X. MAGNETIC PROPERTIES OF THE IGNEOUS ROCKS DREDGED FROM THE JAPAN SEA BY HAKUREI-MARU

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Measurements of magnetic properties, such as, intensity of natural remnant magnetization (NRM), susceptibility, stability against alternating field (AF) demagnetization, thermomagnetic (Js-T) curves and Curie temperatures, were carried out on the eleven samples which were dredged from the Japan Sea by Hakurei-maru.

Fig. X-1 shows the Js-T curves of the samples. Many of them have high Curie temperature which may be that of magnetite, but some show a second peak at about 500°C which may corespond to the oxidization of titanomagnetite.

Js-T curves could not be constructed for two samples because their intensities were too weak.

Table X-1 shows the NRM intensity, susceptibility and other features. Direction of magnetization is meaningless in the case of dredged samples but intensity and stability of magnetization can both have some significance. These samples show two patterns of stability. Some have intermediate stability which is shown by MDF values of 200 to 300 Oe, while the stability is weak in others with MDF values of 50 to 100 Oe. A brief summary of the magnetic properties of lithologies recovered by dredging is given below.

Welded Tuffs were obtained at 4 sites, D248-1, D249-1, D249-3 and D264-5. Their intensities correspond to a commonly occuring value of 5×10^{-4} emu/cm^3. One exception to this is the sample from D264-5 which has an intensity of 4×10^{-6} emu/cm^3.

Stability is intermediate, except D248-1 which has a MDF value of 110 Oe.

Table X-1 Magnetic properties of the samples

Sample No.	NMR Int. (emu/cm^3)	Susceptibility (10^{-6} emu/g)	Js. (emu/g)	MDF (Oe)	Curie T. (°C)
D248-1	4.74×10^{-4}	356	0.43	120	589
D249-1	1.51×10^{-4}	94	0.185	220	593, 330
D240-3	7.71×10^{-4}	125	0.146	300	582, 333
D264-5	3.83×10^{-6}	20	0.0009	220	
D266-1	6.0×10^{-5}	198	0.29	45	576
D280-A	4.72×10^{-2}	416	0.71	70	577, 325
	2.27×10^{-4}				
D289-1	3.6×10^{-7}	24	0.006	50	
D225-1	9.0×10^{-5}	38	0.03	120	360
D254	8.13×10^{-5}	40	0.04	310	514
D280-6	8.9×10^{-6}	39	0.05	200	589
D280-14	1.2×10^{-6}	23	0.028		693, 536

Js.; Saturated magnetization (sample weight is about 150 mg).
MDF; AF magnetic field which reduces NRM intensity to half.

