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# Trefgarn

## Highlights

Tors and profiles through weathered ancient bedrock and slope deposits have elucidated the processes behind tor formation. The site provides evidence for pre-Pleistocene deep tropical and Pleistocene periglacial weathering which combined to form the tors.

## Introduction

Trefgarn is an important geomorphological site for the study of tors. It comprises two tors, Poll Carn and Maiden Castle, adjacent blockslopes and a quarry section showing deeply weathered bedrock overlain by superficial slope deposits. The site therefore displays several key elements that have featured in papers on the theory of tor formation. The tors were first investigated by Linton (1955) and the site has also featured in studies by Charlesworth (1929), Evans (*in Jones* 1965), George (1970) and John (1970a, 1971a, 1973). More recently, Battiau-Queney (1980, 1984) provided detailed accounts of the site.

## Description

The site comprises three main geomorphological elements —1) the two spectacular low-level tors of Poll Carn [SM 952 245] and Maiden Castle [SM 954 248] developed in Precambrian rhyolite between 110m and 125m OD, with associated blockfield slopes; 2) the narrow gorge between Great Trefgarn and Little Trefgarn Rocks through which the modern Western Cleddau river runs at c. 25m OD and; 3) part of the disused quarry [SM 958 240] where deeply weathered Silurian andesites are truncated and overlain by possible alluvial (Battiau-Queney 1980, 1984) and slope deposits. The tor forms at Trefgarn are of the crestal type, but they are unusual in occurring on a rolling landscape at extremely low altitude.

## Interpretation

Linton (1955) proposed a two-stage model for the formation of features such as the tors at Trefgarn. First, a period of deep weathering under warm humid conditions (probably during the Palaeogene) developed a thick regolith, with corestones occurring where joint planes were most widely-spaced. Second, the products of weathering (the regolith) were removed by mass-wasting processes, leaving the corestones as upstanding tors. Linton proposed that the tors had probably been exhumed under periglacial conditions during the Pleistocene when solifluction and meltwater would have been efficient agents in removing the regolith. During this period, periglacial activity may also have modified the tors (Linton 1955). Linton noted that at Trefgarn the rotting guided by joint planes had been so deep "as to produce masses of quite fantastic outline".

Since Linton's (1955) paper, however, others have maintained that tors elsewhere (Dartmoor and the Pennines) were formed essentially under Pleistocene periglacial conditions (Palmer and Radley 1961; Palmer and Nielson 1962). John (1971a) also noted that the present form of the tors at Trefgarn has evolved in response to periglacial processes. It is relevant to note that a considerable variety of tor morphology exists in both present and past periglacial regions (Embleton and King 1975b), and it would appear that no single hypothesis can satisfactorily cover all cases. Recent work in the Trefgarn area, however, has thrown additional light on the problem.

Battiau-Queney (1980, 1984) included Trefgarn in a study of the 'pre-glacial' evolution of Wales. She described exposures in a disused quarry downslope from the tors; the Silurian andesite (at [SM 959 240]) was weathered to a depth of several metres. This weathering profile was truncated and overlain by poorly sorted and weathered deposits of alluvial origin. She considered that the weathering horizon (saprolite) was of Tertiary age on the basis of both physical and chemical properties which included — the depth of weathering (several metres), the fine texture of the material with a

high percentage of particles < 50 microns, the clay mineralogy of the deposits which included a high percentage of newly crystallised clay minerals in the profile, the appearance of quartz 'particles' and the massive loss of silica. She argued it was unlikely that the saprolite had developed during Pleistocene interglacial conditions because the weathering products were generally located on interfluvies, indicating that their formation had preceded incision of the valley; and because the presence of kaolinite, produced by the hydrolysis of silicates and the solution of quartz, indicated that the chemical processes had been operative for a considerable duration conditions most readily facilitated by a protracted hot and wet climate. She considered that the poorly sorted and weathered alluvial deposit capping the weathered profile had been laid down by a palaeo-Cleddau river flowing in a larger and higher valley than the present one. Detailed evidence to support the latter interpretation, however, was not presented, and the sediments can equally well be interpreted as slope deposits.

Battiau-Queney argued that the Trefgarn tors had formed in response to slow but prolonged uplift along an old structural axis developed in the Precambrian rocks. Where subaerial denudation had exceeded the rate of chemical weathering, corestones were exhumed leaving tors at the land surface. Thus, a sharp deterioration of climate was not required to trigger the exposure of the tors (Battiau-Queney 1980, 1984). It is pertinent to note that the products of this 'tropical weathering', described at Trefgarn by Battiau-Queney, have survived in an area thought by most authors (for example, Griffiths 1940; John 1971a; Bowen 1974) to have been glaciated. This, Battiau-Queney suggested, indicated that Trefgarn had not been glaciated.

Trefgarn is also notable for the spectacular, deep, rocky gorge between Little and Great Trefgarn Rocks. Charlesworth (1929) considered that the Western Cleddau river had carried meltwater from a series of proglacial lakes impounded in north Pembrokeshire by the 'Newer Drift' ice-sheet, implying that the gorge had been used as a subaerial meltwater channel. This assertion was upheld by Evans (*in* Jones 1965) who suggested that quarrying operations within the gorge had revealed a complete lack of glacial sediments, therefore indicating that the gorge had probably been cut by large volumes of meltwater, a conclusion followed by John (1971 a).

The geomorphological evolution of the landform in assemblage at Trefgarn is the subject of some debate, but the site provides evidence for a range of geomorphological processes that have played an important role in the shaping of the south-west Wales landscape. In particular, the site exhibits several key elements that have featured in theories of tor formation, and the site shows evidence for probably pre-Pleistocene and Pleistocene geomorphological events and processes.

## **Conclusions**

The landforms at Trefgarn provide evidence for the wide range of the erosional and weathering processes which have shaped the landscape of south-west Wales. The upstanding rock outcrops (tors) have been used as examples in developing theories on the formation of such landforms.

## **References**