Permeability variation in the development process of an accretionary prism

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1. Background and purpose of research

To clarify the accumulation process of the methane hydrate in an accretionary prism, we must understand the behavior of fluid containing the methane in the accretionary prism.It is considered that fluid flow and structural transformation in an accretionary prism influence each other. It is necessary to examine both the influence of the structural transformation on the fluid flow and the influence of the fluid flow exerts on the structural transformation.In this research, we estimate the variation of the porosity and the permeability to know the influence of the structural transformation on the fluid flow.

2. Method of research

In this research, the structural model was made by Distinct-Element Method (DEM), and the permeability was calculated by Lattice Boltzmann Method (LBM).

First we set 35,000 particles in the area of 11,250m∗200m∗700m (length ∗width ∗height). We pushed the side wall, and made the accretionary prism model whith overthrust faults. Second, we divided the accretionary prism model to small cubic areas, and calculated the porosity and permeability in each area. Last we studied the relations between the transformational structure and the variation of the porosity and permeability.

3. Simulation result and discussion

First, we evenly press the fluid from the whole area of the bottom part into the three-dimensional structural model. This corresponds to the fluid supply from a décollement. As a result, we can find that the transition of flow velocity at the fault position.

Second, we calculate the porosity for the cubic area cut out from the accretionary prism model. We found the area of the low porosity exists on the hanging wall, and the area of the high porosity extends in the footwall and the upsurge part.

Last we calculate the permeability for the unit cut out from the accretionary prism structure. We found that the area of the low permeability exists on the hanging wall, and the area of the high permeability extends in the footwall fault and the upsurge part. Even if it is same depth, the permeability is different in the hanging wall and the footwall.

In this research, we found the permeability variations in fault zones. It suggests that the fluid flow changes at the fault zone.