Notes on paleomagnetic sampling in Iceland

LEÓ KRISTJÁNSSON
Science Institute
University of Iceland, Dunhaga 3, 107 Reykjavík

ABSTRACT
This paper presents various general paleomagnetic results from Iceland, which may be of use in stratigraphic research, especially in the mapping of polarity zones in the field. It includes estimates of mean magnetization intensities in basalts and angular frequency distributions of remanence directions, as well as a discussion of several problems commonly encountered in stratigraphic correlation using paleomagnetic methods. Advice on procedures and precautions for this type of research is given, based on experience in several large surveys.

INTRODUCTION
During the last 12 years or so, the present author has participated in quite extensive paleomagnetic studies on lavas from several Miocene to early Pleistocene areas in Iceland. Results from these studies have been published in several papers, each dedicated to a specific area or topic. In the course of this research, various results have also been obtained, which were too general for inclusion in the above papers, but which may be of some value to other current and future studies of related character in Iceland and elsewhere. Specifically, one is aiming to improve the method of mapping of lava magnetic polarities as a reliable stratigraphic tool, both as done on hand samples in the field, on cores from wireline drilling operations, in the laboratory, and by interpretation of aeromagnetic anomalies. This paper relates some of the above mentioned general results. It presupposes knowledge of certain physical principles and measurement methods, as outlined e.g. by Kristjánsson (1983).

REMANENT AND INDUCED MAGNETIZATIONS
Any sample of rock contains both a remanent and an induced magnetization vector. The natural remanence (N.R.M.) is the vector sum of an original thermal remanence (T.R.M.) and secondary magnetizations such as viscous (V.R.M.) and isothermal (I.R.M.) remanences.

Of these, the I.R.M. is manifested mostly as lightning remanence or drilling remanence. The former occurs mostly on ridge and crag outcrops; it is rare in NW- and N-Iceland, occurs occasionally in Esja and Borgarfjörður, but is commonly observed in the Snaefellsnes and Reykjanes peninsula. It is easily recognized by its effect on a compass close to the outcrop, by its very high intensity and by a coercivity of only 100–250 Oe. (1 Oe = 10⁻⁴ T). Drilling remanence also has a low coercivity and is very inhomogeneous within samples. It is probably caused by a combination of high fields and shear stresses near some drill bits and/or tools used in extracting cores.

V.R.M. is in most samples of small intensity compared to the original T.R.M. before a.f. demagnetization treatment, and is eliminated by 100–150 Oe peak a.c. fields. In NW-Iceland, the intensity of V.R.M. may average 0.4 A/m, but in other areas investigated it seems to average 0.2 A/m. (1 A/m = 10⁻⁵ Gauss). However, it may be envisaged that the V.R.M. resides in large or unexsolved titanomagnetite grains in a sample, whereas the T.R.M. lies in small, elongated and/or exsolved grains. Accordingly, there is a general inverse correlation within lavas, of V.R.M. and induced magnetization on one hand and original T.R.M. on the other, and in a significant number of cases the V.R.M. dominates. Thus, in about 6% of our lava samples from Snaefellsnes and Myrar collected in 1980–82, directional changes between N.R.M. and 200 Oe demagnetization exceeded 90° (whereof about 1% may include lightning effects). This is of course most noticeable in lavas having reverse T.R.M., as the