Winnats Pass

[SK 136 826]

Highlights

The Winnats Pass, often known just as Winnats, is the most spectacular, deeply incised karst gorge in the Peak District and has a complex origin which dates back to the Carboniferous. It is Derbyshire's best example of a fluvially excavated gorge and one of its most famous karst sites. It provides a superb transect through the Lower Carboniferous marginal reef belt.

Introduction

Incised into the northern margin of the limestone plateau 1 km west of Castleton, the Winnats Pass is regarded as one of the finest karst gorges in Derbyshire. It displays evidence of fluvial incision during periglacial events, while additional interest is provided by its complex origins which involves Pleistocene modification to a Carboniferous submarine ravine. The gorge displays a relatively clean section through the Lower Carboniferous (Dinantian) reef belt.

The origin of the gorge has been discussed by several authors, often with little supporting evidence (Sadler, 1964; Warwick, 1964; Broadhurst, 1972; Millward and Robinson, 1975; Ford, 1977a, 1986a), but no comprehensive geomorphological or chronological study of the Winnats Pass had been published until Ford presented a detailed account (1987). The geology is discussed in Broadhurst and Simpson (1973). Several caves exposed in the gorge walls and on the plateau nearby provide additional information on the evolution of the gorge (Beck, 1980; Shaw, 1983). Their relationship to the Winnats is discussed in Ford (1986a).

Description

The Winnats is a narrow steeply graded gorge cut into the steep slope on the edge of the limestone massif at the head of the Hope Valley (Figure 4.6). It drains a relatively small area of the limestone plateau at an elevation of about 400 m near Winnats Head Farm, and debouches onto the floor of the Hope Valley at 250 m altitude about 1 km west of Castleton (Figure 4.7). Less than a kilometre long, the gorge is bounded by cliffs up to 100 m high. Its floor is dry, as all the drainage sinks underground, and scree slopes mantle most lower parts of the sides.

Due to its position on the edge of the limestone plateau, the gorge is entrenched into, and reveals a profile through, the Carboniferous reef belt. Behind the reef to the south are the horizontally bedded lagoonal mudstones, while the reef itself is made up of thick algal bioherms. The fore-reef is dominated by two separate facies. The Beach Beds are submarine debris slopes of material transported across the reef by tidal and wave scour. The Boulder Beds are fossil talus slopes derived from pre-Namurian uplift and erosion of the reef, and postdate the beach beds (Simpson and Broadhurst, 1969). The head of the gorge is incised into the back-reef lagoonal limestones, the Bee Low Limestones, while the bulk of the gorge exposes the main algal apron reef, and the boulder and beach beds of the fore-reef.

Several caves occur in the sides of the gorge. Winnats Head Cave contains some old, high-level phreatic chambers, while Suicide Cave consists of largely abandoned passages near the foot of the gorge; an abandoned inlet system to Speedwell Cavern, the Pilkington's Cavern series, lies about 200 m south of the Winnats.

Interpretation

The origin of the Winnats Pass has proved to be controversial and enigmatic. Various ideas have been put forward to explain its origin, most of which were summarized by Ford (1986, 1987). The main theories have involved:

1. Exhumation of an inter-reef channel of mid-Dinantian age, contemporaneous with the deposition of the reef belt.

2. Recent exhumation of an erosional channel cut through the reef belt during a period of uplift in very late Dinantian or early Namurian times, and subsequently infilled with Namurian shales.
3. A collapsed cavern.
4. Superimposition of a drainage network, initiated on the Namurian shale cover, and subsequently incised into the limestone.
5. Fluvial excavation, during stages of periglacial climate within the Pleistocene, followed by underground capture of the drainage to leave the gorge dry.

The first hypothesis (suggested by Broadhurst, 1972), that the gorge was a resurrected Lower Carboniferous sea-floor channel, was discounted by Ford (1987) as he and others (e.g. Parkinson, 1953) noted that the three major lithofacies, the lagoonal, reef and fore-reef facies, strike across the pass in such a way as to preclude the possibility of a significant inter-reef channel having been present. This evidence also precluded Sadler's idea (1964) that the pass was a submarine channel in Asbian times. The Beach Beds survive up to an elevation of at least 300 m, so any channel could not have extended any deeper than that, if it was to be the source of a submarine fan; however, a very shallow channel may have existed. The presence of outcrops of the Boulder Beds in the upper part of the gorge (Figure 4.7) led Ford to suggest (1987) that the site of the Winnats was a moderately shallow channel, eroded during a period of pre-Namurian uplift and subsequently infilled with Namurian shales. The concept of the Winnats gorge originating as a collapsed cavern has been refuted by many authors. Warwick (1964) preferred the superimposed drainage hypothesis, although there is no direct evidence for it at this site.

