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Occurrences of the boundary fault with pseudotachylyte in the Yokonami Melange, the Cretaceous Shimanto Belt, SW Japan

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The faults with pseudotachylytes have been found from the Okitsu melange and the Mugi melange in the Cretaceous Shimanto Belt. The boundary faults are located at the northern edge of the melange formations. In addition, both faults are in the latest Cretaceous Shimanto Belt. A similar boundary fault has been reported in the Yokonami melange which is in the earliest Cretaceous Shimanto Belt. No pseudotachylytes has been identified in the fault so far although the fault setting is similar with the others with pseudotachylytes.
Kirkpatric (2009) examined the occurrences of pseudotachylytes from outcrop-scale to microscopic-scale. He pointed out that pseudotachylytes are relatively common and suggested that melt lubrication can be a significant mechanism for fault weakening. Pseudotachylytes, we have thought that it is rare, may be more common also within the Shimanto Belt. In this study, we observed the northern boundary fault in the Yokonami melange to examine the occurrences of pseudotachylytes.
The Yokonami melange is in the northern most part of the Cretaceous Shimanto Belt. It is bounded by the fault to the Susaki formation in the north and to the Shimotsui formation in the south. The Susaki and Shimotsui formations are coherent units composed mainly of sandstone and mudstone. The Yokonami melange is consisted by tectonic melange, which composed of blocks of sandstone, siliceous shale, siliceous tuff, chert, red shale, and greenstone surrounded by black shale matrix. The boundary fault is located at the northern edge of the Yokonami melange.
The boundary fault is composed mainly of black shale comprising the Yokonami melange. The thickness of fault zones is ~6m. The main fault zone is ~ 1.5m in thickness at the center of the fault zone. 3-4 cataclastic fault zones (up to tens cm in thickness) are observed within the main fault zone. The thin, sharp and linear faults (~1mm in thickness) occur in the cataclastic fault zones. Very fine materials are observed in the sharp and linear faults. It is hard to identify the injection vein and/or embayment texture in the outcrop scale.
Samples were obtained from the thin fault zone with surrounding cataclasites. We observed the microstructure under optical and secondary electron microscopes. Reddish-brown to brown materials are observed along the thin, sharp and linear fault. Mixture of quartz blocks and clay matrix represent flow texture. The quartz blocks may be fragments of mineral veins. The quartz blocks along the sharp fault are composed of very fine quartz crystals representing blocky structure. The quartz crystals show undulated extinction indicating the crystalline plasticity. Injection veins with curvature edge are identified. Embayment is also observed at the boundary between injection veins and quartz blocks. Flow texture is occurred in clay matrix. Embayment textures are observed pervasively in the small quartz grains.
Mixture of quartz blocks and clay matrix showing flow texture are also identical in the electron microscopic observation. The composition of clay matrix is illite or chlorite. The reddish-brown materials along the sharp fault are also illite or chlorite. Fibrous hourglass texture, gruel-texture and vesicles are also observed as a melt-texture. It is possible, however, artifacts in the making procedure of thin sections. Very fine droplets of titanium oxides are also observed in the flow textures.

As described, many textures such as flow texture, injection veins, embayment textures and fine titanium oxides are observed in the fault zones in the northern edge of the Yokonami melange. The textures are consistent with that reported from the other faults with pseudotachylytes. Therefore, we can conclude that the boundary fault in the Yokonami melange is a fossil seismogenic fault along a subduction zone.

Keywords: pseudotachylytes, injection vein, flow textures, embayments, melt-texture, SEM obserbation