Nanjizal Cove (Mill Cove), Cornwall

[SW 357 236]

Introduction

Nanjizal Cove or 'Mill Cove' is located south of Land's End, and exhibits partially mineralized veins within the Land's End Granite in fine cliff and wave-cut beach sections. The mainly quartz-tourmaline veins are situated well within the granite with no evidence of a country rock contact or roof zone. The veins are recorded as carrying only a little cassiterite and wolframite.

The rocks of the Land's End Granite in the cove are cut by numerous small parallel veins resembling a sheeted-vein complex, although carrying quartz and tourmaline this southern area of the granite is only weakly mineralized. No large mines or workings are recorded in the area, although some stoping along the wider veins can be found as small trial pits.

The general granite landscape features are similar to other coastal exposures elsewhere in the Land's End Granite in which very regular and rectilinear patterns of joints give rise to a castellated appearance to the cliff sections.

A recent important detailed paper reports a re-examination of the Nanjizal mineralization by a team from the Camborne School of Mines (Leboutillier *et al.,* 2002).

The Land's End Granite has been studied in detail, and the extensive literature includes the works of Exley and Stone (1964, 1982), Exley *et al.* (1983), Booth and Exley (1987), Goode and Taylor (1988), and Floyd *et al.* (1993).

Description

On the extreme southern side of the cove the granite is well exposed in a series of cliff sections which are cut by numerous near-vertical mineralized fractures similar to a stockwork. The inner parts of the veins contain quartz, which is lined by black tourmaline. Rare, small crystals of cassiterite can be found in the central part of some veins but otherwise the veins contain no ore minerals. The fractures/veins strike across the beach and out to sea. The faulted structure consists of a series of discrete fractures within a zone some 3–5 m wide. Marine erosion along this trend, which is a line of weakness, has caused the formation of parallel rock crags and a spectacular narrow arch (see (Figure 7.35)). Elsewhere, some of the tourmaline-quartz veins trend around 1600–170°. Areas of the granite where veining is most intense are often reddened, probably due to the alteration of feldspar. The footwall of the major lode outcrops in a waterfall, and the associated cliff section consists of brecciated and tourmalinized granite with tourmaline-quartz veins resembling a sheeted-vein complex. Preferential weathering between the granite and the veins (of various widths up to 60 cm across but mostly a few centimetres) has caused a hummocky surface to the rocks on the beach.

The tourmaline-bearing fractures are cut by some small to large cross-course veins. It can be seen that the cross-course trend is the youngest, but in most instances the tourmaline-quartz veins are not noticeably displaced. These cross-courses form a few major structures (*c.* 0.5 m), which contain breccia structures noticeably with crusts of crystalline quartz. These are similar structures to those seen at the Penlee Quarry GCR site, on the eastern coast of the Land's End peninsula.

The granite in places grades into a relatively course variety rich in K-feldspar megacrysts, which sometimes show a rough alignment. The feldspars are often a few centimetres in length. Areas of a finer-grained granite can also be recognized.

Narrow veins of black tourmaline with quartz are common in the granite, along with a few nodular patches of tourmaline rock. Around the stockwork area the granite contains a large number of tourmaline-lined miarolytic pockets.

The brecciated structures are formed around unmineralized granite blocks; these appear to have acted as centres for the growth of layers of both quartz and chalcedony. The areas between the granite clasts are heavily reddened by hematite.

Interpretation

High-temperature hydrothermal (hypothermal) quartz-tourmaline veins within the Land's End Granite are well exposed at Nanjizal Cove. At Nanjizal there were several small trial mineral workings similar to others throughout the southern exposures of the Land's End Granite between Land's End and Porthgwarra, although these are all recorded as showing poor contents of ore minerals. To the north of Land's End relatively rich veins are recorded immediately south of Cape Cornwall and to the east towards Sancreed. However the mines and trial workings on these veins produced only low tonnages of ore and are relatively unimportant compared to the major ore production lodes located between Cape Cornwall and Pendeen (see Dines, 1956 for detail of outputs).

In discussing the distinct variation in the mineralization between the northern and southern areas of the Land's End Granite, a large number of factors have to be taken into consideration and the reasons are complex. It is possible that the closeness to country rocks or to the roof zone of the granite, or the presence of metabasic rocks in the succession are fundamentally important to the source of metals, and that deep within the granite perhaps there is little tin and other metals available. Certainly it would seem that the southern Land's End Granite is remote from an emanative centre.

It has been noted that structural parameters might be important; certainly there is a change of joint pattern from the northern to southern outcrop of the Land's End Granite. The major fracture pattern carrying the essentially tourmaline-rich granite veins is north-east-south-west. The rich mineral veins in the Land's End Granite to the north-west, in the Cape Cornwall to Zennor area, have a north-west-south-east trend, whilst to the east the regional trend tends towards east-west. Such changes in pattern can be seen on a local scale at Cligga Head in the sidewall of a granite cusp, and possibly the Land's End Granite is related to a later, concealed granite below the present-day erosion levels. However, more likely is a variation in the local stress regime at the time of granite consolidation, emphasizing one direction greater than another.

