Haytor Iron Mine, Devon

[SX 772 770]

Introduction

The Haytor Iron Mine GCR site, at Haytor Vale, lies 4.5 km west of Bovey Tracey. Haytor Iron Mine provides underground exposures of stratiform iron ores sited within the metamorphic aureole at the eastern margin of the Dartmoor Granite (see (Figure 7.15)). The deposit is the largest and best developed of a group of iron mines in the eastern Dartmoor region which are notable for the presence of magnetite and various calc-silicate minerals.

The iron mines of the district to the west of the village of Ilsington include Haytor Mine, Smallacombe Mine [SX 777 766], and Atlas Mine [SX 778 762], and have a long history of working. Dines (1956) stated that 'lode stones' were known from Haytor Mine in the 16th century or earlier, and recorded the production of various types of iron ore, including magnetite, 'brown hematite' and mineral pigments, in the 19th century. There was some prospecting in the 20th century in the period leading up to and including the First World War, after which the mines remained closed. Hamilton Jenkin (1981) reported that Haytor Mine was developed opencast [SX 7715 7703] and by an incline shaft prior to 1828, and that Smallacombe Mine was worked initially by adits, but was subsequently developed as an open quarry, known as 'Smallacombe Cutting'. At Haytor Mine, in the period after 1828, the mine was worked by an adit level driven from a portal [SX 7728 7713] in the valley bottom some 200 m east of the Rock Inn at Haytor Vale. This level intersected the ore some 36 m beneath the opencast workings and is the principal means of access at the present day. Haytor Mine has received considerable attention from geologists and mineralogists, including Foster (1875), MacAlister (1909), Collins (1912), and Scrivener *et al.* (1987).

Description

Haytor Mine is situated some 500 m to the east of the contact of the Dartmoor Granite, and lies within its metamorphic aureole. At the adit level, the portal is driven towards the south-west in a barren sequence of metapelites with thin quartzite interbeds that are mapped as part of the Late carboniferous (Namurian) Crackington Formation. Some 150 m along the adit level there is a high-angle fault, apparently trending north-east-south-west, which brings the barren metamorphosed shale and sandstone strata into contact with siliceous metapelite, which forms the host rock to the ore deposit. At adit level, the deposit comprises three conformable beds which dip to the north-east at 30°–35°. The uppermost bed is 3.05 m thick, with some 0.61 m of included hornfels waste, the middle bed is 4.27 m thick with some 0.30 m of waste, and the lowest is 1.83 m thick with about 0.3 m of waste. The total thickness of ore-beds and intervening barren hornfels is 11.50 m. Immediately above the lowest ore-bed is a sill-like body of tourmaline-bearing aplite, with irregular margins, up to 0.30 m thick.

The ore-beds are exposed in two stopes, which are partly backfilled with waste, and in short exploratory drives. The higher-level stope, which corresponds to the upper ore-bed, shows faces in low-grade, massive magnetite ore with common partings of hornfels and siliceous or cherry rock. The lower stope, which worked the middle and lowest ore-beds, shows banded magnetite ore with local seams and patches of garnet and minor aggregates of sulphide minerals.

Much of the ore consists of an intimate intergrowth of magnetite and hornblende, which may be massive or show bedding-parallel banding marked by the predominance of one or other mineral phase. Some joints show coarsely crystalline magnetite, and there are fibro-radiate aggregates of hornblende in places. However, in spite of some early references, for example Dines (1956), no actinolite has been found in the ore-beds. A minor component of the ore-beds is garnet, which occurs as discontinuous layers and irregular pockets of coarse crystals. Scrivener *et al.* (1987) demonstrated that the garnet crystals typically comprise a core zone, with an irregular corroded margin, and an outer zone, which is paler in colour. In terms of composition, XRD and SEM-EDA investigations have shown that the core is pure andradite, while the outer zone is andradite$_{90}$-grossularite$_{10}$. Other minor minerals in the ore-beds include axinite, siderite, calcite and apatite, and there are also traces of sulphides such as arsenopyrite, pyrite, chalcopyrite and sphalerite. Of historical and mineralogical interest is the rare occurrence of pseudomorphs in chalcedony after datolite; these were originally considered to be a distinct mineral species termed 'haytorite' (Lévy, 1827; Phillips, 1827; Tripe, 1827), figured in Embrey and Symes (1987) (see (Figure 7.16)).

