Behavior of a Fault arose by a Water Level Variation and its Poroelastic Understanding - a case of a fault near TRIES -

ISHII Hiroshi and Yasuhiro ASAI

Tono Research Institute of Earthquake Science (TRIES), Association for the Development of Earthquake Prediction (ADEP).

How do faults behave by water level variation In the Vicinity of a Fault ?

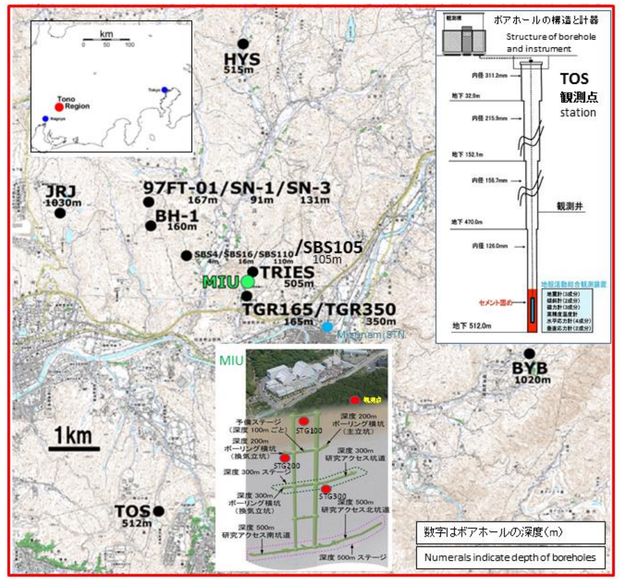
It is important to investigate behavior of active faults from view point of earthquake occurrence, earthquake prediction and stress accumulation. We have made observations in the case of water spring in vertical borehore site and performed pumping experiments close to NNW fault. And we investigated behavior of the fault occurring by water level changes.

Tono Research Institute of Earthquake Science (TRIES) has developed a multi-component borehole instruments for continuous observation. The instrument is equipped with stress meters, strain meters, seismometers, tilt meters, agnetometers, and a thermometer, and we can choose the contents of the instrument as we like. At the present time about 15 borehole stations are in operation. The depth of the deepest borehole is 1030 m. There is a fault near our institute. We have investigated a relationship between a variation of underground water and a behavior of the fault by using geophysical data obtained from borehole observations.

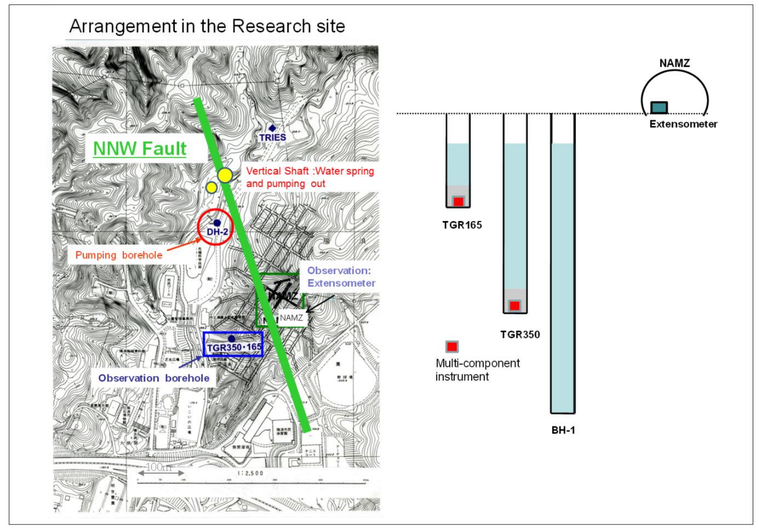
Near our observation stations deep boreholes with diameters of 4m and 6.5m are under construction. And depth is about 500m at the present time.

