

Temperature depth profile in a 700 m deep vertical borehole in Aso volcanic zone

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Temperature profile measurements in scientific-drilling boreholes and determination of heat flow from the measured temperature profiles are important approaches to understand the temperature distribution and thermal structure around volcanic regions and seismogenic fault zones. A scientific-drilling borehole down to ~700 m deep was penetrated through the Futagawa Fault ruptured during the 2016 Mw 7.1 Kumamoto, Japan earthquake in Aso volcanic region. To obtain the fundamental features of the temperature profile in the borehole, we repeated measurements of temperature depth profile totally four times, i.e., once per two –three months from the borehole penetration was completed in March 2018. As a preliminary result, the temperature depth profile showed a popular trend between depth ranges of 200 –310 m and 430 –650 m where the formation temperature may not be influenced by weather and seasonal temperature change on surface. The temperature in the two depth ranges linearly increased with depth increasing, and showed a geothermal gradient of ~55 °C/km. This geothermal gradient is much higher than the global average geothermal gradient 20 –30 °C/km, being considered reasonable in a volcanic region. However, a very unexpected temperature distribution feature was observed in the depth range of 310 –430 m. The temperature was almost the same in the ~120 m depth interval; and the geothermal gradient was only ~1 °C/km. To make sure if this special temperature distribution is a natural phenomenon, we will continuous our temperature measurements and monitoring in the borehole.

Keywords: Drilling , Temperature, Geothermal gradient