# (U-Th)/He thermochronometric mapping in NE Japan Arc: Insights into understanding long-term crustal deformation

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A paradox of deformation in NE Japan Arc is that the short-term deformation observed by geodetic techniques and the long-term deformation estimated from geomorphic and geologic evidence is different in rate and/or direction (e.g., Ikeda, 1996, Active Fault Res.). Deformation observed by geodetic research consists of elastic deformation canceled by earthquake cycles and inelastic deformation expended in developing landforms. To separate the two components, using geomorphic/geologic techniques is a practical approach to estimate inelastic deformation (Ikeda et al., 2012, J Geol Soc Jpn). We performed apatite and zircon (U-Th)/He (AHe and ZHe) thermochronometric analyses from Cretaceous or early Paleogene granitic rocks along two profiles across NE Japan Arc for estimating its long-term vertical deformation rates. The northern profile (N-profile) ranges across the Kitakami Mountains, Ou Backbone Range (OBR), and Taihe-Shirakami Mountains, while the southern profile (S-profile) includes the Abukuma Mountains, OBR, and Iide-Asahi Mountains. So far, AHe and ZHe ages of the S-profile and AHe ages of the N-profile have been obtained. AHe ages on the fore-arc side, i.e., Kitakami and Abukuma Mountains, are older than about 50 Ma, implying a stable tectonic/geologic setting over the Cenozoic. On the other hand, young AHe ages of <10 Ma are obtained in OBR and the back-arc side, namely Taihe-Shirakami and Iide-Asahi Mountains; the youngest ages are ~1 Ma in OBR. These AHe ages can be grouped into three populations of ~10 Ma, ~5 Ma, and <3 Ma, which are consistent with uplift stages of the mountains estimated from provenance analyses of the adjacent basins (e.g., Nakajima et al., 2006, PPP; Moriya et al., 2008, J Geol Soc Jpn). In addition, the sample localities are generally at some distance from high geothermal gradient zones around volcanic centers. Therefore, the AHe ages obtained are interpreted as reflecting a record of uplift and denudation over the last ten million years. On the back-arc side, AHe ages are generally estimated at ~10 Ma in the Iide-Asahi Mountains to the south, but at ~5 Ma in the Taihe-Shirakami Mountains to the north. Taking into account that Moriya et al. (2008) proposed that uplift of the Asahi Mountains is older than that of the Dewa Hills to the north at ~5 Ma, the AHe ages around 10 Ma may indicate the initiation of uplift of the Iide-Asahi Mountains. Both the AHe and ZHe ages tend to yield younger ages from mountain bases to ridges in OBR and the back-arc side. This observation is in contrast with the case of the Kiso Range (Sueoka et al., 2012, AIR) and northern Akaishi Range (Sueoka et al., 2011, J Geogr), reverse fault block mountains in SW Japan Arc, where thermochronometric ages young from ridges to the marginal faults. The difference might arise from the existence of the volcanic arc, i.e., horizontal heterogeneity of the thermal structure and/or domal isostatic uplift derived from magmatic intrusions, but this is still debatable. For more detailed constraints on the thermal histories, we are planning to apply other thermochronometers, such as the apatite/zircon fission-track and zircon U-Pb methods, and to conduct additional AHe and ZHe age determinations.

Keywords: NE Japan Arc, (U-Th)/He thermochronometry, long-term crustal deformation

 