Thermoluminescence Ages of Alteration in the Southern Part of Kii Peninsula, Southwest Japan

Takahiro Hanamuro[1]; Koji Umeda[1]; Shingo Tomiyama[2]

[1] JAEA; [2] mrc

High temperature hot springs, such as Yunomine Hot Spring (YHS; 92.5 degrees Centigrade) and Kawayu Hot Spring (70.0 degrees Centigrade) of Hongu-cho, Tanabe City, Wakayama Prefecture and Tosenji Hot Spring (THS; 51.2 degrees Centigrade) and Kamiyu Hot Spring (KHS; 57.8 degrees Centigrade) of Totsukawa-mura, Nara Prefecture, are distributed in the southern part of Kii Peninsula (Kinbara, 1992; Abe, 1986, etc.), although no Quaternary volcanoes exist around there. Moreover, the high heat flow of 80 to 100 mW/m^2 is observed in the southern part of Kii Peninsula (Furukawa et al., 1997), and hydrothermal alteration zones that thought to be generated by geothermal activities are specified around Hongu area (NEDO, 1994), so it is known as the geothermal anomaly area. To grasp the alteration age reset by these geothermal activities, thermoluminescence dating of the quartz in the samples from THS, KHS, Yunomine Alteration Zone (YAZ; including YHS), Takayama Alteration Zone (TAZ) and Heijigawa Alteration Zone (HAZ) are measured. These samples were collected according to the gush part of the hot springs, mineralized vein, and quartz porphyry vein, and the relation of the distance from these parts and measured ages were considered.

The result of dating is that the samples from THS show the age between ca.120 to 24 ka, the samples from KHS show the age between ca. 220 to 120 ka, the samples from YAZ show the age between ca. 980 to 15 ka, the samples from TAZ show the age between ca.680 to 260 ka, and the samples from HAZ show the age between ca. 1 Ma to 330 ka. As to the relation of the alteration age and distance from the points which are considered to be the center of alteration, the age were so young that it was close to the gush part of the hot spring at YHS, but no clear tendency were shown in other area.

It is suggested that hydrothermal activities over ca. 100 degrees Centigrade were continued till tens of thousands of years ago at YAZ and THS, and till hundreds of thousands of years ago at TAZ, HAZ and KHS. And it is also suggested that the alteration caused locally because of the variation of the alteration age and discontinuous distribution of alteration in each area.

Kumano Acidic Igneous Rocks, Omine Acidic Rocks, and a lot of quarts porphyry veinlets related these acidic rocks are distributed in the southern part of Kii Peninsula. These activities are considered as ca. 14 Ma by K-Ar dating (Sumii et al., 1998; Sumii and Shinjoe, 2003; NEDO, 1994). It is difficult to be thought as the heat of magmas and high temperature rock bodies from those volcanic activity is maintained during tens of or hundreds of thousands of years (Oishi et al., 1995, etc.). Moreover, it is suggested that the origin of hot spring water is rainwater because of oxygen and hydrogen isotopes (NEDO, 1994), and results of noble gas isotope analyses show the contribution of mantle-delivered helium. Therefore it is considered that low alteration activities is caused by the hydrothermal activity that originated rainwater added heat and gases from deep fluid under these area (Umeda et al., 2006).

References

Abe, K. (1986): Bulletin of the Geological Survey of Japan, 37(9), 479-489. (in Japanese)

Furukawa, Y., et al. (1997): Chikyu Monthly, 19, 683-689. (in Japanese)

Kinbara, K. (1992): Distribution Map and Catalogue of Hot and Mineral Springs in japan, Geological Survey of Japan, 394p. (in Japanese)

Oishi,A., et al. (1995): Journal of the Balneological Society of Japan, 45, 63-75. (in Japanese)

NEDO (1994): Report of Geothermal Development Promotion: Hongu Area, vol.37. (in Japanese)

Sumii,T., and Shonjoe,H. (2003): Island Arc, 12(4), 335-347.

Sumii,T. et al. (1998): Journal of the Geological Society of Japan, 104(6), 387-394. (in Japanese)

Umeda,K. et al. (2006): Journal of volcanology and geothermal research, 149, 47-61.