Structural Inhomogeneity and Strain-Stress Accumulation in the Niigata-Kobe Tectonic Zone (Atotsugawa Fault Atea)

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Under the framework of the ongoing earthquake prediction research program, an integrated geophysical observations have been undertaken in and around the Atotsugawa fault system (AGF), central Japan. The AGF, located within a zone of high strain rate (the Niigata-Kobe Tectonic Zone) running in the northern part of central Japan with ENE-WSW direction, is responsible for the 1858 Hietsu earthquake of M 7.0. This observation project, which started from 2004, consists of dense seismic observation, magnetotelluric survey, GPS measurement and refraction/wide-angle reflection experiment. Major finding so far obtained is a very low velocity anomaly (~5%) situated in the lower crustal part beneath the AGF. The upper crustal structure around the AGF is characterized by high velocity (6~6.3 km/s) patches with less seismic activity. They are 10~20 km in size and well correlates with damaged area by the Hietsu event. These high velocity patches probably represent asperities of this earthquake. The seismic activities are concentrated in the peripherals of these patches where remarkable scatterors were imaged both from passive and active seismic sources. Both edges of the AGF are bounded by low velocity areas dominated by the present volcanic activities. suggesting the anelasticites associated with the volcanism may determine the size of this fault.

The low velocity body in the lower crust extends upward to a boundary part of the high velocity patches. This upwelling part shows low resistivity, indicating the existence of fluid. The GPS measurement indicates almost the entire part of the AGF is locked although some ambiguity remains in an area not well covered by our array. Present results suggest that the prominent lower crustal velocity anomaly controls the loading process to the AGF and the stress concentration at the boundaries of asperity with aid of fluids.