

Deep Fault Drilling Project, Alpine Fault, New Zealand

SHIGEMATSU, Norio^{1*}; OKADA, Tomomi³; KATO, Naoki²; KOMETANI, Yusuke⁴; MORI, Hiroshi¹; NISHIKAWA, Osamu⁵; YOSHIDA, Keisuke⁶; TAKAGI, Ryota⁷; LIN, Weiren⁸; MATSUMOTO, Norio¹; TOGO, Tetsuhiro¹

¹Institute of Earthquake and Volcano Geology, AIST, ²Tohoku University, ³Graduate School of Science, Osaka University, ⁴Yamaguchi University, ⁵Graduate School of Engineering and Resource Sciences, Akita University, ⁶National research institute for earth science and disaster prevention, ⁷ERI, The University of Tokyo, ⁸JAMSTEC

The Alpine Fault is mature (>460 km offset), active (25 mm/yr), and late in its seismic cycle. It ruptured in AD 1717, has a 330 yr return time, and M8 earthquake probability is c. 30% in the next 50 yrs (Berryman et al. 2013). The objective of the Deep Fault Drilling Project (DFDP) is to collect materials, measure ambient conditions, and monitor at depth on the Alpine Fault, to understand earthquake processes and the formation of a continental orogen. Second phase of DFDP was carried out at the Whataroa River.

An open hole with depth of 893.18 m was drilled without coring during the DFDP-2. The drilling revealed the several features of the hanging wall of the Alpine Fault. The thickness of quaternary sediments at the Whataroa River is about 240 m. Cutting samples were collected with interval of 2 m and the microstructural changes within the fault zone were revealed. Geophysical wire-line loggings were carried out. The result of temperature logging indicates that the geothermal gradient in the hanging wall is as high as 100 °C/km.

Water level, density, viscosity and other properties of mud water were continuously monitored, which are expected to constrain the hydrological property of fault zone.

DFDP-2 unfortunately failed to get the drill-core samples and penetrate the Alpine fault due to several problems during drilling. One of the objectives of DFDP-2 was to reveal fault behavior at depth and core-log integration is essential. However it is impossible to achieve this. The Alpine fault is a unique and scientifically intriguing fault, and it is worth being drilled again at the Whataroa River. A strategy for succeeding at the drilling should be important.

Keywords: Fault Zone Drilling, Alpine Fault