Porthleven

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Highlights

One of Cornwall's most controversial geomorphological localities, Porthieven provides possibly the oldest evidence of Pleistocene glacial conditions in the South-West. Its famous 50-ton erratic of gneiss, known as the Giant's Rock, could have arrived here on floating ice.

Introduction

Porthleven has long been famous for the large stranded erratic known as the 'Giant's Rock'. Its exact origin and mode of emplacement have been much debated but never satisfactorily solved: both, however, have significant repercussions for regional Pleistocene conditions. The Giant's Rock was first described in detail by Flett and Hill (1912). Subsequently, it has figured prominently in the scientific literature (e.g. Davison, 1930; Robson, 1944; Flett and Hill, 1946; Mitchell, 1960, 1965; Everard *et al.,* 1964; Stephens, 1966b, 1970a, 1973, 1980; Stephens and Synge, 1966; Kidson, 1971, 1977; Hall, 1974; Scourse, 1985a, 1996c; Holder and Leveridge, 1986; Todd, 1987; Goode and Taylor, 1988; Bowen, 1994b).

Description

The Giant's Rock [SW 623 257] lies some 400 m north-west of Porthleven harbour on a wide shore platform, locally named Pargodonnel Rocks (Figure 6.6). It is fully exposed only at low tide and rests in a large rock pool on the abraded platform surface from which, significantly, it is never shifted even in the heaviest storms (Flett and Hill, 1912; Hall, 1974). The erratic measures 3 m in length and weighs an estimated 50 tons. It is highly polished, brown in colour, and is composed of garnetiferous microcline gneiss, with garnet crystals up to 1 cm across (Hall, 1974; Stephens, 1980). On the remainder of the platform there are other numerous smaller boulders including those of slate, granite, gabbro and vein quartz. Towards the base of the steps, which lead down into the small cove from the cliff top, are patches of iron-stained and cemented sand and gravel (the latter quite well rounded in places) which adhere to the slate bedrock. These are probably the remains of a raised beach deposit from which other small boulders, elsewhere on the platform, may have been washed. Stephens (1973) noted that the platform extended to substantial notches (which contain the cemented raised beach gravels) in the base of a rock cliff now being re-exposed and re-trimmed by wave action.

Interpretation

Flett and Hill (1912) provided one of the most significant accounts of the erratic, establishing that the rock-type could not in fact be matched with any other British example. They later argued that it had been stranded … by the ice floes of the Glacial Period.' (Flett and Hill, 1946; p. 168).

Modern interpretations have centred on whether the Giant's Rock was deposited directly by glacier ice or was floated into position on pack ice or on a massive iceberg. Mitchell (1960, 1965) argued that, in view of the widely held relationship between Pleistocene glacial stages and low eustatic sea levels, the erratic could only have been borne to its present position directly by an ice sheet; he used the Porthleven erratic on the south Cornish coast and the beds at St Erth (part of which he then regarded as till) to define his southernmost limits for an ice sheet of Lowestoft (Anglian) age. The St Erth Beds, however, have since been securely reestablished as marine in origin (Mitchell *et al.,* 1973a; Jenkins *et al.,* 1986), and Mitchell's proposed Anglian ice limit in this region would appear to have no foundation.

Kidson (1971, 1977) propounded that large erratics found on shore platforms around the Croyde–Saunton Coast in north Devon, and indeed those along the south coast as far east as Prawle Point (including, by implication, the Giant's Rock?), were also emplaced directly by an ice sheet. He argued that the erratics at Croyde and Saunton had been derived from

Wolstonian (Saalian) Irish Sea glacial sediments (which include the Fremington Clay; see Chapter 7) and then incorporated into raised beach deposits during the Ipswichian Stage. Although this Wolstonian ice sheet may also have impinged on the Cornish coast at Trebetherick Point and in the northern Isles of Scilly (Kidson, 1977), there are no coherent glacial sediments anywhere else along the south Cornish and Devon coasts which suggest a more extensive inundation by ice at this time (Stephens, 1966b; Kidson and Bowen, 1976). Recent amino-acid dating studies of raised beach deposits in the region (e.g. Andrews *et al.,* 1979; Davies, 1983; Bowen *et al.,* 1985; Davies and Keen, 1985) have shown that raised beach sediments from at least two separate interglacial phases of the Pleistocene are present. In many cases, however, the raised beach deposits are unfossiliferous and cannot be dated; the true age relationship of the erratics to the local raised beach deposits therefore remains uncertain in the vast majority of cases.

