Geophysical Research Abstracts, Vol. 9, 03057, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03057

The Lichi Mélange: A collision mélange formation along early arcward backthrusts during forearc basin closure, Taiwan arc-continent collision

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In the SW Coastal Range the Lichi Mélange lies between the collision suture of Longitudinal Valley to the west and the Taiyuan remnant forearc basin to the east. Field survey indicates that the Taiyuan forearc basin sequence and its volcanic basement thrust westward over the Lichi Mélange along the east-dipping Tuluanshan fault. The Lichi Mélange shows varying degrees of strata fragmentation, mixing and shearing and appears wide range of facies from the weakly-sheared broken formation facies with discernible relic sedimentary structures to the intensively- sheared block-in-matrix mélange facies with pervasively scaly foliation dipping to the southeast. Sedimentological study reveals that the subangular to subrounded, fractured, matrix-supported meta-sandstone conglomerates in the pebbly mudstone layers are repeatedly found in the broken formation facies of the Lichi Mélange. Their composition and occurrence are identical to the deep-sea fan conglomerate beds in the Taiyuan remnant forearc basin strata to the east. Benthic foraminiferal fauna are similar in the Lichi Mélange regardless of various intensity of shearing and strata disruptions, and are compatible with the benthic foraminiferal fauna in the Taiyuan remnant forearc basin turbidites, supporting that the protolith of the Lichi Mélange was originally deposited in the North Luzon Trough. Age determination of planktic foraminifers further demonstrates that the Lichi Mélange is early Pliocene age (3.5˜3.7 Ma), implying that the Lichi Mélange is deposited in a short time interval and deformation occurs soon after its deposition. The Lichi Mélange age is just coeval to the lower part, but much younger than

the upper part (3˜1 Ma), of the Taiyuan coherent forearc basin strata, indicating that the upper Taiyuan forearc sequence (3.7˜1 Ma) is deposited continuously in the remnant North Luzon Trough regardless deformation in its western part (the proto-mélange), a scenario analog with the modern configuration of the Huatung Ridge-remnant North Luzon Trough off southern Coastal Range in the active arc-continent collision zone north of 21oN. In addition to kaolinite (11˜15%), the clay mineral composition of the Lichi Mélange is compatible with the Taiyuan remnant forearc turbidites. In the Coastal Range, kaolinites are found only in the volcanic rocks of the Tuluanshan Formation. This additional kaolinite in the Lichi Mélange can not be derived from the exposed accretionary prism to the North Luzon Trough by sedimentary mass slumping process because no such volcanic rocks exposed now in the accretionary prism west of the Coastal Range. Instead, they could derive from the Tuluanshan Formation when it was emplaced into the Lichi Mélange by thrust in the last 1 Ma when the Luzon arc-forearc was accreted to form the southern Coastal Range, thereby re-distribute the kaolinites from the volcanic arc rocks into the Lichi Mélange by fluid flows along the ubiquitous geological fractures in the mélange, consistent with the field occurrences of the large, rootless, fault-bounded volcanic rocks of andesitic breccia, tuff, agglomerates floating in the intensively-sheared block-in-matrix mélange facies of the Lichi Mélange. Mélange is commonly considered to be developed in the accretionary prism of subduction zone. However, the Lichi Mélange in the SW Coastal Range originates from the thrust forearc strata, representing a unique forearc mélange in the worldwide orogenic belts. The young age, wide distribution, especially a continuous offshore-onshore connection of the mélange counterpart, the Lichi Mélange provides a unique example to look into active modern mélange-forming process by forearc thrusting during progressive closure of the forearc basin in the active arc-continent collision region.