The Valley of Rocks

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Highlights

The Valley of Rocks is one of Devon's most spectacular and controversial landforms. Some authorities maintain that it was cut by glacial meltwater, others that it was formed by marine capture of a formerly more extensive East Lyn River.

Introduction

The Valley of Rocks is noted for a large dry valley and a series of periglacial features. The origin of the valley is much disputed, but has a major bearing on coastal and drainage evolution in north Devon. The site has been referred to by E. Arber (1911), Steers (1946), Simpson (1953), Mottershead (1964, 1967, 1977c), Stephens (1966a, 1966b, 1970a, 1974, 1990), Gregory (1969), Pearce (1972, 1982), M. Arber (1974) and Cullingford (1982). A detailed description and reinterpretation of the landforms was given by Dalzell and Durrance (1980).

Description

The Valley of Rocks or 'the Danes' [SS 700 495] extends some 2 km from Wringcliff Bay in the west to the western side of Lynton, and lies roughly parallel with the east-west-trending north Devon coastline (Figure 7.18) and (Figure 7.19). It is cut in the sandstones and slates of the Devonian Lynton Beds. On its southern margin it is backed by the high ground of Exmoor which locally rises from *c.* 260 m to 318 m OD. To the north, the valley is separated from the sea by the mass of Hollerday Hill and a narrow westward-running ridge, precipitous on its seaward side, capped by tor-like buttresses and mantled with scree. Although the Valley of Rocks terminates at Wringcliff Bay, its perceived course continues west to Lee Bay through a col in which Lee Abbey is situated. The principal 'tors' crop out on the valley's northern margin and are of both the crestal and valley-side types. These include the castellated turrets of rock known as Castle Rock, Rugged Jack and Chimney Rock. Valley-side tors also crop out on the south-facing slopes of the valley (e.g. the Devil's Cheesewring).

Considerable thicknesses of head are exposed in the coastal cliffs. Mottershead (1967, 1977c) recorded up to 25 m of such deposits comprising angular slate and sandstone fragments in a poorly sorted matrix of fines. At Lee Bay, a thick sequence of Pleistocene sediments is exposed in the coastal cliff at the head of the bay (Dalzell and Durrance, 1980). This sequence overlies a rock platform at *c.* 7 m OD and comprises (maximum bed thicknesses in parentheses):

4. Coarse angular rock fragments with some sub-rounded pebbles (*c.* 18 m) (head)

3. Subrounded pebbles (*c.* 3.5 m)

2. Mixture of well-rounded and subrounded pebbles with sand layers (*c.* 3.0 m)

1. Well-rounded pebbles in a sandy matrix (*c.* 3.5 m)

Beds 1–3 were described by Dalzell and Durrance (1980) as waterlain, comprising a mixture of fluvial and marine materials. They also showed that the Valley of Rocks and the smaller valley near Lee Bay (the Lee Abbey gap) have a substantial infill of Pleistocene scree and solifluction deposits.

Interpretation

Following Balchin's (1952) work on the erosion surfaces of Exmoor, Simpson (1953) put forward the view that the dry valley remnants could be explained by marine erosion and capture of a formerly more extensive River Lyn, which then flowed west. He concluded that the East Lyn river originally flowed from Lynmouth through the Valley of Rocks, the Lee

Abbey gap, Crock Point and Martinhoe Manor to Heddon's Mouth. Such an interpretation, based entirely on the present form and location of the remnant dry valley floors, was followed by Mottershead (1964, 1967, 1977c) (Figure 7.20) who stressed the similarity between the channel form and direction of the present East Lyn river east of Lynmouth, and the Valley of Rocks. Thus, he suggested that the Valley of Rocks represents the former course of the East Lyn before it cut down to its present level, and before its outlet at Lynmouth existed. As a result of the capture of the East Lyn and the abandonment of the Valley of Rocks, the course of the East Lyn to the sea was dramatically shortened. Initially, it probably reached the sea via large waterfalls, but with continued erosion upstream, the course became graded and more subdued to its present, but still sharply incised, form (Mottershead, 1977c).

