Reviewed research article

Extension of the Middle Miocene Kleifakot geomagnetic instability event in Ísafjörður, Northwest Iceland

Leó Kristjánsson

Institute of Earth Sciences – Science Institute, University of Iceland, Sturlugata 7, 101 Reykjavík, leo@hi.is

Abstract — *Detailed records of past geomagnetic polarity transitions and excursions are seldom found in extrusive volcanics. One type of such events seems to involve very irregular variations of the magnetic field direction. Several examples of that type have been discovered in paleomagnetic surveys on the Neogene lava pile of Iceland. Lava sequences spanning the most notable event are accessible in the two tributary fjords Mjóifjörður and Ísafjörður south of Ísafjarðardjúp, Northwest Iceland. Paleofield direction results from about 80 sampling sites in these sequences have been described in previous publications. The present paper adds 20 sampled sites in Ísafjörður, extending the area where parts of this „Kleifakot instability event" of the geomagnetic field are recorded, to 5–6 kilometers along the fjord. Intermediate paleofield directions in the collection often agree closely with each other in correlated strata, even more than 4 kilometers apart. Events like this can provide valuable correlation tools for future stratigraphic mapping and various studies on volcanological features in the relatively uncharted region around Ísafjarðardjúp and beyond. Globally, recognition of the existence of such events will aid in the interpretation of results in other kinds of paleomagnetic studies. The role of geomagnetic paleo-intensity determinations is discussed briefly in this context.*

INTRODUCTION

Paleomagnetic research and some of its methods

The existence of the Earth's magnetic field has fascinated both scientists and the general public for centuries, but many aspects of its sources, its long-term history and its characteristics are still not well known. The configuration of this vector field at the Earth's surface resembles a field that would be created by a magnetic „dipole" (i.e. a short bar magnet or a current coil close to its center). Gradual changes observed worldwide in directions and intensities of the field on time scales of years to millennia, are termed its „secular variation".

Paleomagnetism is the branch of geoscience which involves research on the remanent magnetization (remanence) vectors in geological formations. It is primarily based on the fact that in many rocks the remanence carries information about the direction of the geomagnetic field prevailing at certain times in their history. A convenient way of presenting and comparing such directional results from different sites makes use of the so-called virtual geomagnetic pole (VGP) corresponding to the known paleomagnetic field direction at a site. A VGP position is calculated from a primary paleomagnetic direction (corrected for tectonic tilt of the strata) and the site coordinates, assuming the geomagnetic field to be caused by only a central dipole magnet pointing away from the position of that VGP. In addition to the secular variation, the field alternates at irregular intervals between opposite polarities, termed „normal" (N, with VGPs mostly in high northern latitudes) and „reverse" (R).

The natural remanence (NRM) in a rock sample may consist of components of different ages, being due to different processes, and having different stability when subjected to heating or magnetic fields. Two types of remanence are most common in Icelandic lava flows and hence of interest to the present study. They are thermal remanence (primary TRM) acquired