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How the structure of a continental margin affects the development of a fold and thrust belt. 2: Imaging basement structures with seismic velocities and seismicity in south-central Taiwan

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We investigate the geophysical signature within the south-central Taiwan fold and thrust belt of the reactivation of pre-existing structures developed on the Eurasian margin. Seismic tomography (P-wave) and earthquake hypocenters are combined to trace structures mapped on the margin offshore western Taiwan into the fold and thrust belt. The extensional tectonic history of the margin began in the Early Eocene and culminated in the Late Eocene to Early Oligocene with sea-floor spreading and the opening of the South China Sea. Several NE trending basins developed during the rifting of a pre-Cenozoic basement and these were filled with Eocene sediments. Further extension on the outer margin took place during the Middle to Late Miocene, forming basins that are now involved in the Taiwan deformation. Finally, the margin's transition from the platform to the slope takes place across south-central Taiwan and is oriented at a high angle to the active deformation front. We define the basement as pre-Eocene rocks and use a P-wave velocity (Vp) of 5.2 km/s as a proxy for the interface between them and their younger cover. This Vp interface is characterized by highs and lows that can be interpreted to image basement topography whose possible causes we investigate here. In the Hsuehshan Range there is a pronounced shallowing of the 5.2 km/s surface across the Shuilikeng fault. It is accompanied by an east-dipping cluster of seismicity down to more than 25 km depth, and forming what appears to be a crustal ramp across which the Eocene-age Hsuehshan Basin is being inverted. Westward, the 5.2 km/s interface forms a high called Paikang basement high, the southern flank of which is the on land projection of the Mesozoic basement shelf break. Southward, there is an increase in seismicity and topography that is associated to a NE-SW oriented lateral structure in the fold and thrust belt. South of this lateral structure, beneath the Alishan Range, a shallowing of the 5.2 km/s interface marks a change in the structural grain of the fold and thrust belt. This, together with the increase in predominatedly scattered seismicity that reaches greater than 20 km depth, can be interpreted to indicate basement involvement in the deformation. To the south of the Alishan Range a zone of higher velocity whose orientation is roughly parallel to that of the Mesozoic basement shelf break is interpreted as a basement high. Here, there appears to be SW-dipping clusters of hypocenters associated with the shallowing of the 5.2 km/s surface. We interpret this shallowing of the 5.2 km/s surface to be related to an extensional fault block (or blocks) on the upper slope area of the basement. The seismicity clusters are possibly imaging the reactivation of the extensional faults that bound it.