# THERMAL PROCESS AND GEOTHERMAL ENERGY IN AND AROUND THE YAKEDAKE VOLCANO, GIFU-NAGANO, JAPAN

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The thermal process and the geothermal energy in and around the Yakedake volcano, Gifu-Nagano, Japan are considered quantitatively. The hydrothermal activity is intense in the valleys at the western foot and the Nakanoyu area. The hot water flow is discharged mainly from the Gamada River geothermal area.

The area under investigation is in a rugged section of the southern part of the Japan Alps Mountains. Yakedake is an active volcano with a lava dome, belonging to the Norikura volcanic zone, which is made up of a Quaternary biotite-bearing hypersthene hornblende andesite. The fumaroles in the summit dome areas of Yakedake and the parasitic volcano, Iwodake are active.

YAKEDAKE AND IWODAKE SUMMIT AREAS

The measured temperatures of six solfatara in the northern summit dome of Yakedake were 61 - 93°C at the altitude of 2240 to 2270 m in September, 1987. There is a sublimation of pure sulfur around the solfatara. Yakedake has a crater lake, which is shown in Fig. 1. On Iwodake, many fumaroles are found in the bottoms of the large rocks on the southern dome at the altitude of 2105 to 2135 m. Some ones are found in a small circle holes at the ground, which is shown in Fig. 2. The measured temperatures of eleven fumaroles in the southern summit dome of Iwodake were 40 - 65°C. It seems that these temperatures in Yakadake and Iwodake have risen with time since August, 1981. By assuming $\delta T$ = 400 deg.(temperature difference between the inside and the of dome), the geothermal energy of Yakedake summit dome at the altitude of 2100 to 2455 m is calculated to be 2.5 x $10^{17}$ J, which represents a power output of 300 MW averaged over 30 yrs. On the other hand, by assuming $\delta T$ = 300 deg., that of Iwodake at the altitude of 2100 to 2138 m is calculated to be 1.9 x $10^{15}$ J, which represents a power output of 2 MW over 30 yrs.

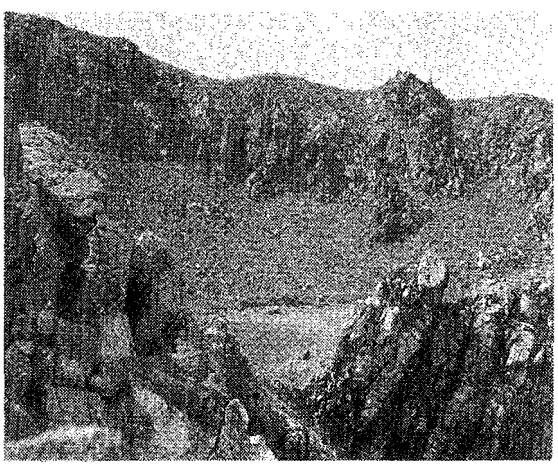

Fig. 1: View of the crater and the lake of Yakedake from northern crater-rim, in Sept., 1986.

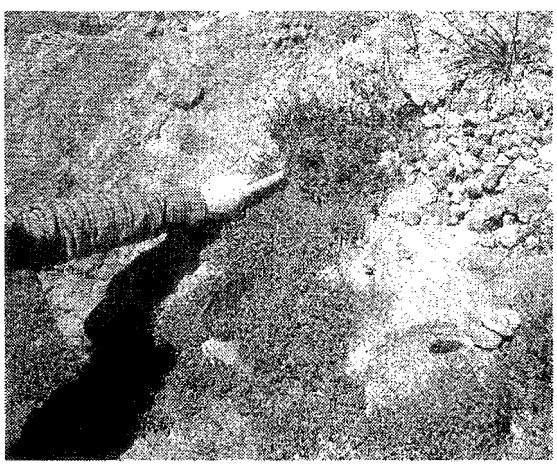

Fig. 2: Fumarole of a small circle hole type on the Iwodake summit dome, in Sept., 1987.

HEAT PROCESS

From the results of the thermal investigations of hot springs, a geyser, fumaroles, solfatara, travertine terrace and boreholes, the thermal structure in and around the Yakedake volcano is also presented. These new results show that the direction of heat energy from the Yakedake volcano magma body will be coincident with that of water river system from the summit dome.

There are many hot springs, a geyser and a travertine terrace by hot water flow along by the water river system of the Gamada River on the north-western foot of the volcano. Geysers are evidence of boiling at depth. Fig. 3 shows a view of Karukaya geyser in the Gamada River geothermal area. The vertical temperature distribution, measured by a thermistor thermometer with a precision of 0.1°C, in the Karukaya geyser is illustrated in Fig. 4.

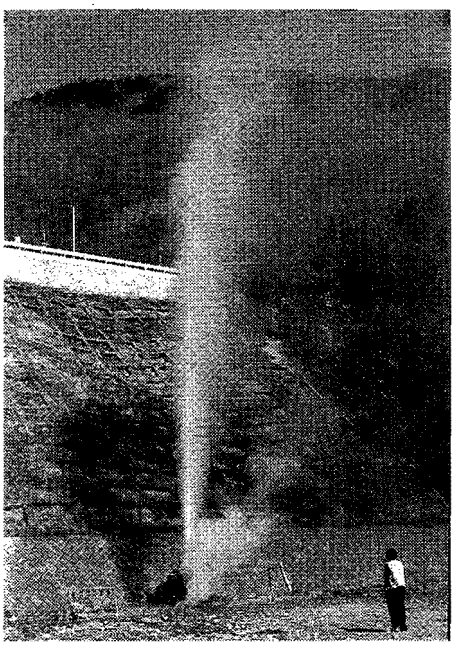

Fig. 3: View of the Karukaya geyser in the Gamada River geothermal area, in April, 1987.

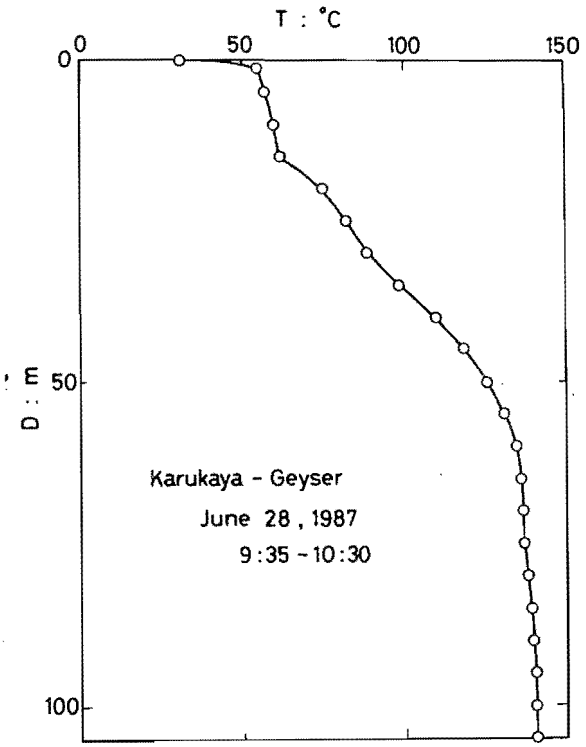


Fig. 4: Vertical temperature distribution in the Karukaya geyser.