Both Ford (1987) and Millward and Robinson (1975) advocated the Pleistocene periglacial hypothesis after comparison with other dry valleys in the area; the latter described the pass as 'cut by swift torrents of water passing down during certain pluvial phases at the end of the Ice Age'. The major problem with this hypothesis was the tiny catchment area feeding into the gorge. Ford (1987) suggested that this problem could be overcome if a large mass of stagnant ice filled Rushup Vale and fed meltwater into the valley, thus vastly increasing its catchment. The meltwater runoff during periglacial periods would have accelerated erosion of any shales which may once have filled a pre-Namurian valley. The timing of this must have occurred after the Hope 'Valley had cut down to the level of the Hope Terrace, as the floor of the Winnats is graded to this level, and the Namurian shale cover has been stripped back. This is interpreted as having taken place during the retreat stages of the Wolstonian glaciation, with perhaps some later modification during the Devensian. The steep initial gradient down the reef front, possibly aided by an easily excavated shale infill, contributed to the deep incision and spectacular morphology of the gorge.

Speleothem dating of several of the Castleton caves (Ford *et al.,* 1983; Ford, 1986a, 1987) has shed some light on the timing of incision in the gorge. The re-discovery of Pilkington's Cavern (Pilkington, 1789; Shaw, 1983) in Speedwell Cavern, the top of which is only some 200 m south of Winnats Pass, provided key evidence for the timing of incision. To function as an active swallet, Ford argued that the cave must have had a significant catchment area, which almost certainly extended into the area now occupied by the pass. The underground morphology demonstrates that the cave system was active before the Winnats had been cleared of shale and re-established as a gorge, and provides evidence that the shale cover had only been partially stripped back. Pilkington's Cavern therefore pre-dates the gorge incision, and has tentatively been assigned to the Cromerian interglacial (Ford, 1987). However, recent work on some infilled caves at Eldon Hill quarry (Farrant, 1995) suggests the shale cover had been stripped back earlier than previously thought and that significant cave development had begun in the area over 780 ka ago.

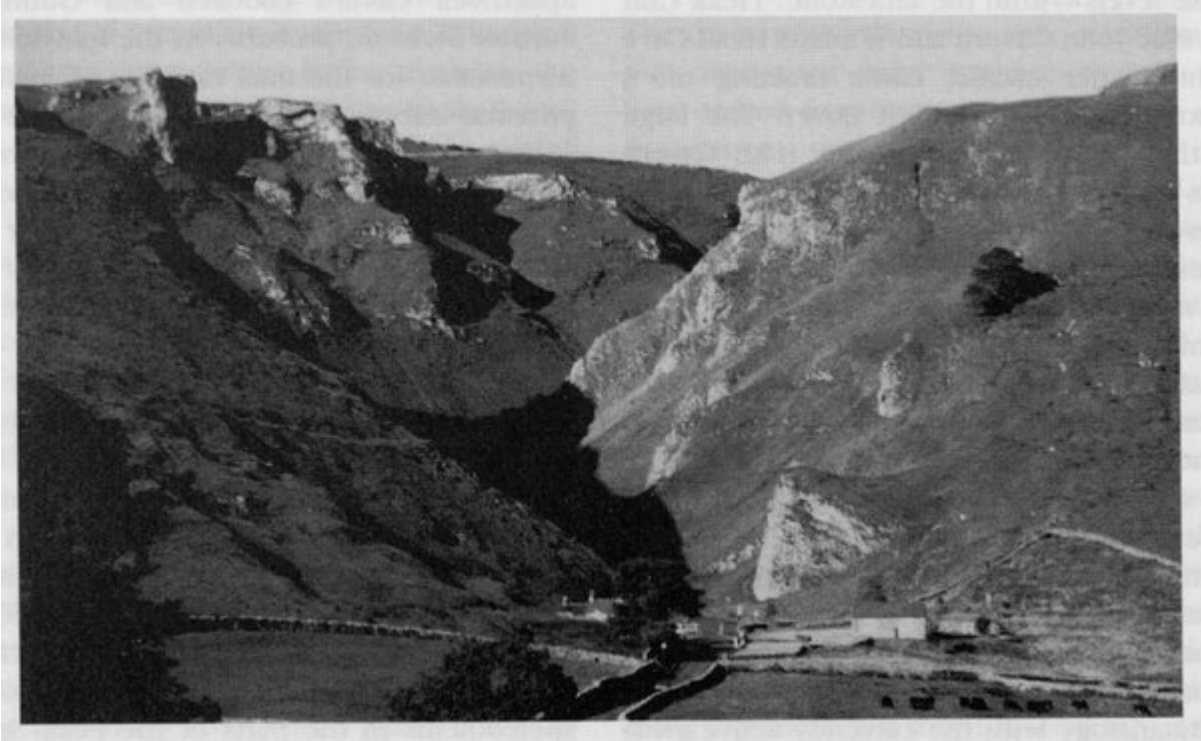
Ford concluded that the Winnats originated in series of stages, beginning in the Dinantian as an inter-reef hollow. It was then uplifted and excavated subaerially, to form a moderately deep channel during pre-Namurian or early Namurian times, before it was resubmerged and infilled with shales. It was exhumed and reactivated in the mid-Pleistocene when meltwater scoured out the shale fill to deepen the valley, and was further trimmed and modified during the Devensian.

