Lady's Rake Mine, Durham

[NY 806 341]

Introduction

Lady's Rake Mine is an abandoned mine which worked lead ore-shoots in the NE–SW-trending Lady's Rake Vein, mainly in the Tynebottom and Jew limestones. The total recorded output of lead concentrates amounts to 7486 tons between 1882 and 1908 (Dunham, 1990). Historical descriptions of the mine, including some contemporary photographs, have been presented by Beadle (1971, 1980).

The principal mineralogical interest of the mine lies in a highly unusual assemblage of ore minerals found in abundance on the spoil heaps. This includes galena, sphalerite, niccolite and ullmanite in association with abundant magnetite and some calc-silicate minerals. Investigations by Young *et al*. (1985b) have identified this as a sulphide-bearing skarn assemblage, unique in the Pennines, and genetically associated with the Whin Sill which is here emplaced within, or close to, the Teesdale Fault. The assemblage gives important insights into the genesis and timing of Pennine sulphide-bearing veins and their relationship to the Whin Sill.

No mineralization is exposed at the surface and all underground workings are flooded and totally inaccessible. The unique mineral assemblages for which this mine is so important are known only from abundant material remaining on the spoil heaps.

Description

Lady's Rake Vein, the principal structure worked at this mine, is known to have carried galena in association with some sphalerite in a matrix of barite, ankerite and siderite (Dunham, 1948, 1990). The spoil heaps adjacent to the Lady's Rake Shaft [NY 8063 3414] and adit (Figure 3.8) contain representative examples of this assemblage. Parts of the dumps are, however, notable for the presence of an abundance of large blocks of magnetite-rich rock. In hand specimen this rock typically exhibits magnetite forming almost pure, fine-grained, dull-grey masses up to 10 cm across. Fine- to medium-grained calcite is common and in numerous specimens magnetite veinlets may be seen cutting the calcite. A calcareous alga, replaced by magnetite, was found in one thin-section of this rock (Young *et al.,* 1985b). Many specimens show streaks and pockets, up to 1 cm across, of greenish-white phyllosilicates which include talc, chlorite and smectite. Streaks and pockets of galena and sphalerite are locally common and in places niccolite is conspicuous as spots and patches up to 1 cm across (Figure 3.9). Thin pale-green coatings of annabergite commonly betray the presence of niccolite within weathered blocks. Minor constituents, not visible in hand specimen, include ullmannite, gersdorffite and pyrrhotite.

Magnetite-rich ore with abundant galena, although without obvious nickel mineralization, is also common on the spoil heaps from a trial shaft [NY 8028 3446] approximately 427 m north-west of Lady's Rake Shaft (Figure 3.10). Small amounts of magnetite-bearing rock with ugrandite garnets, although without sulphides, are present on the spoil heaps of the Cadger Well Level [NY 7978 3480] at the head of the Harwood Valley, approximately 1 km north-west of Lady's Rake Shaft.

Interpretation

The magnetite- and niccolite-bearing rock at Lady's Rake Mine and the nearby workings is unlike any previously described from the Northern Pennines. The common factor is that the workings at each locality cut the Teesdale Fault or related fractures.

Contemporary records and mine plans show that at Lady's Rake Mine the Jew Limestone Level cut the Teesdale Fault near its junction with the Teesdale-Winterhush Vein. Dunham (1948) noted that the plans recorded the fault as a 12

m-wide 'whin dyke', although was unable to confirm the presence of dolerite. Young *et al.* (1985b) were unable to find dolcrite on the dumps at either Lady's Rake or the nearby trial-shaft, but suggested that the hard, grey magnetite-rich rock, abundantly present at both localities, might have been taken by the miners as 'whin' or dolerite. Dunham (1948) recorded that the Cadger Well Level at the head of the Harwood Valley was reported to have been driven through the Teesdale Fault into dolerite, and Young *et al*. (1985b) noted the presence here of dolerite fragments on the same part of the dump as samples of magnetite-rich rock.

Elsewhere in Teesdale, metamorphism of limestones within the contact aureole of the Whin Sill has produced garnet-bearing calc-silicate assemblages (Dunham, 1948; Robinson, 1970). The mineralogy of the ore specimens from Lady's Rake Mine and the nearby workings, with abundant magnetite, calcite, locally ugrandite garnet, and in one instance a remnant calcareous alga replaced by magnetite, suggests a skarn environment within the contact zone of the Whin Sill. Young *et al*. (1985b) produced evidence that the top of the Whin Sill may lie only a few metres beneath the deepest workings at Lady's Rake Mine, and suggested that the Whin Sill may have been intruded into the Teesdale Fault where reaction with limestone wall-rocks produced the magnetite-rich skarn assemblages.

