Numerical simulation of fault activity under interaction of structural deformation and fluid effects

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1. Background and purpose of research

When the geologic structure is transformed, it is thought that the existence of the fluid greatly influences. The existence of the fluid greatly changes a dynamic balance in the structure like the decrease the effective stress in the structure according to the rise of the fluid pressure. Therefore, the deformation of the structure becomes complex, and falls into disorder greatly by the existence of the fluid. It is necessary to think about the interaction of a structural deformation and the fluid in a lot of cases to have received the influence with the fluid there, and considering the mechanism of the deformation as for many of complex structures.

Then, the structural deformation modeling that used the numerical simulation to make distinct element method (DEM) and lattice Boltzmann method (LBM) which done in the coupling as an approach to such a structural transformation was done in this research.

2. Method of research

The numerical simulation of this research with the coupling of DEM-LBM is special feature. This can calculate a structural transformation and the fluid flow at the same time by doing LBM that handles fluid flow and DEM to handle a structural deformation in the coupling.

We set the area of two dimensions; the top and the bottom in the area were arranged walls that cannot penetrate both of the solid and fluid. We set the right and left side both periodic boundary.

3. Simulation result and consideration

The normal fault was formed by adding the shortening displacement to the particle group in the particle group. As for the fluid at that time, the movement to the surface level after along the fault plane was confirmed. It is thought that this is because the rise of the porosity of the fault plane by the fault activity is caused, and the fluid into which it had been being compressed there as a passage by the particle group flowed out.

4. Conclusions

The interaction of a structural deformation and the fluid was able to be reproduced by this research. The fault activity and the flow of the fluid according to it were confirmed by the simulation.