

Stress measurement at the Kamioka mine using intelligent type strainmeter

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In situ stress measurement was performed with the stress relief technique using the intelligent type strainmeter with a diameter of 22 mm at the Kamioka mine in January–February, 2006. We estimated principal stresses by using strain changes due to overcoring and compared our result with stress measurements determined by other techniques such as the hydraulic fracturing technique.

The Kamioka mine is located in the northern region of Gifu prefecture. A vertical borehole with the depth of 35 meters was drilled at about 1 km north of the Atotsu entrance of the mine. The intelligent type strainmeter was developed by Nagoya University and can observe strain change in the order of $1E-8$. The instrument was installed in the borehole filled with mortar at the depth about 34 meters on January 26, 2006. Mortar was hardened and attached the instrument to the surrounding crust. The instrument can observe strain changes on the lateral plane in the 4 directions, strain changes in the 4 directions inclined to the lateral plane, azimuth of the instrument and temperature change. A battery module and a memory module as well as strainmeters are built in the instrument. Continuous measurement of strain changes can be performed for a few weeks without any connection to the exterior. In this stress measurement, strain changes were recorded every 30 seconds. Overcoring was performed on February 1, 2006. The core obtained had diameter of 85 mm, which was 3.86 times as large as diameter (22 mm) of the strainmeter and was 2.36 times as large as diameter (36 mm) of the borehole.

When we calculate principal stresses with the stress relief technique using the intelligent type strainmeter, it is necessary to consider the influence of stainless of the instrument and mortar on deformation of the core. Mukai et al. (2004) suggested the calculation method of principal stress on a plane under consideration of three layers of stainless, mortar and crust in Seismological Society of Japan Autumn Conference 2004. In this study, we estimated principal stresses on the lateral plane at the Kamioka mine by applying the calculation method to the lateral strain changes due to the overcoring. In addition, we tried determination of three-dimensional stress by using strain changes in the directions inclined to the lateral plane as well as the lateral strain changes.