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美濃帯チャートの透水性と続成組織
Fluid transport property and diagenetic microstructure of chert in the Mino Belt

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Pore fluid pressure along plate boundary megathrust is controlled by both fluid supply and fluid transport property, and it affects on faulting and earthquake mechanics. In the case of subduction zones where relatively old (older than 50 m.y. in age) oceanic plate subducts, oceanic crust is covered with thick pelagic siliceous sediments composed of diatomic and/or radiolarian oozes. In the Japan Trench, Kimura et al. (2012) pointed out that the volume of dehydrated fluid during silica diagenesis from opal-A to quartz through opal-CT is significant compared to that from clay mineral (smectite-illite) transition. However, fluid transport property of siliceous sediments has not been well-understood yet. In this study we conducted both permeability measurement and microstructural/microchemical observation of bedded chert from Inuyama-section in the Mino belt, Jurassic accretionary complex in Japan, as an on-land analog of subduction zone where old oceanic plate subducts.

Initial porosity of chert samples at atmospheric pressure is 0.4 to 2.2 %. Permeability was measured at room temperature under isostatic confining pressures of 5 to 120 MPa, by the steady state flow method with nitrogen gas as a pore fluid. Water permeability was then obtained by using Klinkenberg equation. At effective pressure of 5 MPa converted water permeability is 10^{-17} to 10^{-19} m^2, decreases with increasing effective pressure down to the ranges of 10^{-20} to10^{-21} m^2.

Optical and electron probe microanalyzer (EPMA) analyses show that chert is composed of radiolarian fossils filled with quartz and chalcedony, and red-colored matrix. Red matrix shows ˜95 wt.% of SiO_2, whereas >99 wt.% of SiO_2 are commonly observed from inside part of the radiolarian fossils. Such high concentration of SiO_2 within radiolarian fossils indicates that dissolved silica was precipitated into cavities maintained by radiolarian tests. This process would be related with silica diagenesis, occurring as dissolution-precipitation processes.

Silica mineral precipitation onto pore spaces would contribute to construct characteristic low porosity and permeability of chert. Our result shows that silica diagenesis works as not only a fluid source but also as a process for porosity/permeability reduction in convergent margins characterized by old subducting oceanic plate.

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