QUATERNARY VOLCANISM AS THE HEAT SOURCE FOR SOME GEOTHERMAL FIELDS IN KYUSHU, JAPAN

HAYASHI, M. Geothermal Research Center, Kyushu Univ., Hakozaki, Fukuoka 812, Japan

The relation between volcanic and geothermal activities in Kyushu will be discussed in terms of the activity index and radiometric ages of volcanic rocks distributed in and close to geothermal fields. The activity index is defined as the ratio of temperature measured in a well to the boiling temperature, and ranges from 0 to 100 (Hayashi, *et al.* (1981) GRC Transactions, 5, 177-179).

There run two volcanic belts in Kyushu: the Daisen volcanic belt trends from ENE to WSW including Yufu-Tsurumi Volcano, Kuju Volcano and Unzen Volcano, and the Kirishima volcanic belt trends from NNE to SSW including Aso Volcano, Kirishima Volcano, Sakurajima Volcano and Ikeda Volcano. Hornblende andesites characterize the former and pyroxene andesites the latter.

Fig. 2 shows the relation between volcanic and geothermal activities. In geothermal areas where hornblende andesites are abundant, very active fields (AI above 80) are located in the vicinity of a volcano younger than 0.20 Ma: 0.17 Ma at Otake, 0.11 Ma at Hatchobaru, 0.10 Ma at Iwozan, 0.07 Ma at Unzen, 0.05 Ma at Beppu, and 0.06 Ma at Garan. On the other hand, in geothermal areas covered with pyroxene andesites, the associated volcano is much younger: 0.02 Ma at Kirishima and 0.03 Ma at Satsunan. Less active reservoirs (AI from 60 to 80) are associated with volcanoes in the range of 0.15 to 0.30 Ma in geothermal areas where hornblende andesites are predominant: 0.19 Ma at New Hatchobaru, 0.31 Ma at Takenoyu, 0.26 Ma at Kurokawa, and 0.29 Ma at Noya. However, in geothermal areas rich in pyroxene andesites, the less active reservoirs are often found in places covered with lava flows younger than 0.03 Ma.

The above facts suggest that a volcano consisting of hornblende andesite tends to cool down more slowly than one consisting of pyroxene andesite. In addition, larger volcanoes tend to have a longer life as heat sources. As mentioned above, the geothermal activity of a reservoir is closely related to the age of associated volcanoes and also to their chemical composition and volume. Accordingly, the research on volcanoes should be the first required step for geological exploration of geothermal resources.

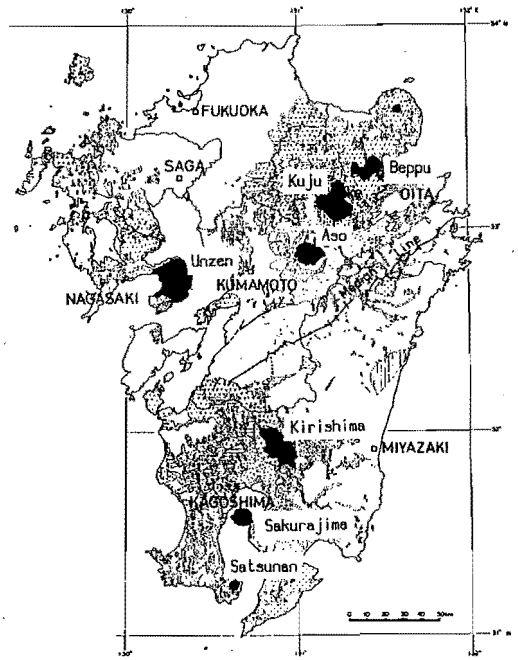

Fig. 1 Volcanoes and Geothermal Fields in Kyushu

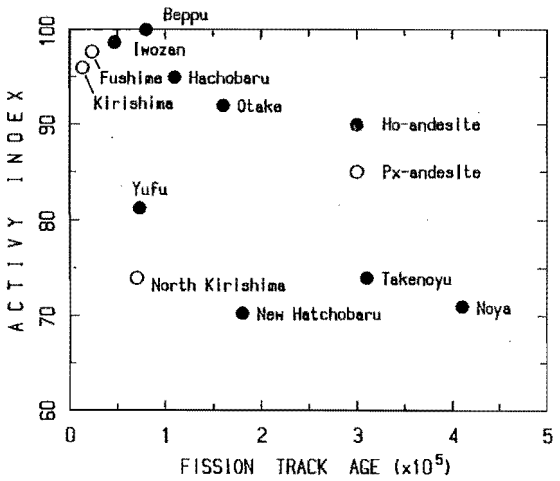

Fig. 2 Relation between volcanic and geothermal activities for geothermal fields in Kyushu, Japan