

Forearc and backarc basin-filling stratigraphy as an archive of plate tectonic history

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Basin-filling stratigraphy can be defined as "the study of basin-filling sediments from the standpoints of unconformity events, stress regimes, succession trends and three-dimensional development patterns of depositional systems with consideration of their controlling factors such as plate tectonic conditions." The basic unit of basin filling stratigraphy can be a tectono-sequence unit, which can be bounded by regional major unconformities, or the turning points of stress regimes, basin evolution stages and succession trends of depositional systems such as upward shallowing and deepening trajectories. This paper presents representative cases of basin-filling stratigraphy for forearc basins and backarc to intraarc basins, which might be reflecting the plate tectonic histories, using examples of the NE and SW Japan convergent margins. The basin filling stratigraphy of forearc basins is strongly controlled by the morphological variation and volcanic arc setting, both of which influence internal unconformity formation, sediment supply, differences in depositional systems and succession trends. The marine sloped to submerged ridge type is mainly filled with deep marine turbidites or shales. The terraced to shelved, overfilled type commonly shows a transgressive to regressive pattern consisting of turbidite, slope, shelf to shallow marine systems in response to the increase of clastic supply from the adjacent volcanic arc. Internal deformation of basin filling sediments is quite common in case the forearc setting is compressional. The benched type, which has an emergent trench slope break ridge, characteristically shows a regressive succession from marine to fluvial systems, or thick aggradation of bay to coal-bearing fluvial systems. If the forearc setting maintained for a geologically long time, it is estimated that the morphological forearc basin types can be transferred from the submarine sloped, submerged ridge type to the shelved, benched types, as the trench slope break ridge tends to develop along with the accretionary prism development due to plate subduction.

The basin filling stratigraphy of backarc to intraarc basins is commonly characterized by the basin evolution stages, since backarc/intraarc basins are, in most cases, initiated as rift basins, and followed by tectonic inversion into a compressional stress field. The boundary between syn-rift and post rift stages tends to show a regional break-up unconformity, and the inversion stage creates areal uplift-related unconformities. The mass balance between the accommodation space created by subsidence and sedimentation may control the succession trends for the syn-rift, post rift and tectonic inversion stages. The syn-rift to early post rift stage usually shows a transgressive upward-deepening succession trend, whereas the tectonic inversion stage causes an upward-shallowing trend due to increasing sediment supply from the provenance.

Keywords: basin filling stratigraphy, forearc basin, backarc basin, plate tectonics, succession trend, unconformity event