T043-006 Room: C416 Time: May 29 10:15-10:30

DEM Simulation of Structural Development Processes-3; Continental Collision of India-Eurasia

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The collision tectonics of the Indian sub-continent to the Eurasian Plate is one of the most spectacular events of current tectonic processes of the Earth, and this type of tectonics is sometimes referred to as 'indentation tectonics', a type of plate tectonic deformation due to a collision of a small continental block into a continent of larger size. This indentation tectonics causes complicated deformations around the boundary of the two continents. This tectonic model is extremely important to understand the development process of the sedimentary basins in the region from view points of the petroleum exploration industry. The model is also quite useful to assess the future activity of major fault systems from view points of disaster prevention.

In order to examine the deformation processes, a series of physical experiments have been conducted and the results explained the major tectonic features in the Eastern Asia excellently. The tectonic process can also be examined with a numerical technique, the Discrete Element Method (DEM), because the deformation is primarily controlled by major faulting which can be simulated with the DEM. This paper presents some preliminary results of the DEM simulation applied to the Indo-Eurasia type continental indentation tectonics and the results were compared with the experimental results.

A series of DEM simulations were conducted. The differences between them are the relative position of the indenter (e.g. India), and the bonding condition between the particles. In all simulations, the particle size includes a variation of 40% from the average. This variation is necessary to generate fault systems with no strong constraint on particular directions. Our previous study suggests that homogeneous particles can generate only faults in three directions where the initial arrangement of the particles is in the closest packing condition.

Our DEM simulations produced progressive development of fault systems as the indentation of the small rectangular block proceeded. The faults consist of two major sinistral (left-lateral) strike slip fault from the left corner of the indenter, which propagate to the right margin of the particle assembly. As the displacement of the faults proceeds, the particle assemblies segmented by the faults are displaced toward the right and rotated in the clockwise direction. The outline of the right-hand-side of the particle assembly is broadened adjacent to the indenter to overcome the space problem due to the indentation. The layers in front of the indenter decrease the thickness, suggesting the region being compressed by the indentation.

These simulation results showed that the overall geometry and progressive development of major fault systems associated with secondary basins are broadly similar to those of the analogue experiments, whereas the secondary fault systems seen in the experiments were less developed in the simulation. Despite there still need further refinements in the technique, the DEM approach to the geological deformation can be a powerful tool to simulate fault related structures.

Major Tectonic Features in Eastern Asia (from Tapponnier et al., 1986)

Analogue Model (from Tapponnier et al., 1986)

DEM Simulation (Our Study)