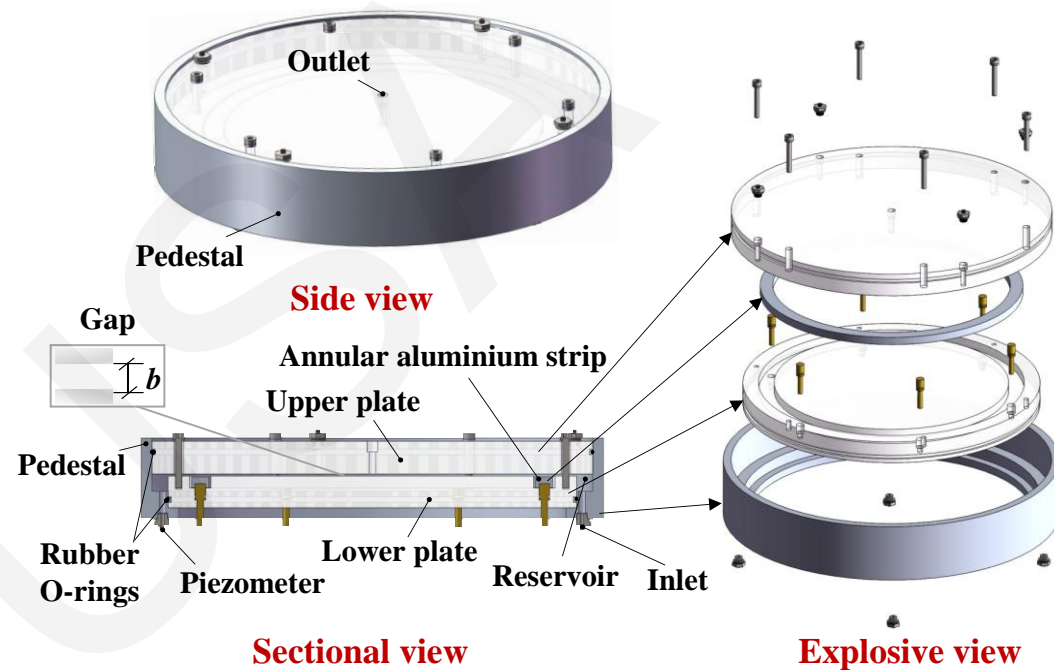
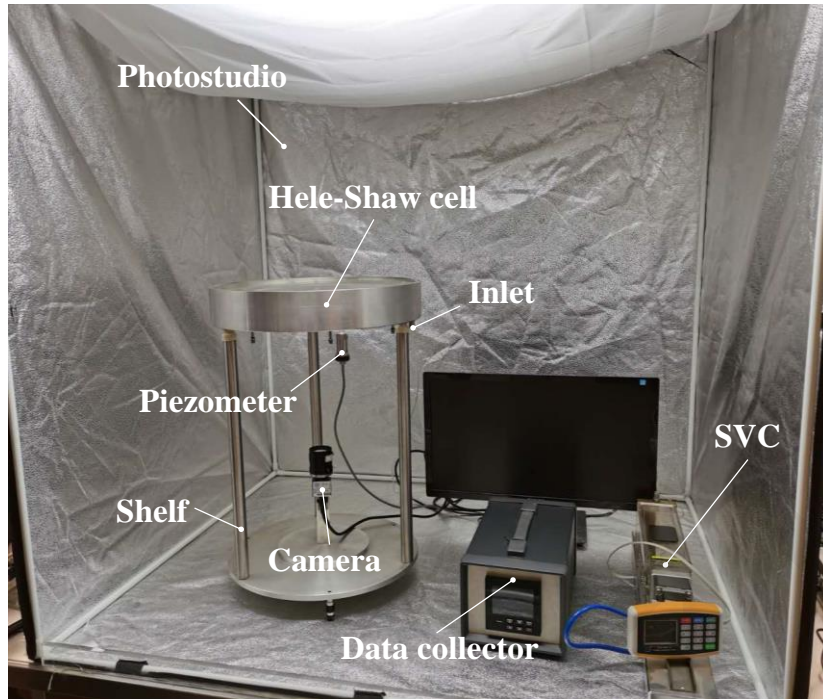


