# Arc-parallel extension of forearc region vs. 3-D bending-buckling mode of oceanic lithosphere at subduction zones

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In this study, we consider the fundamental physical origin(s) of arc-parallel horizontal extension tectonics, being dominant at some island-arc systems with the currently active back-arc opening. Next, by taking account of both the trench-parallel and trench-normal configuration of the bending-buckling oceanic lithosphere, we discuss the evolutionary process of island-arc systems.
We use the expression of 3-D principal stress axes (the maximum, intermediate, and minimum are S1, S2 and S3, respectively). At the island-arc systems with active back-arc extension such as the Okinawa Trough, Bismarck Sea etc., most of the S3 being approximately inferred from the low-angle T-axes of normal fault or strike-slip type earthquakes within the forearc overriding lithosphere, strike in the arc-parallel direction.
For the arc systems with the active back-arc extension, it seems that the forearc intra-plate shallow seismicity is lower than that of the back-arc.
When the dynamic process associated with the deflection and buckling of oceanic lithosphere at a trench-parallel zonal area from trench to outer-rise permits the horizontal migration of trench axis geometry towards ocean-side, we can expect some trench-ward retreat of the gradually lengthening forearc segment. The seafloor age of PH (Philippine sea plate) tends to become younger in the southwestward direction at least along the southern half of the Ryukyu trench. Recent geodetic GPS data by the GSI (Geographical Survey Institute, Japan) for the Ryukyu-Okinawa island arc system do not contradict the southward (or SSE) retreat of the arc from the back-arc continental area. This geodetic information implies the inevitable relative trench-ward migration of the axis of the Ryukyu Trench from the back-arc continental side. Thus, at least for the Ryukyu-Okinawa island arc system, the arc-parallel extension of forearc region is a passive phenomenon due to the active regime of back-arc extensional opening.
By considering the activity of regional shallower earthquakes within the overriding lithosphere accompanying the back-arc extensional tectonics, we conclude that the primary governing tectonic origin of arc-parallel extension at the forearc region is the back-arc extensional rifting or opening. In other words, the arc-parallel extension of forearc region is a secondary or passive phenomenon due to the active regime of back-arc extensional rifting or opening.

Keywords: arc-parallel horizontal extension, bending-buckling of oceanic lithosphere, subduction zones, back-arc extension

 