Postlip Warren, Gloucestershire

[SO 997 265]

R.G. Cooper

Introduction

Postlip Warren is an area at the top of the Cotswold cuesta, on Cleeve Hill, north-east of Cheltenham. Cleeve Hill is the highest part (300 m above OD) of the dissected Jurassic limestone escarpment, in a region of intra-Jurassic subsidence remarkable for its considerable thickness of Inferior Oolite *(c.* 107 m). The Inferior Oolite is composed mainly of limestones, with occasional sandy beds, for example the Harford Sands. The hill is deeply dissected by dendritic dry-valley systems that feed the dip-slope River Coln and the scarp-face river, the Isbourne. There are also two groups of anomalous troughs, one group occurring along the main scarp face above Prestbury and Southam, and another group truncating spurs near Postlip Warren (Figure 6.2).

Description

The troughs are dry and grass-covered, occurring at or near the crest of the escarpment, at heights exceeding 240 m above OD (Figure 6.3). The Postlip Warren group consists of three features truncating the spur between the Postlip and Corndean valleys. They are approximately parallel, and 12–15 m deep. They are aligned perpendicular to the major valleys. They have convex longitudinal profiles, with irregularities, rather than the normal concave longitudinal profile of most stream valleys. In places the maximum angle of the longitudinal profile approaches 10°. The bottoms of the troughs are broad and flat (Figure 6.4) and (Figure 6.5), and typically they have a width of 50–70 m from one break of slope to the other. From crest to crest, the widths are of the order of 150 m. They are characterized by asymmetry, with a tendency for the slopes on the plateau side to have a maximum steepness of 18°–21°, and those on the embayment side to stand at 10°–14.5° (Goudie and Hart, 1976). A further group of small depressions runs parallel to the Postlip Warren troughs. Most of them have a dominantly linear form, but they are in essence closed depressions. They contain a relatively deep fill of dark-brown clayey material, attain depths of 3–5 m and tend to follow the contours.

One of the main troughs ('Trough 3' of Goudie and Hart, 1976) contains more than 4.9 m of dark-brown clayey fill with oolitic fragments. The content of coarse oolitic material increases with depth.

Interpretation

The troughs are a distinctive type of landform because:

- they possess a constant asymmetry;
- they possess irregular or closed longitudinal profiles;
- they contain, in at least some cases, a deep, non-alluvial fill;
- they run parallel to the main relief trends;
- they truncate major drainage lines; and
- in some cases they rise where there is little or no catchment area.

Goudie and Hart (1976) argue that they are neither solutional nor glacial features. They point out that the deep fill and the closed nature of some of the features is consistent with a solutional origin, but that a solutional origin does not fully explain either the asymmetry of the cross-profiles of the troughs or the way in which the troughs run parallel to the main relief trends.

Another possible hypothesis for the origin of the troughs is that they are some type of glacial form. The up-and-down longitudinal profiles could have been formed by sub-glacial streams under hydrostatic pressure. The absence of a normal catchment for the troughs lends support to this idea. Many sub-glacial channels also have flat bottoms. However, there is little evidence for glaciation in this part of the Cotswolds. Also, the sub-glacial meltwater hypothesis fails to account for the orientation of the troughs along the scarp face, rather than down it, and the striking asymmetry of their cross-profiles.

Goudie and Hart (1976) conclude that the most satisfactory hypothesis explains the troughs as large-scale gravitational slip features produced by the foundering of large masses of oolitic limestone over less-competent Liassic clays and marlstones. It may be expected that the face along which slip took place would be relatively steep and that the opposite slope would be relatively gentle. Likewise it may be expected that the troughs would develop parallel to the edges of either the escarpment or embayments within it. Kellaway (1972) has suggested that over-steepening of the escarpment by ice coming down the Severn Vale is a possible contributing factor, though accelerated spring sapping or periglacial cambering could have similar effects. Small-scale superficial cambering is evident in many quarry sections on Cleeve Hill, notably at [SO 987 272]. Once the depressions were formed, water may have flowed along them under nival conditions (Beckinsale, 1970) and solutional activity may have accentuated initial irregularities.

The deep fill of the troughs is explained as soil that was washed down into the troughs from the slopes on the embayment side (Goudie and Hart, 1976). Before movement took place, the original land surface would have been approximately flat. The asymmetry may be explained by the development of shallow rotational movements of underlying blocks of thick Inferior Oolite as they foundered or cambered into the Liassic clays. The flat surface became inclined towards the developing trough, and with this change in slope angle the soil cover became unstable and sludged or washed down. On this hypothesis there need be no catchment area and the depressions might be expected to truncate the main dendritic dry-valley systems of the area.