Interpretation

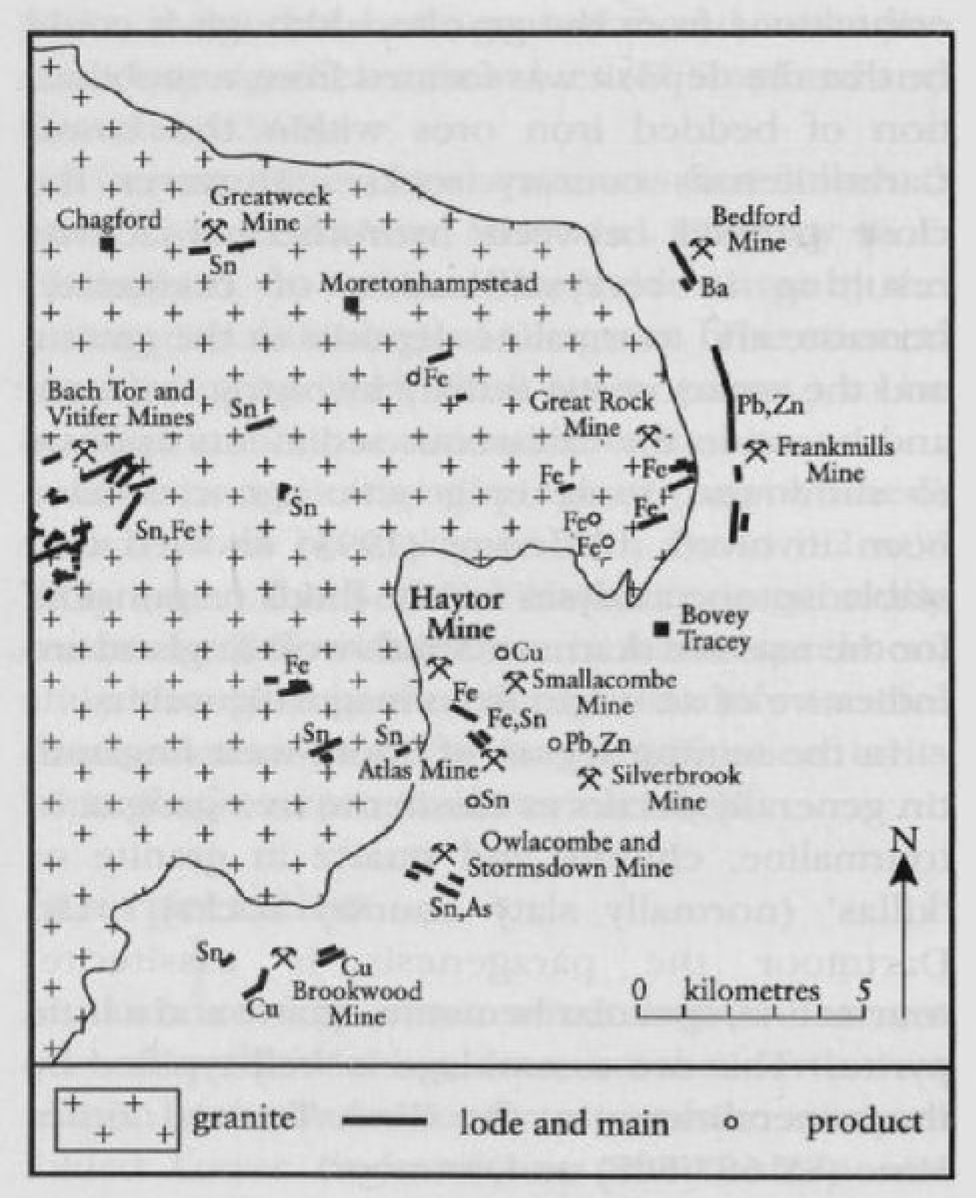
The Haytor Iron deposit is considered to be an example of a magnetite skarn, originating from the contact metamorphism and early hydro-thermal alteration of a ferruginous host. In consideration of this are two genetic factors, namely, the original nature of the host, and the source of the metamorphic heat and hydrothermal fluids. As far as the latter is concerned, the proximity of the Dartmoor Granite, and the presence within the deposit of an aplite sill, strongly suggest that the granite and its associated hydrothermal fluids were the main agencies in the skarn formation. Radiogenic isotope work (Chesley *et al.,* 1993) provided a ^{40}Ar-^{39}Ar age of 280.3 ± 1.0 Ma for hornblende from the Haytor deposit, which is in very close agreement with a U-Pb age of 280.4 ± 1.2 Ma for the granite from the nearby Haytor Quarry (Scrivener, pers. comm.). Scrivener *et al.* (1987) drew attention between the similarity of fluid-inclusion characteristics in quartz from the magnetite-hornblende skarn and those in tourmalinite veins and wall-rocks from the Dartmoor Granite, suggestive of a genetic relationship. Other notable magnetite-bearing skarns in South-west England are the cassiterite-magnetite-tourmaline 'floors' of Grylls Bunny, near St Just-in-Penwith (Jackson, 1974), and the cassiterite-magnetite orebodies at Magdalen Mine, Ponsanooth (Dines, 1956), which contrast with the more calc-silicate-dominated skarns exposed at the Red-a-Ven Mine GCR site, at Meldon, on the north-west margin of the Dartmoor Granite.