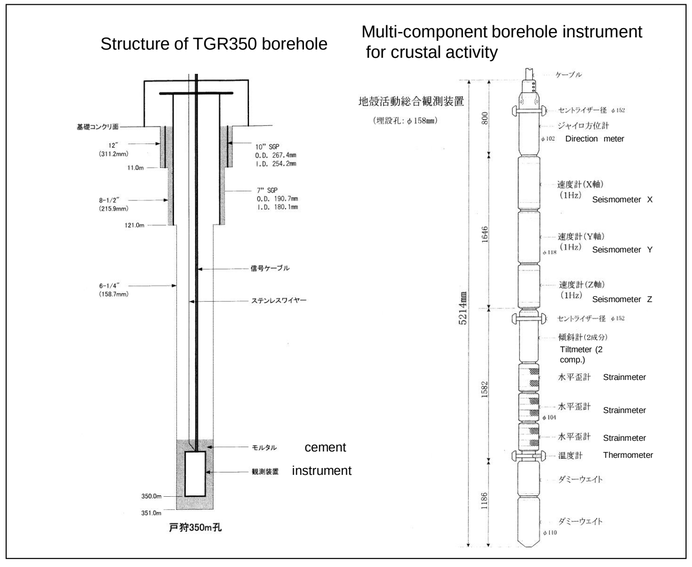
During the construction spring water sometimes happens and we analyzed the data caused by this.

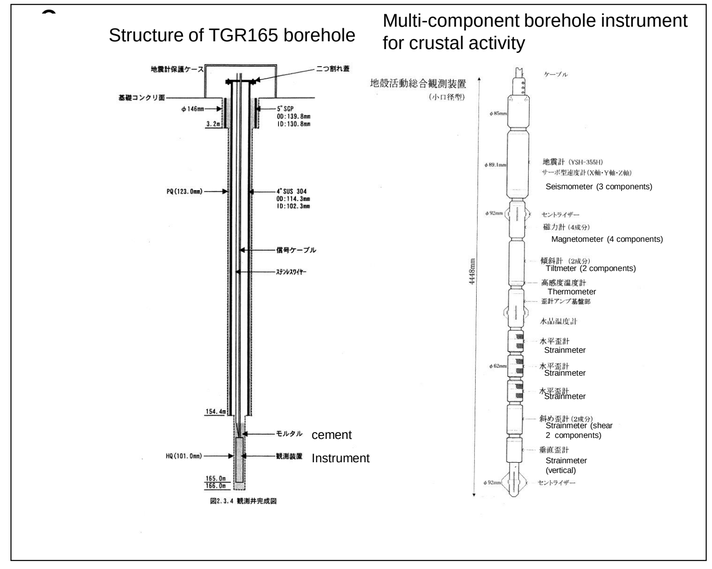
We also made experiments of water pumping out for a borehole near the stations and analyzed the data caused by this.



東濃地震科学研究所のボアホール観測網，MIU: 瑞浪超深地層研究所
MIUの図は、日本原子力研究開発機構(JAEA)のホームページから引用
Borehole observation net of Tono Research Institute of Earthquake Science (TRIES)
MIU: Mizunami Underground Research Laboratory



