Paper Number: 2787

Contrasting development of foreland basins in western Taiwan: Its implications of kinematics of orogenic evolution

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Taiwan is one of the most active tectonic belts in the world. Today's shortening across the thrust-fold belt front in the foothills is generally greater than one centimeter per year and laterally increases to the south. Restoration of balanced cross-sections across the thrust-fold belt in northwestern and southwestern parts respectively also indicates lateral change in long-term shortening and rate of thrust front migration. In this study, we made tectonostratigraphic analysis on two coeval peripheral foreland basins and demonstrate variation in evolutionary mode of the basins. The reconstructed subsidence history in the basins provides crucial evidence for unravelling the kinematics of the southward propagating orogenic belt during arc-continent collision.

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

Variation in the evolution of the foreland basins reflects spatial variation in rigidity of the lithosphere and strongly implies contrasting development, monotonous vs. episodic, of the northern and southern parts of the orogenic belt respectively. The heterogeneous lithospheric rigidity may have resulted from differential extension before the foreland basin development. The nearly synchronous initiation of both basins (4.4 Ma) indicates that the rate of southward propagation of the orogenic belt is greater than

previously proposed and that faster westward migration of the thrust front occured in the southern basin at 4.4 Ma.