# Visualizing the dynamic progression of backward erosion piping in a Hele-Shaw cell

Gang ZHENG, Jing-bo TONG, Tian-qi ZHANG, Zi-wu WANG, Xun LI,  
Ji-qing ZHANG, Chun-yu QI, Hai-zuo ZHOU, Yu DIAO  
*School of Civil Engineering, Tianjin University, Tianjin 300072, China*

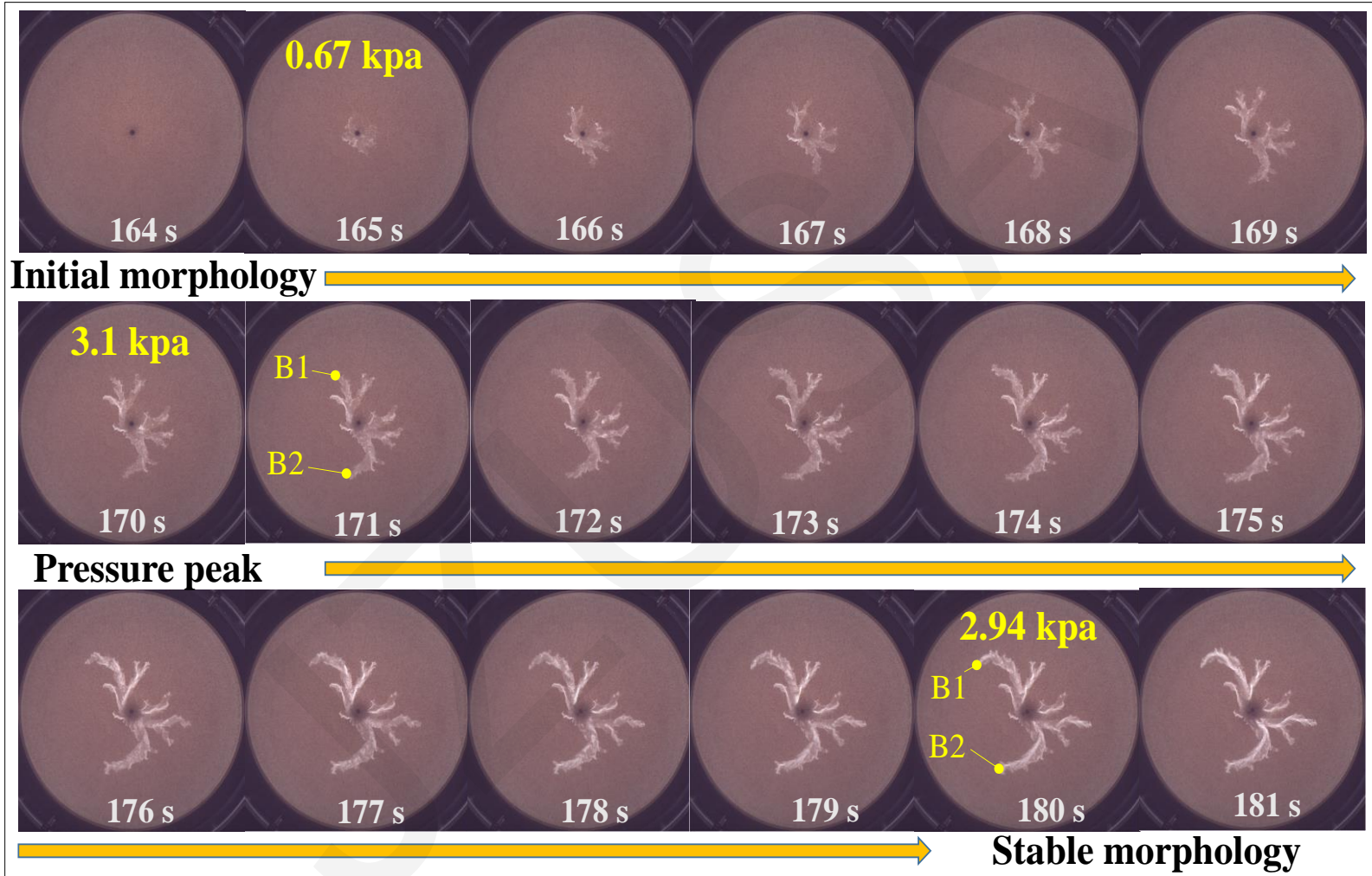
Cite this as: Gang ZHENG, Jing-bo TONG, Tian-qi ZHANG, Zi-wu WANG, Xun LI, Ji-qing ZHANG, Chun-yu QI, Hai-zuo ZHOU, Yu DIAO, 2022. Visualizing the dynamic progression of backward erosion piping in a Hele-Shaw cell. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 23(11):945-954. <https://doi.org/10.1631/jzus.A2100686>

