SUBSURFACE STRUCTURE OF CO-SEISMIC FLEXURAL-SLIP FAULT SCARPS ALONG THE CHELUNGPU SURFACE RUPTURE ZONE REVEALED BY HIGH-SOLUTION SEISMIC AND RADAR REFLECTION PROFILINGS

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A magnitude M_L 7.3 (M_L, Central Weather Bureau of Taiwan) earthquake struck central Taiwan at 1:47 a.m. local time on September 21, 1999. It was responsible for over 2,400 fatalities; more lives would have been lost if the earthquake had occurred during daytime. Damage estimates, including calculations for lost productivity, range between US$20 and $30 billion. This earthquake was named 921 Chi-Chi earthquake later. Chelungpu fault, the Chi-Chi earthquake trigger, extends in north-south direction from the eastern margin of Taichung basin.

High-resolution seismic and radar reflection profiling were conducted for understing the subsurface structures of the co-seismic flexural-slip fault scarps along the Chelungpu surface rupture zone, which occurred during the 1999 Chi-chi (Taiwan) earthquake. The detailed seismic and radar reflection imaging analyses reveal that there are many subsurface co- and paleo- seismic faulting and folding structures recorded in the uncousoludated alluvial stratigraphic units. The seismic reflection profiling shows that multiple paleoseimic events occurred in a ~400m wide fault-fold zone which caused a displacement calculation along branch subsurface faults. The radar-reflection imaging results indicate that there are many near-surface branch co-seismic faulting planes under the co-seismic flexural-slip fault scarps.

The seismic section of the upthrown block of some portion of Chelungpu fault reveals reverse fault pattern at the depth shallower than 100m, however normal fault at depth deeper than 100m. The fault strands with high angles are downward converging. Some portion of the Chelungpu fault pattern have the characteristics of strike-slip fault even most portions of the fault are thrust.

Some part of Chelungpu Fault has no surface rupture. The zone without surface rupture coincided lateral ramp of thrust fault. The lateral ramp of thrust is defined as a ramp

in the thrust surface that is parallel to the direction of transport of the thrust sheet. This zone of ramp also refered as a tranfer zone disturbs thrust wedges with complex deformation. Such domains reveal structures that are oblique to the thrust belt.

This study shows that the combination of seismic- and radar reflection profiling is a valid method for understanding the subsurface structure and paleoseimic events on a flexural-slip fault scarp covered by a thick-unconsolidated alluvial deposits.

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