

3-2 Advancing In Situ Rock Stress Measurement Techniques at the Mizunami Underground Research Laboratory — Case Study: Successful Overcoring Tests Excluding Groundwater —

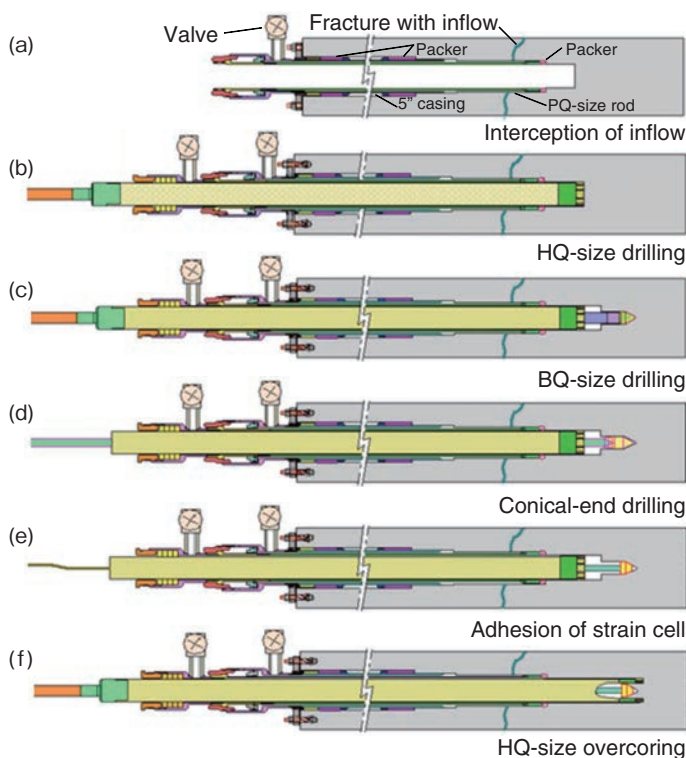


Fig.3-7 Drilling tool to prevent inflow and its measurement procedure

To protect the strain cell from groundwater inflow, an oversized casing was installed at the point of the borehole (HQ-size: $\phi 100$ mm), where the strain cell is attached.

The evaluation of *in situ* rock stress is important in the design and construction of underground structures such as underground power stations and geological disposal facilities for high-level radioactive waste. In fact, *in situ* stress is recognized as the primary factor in the development of an excavation disturbed zone (EDZ). An EDZ is likely to be less stable than the undisturbed rock mass and to provide higher permeability pathways for groundwater flow near excavations.

Hydraulic fracturing tests in a borehole drilled from the surface and overcoring tests in boreholes drilled from a gallery were used to determine the *in situ* rock stresses. In 2009, the Japanese Geotechnical Society standardized the techniques used in compact conical-ended borehole overcoring (CCBO). However, the CCBO technique does not work if groundwater is present because water reduces the effective adhesion of the strain cell to the rock. Furthermore, the occurrence of dinking at the conical-ended overcore does not allow



Fig.3-8 Rock stress measurement
GL.-300 m gallery.

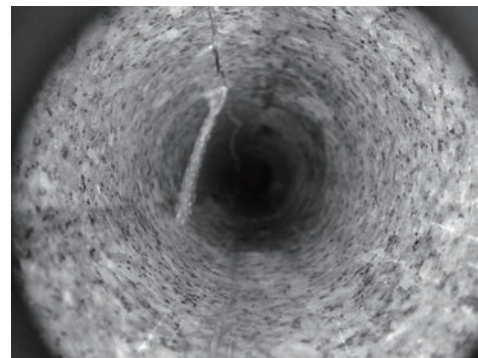


Fig.3-9 Groundwater inflow in borehole
Diameter of borehole: $\phi 100$ mm.

evaluation of the *in situ* stress.

As a countermeasure, we developed a tool to prevent groundwater inflow (Fig.3-7) and adapted the tool for use in CCBO *in situ* stress determination in the GL.-200 m and -300 m galleries at the Mizunami Underground Research Laboratory (Figs.3-8, 3-9). Numerical analysis was used to interpret the stress concentrations around the conical-ended core in this case study. The conclusions are as follows:

- (1) The *in situ* rock stresses were successfully determined using the inflow prevention tool.
- (2) Numerical analysis indicates that tensile stress occurred at the ridgeline of the conical-ended overcore and microfractures developed at this measurement point.
- (3) This work confirms the importance of determining the borehole orientation with respect to the regional stress fields to reduce the risk of core dinking.

Reference

Sato, T. et al., Study of Core Disking Phenomenon on Compact Conical-Ended Borehole Overcoring Technique –A Case Study for Measurement in Borehole with Inflow at Toki Granite–, Journal of MMIJ, vol.129, nos.2-3, 2013, p.59-64 (in Japanese).