Mineralogical characteristics of fault rocks in the aftershock regions of the 2000 Western Tottori earthquake and its spatial distribution

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A large earthquake (*Mw*6.6) occurred on 6 October 2000 in the western part of Tottori Prefecture, southwestern Japan. The main shock was considered as an almost left-lateral strike-slip event with the hypocenter located at 35.269 ˚N and 133.357 ˚E. The rupture process and slip distribution of the main shock was estimated from coseismic strong motions and geodetic data. These previous studies suggested that slip of the main shock mainly occurred in the southern part of the aftershock regions. Furthermore, Yukutake et al. (2007) estimated regional stress field before and after the main shock using aftershock focal mechanisms, and proposed that southern part of the aftershock regions may be dramatically weak in friction compared to northern and central parts. However, there are currently few researches attempting to understand regional slip behaviors of both main shock and aftershocks in association with spatial heterogeneity of physical properties of fault materials.

Mineralogical characteristics of rocks is one of the valid candidates that is likely to dominate its physical properties, and in general, increase in amount of frictionally weak minerals can reduce frictional strength of fault rocks. For understanding spatial slip behaviors in aftershock regions of the 2000 Western Tottori earthquake, we first need to investigate spatial variations in mineral composition of fault rocks. We collected more than 100 bulk rock samples from 14 fault-related outcrops, that distribute in northern, central, and southern parts of the aftershock regions. We then acquired XRD profiles of the powdered samples with internal standard (Al_2O_3) of 20 wt.%, and estimated the amount of minerals by using the RockJock software. The results clearly indicate that intact host rocks have similar mineralogical features regardless of sampling locations; they are granitic rocks composed of quartz, K-feldspar, and plagioclase. In contrast, mineral compositions of fault rocks show different characteristics by locations. In northern part of the aftershock regions, fault rocks are poor in K-feldspar and plagioclase and are rich in halloysite. In central part, fault rocks are poor in K-feldspar and plagioclase and are rich in illite. In southern part, fault rocks are poor in plagioclase and are rich in halloysite. These information tell us the representative mineralogical features of fault rocks in each part of the aftershock regions. Future friction experiments, by using representative fault rock samples under in-situ conditions, will give us a direct glimpse into the spatial variations of frictional properties in the aftershock regions of the 2000 Western Tottori earthquake, such as frictional strength and its velocity dependence. All of these information, not only seismological data but also mineral composition and physical properties of fault materials, should be incorporated for understanding the spatial heterogeneity of slip behaviors of the main shock and aftershocks of the 2000 Western Tottori earthquake.

Keywords: The 2000 Western Tottori earthquake, Fault rock, Mineral composition, XRD analysis

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