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A PALAEOMAGNETIC STUDY OF THE PYROCLASTIC FLOWS IN THE SHIKOTSU AND NOBORIBETSU AREA

Palaeomagnetic studies of the Pliocene and Pleistocene volcanic products in Hokkaido, 1st report

by

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(With 1 table and 6 text-figures)

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Introduction

The Pleistocene pyroclastic deposits including pumice flow and fall are widely developed in the Shikotsu and Noboribetsu area, southwestern part of Hokkaido, N.E. Japan, as they will be reported in this volume of the present journal by M. MINATO et al.

Amongst these volcanic deposits, pumice flows may be enumerated below as the Shikotsu pumice flow, Morino pumice flow, Shadai pumice flow, Ponayoro pumice flows I and II, and Noboribetsu pumice flow, in descending order. The exact ages of these pyroclastic flows have, however, been still uncertain up to date except for the Shikotsu pumice flow, the C^{14} age of which is said to be about 30, 000 ± yrs. B.P. (KUMANO, 1970).

The author has long cooperated with Drs. Minato and Hashimoto and Mr. Kumano in field to settle the stratigraphical sequence of these pyroclastic deposits and tried to correlate them with terrace chronology, in desiring to bring them close to the present international standard scheme as much as possible. Nevertheless, sufficient data in this regard were not obtainable, even though history of climatic change has been somewhat clarified step by step by pollen analysis and sea level lowering inferred from the height of the base of these pumice flows. These data are useful in correlation.

Further, the author has expected that the application of magnetic study on these pyroclastic deposits would contribute to settle the stratigraphical position of them, especially from the determination of polarity.

The result will be briefly given below. As a matter of fact, all the pumice flows placed in the laboratory works show normal polarity in geomagnetism without exception. Therefore, the pumice flows ranging from the oldest (Noboribetsu) to the youngest one (Shikotsu) may be correlatable to the Brunhes normal epoch and not dated back to the Matuyama reversed epoch.

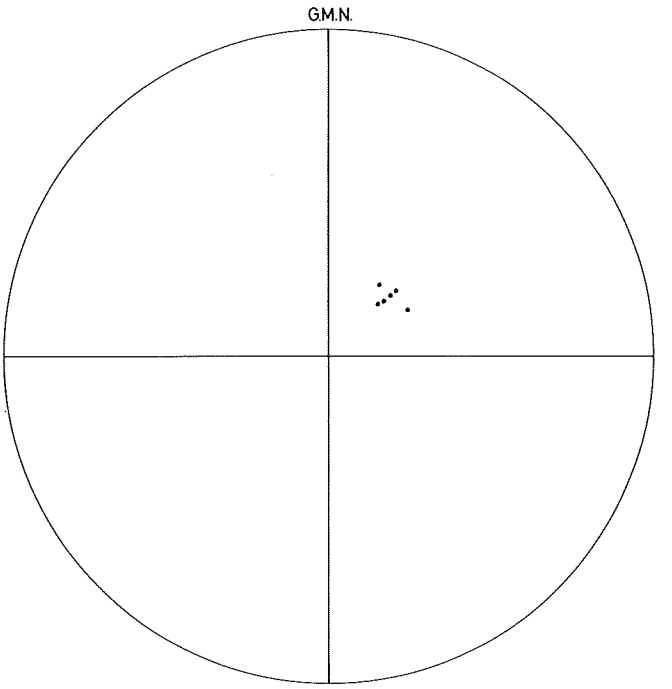
Result of Measurement

More than 50 oriented samples were collected from many localities and various pumice flow units in cooperation with Drs. MINATO, HASHIMOTO and Mr. KUMANO. Directions and intensities of each sample were measured by means of an astatic magnetometer in our department. The result of measurements will be shown in the table 1 and text-figures 1-2. The stability of

