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QUATERNARY STRESS CHANGES IN NORTHERN TAIWAN AND THEIR TECTONIC IMPLICATION

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ABSTRACT

The present stress field in northern Taiwan shows an extensional condition with minimum horizontal stress directions varying from E-W in the western part to N-S in the eastern part. This stress condition can be traced back to the Pleistocene from the regional fault and fold pattern, the orientation of igneous dikes, and the alignment of volcanic vents. Detailed analyses from a large number of fault-slip data have further substantiated the time-stress variation of northern Taiwan from a pre-Quaternary NW-SE compression to an early Pleistocene N-S compresion, and finally to an extensional stress condition.

The rotation of the principal stress axes and the transition of stress condition from compressional type to extensional type are probably related to the late Pliocene subduction of the Philippine Sea plate under northern Taiwan and subsequent opening of the southern Okinawa Trough which started about 1.9 Ma ago.

INTRODUCTION

The island of Taiwan has been experiencing a vigorous orogeny which is generally attributed to the collision between the Asiatic continent and the Luzon arc since early Pliocene (e.g. Biq, 1972; Chai, 1972; Bowin *et al.*, 1978; Chi *et al.*, 1981). This orogeny has produced a highly deformed terrain of Taiwan marked with severe folding and thrusting. Presently, active crustal deformation (Chen, 1974; Biq, 1976, 1984; Tsai *et al.*, 1983) and frequent earthquakes (Hsu, 1971; Wu, 1978; Tsai *et al.*, 1977, 1981) is still going on.

Strong compressional stresses have been interpreted as the cause of folding and thrusting in the mountain belt during the collision. The present stress field as inferred from earthquake focal mechanisms also indicates strong compression in most parts of the island (Lin *et al.*, 1986; Lee, 1986). In northern Taiwan, although extensional stress condition has been shown by earthquake focal mechanisms, they are not yet taken as a regional feature.

The present paper deals in greater detail with possible stress-orientation indicators, such as: the trend of regional fold axes, the orientation of igneous dikes, the alignment of volcanic vents, fault patterns, and fault-slip features, in the hope of reconstructing Quaternary regional stress history. By further comparing the stress history with other tectonic studies, the salient features of the Quaternary tectonism in northern Taiwan could be delineated.

REGIONAL STRUCTURAL PATTERN

The regional structural lineaments of Taiwan including major fault traces, fold axes, and trend of schistosity planes, are generally parallel to the longitudinal axis of the island. They vary