Priest's Cove, Cape Cornwall, Cornwall

[SW 352 315]

Introduction

The Land's End Granite is renowned for the geology of its contact relationships, for the adjacent variety of contact metamorphic hornfelses, and associated mineralization, especially in the coastal strip from Cape Cornwall to Pendeen. At Priest's Cove, biotite granite is intimately veined by a later variety with associated pegmatite pods and tubes. There is evidence of a major faulted contact with andalusite-biotite hornfels. Comparisons can be made between the tourmaline 'pods' of Priest's Cove and the massive tourmalinized features at Porth Ledden [SW 353 321].

Priest's Cove lies to the south of Cape Cornwall (see (Figure 7.7)). Above the cliffs of Priest's Cove were situated the St Just United mines which worked a series of lodes for tin. The chimney and mine buildings on the Cape Cornwall promontory (see (Figure 7.8)) are the remains of the St Just Amalgamated mines which also worked tin-bearing lodes; eventually the two groups were merged sometime after 1878.

Important petrological and mineralogical features are remarkably well-exposed in the cliffs and rock platform of Priest's Cove, which include:

1. the development of pegmatitic features associated with the granite;
2. comparison of the tourmalinization present at the faulted Priest's Cove contact and the unfaulted Porth Ledden contact, to the northeast of Cape Cornwall; and
3. a study of the controls of mineralization.

Dines (1956) described the mining setts of the St Just Amalgamated and St Just United mines. The mines worked tin from a group of lodes trending south-eastwards from the southern side of the Cape Cornwall headland. The rocks hosting the mineralization are granites, overlain at Cape Cornwall by contact metamorphosed country rock ('killas') and some altered basic igneous rocks ('greenstones'). Records of output from St Just United between 1862 and 1904 were 1870 tons of 'black tin' (unrefined ore).

Details of the rocks in the Cape Cornwall area related to the contact phenomena of the Land's End Granite and adjacent killas, and late-stage granitic processes are given by Reid and Flett (1907), and Goode and Taylor (1988). The petrography of the Land's End Granite has been detailed by Booth and Exley (1987). Hall (1994) also described the geology of the area, while aspects of pegmatite development have been described by Hosking (1952), and hydrothermal activity by Jackson *et al.* (1982). The detailed petrology of the granitic rocks of the area between Priest's Cove and Porth Ledden has been described in the Cape Cornwall GCR site report presented by Floyd *et al*. (1993). Most recently Powell *et al*. (1999a,b) have described formation and emplacement styles of the Land's End Granite.

Description

Priest's Cove provides excellent exposures of folded spotted slates and hornfels of various types. In the cliff exposures close to the boat ramp can be seen some small-scale overturned folds. These are associated with considerable quartz veining filling tension gashes, and deformation of harder arenaceous bands in the mostly argillaceous slates. On the south side of the cove, a fault is marked by a small cave; this separates the hornfels from massive granite to the south. The Land's End Granite here is only slightly porphyritic, contrasting with the strongly megacrystic granite seen at Land's End and at the Nanjizal Cove GCR site. The granite is sheared and reddened close to the fault. The granite is also traversed by narrow bands of altered (greisened) granite and thin tourmaline veins. The Mylor Slate Formation meta-sedimentary rocks have been strongly mineralized and in places brecciated. Two joint-sets in the granite are occupied by early pegmatites and later quartz-tourmaline and greisen-bordered veins carrying mineralization. In places both the quartz and tourmaline form coarse aggregate masses.

The relationships between several periods and types of mineralization, along with pegmatite development associated with several texturally different types of granite, are exposed in the extensive wave-cut rock platform. At Priest's Cove the main granite seen to the south of the vertical faulted contact is medium- to fine-grained and sparsely megacrystic, somewhat different to much of the Land's End Granite elsewhere. However, Priest's Cove is well known for an area of coarse-grained granite exposed at low tide. This appears to intrude the main granite near the low-water mark and is important for the sporadic development of 'stockscheider' pegmatite along this contact. It is possible that the main fault displaced seawards a shallow-dipping roof contact, or alternatively the pegmatite might be due to a later intrusion. Some of the planar pegmatites have well-developed comb-textured feldspar megacrysts which are associated with areas of aplite.

