the Kisokoma Granodiorite at higher temperature was constrained by hornblende K-Ar ages (Yuhara et al., 2000) and isoprene Rb-Sr ages (Yuhara and Kagami, 2006). We used FT dating method and (U-Th)/He dating method which have lower closure temperature and more suitable to approach the phenomena in shallower parts of crust.