# How close to the Kobe Earthquake did seismology come?

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Ten years have passed since the 1995 Kobe earthquake. However, how did our insights into this epoch-making inland earthquake deepen? It is worth reviewing researches during these 10 years and pointing out unsolved problems. Here I review researches related to crustal deformations and tectonics, and present questions that I have thought in my mind.

The biggest controversy was whether the fault motion occurred right beneath the zone of intensity 7 in the Kobe city. Hirata et al.(1996) showed that little aftershocks are located beneath this zone based on the joint observation of aftershocks by universities. Hashimoto et al.(1996) derived the same conclusion from the analysis of geodetic data. Yoshida et al.(1996) and Horikawa et al. (1996) concluded that slip occurred in a deeper part beneath the Rokko Mountains on the basis of joint inversion of teleseismic, strong motion and geodetic data There is no doubt that there is no fault motion that radiated seismic waves of large amplitude from the seismological standpoint. Ide and Takeo (1997) estimated frictional parameters based on slip distribution.

Many inversion studies assume fault plane a priori using other information and understanding of configuration of source faults has not been well established. They have similar fault planes which dip northwest-ward on the Kobe side and southeast-ward on the Awaji side. The largest difference is found beneath the Akashi strait. Hashimoto et al's(1996) model has a discontinuity, and Cho and Nakanishi (2000) obtained the stepover of fault segments shallower than 9km by inverting three-dimensional moment tensors. On the other hand, Ozawa et al.(1997) assumed continuity between segments on both sides. Koketsu et al.(1998) concluded such a connetcting fault is responsible to the displacement of the Akashi Kaikyo Bridge. However continuous fault model has a segment whose strike is inconsistent with the mechanism of the main shock and little aftershocks were found with the fault plane of this strike.

There is a widespread thought that seismically active period started in the southwestern Japan at the Kobe earthquake. This is based on the history where inland earthquakes have occurred about 50 years before interpolate earthquakes along the Nankai trough. The problem is its mechanism. Pollitz and Sacks (1997) proposed that stress disturbance due to the 1944 Tonankai and 1946 Nankai earthquakes is transmitted through the mantle for 50 years. Hori and Oike (1999) considered that the stress on the fault close to the critical state decreases and that fault ruptures before the next Nankai earthquake due to the stress accumulation afterward. Hashimoto (1998) pointed out that stress accumulation is high on the Rokko fault system on the basis of analysis of geodetic data. Iio (1996) thought that slow slip on a detatchment beneath the Tamba Highland loaded the Rokko fault system. Iio(2004) proposed that the unslipped zone of the Rokko fault in 1596 had been loaded and slipped in 1995. Numerical simulation is expected to contribute to the research of this problem so much.

The motion of the Rokko fault system must be closely related to the building of the Rokko Mountains. When we calculate vertical movements for the estimated fault models, we get larger uplift in the western part than in the eastern part where the present summit resides. This suggests the contribution of other earthquakes than the Kobe earthquake, or there might be slow deformation that raises the Rokko Mountaints. The measurement of uplift since 1995 is essential to resolve this problem.

I presented several unsolved questions related to the Kobe earthquake. These are considered to be basic ones in seismology and related sciences. Everyone has other important questions from his/her own points of view such as postseismic deformations and crustal structure etc. I expect answers to these question will be given during the next decade.