In marked contrast, Stephens (1966a, 1966b) suggested that the valley remnants had formed as ice-marginal drainage channels cut in Wolstonian times (Saalian Stage) when glacier ice was believed to have reached Barnstaple Bay — and consequently may have impinged upon the north Devon coast for substantial portions of its length. Stephens' model implies that the pre-Wolstonian drainage pattern must have been substantially similar to that of today. As ice advanced and fringed the Exmoor coast, a lake formed in the Lyn Valley behind present-day Lynmouth (Figure 7.20). The Valley of Rocks was believed to have been cut by water spilling westwards from this impounded lake. As the ice wasted, the rivers reverted to their original courses and the Valley of Rocks was left dry. A meltwater origin was also considered plausible by Gregory (1969), but Mottershead (1967, 1977c) reviewed this mechanism and although he, and subsequent workers, have found no positive evidence against it, he argued that the concept of marine capture was probably more straightforward. In support of his model, Stephens noted that erratics and striated pebbles had been found in the area (including an example of the renowned Ailsa Craig microgranite), and that a number of often abrupt and now dry channels in the area had probably been formed in the same manner.

Dalzell and Durrance (1980) used electrical resistivity techniques to establish the origin of the dry valley system at the Valley of Rocks and Lee Bay (Figure 7.18). Their results showed that considerable, but variable, depths of Pleistocene deposits capped the Devonian strata. For the most part, the infill was interpreted as solifluction material derived from the valley sides, distinguished by a high proportion of fine sediment. A coarse surface layer of boulders and blocks, averaging between 2–5 m thickness, was discerned to the west end of the Valley of Rocks (Figure 7.18). At the eastern end a similar layer, but of finer material, was also noted. The thickness of superficial material in the Valley of Rocks increases west from 27 m at the highest point in the valley floor to 35 m at its lowest point. The pattern at the west end, however, is complicated by mass movement caused by marine erosion; here the rockhead profile is obscured (Dalzell and Durrance, 1980).

These results led Dalzell and Durrance (1980) to suggest that the rock-floor profile of the Valley of Rocks shows a gradation to a level lower than that of the Lee Abbey gap. Instead, the Valley of Rocks grades more readily to the heights and erosional remnants at Duty Point and Crock Point (Figure 7.18), which were therefore regarded as fluvially rather than marine-eroded surfaces. At the same time, the present Lee stream, with its gently profiled upper section, appears to grade more naturally with the rock-floor profile of the Lee Abbey gap (Figure 7.18).

Thus, Dalzell and Durrance rejected Simpson's (1953) and Mottershead's (1964) argument that the East Lyn had once flowed westwards through the Lee Abbey gap, and proposed instead that it had flowed in a course through the present Wringcliff Bay around Duty Point to Crock Point. The Lee stream would then have flowed east through the Lee Abbey gap to join the East Lyn as a tributary. A first stage of river capture by marine erosion in the Lynmouth area left the Valley of Rocks dry, save for the Lee tributary. Subsequent marine erosion, which formed Lee Bay, then captured the Lee to its present course. Since the platform of Devonian rocks in Lee Bay is overlain by raised beach and fluvial deposits (of presumed Ipswichian age) and then by periglacial head, Dalzell and Durrance argued that the coastal dissection had happened, at latest, in Ipswichian times; aggradation of head deposits in both the Valley of Rocks and the Lee Abbey gap could not have occurred if these valleys had been fluvially active throughout the Devensian.

