South Wales RIGS Group Site Record
RIGS Description

SECTION A

General	South Wales
Site Name: Craig y Fro Ridge Features	**File Number: AH_18**
RIGS Number: 797	**Surveyed by: AJ Humpage**
Grid Reference: SN 97450 20865	**Date of Visit: 1 September 2011**
RIGS Category: Scientific / Educational	**Date Registered:** Unknown
Earth Science Category: Geomorphologcial	
Site Nature: Roadside / valley head	**Documentation prepared by: AJH**
Unitary Authority: Powys CC	**Documentation last revised:** 3 October 2011
OS 1:50,000 Sheet: 160	**Photographic Record:** See images attached to this report
OS 1:25,000 Explorer Sheet: OL12	
BGS 1:50,000 : Sheet 213 (Brecon) and 231 (Merthyr Tydfil)	

RIGS Statement of Interest: This site forms part of a network of important scientific sites within the South Wales RIGS area associated with ice front still stand and re-advance during the Loch Lomond Stadial (Younger Dryas) in glaciated valleys.

The site provides a good example of an apparent small cirque and suite of arcuate morainic ridges with a northerly aspect and backed by a large plateau to the west. This setting means that it was well sited from both the point of view of orientation with respect to the prevailing wind and position to receive and store snow scoured from the slopes by prevailing westerly winds during Younger Dryas Stadial times. The site therefore has intrinsic palaeoclimatic and geomorphological interest. Most researchers have considered the features at this site to be glacial in origin (e.g. Lewis 1966; Walker 1980, 2007; Shakesby 1992, 2002), however, the elevation of this site c.390m OD is far lower than other similar Younger Dryas glacial features elsewhere in the Brecon Beacons. As a consequence, doubt has been cast upon the ability of Craig y Fro, with its relatively small headwall, to sustain a cirque glacier during the Younger Dryas (Carr et al 2007), as the glacier dynamics equation does not suggest that the mass balance is sufficiently favourable to support the presence of ice at this time. As a consequence, Carr et al (2007) proposed an alternative mechanism for formation, that of the features being associated with a Rock-Slope Failure on the headwall post-dating the deglaciation after the Late Glacial Maximum.

Subsequently, drilling at the site by BGS and detailed analysis of the resultant cores has confirmed the preference for the glacial origin of these features, with the glacier being sourced by a large upwind snow blow area, a hypothesis first proposed by Robertson (1988).

Geological setting/context:

Craig y Fro lies at the head of Glyn Tarell, a major glacial trough that feeds the Usk valley system. The main A470 trunk road curves around the base of the headwall, and below the road, are prominent depositional landforms up to 10m high. These landsforms comprise a prominent inner ridge and a series of outer, more subdued, laterally less extensive ridges. There are prominent breaks of slope at the base of the outermost ridge and on the inside slope of the innermost ridge, where it abuts a peat-filled basin. The inner ridge runs upslope to the north-west and is cut through by the A470. Lewis (1966) considered that there were eleven different ridges, but most workers have suggested there are only three or four (e.g. Robertson 1988). The innermost ridge is the most pronounced. It is arcuate and rises 10m above the bedrock basin underlying the peat bog. This ridge has slope angles of 15-25^{o}. The remaining ridges are more subdued and less laterally extensive. The ridge complex has been considered to be glacial in origin (Lewis 1966, Walker 1980, Robertson, 1988; Shakesby 1992, 2002) and pollen and radiocarbon dating evidence from the paet basin support the view that the ridges were formed during the Locj Lomond Stadial (Younger Dryas) (Walker 1980; Matthews et al., in prep).

Some features have led to the Younger Dryas origin being questioned, not least the low altitude (c. 370 -400m OD compared to other such landforms in the Brecon beacons and the headwall is unimpressive, making the low altitude of the feature even less easy to attribute to glacial action. However, the presence in the ridge sediments of abraded, striated clasts in only a small sample studied is strong evidence for a glacial origin. Further evidence supporting the glacial origin are the presence in exposures in the ridge extending above the A470, where abraded, striated clasts in a sandy matrix were revealed (Shakesby and Matthews 2007). South-west of the headwall (Rhos Dringarth; SN 960 215] is a large sloping area from where wind-blown snow could maintain the glacier, which is at a similar altitude to the morainic features in Craig Cwm-du [SN 945 213] at between 350 and 400m.