Some areas to the north and south side of Cape Cornwall show remarkable development of tourmaline pods and masses, interpreted as being both of magmatic origin and also later hydrothermal growth accompanying cassiterite vein infill. Halls *et al.* (2001) provided field evidence for discrete episodes of intrusion during the emplacement of the Land's End Granite, based on results obtained from detailed mapping and observation of the Porth Ledden coastal section.

Pegmatitic 'spots' in the main granite are not related to faulting or vein structures, and consist of lenses of pink feldspar and quartz with euhedral black tourmalines. These sometimes abut against the contact, where a dark selvage of almost pure schorl (tourmaline) is often formed. However, the volume of the 'pods' of tourmalinite in Priest's Cove is small in comparison with that in Porth Ledden.

The main fault lode exposed at the base of, and in the cliff section at, Priest's Cove has been worked along a trial adit. This demonstrates very well features of the mineralized lodes in this area. The brecciated zone is up to 2 m wide, trending north-west–south-east with a dip of 70°–85° N. This is a similar trend to some of the lode structures of the Botallack–Geevor region to the north. Brecciation appears to'be a normal associate of faulting and hydrothermal activity in Cornish lodes. The Priest's Cove lode-breccias may have formed during stoping contemporary with granite intrusion. The wall-rocks are formed from granite breccia and massive quartz vein material, while thin stringers of tourmaline become important towards the footwall.

Interpretation

One of the important features of the Priest's Cove to Porth Ledden section is the evidence provided for the relationship of magmatic to hydrothermal tourmalinization and the relationship of both to mineralization. Post-magmatic processes in South-west England and Brittany have been described by Charoy (1982). From the evidence at Priest's Cove it would seem that the tourmaline formation could be related to contrasting mechanisms. Magmatic tourmalinites, like the pegmatites, tend to be barren of ore minerals. It was the main-stage mineralization process which generated the tin-tourmaline association.

Authors such as Charoy (1982), and Manning (1985) have suggested that tourmaline-quartz rocks are evidence of the unmixing of a fluid phase from the granitic magma. Charoy (1982) established a sequence of unmixing events for the Cape Cornwall area (see (Figure 7.9)), with tourmalinites and tourmaline-bearing granites being of magmatic origin, while tourmaline with cassiterite appears to be of hydrothermal origin. The relative distribution of these varieties may be dependent on the nature and distribution of post-magmatic hydrothermal convection cells. It may be that the fracture system in the granite is better developed in the Priest's Cove area, leading to greater metallogenesis at that location.

From the work of various authors, including Charoy (1979), it is suggested that a staged evolution occurred, namely:

1. the normal sparsely porphyritic granite (granite porphyry of Charoy) crystallized;
2. a related fluid phase was responsible for the pegmatite of Priest's Cove and the tourmaline granite at Porth Ledden; and
3. tourmaline granite differentiated into a megacrystic contact facies and the tourmalinite of Porth Ledden.

Unlike the extensive petrological, mineralogical and geochemical studies that have been undertaken for the Megilligar Rocks at the Tremearne Par GCR site, studies on the Priest's Cove to Porth Ledden section are limited. Therefore the

