Study on Magnetization of the Japanese Rocks

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Results of the measurements of the n.r.m. of Japanese sedimentary and igneous rocks ranging in age from Palaeozoic to Quaternary are summarized as follows:

1) Tertiary and Quaternary rocks

As shown in Fig. 1, the direction of the magnetization of the rocks in these ages is approximately parallel or antiparallel to that of the present dipole field. Reverse magnetization is found in volcanic rocks and sediments of the late Miocene and Plio-Pleistocene in ages.

2) Palaeozoic and Mesozoic rocks

The rocks show a regional difference in their directions of the magnetization. Vectors
Fig. 2 Direction of the n.r.m. of Palaeozoic and Mesozoic rocks

Fig. 3 Schematic diagram of the formation of the Japanese arc. The arrows show the directions of the n.r.m. of the Palaeozoic and Mesozoic rocks.
A: Japan at the end of the Mesozoic era.
B: The Japanese arc at present.

Fig. 4 Map of Japanese Islands and the bending of south-western and north-eastern parts.
AB: Axis along which south-western part lies.
CD: Axis along which north-eastern part lies.
E: Fossa Magna
G: Fuji volcanic zone
of the n.r.m. are all north-easterly in the south-western part of Japan and north-westerly in the north-eastern part (Fig. 2). The angle between the mean directions in both parts reaches 45°. No reverse magnetization was found in Palaeozoic and Mesozoic rocks.

A simple interpretation to account for the above-mentioned facts is as follows: Until the end of the Mesozoic era, Japan was a comparatively straight land mass which afterwards (probably in the Palaeocene) became deformed and bent by the crustal movement which occurred at the periphery of the Asian continent, the present arc being formed (Fig. 3). The bending has been very small from the Miocene to the present.

A geotectonic line known in Japan as the "Fossa Magna" is the fissure along which the bending is largest and with which the Fuji volcanic zone is associated (Fig. 4).

Reversals of the geomagnetic field (at least twice in frequency) or self-reversals of the remanent magnetization of rocks took place in the Tertiary era. No evidence has been found for reversals in the Palaeozoic and Mesozoic eras.

**DISCUSSION**

T. Nagata:

Tokyo University group has obtained the same conclusion by tracing back the position of virtual magnetic pole. The line of movement of the pole derived from N-E Japan rocks can roughly agree with that derived from S-W Japan rocks, only when we assume a bending of Japan island, similar to that proposed by Kawai, took place before Tertiary.

P.M.S. Blackett:

I want to congratulate Dr. Kawai, Kume & Ito on this striking work. I would like to ask what was the age of the normally magnetized late Palaeozoic and early Mesozoic rocks. For instance Permian rocks everywhere else seem to be reversed.

N. Kawai:

The n.r.m. of the Mesozoic and Palaeozoic rocks we have collected so far is normal and no reversed magnetization has been observed. Unfortunately the accurate dating of the rocks of these ages, especially for igneous rocks, is difficult but it is certain that no Permian rocks possess the r.n.r.m.

A. Cox:

What are the rock types included in this study? Is there any possibility that the average ages of the magnetizations of rocks on the two sides of the Fossa Magna are different?

N. Kawai:

Rock types for the Palaeozoic and Mesozoic are black shales, red beds and igneous rocks such as granite and those in the Tertiary are volcanic and pyroclastic sediments.

There is indeed a great difference in age of the magnetization in both side of the Fossa Magna.
S. Akimoto:

I have found in your slide that the palaeomagnetic results from the south-western part of Japan and Hokkaido resemble very much with each other. How do you explain this fact?

N. Kawai:

Hokkaido seems to have had a different tectonic structure from Honshu and we are going to extend our study on the formation of the Japanese arc to try to explain the movement of Hokkaido Island.