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Influence of compaction and diagenesis of non-lithified sediments on their mechanical behavior and their fate in subduction zones

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The mechanical behavior of non-lithified sediments entering subduction zones evolves along with primary changes in physical (decrease in porosity under increase of stress) and mineralogical (smectite-to-illite transformation under increase in temperature) properties. The respective contributions of both processes, as well as their relative timing is not well constrained, because technical limitation of coring prevents the collection of natural samples at depths below $\sim$1500 m below seafloor, leading us to adopt an experimental approach to these questions.
As starting material for our experiments we chose to use natural samples (siltstones) from the Upper Miocene Miura-Boso accretionary prism, central Japan, which is a unique example of an onland accretionary prism (Ogawa (1989), Yamamoto et al. (2005)). On this site, the deformation is mainly localized on horizontal contraction structures between which rocks are almost free from deformation. In addition the maximum burial depth for these sedimentary rocks is estimated to have been shallower than 1000 m (Yamamoto et al., 2005). Thus, diagenesis is not advanced as shown by the abundance of smectite in this area (Kameda et al., 2010).
This configuration let us the possibility to collect rocks barely deformed and metamorphosed, which can therefore be considered as analogous of sediments entering subduction and constitute ideal starting materials for experiments.
By our experimental approach, we evaluate the effects on mechanical properties of the two following processes, occurring simultaneously in natural rocks:
(1) Mechanical compaction, that is to say the decrease of porosity under increase of effective vertical stress using odometer tests and uniaxial compression experiments. Our experimental devices permit to explore a wide range of vertical stress, up to 100 MPa. These experiments are conducted on core and crushed powder of our Miura-Boso starting materials.
(2) Diagenesis, that is to say the effect of changes in mineralogy, and especially the smectite-to-illite transition that occurs relatively soon in the process of burial of sediments in subduction zone ($\sim$ 60°C Freed and Peacor, 1989). In order to explore this transformation we submitted, in temperature-pressure vessels, our Miura-Boso starting materials (powders as well as core samples) to P-T conditions favorable to the smectite-to-illite transformation.