The innermost frontal ridge occurs where the glacier would have been best developed: the less extensive outer ridges indicate that the glacier was initially restricted to a smaller width of the headwall and extended farther down-valley prior to retreating slightly to adopyt a broader shape when it formed the inner ridge. In comprising comparatively closely-spaced multiple ridges, the whole complex is not very different from other sites in the Brecon Beacons (e.g. Cwm Llwch). The better lateral moraibne development on the north-west side of the glacier can simply be related to down-valley flowline combined with a greater supply of debris to the glacier margin here as a result of a more actively eroded north-west section of the headwall, which is consequently more rugged than elsewhere (Shakesby and Matthews 2007). Robertson (1988) calculated that the glacier had an area of 0.15km^2 and an equilibrium line altitude of 426m. He showed that the glacier had a particularly large snow-blow area for glaciers in the Brecon Beacons, which could account for its relatively low altitude.

Possibility of alternative periglacial and mass movement origins
(from Shakesby and Matthews 2007)

To date, no proposal of a non-glacial origin has been published (although see Carr *et al.,* 2007), but given the range of alternative such origins suggested for depositional ridge complexes elsewhere in the Brecon Beacons, they should be considered. Two main concerns might be seen with a glacial origin for the entire depositional complex:

1) The low equilibrium line altitude (although, as indicated earlier, the glaciers below Craig Cerrig-gleisiad and Craig Cwm-du extended to below 400m): and
2) The plan form of the feature, which might be viewed as atypical of a moraine complex and better interpreted as a paraglacial or periglacial landform representing a single landform with a multiple-ridged section which actually continues downvalley in the form of a less distinct, tapering undulating drift mass. Lewis (1966) considered that some of his eleven ridges occurred in this outer drift mass, where they formed “minor domings” that he thought were “submerged in periglacial deposits”. Robertson (1988) on the other hand, distinguished this area from the inner ridge complex.

A periglacial (pronival rampart) origin can be excluded given the large distance even of the innermost ridge from possible sources of debris derived from the headwall, and certainly as regards explaining the outer ridges. Moreover, Robertson (1933) reported the presence of green sandstone within the diamict in the innermost ridge, which only crops out in the headwall at a level between the A470 road and the peat bog behind the innermost ridge. An origin for the latter by the transport of debris over the surface of a snowbed banked up against the headwall is thus not feasible.

A landslide origin might seem attractive in explaining better the transverse ridged plan form of the main complex and the undulating drift mass farther downslope, if this is viewed as part of the same landform. There is support from the orientation of the headwall, which is not dissimilar to that of the unstable part of Craig Cerrig-gleisiad thought to have been the source of a landslide there. Setting aside differences of opinion about the acceptance or rejection of the drift mass “tail” as part of the same landform as the multi-ridged inner section, there are several problems with this explanation at the Craig Y Fro site. They are :

1) The lack of signs of instability on the head wall (c.f. Craig Cerrig-gleisiad);
2) The presence of striated and abraded clasts in the innermost ridge;
3) The clear continuance up the headwall of this feature to form a prominent lateral ridge, which also contains abraded and striated clasts; and
4) The dearth of debris between the headwall and innermost ridge (where there is a typical glacially-eroded basin now largely peat filled).

Finally, a combined landslide and glacial origin, similar to that envisaged for the Craig-Cerrig-gleisiad depositional landforms, might seem attractive given the problems with an explanation by landsliding alone. Conceivably, a landslide would produce a relatively extensive tongue of debris spread from the headwall downvalley. The most suitable time for landslide occurrence would have been immediately following deglaciation, as argued for the Craig-Cerrig-gleisiad depositional landforms. Glacier development during the Younger Dryas would then have re-worked landslide debris near the headwall to produce the pronounced basin and the innermost terminal

and northern lateral ridges. This explanation would account for the striated and abraded clasts in these ridges, the greater lateral extension of the innermost ridge and its more pronounced form (reflecting its formation by a different process to that for the outer ridges) and the comparative lack of talus on the headwall or at its base (because this debris had been glacially – entrained and incorporated into the ridges). There remains the problem, however, of the lack of evidence of headwall instability, in stark contrast to Craig-Cerrig-gleisiad where the evidence is abundant.

In conclusion, the evidence points strongly to an entirely glacial origin for the Craig Y Fro depositional landforms. Any alternative requires special pleading and/or unnecessarily complex explanations.

