

Nature and distribution of the deformation front in the Luzon Arc-Chinese continental margin collision zone at Taiwan

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Abstract

Marine seismic reflection profiles from offshore SW Taiwan combined with onland geological data are used to investigate the distribution and nature of the deformation front west of Taiwan. Locations of the frontal structure west of Taiwan are generally connected in a linear fashion, although the alignment of frontal structures is offset by strike-slip faults. The deformation front begins from the northern Manila Trench near 21°N and continues northward along the course of the Penghu Submarine Canyon in a nearly N–S direction north of 21°N until it reaches the upper reaches of Penghu Canyon at about 22°15'N. The deformation front then changes direction sharply to the northeast. It connects to the Chungchou thrust fault or the Tainan anticline in the coastal plain and continues northwards along the outer Western Foothills to the northern coast of Taiwan near 25°N. Characteristics of structural style, strain regime, sedimentation and tectonics vary along the trend of the deformation front. Ramp anticlines, diapiric intrusion and incipient thrust faults are commonly associated with the deformation front. Variations in structural style along strike can be related to different stages of oblique collision in Taiwan. The deformation front (collision front) west of Taiwan can be considered as a boundary between contraction in the Taiwan orogen and extension west of the collision zone. The deformation front east of the Tainan Basin and its northward extension along the outer limit of the Western Foothills is the surface trace separating the foreland thrust belt from the nearby foredeep, not a boundary between the Chinese and Taiwan margins. The submarine deformation front off SW Taiwan is the surface trace separating the submerged Taiwan orogenic wedge from the Chinese passive continental margin, not a surface trace of the plate boundary between the Eurasian and Philippine Sea plates.

Introduction

The island of Taiwan was formed by oblique collision between the Luzon Arc and the Chinese continental margin in late Cenozoic time (Suppe, 1981; Ho, 1988; Biq, 1997). Taiwan is situated on the plate boundary separating the Eurasian plate to the west from the Philippine Sea plate to the east (Figure 1). The surface trace of the active plate boundary between the Eurasian and Philippine Sea plates was proposed by Bowin et al. (1978) to follow the tectonic front of the Manila Trench continuing northward and connecting with frontal thrust faults in western Taiwan (Figure 1). The former part of the northern Manila Trench is now buried beneath the western Taiwan foredeep and the frontal thrust of a series of westward imbricate thrusts west of the Central Range. The surface extension of the Manila Trench into western Taiwan is considered to be the western limit of major thrusts in western Tai-

wan rather than the location of the subduction zone. The westernmost limit of thrust faults in western Taiwan is defined as the tectonic front or deformation front, although the exact location remains uncertain (Ho, 1982). However, the frontal thrust of the west-verging fold-and-thrust belt in western Taiwan is generally considered as the outer limit of the Western Foothills (Ho, 1988).

Reed et al. (1992) have mapped structures in the slope region off southwest Taiwan. They found west-verging ramp anticlines mainly in the lower slope and determined locations of the westernmost contractional structures (deformation front) off southwest Taiwan. The submarine deformation front extends southwards along the edge of the lower slope and gradually merges into the Manila Trench in a NNW–SSE direction but turns to a NNE–SSW direction north of 22°N towards Taiwan (Figure 2). However, interpretation of NNW–SSE trending structures of the submarine deformation front connected to NNE–