# Hele-Shaw Test



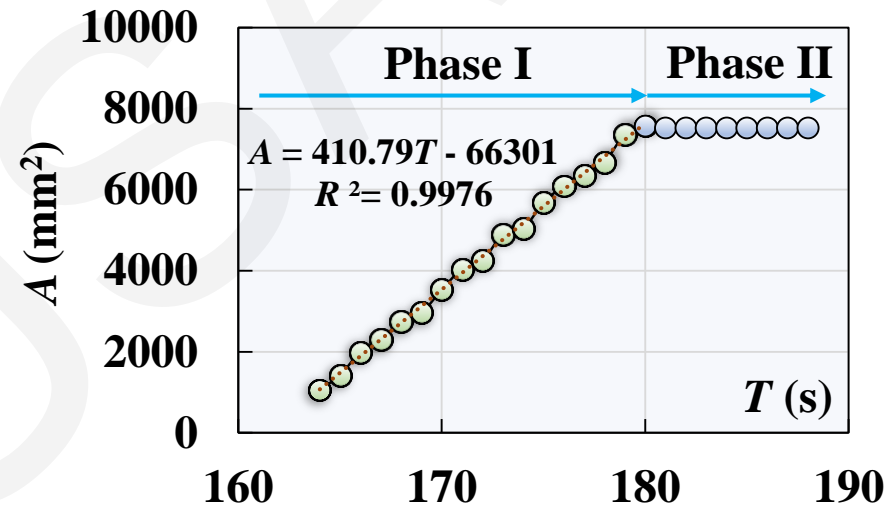
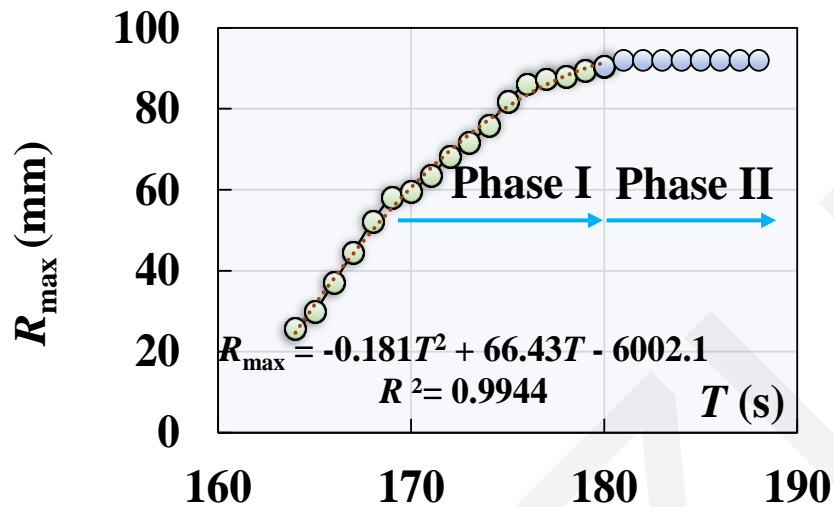
- A Hele-Shaw cell was developed to visualize the dynamic progression of BEP

