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Magnetic structure of the tsunami inundation area of the 2011 off the Pacific coast of Tohoku Earthquake

OKUMA, Shigeo[1*] ; UEDA, Takumi[1] ; NAKATSUKA, Tadashi[1] ; MITSUHATA, Yuji[1] ; JINGUUJI, Motohara[1] ; UCHIDA, Toshihiro[1]

[1]Geological Survey of Japan, AIST

In June 2012, the Geological Survey of Japan (GSJ) conducted an airborne EM and magnetic survey over the inundation area by the tsunami of the 2011 off the Pacific coast of Tohoku Earthquake, northeast Japan. The purpose of the survey was mainly to map the resistivity of the subsurface structure associated with sea water invasion by the tsunami. Airborne EM data were successful for revealing the subsurface resistivity distribution as an aid for groundwater assessment of the study area.

Aeromagnetic data were also observed by the survey and processed (Okuma et al., 2013). However, it turned out that the magnetic data seem to be contaminated by artificial noise with amount of ˜20nT probably caused by the survey helicopter. To mitigate directional errors (Herringbone effect), the generalized mis-tie control method (Nakatsuka and Okuma, 2006) was applied to the observed magnetic data and magnetic anomalies were reduced onto a smoothed observation surface. According to the compiled aeromagnetic anomaly map of the Southern Sendai Plain, magnetic highs lie over the Cretaceous granitic rocks with high magnetic susceptibilities (˜10^{-2} SI; PB-Rock 21) outcropping on the north-trending Wariyama Mountains, which may constrain the groundwater flow system. The magnetic highs also extend NE and reach the Pacific coast, implying the existence of Cretaceous granitic rocks. In a map of the Matsukawaura area, an obvious magnetic high lies over the northern edge of the lagoon without any signatures of magnetic sources on surface. To better understand the subsurface structures of the survey areas, we applied 3D imaging (Nakatsuka and Okuma, 2013) to the observed magnetic anomalies. The preliminary results of the imaging indicate magnetization highs lie below the Wariyama Mountains and coastal regions between the Torinoumi Lagoon and Ushibashi river mouth in the Southern Sendai Plain. An obvious magnetization high is present below the northeastern edge of the Matsukawaura Lagoon, corresponding to granitic rocks with high magnetic susceptibilities (˜10^{-2} SI; PB-Rock 21) at a depth of around 300m below the surface in a hot spring exploration well. The details of the 3D imaging will be shown in the presentation.

Keywords: airborne EM survey, tsunami, groundwater environment, aeromagnetic survey, magnetic structure, basement