

# KUWANO LAB.

Various soil behaviour  
-supporting ground, sliding ground, sinking/falling ground-



Department of Human and Social Systems

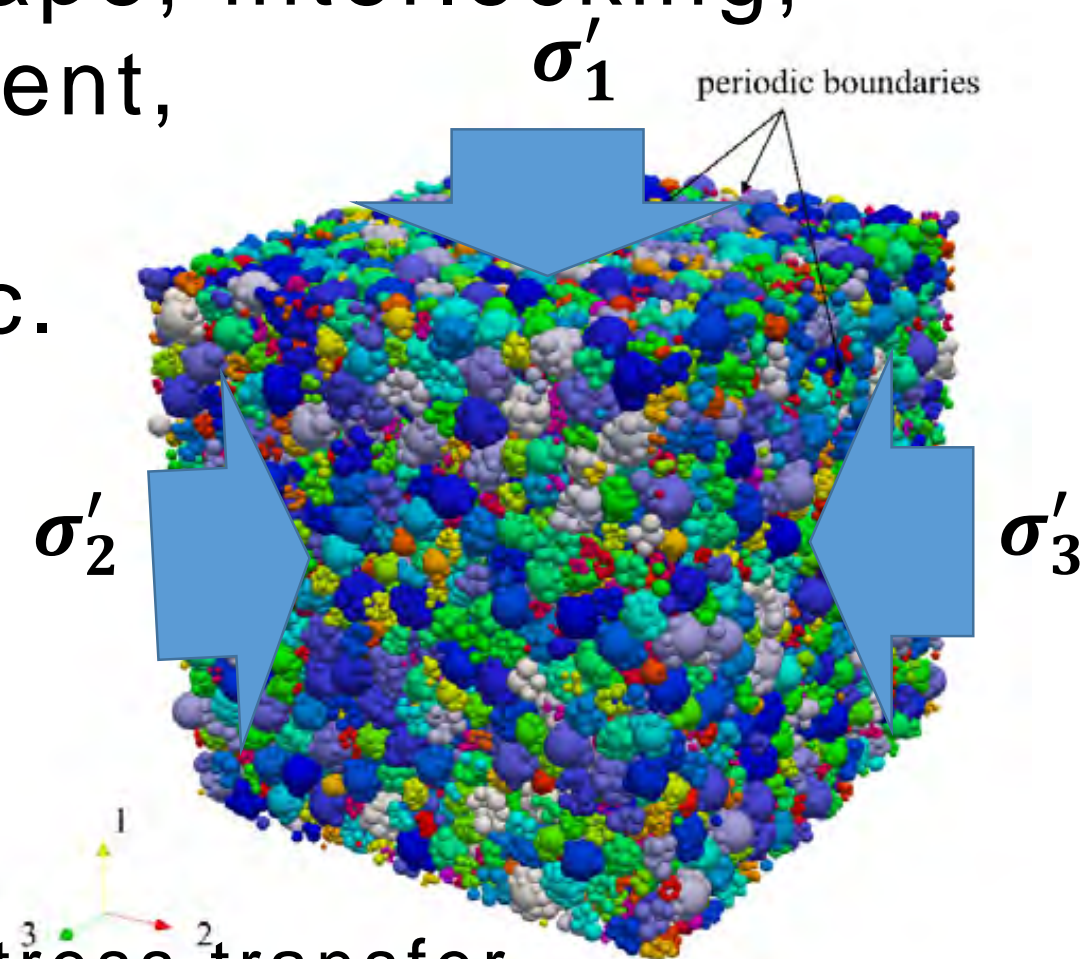
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## Mechanisms of various ground behaviours

