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Shallow geologic structure of the Futaba fault, northeast, Honshu, Japan, based on gravity survey

Kyoko Terui[1*], Shin Koshiya[2], SAKURAI, Syohei[2], Hiroshi Sato[3], Tatsuya Ishiyama[3], Naoko Kato[3], Susumu Abe[4], Motonori Higashinaka[4]

[1]Iwate Univ., [2]Iwate Univ., [3]ERI, Univ. of Tokyo, [4]JGI, Inc.

The Futaba fault is known as a lateral strike slip fault in the Cretaceous period and has a remarkable fracture zone, few hundreds meter wide. The fault trends NNW-SSE and is divided into two branches, western F1 and eastern F2 faults in the northern Abukuma mountains, respectively, and between these faults the Wariyama horst is developed. During early to middle Miocene, E-W extensional stress field caused large normal displacement along the western fault F1 to from a half graben filled with clastic sediments including breccia. In the present, the eastern fault F2 is active, along which left lateral offset with western upheaval ingredient is observed geomorphologically. Thus, the Futaba fault has complicated history of development.

In this study, we conducted gravity survey to clarify the subsurface structure and to model the density structure around the fault. A survey line is east to west across the Wariyama horst and about 12 km long from Shinchimachi, Fukushima Pref., to Marumori, Miyagi Pref. Each interval of observation sites is about 200m in a plain and is about 100m around Futaba fault. The gravity meter of this study is LaCoste and Romberg Model-G824. Error of measurement at each site is less than or equal to 0.02 mGal. The elevation of each site is leveled with an electric level. Errors for leveling are 7mm. We made the normal processing of the data including tidal, drift, terrain, free-air, and Bouguer corrections to obtain Bouguer anomalies, according to the methodology described by Geological Survey of Japan, AIST (2004). We assumed that, applying the empirical equation after Gardner et al. (1974) and Brocher et al. (2005) to P-wave velocity due to a refraction experiment carried out along the same line, the density for the Bouguer and terrain corrections is 2.2 g/cm^3.

The resultant Bouguer anomaly after regional trend correction ranges from 102.5 mGal to 88.6 mGal. The largest value is obtained in the Wariyama horst, where pre-Cenozoic basement is distributed. In the east of the horst, where marine Pliocene formations are exposed, the anomaly decreases to the minimum value gently from the eastern end to west. In the west to the horst, where the main constituent formations are lower to middle Miocene, the anomaly shows two local maximums. They are supposed to be due to concealed half grabens.

We will show the relationship between F1, F2 faults and the main half graben based on the density model.