

Relationship between the oblique opening system in the back-arc basin and Hamilton's principle

*Takao Eguchi

Within a certain arc - back-arc system at spherical subduction zones, some spatiotemporal changes in peripheral tectonics, such as collisions at adjacent plate boundaries, or sudden changes in trench axis morphology, would occasionally create an "arc rift system" or "back-arc rift system." As such a rift system grows, a back-arc basin would be formed.

Among active back-arc basins around the world, in the Andaman Sea, the Bismarck Sea, the Lau Basin, etc., active extension tectonics that can be regarded as oblique expansion (expanding in a direction not perpendicular to the ridge axis strike) rather than so-called orthogonal expansion is progressing.

Some successfully developed back-arc opening systems inevitably require the replenishment of the melt materials while actively or passively exciting the upper mantle flow. In other words, the back-arc oblique opening phenomenon is an energy dissipation problem including the dynamics of the upper mantle flow, etc.

The length of the ridge segment of the back-arc oblique extension system is variable. There are also back-arc basins with an echelon-arranged scheme of short parallel ridges, starting from a relatively longer transform faults (e.g., the Andaman sea, Bismarck sea, and Lau basin. In the central Andaman sea, there is a relatively longer oblique opening ridge segment.

We investigated the dynamic background in the length difference of these back-arc oblique opening ridge segments, as an energy dissipation problem including the effect of the upper mantle flow regime.

Specifically, regarding the total energy dissipation in the active back-arc basin with oblique expansion, we discussed by modelling the amount of energy dissipated along the transform fault(s) and the amount of dissipation at ridges. The latter dissipation is strongly associated with the upwelling flow having been originated at a certain depth toward the opening ridge segment(s).

In this study, we discussed the dynamics in the back-arc basins with such an oblique extension system from the viewpoint of Hamilton's principle.

Keywords: back-arc oblique opening, energy dissipation, upwelling flow, Hamilton's principle