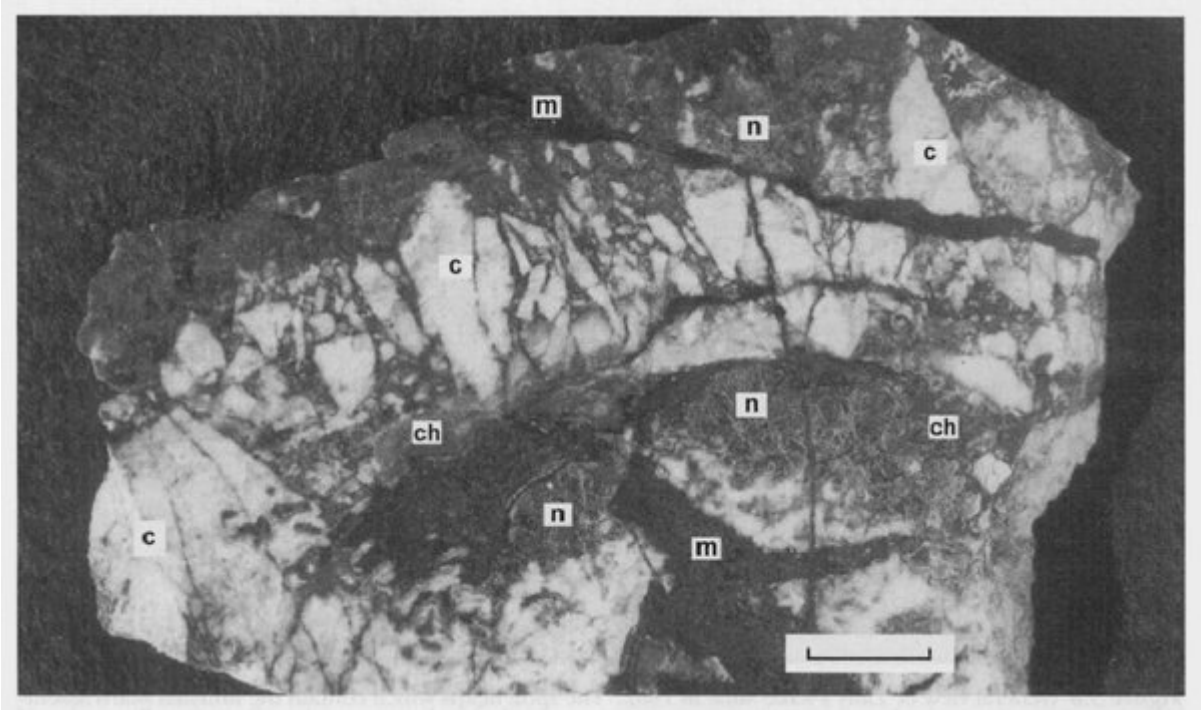
In their brief review of other nickel mineral occurrences within the Northern Pennine Orefield, Young *et al.* (1985b) noted the apparently close association between these and the Whin Sill. Drawing comparisons with the Nippissing Sill of the Cobalt–Gowganda region of Ontario (Jambor, 1971; Petruck, 1971) they canvassed the view that the nickel may have been derived from the Whin Sill. The limited evidence available from the nickel-bearing minerals at Lady's Rake Mine suggests formation temperatures of 550°C or higher. This is appreciably higher than the highest temperatures previously proposed for the main Northern Pennine mineralization (e.g. Smith and Phillips, 1974; Vaughan and Ixer, 1980). Young *et al*. (1985b) suggested that the mineralogy of the Lady's Rake ores may therefore be the product of skarn alteration in the contact zone of the Whin Sill accompanied, or followed by, the introduction of nickel-rich fluids from the cooling sill. The abundance of galena and sphalerite, sulphides typical of the main Northern Pennine mineralization, in the magnetite-rich ores at Lady's Rake Mine and the trial shaft, are suggested to be the result of the circulation, within the Teesdale Fault System, of at least some of the main Northern Pennine mineralizing fluids whilst the Whin Sill was still hot.

