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Visualization of the deep-seated fluid ascending along the fault

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1. Introduction

It is known that deep-seated fluid is highly saline water and includes gas. In addition, it is thought that fluid rises from the deep part under the ground. Therefore it is thought that the deep-seated fluid has a big influence on environment of deep part groundwater.

It is known that the groundwater mix deep-seated fluid derived from the slab, based on the result of geochemical analysis at the inland from Northeast Yamaguchi to Southwest Shimane (Murakami and Tanaka, 2009). The most of these fluids spout out at the surface of the ground. However, the fluid erupted from only the flowing borehole in Tokusa basin, Yamaguchi. We cannot identify the deep-seated fluid if we don't play drilling operation. Therefore, we cannot identify the fluid if we play field investigation. And, distribution and flow of the deep-seated fluid is not known in underground.

I used the CSAMT method in this study in Tokusa Basin and tried visualization of the distribution of the deep-seated fluid underlying underground.

2. Geological setting

The bedrock consisted of Late Cretaceous welded tuff and rhyolitic lava of Abu group in Tokusa Basin. Sediments of the Quaternary period cover the bedrock in the basin. Based on the result of gravity survey, thickness of the sediments are up to about 200 m. The point of the fluid spout out from the borehole is three places in total and is distributed along Tokusa-Jifuku fault dislocation estimated by NE-SW direction.

3. Results

Groundwater from the borehole : Electric conductivity of the groundwater is higher than general groundwater (211 mS/m, 426mS/m and 1,310 mS/m). Water quality type are NaCl type or NaHCO3 type. Though the groundwater is an inland, it is highly saline water.

The surface groundwater : Electric conductivity of the groundwater varied considerably ranging from 5.80 to 22.8 mS/m. The water quality type of most surface groundwater is CaSO4 type. However, the groundwater of the north side of the fault tends to be slightly higher Na+ and Cl- than the groundwater of the south side of the fault. Based on the result of groundwater level survey, the surface groundwater flows to the river of the northwest direction across the fault from the southeastern direction.

Distribution of resistivity : Fig-1B shows the resistivity profile line X-X'. As a result, H1 was a high resistivity zone more than 1,000 ?m and caught distribution of the bedrock. And, L1 and L2 were low resistivity zone less than 100 ?m and 30 ?m. These low resistivity zone is the area where the deep-seated fluid gets mixed with.

4. Discussion

The area of L1 where low resistivity is distributed in Fig.1B is known that distribution Tokusa-Jifuku fault and the highly saline groundwater is identified in the direct top. As a result, L1 that low resistivity zone catches the rise of the deep-seated fluid along the fault. It is thought that the deep-seated fluid ascending along the fault penetrates in sediment, because low resistivity zone L2 distributes the north side of the fault and the shallow groundwater of the NaCl type distributes. Namely, the deep-seated fluid ascending Tokusa-Jifuku fault (L1) mixes the shallow groundwater in sediments, but the flow is regulated by the shallow groundwater system which flows from the south of the Tokusa Basin to the north (L2). The plural ratio resistivity distribution across Tokusa-Jifuku fault shows similar tendency to Fig.1B. Therefore, the deep-seated fluid distributes not only the place where the fluid spouts out from the borehole but also in the range of at least 1.5km along the fault in the underground of the Tokusa Basin.

When the fluid spouts out from the borehole in the place where the sediments distributes, it is necessary to considerate that the fluid may be widely distributed along fracture zone such as faults in the underground.

Keywords: Deep-seated fluid, CSAMT method, Tokusa-Jifuku fault

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