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A comparison of the modern Nankai megasplay fault and the exhumed ancient megasplay fault, the Nobeoka thrust

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Megasplay fault branched from plate boundary megathrust in subduction zone is located around the border between outer and inner wedges and is considered to cause great earthquake and tsunami such as 1960 Alaska earthquake, 1944 and 1946 Nankai-Tonankai earthquakes, and 2004 Sumatra earthquakes. Therefore, understanding the fault mechanics of the megasplay faults is essential toward assessing their role in the plate boundary processes and seismo-tsunamigenesis. Seismic reflection studies for the megasplay faults in 2D and 3D in the Nankai forearc present the reflector with negative or positive polarities of various amplitude for the megasplay fault, and suggest complicated petrophysical properties and condition of the fault and its surroundings. The Nankai megasplay fault at a depth of ~5km is going to be drilled and cored by Integrated Ocean Drilling Program, NantroSEIZE experiments and is expected for great progress of understanding of the fault mechanics. Deep portion of the megasplay fault and its connection to the plate boundary megathrust is, however, impossible to be accessed by direct drilling. Far and near field geophysical observation is therefore only way to access the modern and active megasplay fault. On-land exhumed and fossilized megasplay faults, on the other hand, give a clue for the fault mechanics when they were active in depth although the exhumation and fossilization process modifies their primary properties due to physico-chemical weathering and crack opening by unloading. Our previous studies from the Nobeoka thrust in Kyushu, southwest Japan present well-preservation of primary faulting processes and clear contrast of physical property between the hanging wall and footwall.

We have conducted the seismic, drilling, coring and logging investigation into the Nobeoka thrust to the depth of ~250 m including ~40m hanging wall and ~210 m footwall. The coring was ~99% recovery and full logging was successful. The result of the logging together with triangular S-wave vibro-seismic array investigation presents a clear contrast between the hanging wall and footwall. The results indicate how the fossilized megasplay fault is useful to investigate the primary properties in depth, excluding the secondary effects associated with exhumation and surface weathering.