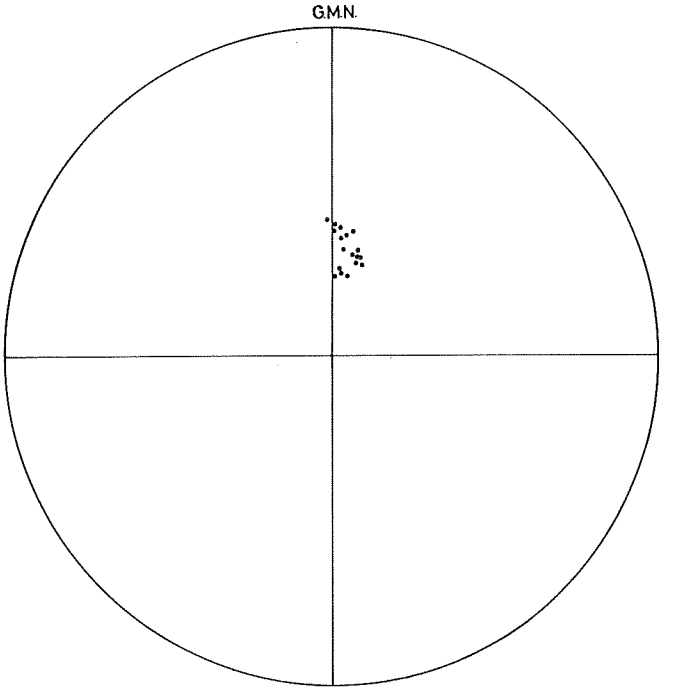
Table 1

	Direction N.R.M. D.	I.	Intensity of N.R.M. x 10^{-3} e.m.u./gr.	JT/JN
Shikotsu pumice flow	N10E	55.5	2 – 3	0.89
Morino	N30E	55	0.1 – 0.05	1.57
Ponayoro $^{II}_{I}$	–	–	0.3 – 0.01	2.00
Shadai	N38W	45	1 – 0.3	2.30
Noboribetsu	N44E	60.5	5 – 8	0.47

Shikotsu pumice flow — Lower terraces
Morino pumice flow, Shadai pumice flow — Middle terraces
Ponayoro II pumice flow, Ponayoro I pumice flow, Noboribetsu pumice flow — Higher terrace

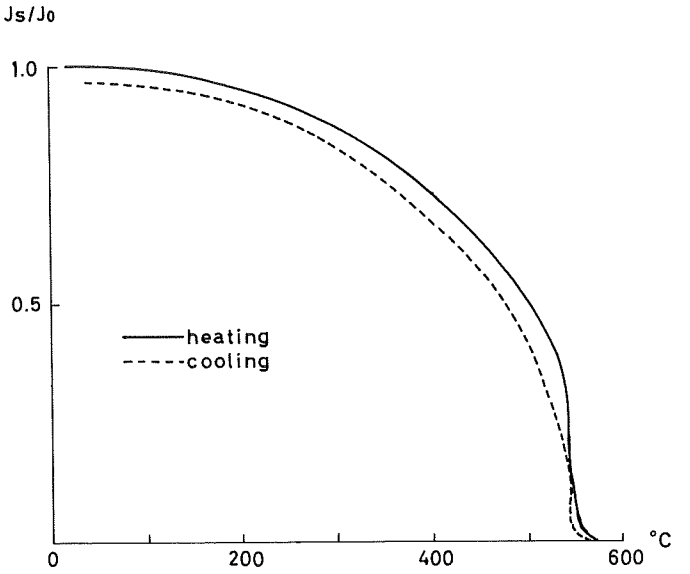


Text - fig. 1 Directions of N.R.M. of the Noboribetsu welded tuff.

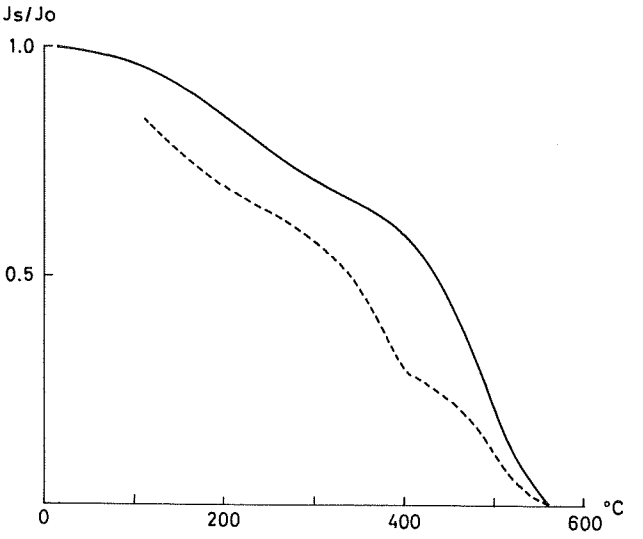


Text - fig. 2 Directions of N.R.M. of the Shikotsu welded tuff.

