
B3 Penlee Point

[SW 474 269]

Highlights

At Penlee Point, spectacular contact-metamorphic and metasomatic mineral assemblages are superimposed on a dolerite sill and its sediment rafts.

Introduction

The site is located within the Land's End Granite aureole. It is topographically 600–700 m from the inferred contact, and it exhibits the effects of low-grade contact alteration. Apart from brief descriptions within the Survey Memoir (Reid and Flett, 1907), Floyd (1966a) recognized two sills in this section of the aureole, the uppermost of which (Penlee Sill) constitutes this site; the lower sill (Gwavas sill) is exposed along the foreshore to the north (Figure 4.8). It is generally assumed that both these massive greenstone sills represent offshoots from a parent body in the huge, working Penlee (or Gwavas) Quarry near Newlyn, the rocks of which might represent a feeder pipe to all local sills (Floyd, 1966a), although compositionally it is more differentiated than the strictly basic sills and no direct contact is seen with the Penlee Sill of this site.

Description

The site includes about 300 m of rocky foreshore around Penlee Point and the disused Penolva and old Penlee quarries just inland (Figure 4.8). The central mass of the Penlee Sill is seen on the foreshore, while the lower contact is within Penolva Quarry and the upper is exposed in Penlee Quarry. A relatively uniform sill-like body (about 30 m thick) is indicated, with narrow flinty adinoles at the contacts with the normal aureole pelites whose dominant bedding foliation dips eastward at about 25°.

On the foreshore opposite Penlee Point, a small biotitized and heavily spotted pelitic raft is apparently enclosed within the sill. The basic rock is foliated at the contact, with the development of a cummingtonite–cordierite assemblage (Lacy, 1958) that replaces the usual actinolite–plagioclase association of other altered parts of the sill margins.

The sill is within the granite aureole; it shows the superimposed effects of albite–epidote hornfels facies of contact metamorphism on a variably textured and differentiated basic intrusive. The marginal zones are fine-grained, actinolite–albite–ilmenite-dominated hornfelses derived from a doleritic precursor, whereas the central portion is a coarser metagabbro with relict pyroxene fringed by actinolite, and calcic plagioclase partially replaced by albite. Other secondary minerals include chlorite, minor epidote, quartz, white mica and sphene. Owing to the low-grade nature of the alteration, these effects are similar to those exhibited by the regionally metamorphosed, massive greenstones seen in south Cornwall. The direct effects of contact alteration, however, are seen in the patchy development of metamorphic biotite replacing fibrous actinolite or nucleating on ilmenite grains, and this gives the normally greenish rock a brown tinge. Later, granite-induced hydrothermal effects are the variable chloritization of mafic constituents and the development of large, zoned, blue tourmaline (schor-lite) crystals replacing altered matrix (Figure 4.9). Asbestiform actinolite veinlets are also common, together with small irregular pockets of late amphibole within the metagabbroic portion of the sill. In the small cove next to the lifeboat house, a large quartz vein with smaller apophyses intrudes a variably biotitized greenstone which has been almost totally chloritized adjacent to the vein.

Interpretation

The site provides a compact example of a small greenstone sill that has undergone low-grade contact metamorphism by the Land's End Granite. Contact-metamorphic biotite, together with relatively late-stage hydrothermal effects can be

