Ecton

[SK 097 581]

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Introduction

Ecton Quarry, in Derbyshire, provides a rare exposure in Great Britain of a cemented limestone talus of presumed Late Devensian age. Talus slopes are steep valley-side slopes formed by the accumulation of debris at the foot of a rockwall (Ballantyne and Harris, 1994) and are a common geomorphological component of the Peak District landscape. The term 'talus' is used to describe both the form of the slope and its constituent material. Although the term 'scree' is often used as a synonym for talus, in modern usage this term is reserved for a slope cover of predominantly coarse debris, irrespective of location. Talus slopes are not restricted to present or former periglacial environments but occur in all areas where the products of rock weathering can accumulate at the foot of a cliff or slope. The talus at Ecton comprises stratified layers of coarse angular debris and finer, more weathered material, which, unusually for Great Britain, has been cemented by deposition of calcite in the voids between individual particles.

As described in 'Talus slopes and screes', in the introduction of this chapter, talus slopes commonly take one of three forms: talus sheets, talus cones and coalescing talus cones. Both active and relict talus slopes are found in Britain. Relict talus slopes are found in many areas of Britain subjected to periglacial conditions, for example at Gilman Point in the Marros Sands GCR site in south-west Wales (Campbell and Bowen, 1989). These periglacial conditions persisted during the Late Devensian in areas beyond the limit of the ice maximum and relict talus slopes therefore are important palaeoenvironmental indicators. Ecton Quarry is particularly important because the talus exposed there is of a cemented nature. This type of talus is unusual in Britain and is confined to limestone areas such as the Peak District. Burek (1977) has described the site in detail.

Description

Ecton Quarry is a small disused quarry on the east side of the Manifold Valley in the Peak District of Derbyshire. Lower Carboniferous (Dinantian) limestone dominates the solid geology of this area (Aitkenhead *et al.,* 1985). Ecton Quarry provides a large exposure of the Ecton Limestone (Prentice, 1951, 1952), a predominantly grey or brownish grey to dark grey, thinly bedded, bioclastic limestone. Cemented talus occurs throughout the quarry, although it is particularly evident in the upper layers. Here, the cemented talus forms a more resistant layer and therefore protrudes from the back wall of the quarry. Recent weathering has dislodged many blocks of cemented talus from the quarry walls and these now form loose blocks on the quarry floor. The maximum recorded depth of the cemented talus in the quarry is 24 m. Above the quarry walls on the modern land surface is a layer of silty drift (Burek, 1985, 1991) and a thin soil. The silty drift is a mixture of insoluble residue of limestone and loess (Piggott, 1962).

The talus consists of an accumulation of angular limestone and chert clasts held in a cemented matrix. Two facies are identified; a fine-grained talus with clasts normally in the range of 1–5 cm in diameter and a coarse talus with clasts up to 15 cm in diameter (Figure 7.19). Crude bedding is present in the form of stratified units of these coarse and fine facies. The coarse layers are 0.3–2 m in thickness and generally are more cemented than the fine layers. The fine layers contain less angular limestone clasts and display solution features, commonly filled with a red-brown clay. Individual clasts dip at angles of up to 35°, although the majority of clasts dip at angles typically *c.* 20°.

Interpretation

Unconsolidated scree is forming on many Derbyshire slopes today but cemented facies are rare. The Ecton deposit is best interpreted as a cemented talus rather than a calcrete (Cope, 1999), because the latter requires the upward movement of calcium to cement the deposit. This process normally is associated with more arid climates than that of Britain today, where evaporation is a key factor. With cemented talus, the calcium that contributes to the formation of the calcium carbonate ($CaCO_3$) is deposited from the surface downwards. Usually it is derived from solutions originating as rainwater percolating through the more finely divided and powdery scree components and dissolving minor amounts of calcium in the process. In coastal locations this cement is often influenced by sea spray and has been specifically identified as brucite ($Mg(OH)_2$), hydromagnesite ($MgCO_3OH$) and minor amounts of aragonite ($CaCO_3$) (Flinn and Pentecost, 1995). However the cement matrix at Ecton is a low-magnesium calcite.

The silty drift and soil that overlie the quarry provide information on the age of the cemented talus. These deposits are often preserved down fractures as well as on the surface (Burek, 1985, 1991). This commonly is taken to indicate that the area was not glacierized during the Late Devensian because formation of the silty drift requires both a period of chemical weathering and periglacial activity. The silty drift therefore is not present within the limits of the last glacial maximum. The loess contributes quartz and the silty drift contributes silica and clay minerals to the mineralogy available for redistribution down the profile. There is also a component of calcite present (Burek, 1991). This is then available for cementation purposes at a later date. There are other examples of cemented scree in the White Peak, such as those at [SK 137 618] and [SK 137 611], as well as partly cemented scree slopes in Lathkill Dale (Ford, 1964; Burek, 1977). Each of these has a thin layer of silty drift that has been soliflucted from above on to the talus deposit. This is important because it provides a relative age for the cementation of the talus.

Conclusions

The cemented talus accumulated under environmental conditions markedly different to those of today. Frost action was probably more important than either ice or snow cover in the formation of these deposits and limited runoff is suggested in order to allow the scree to form without contemporaneous removal. Subsequently, annual rainfall was higher than it is today, but there was neither continuous permafrost nor frozen groundwater within the top layers of material, as this would not allow percolation and subsequent deposition of calcium carbonate as a cementing agent in the voids. Discontin uous permafrost would allow the scree to accumulate and subsequent higher temperatures would encourage the calcite to precipitate and cement the deposit. A Late Devensian age is suggested for the cemented talus at Ecton because this is the last time that these environmental conditions were fulfilled.

References

(Figure 7.19) Cemented talus at Ecton Quarry showing the finer-grained of the two facies. Note the angular nature of the clasts. (Photo: C.V. Burek.)