ELSEVIER

Marine Geology 169 (2000) 305–325

MARINE GEOLOGY
INTERNATIONAL JOURNAL OF MARINE GEOLOGY, GEOCHEMISTRY AND GEOPHYSICS

www.elsevier.nl/locate/margeo

Fault-controlled genesis of the Chilung Sea Valley (northern Taiwan) revealed by topographic lineaments

Gow-Shyh Song*, Chung-Ping Ma, Ho-Shing Yu

Institute of Oceanography, National Taiwan University, P.O. Box 23-13, Taipei 10764, Taiwan, ROC

Received 12 January 1999; accepted 23 June 2000

Abstract

The Chilung Sea Valley lies parallel to the coastline off northern Taiwan. It connects the coastal area to the Chilung Shelf through a descending rugged surface. This valley is about 65 km in length, 7–15 km in width, and ends, once across the shelf break, off the Santiaochiao coast in northeastern Taiwan. The descending gradient of the Chilung Valley floor is approximately 1/500, being very close to that of the Chilung Shelf. This implies that the valley might have originated from a solely tectonic event that acted on the shelf surface. On the basis of a well-controlled bathymetric data set collected in the study area, some topographic lineaments were extracted. Tracing these topographic lineaments that connect to a series of the NE–SW orientated faults extending from on-land Taiwan into the ocean, we identified three right-lateral strike–slip faults truncating these lineaments. The occurrence of these right-lateral strike–slip faults is suggested to result from compressive shearing under the orogeny of the convergence between the Philippine Sea plate and the Eurasian plate. The shearing upon the fault plane has been inhomogeneous along the path of the Chilung Valley, and has affected the shape of the valley.

Keywords: Bathymetry; Topographic lineament; Taiwan; Sea valley; Tectonic

1. Introduction

Taiwan lies in the convergence zone between the Philippine Sea plate and the Eurasian plate. In this area, the Philippine Sea plate is moving northwest relative to the Eurasian plate at a rate of 7 cm/yr (Seno, 1977). Consequently, it carries the northern tail of the Luzon Arc (Hsu and Sibuet, 1995), and obliquely collides with the Eurasian plate in forming the Taiwan Orogen. The collision process is then transformed into a subduction process as the sutural trace goes northeast and turns eastwards into the Pacific Ocean off the city of Hualien (at 24°N). On the ocean floor, the Philippine Sea plate subducts to the north beneath the Eurasian continental margin forming representative submarine topographic features, in sequence from south to north: the Ryukyu Trench, the Ryukyu Arc, and the Okinawa Trough (Fig. 1) (Karig, 1973; Bowin et al., 1978; Tsai, 1978, 1986; Ho, 1982, 1986; Barrier and Angelier, 1986; Huang and Yin, 1990; Huang et al., 1992; Teng et al., 1992).

The Okinawa Trough is the morphological expression of a back-arc rifting in the offshore region of northeastern Taiwan (Kimura, 1985; Letouzey and Kimura, 1985; Sibuet et al., 1987). Kimura (1985) named a zone the Greater Okinawa Trough, which has a width about twice that of the Okinawa Trough. The north boundary of this zone is traced by the

* Corresponding author. Tel.: +886-2-23660883; fax: +886-2-23697428.

E-mail address: song@gssong.oc.ntu.edu.tw (G.-S. Song).

0025-3227/00/$ - see front matter
PII: S0025-3227(00)00084-0