

Deep seismic reflection profiling in geothermal area: case study of Shirasawa and Shichigashuku calderas

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Along the Ou Backbone Range, northern Honshu, many piston-cylinder type calderas have been developed in Late Miocene to Pliocene. Recently, such calderas formed in late Miocene are focused as a possible resource of geothermal power plants. To obtain the physical data to estimate the state of deep sited fluids and fractures is significance. Since late 90's, deep seismic reflection profiling was carried out to image the deeper extension of active faults. Some of the seismic lines are crossing such caldera (Sato et al., 2002a Tectonophys.; Sato et al., 2002b EPS). Here, we introduce the seismic sections and results of magnetotelluric investigation and discuss possible strategy for future's site survey.

Shirasawa caldera: The Shirasawa caldera is a piston-cylinder type caldera with 10-km-diameter and welded tuff and lake deposits are cropping out as caldera fill. By seismic reflection profiling using vibroseis trucks, low frequency strong reflectors are imaged 3 to 5 km beneath the caldera and estimated to be a possible evidence showing fluids. The estimation is well accord to the velocity structure obtained seismic tomography (Nakajima et al., 2006 EPS).

Shichigashuku caldera: This caldera is located southern part of Miyagi prefecture and shows piston-cylinder type. Across this caldera, deep seismic reflection profiling was performed in 2013 (Sato et al., 2013: JpGU). Also, magnetotelluric survey is carried out. P-wave velocity structure across the caldera shows low velocity part, which corresponds to the caldera fill, but does not suggest any characteristic feature showing existence of fluids. Magnetotelluric section suggest the distribution of vertical low resistivity zone connected slab to active volcanoes and low resistivity part which located in the mid-to upper crust beneath caldera, showing the possibility of existence of fluids.

Significance of integrated geophysical exploration

To understand the physical state and material of deep sited portion beneath caldera, integrated research using several methods, active / passive seismic investigation, MT methods. Seismic reflection survey is not effective for rock unit, which does not have layering. However, it has a potential to evaluate the density of fractures and their pattern.

Keywords: geothermal area, caldera, seismic reflection profiling, magnetotelluric inversion, Shirasawa caldera, Shichigashuku caldera