Deep drilling 1978 into oceanic crust in Iceland – revisited

MARCOS ZENTILLI[1] AND JÓHANN HELGASON[2]

1. Department of Earth Sciences, Dalhousie University, Halifax, Nova Scotia B3H 4R2, Canada <zentilli@dal.ca>

2. Geodesy and Geographic Information Division, National Land Survey of Iceland, Stillholti 16-18, 300 Akranes, Iceland

Forty years ago, during the developmental years of Plate Tectonics, there was a need to better understand the oceanic crust, generally too deep for conventional drilling. An alternative was to bore into oceanic islands. Members of Dalhousie's Geology Department (James Hall and others) spearheaded the multinational Iceland Research Drilling Project (IRDP). In 1978 a ~2000 m drillhole with 98% recovery was completed by drillers from Quebec, through a tilted (~3 km) section of Neogene basaltic lavas, into a dike swarm at the head of Reydarfjordur, eastern Iceland. This was the best studied section of zeolitized basalts anywhere in the world, the field area of renowned British geologist George P.L. Walker (1926–2005). Many Canadian and international students and faculty benefitted from the experience.

The expectation was that a complete profile of oceanic crustal layers 1 to 3 would be intersected: subaerial flows, then pillow basalts, an increasing proportion of mafic feeder dikes to nearly 100% at depth, then perhaps gabbro and plagiogranite bodies. The core was logged and studied in detail for paleomagnetism, mineralogy of alteration, structure, geochemistry and geochronology. Temperature at the bottom was 80°C and artesian hot water exited the well at ~50°C. Unexpectedly, the proportion of dikes did not increase with depth, but remained constant, the reason being that the dikes at the site are younger than, and thus did not feed, the drilled volcanic pile. Later field work by the second author revealed downward-terminating dikes interpreted to indicate the dike magma flowed laterally from the Breiðdalur central volcano located tens of km to the south. The presence of epidote alteration explained increased seismic velocities at depth.

Numerous theses and publications contributed to make the IRDP drillhole one of the best studied in Iceland. The archival core is presently curated at the geology and heritage museum and research centre in Breiðdalsvík; a section of the institution is dedicated to field and laboratory equipment and documents of the late George P.L. Walker.

A recent visit to the project area revealed that one of the most important social contributions of IRDP, still remembered by the local inhabitants, was the discovery of hot water in what was then considered a "cold" area (too distant from the active zone). To this day, the well provides free heating to an adjoining farm, and deep drillholes like IRDP's now feed 80°C water to an outdoor swimming pool and year-round health/recreation centre in the nearby fishing port of Eskifjörður.

Atlantic Geology, 2018, Volume 54
Atlantic Geoscience Society Abstracts – 44th Colloquium & Annual General Meeting 2018
doi: 10.4138/atlgeol.2018.003