Dean Quarry, Lizard, Cornwall

[SW 804 204]

Introduction

Sections in Dean Quarry, near St Keverne, on the Lizard Peninsula, expose parts of the layered gabbro sequence of the eastern (upper) unit of the Lizard Complex (see (Figure 7.63)).

In many recent studies it has been proposed that the Lizard Complex represents a deformed and dismembered ophiolite, the gabbros being part of the standard model for oceanic crust, and the idealized ophiolite being formed at mid-oceanic ridges (Styles and Kirby, 1980). Powell *et al.* (1996) gave a re-interpretation of the internal structure of the Lizard Complex.

However, more recently, it has been suggested that the complex peridotites originally formed in a non-volcanic rifted-margin setting, rather than mid-oceanic ridge, the rocks being exhumed from upper mantle to lower crustal depths during a period of early Devonian rifting and break-up. During the late Devonian the Lizard Complex was thrust NNW along major low-angle detachment and became incorporated in a series of Variscan nappes (Cook *et al.,* 2000, 2002).

Dean Quarry lies on the coast at Dean Point, where quarrying commenced towards the end of the 19th century. However, the old quarry considered here was vigorously worked for a known period of 30 years, with aggregate directly transported from the quarry by sea. The old quarry has now been virtually abandoned and a new quarry opened to the south, which exposes slightly lower units of the complex. The old quarry has been of considerable mineralogical interest as a source of zeolites throughout its quarried life, with new zeolite-rich sections being constantly revealed. The zeolite para-genesis of Dean Quarry has been described by Seager (1967, 1969), with individual minerals being described by Holyer (1972, 1975), and Elton *et al.* (1997).

Description

The gabbro exposed at Dean Quarry is compositionally homogenous, although it does show textural variations, with compositional layering showing a general steep east-west orientation locally preserved. The layering is due to variations in the contents of olivine, plagioclase and clinopyroxene.

The succession in the quarry is almost vertical and consists of at least two layered gabbroic units. The quarry has been worked on four levels. In the northern face, the lower part of a rhythmic unit is exposed, composed predominantly of olivine, plagioclase and ilmenite. The western gabbro is cut by veins, and has some cavities filled with carbonates (calcite) and zeolites. In the upper level on the south side, extensive developments of pegmatitic gabbro are exposed. The gabbros here are altered, with zeolites overgrown by calcite and montmorillonite.

The gabbro in Dean Quarry varies considerably in texture, from very fine-grained to pegmatitic, and although mostly fresh some areas are altered, even showing a slight schistose fabric. The gabbro is cut in several places by meladiorite dykes.

Zeolite minerals are usually found associated with basaltic rocks, but at Dean Quarry they occur in gabbro in veins trending ENE–WSW and SSE–NNW through the quarry. The development of the zeolite veins is at all times intermittent. Some of the veins are very rich in certain sections, although have been barren for considerable periods of quarrying activity.

The zeolite minerals and prehnite have long been known during the extractive history of the quarry, but it was the work of Seager (1967, 1969) that provided the first detailed para-genetic mineral sequence.

In Dean Quarry, natrolite (occurring as prisms up to 10 cm in length) and analcime (usually as white to pink trapezohedral crystals) are often associated with yellow to brown lustrous calcite, the assemblage commonly found in association with

green prehnite. Veins carrying calcite and pink adularia are relatively common. The veins also contain varying amounts of pectolite, scolecite, stilbite, heulandite, gyrolite, chabazite, pyrite, djurleite, malachite and quartz. Elton *et al.* (1997) reported the presence of stevensite and kerolite from Dean Quarry, occurring as pseudomorphs after pectolite and as micro-crystalline anhedral masses in veins and cavities, associated with calcite and prehnite.

When first opened, the new quarry on the lowland side of Dean Point was reported as being notably barren, but recently veins carrying zeolite material have been exposed. Such veins run ENE–WSW, and contain calcite, analcime, natrolite and chabazite. At times analcime is altered to montmorillonite. Also recorded are pink, euhedral crystals of orthoclase feldspar. Veins running SSE–NNW contain mostly prehnite, often associated with twinned chabazite, calcite and natrolite. Stilbite often occurs as epimorphs after natrolite, while in places heulandite occurs as minute crystals.

Minor copper mineralization is recorded from the lowest levels of the quarry, occurring as crystal groups of native copper, chalcocite, cuprite and malachite.

