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Deformational processes and stratigraphic evolution of the onshore and offshore lower trench slope, Hikurangi active margin, New Zealand

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On active margins, the morphology of the lower trench slopes result from subduction wedges development and evolution which are themselves controlled by the motion and coupling of the downgoing slab. Subduction activity is therefore responsible for the distribution and the evolution of lower trench slope sedimentation area ($e.g.$ trench-slope basins). In this context, the syn-subduction sedimentary infill may records the variation of regional tectonic regimes ($i.e.$ compression, responsible for uplift and contraction of sedimentary domains ; extension, responsible for subsidence and widening of sedimentary basins), but may also reflects more local deformation processes during a tectonic episode.

Since 25 My, oblique convergence between the Indo/Australian and Pacific plates is responsible for the westward subduction of the thick Hikurangi plateau (10 to 15 km thick) beneath the North Island, New Zealand. At present time, the Hikurangi subduction wedge extends, onshore and offshore, along eastern North Island. It can be subdivided onto two main structural domains from the trench to the forearc basin: the outer ($i.e.$ trenchward) subduction wedge (accretionary prism sensu-stricto) and the inner ($i.e.$ arcward) subduction wedge (including a deformed but non-accreted basement composed of pre-subduction series of the former margin). The inner subduction wedge comprises, onshore and offshore Miocene and Pliocene syn-subduction sediments deposited on a lower trench slope.

This study highlight the close interplay between tectonic activity and the stratigraphic pattern of the lower trench slope in such an active subduction setting. Offshore, the compilation of seismic stratigraphy and wireline logs data (gamma ray and sonic) permits to characterize and hierarchize major unconformities which are attributed to the deformation of the underlying basement. Onshore, our detailed stratigraphic and tectonic analysis demonstrate that major sedimentary discontinuities (brutal facies changes, $e.g.$ drowning of a mixed carbonaceous/siliciclastic shelf by basin plain facies associations) are also related to tectonic activity and not to climatic and eustatic changes. Strong variations of the depositional environment through time show that the tectonic control is mainly expressed by slope creations (inversions of the vergence of sedimentary systems), by changes in turbidite facies, and by the creation of new sediment sources ($e.g.$ uplift of structural ridges).

Considering the stratigraphic patterns of the onshore and offshore domains, we characterize the stratigraphic record of regional tectonic events ($i.e.$ onset of subduction, beginning of regional subsidence) and of local tectonic events ($i.e.$ local uplift of structural edges of the trench-slope basins, acceleration of basin subsidence). The characterization of onshore and offshore discontinuities permits to correlate them precisely and therefore to highlight the spatial distribution and the evolution through time of tectonic deformation across the subduction wedge. Moreover we could constrain the characteristics of deformation of the inner subduction wedge during the last 25 My of convergent plate boundary.