

The 1997 Kagoshima earthquake fault cuts through the north-dipping Shimanto Supergroup

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The 1997 Kagoshima earthquake (M6.6; the 1st event) occurred in southern Kyushu, Japan, subsequently involving another earthquake (M6.4; the 2nd event) in the vicinity two months later. The both focal mechanisms show lateral fault type with a tensional axis of NW-SE direction, which is consistent with their aftershock distributions. This source area has shown no active fault identified. The western offshore of the events is located at the northern margin of the Okinawa trough, where backarc spreading is on-going; however the seimogenic background of the events still remains unknown. Here we understand the seismotectonics in this area based on the analyses of aftershock data and seismic reflection data.

We have early aftershock data (29Mar1997 - 19Jun1997) of the Kagoshima University and the catalogue (2001 - 2009) of NIED Hi-net, the nation-wide dense network in Japan. We relocated the hypocentres using a common velocity structure to compare aftershock distribution through the terms of both datasets. The relocated hypocentres show existence of seismic gap areas throughout the dataset terms. There is a large seismic gap close to the mainshock, which is consistent with large coseismic slip area. Also other seismic gaps like narrow band are observed.

Next we analysed the seismic survey data. We have the dataset of the seismic survey conducted in 2000, of which the survey line runs in the direction of NNW-SSE across the 1st event fault. We applied the developed Multi-Dip CRS method that is powerful tool to clarify seismic image and delineate fine reflections. The obtained seismic crosssection shows that north dipping reflectors are dominant; especially there is a remarkable reflector in the depths of 8-10km in the north of the fault. The north dipping reflectors become obscure around the source fault.

The relocated aftershocks are superimposed with the crosssection. The aftershocks distribute vertically but include seismic gaps which correspond to the narrow band gaps described above. Interestingly the seismic gaps are located in the extension of the north-dipping reflectors, implying that the north dipping structure in the subsurface may control the aftershock activity. We interpret the results as follows. The common dip direction would indicate that the north dipping structure is related with the Shimanto Supergroup formed in the Cretaceous. The seismic section shows that near-vertical fault plane cuts through the Shimanto Supergroup, that is, the rupture occurred on the plane suitable to the present stress field, almost independent of the existing Cretaceous structure. In addition, the fault would be relatively recently formed since the fault displacement on surface has not been confirmed. Thus the 1997 event may be seismic activity that is attributed to the eastward block movement following the recent backarc spreading of the Okinawa trough.

Keywords: Seismic Reflection Survey, The 1997 Kagoshima earthquake