Geological interpretation of the Land's End Granite by various authors has shown some considerable differences in texture and chemistry. The difference of textural, mineralogical and chemical types of the granite needs further study and interpretation. This leads to discussion of the comparison in the use of textural classifications such as that of Dangerfield and Hawkes (1981) compared with the mineralogical and chemical classification of Exley *et al.* (1983).

Mount (1985) has speculated that the separate evolution and proximity of a fine-grained granite at depth in the Pendeen area has contributed towards the extent of mineralization in the Geevor Mine complex. Perhaps the southern part of the Land's End Granite represents the true metallic potential of type-B megacrystic granite, in comparison to a Li-mica granite which may be present in the Botallack–Geevor area.

Conclusions

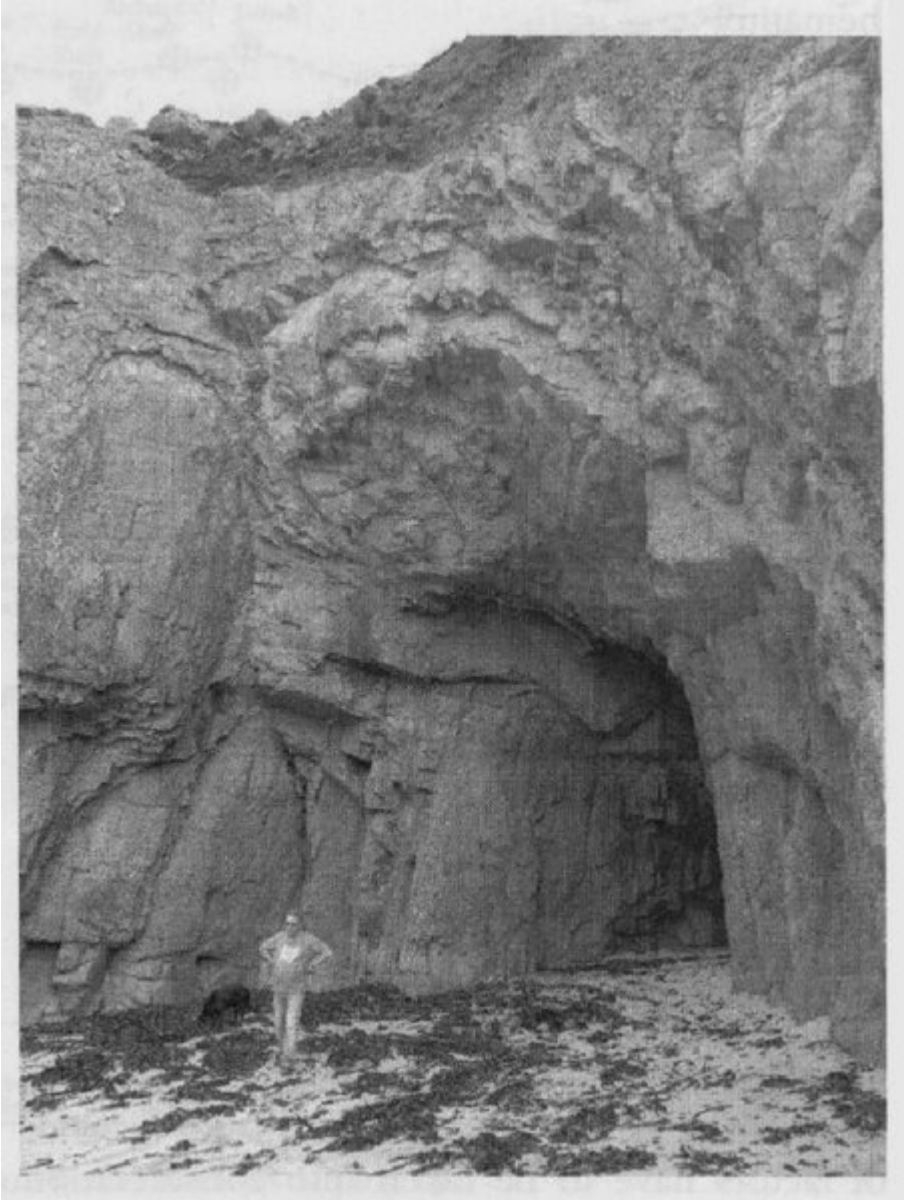
The excellent exposures at Nanjizal Cove demonstrate the nature of mineralized veins within the Land's End Granite mass. However the ore mineralization is weak and sporadic.

Two distinct trends of veining can be studied, namely an early phase of tourmaline-quartz-cassiterite mineralogy and a later cross-course mineralization characterized by weathered iron oxides. Within the more pronounced fractured zones in the granite, cassiterite is sparingly found. Some of the veins and associated rocks are noticeably brecciated, with inclusions of blocks of non-mineralized granite (cockaded breccia structures).

The Nanjizal Cove area of the Land's End Granite demonstrates the weak nature of mineralization within the granite (away from contact or roof zone) which can be directly compared with the granitic rocks and contact areas to the north, in the Cape Cornwall-Pendeen area.

The lower-temperature cross-course type of mineralization is characterized by distinctive breccia structures, cockaded structures formed around unmineralized blocks of granite.

References



(Figure 7.35) Nanjizal Cove. (Photo: Steve Parker.)