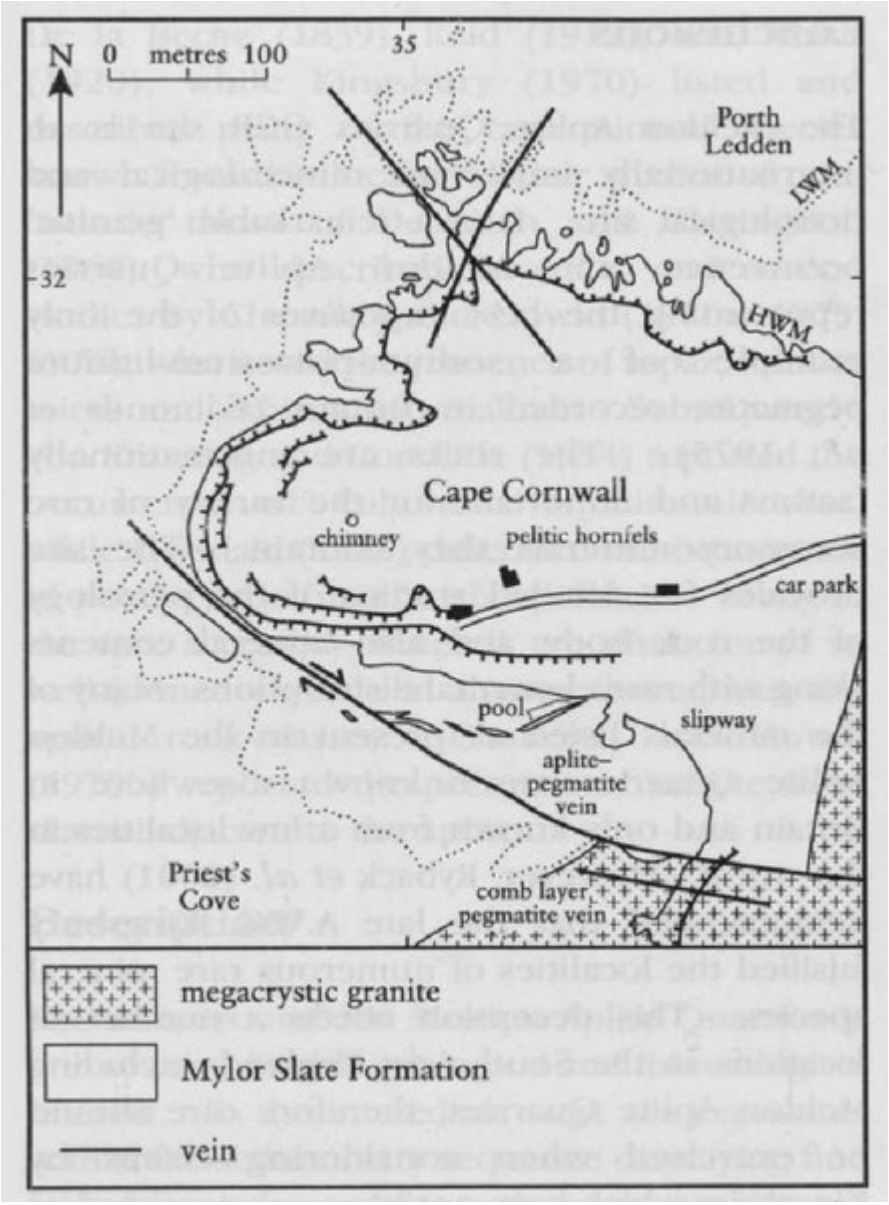
understanding of the late-stage granite processes at Priest's Cove awaits further studies. Only limited geochemical work has so far been described for the chemistry of individual mineral phases. Differences could relate to magmatic variation in the Land's End Granite or evidence of magmatic differentiation.

Conclusions

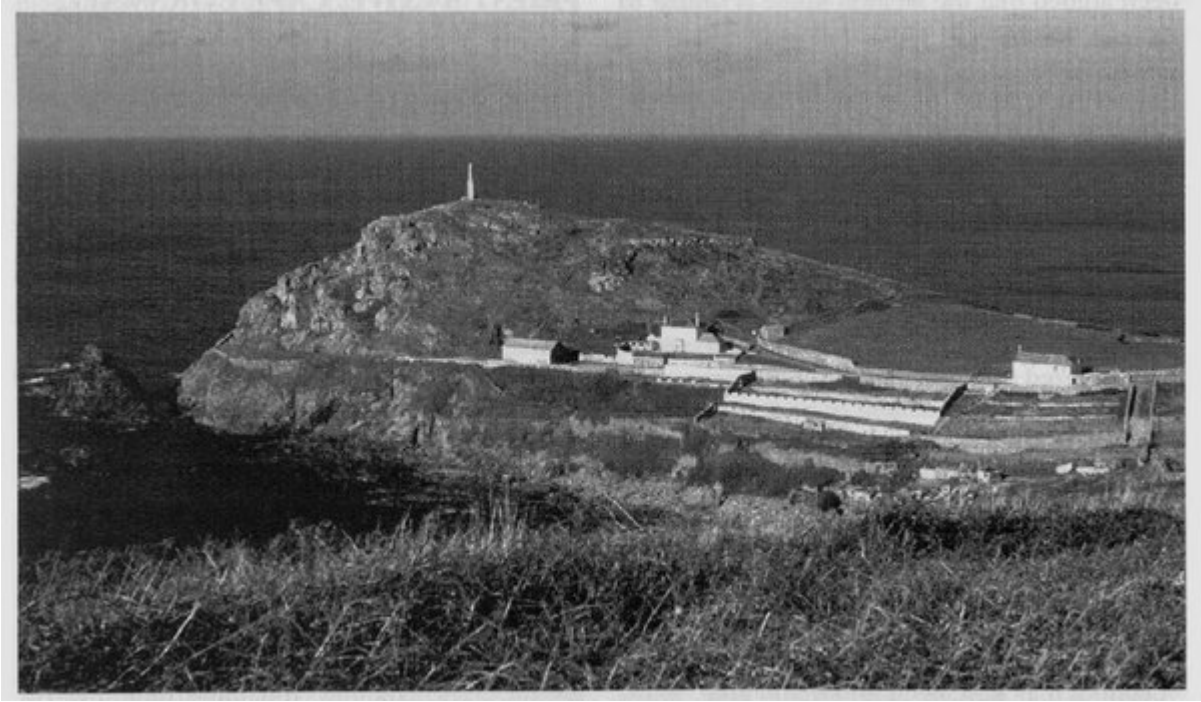
The Priest's Cove to Porth Ledden coast section provides excellent exposures in an area of classic granite-related coastline. At Priest's Cove a faulted contact between the Land's End Granite and Mylor Slate Formation metasedimentary rocks has been mineralized and hydrothermally brecciated.