In contrast, many authors have favoured ice-rafting as the most likely mechanism for emplacement of the Giant's Rock and similar large erratics in the South-West. Indeed, Tricart (1956) also favoured this mechanism to explain the presence of large erratics on the French Channel coast. However, if floating ice carried the erratics to the south coast, then problems arise regarding contemporary Pleistocene sea levels. Mitchell (1972) sidestepped the problem of low sea levels during glacial stages by arguing that these erratics were rafted into position at the beginning of the Saalian Stage when the level of the sea might still have been relatively high after the preceding, warm, Hoxnian Stage. Similarly, Stephens (1966b) argued that the large erratics could have been emplaced by pack-ice and icebergs during the waning of an early pre-Saalian (Anglian?) glacial period when world sea level would have been high enough to allow the erratics to be 'floated' into position (Fairbridge, 1961). As an alternative hypothesis, Stephens suggested that towards the end of the Saalian ice-sheet glaciation, isostatic depression of the land had allowed the sea to move icebergs against these coasts despite a generally low eustatic sea level. Such a mechanism is similar to recently proposed models of Late Devensian glaciomarine sedimentation in the Irish Sea Basin (e.g. Eyles and McCabe, 1989, 1991). Bowen (1994b) recently suggested that the Giant's Rock could have originated in Greenland and then been transported to the South-West on ice-floes from a disintegrating, Early Pleistocene, Laurentide ice sheet.

In support of the ice-rafting hypothesis, the most convincing evidence is that the erratics are very largely confined to a narrow coastal zone, invariably below 9 m OD, and within the reach of storm waves today (Stephens, 1966b). Also, comparable very large erratics are not known from inland locations in the region, with the exception of those recorded from the Fremington Clay in the low-lying Barnstaple Bay area (Stephens, 1966b). Smaller examples, however, are found at various levels around the south coast, and some may have sources in Brittany, the Channel Isles and Cotentin (Kellaway *et al.,* 1975; Mottershead, 1977b); they may have been worked from sea-bed deposits, carried up and finally emplaced by successive transgressive Pleistocene high sea levels. Such a mechanism is not plausible for emplacement of the Giant's Rock which does not shift at all even in the heaviest of storms and wave regimes of the present day. This has led some authors to consider the possibility that the Giant's Rock is not a glacial erratic: it may have been derived from the Normannian High by means of slumping during the deposition of the Mylor Slates in Devonian times (Holder and Leveridge, 1986; Goode and Taylor, 1988). Such a view is not, however, widely held.

Conclusion

The Giant's Rock is the most impressive and intriguing of the large erratics found around the south and west coasts of Britain. Despite having attracted scientific interest for nearly a century, its exact origin and mode of emplacement are still unknown and it remains the subject of much controversy. Although some workers have maintained that the 50-ton erratic was emplaced directly by glacier ice, most believe that it was delivered to its present location on floating ice. One recent interpretation invokes Greenland as a possible source and a disintegrating Laurentide ice sheet as a transport mechanism. The Porthleven erratic and the classic examples of the Croyde–Saunton Coast (some of which are found in a stratigraphic context) are central to the reconstruction of earlier Pleistocene events in the region: they have major implications for the extent of pre-Devensian ice sheets, for Pleistocene sea levels and, more controversially, for a possible mechanism involving isostatic depressions of the land's crust proximal to ice-sheet margins.

References

(Figure 6.6) The Giant's Rock at Porthleven, the South-West's most famous erratic — author for scale. (Photo: S. Campbell.)