Intraslab thrust faults imaged along the eastern Nankai subduction zone: Causes of 2004 large earthquakes off SE Kii Peninsula?

Jin-Oh Park[1]; Tetsuro Tsuru[2]; Koichiro Obana[2]; Takane Hori[2]; Shuichi Kodaira[2]; Yoshiyuki Kaneda[3]

[1] JAMSTEC, IFREE; [2] IFREE, JAMSTEC; [3] JAMSTEC,Frontier,IFREE

The Nankai subduction zone off southwest Japan is known as one of the best-suited convergent plate margins for studying subduction zone earthquakes. Historically, large earthquakes along subduction zones have occurred with a recurrence interval of 100-200 years [Ando, 1975] along the Nankai Trough margin. The last two large earthquakes that occurred off the Kii Peninsula were the 1944 Tonankai and 1946 Nankaido events. Recent multichannel seismic (MCS) reflection profiles revealed steeply landward-dipping splay faults [Park et al., 2002] and a trough-parallel subducted ridge [Park et al., 2003] in the 1944 Tonankai coseismic rupture area of the eastern Nankai subduction zone off southeast Kii Peninsula. In September 2004, unprecedented, large intraslab earthquakes (M 6.9, M 7.4, M 6.4), whose epicenters are located beyond seaward edge of the 1944 Tonankai coseismic rupture area, occurred in the vicinity of the trench axis off southeast Kii Peninsula. In order to improve seismic reflection image quality around the rupture area of the 2004 events, we reprocessed the previous MCS data acquired around the 2004 events. Moreover, we collected new MCS reflection data around the rupture area of the 2004 events on board the R/V Kairei (KR04-13 cruise) of the Japan Agency for Marine-Earth Science and Technology in October 2004. We used a ~5-km, 204-channel streamer and a 12,000 cubic inch (~200 L) air-gun array. Receiver spacing was 25-m, yielding 51-fold coverage at 12.5-m CDP spacing. In this paper, we show several migrated MCS images of intraslab thrust faults cutting through the subducting oceanic crust from the uppermost mantle, and discuss their implications for the 2004 earthquakes generation. We propose a hypothesis that the trough-parallel subducted ridge has been strongly coupled with upper crustal rigid backstop, and thus might produce those intraslab thrust faults seaward of the ridge.