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Significance of the Tanna Fault in the convergence tectonics around the northeastern Izu Peninsula

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The Tanna fault is one of the most active faults in Japan with a left-lateral slip of 2m/1000 year over 500 hundred thousand years (Kuno, 1936). On the other side of the Ashigara plain, parallel to the Tanna fault, there exists the Kozu-Matsuda fault whose vertical slip rate is 2-3m/1000 year. In this report, we present new evidence that shows the Tanna fault has a dip slip component where the eastern side subsides against the western side, and propose an idea that the area enclosed by the Tanna and Kozu-Matsuda faults has been undergoing buoyant subduction.

Having shown that the inclination angle of the eastern flank of Hakone Volcano is steeper than the western flank, Suzuki (1971) suggested it indicates an inclining of the edifice of Hakone Volcano to the east. Using 50m-mesh digital altitude data around Hakone volcano, we calculated average inclination angle at each of the mesh and found that the difference in the inclination angle between the eastern and western parts is seen not only in Hakone volcano, but in the regions to the north and south of the volcano, and the boundary in the difference corresponds to the Tanna fault.

It was already pointed out by Kuno (1936) that motions of the Tanna fault had dip slip components besides left lateral components, but no one has ever noted significance of the fact. We suggest that the vertical slip on the Tanna fault as well as the thrust movement of the Kozu-Matsuda fault can be understood by supposing that the area between the two faults has been subsiding (we call the area the Manaduru block here), and consider that the subsidence manifests buoyant subduction of the Manaduru block associated with the motion of the Philippine Sea plate. Tsuboi (1932), who analyzed crustal deformation caused by the 1930 Northern Izu Earthquake, estimated that the land on the western side of the Tanna Fault displaced at the earthquake. This estimate is concordant with the idea that the Manaduru block constituting the eastern side of the fault has been moving stationary towards north and the western block that has been usually dragged by the motion rebounds at the occurrence of the earthquake. However, since the slip rates on the Tanna and Kozu-Matsuda faults are about one tenth of the relative plate velocity of the Philippine Sea plate, it cannot be considered that the Manduru block moves with the Philippine Sea plate riding on the plate. We speculate that the difference in the motions may provide a clue to elucidate fault model of the so-called Odawara earthquake.

Keywords: Izu Peninsula, Tanna fault, Koju-Matsuda fault, Hakone volcano, Inclination, Buoyant subduction