References:

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SECTION B

PRACTICAL CONSIDERATIONS: Please score Accessibility and Safety Red Amber or Green			
Accessibility:			X
Comment: Private property and public roads			
Safety:			X
Comment: Beware of fast moving traffic on main road. Steep slope down from lay-by			

Conservation status:

There are no known designations of this location although it lies between two "arms" of the Brecon Beacons SSSI.

OWNERSHIP/PLANNING CONTROL:

Owner/tenant: National Trust / BBNPA

Planning Authority: Brecon Beacons National Park Authority

Planning status/constraints/opportunities: There are no known planning constraints or opportunities.

CONDITION, USE & MANAGEMENT:

Present use: Mainly open upland rough grazing

Site condition: Generally good

Potential threats: Road improvements.

Site Management: Maintain current usage

SITE DEVELOPMENT:

Potential use (general): This site is of interest to the general public as it is easily accessible and located adjacent to large lay-by, making it suitable for an on-site interpretation initiative, not least as it has interesting geomorphological controversy associated with it, and thus is of considerable interest to Quaternary scientists and geomorphologists at the international as well as national level. The distinct ridges attract the attention of interested passers-by. It lies along the Fforest Fawr Geopark *Glyn Tarell* Geotrail published in 2012.

Potential use (educational): The site provides a classic example of arcuate ridges formed by a small glacier during the Younger Dryas Stadial (12 900 -11 500 years ago). It, therefore, provides an excellent, easily accessible site to discuss aspects of the glacial activity during the Younger Dryas.

Other comments:

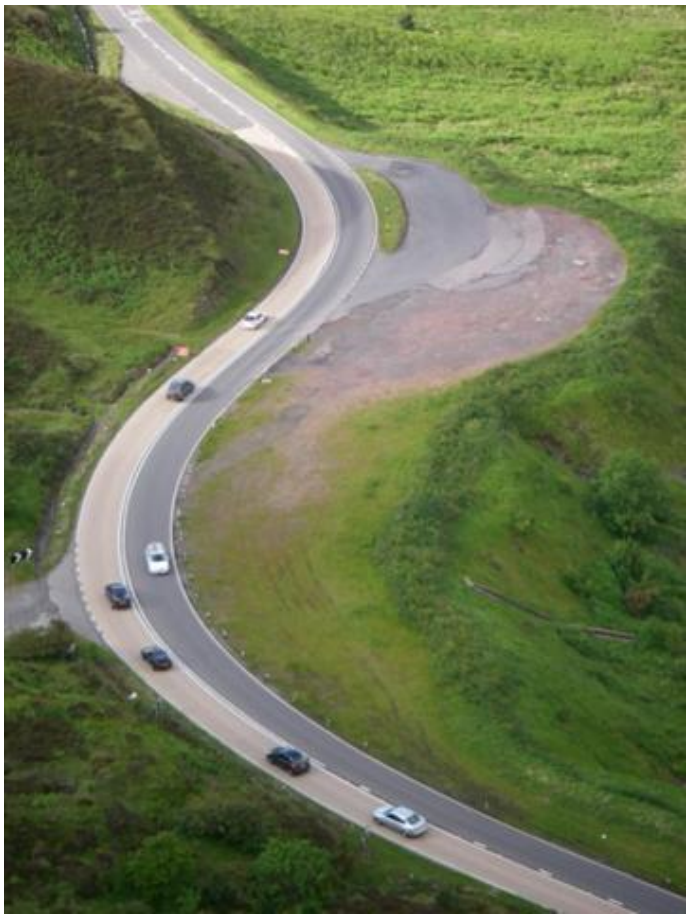
This site is included on the route of the Fforest Fawr Geopark Glyn Tarell Geotrail published in 2012

Photographic Record

View downvalley showing the ridges which form the distinctive feature of Craig y Fro. These have been variously described as landslide ridges and as terminal moraines associated with a Loch Lomond (Younger Dryas) cirque glacier. The latter interpretation is now favoured, even though the altitude of this site is lower than similar features elsewhere in the Brecon Beacons.

View west looking into the peat filled basin below the road, behind the uppermost (oldest morainic ridge (right side of photograph)

View north showing the Loch Lomond Stadial morainic ridges in the middle distance.



The lay-by adjacent to the Craig y Fro site – note steep slope to right dropping to the peat filled basin.

BGS Dando drilling rig drilling two boreholes to bedrock through the peat filled basin