Tectonic behavior of a forearc basin reconstructed using turbidites: an example from the Plio-Pleistocene Kakegawa Group, central Japan

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The present study reconstructed the tectonic behavior of a forearc basin using the characteristics of turbidites. Topographic obstacles within a basin affects on the pathway of a turbidity current, causing the flow reflection or deflection within the basin. Turbidites recording flow reflections by outer rim of a forearc basin have been reported from the middle part of the Plio-Pleistocene Kakegawa Group, distributed in western Shizuoka, central Japan. Previous studies reconstructed basin geometry using reflected turbidites using the following concepts: (1) a turbidite sand bed tends to be thicker at the foot of slope where turbidity currents are locally stagnated. Thus the lateral thickness variation of a turbidite sand bed provides the location of foot of slope(s) within the basin. (2) A mud bed covering a turbidite bed becomes thickest at the basin center. The basin geometry reconstructions in the several horizons in the middle Kakegawa Group revealed the shift of the basin center and basin width through time. This methodology needs to be applied for the lower Kakegawa Group in order to understand the tectonic evolution of the basin. The present study described the turbidite beds in the lower part of the group and measured paleoflow and paleoslope directions from the ripple cross-lamination and inclined axis of small slump folds in order to reconstruct the behavior of the early phase of the Kakegawa Forearc Basin.

The lower Kakeagwa Group consists of alternations of sand and mud beds. The turbidite beds in the middle group are made up of fine-grained to very-fine-grained sand and show the characteristics of reflected turbidite without distinct massive division. The turbidites in the lower part, however, show the characteristics different from those in the middle part: they have a massive division with a coarse-grained to very-coarse-grained basal part, and thinner parallel and cross laminated divisions, showing the features of proximal turbidite. Some turbidites host wavy lamination, showing convex-up geometry, which is interpreted as the internal structure of antidunes. The top of the underlying mud beds are locally missing, where the overlying sand bed decomes thicker, and there are local mud clasts beds within the mud bed in some locations: these characteristics are interpreted as having been associated with a small-scale submarine slide. The dominant flow directions range from the east to the south, indicating offshore-ward flows. The division deposited from a reflected current is thinner than that in the middle part, and is not found in some turbidites: the turbidite beds in the lower part are thus interpreted as having been deposited mostly from obverse turbidity currents and having deposited on a slope environment dipping toward the offshore. The studied part of the lower group was resulted from the progradation of sediments from the north, and the basin center appears to have been located further offshore than that in the middle part of the group. Our turbidite observation resulted that there is a minor changes in frequency of reflected turbidites in the measured successions. For knowing the reason for such changes, we need more description of the turbidites in the distal area. As one of the possible reasons, the variation in uplift rate of the outer rim of the basin could be considered.

Keywords: Kakegawa Group, turbidite, forearc basin

