

Diagenetic processes along subduction plate boundary:Mugi melange, The Cretaceous Shimanto Belt, Shikoku, SW Japan

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The porosity of sandstone decreases from 60 to several % with burying along subduction interface. The understanding of diagenetic process is significant to understand the process of change into brittle properties of sediment. The purpose of this research is to understand the diagenetic process of sandstone from the on-land accretionary complex, and discussed about the relationships between the diagenetic process and the onset of seismogenic zone. Various models for the onset of the seismogenic zone are proposed. This paper pays attention to diagenetic process of sandstone which is the most amount in volume of sediment underthrusting into subduction zone.

The study area is the late Cretaceous Mugi melange, Shimanto belt, Shikoku. This study area is suitable for the purpose of this research because sandstone blocks are abundant and subduction related deformations are well preserved. As diagenetic processes of sandstone, it has been considered to be a two processes such as the compaction with grain size reduction and the cementation that the mineral precipitates between grains, both which can decrease porosity of sandstone.

Web structure is observed pervasively within sandstones as a thin and black line in the outcrop scale. Web structure may be formed by grain size reduction and compaction. Under microscopic scale, web structure represents a zone of smaller grain compared with that of surroundings. Calcite cement which is formed by a chemical reaction is observed in pore space between sandstone grains.

In this study, the grain distribution of the web structure examined and the area % of the calcite that carbonate cement material were measured. Then, we estimated the pressure and the depth of onset of web structure and calcite cement formations from an empirical law which obtained from tri-axial experiment of porous sandstone combined with porosity and grain size of the study area.

As a result, grain size reduction occurred within the web structure due to brittle failure. The area % of the calcite cement was 4.7% in average, and 10% in maximum. On the basis of the EDS mapping, it is considered that the cementation was developed after formation of web structure because the web structure does not contain the cement material in it. Therefore, when compactive cataclasis happens, assuming that the pore space was filled by fluids which are now observed as calcite cement, the porosity of sandstone was 10% or less. Moreover, the depth of compaction estimated from the combination of an empirical law of tri-axial experiment, and the porosity and grain size from this research represents 7.1 km in average and the 2.2 km in minimum. This result suggests that diagenetic process of sandstone was completed in subduction zone before the study area reached at the depth of seismogenic front (about 10km). It proposes that the diagenetic process of sandstone is important as the earthquake preparation process.