Conclusions

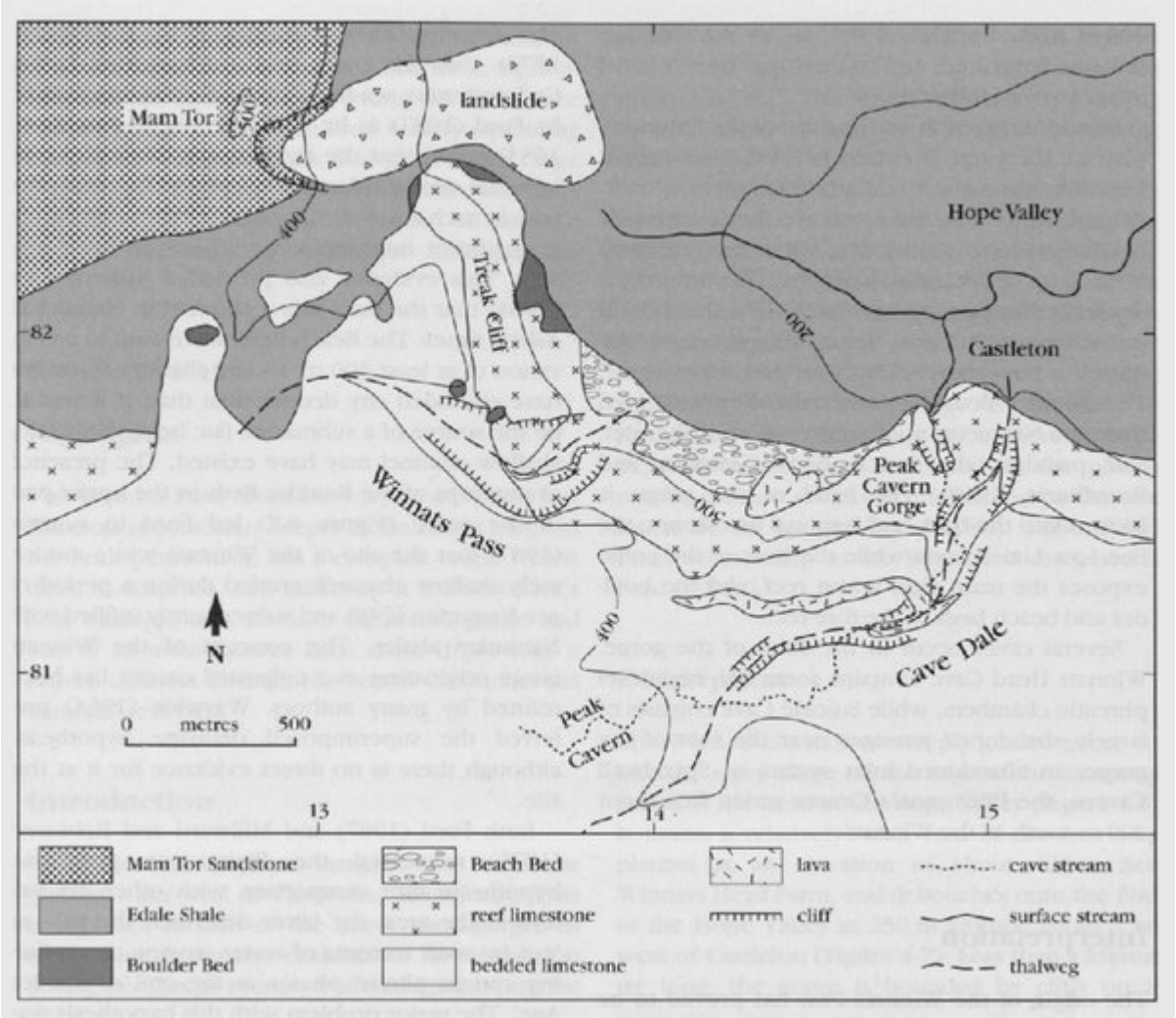
Winnats Pass is the finest meltwater gorge in the Peak District. Its evolutionary history is both long and controversial, with early stages dating back as far as the Carboniferous. Speleothem dating and morphological studies of nearby caves

suggests the gorge was mainly excavated by meltwater draining from a stagnant ice mass in the Rushup Vale during a retreat phase of the Wolstonian glaciation. The gorge appears to be located on the line of a Carboniferous ravine which was the product of both submarine and subaerial erosion.

References



(Figure 4.6) The limestone gorge of Winnats Pass, seen from the Hope Valley. (Photo: T.D. Ford.)



(Figure 4.7) Geological map of the Castleton reef belt containing Winnats Pass and Cave Dale.