Origin of the volcanic Storøya Group, Leka. Results from new geochemical investigations

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The Storøya Group has previously been interpreted as representing ocean island volcanism closely connected to the oceanic lithosphere material of the Leka ophiolite. New geochemical data indicate that the Storøya volcanites alternatively may be interpreted as formed in an oceanic rift environment and thus constitute an integral part of the Leka ophiolite complex. If so, this oceanic crust represents an 'anomalous' ridge segment.

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Rocks of the Storøya Group (Storøya formation, Prestvik 1974) of Leka underlie most of Leknesøyene, the group of islets north of the island of Leka (Fig. 1). The Storøya Group comprises essentially two formations:

(i) Metavolcanic rocks with predominantly pillow lavas with subordinate massive lava flows, and/or sills, and hyaloclastic horizons.
(ii) Metasediments with black shale, volcaniclastic shale/schist, and ribbon chert.

The Storøya Group has been described in several papers (e.g. Prestvik 1974, Prestvik & Roaldset 1978). On the basis of major and some trace element analyses it has been concluded that the volcanic rocks of this group are mainly hawaiitic in composition and of typical ocean island affinity.

The relationship between the Storøya Group and the Leka ophiolite has been considered somewhat uncertain. The Storøya rocks are spatially in close contact with the ophiolite. Their contact with metagabbro on the islets Klakken and Steinsøya (Fig. 1) is, however, of tectonic origin. The contact to ultramafic rocks is also tectonic. This is observed on a skerry between Storøya and Burøya, where a wedge of deformed serpentinite is squeezed into metasediments. No contacts between the Storøya and the Skei Group (Skei formation, Prestvik 1974) are exposed. In spite of these uncertainties the conclusion has been that the Storøya Group is associated with the ophiolite – and obducted together with it – rather than being a time equivalent of the younger Skei Group. This view is based on the assumption that the rocks of the Storøya formed in an oceanic environment as an oceanic island or seamount.

New geochemical work has now been done on the volcanic rocks of the Storøya Group. This

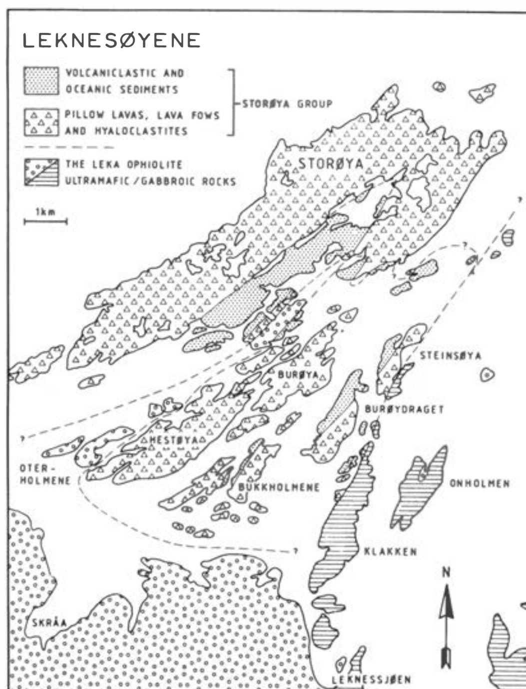

Fig. 1. Simplified geological map of Leknesøyene, Leka.

