

Distance Changes in the South Iceland Seismic Zone 1977-1984

SIGURÐUR ERLINGSSON*

and

PÁLL EINARSSON

Science Institute,

University of Iceland, Reykjavík

ABSTRACT

A sequence of large earthquakes is expected with high probability in the South Iceland Seismic Zone within the next two decades. In response to this long-term prediction, 19 geodimeter lines were installed in 1977-1981. Remeasurements in 1983-1984 show that measurable crustal deformation has occurred. The distance changes are irregular, however, and are not consistent with a simple model of gradual accumulation of strain along a transform type plate boundary. Strain build-up is apparently not a steady-state process in this seismic zone. It may even be discontinuous and strongly affected by external events such as rifting and magmatic activity in the volcanic rift zones.

INTRODUCTION

The South Iceland Seismic Zone is a part of the Mid-Atlantic plate boundary that crosses Iceland (Einarsson, 1986). It is a transform type plate boundary that connects the obliquely spreading boundary on the Reykjanes Peninsula to the Eastern Volcanic Zone of Iceland (Fig. 1). Spreading at this latitude is taken up by two parallel rift zones, the Western and the Eastern Volcanic Zone, and it has been suggested on petrological and structural grounds, that the Eastern Zone is a propagating rift taking over the

rifting from the dying Western Zone (Meyer and others, 1985; Óskarsson and others, 1985; Einarsson and Eiríksson, 1982; Einarsson, 1988). The seismic zone has been the scene of many destructive earthquakes in historic times, which in this part of the world spans the last 1100 years. Maps of destruction areas, microearthquake epicenters and surface ruptures of earthquakes delineate an E-W trending, 10-15 km wide seismic zone (Einarsson and others, 1981). Geometric configuration of the plate boundary suggests left-lateral transform motion along the zone. Yet there is no indication of a major E-W fault in the area. Instead, the earthquakes are associated with right-lateral strike-slip along N-S striking faults or fault zones. This led Einarsson and Eiríksson (1982) to suggest that the South Iceland Seismic Zone is a transient feature, migrating southwards and sideways in response to the southwards propagation of the Eastern Volcanic Zone.

Magnetic anomalies indicate that the Reykjanes and Kolbeinsey Ridges are spreading at a half-rate of about 1 cm per year (Talwani and Eldholm, 1977; Vogt and others, 1980). If all the spreading takes place in the Eastern Volcanic Zone this would imply that the average displacement rate across the transform zone is 2 cm per year. The transform displacement is smaller if the Western Volcanic Zone takes up some of the spreading. The Hreppar crustal block is thus moving to the west at a rate of 1-2 cm per year with respect to the Eurasian plate. The

* now at the Royal Institute of Technology, Stockholm