

On the causes of across-arc mountain ranges in the back-arc region of Tohoku arc:
Importance of north-south compression

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In the back-arc region of the Northeast Japan (Tohoku) arc, we can recognize across-arc (east-west direction) mountain ranges, while the most significant topographic structure, which are the Ou backbone range and the Dewa range, runs in the north-south direction. The across-arc mountain ranges and the Ou and Dewa ranges constitute topographic high of a ladder structure.

It has been widely believed that the ladder structure of the back-arc region of the Northeast Japan arc is caused by the upwelling of hot material due to mantle wedge convection driven by the oceanic plate subduction (hot finger model; Tamura et al., 2002). If we turn our eyes to other subduction zones, however, it is very rare to see such a ladder structure. This suggests that the primary cause of the ladder structure in the Northeast Japan arc should not be the mantle wedge convection, because this can occur in other subduction zones.

In island arcs under a compressional stress regime, topographic high always coincides with the volcanic front. On the other hand, this relationship does not hold true for islands arcs under a tensile stress regime. Therefore, in making across-arc (east-west direction) mountain ranges in the Northeast Japan arc, the north-south compression seems to be important, although the direction of the principal compressional stress (σ_1) is east-west. Focal mechanisms of earthquakes in this region, which are mostly reverse faults with an east-west compressional stress axis, do not contradict with this hypothesis.

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