### Supporting

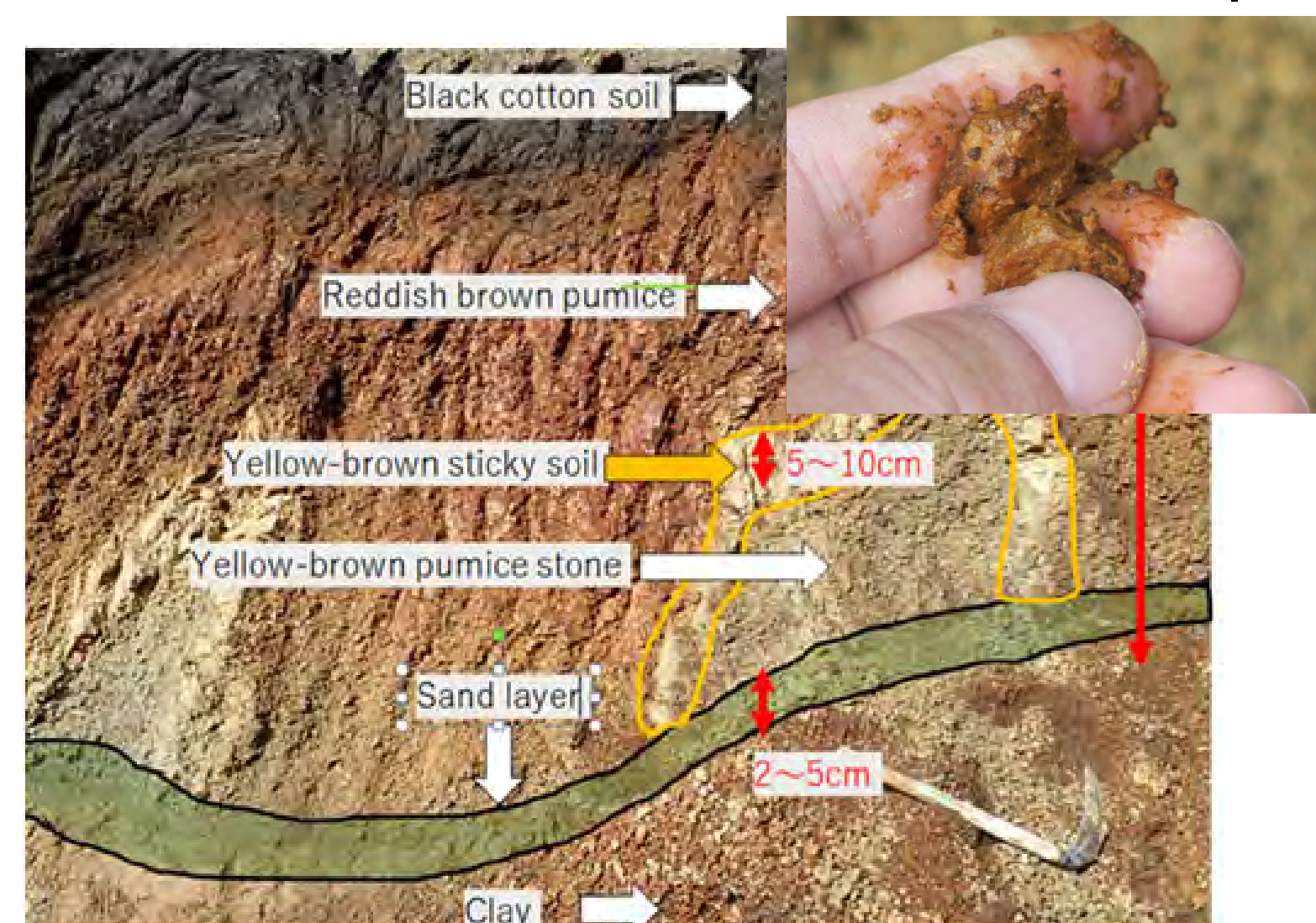
Ground = Soil plays an important role in supporting structures. It consists of soil particles such as sand/clay and water in the void spaces. The mechanical behaviour of soil is influenced by a variety of factors, including particle size, shape, interlocking, soil structures, water content, drainage conditions, confining pressure and etc. Mechanisms of stress transfer in soil are explored by experiments and numerical analysis.



