New Type of the Earth Inductor and its Use for the Prospecting of the Underground Structure

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NEW TYPE OF THE EARTH INDUCTOR AND ITS USE FOR THE PROSPECTING OF THE UNDERGROUND STRUCTURE.

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We designed a new type of the Earth Inductor, and used it for the prospecting of the underground structure of the magnetic deposits at Kaneyamamachi, Igugun, Miyagi-Prefecture.

1. The structure of the Earth Inductor

This instrument constracted from three parts, namely rotor, coil and drum shaped magnetic inducing parts, constracted from high permeability metal of Sendust. The diamagnetic coefficient in the magnetic induced parts becomes change according to the axis of rotor coincids with the direction of the outer magnetic field, or not.

H_0: outer magnetic field

H_1: effective magnetic field

μ : apparent magnetic permeability

K: susceptibility $\mu=1+4\pi K$

$\left.\begin{matrix}N_1\\N_2\end{matrix}\right\}$: diamagnetic coefficient

(a) when the axis of the rotor coincides with the direction of the outer magnetic field, induced magnetic force is as follows:

$$B_1=\mu H_1=\mu\frac{H_0}{1+N_1K}=\frac{1+4\pi K}{1+N_1K}H_0$$

(b) When the axis of the rotor is perpendicular to the direction of the outer magnetic field, similarly,

$$B_2=\mu H_2=\frac{1+4\pi K}{1+N_2K}H_0$$

Accordingly, as the rotor rotates, the induced magnetic force in the induced parts alternate between B_1 and B_2. Then, the induced electric potential in the coil becomes as follows:

Now $\frac{1+4\pi K}{1+N_1K}=\mu_1,\quad \frac{1+4\pi K}{1+N_2K}=\mu_2$

$$E=-\frac{1}{c}\frac{d}{dt}\int B_m df=-\frac{1}{c}H_0\frac{d\mu}{dt}\times\int df=-\frac{1}{c}H_0\, nf\frac{d\mu}{dt}$$

n: number of the coil

f: cross section of the coil

ω: number of the rotation

H_0: magnetic force in γ

E: electrical potential in volts

Consequently

$$E=\frac{1}{10^8}n.f.H_0\omega.(\mu_1-\mu_2)\sin\omega t$$

We can read the alternate electrical potential by the milivoltmeter after using the rectifier. We compensate the induced electric potential to zero by using the auxiliary magnet. By knowing magnetic moment of the magnet and its distance from the rotor we can calculate the outer magnetic field. The sensibility of this instrument is $10\gamma/\mu$ amp. The

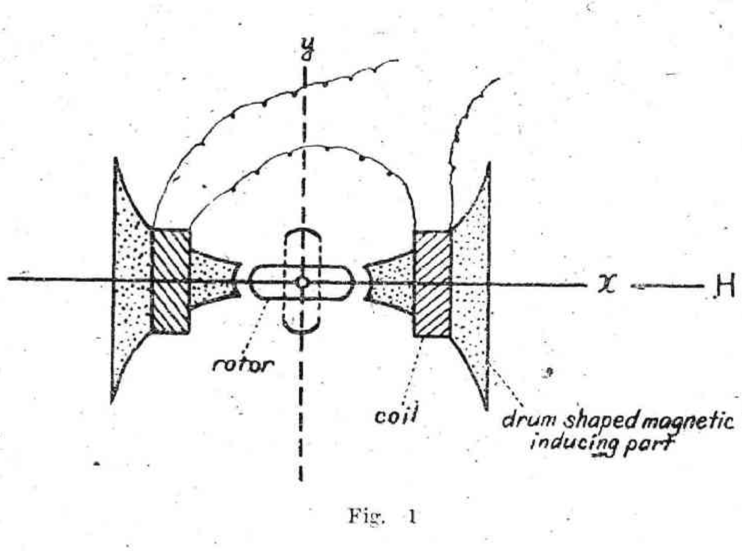

Fig. 1

drum shape of the induced magnetic parts is made up along the B-shape, because to minimize the diamagnetic coefficient. The relation between B and H in the case of the axis of the rotor coincide with the direction of the outer field or perpendicular to it, is illustrated in Fig 2.

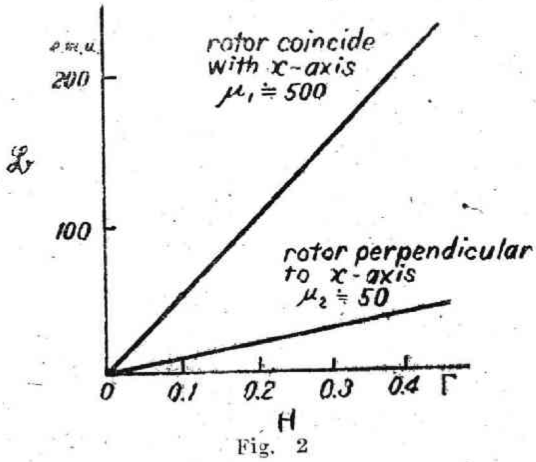

Fig. 2

2. Application for the prospecting of the underground structure

We prospected the magnetic deposits at Kaneyamamachi, Igugún, Miyagi-Prefecture by using this apparatus, and found that the results was coincides with the surveyed geological structure. The geological structure of the observed district is as illustrated in