# Test results



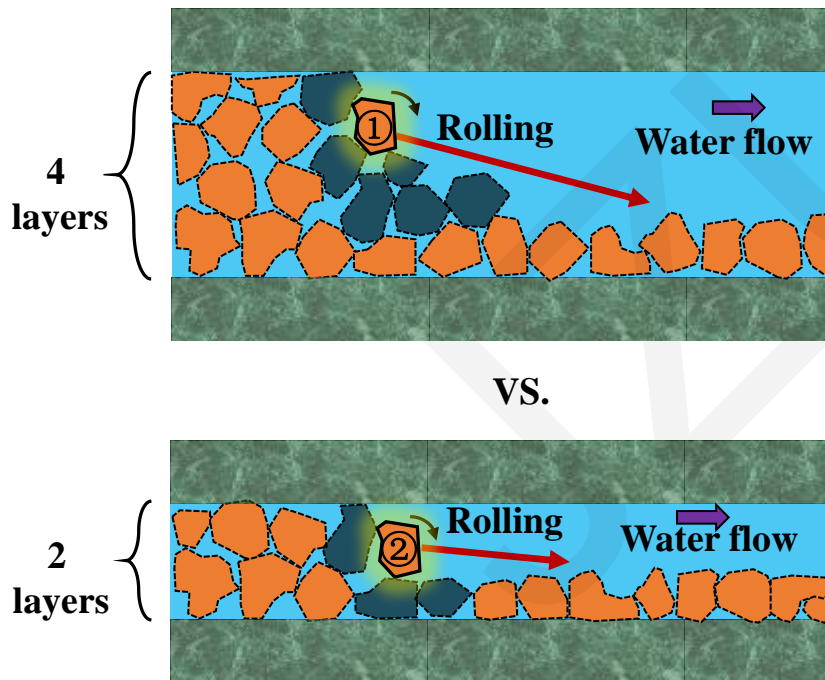
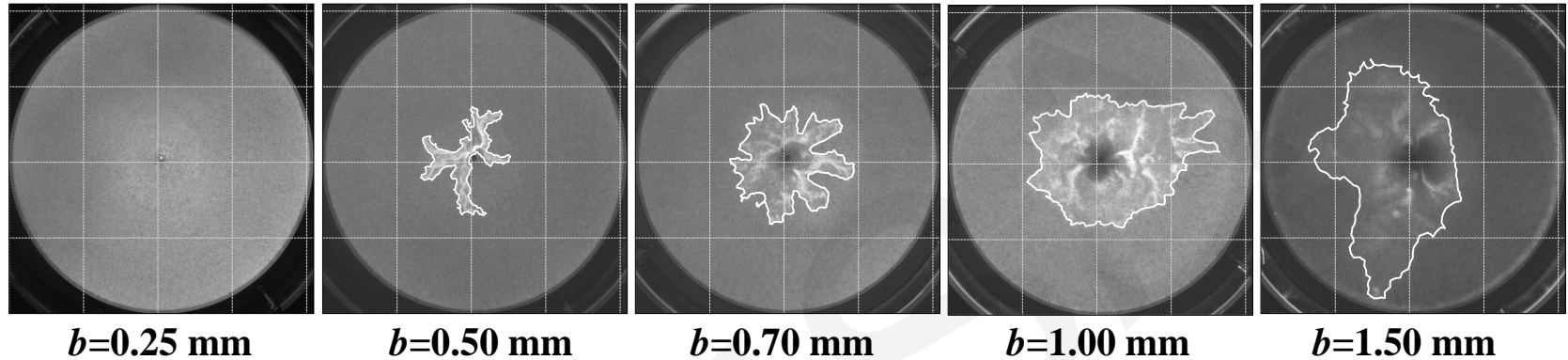
- Morphology and Process of Erosion observed in a typical test

# Test results



- Variations in maximum erosion radius  $R_{\max}$  and erosion area  $A$  with time

# Impact of sample thickness



- Sand grains in a thicker sample may exhibit higher mobility

# Conclusions

1. The process of BEP observed in a uniform, porous medium driven by a sudden flow of water can be divided into a piping progression phase and a piping stabilization phase.
2. The morphologies of erosion under different fluxes of water indicated that a higher flux of water may produce more branched patterns when the gap was not too wide.
3. The granular system of a thicker sample has more degrees of freedom, which increases the mobility of the sand grains.