Some Xenoliths from the Alkalic Rocks of Teneriffe, Canary Islands

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Abstract. 1. Xenoliths of ultrabasic, ultramafic, gabbroic or syenitic type occur in Teneriffe: dunites and clino-pyroxenites in the old alkalic basalt formations of Teno and Anaga peninsulas; gabbroic xenoliths in the Pedro Gil region; nepheline-syenite xenoliths in the Las Canadas and Vilaflor regions where intermediate and phonolitic lavas are abundant; ultramafic, clino-pyroxenite and syenitic xenoliths in the Anaga peninsula where there are many intrusions of nepheline-syenite and phonolitic syenite. Several xenoliths show signs of cataclasis, recrystallisation or reaction of their minerals with the host liquids.

2. The ultrabasic, ultramafic and anorthoclase-rich xenoliths appear to be of cumulus origin, subtracted from basic to intermediate alkalic liquids. Major cumulus phases are: magnesium-rich olivine, sub-silicie, aluminous pyroxene, titanomagnetite, sub-silicic potassic kaersutite, and anorthoclase. It is suggested that the xenoliths formed at depths between 11 km and 30 km, largely under wet conditions that helped suppress formation of cumulus plagioclase.

3. The subtraction of kaersutite from liquids of intermediate composition is thought to be a means of producing the gap in silica content between the Teneriffe trachybasalts and the more siliceous trachyphonolites and phonolites. It is also suggested that the subtraction of kaersutite and anorthoclase would considerably deplete residual liquids in alumina whilst enriching them in soda and this might be the means of producing peralkaline liquids.

4. The presence of the xenoliths supports the geophysical data that indicated that Teneriffe has a sub-crustal structure of plutonic rocks. Correlation of the Teneriffe plutonic xenoliths with exposed plutonic basement rocks from other Canary Islands, which are believed to have similar sub-crustal structures, is considered necessary.

Introduction

Over the last several years there has been an increasing interest in studies of xenoliths from the volcanic rocks, especially those of alkalic type, of the oceanic islands; White (1966) and Kuno (1969) on mafic and ultramafic xenoliths from the Hawaiian lavas; Jackson (1967) on the significance of xenolith data in elucidating the nature of the mantle beneath the Hawaiian volcanoes; Le Maitre (1965 and 1969) on gabbroic xenoliths from the S. Atlantic islands of Gough and Tristan da Cunha; Bennell (1969) on xenoliths from the Azores; and Frisch and Schmincke (1969), Ibarrola and Viramonte (1967), and Fuster et al. (1970), on xenoliths from different islands of the Canary archipelago. This paper is a further consideration of xenoliths from the Canary islands and it examines, in particular, the petrography and mineralogy of some ultramafic types from Teneriffe. The results of the study confirm, among other things, that kaersutitic amphibole of a limited compositional range was present, probably as a stable primary phase, in many Canary and other Atlantic island xenoliths prior to their inclusion and eruption in the host lavas — results that emphasise the necessity of determining
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the stability field in which this mineral crystallises. It is also considered that the data obtained support the views of White (op. cit.), Jackson (op. cit.), Fuster et al. (op. cit.) and others that plutonic, and possibly layered, complexes exist below some volcanic islands, and that many xenoliths might have their origin in these complexes rather than in the mantle.

Geological Background

The Canary archipelago comprises La Palma, Gomera, Hierro, Teneriffe, Gran Canaria, Fuerteventura and its northern, structurally related, neighbour Lanzarote. Geographically the islands lie off the N.W. African coast at the edge of the continental slope, between latitudes 27°35' N and 29°25' N and longitudes 13°25' W and 18°15' W. Fuerteventura, the most easterly island, is barely 100 kms. from the African mainland. Structurally the islands occur in a region of faults, a major one of which to the west of Fuerteventura and Lanzarote separates these two islands from the western members of the group (Dash and Bosshard, 1968). Geophysical evidence, presented by the latter authors and based on seismic data, also shows a change from a truly oceanic environment in the west of the Canaries to a transitional one in the east, with a gradual increase in the depth of the Moho as the fault line west of Fuerteventura-Lanzarote is approached. Apart from minor sedimentary horizons in Fuerteventura, and to a lesser extent elsewhere, the islands are built of volcanic rocks with associated plutonic complexes or isolated intrusives. Ignoring the islands of Fuerteventura and Lanzarote whose

Fig. 1. Geology of Teneriffe—modified after Hausen (1956)