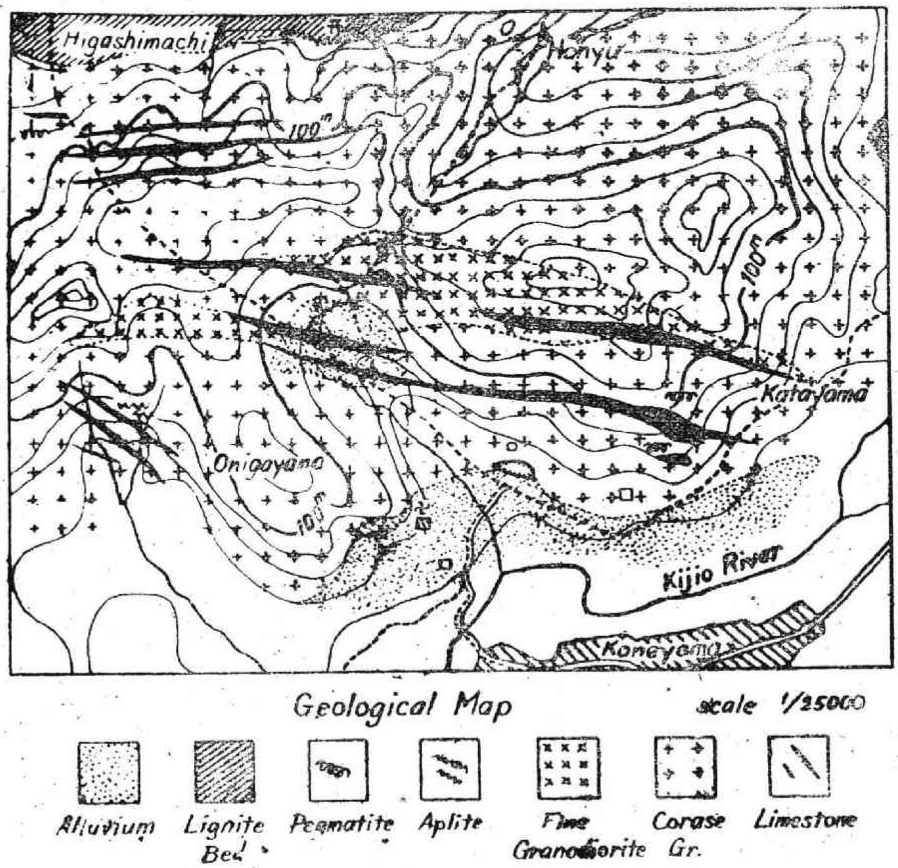

Fig. 3

Fig 3, and it is situted at the northern margin of Abukuma Range and is formed by the intrusion of the granit group accompanied with the mountian movements to the limestone at the last stage of Paleozoic or at the first stage of Mesozoic. The distribution of this magnetic field is illustrated in Fig. 4.

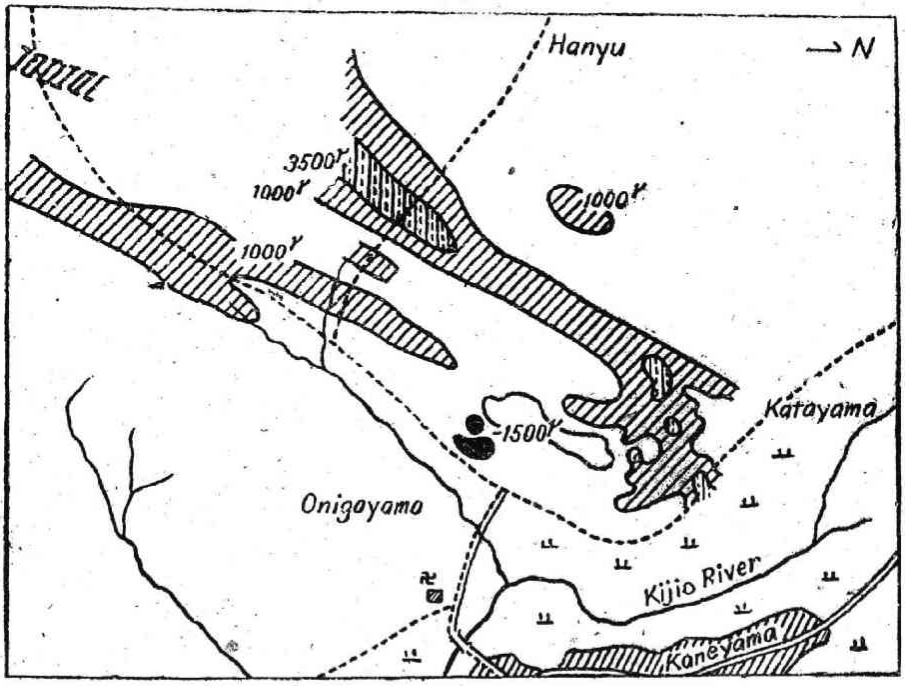

Fig. 4