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BUTSURI-TANSA(Geophysical Exploration)

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[\[Image PDF \(2341K\)\]](#) [\[References\]](#)**Surveys for underground cavities with the HFCSMT system in near-field regions**Hidenori Itai¹⁾²⁾, Shun Handa³⁾, Ryosuke Kitamura⁴⁾ and Yuji Yoshida⁵⁾

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ABSTRACT The surveys for the tunnels at depths of about 15 m and 2 m were made with a high frequency controlled source magneto telluric (HFCSMT) system, of which transmitter is a horizontal loop-coil, in Kouyama and Sueyoshi, Kagoshima prefecture, respectively. These tunnels in Shirasu layer were the air-raid shelters made in the Second World War. In Sueyoshi, the survey was performed for three positions of the transmitter that are at the distance of 20, 40 and 100 m from the receiver.

The changes of the apparent resistivity values related to the cavity are found clearly just upon the tunnels. These changes are intensively larger than those calculated in the 2-dimensional resistivity model based on the MT theory. In Kouyama, a source-receiver distance is so short that the far-field condition is not satisfied, because of the geometry of the survey area and low power of our transmitter. The result in Sueyoshi implies that the apparent resistivity values for underground cavities are strongly amplified in the near-field region for electromagnetic waves from a vertical magnetic dipole.

In order to examine this idea, the experiment was conducted on the farm of Saga University; a cavity of one meter in diameter and of 1.3 m in length was buried at a depth of 2.3 m. The observations were made also for various transmitter-receiver distances. The experiment intensely supports the results of the surveys, because the phenomena that the apparent resistivity contrast increases as decrease the source-receiver distance is clearly seen.

Therefore, the HFCSMT method with the horizontal loop-antenna in the near-field condition is effective to detect underground cavities and tunnels and to estimate their horizontal positions at the shallow part of the subsurface.

Key words: high frequency CSMT, survey of underground cavities, near-field

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