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Syn-tectonic fluid-flow characteristics of a reactivated crustal-scale fault zone: inferences from structural and geochemical observations, Median Tectonic Line, SW Japan

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The Median Tectonic Line (MTL) is a major crustal-scale fault in Japan that separates the low-P/high-T Ryoke metamorphic belt of mainly subduction related granitoids from the high-P/low-T Sambagawa Belt of accretionary complex metasedimentary rocks. We present an integrated field, microstructural and geochemical study of Ryoke-derived fault rocks from two transects near the villages of Miyamae and Tsukide, $\sim$ 15 km along strike from one another in western Mie Prefecture, SW Japan.

The study has highlighted two distinctive structural domains associated with the MTL: 1) a narrow fine-grained foliated fault core; and 2) a wider damage zone of variably fractured mylonites to the north of the fault zone. The damage zone grades progressively into Ryoke protolith mylonite at distances over $\sim$ 400 m north of the MTL central slip zone. Whole-rock geochemical analyses suggests that variably fractured mylonites 50-350 m north of the MTL central slip zone within the Tsukide field area have undergone a more varied and extensive alteration in comparison to that experienced across the Miyamae field area. The fine-grained foliated fault rocks within the core of the MTL have experienced the most intense deformation, but show the apparently least altered geochemical signature relative to other fault rocks as they show whole-rock major and trace element concentrations closest to protolith values.

Our structural and geochemical observations suggest that the damage zone of variably fractured mylonites to the north of the MTL fault core is characterised by a high

permeability crack geometry porosity network. In contrast, the phyllonitic fault core at Miyamae is likely to be characterised by a strong permeability anisotropy where across-fault fluid flow is inhibited and focused fault-parallel fluid flow occurs through a connected network of tubular geometry porosity and permeability.