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Preliminary result of magnetotelluric soundings in the fold–thrust belt of Taiwan and possible detection of dehydration

Chien-chih Chen *, Chow-son Chen

Institute of Geophysics, National Central University, Chungli 32054, Taiwan

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Abstract

Until the magnetotelluric (MT) soundings were conducted in the last two years, there was no systematic view of the deep electric conductivity in the fold–thrust belt of the Taiwan orogen, being a typical example of arc–continental collision. Presented in this paper are the initial results and preliminary interpretation of the MT survey in Taiwan. The determinant response of the impedance tensor was calculated for inversion and Occam's inversion which could generate smooth models was mainly used for interpreting MT data at each site. The existence of a conductive zone with depths of 10–20 km beneath the Island of Taiwan is undoubtedly the most important feature found in this study. The depths are well correlated with the inferred depth of dehydration reactions of Suppe (1981) and the top of the aseismic lower crust observed by Wang et al. (1994). Thus, the authors believe that the cause of this conductive zone is probably the fluids released from dehydration reactions. Additionally, close to the Lishan fault the MT data show strong distortions which may be the result of induction in more complex three-dimensional structures. Further multi-dimensional analysis of the data is required in the future for delineating a more realistic image of the subsurface heterogeneous structure.

Keywords: magnetotelluric method; fold–thrust belt; Taiwan; electrical structure; dehydration

1. Introduction

The Island of Taiwan is located in the active boundary between the Philippine Sea plate and the Eurasian plate. The relative plate velocity between the Philippine Sea plate and Eurasian plate is about 71 km per million year and approximately in the direction N50°W (Seno et al., 1993). The overall plate configuration in the vicinity of Taiwan is well defined by seismicity. While the Philippine Sea plate is subducting northwestward from the Ryukyu Trench in the northeast of Taiwan, the Eurasian plate is subducting beneath the Philippine Sea plate along the Manila Trench in the south of Taiwan. Thus, Taiwan lies in the region in which the polarity of the subduction changes (Suppe, 1987).

The rapid arc–continental collision is responsible for the complex geological setting and the rugged topography. The geology and tectonics of Taiwan (Fig. 1) were described in detail in the two introductory volumes of Ho (1982, 1986). The two major tectonic provinces of Taiwan are separated by a narrow, linear feature known as the Taitung Longi-

* Corresponding author. Fax: 886-3-4222044;
E-mail: s123@sal.gep.ncu.edu.tw

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