Conclusion

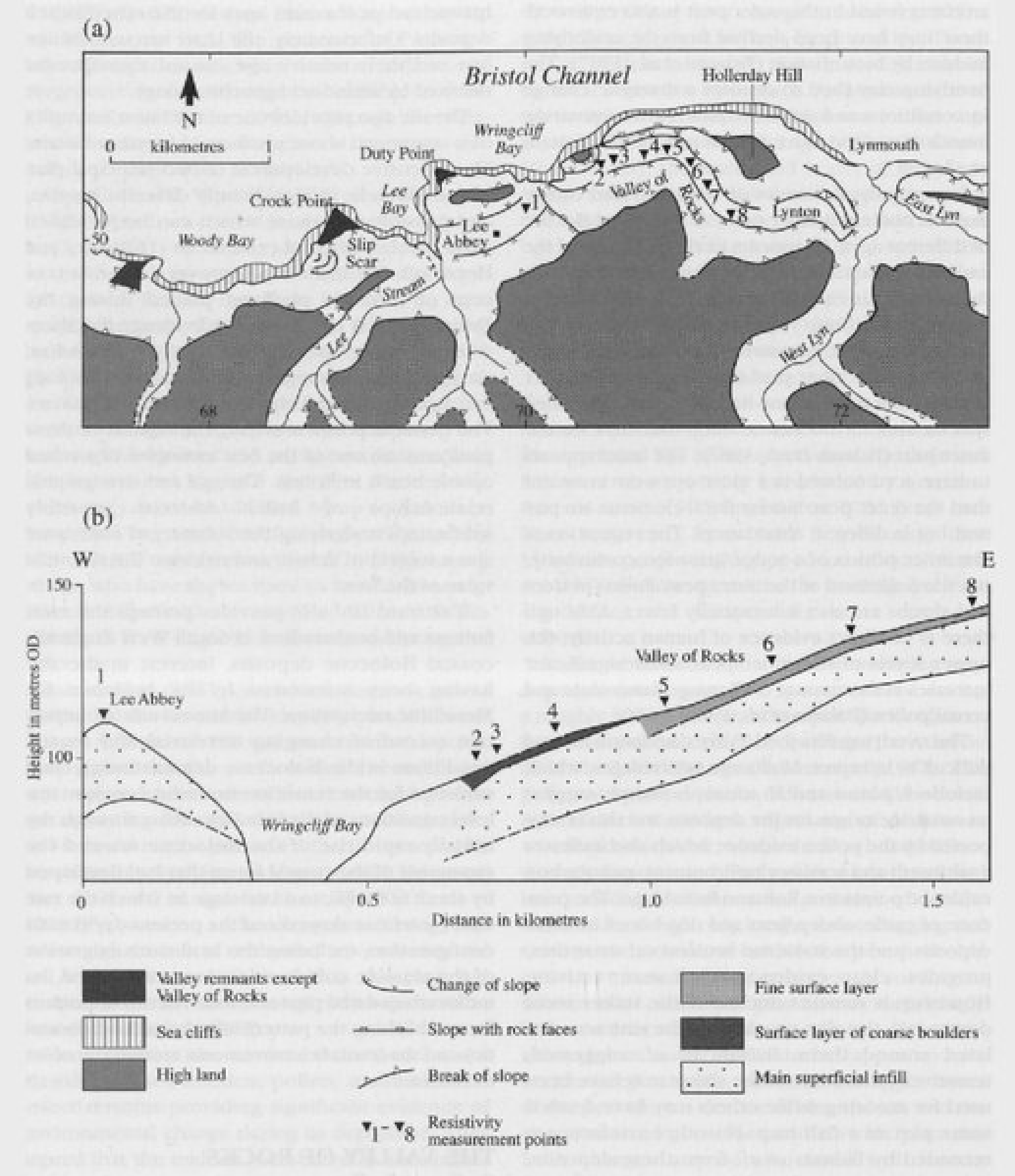
The Valley of Rocks is a spectacular landform, the age and origin of which have been much disputed. The site has nonetheless played a focal role in the development of ideas concerning coastal and drainage evolution in north Devon.

Two main theories have been put forward to account for the dry valley system. One explanation is that the Valley of Rocks was formed by marine capture of a formerly more extensive East Lyn River; another is that the feature is a marginal glacial drainage channel cut as water overspilled from an ice-impounded lake. Recent work graphically shows the problems of interpreting landforms such as this from their present surface morphology. The Valley of Rocks, and also that at Lee Abbey, are in fact underlain by considerable thicknesses of Pleistocene solifluction and head deposits which mask the true profiles and gradients of the rock floors. The application of electrical resistivity techniques shows that the Valley of Rocks and its perceived extension into Lee Bay (the Lee Abbey gap) could in fact be the result of a more complex sequence of marine erosion and river captures, with the Lee Abbey gap being the abandoned channel of a tributary of the East Lyn.

