

Stress field and pore-pressure distribution in seismogenic zone of Kyushu, Japan inferred from and focal mechanisms

CHIKURA, Hiromi¹, MATSUMOTO, Satoshi^{1*}, OHKURA, Takahiro², MIYAZAKI, Masahiro¹, ABE, Yuki², SHIMIZU, Hiroshi¹, Inoue Hiroyuki², NAKAMOTO, Manami¹, Shin Yoshikawa², YAMASHITA, Yusuke¹, UEHIRA, Kenji¹

¹Institute of Seismology and Volcanology, Kyushu Univ., ²Aso Volcanological Laboratory, Kyoto University

In the upper crust of Kyushu district, Japan, an area with high seismic activity is found in the middle part. This area is called Beppu-Shimabara graben (B-S area) because of existence many normal faults in this region. Many active volcanoes exist (i.e. Unzen, Aso, Kuju, Beppu), and historical large earthquakes occurred in this region. The major mechanism of earthquakes in the Kyushu district is strike slip type. Generally, extensional (minimum principal) stress is in north-south direction in Kyushu. On the other hand, microearthquakes normal faulting also occurs in B-S area. Basic question is why seismic activity is high and stress field changes in B-S area.

Elastic and inelastic feature of crust could be inferred from both of stress and strain field. We performed stress tensor inversion by using polarity data of first motion at direct P wave arrival. The data were obtained at stations operated by NIED, JMA and Kyushu University. In addition, we deployed more than 35 temporal seismic stations around the graben in order to determine the stress field. Directions of principal stresses are obtained at spatially distributed grid points every 20 km interval. The minimum axes of the principal stress are generally oriented in NNW-SSE direction. The maximum axes are almost in WSW-ENE direction. The stress rates are greater than 0.75 at most of the point in B-S area, implying the maximum stress is close to the moderate principal value. In addition, the minimum axes in the graben rotate counterclockwise. This stress field change requires a mechanism either relaxing the stress in east west direction or vertically loading in this region.

Following Terakawa et al. (2010), we estimated average pore-pressure at each grid point

They estimated fluid pressure from variation of the fault plane under the uniform stress field. Assuming fault slip controlled by Coulomb failure criterion, we obtain the pore fluid pressure distribution and its average value at the each grid point. The high pressure area is found around the fault zones. On the other hands, B-S area is in the low pressure condition. Two major high seismicity regions in Kyushu district have different feature each other. The seismic activity in B-S area is under the high stress ratio and the low average pore-pressure. On the other hand, the fault zones have opposite feature to B-S area. This suggests the possibility that the high seismic activity in B-S area is caused by low strength of the medium

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