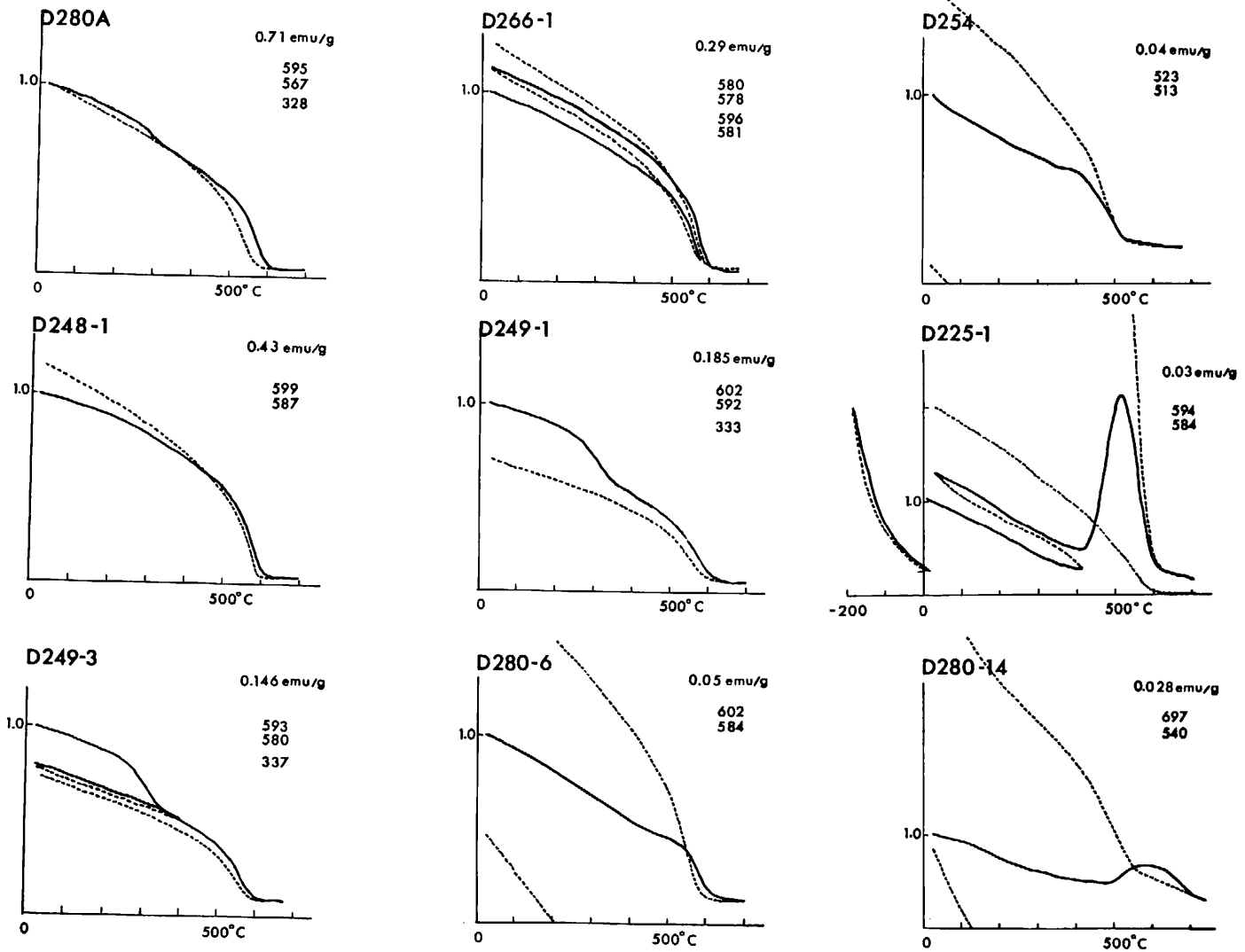

Fig. X-1 Thermomagnetic curves of the samples. D264-5 and D289-1 have too weak saturated magnetization to be measured by the thermomagnetic balance.

Granitic rocks were obtained at 3 sites, D266-1, D280-A and D289-1. Intensities are highly variable. D280-A is about 10^{-4} emu/cm^3 while D266-1 has a value of 5×10^{-5} emu/cm^3. In comparison with certain onshore granites in Japan, intensities are a little stronger, however D289-1 is very weak with a value of 4×10^{-7} emu/cm^3. The relatively high susceptibilities measured in samples D280-A and D266-1 suggest that they may belong to granites of the magnetite series which are found in four districts onland (KANAYA, 1973). Their stability is rather weak with a value of MDF 40–70 Oe. D248-A has an intensity change in one sample from 4.2×10^{-2} emu/cm^3 to 2.3×10^{-4} emu/cm^3 in a 9 cm length section. Some condensation of magnetite may be responsible for this change. The magnetic minerals of the granites are all magnetite which has a Curie temperature of 578°C and a lattice parameter of 8.396 Å.

In other samples, intensity is a little weak, 10^{-4} to 10^{-6} emu/cm^3. D280-6 and D254 have the pattern of oxidized titanomagnetite. D225-1 shows an irreversible Js-T curve which may indicate oxidized titanomagnetite of very high ratio of titan. This is also suggested by the Curie temperature of 360°C and lattice parameter of 8.375 Å of magnetically separated minerals. Sample D225-1, however, has a high sulfur content (1%), so that the pattern of Js-T curve of D225-1 which shows a very high second peak may not be oxidized titanomagnetite but instead correspond to a nonmagnetic mineral which was alterd to magnetite in the presence of sulfur at high temperature. In the case of D280-14 the initial magnetic mineral cannot be easily distinguished. Two Curie temperatures are exhibited by samples D249-1 and D249-3. The second component may be oxidized titanomagnetite or possibly pirotite although it is not clear.

Reference

KANAYA, H. and ISHIHARA, S. (1973) Regional variation of magnetic susceptibility of the granitic rocks in Japan. *J. Japan. Assoc. Min. Petr. Econ. Geol.*, vol. 68, p. 211–224.