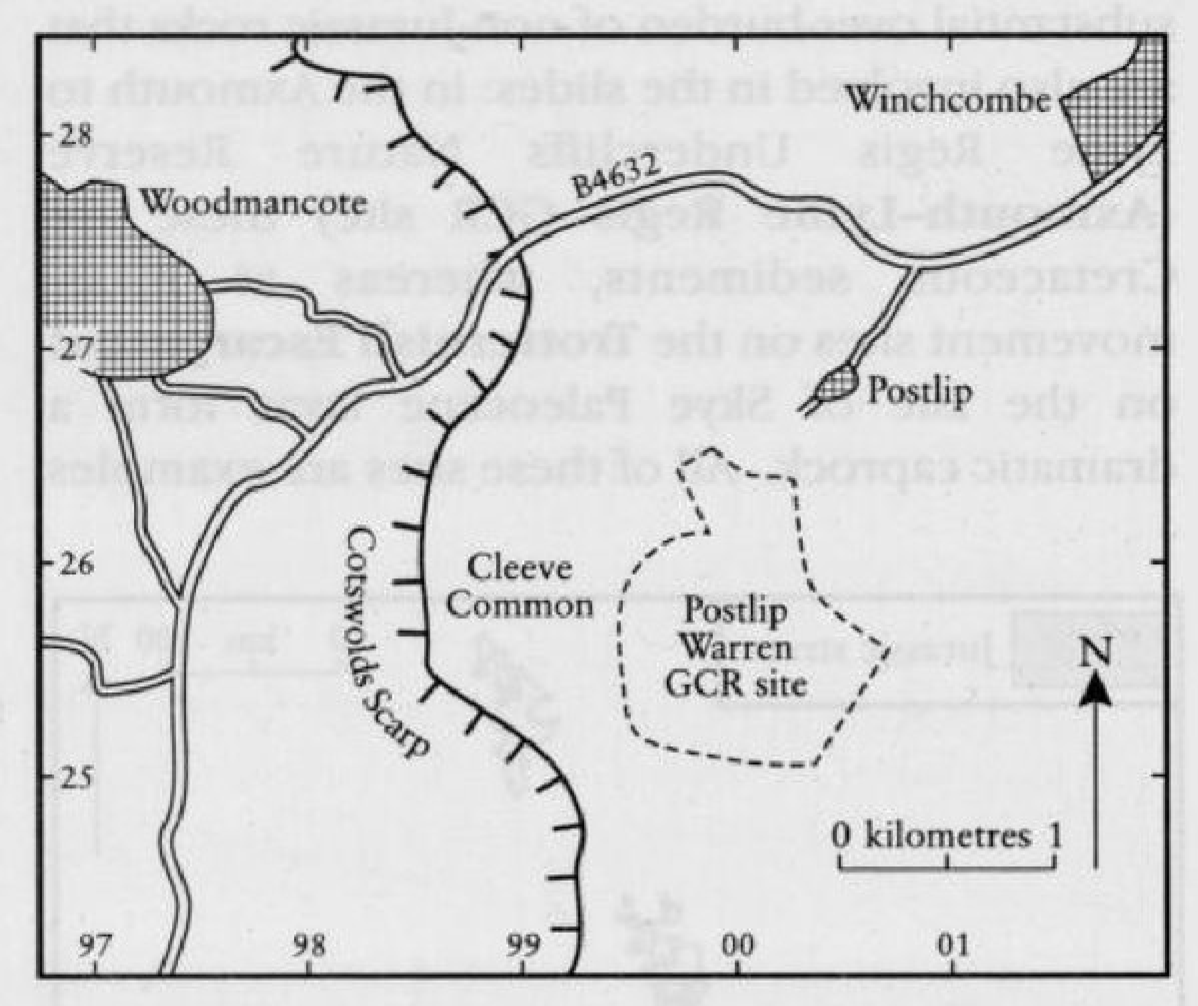
The troughs bear comparison with the 'ridge-and-trough' features at Lower Slaughter in the north Cotswolds and are similar to features described generally in the literature as gulls, vents, grabens, dip-and-fault structures, rock labyrinths or camber crests (see Brunsden, 1996b).

Conclusions

Postlip Warren provides very clear physiographical evidence of large-scale gravitational slip processes. It exhibits the longest, deepest, and most-pronounced gravitational troughs in Great Britain, clearly displaying asymmetry and deep fill.