There has been considerable speculation on the nature of the iron-rich host from which the skarn was formed. Foster (1875) favoured the alteration of sedimentary iron ores within the 'Culm Measures', while Dines (1956) suggested an origin from greenstones (altered basic igneous rocks) in the Upper Devonian or Lower Carboniferous strata. Scrivener *et al.* (1987) suggested that the ores represent the alteration of ferruginous beds in the Ashton Shale, which is the lowest part of the Late Carboniferous Crackington Formation. The matter remains problematic as no such protore rocks have been demonstrated in the most recent geological survey. It is considered more likely that the ores have been developed in a faulted block of Lower Carboniferous chert (the Teign or Mount Ararat cherts), which have extensive outcrops to the east of Ilsington, and which comprise bedded cherts with interbeds of calcareous shale and local basic lava and tuff. The presence of the calc-silicate minerals at Haytor Mine certainly supports an origin from a calcareous host.

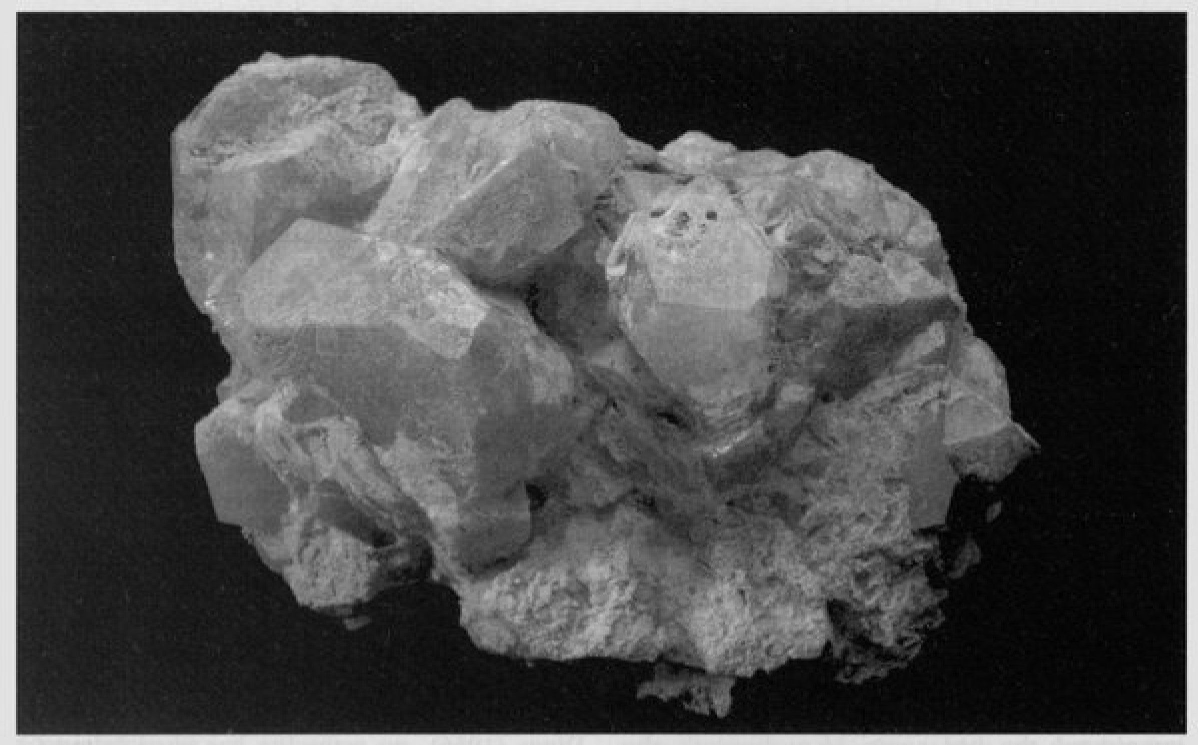
Conclusions

Haytor Mine is an excellent example of a magnetite skarn, a type of deposit unusual in South-west England, contrasting with the more calc-silicate-dominated domains present on the north-west margin of the Dartmoor Granite, seen for example at the Red-a-Ven Mine GCR site. The underground workings preserve exposures of the ore in good condition, associated with examples of minor mineral occurrences such as garnet and axinite.

References



(Figure 7.15) Location of Haytor Iron Mine on the eastern edge of the Dartmoor mining area. After Durrance and Laming (1997).



(Figure 7.16) 'Haytorite' from Haytor Iron Mine, Devon. (Photo: © The Natural History Museum, London.)