Longhoughton Quarry, Northumberland

[NU 231 153]

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Introduction

Longhoughton Quarry, 4 km north-east of Alnwick in Northumberland, is located at the western end of a number of quarries collectively known as 'Howlet Hill Quarry', which were formerly worked for sets and road metal (Figure 6.26). It provides an excellent example of the thermal metamorphism of sedimentary rocks overlying the Great Whin Sill. The chilled upper surface of the sill is clearly exposed in the quarry and baked rafts of sedimentary rock can be seen within the quartz-dolerite. The sill is intruded just below the (basal Namurian) Great Limestone at this site and nearby it cuts across two E–W-trending faults with no offset. This cross-cutting relationship provides evidence that the sill was intruded after the main movement on E–W-trending fractures in this area. However, shearing and slickensides within the dolerite imply that strike-slip movement also occurred after emplacement of the sill.

The area was first surveyed between 1860 and 1864 by the Geological Survey and, following revision of the six-inch maps in the 1920s, was published at the one-inch scale in 1930 as Sheet 6 (Alnwick). The quarries were described by Carruthers *et al.* (1930) in the memoir that accompanied the published map, and the timing of faulting and intrusion in this area was discussed by Jones *et al.* (1980), Turner *et al.* (1995) and Chadwick *et al.* (1995).

Description

A 20 m-high face at the north end of Longhoughton Quarry exposes the Great Whin Sill, which is intruded into sandstones and mudstones just below the Great Limestone. The overlying strata are thermally metamorphosed, and rafts of the overlying sandstones and mudstones, incorporated into the upper parts of the sill and prominent in this quarry, have been recrystallized. The chilled, fine-grained to glassy upper margin of the sill is exposed all along the eastern side of the workings. Just below the upper margin is a zone in which bands of small amygdales occur. The main part of the sill at this site is typical of the Great Whin Sill and has well-developed columnar jointing. It comprises homogeneous quartz-dolerite containing plagioclase, clinopyroxene, magnetite-ilmenite, quartz, orthopyroxene and small amounts of biotite, hornblende and carbonate. There is no evidence of a pegmatitic zone or segregation veins. A small fault at the western side of the quarry has exposed the basal margin and underlying indurated sandy mudstones. The basal contact can also be seen 300 m north-east of the summit of Howlet Hill, where thermally metamorphosed sandstones and mudstones are exposed at the base of a quartz-dolerite crag.

Just 0.5 km to the west of this GCR site the sill transgresses upwards through sandstones and mudstones and is intruded fully into the Great Limestone. A further 1 km to the west is an isolated outcrop of quartz-dolerite that was intruded above the Great Limestone.

Immediately to the south of the site, the sill cuts across the E–W-trending Longhoughton Fault with no apparent offset. The fault has undergone over 1.5 km of lateral movement (Carruthers *et al.,* 1930) although the Great Limestone outcrops on either side of the fault happen to coincide (Figure 6.26). Farther to the south, the sill crosses another E–W-trending fault, also with no offset, but to the south of this fault it intrudes the Acre Limestone, over 60 m lower in the succession. Horizontal slickensiding can be seen on some vertical surfaces of dolerite at Longhoughton Quarry and at nearby Ratcheugh Quarry. There is also evidence that the dolerite has been sheared.

Interpretation

Tate (1868) studied many outcrops of the Great Whin Sill throughout Northumberland and although Longhoughton Quarry was not so extensive at that time, he described the dolerite at nearby Ratcheugh Quarry as 'porphyritic' with large

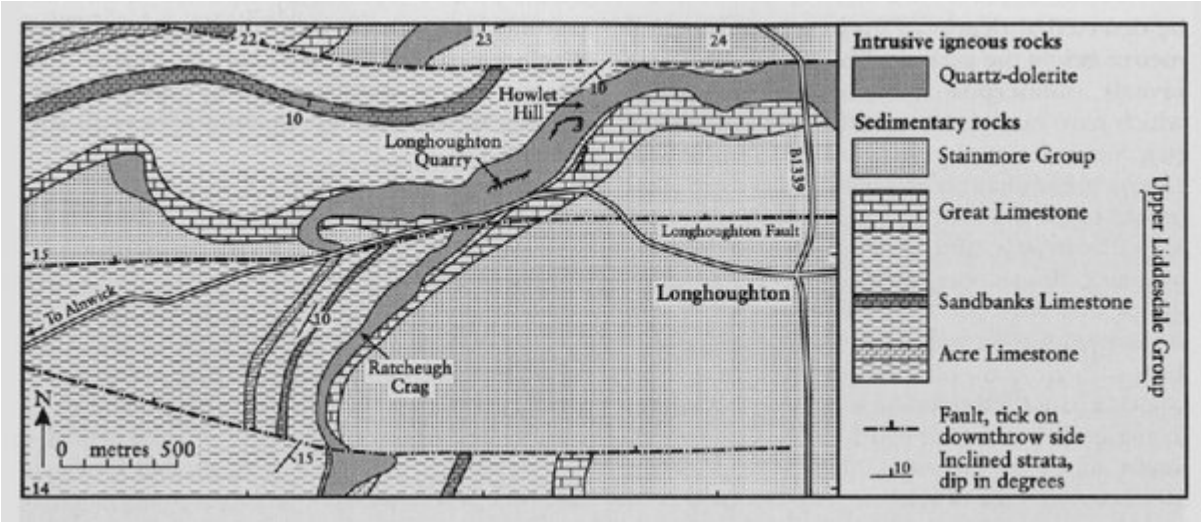
feldspar crystals scattered through the outcrop. His studies provided abundant evidence for the intrusive nature of the Great Whin Sill and led to a general acceptance. In particular, chilling of the upper margin of the sill, incorporation of rafts of the overlying sedimentary rock and thermal metamorphism of the overlying strata, all evidence of intrusion, are demonstrated in spectacular fashion at this GCR site.

The relationship of the Great Whin Sill to the Longhoughton Fault here shows that the sill postdates the main fault movement. The sill cuts directly across the fault plane with no offset. Nevertheless, horizontal slickensides and shearing on some vertical faces in the quarries imply that there was also some late-stage strike-slip movement along related fractures after emplacement of the sill (Jones *et al.,* 1980). This is valuable evidence to add to that from elsewhere that E–W-trending faulting occurred before intrusion, such as quartz-dolerite dykes intruded locally along faults (see Wydon GCR site report) and transgression of the sill along fault planes (see Steel Rigg to Sewingshields Crags GCR site report).

Conclusions

The Longhoughton Quarry GCR site shows abundant features that prove the intrusive origin of the Great Whin Sill, such as the metamorphism of overlying strata, chilling of the upper margin and rafts incorporated from the overlying sedimentary strata. In addition, the relationship of the sill to the nearby Longhoughton Fault provides evidence relating to the sequence of events in northern England in Late Carboniferous times. The intrusion of the sill clearly post-dates the main movement on the E–W-trending fault, but shearing of the quartz-dolerite and the presence of horizontal slicken-sides on vertical rock faces show that there was also some strike-slip (lateral) movement after emplacement of the sill.

References



(Figure 6.26) Map of the area around the Longhoughton Quarry GCR site. Based on Geological Survey 1:10 560 Sheet Northumberland 29SE (1926).