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Contrasting development of fold-thrust belt and foreland basins in western Taiwan

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Taiwan is one of the most active tectonic belts in the world, which can be demonstrated by Today's significant shortening across the orogenic belt. The shortening across the thrust-fold belt front in the foothills is mostly greater than one centimeter per year and laterally increases several times to the south. In NW Taiwan, restoration of reconstructed balanced cross-section across the foothills belt shows that the migration distance of the deformation rate during the Pleistocene in SW Taiwan is about 3 times of that in NW Taiwan. Oblique collision initiated at 6.5 ma has been applied to reconstruct propagation rate of the growing orogenic belt. On the other hand, thermo-chronological studies from the central range suggest that the collision could be simultaneous along the plate boundary. In this study, we propose three questions given arise from the above tectonic features: 1.when did the variation in westward migration rate of orogenic belt front begin ? 2.what is the evolutionary mode under the tectonic condition of oblique arc-continent collision? and 3.what answers can be given by the stratigraphic records in the foreland basin? Below, we present our studies of fold-thrust belt and foreland basins in western Taiwan and attempt to answer the proposed questions in the final.

The foreland of western Taiwan is divided by a pre-orogenic basement high into two foreland basins. The one to the north started during 4.4–3 Ma and after that encountered rapid subsidence during 3–1.6 Ma, manifesting the intense oblique collision and fast growing orogenic belt. Subsidence rate decreased after 1.6 Ma, corresponding to the diminishing orogenic activity. In contrast, stratigraphic analysis in the foreland basin to the south indicates back-and-forth migration of the basin margin. Three distinct episodes of rapid subsidence during the basin development have also been identified, the initial rapid subsidence at 4.4-4.2 Ma happening only in the proximal part of the basin and the following two younger episodes of rapid subsidence events at 2-1.8 Ma and 0.45 Ma in the areas progressively farther from the orogenic belt. Cratonward shifting rate of the forebulge has been increasing in the southern one, in contrast with the constant rate in the northern one.

Variation in evolution of the foreland basins reflects spatial variation in rigidity of the basin base and strongly implies contrast development, monotonous vs. episodic, of the northern and southern parts of the orogenic belt respectively. The heterogeneous rigidity might have resulted from differential extension before the foreland basin development. The nearly synchronous initiation of both basins at 4.4 Ma indicate that the rate of southward propagation of the young orogenic belt is much greater than the previously proposed and that faster westward shifting of thrust front had come in the southern basin at 4.4 Ma.

There is also a well correspondence between development modes of fold-thrust belt and foreland basin; higher propagation rate of fold-thrust belt front inclines to be accompanied with episodic development of foreland basin while monotonous foreland basin development implies steady movement of fold-thrust belt front in slower rate.