Mesoscale structures of a large shear zone developed within pelagic siliceous sediments

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Subduction zones where old oceanic plate underthrust are characterized by thick pelagic incoming sediments originating from diatomaceous/radiolarian oozes. For a better understanding of deformations along plate boundary megathrust in such a setting, we investigate the Ohwaki outcrop in the Mino Belt, which represents a shear zone of a master floor thrust of imbricated thrust sheets composed of cherts and clastic rocks.
The occurrence of the shear zone was presented by geologic mapping based on aerial photographs taken by an unmanned aerial vehicle (UAV). A ~50-m-thick cataclastic shear zone composed of early Triassic carbonaceous black shale matrix including angular blocks of bedded/massive chert, siliceous mudstone, and shale with sandstone blocks bounds early-middle Triassic pelagic rocks and middle Jurassic terrigenous rocks. In contrast to the disrupted and cataclastic deformation of carbonaceous black shale within the shear zone, hanging wall strata of thick bedded/massive chert only exhibits early-stage ductile asymmetric folds.
Stratigraphically controlled occurrence of the shear zone is analogous to the plate boundary fault in the Japan Trench drilled by IODP Expedition 343 and in-sequence thrusts of imbricated chert-clastics sequence in the Inuyama area, in terms of shear localization to weak horizon within pelagic sediments. However, total thickness of the shear zone observed in the Ohwaki outcrop is one order larger than other strata-bound fault zones. Occurrence of a thick shear zone with angular blocks of host rocks would be likely to reflect shear zone thickening caused by strain hardening due to post-failure fluid discharge and hydrofracuring maintained by fluid overpressure. It is speculated that low permeability of lithified chert (10^{-19} to 10^{-21} m^2) would contribute to fluid pressure fluctuation in large shear zones within pelagic sediments.