No detailed evidence to reject the glacial drainage hypothesis has, however, been put forward. Nonetheless, in favour of the river capture theory, M. Arber (1974) has argued that many streams flowing northward off Exmoor fall to the sea via waterfalls. She has cited this as evidence for rapid coastal retreat in the Pleistocene, the rivers still not having adjusted significantly to the most recent change in base level (but see Chapter 7; Introduction).

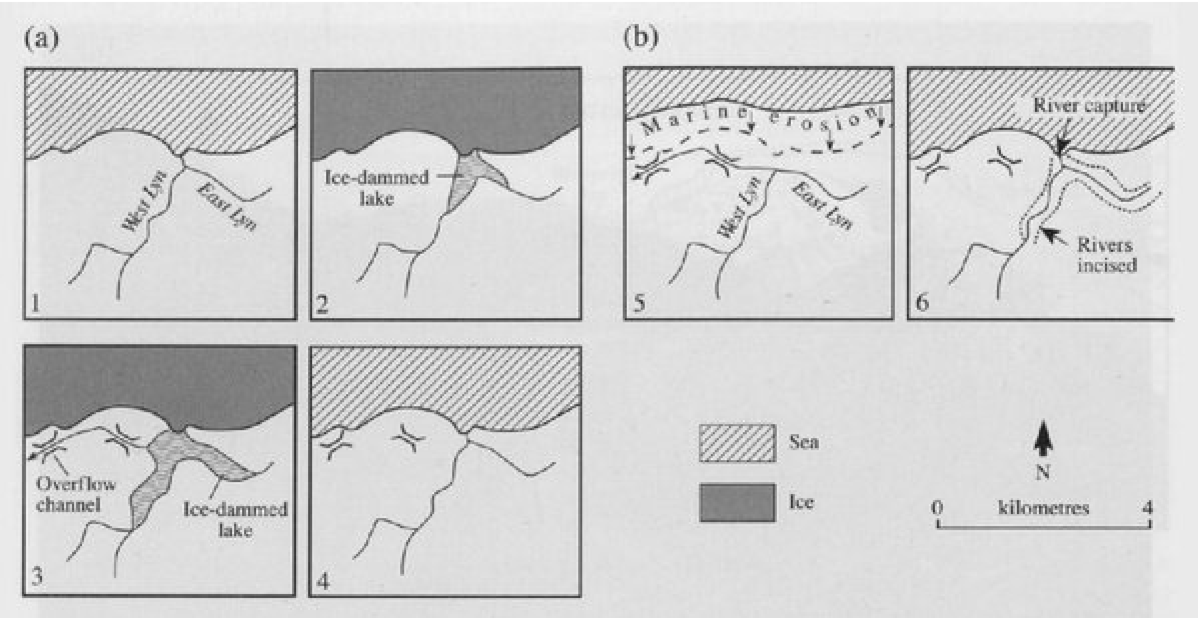
The conservation value of this site is enhanced by the well-developed tor-like buttresses and scree slopes on the margins of the dry valley system (Figure 7.21), and by the head and solifluction deposits which infill the valleys. The head deposits are well exposed in the sections at Lee Bay, and their association with raised beach deposits of proposed Ipswichian age there provides rare stratigraphic evidence for the relative dating of such landforms. Much of the head which infills the dry valleys is believed to have accumulated under periglacial conditions in the Devensian, when glacier ice is not thought to have reached this part of the Peninsula. Although the tor-like features have not yet been studied in detail, they are believed to have been significantly modified at this time, although in common with granitic tors, it is likely that they evolved in response to processes operating over more protracted timescales.

