A1 Lizard Point

[SW 695 116]–[SW 706 115]

Highlights

The best sections of the Old Lizard Head 'Series' metasediments and associated metabasalts, the Landewednack Hornblende Schists, occur here. Also exposures and boulders of the Man of War Gneiss are of importance.

Introduction

The earliest detailed description of the micaceous and hornblendic schists, that occur around the southern tip of the Lizard Peninsula was by Bonney (1883), who regarded them all as metamorphosed sediments. Somervail (1884) suggested that the hornblendic rocks were magmatic and this has been accepted by all subsequent workers. Flett and Hill (1912) give a full review of all earlier work, together with their own detailed descriptions of the range of metasediments. They regarded the hornblendic rocks as a series of metamorphosed basaltic lavas, tuffs and intercalated sediments and introduced the name Landewednack Hornblende Schists, derived from the hamlet one kilometre to the north. They pointed out that the sediments and metabasalts were interbedded and components of a coherent rock group but there was no 'way up' evidence to establish which group was the older. They described the mineralogy of the schists, which indicated high grades of metamorphism with the development of garnet and sillimanite. The metamorphic assemblages were discussed in greater detail by Tilley (1937) who also described unusual cordierite–anthophyllite rocks from Pistil Ogo, about 400 m north of Lizard Point.

Boulders of a dioritic gneiss with a very characteristic banded appearance are abundant on the beaches along the section; they can be seen *in situ* on the southern tip of Vellan Drang at very low tides. This is the Man of War Gneiss, named after the largest of the skerries and is the least accessible and least known of all the Lizard rock types.

Description

The Old Lizard Head metasediments and the Landewednack Hornblende Schists are intimately associated and in many places are interbedded. To the east of Polbream Cove the rocks are almost entirely amphibolite, whereas to the west they are dominantly metasediments. The large cliffs below the lighthouse form a thick, gently dipping, bedded sequence of very uniform amphibolites. Closer inspection shows that the bedding is also a metamorphic foliation and that the sequence has been isoclinally folded. This is shown by a strong lineation of the hornblende prisms and the presence of small intrafolial folds. The intensity of deformation and metamorphic recrystallization has destroyed most of the original igneous structures in these rocks. However, within the amphibolites and the schists there arc a few coarser-grained, dyke-like bodies. Within the amphibolites are thin epidotic layers, formed during a very early stage, prior to deformation, which makes the folds more obvious. Most writers have suggested that the epidote was derived from calcic sediments. Also present are epidotic pods and cross-cutting veins that have clearly formed later. The majority of the rocks here give the impression that they are derived from a series of lava flows or sills, but, in a few places, horizons are present that have a less-uniform character and a fine-grained, fragmental nature that possibly could be derived from tuffs or volcaniclastic sediments.

To the west of Polbream Cove the sequence is dominantly of mica schists, although some layers of amphibolite and green hornblendic schists are also present. The hornblendic schists are transitional in lithology between the amphibolites and the sediments and are probably derived from tuffaceous sediments with a mixture of clastic and basic volcanic detritus. The interbedding and common deformational history of the sediments and amphibolites is good evidence for them being a largely extrusive sequence. The schists vary somewhat, but are dominantly muscovite rich, although quartz-rich varieties are also present. They tend to be fine-grained and rather phyllitic in appearance, although much of this is due to late shearing and belies the original high metamorphic grade shown by the wide occurrence of garnet, fine sillimanite and possibly kyanite.

At Pistil Ogo, associated with the greenschists, are the unusual cordierite–anthophyllite schists described by Tilley (1937) that have a characteristic blotchy appearance due to the clots of cordierite.

In a few places around Polpeor and Pistil Ogo, there are small pods of quartzofeldspathic material that could possibly be the first stages of partial melting. In the cliffs close to Lizard Point there is a much more substantial sheet of granitic rock which is several metres in thickness.

The beaches along this section are littered with boulders of a banded dioritic gneiss with a marked segregation of the mafic and felsic minerals. This is the Man of War Gneiss which forms many of the offshore skerries, and the southern part of Vellan Drang, the series of reefs which are accessible at very low tides. The reefs and skerries are almost entirely encrusted with barnacles, etc. and it is very difficult to see any contact relations. However, what little can be observed confirms the early report of Fox and Somervail (1888) that it is a *lit-par-lit* intrusion into the Old Lizard Head 'Series'.

Interpretation

This is the only site on the Lizard where the metasedimentary sequence can be clearly seen. The only other coastal section is a short section at Porthallow where it has been affected by intense shearing and alteration. Small, inland exposures are very poor and deeply weathered. The sedimentary origin of the rocks has been recognized since the earliest work (De la Beche, 1839), even though none of the original sedimentary features are preserved. The close relationship with the amphibolites is also clearly demonstrated and their common structural history and transitional rock types establish the former as an extrusive sequence.

The chemical composition of basalts is a good indicator of the tectonic regime of their origin and several workers have analysed rocks from this section and localities nearby (Floyd, 1976; Kirby, 1979b; Styles and Kirby, 1980). Trace-element discriminant diagrams presented by these authors give a strong indication that these amphibolites have the chemical signature of ocean-floor basalts. The recent study of REE geochemistry by Sandeman (1988) shows a generally flat pattern with about 20 x chondritic abundances typical of mid-ocean ridge basalt (MORB). The recognition that the Landewednack Hornblende Schists have MORB affinities is important, as it connects this lower tectonic unit with the rest of the ophiolite complex. Their chemistry shows that they are not comagmatic with the other ophiolitic rocks, but this is not surprising, bearing in mind that the Lizard has features suggesting a slow-spreading centre and that small, transitory magma chambers would be expected rather than a single large one. This chemical type contrasts with most of the other basaltic rocks of south-west England, but is similar to the greenschists of the Start Complex.

The chemical data from the Man of War Gneisses (Sandeman, 1988) show that the contents of large-ion-lithophile elements, such as Sr, K, Rb and Ba, are high and that Ti is low compared with MORB. This indicates that they have similarities to arc-related rocks, which shows that they are not related to the Landewednack Hornblende Schists, but have a greater similarity to later magmatic episodes such as the Kennack Gneiss.

This site is very important in Lizard geology as it is the best section of the metamorphosed equivalents of the sea-floor sediments and basalts of the ophiolite complex. This upper part of the typical ophiolite sequence is never seen in its correct position in the Lizard ophiolite stratigraphy; it is only preserved in slivers attached to the base of the main ophiolite slab during obduction.

Conclusions

This site consists of metamorphosed sediments and magmatic rocks of the Lizard Complex. This includes the Old Lizard Head 'Series' (metamorphosed fine-grained sediments) and the Landewednack Hornblende Schists (metamorphosed basaltic lavas) which are intruded by the Man of War Gneiss (metamorphosed dioritic rocks). The Lizard Complex has been interpreted as a piece of ancient, early Devonian, oceanic crust (ophiolite) that was thrust to the north during the late Devonian. Studies of the chemistry of the 'basalts', show clear affinities with basalt erupted on the present-day ocean floor, at mid-ocean ridges. The later 'diorites' have a chemistry which is similar to that seen in the igneous rocks formed in modern island arcs at the margins of the oceans. This is the best site to examine sediments and volcanics which formed part of the floor of the Variscan ocean before it was subsequently destroyed by continent–continent collision.

References