Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)
©2015. Japan Geoscience Union. All Rights Reserved.

SGL37-03 Room:103 Time:May 24 14:45-15:00

# Formation of forearc basins and its relationship to subduction zone dynamics

NODA, Atsushi[1*]

[1]Geological Survey of Japan, AIST

Forearc basins along subduction zones are important for studying sediment routing systems, submarine resources, and natural hazards. However, there are still many unresolved problems about them, for example, how do they evolve? or how do they interact with growth of accretionary prisms or intensity of tectonic erosion of the same age? Forearc basins were proposed as basins developed at landward side of accretionary prisms, whose depocenters migrated seaward as growth of the accretionary prisms [1] or landward as uplift of the outer arc highs [2]. However, there are some forearc basins without accretionary prisms along tectonic erosion-dominated subduction zones, which are controlled mainly by normal faults [3]. In addition, it was realized that sediment flux at the trench is important to control volume of outer wedge [4], suggesting it could also influence formation or style of evolution of forearc basins. In fact, subsidence curves of modern and ancient forearc basins are more variable than those of foreland, rift, or strike-slip basins [5].

In this study, I tried to understand formation of forearc basins by means of geological and geomorphological characters of 37 forearc basins with the outer wedges (frontal and middle prisms) in the world. I also measured width ($W_{basin}$) and sediment thickness ($T_{basin}$) of forearc basin, width ($W_{wedge}$) and slope angle ($\alpha$) of outer wedge, slab dip angle under the wedge ($\beta$), orthogonal convergent rate of subducting plate ($V_{orth}$), thickness of trench fill sediments ($T_{trench}$).

As a result, forearc basins can be divided into 5 types (compressional/extensional accretionary, compressional/extensional strike-slip, and non-accretionary). A character of the compressional accretionary type is landward tilt of the basin due to uplift of outer arc high associated with backthrust or splay fault. Basin formation of this type may be related to self-similar growth or thickening of the outer wedge. In the extensional accretionary type, seaward migration of outer arc high by gravitational force, generating listric normal faults in the basins, can subside the basin. Internal or basal friction may be too weak to keep the taper angle of the wedge. The non-accretionary basins do not have conspicuous outer arc highs, resulting from tectonic erosion-induced subsidence. Strike-slip type shows intermediate characters between accretionary and non-accretionary types, but whose depocenters occasionally migrate parallel to the trench. Some basins show changes from non-accretionary type to accretionary one, and vice versa.

Width of wedge ($W_{wedge}$) has a positive correlation with $T_{trench}/V_{orth}$ as a proxy of sediment flux at the trench. $T_{basin}$ has a positive correlation to $W_{basin}$ for the accretionary type, but is basically constant for the non-accretionary type. $W_{basin}/T_{basin}$ of the accretionary type is almost constant regardless of $W_{wedge}$, but shows a negative correlation to $W_{wedge}$ for the non-accretionary type. For all types of forearc basins, $T_{basin}$ has a positive correlation to $W_{wedge}$ or $T_{trench}$.

Variations of sediment flux at subduction zones can influence degree of growth/decay of outer wedges, and then, may switch the type of forearc basins. Changes from accretionary to non-accretionary type may cause subsidence of outer arc high because of tectonic erosion, which leads to remove accommodation space and erode the basin strata, and then produces a new basin with large $W_{basin}/T_{basin}$. On the other hand, changes from non-accretionary to accretionary type may uplift a part of the basin as an outer arc high, and generate a new basin at the landward side.

[1] Karig, D.E., 1974, *Ann Rev Earth Planet Sci* 2, 51–75; [2] Seely, D.R., 1979, *AAPG Memoir*, 29, 245–260; [3] von Huene, R. and Lallemand, S., 1990, *GSA Bull*, 102, 704–720; [4] Clift, P.D. and Vannucchi, P., 2004, *Rev Geophys*, 42, RG2001; [5] Xie, X. and Heller, P.L., 2009, *GSA Bull*, 121, 55–64.

Keywords: forearc basin, subduction zone, sediment flux, accretionary prism, sedimentary basin