

Conditions of brittle-ductile transition observed for porous Kakegawa siltstone at high pressure

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It is well known that porous sedimentary rocks such as siltstone and sandstones sometimes experience brittle-ductile transition at high pressure conditions and the transition pressure depends on porosity of the tested material. Such a yielding characteristic is important to understand the deformation processes within accretionary prisms, in which physical properties such as porosity decreases gradually with depth due to dewatering and compaction processes. This research aims to reveal how the yielding criteria of the porous materials within accretionary prisms change with depth condition.

The sample used in this study is a Pliocene siltstones collected from the Kakegawa Formation, Kakegawa area, Shizuoka Prefecture. The Kakegawa Formation is a sedimentary rock deposited within a forearc basin

(Sugiyama et al. 1988), and this is not a representative of accretionary materials in a strict sense. However, there are some advantages of using the rock samples from the Kakegawa Formation for our study. Most importantly, non-deformed and homogeneous rock samples with variable values of porosities within relatively high porosity range can be collected.

A series of triaxial compression tests has been performed on the cylindrically shaped specimens of siltstone samples. At around 10-15 MPa confining pressure, stress-strain curves changes from a typical brittle behavior associated with an abrupt stress drop to a ductile mode curve, on which no clear stress drop is recorded and the differential stress increases slightly with the increase of strain. Important point to be noted here is that the strength of the sample gradually increases with confining pressure still within the ductile regime.