
Rockall

Highlights

This is one of the few occurrences of alkali granite in the British Tertiary Volcanic Province and it is notable for its unusual mineralogy, including elpidite, leucophosphite and a Ba–Zr mineral 'bazirite'.

Introduction

The geological interest of Rockall lies in its relevance to the development of the North Atlantic Ocean and in its geochemistry and mineralogy which distinguishes it from the majority of intrusions in the BTVP. The island rises about 20 m above sea-level and consists entirely of peralkaline granite. Specimens were collected from Rockall early in the eighteenth century but the earliest detailed petrological and chemical descriptions were by Judd (1897) and Washington (1914). The geology has been described by Sabine (1960) and in accounts of expeditions to the islet in 1971 and 1972 (Harrison, 1975).

Description

Rockall is composed of moderately coarse-grained, aegirine/acmite-riebeckite granite with small segregations of finer-grained, peralkaline micro-granite and xenoliths. Modal analyses of the granite gave the following mean (volume) percentage values: quartz 22%, feldspar 53%, ferromagnesian minerals 23% and accessory minerals 2%. Both felsic and mafic variants occur within the main body of granite; the variant with the highest modal percentage of ferromagnesian minerals (68%) has been termed rockallite (cf. Sabine, 1960). The granite contains drusy cavities which are lined by a variety of minerals including elpidite, leucophosphite and a barium–zirconium silicate (bazirite). Monazite may be embedded in the elpidite and apatite has been observed. Fine-grained, ovoid dark-coloured xenoliths up to 1 m by 0.3 m frequently carry quartz and feldspar megacrysts but otherwise have virtually identical mineralogy to the main mass of the granite. Sharp boundaries exist between the inclusions and the granite but no definite chilled contacts are present. The granite has been dated at c. 52 Ma (Harrison, 1975).

The Rockall Granite is apparently emplaced into the lavas and microgabbros of probable Cretaceous age which form Helen's Reef (Roberts *et al.*, 1974). The presence of continental crust is indicated by granulite-facies Precambrian rocks recovered from drill cores and bottom dredging (Roberts *et al.*, 1972, 1973); the metamorphic rocks are similar to granulites exposed in the Outer Hebrides and north-west Scotland. The Helen's Reef microgabbro is associated with troctolites and they are probably responsible for a major negative magnetic anomaly in this area.

Interpretation

The Rockall Granite and the nearby microgabbro of Helen's Reef may be part of a central complex intruded into Cretaceous igneous rocks and Precambrian granulites. Although the Helen's Reef rocks have yielded a Cretaceous age in comparison with the Eocene age obtained from the Rockall Granite, it has been argued that the microgabbro could be of early Cenozoic age (Beckinsale, in discussion of Durant *et al.*, 1976). Harrison (1982) compares the composition of Helen's Reef microgabbro with (tholeiitic) non-porphyritic central magma-type rocks of the Inner Hebrides (for example, those of Centre 2, Mull), pointing out that the composition is unlike that of oceanic tholeiites; he also argues that there is no petrographic or chemical affinity with the Rockall Granite. However, this would not preclude both intrusions belonging to the same central complex, since both tholeiitic and (mildly) alkaline intrusions are well-documented from other centres, as, for example, on Skye (compare the mafic rocks of the Cuillin Centre with the mildly alkaline granite of Strath na Crèitheach).

The Rockall Granite, with its suite of rare minerals, is compositionally comparable with the earlier, alkali-microgranite boss of Ailsa Craig (62 Ma; Harrison *et al.*, 1987) and with some members of the Eocene and younger alkaline complexes

present along much of the East Greenland coastal belt (Nielsen, 1987; Upton, 1988). The Rockall Granite may have been formed by a small amount of partial melting in the upper mantle during the waning stages of igneous activity on the margins of a major hot-spot which existed over the area of the North Atlantic during the Tertiary (White, 1988).

Conclusions

Rockall is a small intrusion of granite which contains a suite of uncommon minerals. It appears to intrude lavas and metamorphic rocks which form the Rockall microcontinent. It was probably formed at a late stage in Tertiary rocks igneous activity within the British Tertiary Volcanic Province and the North Atlantic, at a time when the upper mantle was cooling off after the main phase of magmatism during the Palaeocene.

References