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Numerical simulation of silica diagenesis in subduction zones

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A bedded chert in accretionary complex is a sedimentary rock composed mainly of pelagic sediments such as radiolarian ooze, and its major component is SiO_2. Silica in chert are transformed from amorphous silica into quartz via cristobalite phase during diagenetic process (Opal A->Opal CT->Quartz). In the process, structured water of silica minerals is dehydrated as much as 21.7% by volume (Mizutani, 1970). This water, can be supplied to deep plate boundary in subduction zone, and can generate an excess pore pressure which drops effective stress and rock strength. This process is important when concerning plate boundaries especially inside old plate subduction zones such as Japan trench, because pelagic sediments are deposited thickly on old oceanic plates. In the Kamiasou unit, Mino belt, red bedded chert is formed partly with white chert layer, which is a fossilized conduit of dehydrated water from silica . In this study, we perform numerical analysis the ratio of Opal A, Opal CT, and Quartz, the amount of dehydrated water, and the dehydration rate through silica diagenesis varing depth and temperature in order to estimate the formation condition of white chert layer. For this calculation, we chose kinetic parameters reported by Mizutani(1970), and observed values of sedimentation rate, geotherm, subduction angle and subduction rate in modern Japan Trench. As a result, we estimated the formation condition of white chert layer in the Inuyama area by calculating the depth and temperature where the phase transition and dehydration of silica diagenesis is significantly advanced.

Keywords: chert, diagenesis, subduction, kinetics