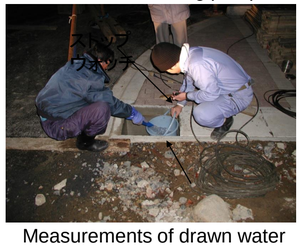




Pictures in the Pumping Experiment

Installation of drawing pump

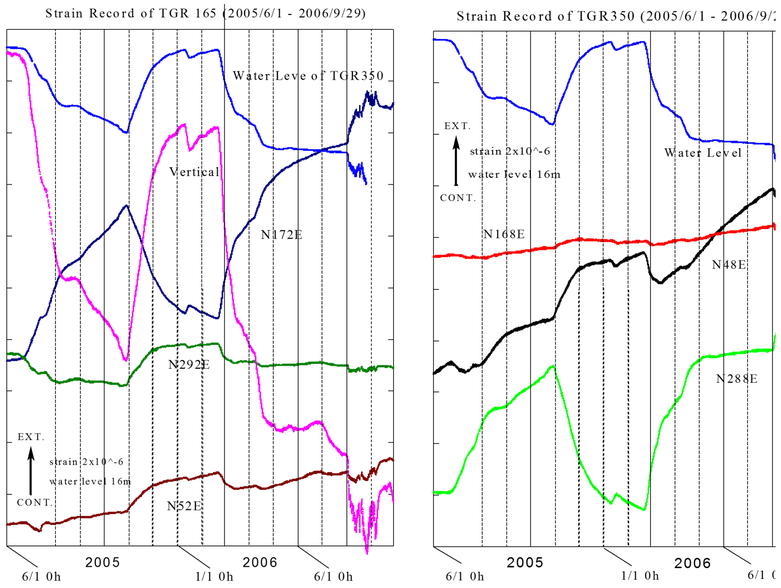
DH-2 borehole（Φ98mm）



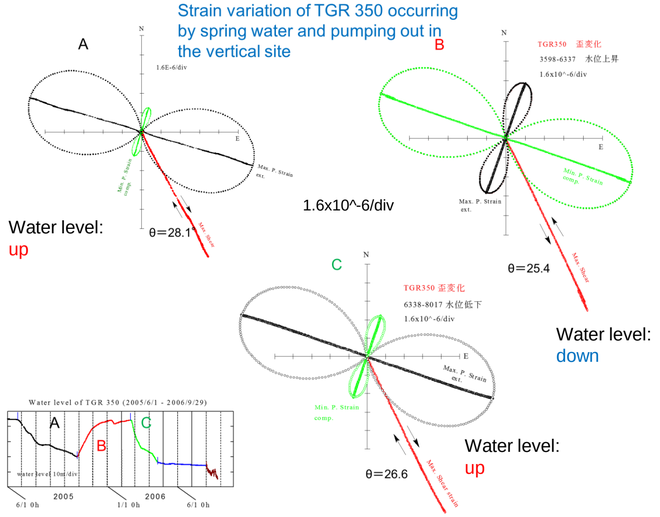
Measurements of drawn water
（Pumping water up at a rate of 40 litter/min）

Drainage of drawn water

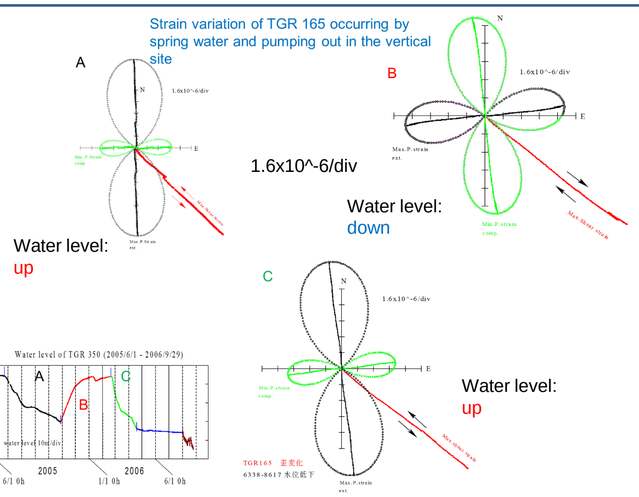
Observed strain data occurring by spring water and pumping out in the vertical sit



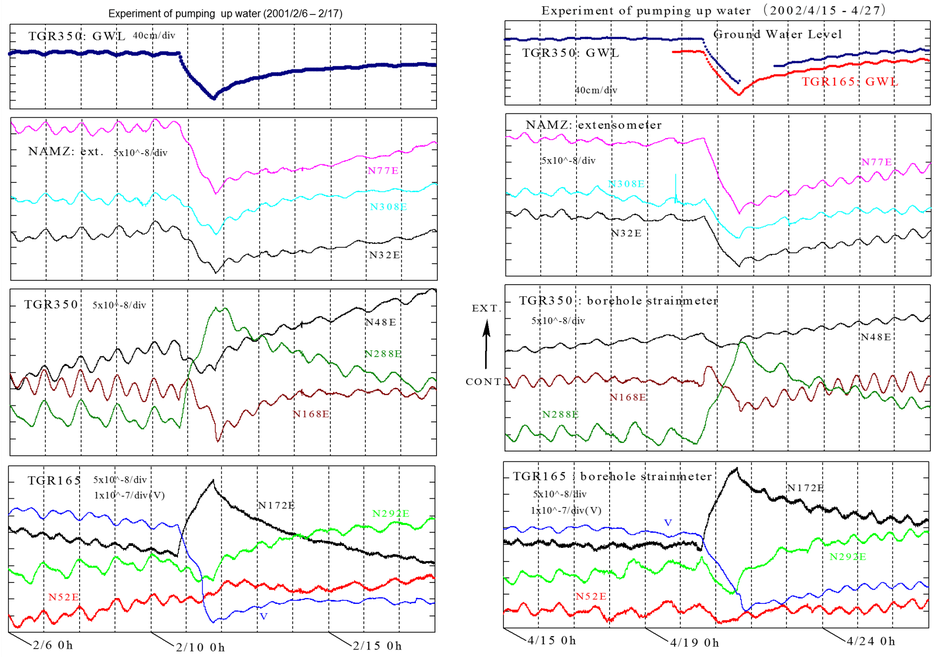
Strain variation of TGR 350 occurring by spring water and pumping out in the vertical site



