Effect of Two Dimensional Electric Imaging Method on Groundwater Exploration by Correlating with Test Well Drilling in Tanzania

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1. Introduction

Groundwater exploration was carried out applying Two Dimensional Electric Imaging Method (2D imaging) in Tanzania, East Africa in order to supply safe water to village people. On the basis of 2D imaging result, test wells were drilled in two adjacent sites. Although two test wells were in a short distance, different results were obtained. However, effectiveness of 2D imaging was confirmed through the study.

2. Topography and geology of the site

The study area is located on the river terrace. Its altitude is about 40m. Neogene sediments are widely distributed and are overlain by terrace deposit. Aquifer is occurred in the Neogene sediments which frequently change in facies and water quality varies according to the changing in facies. Therefore, the area is evaluated as difficult to develop groundwater. In fact, more than 10 wells were sunken in the Neogene sediments in 1990s, only one well was successful, and others were failed due to insufficient yield.

3. Study results

(1) Site A

Three survey lines (sounding depth: 100m) were allocated in the area to select a test well site. 2D imaging shows that a zone of which resistivity is 5 ohm-m in the northern side of the area. It is likely affected by salt water. Avoiding the zone, a zone of resistivity 10-20 ohm-m distributed at 20-50m depth in the southern side of the area was selected as the first test well site. Screen pipes were installed in the section from 25.5 to 51.2m where resistivity was 10-20 ohm-m in 2D Imaging (figure to the left). Static water level is 17.8m below ground level (bgl). As the bottom of clay bed is 21m bgl, groundwater is considered as confined. In the pumping test, a 34.7m of draw down was observed against the yield of 24 L/min, almost reaching the bottom of the well. Groundwater showed 22,800 of TDS value, therefore, groundwater was affected by salt water. The well was evaluated as unsuccessful from view points of yield and water quality.

(2) Site B

Site B is located about 370m north east from the site A avoiding low resistivity zone observed at site A. 2D imaging shows that a zone of 35-80 ohm-m supposed to be sand, or sand and gravel appears in a depth of 5-20m bgl. In a depth of 20-50m, resistivity is more than 10 ohm-m in the eastern side of the survey line and less than 8 ohm-m in the western side of the line. The latter is likely affected by salty water. Therefore, a zone of 35-80 ohm-m in a depth of 5-20m was supposed to be an aquifer, then, the second test well was drilled to survey this zone. Lithological sequence of the well was mainly sand and intercalated with clay at depths 0-6m, 31-35m and 46-48m. Screen pipes were installed in sections 13-21.5m bgl and 38.6-44.3m bgl. Static water level is 10.48m bgl. Since the water level is below the bottom of the clay (6m bgl), groundwater is considered as unconfined. In the pumping test, a 2.66m of draw down was observed against yield of 264 L/min after 48 hours pumping. TDS value was 740. As both yield and water quality are suitable for the source of rural water supply, the well was decided to be used as the source.

4. Conclusion

In the study, low resistivity zone was detected and its horizontal and vertical distributions were analyzed by 2D imaging. Although the first well was failed, the second well was successful as the source of rural water supply from the view points of yield and water quality. It is concluded that 2D imaging is useful for groundwater exploration in the area where aquifer frequently changes in facies.

5. Acknowledgement

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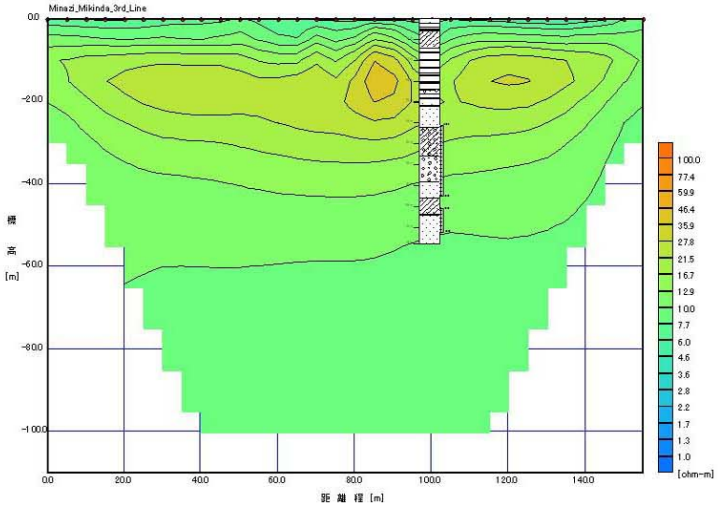
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27.8
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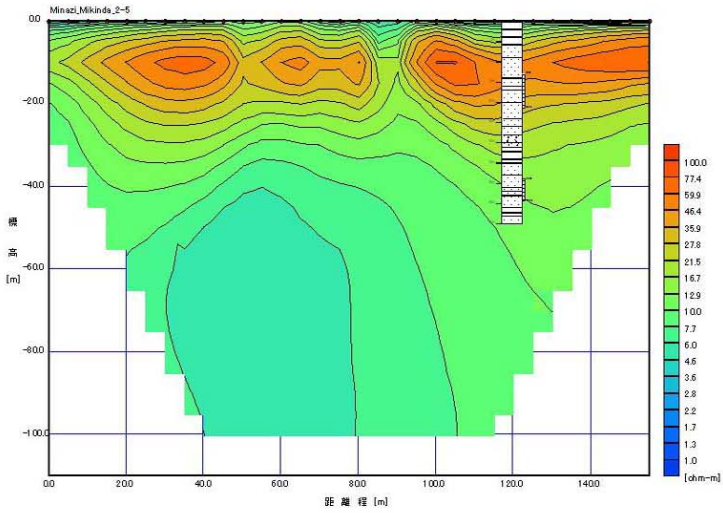
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