Detailed gravity survey in western part of Aso Caldera to detect active fault caused the 2016 Kumamoto Earthquake

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1. Background

Surface ruptures associated with the 2016 Kumamoto earthquake continued 4 km into northwestern part of Aso Caldera along an extension of Futagawa fault. Although any active faults had not mapped in this area before the earthquake, trenching surveys showed that these faults had repeatedly moved every 2000-3000 years since the late Pleistocene. A plausible cause of a difficulty to recognize active fault in this area is to be covered by young volcanic layers produced from the center cones. Therefore, we carried out a detailed gravity survey around the endpoint of the surface ruptures in order to elucidate a possibility to evaluate active fault distribution based on basement structure.

2. Survey and Analysis

Target area of this survey is a 2.8km x 2.6km rectangle around the eastern endpoint of the surface rupture which continued from Aso campus of Tokai university to Aso Farm Land. Relative gravity was measured by SCINTREX CG-6 at every 200 m grid point in this area (total of 203 points). After a general processing such as terrain correction and free-air correction to the acquired data, Bouguer anomaly was calculated with assumption density of 2.3 g/cm^3. Besides, some filtering analyses such as regional trend removal and vertical gravity gradient were also applied to detect relative shallow structure.

3. Results

Semicircle low Bouguer anomaly centered to the eastern side is found in the entire target area. It seems to be a part of the low anomaly on the northern slope of the central cones suggested by Komazawa (1995). Residual anomaly removed curvilinear regional trend shows followings: 1) Western edge of the low anomaly shifts in dextral on a line of the surface rupture. 2) In the low anomaly zone, distribution pattern is different from each other on the both side of a line of the surface rupture. Since vertical gravity gradient also shows the same pattern, it may reflect the basement structure cumulatively displaced by Futagawa fault. On the other hand, there is N-S trend low anomaly instead of such ENE boundary under Janoo volcano east off the surface rupture. These results suggest a possibility to evaluate active fault distribution also under young volcanic rocks by focusing on basement structure by gravity survey.

Keywords: Aso Caldera, Gravity survey, Active fault, Kumamoto earthquake, Surface rupture, Basement structure

