

PALAEOMAGNETISM OF SOME LAVAS FROM THE SOUTH SANDWICH ISLANDS

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COLLECTION AND PREPARATION

DURING the course of the British Antarctic Survey/Royal Navy survey expedition to the South Sandwich Islands in March 1964 (Baker and others, 1964), eight orientated samples were collected from Recent lava flows. Samples 1, 2 and 3 were taken by J. F. Tomblin from Candlemas Island, and P. E. Baker obtained samples 8.1-5 from the north-eastern side of the Hewison Point promontory, Thule Island.

The samples were cored in the laboratory to provide orientated 2 cm. cylindrical specimens suitable for the measurement of their magnetic properties.

MAGNETIC MINERALS

An examination of polished surfaces of specimens 2B and 8.2B under the microscope showed the presence of well-formed magnetite crystals that exhibit no evidence of alteration. No ilmenite or pyrite are present. The magnetite grains are isotropic and show no intergrowths when examined with a $\times 100$ oil-immersion objective. The inference from this is that the natural remanent magnetization (N.R.M.) is the result of a thermo-remanence gained by the magnetite grains on extrusion of the lavas.

Specimen 2B displayed euhedral grains, which are usually cubic in section. Some of the larger ones, up to 50μ in diameter, exhibit a small amount of alteration to hematite around their margins but this should not be enough to affect the N.R.M. It is almost certain, in any case, that this oxidation occurred during formation. Specimen 8.2B has grains of magnetite up to 10μ in diameter showing no oxidation. Samples 1 and 3 showed evidence of the same oxidation as sample 2, but samples 8.1-5 did not.

TABLE I. MAGNETIC MEASUREMENTS OF SAMPLES FROM THE SOUTH SANDWICH ISLANDS

Sample Number	Specimen Number	N.R.M. Direction		Intensity J_N ($\times 10^{-4}$ e.m.u./cm. ³)	Susceptibility χ ($\times 10^{-4}$ e.m.u./cm. ³)	Königsberger Ratio Q_N
		Declination ϕ	Inclination I			
1*	A	022°	70° UP	82	28	3.0
	B	018°	71° UP	87	29	3.0
	C	022°	71° UP	91	27	3.4
2*	A	359°	88° UP	75	26	2.8
	B	351°	52° UP	72	—	—
3*	A	358°	71° UP	55	30	1.8
	B	350°	60° UP	84	36	2.3
8.1†	A	043°	66° UP	80	36	2.2
	B	027°	66° UP	75	35	2.1
	C	034°	61° UP	77	36	2.2
8.2†	A	018°	60° UP	71	46	1.6
	B	004°	66° UP	90	36	2.5
	C	005°	57° UP	80	34	2.4
8.3†	A	375°	88° UP	122	34	3.6
8.4†	A	043°	64° UP	107	34	3.2
	B	024°	66° UP	103	36	2.8
8.5†	A	040°	57° UP	80	29	2.8
	B	033°	70° UP	103	25	4.2

* Lava collected from Candlemas Island by J. F. Tomblin.

† Basaltic andesite collected from lava flow on Hewison Point, Thule Island, by P. E. Baker.

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TABLE II. STATISTICAL ANALYSIS OF MAGNETIZATION DIRECTIONS

Samples	Magnetization	Mean Direction of Magnetism		Circle of 95 per cent Confidence. Radius α	Dispersion Parameter k	Number of Specimens N	R
		ϕ	I				
1-3	N.R.M.	4°E.	69° UP	9°	43	7	6.862
1-3	After a.c. demagnetization in 120 oersted	7°E.	64° UP	6°	90	7	6.933
8.1-5	N.R.M.	27°E.	66° UP	6°	63	11	10.840
8.1-5	After a.c. demagnetization in 120 oersted	20°E.	71° UP	4°	110	11	10.909

MAGNETIC MEASUREMENTS

A number of measurements of the magnetic parameters of the specimens were carried out by a method that is now an established routine and which has been described already (Blundell, 1962). The results of these measurements are given in Table I and a statistical analysis (Fisher, 1953) is given in Table II. The measurements of the N.R.M. show that the lavas have behaved in the normal manner that has been observed before with most other Recent lavas, and they have acquired a permanent magnetism in the direction of the Earth's field. This permanent magnetism was most probably formed in the last stages of the cooling of the lavas immediately following extrusion and this thermal acquisition of the magnetism is indicated by the intensities, which are greater than can be gained through induction at ordinary temperatures ($Q_N > 1$). Partial demagnetization of specimens 1A and 1B in successively higher alternating fields removed half the remanence in a field of 120 oersted. This field was then used to demagnetize partially the remainder of the specimens. The directions of the remaining magnetism following this treatment were slightly closer grouped than beforehand and it is suggested that this improvement is the result of having removed an unstable component of the remanence. Thus the mean directions for the two sets of samples (1-3 and 8.1-5) after partial demagnetization probably reflect more truly the prevailing field directions when the lavas cooled. Taking due account of the secular variation, these lavas must have acquired their permanent magnetism when the Earth's magnetic field in the vicinity of the South Sandwich Islands was much the same as it is at present.

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REFERENCES

- BAKER, P. E., HOLDGATE, M. W., LONGTON, R. E., TILBROOK, P. J., TOMBLIN, J. F., VAUGHAN, R. W. and C. J. C. WYNNE-EDWARDS. 1964. A Survey of the South Sandwich Islands. *Nature, Lond.*, **203**, No. 4946, 691-93.
- BLUNDELL, D. J. 1962. Palaeomagnetic Investigations in the Falkland Islands Dependencies. *British Antarctic Survey Scientific Reports*, No. 39, 24 pp.
- FISHER, R. A. 1953. Dispersion on a Sphere. *Proc. R. Soc., Ser. A*, **217**, No. 1130, 295-305.