Westward Extension of the Snaefellsnes Volcanic Zone of Iceland

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On the basis of new geophysical data it is postulated that volcanic features similar to those occurring in the east-west trending Snaefellsnes volcanic zone of Iceland extend at least 100 km to the west of the Snaefellsnes peninsula.

Of the large number of scientific papers dealing with the tectonics of Iceland, few have discussed the active east-west trending volcanic zone extending along the Snaefellsnes peninsula (Figures 1 and 2). Geological mapping, summarized by Sigurdsson [1970], has established that in this zone Pleistocene to Recent volcanics overlie Tertiary basalts unconformably. The volcanics include products of both fissure eruptions and central volcanoes, the central volcanoes appearing to be more common in this zone than in Iceland as a whole. Sigurdsson suggests that the anomalous east-west tectonic trend of the peninsula is due to transcurrent faulting; he ascribed the presence of a WNW-striking volcano-tectonic trend observed in, e.g., fault lines and crater rows to en echelon fracturing in the fault zone.

According to evidence quoted by Sigurdsson [1970] the Snaefellsnes zone has a very low seismicity; lateral displacements across the faults are also small. The significance of the Snaefellsnes zone in the plate tectonics of Iceland is therefore enigmatic, particularly since the extent of the zone has never been delineated.

During a marine geophysical survey organized by an Icelandic government committee in the summer of 1972, continuous reflection seismic (sparker) and total field magnetic intensity profiles were obtained on several lines north and west of the Snaefellsnes peninsula. The lines (Figure 1) were spaced 10 km apart. Magnetic data were also obtained on cross-check lines.

The shelf surface is mostly very flat, having a mean outward slope of 0.1°, but is characterized by local irregularities a few tens of meters in relief. The sparker profiles reveal that the shelf surface is devoid of sediments; subbottom stratification is not brought out owing to the difficulty of penetrating the shelf, which is presumed to be volcanic in origin.

When the bottom profiles are lined up (Figure 3), the irregular areas lie along a series of lines parallel or subparallel to the volcano-tectonic trend on land described by Sigurdsson [1970]. It is therefore suggested that the shelf west of Snaefellsnes is crossed by several rows of volcanoes, which have erupted after the shaping of the shelf surface. These now occur as discrete rough mounds separated by flat sea floor or joined by fissures, as is indicated in Figure 3, and we postulate a common origin for these tectonic features on land and at sea.

Evidence from total field magnetics allows the above postulate to be extended. The largest magnetic anomalies encountered in the survey are localized rather than linear, are of the order of 2000 y and 6-9 km wide, are mostly positive, and tend to fall on the lines of suggested volcanism (Figure 1) within a broad east-west trending belt centered on 65°N. Magnetic anomalies of these dimensions are much less common outside the area under study; thus magnetic data obtained by I. Kristjansson (unpublished manuscript, 1973) and by T. Sigurgeirsson (personal communication, 1973) from an area of similar size immediately to the north reveal only one anomaly with the dimensions stated above.

Within Iceland itself, localized magnetic anomalies of the order of 8 km across are commonly found to be associated with central volcanic complexes and with some volcanoes of the palagonite formation [Sigurgeirsson, 1970]. The anomalies associated with central volcanic complexes, which are mostly positive, have been shown by Kristjansson [1970] to be caused most probably by gabbric material.

Applying this information to Snaefellsnes and the shelf area to the west, we postulate that the large localized anomalies over the shelf are associated with igneous activity, possibly central volcanoes, within the elongated east-west zone of weakness. Not all the anomalies of Figure 1 coincide with a topographic expression. To our knowledge, central volcanoes have not been identified previously on the Iceland shelf.

If our results are substantiated by gravity and other work currently in progress, they would increase the known extent of the Snaefellsnes volcanic zone by at least 100 km to the west. It should also be pointed out that a bathymetric survey [Stefansson, 1962] revealed a deep east-west trending channel cut into the foot of the Icelandic slope at a latitude of 65° (Figure 2), over 200 km west of Snaefellsnes. It may possibly be a manifestation of the Snaefellsnes fault zone, exhibiting a different balance between volcanic productivity and erosional effects due to greater distance from the Icelandic 'hot spot' and greater depth. At this stage we shall not discuss the relationship of this zone to the Mid-Atlantic ridge system.
Fig. 1. Map of the survey area. Fine lines show position of bathymetric-magnetic profiles. Triangles depict local elevations, interpreted as volcanic mounds. Inverted triangles show depressions. Circles indicate positions of major magnetic anomalies. Thick lines define suggested volcano-tectonic trend lines, those on land being according to Sigurdsson [1970].

Fig. 2. Bathymetry of the sea area west of Iceland according to Stefansson [1962]. Depths are in hundreds of meters. The large rectangle shows the area covered in Figure 1. The small rectangle encloses the possible fault zone extension referred to in text.

Fig. 3. Bathymetric (sparker) profiles from the area west of Snaefellsnes, lines joining supposed volcanic features. Depths are in meters.
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References


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