International Geology Review, Vol. 48, 2006, p. 910–941.
Copyright © 2006 by V. H. Winston & Son, Inc. All rights reserved.

Review and New Insights on Foreland Tectonics in Western Taiwan

KENN-MING YANG,[1] SHIUH-TSANN HUANG, JONG-CHANG WU, HSIN-HSIU TING, AND WEN-WEI MEI

Exploration and Development Research Institute, Chinese Petroleum Corporation, 1 Ta Yuan, Wen Shan, Miaoli, Taiwan 36010

Abstract

Taiwan is located on the boundary between the Eurasian and Philippine Sea plates. As a result, foreland tectonics in western Taiwan can be divided into two domains: pre-orogenic extensional structures and those of the outer part of the fold-and-thrust belt that mingled with syn-orogenic normal fault reactivation. This paper proposes a synthetic model for foreland tectonics in western Taiwan, and advances possible mechanisms by which pre-existing normal faults might have affected the evolving thrust tectonics in foreland areas of western Taiwan.

The sedimentary basins of pre-orogenic extensional tectonics are of two types—Paleogene and Neogene—which reflect two stages of continental rifting. Results from several studies have been synthesized to provide a tectonic map displaying the regional distribution of tectonic settings at different stages and the trends of normal faults in the basins. The similarity of the *en echelon* patterns of arrangement for both the Neogene and Paleogene tectonic and structural settings, as shown by the tectonic map, strongly suggests that the entire foreland area was influenced by regional dextral shear. We also provide a detailed description of structures in each tectonic setting, and propose a tectonic evolution model for Cenozoic basin architecture in western Taiwan.

Among the pre-orogenic sedimentary basins, the Neogene ones, in which normal faults extend to the frontal areas of the fold-and-thrust belt in western Taiwan, open northeastward. Structural analysis of the thrust fault geometry indicates that, during development of the fold-and-thrust belt on the rifted continental margin in western Taiwan, the pre-existing normal faults in northwestern Taiwan were reactivated to form inversion structures of various types on different scales, depending on the angle between the strike of the normal faults and the direction of maximum compressive stress field. In southwestern Taiwan, where normal fault reactivation is absent from the eastern part of the foreland areas, pre-existing normal faults interacted with developing low-angle thrusts in the inner part of the fold-and-thrust belt. Normal fault reactivation, regardless of how it occurs, thus plays an important role in forming the deformation front of the fold-and-thrust belt. Based on this view, we propose that the orocline or tectonic arc of the island has been influenced more by normal fault reactivation than by the morphology of basement highs.

Introduction

ACCORDING TO the definition given by the Glossary of Geology (Jackson, 1997), "foreland" refers to the areas in the outer part of a mountain-building belt, and is characterized by nonmetamorphic deformation. A foreland basin system, as defined by DeCelles and Giles (1996), extends from the frontal areas of a mountain-building belt to the margin of craton and includes wedge-top, foreland basin, forebulge, and backbulge. In this paper, we follow the above definitions and regard the foreland areas in western Taiwan as equivalent to the areas covering the onshore fold-and-thrust belt (Western Foothills in Fig. 1), the coastal plain outcropping with alluvial and terrace deposits, and the offshore Tungyintao, Nanjihtao, and Penghu basins (Fig. 1). The fold-and-thrust belt is included because its tectonic development has been strongly influenced by pre-existing normal faults. As for the offshore areas, structural cross sections (Fig. 2) (Sun, 1985; Shiao and Teng, 1991; Chou, 1999; Chou and Yu, 2002) through the Taiwan Strait show that the backbulge of DeCelles and Giles' (1996) foreland basin system is almost equivalent to the linear zone connecting the Tungyintao, Nanjihtao, and Penghu basins; therefore, the entire Taiwan Strait can be considered as the western part of the foreland.

Taiwan is located on the convergent plate boundary between the Eurasian and Philippine Sea plates;

[1]Corresponding author; email: 155055@cpc.com.tw