Conclusions

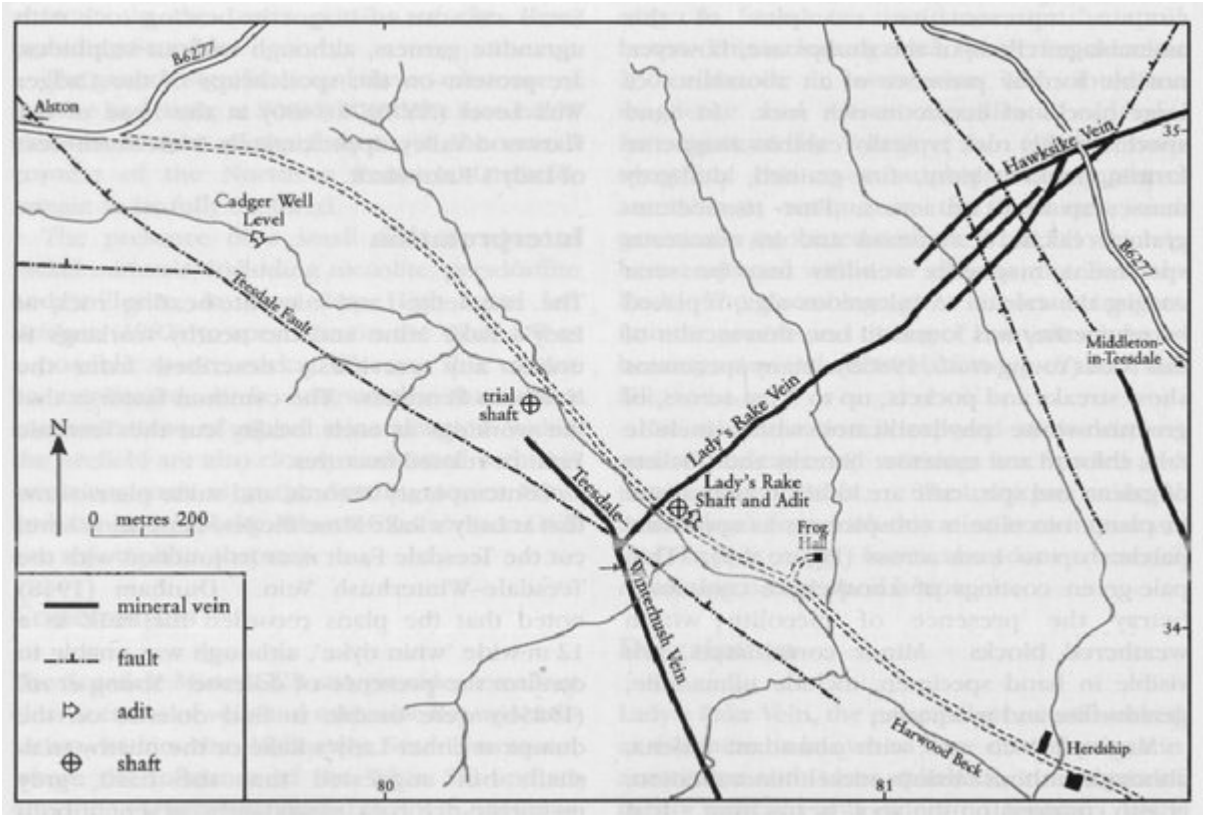
Whereas no mineralization is to be seen in *situ* at Lady's Rake Mine or at the nearby localities, the abundance of ore specimens on the dumps provides excellent opportunities for studying this assemblage which is unique within the Northern Pennine Orefield, and which gives important insights into the timing of mineralization and its relationship to the Whin Sill.

References

(Figure 3.8) General view of Lady's Rake Mine in 1982. The spoil heaps which contain the unusual skarn assemblage are immediately to the right of the buildings. The site of the main shaft is marked by the large rising main in the bottom right of the picture. (Photo: B. Young.)



(Figure 3.9) Cut and polished slab of magnetite-calcite-niccolite ore from Lady's Rake Mine. White calcite (c) is brecciated and veined by magnetite (m). accompanied by some chlorite (ch). Niccolite (n) forms irregular streaks and rounded masses. The scale bar is 10 mm. (Photo: B. Young.)



(Figure 3.10) Sketch map of Lady's Rake Mine showing main veins and mine workings referred to in the text. After Young et al. (1985b).