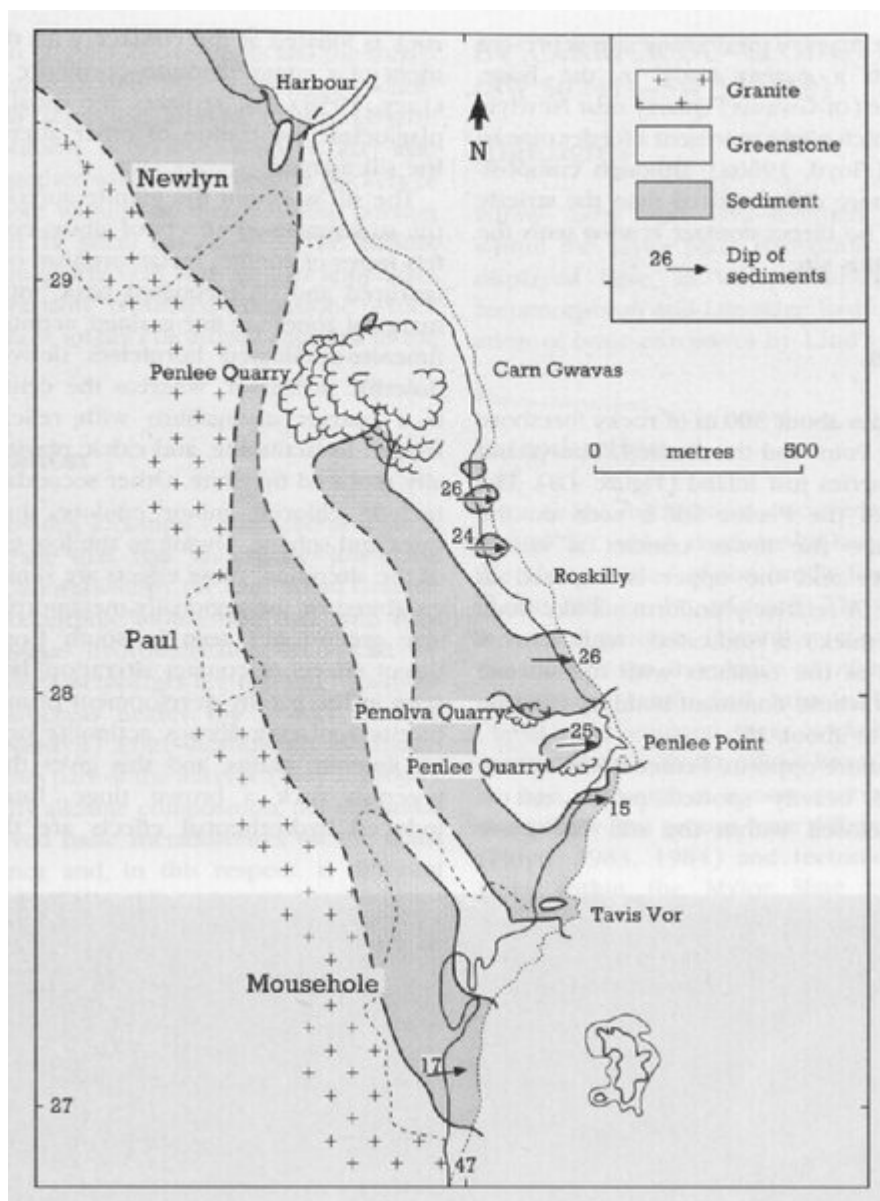
demonstrated. Assemblages are typified by albite–actinolite, whereas nearer the granite (Penlee Quarry at Newlyn) albite–hornblende is characteristic for this part of the aureole (Floyd, 1966a). It has a mildly alkaline composition, not dissimilar to the evolved basic metadolerites on the coast near Penzance and, in this respect, is different from other more massive, chemically primitive, dolerite/gabbro intrusives typical of south Cornwall generally (for example, Cudden Point, described below). Its relationship to the pipe-like (feeder?) intrusion at Penlee Quarry is not clear, but the latter has a different composition, even allowing for hydrothermal alteration effects.

An unusual feature, at Penlee Point proper, is the development of a cummingtonite–cordierite assemblage in the marginal zone of the intrusive adjacent to the enclosed pelitic raft. This probably developed from contact metamorphism of an altered and foliated Ca-poor marginal facies of the dolerite generated during initial regional deformation.

