Roineval

Highlights

The site contains an excellent example of a composite mugearite flow with an aphyric lower member and a strongly feldspar-phyric upper part.

Introduction

A type example of a composite mugearite lava flow forms the summit area of Roineval. Composite lavas on Skye were first described by Harker (1904) who interpreted them as sills, but they were later shown (by Kennedy, 1931b) to be lava flows. More recent investigations include those of Muir and Tilley (1961) and Boyd (1974).

Description

The Roineval flow lies within the ffeinn Totaig Group of lavas in northern Skye ((Table 2.2); Anderson and Dunham, 1966) and rests upon the weathered vesicular top of a non-porphyritic mugearite. The composite flow consists of an upper member with phenocrysts of plagioclase, olivine and titaniferous magnetite overlying an essentially aphyric mugearite. The boundary between the units is gradational over several centimetres, in contrast to other composite flows such as those at Druim na Criche [NG 435 375], in which the two components are separated by a sharp, non-erosional boundary. The upper porphyritic unit at Roineval contains abundant plagioclase phenocrysts together with lesser amounts of altered olivine and magnetite. Boyd (1974) reports homogeneous (An_{55}) cores to the phenocrysts, which are euhedral but often broken, and thin, more calcic rims (*c.* An_{60}), and jackets zoned from An_{51} to An_{40}. A small amount (15 vol.%) of similar plagioclase phenocrysts ($An_{52–50}$) occurs in parts of the otherwise essentially non-porphyritic lower unit. The bulk composition of the upper unit is hawaiitic, that of the lower unit is mugearitic. The porphyritic mugearites show a marked degree of iron enrichment, especially when recalculated to a phenocryst-free base (cf. Anderson and Dunham, 1966, tables 8 and 9; Muir and Tilley, 1961, table 4).

Interpretation

Composite lava flows are a feature of special petrological interest within the Skye plateau lava succession; the Roineval flow is one of several particularly clear examples. The strongly feldspar-phyric top member of the composite flow, overlying rock with a similar matrix composition but lacking numerous phenocrysts, suggests that the source was a differentiated body of magma in which large, labradorite crystals had sunk, together with olivine and opaque oxides, leaving an upper, crystal-free layer of magma. An initial eruption evacuated the aphyric portion, forming the basal mugearite which was rapidly followed by the remaining, phenocryst-rich magma of the upper unit. Boyd (1974) suggests that the slight compositional differences between the upper and lower units may be attributed to the concentration of phenocrysts in the upper part. The lack of chilling between the units, and the manner in which they merge over 10–20 cm, provides proof that there was very little time between the eruption of each unit; the porphyritic unit may well have followed virtually instantaneously. The well-defined break between the porphyritic and aphyric members of the composite flow suggests that there were tranquil conditions in the magma chamber for some time prior to eruption; strong convective or other movement would have mixed the two parts.

The relationships seen in the Skye composite flows strongly suggest that plagioclase feldspar might sink and accumulate in an evolved magma of hawaiitic or, as in this instance, mugearitic composition. This has important petrological implications since it has been claimed, in connection with the formation of layered gabbro complexes, that plagioclase flotation would be more likely (cf. McBirney and Noyes, 1979), in contrast with the earlier view that settling of feldspar occurred in these bodies (for example, Wager and Brown, 1968).

Conclusions

The composite lava flow of Roineval provides evidence that labradorite feldspar phenocrysts might have sunk in the iron-enriched magmas represented by the Skye mugearites. The relationships found at this site therefore have an important bearing on the crystallization processes in magma chambers and on the origin of layered structures frequently present in gabbroic plutons. They support the original models for the origin of igneous layering proposed by Wager and Deer (1939) and elaborated by Wager and Brown (1968), rather than alternative explanations offered by McBirney and Noyes (1979) and others.

References

NORTHERN SKYE (1) Anderson and Dunham (1966)	WEST-CENTRAL SKYE (2) Williamson (1979)	Based mainly on NORTHERN SKYE (3) Thompson *et al.* (1972)
	7. Talisker Group	Preshal Mhor tholeiitic basalts
5. Osdale Group	6. Loch Dubh Group 5. Arnaval Group	Skye Main Lava Series
4. Bracadale Group	4. Tusdale Group	
3. Beinn Totaig Group	3. Cruachan Group*	Transitional and alkali-olivine basalts, hawaiites, mugearites, benmoreites and trachytes. More fractionated types are more common in the higher groups.
2. Ramascaig Group	2. Bualintur Group	
1. Beinn Edra Group	1. Meacnaish Group	

Individual groups are probably geographically restricted (see, for example, Anderson and Dunham, 1966, figure 13).

* The thick fluviatile conglomerates of the Allt Geodh a' Ghamhna site are at the base of this group.

(Table 2.2) Correlation of the divisions of the Palaeocene lavas of the Isle of Skye (mainly after Williamson, 1979, table 1).