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Heterogeneous deformation across the Papaku fault, Hikurangi accretionary prism

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At the Hikurangi convergent margin the Pacific plate is subducted westward beneath the Australian plate. This margin has been the location of major earthquakes as well as slow slip events related to the ongoing subduction. Drill site U1518 which was drilled during IODP Expedition 375, 73 km offshore Gisborne (New Zealand), targeted the Papaku fault, a splay fault of the major decollement in sediments of the frontal accretionary prism. We selected samples from the mostly hemipelagic, weakly consolidated mudstones in the fault zone, as well as from hangingwall and footwall. In order to investigate localized and distributed deformation in the fault zone, we analysed composition, microstructure and crystallographic preferred orientation (CPO). For that we applied μ XRF measurements and optical microscopy, as well as synchrotron texture analysis at DESY in Hamburg.

The samples from hanging- and footwall sediments show a relatively homogeneous microstructure with local compositional layering. While CPO strength in the hangingwall is slightly increasing with depth for all analysed clay mineral phases, the CPO in the footwall samples is in general lower and does not show a clear trend with depth. This might be interpreted as different deformation histories in hangingwall and footwall which is in accordance with previous studies. Fault zone samples show a variety of microstructures, such as mingling of different sedimentary components, locally overprinted by microfaults. CPO strength in the faulted sediments is also variable, with zones showing strong alignment of phyllosilicates and zones showing weak alignment of phyllosilicates. Variations in CPO and variable distribution of sedimentary components indicate a heterogeneous deformation within the fault zone which might be due to local compositional variations.