Fault zone structure and deformation in pelagic sedimentary rocks in the Jurassic chert-clastic complex, Central Japan

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At shallow depths in subduction zones, plate-boundary faulting is highly localized along weak layer such as smectite-rich pelagic clay. However, it remains poorly understood whether localization of plate-boundary slip also occurs at deeper portions of subduction zones. We examined the ~60 m-thick fault zone developed in pelagic sedimentary rocks of the Jurassic chert-clastic complex, Central Japan. The fault zone was developed along the imbricate thrust branched from the plate-boundary fault. In the fault zone, deformation was partitioned into folding in siliceous claystone, shearing along black carbonaceous mudstone layers, and localized slip along discrete slip surfaces. The orientation and geometry of asymmetric, tight to isoclinal folds in siliceous claystone is consistent with top-to-the-south sense of shear during subduction, while intense scaly fabric showing the composite planar fabric in carbonaceous mudstone layers represent shear concentration. Localized slip is represented by polished surfaces with slickenlines, showing a left-lateral shear sense. The Raman spectra of carbonaceous materials in the localized slip surface and scaly carbonaceous mudstone indicate that the intensity ratio of D1 and D2 Raman bands is markedly increased in localized slip surface relative to surrounding scaly carbonaceous mudstone, suggesting an increase in temperature during localized slip. Our results indicate that plate-boundary faulting was highly localized along carbonaceous mudstone, and that the increased heating during left-lateral faulting along discrete slip surfaces may represent seismic slip accommodating strike-slip component during oblique subduction.

Keywords: pelagic sedimentary rocks, fault zone structure, Raman Spectra, plate boundary faulting