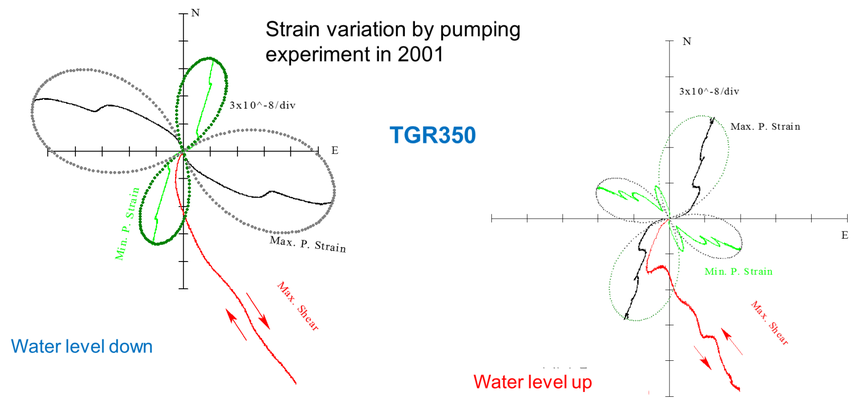
Strain variation of TGR 165 occurring by spring water and pumping out in the vertical site



Strain data obtained by pumping experiments of 2001 and 2002



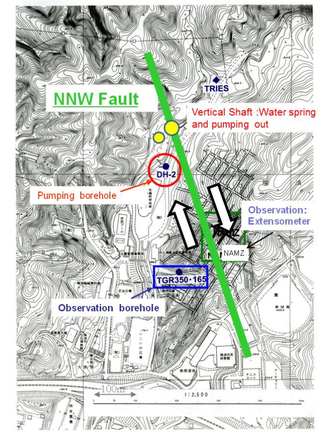
Strain variation by pumping experiment in 2001



Relationship between maximum shear strain (fault movement) and water level of BH-1 borehole

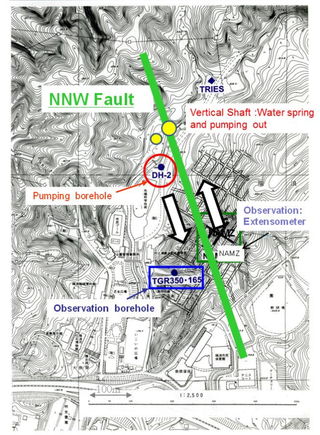
Water level: down

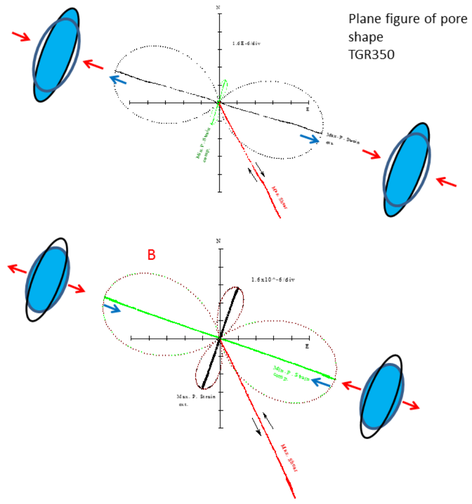
Arrangement in the Research site



Water level: up

Arrangement in the Research site





Summary

The main results obtained are as follows:

1: Water level of TGR350 borehole station with 350m depth decreases by the pumping water and the spring water. Data of the strain meters installed at 350m depth indicate right lateral movements of the fault near TRIES.

2: Data of the strain meters installed at 350m depth indicate left lateral movements of the fault in case of recovery of water level.

3: Strain meters installed at shallower depth (165m) and extensometers installed in sedimentary layer do not indicate such fault movements.

4: We have considered a mechanism explaining the phenomena by using poroelastic understanding.