Evolution of the Median Tectonic Line fault zone during the exhumation

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We present detailed observations of the Median Tectonic Line (MTL) at a large outcrop exposed in the eastern Kii Peninsula, Japan to understand fault behaviours under a range of physical conditions. At the outcrop, the MTL strikes almost E-W and dips to the north and juxtaposes the Sanbagawa metamorphic rocks to the south against the Izumi group to the north. The fault rocks in the described area mainly consist of the Sanbagawa derived rocks.

In the fault core, two slip zones exist. One (upper slip zone) is at the lithological boundary between the Izumi group and the Sanbagawa derived fault rocks. The other (lower slip zone) is located about 1 m beneath the upper slip zone, more conspicuous and considered to be a principal slip zone.

Crosscutting relationship among structures and kinematic indicators in the fault zone indicate that the oldest deformation stage (Stage 1) is distributed deformation with top to the east sense of slip in the outside of the slip zones. Then deformation with top to the east sense of slip was localized into the lower slip zone (Stage 2). After that the slip direction in the lower slip zone was changed in into top to the west sense of slip (Stage 3). The final deformation stage (Stage 4) was top to the north normal faulting along the two slip zones.

The microstructure of muscovite outside of the slip zones suggests that the temperature during stage 1 is high enough for muscovite to be plastically deformed. Powder X-ray diffraction (XRD) analyses Indicate that smectite only appears in limited part of upper and lower slip zones where deformation stages 3 and 4 occur. The fault zone architecture described in this study, therefore, record the faultings at different crustal level.