

Re-arrangement of the shallow-level crustal structure of Southwest Japan Arc due to the collision of the Izu-Bonin Arc

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The central part of Honshu Arc was collided in the South Fossa Magna (SFM) area with the crossing Izu-Bonin Arc (IBA), forming a cuspidate bend of the pre-Middle Miocene basement rocks of the Honshu Arc. Mainly based on structural geological data, this paper summarizes the effects on the basement rocks of SWJA due to this arc-arc collision, the Middle Miocene Japan Sea opening and the clockwise rotation of Southwest Japan Arc (SWJA). Precise discussions on this problem are found in Kano (2002; Bulletin of the Earthquake Research Institute, 77, 231-248).

Northward shift of the pre-Middle Miocene rocks in the Akaishi Mountains in the easternmost SWJA on the frontal side of the SFM collision zone reaches more than 160 km in maximum by a sub-vertical-axis, counterclockwise rotation with N-S trending, left-lateral strike-slip faultings. The faults include the northern part of the Median Tectonic Line, the Akaishi Tectonic Zone and the Itoigawa-Shizuoka Tectonic Line.

The Mesozoic rocks of the Mino and Ryoke Belts to the north of the Akaishi Mountains on the rear side of the collision zone also shifted about 80 km northward about a sub-vertical rotation axis. These northward shifts also had some components of horizontal-axis rotation and resulted in the re-arrangement of geologic bodies of the shallow-crustal level of eastern SWJA.

Chronological and paleomagnetic data clearly suggest that the northward bend occurred in a short period of the Middle Miocene around 15 Ma. This intra-arc bending was originated by a combined effect of the clockwise rotation of SWJA in association with the rapid fan-shape opening of the Sea of Japan and the initial collision of SWJA with the northern tip of IBA, the Kushigatayama Block. The E-W compression due to the intra-arc bending of the eastern SWJA resulted in the formation of N-S trending, km-scale folds (megakinks) with vertical axes in the Mino-Tanba Belt about 150-200 km west of the collision zone, which locates in the inner side of the hinge area of this giant bending. The fold around the Yanagase Fault is one of these km-scale folds. These deformations characterized by horizontal rotations in wide areas on the eastern SWJA probably occurred under a high geothermal regime that weakened its upper crust.

As compared with the initial collision, the following Late Miocene and Pliocene collisions due to the north or northwestward advance of IBA did not affect severely on the pre-existing structures in SWJA. The latest collision with the Izu Block since 1 Ma has caused the rapid uplift of left-stepping, en-echelon arranging mountain ranges on the eastern SWJA.