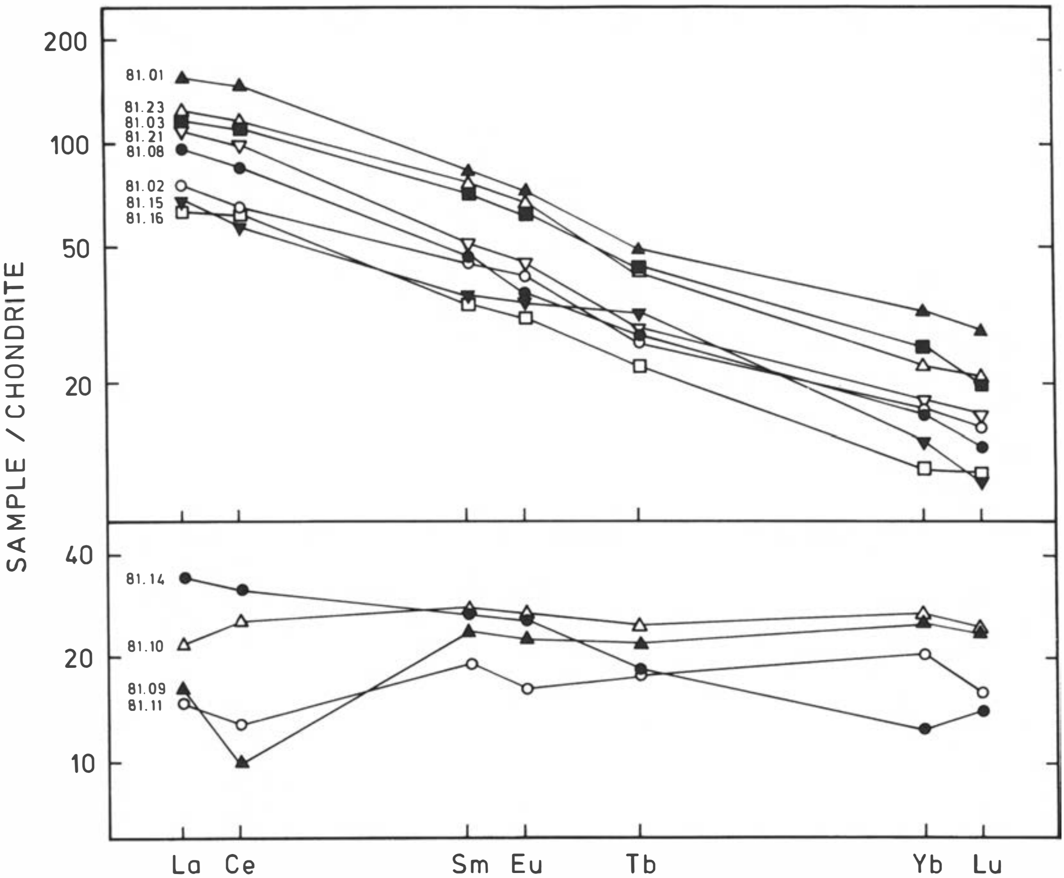

Fig 2. Chondrite-normalized REE plots of 12 Storøya lavas. (Analysed by INAA at IFE, Kjeller, Norway).

shows that the lavas display a broader compositional range than what was previously known. Some of the lavas are rather evolved.

The new REE analyses of 12 Storøya lavas fortify the conclusion of Prestvik & Roaldset (1978) that two compositional types are present. The predominant pillow lava is strongly light REE enriched (Fig. 2), whereas another group, mainly constituting massive lava flows and sills/dikes, has rather flat chondrite-normalized patterns. Significant Eu-anomalies have not been observed. The total abundance of REE corresponds to the range tholeiite to icelandite in modern oceanic island lavas (Prestvik 1982a).

In the Ti-Zr-Y diagram (Fig. 3), the basaltic Storøya rocks plot mainly in the fields of within-plate basalt and ocean-floor basalt, a feature that is expected from the previous investigations.

It has been shown, however, that the Ti-Zr-Y diagram fails to classify some volcanic rocks correctly (Prestvik 1982b). As stressed by Wood et al. (1979), this is especially conspicuous for 'anomalous' segments of oceanic spreading ridges.

The Hf-Th-Ta diagram (Fig. 4) shows this rather clearly. All the light REE enriched pillow lavas of Fig. 2 plot in the field of 'anomalous ridge basalt' rather than in the 'within plate' field. Furthermore, three of the samples with flat REE patterns plot in the field of 'normal ridge basalt' (Fig. 4). This opens for an alternative conclusion as far as the origin of the Storøya Group is concerned. It might be representative of an 'anomalous ridge segment' and as such an integral part of the oceanic crust, and also part of the Leka ophiolite complex. The co-occurrence

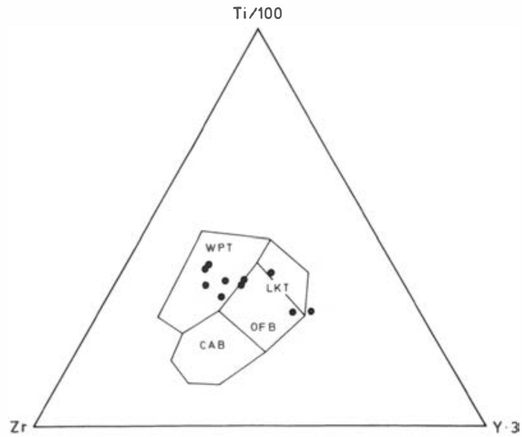

Fig. 3. Basic Storøya lavas plotted into the Ti-Zr-Y diagram. WPT = within plate tholeiite, CAB = calc-alkaline basalt, OFB = ocean floor basalt, LKT = low-potassium tholeiite. (Analysed by XRF at Geologisk Institutt, NTH, Trondheim).

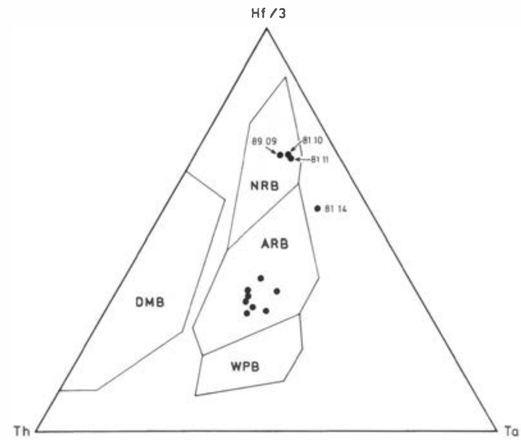

Fig. 4. Storøya meta-volcanics plotted in the Hf-Th-Ta diagram (Wood et al. 1979). (Analysed by INAA at IFE, Kjeller, Norway).
NRB = normal ridge basalt. ARB = anomalous ridge basalt. WPB = within plate basalt. DMB = destructive margin basalt.

of 'normal' and 'anomalous' ridge basalt is well documented from modern ridge segments (e.g. Sigvaldason 1974).

It is thus possible that the Leka ophiolite represents a segment of 'anomalous' oceanic lithosphere.

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