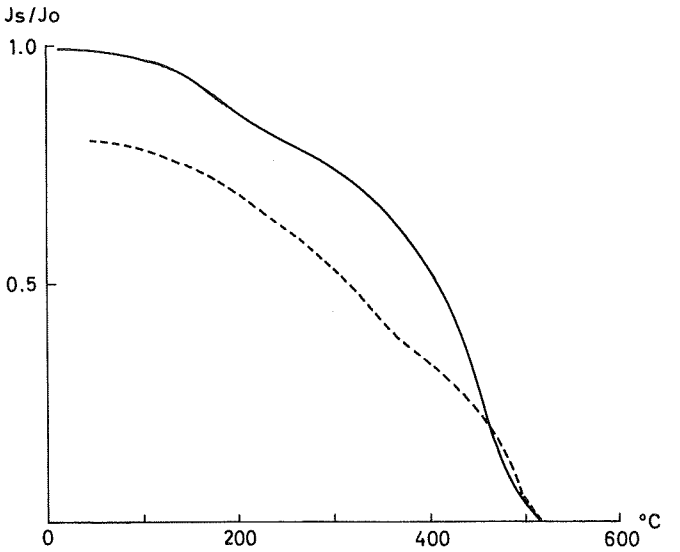
remanent magnetization was thoroughly tested by AC demagnetization method and thermo-demagnetization method. And thermo-magnetic analysis were also applied. The stability of remanent magnetizations of the present samples all seems to be high, as is shown in text-figs. 3-6. Therefore they may be safely employed as good palaeomagnetic data for further consideration.



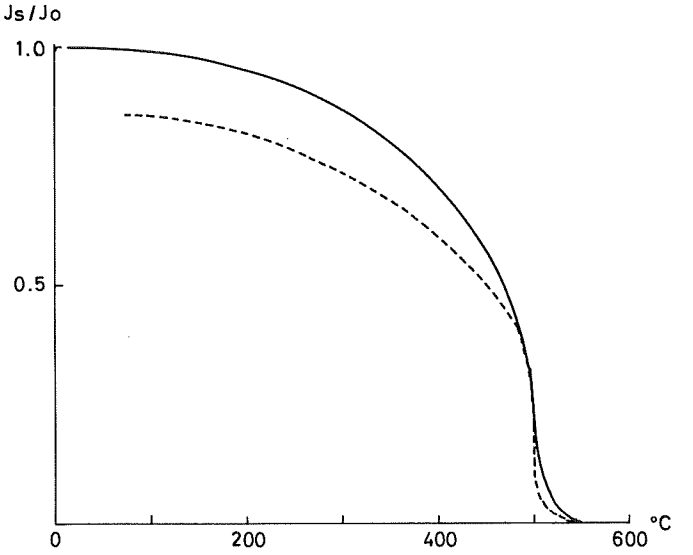
Text - fig. 3 Change in the saturation magnetization with temperature. Sample: Noboribetsu welded tuff.



Text - fig. 4 Change in the saturation magnatization with temperature. Sample: Shadai pumice flow.



Text - fig. 5 Change in the saturation magnetization with temperature.
Sample: Morino pumice flow.



Text - fig. 6 Change in the saturation magnetization with temperature.
Sample: Shikotsu welded tuff.

Discussions

In the present study, no reversed polarity are determined. As shown in the table 1 and figs. 1-2; the magnetic directions of each pyroclastic flow show normal polarities and almost same directions to the present geomagnetic field.

As a result, age of five pumice flows may be considered to have been a volcanic product brought within the time of the Brunhes normal epoch (0-69 × 10^4 y.), (COX et al, 1964, HEIRTZLER et al, 1968).

As shown in the table 1, Jt/Jn ratio of the Shikotsu pumice flow and the Noboribetsu pumice flow, is nearly 1.0. Both pumice flows are highly welded in their texture. This result suggests that these two flows were higher in temperature than their Curie points of ferromagnetic minerals at the time when they finally settled in the present localities, if the intensity of geomagnetic field is assumed to have been nearly the same in condition as the present. The result of thermomagnetic analysis of the Shikotsu pumice flow and Noboribetsu pumice flow suggests that the final temperature of the former is more than 550°C, while that of the latter more than 570°C, as is indicated in fig. 3 and 6 respectively.

On the other hand, the values of Jt/Jn ratio of the Morino, Ponayoro and the Shadai pumice flow obtained in the present study fall within the range of 1.0-2.0. This suggests that temperature conditions of these three flows might be lower than the Curie temperature of ferromagnetic minerals at the time when they were finally settled at the present localities. To determine their exact temperature, however, further laboratory studies on more samples from many localities and horizons may be necessary.

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