Structure and behavior of the Itoigawa-Shizuoka Tectonic Line active fault system, central Japan, in Quaternary time

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The Itoigawa-Sizuoka Tectonic Line (ISTL), central Japan divides NE Japan and SW Japan, is one of the highest average slip rate fault systems in the Japanese islands. Sediments in the zone of Miocene rift basins along the Japan Sea side have been strongly folded and faulted, since the tectonic inversion occurred in Early Pliocene time. Recent surface deformation and the subsurface geometry of the fault system are to be studied to understand the process of intra-arc deformation caused by the ISTL. This research aims to clarify the structure and the behavior of active faults. The geophysical exploration methods such as shallow seismic reflection profiling and subsurface structure sounding were used to clarify the structure of the fault; geomorphological methods were used to clarify the behavior of, and the surface deformation associated with, the fault.

Geometry and sense of slip of ISTL are different in the northern, central and southern. Six study sites were selected along the length of ISTL active fault system from the northern part to the central part. The ISTL northern part is an east-dipping, low-angle fault, on which thrust slip is dominant. The thrust front migrated (jumped) basin-ward from the initial thrust front to the newly created fault as a detachment thrust in or at the base of Pliocene-Earliest Quaternary basin-fill sediments. The central of the northern ISTL, the master fault of the ISTL is also an east-dipping, low-angle fault, but the sense of slip changes from thrust slip to oblique slip (left slip plus thrust slip). An isolated depression develops on the hanging wall of this master fault. South of this basin, oblique slip on the ISTL is partitioned at shallow depths (probably 1-2 km) into a strike-slip fault and thrust faults, whereas to the north of this basin it is not partitioned. It was shown by model calculations that the formation of this basin resulted from local strain concentration at the transition between the slip-partitioning segment and the oblique-slip segment. Slip partitioning occurs also on the central ISTL. However, the dip of this portion of the ISTL is to the west; it is opposite to the dip of northern portions. Therefore, a large geometrical discontinuity exists between northern and central, although the detailed position and the structure of this discontinuity are unknown.