DEM analysis of stress transfer in Investigation of the effect of particle morphology

### Sliding/Flowing

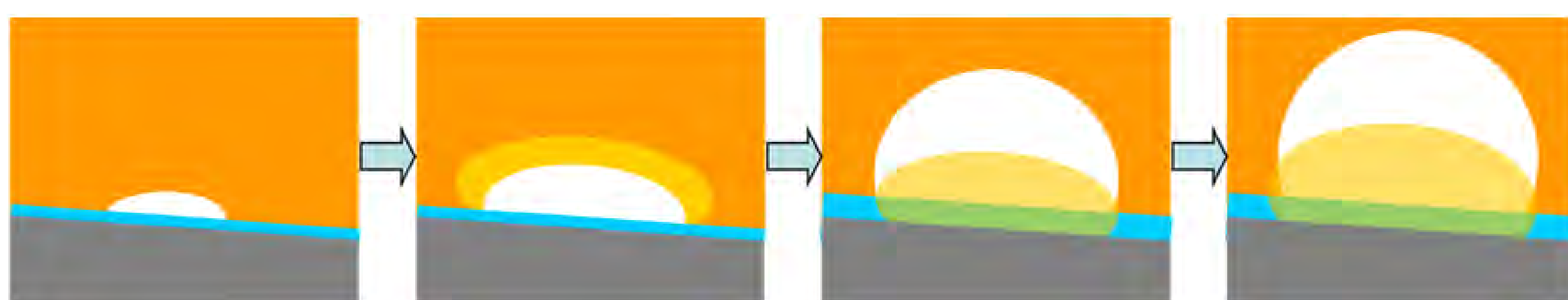
Ground that is normally stable can change drastically when stimulated by earthquakes or heavy rainfall, causing severe ground disasters such as mudslides, landslides and liquefaction.



Ultra-high pore structure soil (porous volcanic pumice with water inside) that underwent slip and flow resulting from the Hokkaido Iburi Tobu earthquake (2018)

### Sinking/Falling/Collapsing

#### Internal erosion due to the flow of ground water

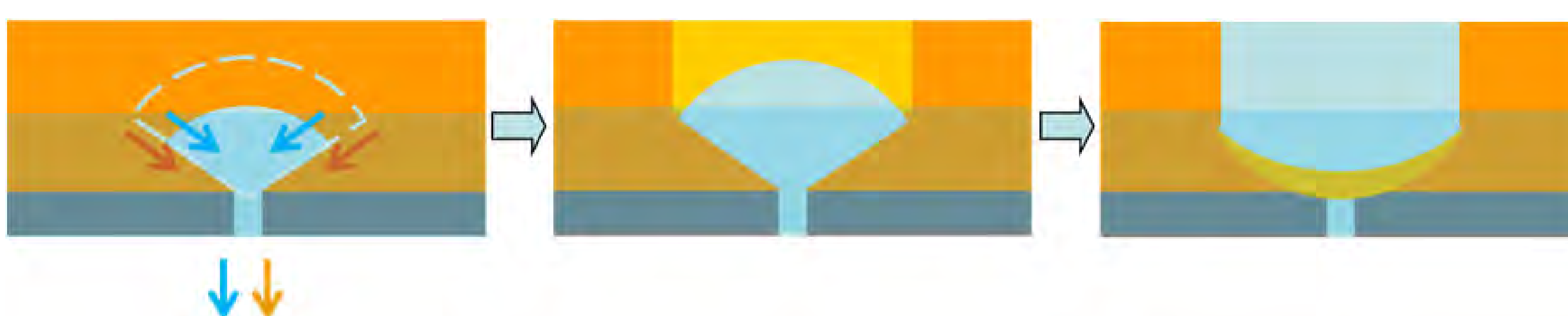


Formation of small cavity due to erosion at some point  
Erosion progressed. Cavity and surrounding loosened area expand  
Failure of cavity ceiling  
By repetition of erosion and failure of cavity ceiling, a cavity moves upward



Sinkhole caused by internal erosion in volcanic "Shirasu" layer in Miyakonojo, Miyazaki (Sept. 2016)

#### Leakage of unbounded soil through a hole



Soil below the ground water level flows with water through the hole. A cavity can expand.  
Ceiling of the cavity reaches near the ground surface.  
Collapse of the soil above the cavity



Simulation of road cave-in accident by laboratory model test