Interpretation

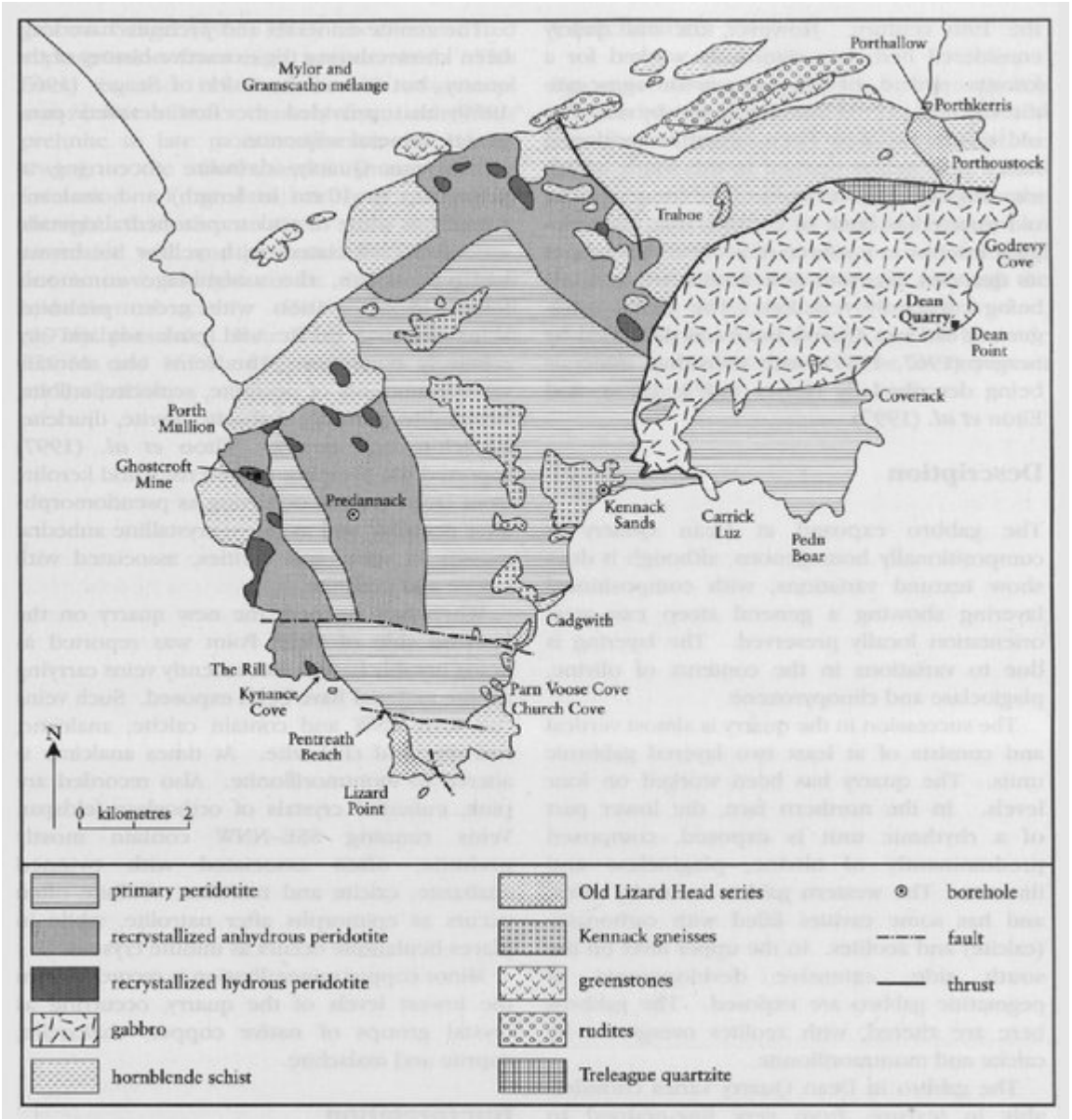
Zeolite minerals are widespread in the Lizard Peninsula, occurring in the gabbros of both Dean and Porthoustock quarries, as well as elsewhere within some of the serpentinites. Dean Quarry is of considerable interest for the nature and significance of the gabbro and especially for the contained zeolite mineralization. The petrology of the gabbro has been described in the papers listed above.

The zeolite minerals occur in a series of pneumatolytic veins running through the gabbro. Seager (1967, 1969) has demonstrated a progression from high temperatures. This trend is also reflected in the associated non-zeolitic silicates, namely from anhydrous prehnite to late montmorillonite and calcite. Owing to the usual basaltic source for the formation of zeolites, it was originally thought that the zeolites were intimately associated with and generated by the gabbro, but is now thought to be due to regional hydrothermal activity. Halliday and Mitchell (1976) presented K-Ar and Ar-Ar dates of 220 Ma and 165 Ma for two phases of zeolite mineralization.

Conclusions

Up to recent times quarrying at Dean Quarry provided fresh exposures of the gabbros and therefore an increase in our knowledge of the gabbros in relation to the origin of the Lizard Complex. This continuous quarrying in the old and new quarry also further enhanced an understanding of the major mineralogical features of the zeolitic assemblage. Although the faces of the old quarry are now rarely worked, studies of zeolite mineralization can still be made and the quarry continues to be an important mineralogical site.

References



(Figure 7.63) Geological map of the Lizard area, showing the location of the Dean Quarry GCR site. Based on Flett (1946), Green (1964), and Styles and Kirby (1980).