Reviewed research article

# A total-field magnetic anomaly map of the Reykjanes peninsula, Southwest Iceland

Leó Kristjánsson and Geirfinnur Jónsson
*Institute of Earth Sciences – Science Institute, University of Iceland, Sturlugata 7, 101 Reykjavík,*
*Correspondence to: leo@hi.is*

**Abstract** — *Aeromagnetic surveys of the Reykjanes peninsula in Southwest Iceland were carried out in 1965 and 1968. They revealed the presence of positive magnetic anomalies in the southern and central parts of the peninsula, whereas a broad negative anomaly followed its northern coast. These variations were caused only to a small extent by the local topography. A map of SW-NE trending fissure swarms in the peninsula, published in 1978, indicated that they were correlated with the positive anomalies as well as with centers of recent volcanism and high-temperature geothermal activity. Processing of the results from the 1968 survey combined with further surveys in 1973, 1985–1986 and 1991–1992 has resulted in a new multicolor map of field residuals in the Reykjanes peninsula and its surroundings. The most prominent feature in the map is lineations of positive anomalies partially overlapping with the volcanic fissure swarms. Susceptibility measurements on drill cuttings indicate that their sources may reach to more than 1.5 km depth.*

## INTRODUCTION

*The Geomagnetic Field* of the Earth is mostly caused by slowly varying electric currents in the Earth's liquid core. For practical purposes, it can be replaced with a bar magnet in the center of the Earth. This hypothetical magnet tends to align with the rotational axis, either parallel or antiparallel to it (at present tilting 11° from it). The geological history is divided into periods of *Normal* and *Reverse* episodes – normal with respect to current field. The last complete turnover of the field occurred 780 thousand years ago. At any location, the geomagnetic field is a vector quantity, which in Southwest Iceland points at about 76°down from the horizontal and has a strength of around 52 microTesla ($\mu$T).

In volcanic areas like Iceland, the measured magnetic field may vary considerably from place to place because of the *Rock Magnetic Field*, which is due to magnetic iron oxides such as magnetite in the nearby rocks. It decreases rapidly with distance, small-scale features faster than larger ones. The attenuation is the same, whether these crustal fields pass through air, water or sediments. At the normal flight altitude of our onshore aeromagnetic surveys, this field may reach 2 $\mu$T or more. Only rocks in the uppermost part of the crust, at temperatures lower than the Curie temperature of the magnetic minerals (578°C for magnetite), contribute to the magnetic field.

The *Rock Magnetism* is a vector, usually either parallel or antiparallel to the current Geomagnetic Field, depending on whether the lava or dike cooled down during a period of „normal" or „reverse" geomagnetic field. These bodies are said to be normally or reversely magnetized.

In airborne and marine magnetic surveys, the field is usually measured at short intervals, on a set of parallel lines. In our case, only the strength of the field is measured, omitting its direction. Subtracting the Geomagnetic Field from the measured field, and correcting for temporal variations of ionospheric origin, results in a „residual field" which is often referred