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Numerical simulation of Kureha-hill formation by means of discrete element modeling

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The Kureha-hill is characterized by anticline structure and it is known that the hill formed by inversion tectonics of the Kureha-yama fault. The Kureha-yama fault is located at the eastern edge of the Kureha-hill and had acted as normal fault (middle Miocene) and reverse fault (Pleistocene). In the late Miocene, the fault had not acted and thick sedimentary layer was formed on its hanging wall. In this study, we employed the software PFC 2D (2 dimensional particle flow code) based on 2D discrete element method, and attempted to discuss the forming processes of the Kureha-hill given by geological studies from the viewpoint of mechanics.

As a soft sedimentary layer, we prepared the modeled layer that the particles (rigid disk) having density and radius of 2000kg/m^2 and of 9.0 - 9.75 m were packed with porosity of 0.1 in the area where width and depth are 4000 m and 400 m. We assumed Young's modulus of 161 MPa, Poisson's ratio of 0.28, compressive strength of 20 MPa, tensile strength of 1 MPa and shear strength of 2 MPa, as elastic constants and strength of the soft sedimentary layer. Thus, we set up the normal stiffness of 5 x 10^{7}N/m, the shear stiffness of 7 x 10^{8}N/m, the frictional coefficient of 0.6 and the contact bound of 1 MN. And we assumed that the bottom part of the sedimentary layer is basement and it behaves as rigid body. The Kureha-yama fault was modeled as a simple fault with constant dip angle of 50 degrees because it is found by previous geological survey and geophysical prospecting.

As a result, it was found the basic structures of the Kureha-hill could be restored by numerical simulation and that geological discussion on formation of the hill was correct mechanically. In addition, we found (1) top of the Kureha-yama fault would have reached at the surface when the fault had acted as normal fault, and (2) large deformation of the basement is required for forming anticline structure.