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How the structure of a continental margin affects the development of a fold and thrust belt. 3: evidences from field mapping and geological cross-sections in south-central Taiwan

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The Eurasian Margin is obliquely colliding with the Luzon Arc to form the Taiwan orogen. This configuration is particularly apparent in south-central part of the island providing a case example to investigate the effects of structural inheritance in the development of the thrust and fold belt. The Eurasian Margin evolved from a pre-Cenozoic continental basement that underwent rifting in the Early Eocene and subsequent sea-floor spreading to form the South China Sea during the late Early Oligocene. The margin underwent localized extension in the Middle Miocene, before the initiation of collision with the Luzon Arc by the Early Miocene.

The important along-strike changes in structure and topography of south-central Taiwan thrust and fold belt are evidenced in the detailed geological map and 3 balanced geological cross sections. A 3D tomography model is integrated in this study to help constrain the structure at depth. Major along-strike changes seem to be related to structures oriented at a high angle to the thrust system. These include changes in strike of thrusts and fold traces, the changing elevation of thrusts and stratigraphic contacts, and the growing importance of Middle Miocene sediments within the thrust system that take place from north to south. Horizontal slices of the tomography model illustrate that N-S changes in velocity have the orientation of the inherited structural grain of the Eurasian margin. In particular, the inherited location of the Mesozoic margin's shelf-slope transition affects the distribution of seismicity and the location of lateral stratigraphic and structural changes. Also, it appears to be associated with the inversion of Eocene- and Miocene-age extensional faults, deeply rooted in the pre-Cenozoic basement that trend oblique to the thrust belt. The inversion of inherited structures affects the uplift of Miocene syn-extensional and syn-tectonic Plio-Pleistocene foreland basin sediments, and of the pre-Cenozoic basement.

Section A shows imbricated thrusts merging into a flat, gently west-dipping detachment at the base of Plio-Pleistocene syn-tectonic sediments in the foothills. While in the area of the Hsuehshan Range, the involvement and uplift of pre-Cenozoic basement is associated to higher topography and to the occurrence of Eocene-Oligocene sediments at the surface. Section B shows thick Miocene stratigraphy and pre-Cenozoic basement rocks involved in the imbricated thrusts. Basement involvement is here also associated with the increased topography observed in the Alishan Range. The Choshui lateral structure that separates sections A and B is associated with a hangingwall culmination wall. It is evidenced in the map by changes in orientation of contacts and fold axis. This lateral structure is also constrained by larger Vp values in the tomography, corresponding to the Alishan basement involvement area. In section C to the south, the imbricated thrusts involve thick Miocene and Plio-Pleistocene sedimentary strata and the westward dipping sole thrust is above the pre-Cenozoic basement. These sedimentary sequences are interpreted to be offscraped above inherited extensional faults that seem to be associated to significant seismic activity at depths of 5-10 km below the sole thrust.