References

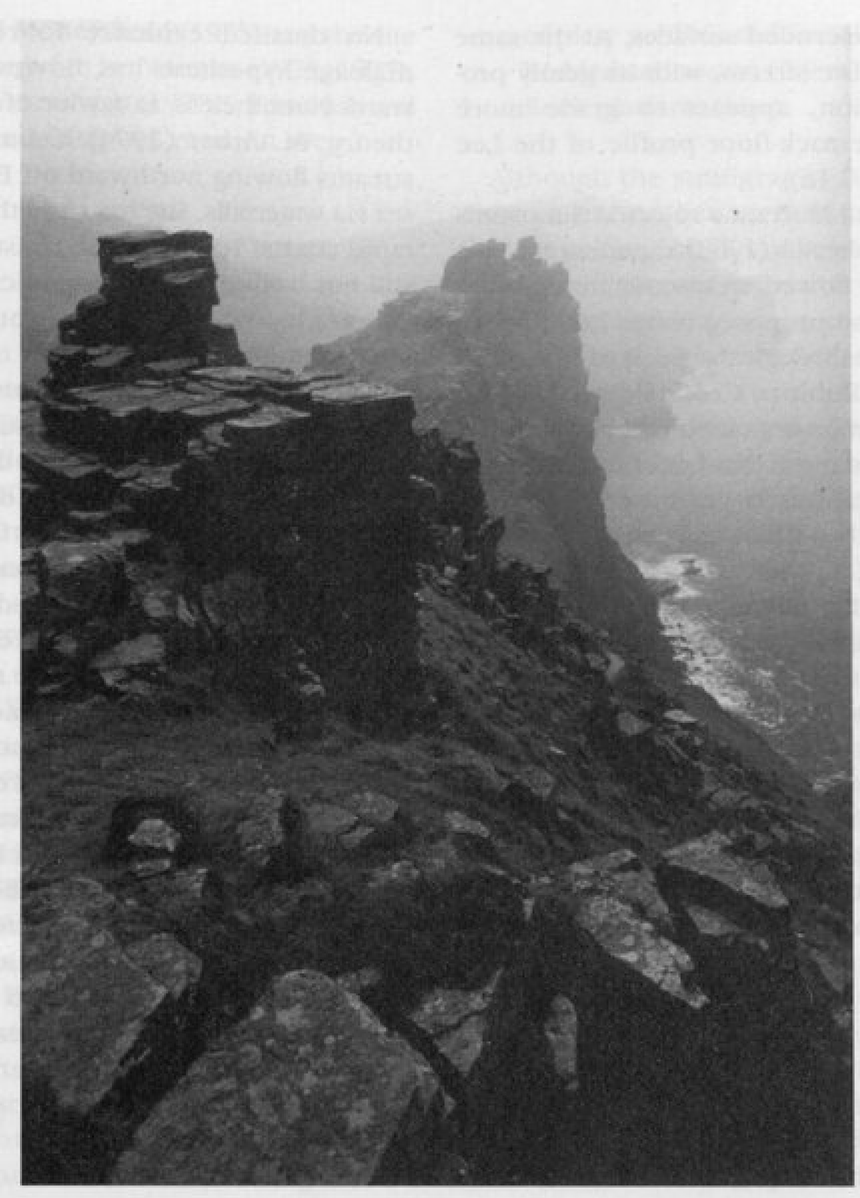


(Figure 7.18) (a) Landforms and Pleistocene deposits between Lynmouth and Woody Bay. (b) Profile of Pleistocene deposits within the Valley of Rocks and at Lee Abbey. (Adapted from Dalzell and Durrance, 1980.)

(Figure 7.19) The Valley of Rocks, looking east from Wringcliff Bay. (Photo: S. Campbell.)



(Figure 7.20) The evolution of the Valley of Rocks by: (a) Pre-Devensian glacial meltwaters; (b) Marine erosion and river capture. (Adapted from Mottershead, 1967, 1977c.)



(Figure 7.21) Tor-like buttresses and precipitous rock slopes on the northern margin of the Valley of Rocks, looking west. (Photo: S. Campbell.)