

Fault zone development in the aftershock area of the 2016 Kumamoto earthquake, Kyushu, Japan

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The Futagawa and the Hinagu fault zones were activated at the time of the 2016 Kumamoto earthquake. To understand how fault zones have developed over a long period of time, it is necessary to observe fault zone structures at the macro to microscope scales. We carried out field surveys in the NE-SW trending aftershock area of the earthquake, and analyzed the development of fractures, slip senses, and mineral assemblages at the fault zone.

The main shock (Mw7.0, April 16) occurred along the ENE-WSW trending Futagawa fault. On the other hand, the foreshocks (Mw6.2, April 14; Mw6.0, April 15) occurred along the NE-SW trending Hinagu fault. After the earthquake, many NE-SW~ENE-WSW trending surface ruptures were found along the Hinagu fault. They indicated dextral slip sense. In addition, a bed composed of lower terrace deposits was folded at the north end of the Hinagu fault. The fold hinge was plunging to NE.

Brittle fault rock zones were distributed in the Higo metamorphic rocks (Permian-Triassic). Andesite dikes (Neogene?) were intruded, also deformed along the faults. Most fault planes with NNW~NNE strike, indicated dextral, sinistral, normal and reverse slip senses. XRD analysis showed that the foliated cataclasite derived from pelitic-psammitic gneiss is mainly composed of smectite, kaolinite, chlorite and laumontite. The foliated gouges are abundant in smectite, contain chlorite and laumontite. NE-SW striking remarkable brittle shear zone was also recognized in the Hinagu Formation (Early Cretaceous), indicated dextral slip sense.

Viewed from the kinematics and the alteration process, the macroscale fault zone in the aftershock area has a long history of deformations. Parts of them were selected, and activated at the time of the 2016 Kumamoto earthquake.

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