

Summary of Physical Properties Measured at Several Boreholes Penetrating through the Chelungpu Fault in Central Taiwan

Jeen-Hwa Wang*

Institute of Earth Sciences, Academia Sinica, Taipei 115, Taiwan, ROC

Received 23 March 2009, accepted 1 September 2009

ABSTRACT

On 20 September 1999, the M_s 7.6 Chi-Chi earthquake ruptured the Chelungpu fault in central Taiwan. After the earthquake, several boreholes of different depths were drilled. Those boreholes penetrated the fault plane. The physical (mechanical, thermal, hydraulic, electric, and magnetic) parameters were measured either on the core samples or through well-loggings. Results are significant for studies of the Chelungpu fault. However, the measured results are published in different articles and reports. It is not convenient for the earth scientists to take advantage of those results. Hence, those results are compiled and described in this paper. In addition, the correlations among a few parameters are also reported.

Key words: Chelungpu fault, Borehole, Well-logging, Physical parameters

Citation: Wang, J. H., 2010: Summary of physical properties measured at several boreholes penetrating through the Chelungpu fault in central Taiwan. *Terr. Atmos. Ocean. Sci.*, 21, 655-673, doi: 10.3319/TAO.2009.09.01.01(T)

1. INTRODUCTION

On 20 September 1999, the M_s 7.6 Chi-Chi earthquake ruptured the Chelungpu fault, which is a ~100-km-long and east-dipping thrust fault, with a dip angle of ~30°, in central Taiwan (Ma et al. 1999; Shin and Teng 2001). The epicenter, fault trace, and the fault plane are displayed in Fig. 1. Mori et al. (2002) noted that fault drillings could resolve some significant seismological issues. After the earthquake, several boreholes of different depths were drilled. Through a joint Taiwan-Japan cooperative project, in 2001 two shallow boreholes near the northern and southern segments of the Chelungpu fault were drilled (cf. Huang et al. 2002; Tanaka et al. 2002). The locations are depicted by “Northern Hole” and “Southern Hole” in Fig. 1. The northern hole, which was located at Fengyuan, consisted of two linked holes: BH-1 from 0 to 293.4 m and BH-1A from 208 to 455.35 m. There was an overlap of 85.4 m between the two holes. The depth of the southern hole was 211.9 m. The distances from the northern and southern drilling sites to the fault trace are 500 and 250 m, respectively.

Huang et al. (2002) observed that the northern hole consists of three major stratigraphic units: Yutenping sand-

stone, Chinshui shale, and terrace deposits; while the southern hole has three major stratigraphic units: the Toukoshan Formation, Chinshui shale, and terrace deposits. They found that the two holes encountered the fault plane of the Chi-Chi earthquake and also recognized two possible fracture zones in the northern and southern boreholes at 225 - 330 and 177 - 180 m, respectively. Detailed description of cores can be found in Huang et al. (2002) and Tanaka et al. (2002). The main results observed by several authors (Otsuki et al. 2001; Huang et al. 2002; Tanaka et al. 2002; and Tanikawa et al. 2004) are (1) for the northern borehole: (a) a random fabric breccia distribution of several tens of centimeters thick; (b) the presence of a fault gouge of 0.5 - 2 cm thick; (c) intrusion of soft clay into layers of fault breccia; and (2) for the southern site, (a) the existence of foliated fault breccia with ultracataclasites and pseudotachylites and (b) a lack of any injection structure. Geophysical well-loggings were also made at the two shallow holes (see Tanaka et al. 2002).

To investigate the physical and chemical properties of the fault zone, the Taiwan Chelungpu-fault Drilling Project (TCDP) was launched in 2004 (Song et al. 2007a). Two deep holes (denoted as Hole-A and Hole-B, respectively, hereafter) cutting through the fault plane were drilled in 2005 (Fig. 1). The two deep holes are 40 m apart: Hole-A reached to a depth of 2003.26 m and Hole-B reached to a depth of

* Corresponding author
E-mail: jhwang@earth.sinica.edu.tw