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アウト・オブ・シークエンス・スラストにおける岩石物性：九州四万十帯延岡衝上断層
Physical properties at out of sequence thrust: Nobeoka thrust, Shimanto Belt, Southwest Japan

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To understand information from geophysical survey combining with natural rocks, direct measurement of physical properties on natural rocks is essential. Mega-splay faults cutting whole accretionary wedges in the latest stage of deformation history in subduction zone are commonly observed in seismic profiles. The mega-splay faults are developing around the shallower portion of seismogenic zone along subduction plate interface, and penetrating to ocean floor in transition zone with higher angle of slope topography between outer and inner wedges. Therefore, the mega-splay fault can be a boundary of physical properties of sediments. The on-land analogue of the mega-splay faults is considered to be an out-of-sequence thrust, which cuts paleo-thermal structures. In this study, we measured physical properties of hanging-wall and footwall of the Nobeoka thrust, which is an on-land out-of-sequence thrust. The samples were cored by Nobeoka thrust drilling project (NOBELL).

Nobeoka Thrust is a major geologic boundary between the Northern and the Southern Belts of the Shimanto accretionary complex in Kyushu, Southwest Japan. The paleo-maximum temperature of hanging-wall and footwall is about 320?C and 250?C, respectively. About 70?C difference in temperature is observed at the thrust. The hanging-wall is composed of phyllite. Major component of footwall is tectonic melange of terrigenious sediments and tuff. Damage zone related to Nobeoka thrust is developed in the footwall. Minor faults with carbonate and quartz veins are densely observed in the damage zone. Cataclasite is also identified in the damage zone in some part. Core was drilled about 250m long and Nobeoka thrust is located about 40m of depth in the core. The damage zone is ranging in the depth from about 40m to 110m. We classified samples into three, phyllite in hanging-wall, cataclasite and melange in footwall. 5 samples for each were tested to get physical properties.

We have conducted P-wave and S-wave velocity measurement under controlled effective pressure. Effective pressure ranges from 5MPa to 65 MPa with 5MPa interval. In the laboratory test, change in pore water volume and axial displacement were recorded. Porosity and density were also measured.

Obtained P-wave and S-wave velocities for phyllite, cataclasite, and melange are 4.71-5.01 km/s and 2.78-2.57 km/s, 4.42-4.76km/s and 2.38-2.48 km/s, and 4.48-4.76 km/s and 2.34-2.44 km/s, respectively. Vp/Vs for cataclasite is relatively low (1.85-1.91) than that for others (1.90-1.95). Porosities for phyllite, cataclasite and melange are 1-5%, 2-10%, and 2-8%, respectively. Density is almost constant for all lithologies.

Amplitude variations with offset (AVO) analysis were taken for the estimation of effective pressure. By comparison between AVO parameters from seismic data and the elastic properties, appropriate effective pressure was estimated as about 50 MPa in hanging-wall and about 5 MPa in footwall. Although the coincidence between AVO parameters was not so good, at least, the difference in effective pressure between hanging-wall and footwall is relatively larger. The bad coincidence is probably due to anisotropy of elastic property especially in hanging-wall.

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