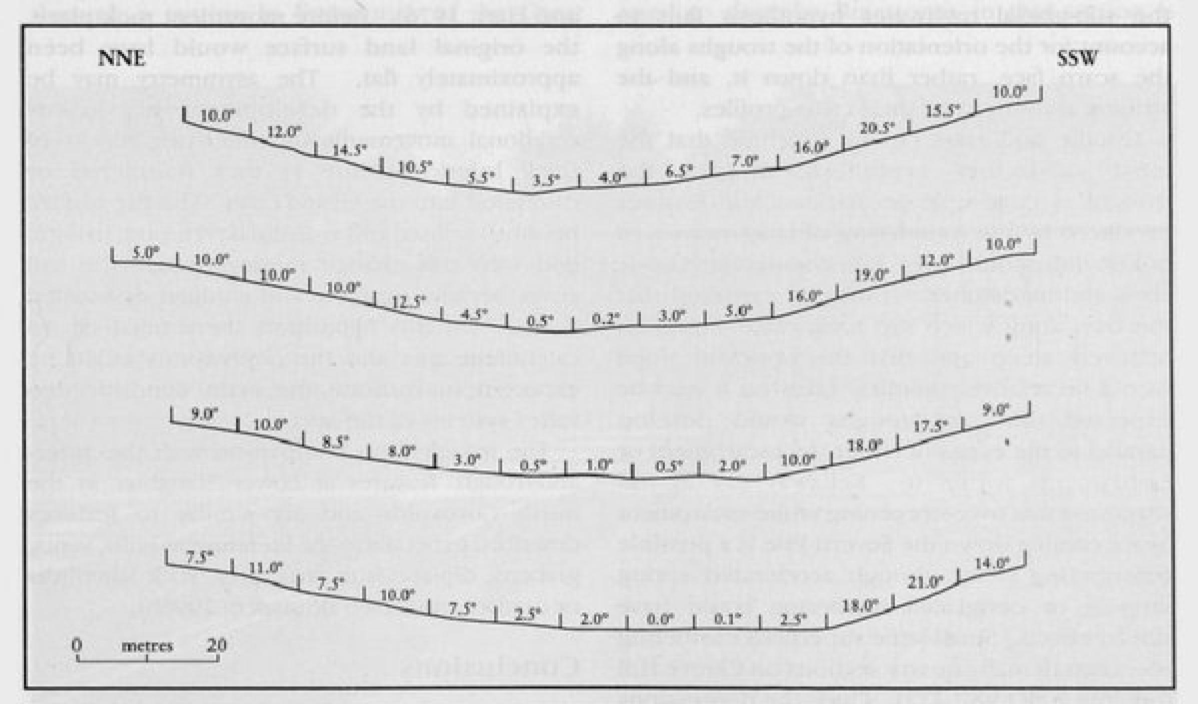
Although very little is known about this site, the dates or the mechanism involved — there is no sub-surface evidence — there is the opportunity to study the subject of material spreading at this site. There is both academic and economic importance in the subject because the forms imply that the whole hill may be in a 'residual strength' condition and might easily be re-activated by inappropriate civil engineering activity.

References

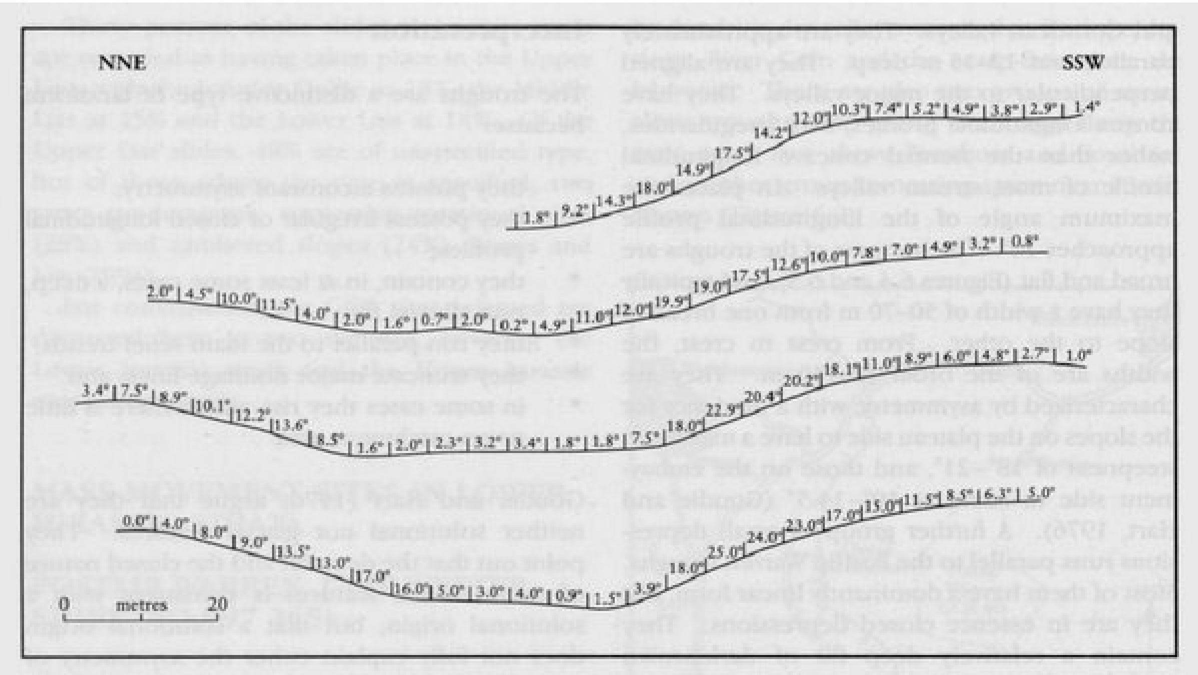


(Figure 6.2) Location of the Postlip Warren GCR site.

(Figure 6.3) View across Cleeve Common showing the deep dissection of the escarpment and the setting of Postlip Warren. (Photo: Gloucestershire Geology Trust.)



(Figure 6.4) Representative slope profiles at Postlip Warren to show distribution of maximum angles. After Goudie and Hart (1976).



(Figure 6.5) Representative profile at Postlip Warren to show broad and flat valley floors.