

Inversion Tectonics and Evolution of the Northern Taihsi Basin, Taiwan

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ABSTRACT

The Northern Taihsi Basin is the deepest part of the entire Taihsi Basin and equivalent to the position of the Northern Taiwan Foreland Basin of late Cenozoic. Also retarded by the Kuanyin Uplift, the Northern Taihsi Basin has suffered from structural inversion due to the fact that it was in the path and stood against the collision of Eurasian and Philippine Sea Plates during the Penglai Orogeny.

The tectonic trend of the Northern Taihsi Basin is N79° E (almost E-W) and quite different from the NE-SW trend of those basins in offshore Taiwan such as the Tungyintao Basin, the Nanjihtao Basin, the Pengchiahsu Basins, and the Taiwan Basin. What kind of tectonic mechanism governs the Northern Taihsi Basin is still a puzzle, but is considered to be probably related to the variant extensional regime with different rifting direction. Due to lack of directly strong evidence, this paper will not focus on this viewpoint. A series of typical horst-graben structures have been found and they indicate that the basin has already been subjected to extension in the synrift stage during Eocene to Oligocene, the tectonic evolution and mechanism will be the main interest of this study.

From Eocene to middle Miocene, the basin still remained in rifting regime, whilst since the late Miocene the regional stress had undergone a basic change owing to stress release on the Taiwan Foreland by the Penglai Orogeny.

From late Miocene, the N79° E pre-existing horst-graben within the Northern Taihsi Basin commenced to be governed by tectonic inversion including strike-slip motion and later bulk contraction of inverted grabens. The commonly found and typical characteristics of inverted structure are that minor and remarkable reverse faults, or minor positive flower structures occur in postrift sequence (the middle and late Miocene), whilst at the depth of synrift sequence the net extension or apparent normal fault still remained and still maintained a normal fault geometry but was in fact thrust faulting in process. Generally speaking, most of the inverted features were developed along graben edge located between major boundary fault and antithetic or synthetic fault. The structural elements with low fault angle and high intersect angle between stress direction and fault strike would be highly inverted rather than those of high fault angle and low intersect angle.

By comparison of each graben, it is certain to find that the extent of inversion decreases not only from the Kuanyin Uplift toward offshore of the Tachia City, but also from Taiwan Island toward the Nanjihtao Ridge. The east part of the Hsinchu Graben was strongly inverted and its graben space was narrowed or eliminated locally. The Paishatun Graben was moderately inverted while the Wulipai Graben and residual grabens near the east side of the Nanjihtao Ridge were just mildly or partially inverted.

The formation of the Northern Taihsi Basin commenced with extension in early Eocene or much earlier than Eocene, highly developed in Eocene, and generally ended in Oligocene. Through small scale rejuvenation in early and middle Miocene, extremely variable compressional or transpressional regimes have superimposed since the stage of the Penglai Orogeny and result in the tectonic inversion of the Northern Taihsi Basin.

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