A variety of pegmatitic, quartz-tourmaline and greisen veins can be viewed in the rock platform and cliffs of Priest's Cove, which are important to studies on the relationship between granites and mineralization, allowing study of the relationship between magmatic and hydrothermal tourmalinization. The readily available wall-rocks of the St Just lodes provide material for study of the nature of the hydrothermal mineralizing fluids in this area of the Land's End Granite. Finally, comparisons can be made between this locality, the Nanjizal Cove GCR site, and other Cornubian Batholith exposures, such as those at the Tremearne Par GCR site.

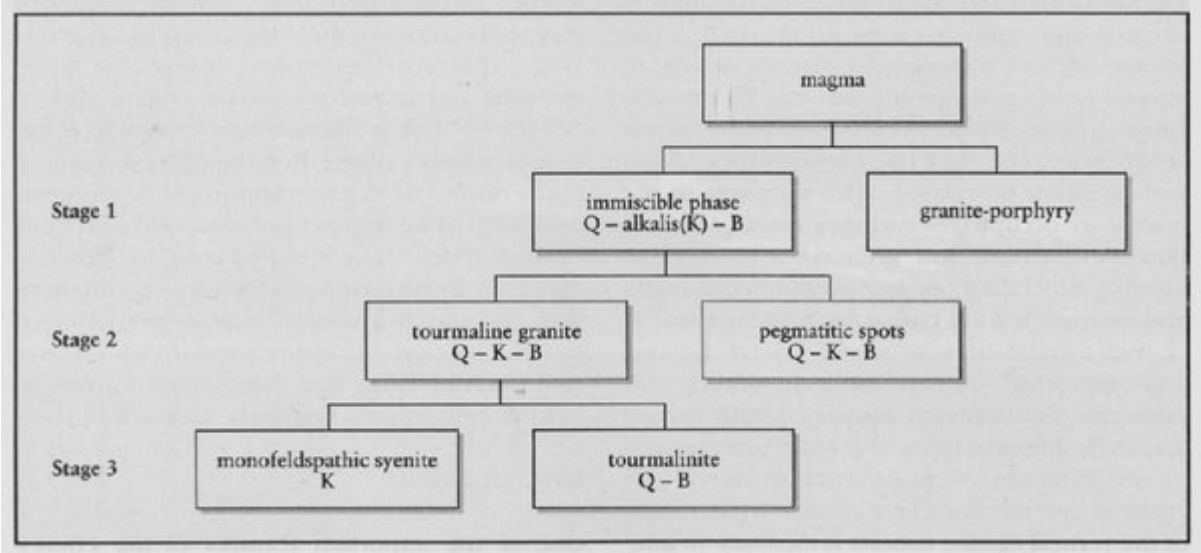
References



(Figure 7.7) Map of Priest's Cove. After Halls, unpublished field guide.



(Figure 7.8) The headland of Cape Cornwall showing mine chimney, remnant mine buildings and processing floors. (Photo: S. Campbell.)



(Figure 7.9) Diagram showing successive unmixing episodes from the crystallizaing magma at Porth Ledden and Priest's Cove. After Charoy (1979).