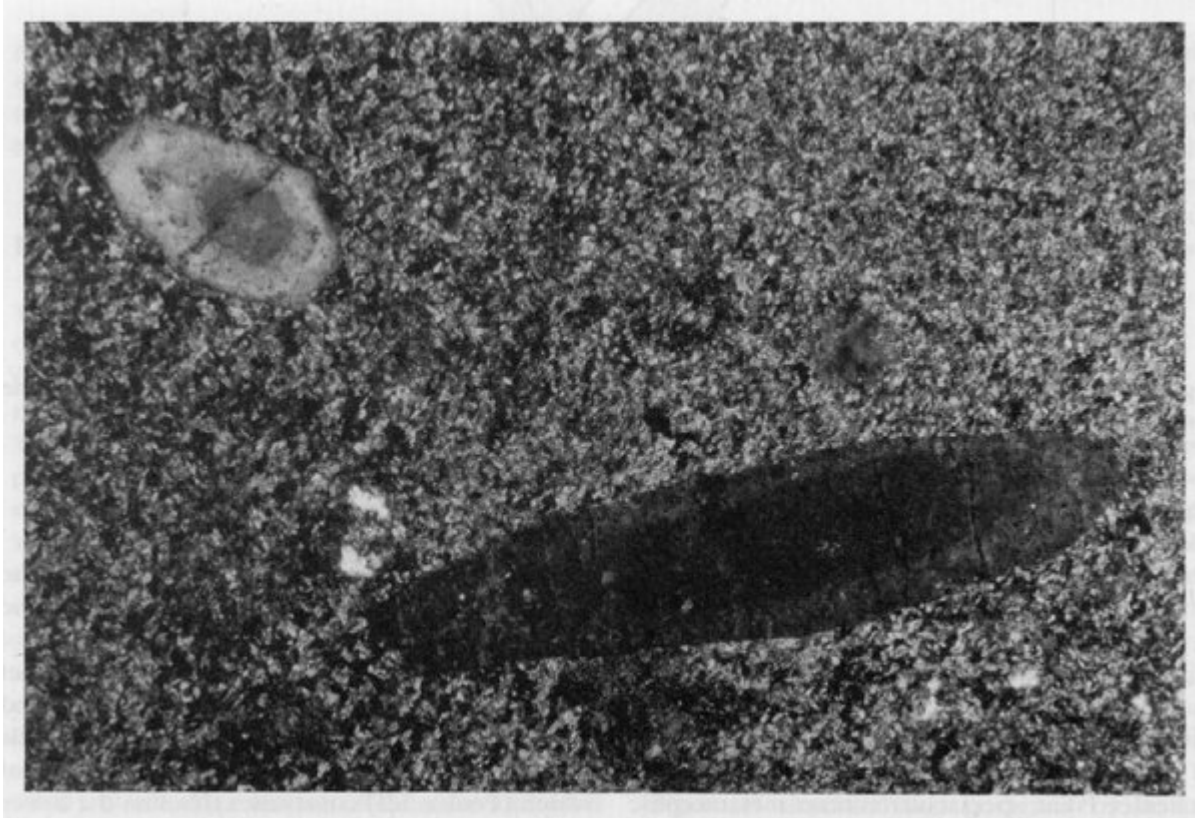
Conclusions

The alkali-dolerite sill at Penlee Point displays a coarse, gabbroic inner zone and raft of pelitic sediment. When the later Land's End Granite was emplaced nearby, spectacular low-grade metamorphic (albite–actinolite and cummingtonite–cordierite) and metasomatic (tourmaline-bearing) mineral assemblages were developed across the sill, its rafts and the enclosing country rock.

References



(Figure 4.8) Geological map of the Mousehole—Newlyn section of the Land's End Granite aureole, showing the distribution of the dolerite sills around Penlee Point (after Floyd, 1966a).



(Figure 4.9) Photomicrograph showing late zoned tourmaline replacing chloritic matrix of contact metamorphosed Penlee dolerite (cross polars). (Photo: P.A. Floyd.)