

South Wales RIGS Group Site Record RIGS Description

SECTION A

General	South Wales
Site Name: Allt Troedrhiwfelen Stream Section	File Number: Site_RAW_JRD_11
RIGS Number: 648	Surveyed by: RA Waters & JR Davies
Grid Reference: SN 7852 3420 to 7889 3397	Date of Visit: January 2011
RIGS Category: Scientific	Date Registered: Owner: Troedrhiwfelen Farm (western part) and Gwernfelen Farm (eastern part) Planning Authority: Carmarthenshire County Council & Brecon Beacons National Park
Earth Science Category: Stratigraphy, Sedimentology, Palaeontology	
Site Nature: Stream section	Documentation prepared by: J R Davies
Unitary Authority: Carmarthenshire County Council & Brecon Beacons National Park	Documentation last revised: 24 th February 2012
OS 1:50,000 Sheet: 146	Photographic Record:
OS 1:25,000 Explorer Sheet: OL 12	
BGS 1:50,000 Sheet: E212	
<p>RIGS Statement of Interest: This site forms part of a network of early Silurian sites (RIGS and GCR) in the type area for the Llandovery Series. Collectively, these sites represent the key sections in the local geology that underpin its international importance and demonstrate the implications of significant new discoveries.</p> <p>The extensive Allt Troedrhiwfelen stream section occupies a critical central position in the type Llandovery area that allows the relationships between sandstone-dominated successions to the north and south and a mudstone-dominated central succession to be assessed and interpreted. Its significance was recognised by Jones (1925), but it is the discovery of new graptolite faunas and the opportunity the section has provided to date the succession using microfossils (acritarchs and chitinozoans) that has underlined its regional importance. This has allowed a number of the early Silurian sea level movements shown to have been key in the fashioning of the type Llandovery succession (BGS, 2008; Schofield et al., 2009; Davies et al., 2010) to be accurately dated and confirmed the nature of lateral facies changes between the more sandy and more muddy parts of the Llandovery succession.</p> <p>The Troedrhiwfelen stream section occupies a critical setting in the type Llandovery area that has allowed key sedimentary events to be accurately dated and helped to establish the nature of lateral facies changes in the region. New dating of the section using both macro and microfossils has been pivotal in the development of a new architectural model for the type Llandovery area that significantly advances geological understanding of this internationally important rock succession.</p>	

Geological setting/context:

The Allt Troedrhifelen stream section occupies a critical location with the internationally acknowledged type succession for the Llandovery Series (early Silurian). Jones (1925, 1949) was the first to recognise that the section exposes a succession of Llandovery strata that differs from that exposed both to the south and further north, in the Crychan Forest region. Many of the rock units he was able to map in these other areas are not present in the Troedrhifelen section and he suspected that they had been cut out by unconformities present within the succession. Cocks et al. (1984) concurred with Jones in so far as they recognised that the Troedrhifelen area lay within a central belt within the Llandovery area in which the succession was predominantly composed of mudstone and that this was distinct from more sandstone-rich successions present to the south and north. However, they interpreted these differences as the product of lateral changes in sedimentary facies. More recent regional work by BGS has broadly confirmed the model of Cocks et al. (1984), but has led to significant amendments to the stratigraphical model for the Type Llandovery succession (BGS, 2008; Schofield et al., 2009; Davies et al., 2010, 2011). This is now shown to comprise a series of coarsening-upwards progradational sequences bounded by flooding surfaces that record the impact of contemporary sea level movements; and new fossil discoveries in the Troedrhifelen stream section contributed significantly to this new understanding.

The Allt Troedrhifelen stream flows from the vicinity of Gwernfelen Farm in a west-north-westerly direction towards its confluence with the Afon Gwedderig. Starting at a point due west of Troedrhifelen Farm for 450 m to the south the bed and banks of the stream provide almost unbroken exposure through a rock succession that dips steeply to the NW, but is structurally inverted and younges to the SE. Western parts of the section expose a predominantly mudstone succession, but units of sandy mudstone and muddy sandstone interrupt this succession and become more prevalent in the eastern part of the section. The lower (western) mudstone facies are included in the Chwefri Formation and comprise banded pale and medium grey silty mudstones with local burrow-mottles. The presence in these rocks of *eoplanktonica* Biozone acritarchs and *maennili* Biozone chitinozoans confirms a late Rhudanian to early Aeronian age (Davies et al., 2010). Local cross-cutting relationships and distorted bedding in this part of the section provide evidence of synsedimentary disturbance. Upstream [7860 3414], capping the lowest exposed coarsening-upwards sequence, a unit of sandy mudstone/muddy sandstone unit is exposed in a small quarry in the north bank of the dingle. This unit is included in the Trefawr Formation (usage of Schofield et al., 2009) and records a period during the *convolutus* graptolite Biozone when more sandy facies prograded into the Troedrhifelen area.

The return of mudstone-rich facies (a higher tongue of Chwefri Formation) above this sandy unit records a regionally important *convolutus* Biozone flooding event which has been shown at this locality also to have introduced *microcladium* biozone acritarch assemblages. Over a 130 m of Chwefri Formation mudstones intervene between this flooding level and the entry of green, burrow-mottled, sandy mudstones of the Rhydings Formation that are part the second coarsening-upwards sequence exposed in the section. This sequence, capped by well bedded Cefngarreg Sandstone Formation, records a further prograde event which, as previously, is

overlain by muddy Chwefri Formation facies that an ensuing marine transgression reintroduced. Samples recovered from the Troedrhifelen section confirmed for the first time that this deepening event occurred in the upper part of the *convolutus* Biozone, as indicated by fragments of *Camograptus lobiferus* and *Ca. harpago*, and that it also marked the first appearance in the type Llandovery area of microfossil assemblages diagnostic of both the *estillis* acritarch and *dolioliformis* chitinozoan biozones.

A final coarsening-upwards sequence overlies this dated level and is marked by the transition upstream into a second unit of Rhydings Formation and from this in turn into more sandy facies that constitute a further unit of Cefngarreg Sandstone Formation. Upstream of the proposed RIGS site there are intermittent exposures in the succeeding Wormwood and Cerig formations which serve to confirm the regional stratigraphical context of the section.

The age of the rock succession exposed by the Allt Troedrhifelen stream section is now well constrained following graptolite, acritarch and chitinozoan discoveries and which allow it to be compared with more sandstone-rich successions present to the north and south (Schofield et al. 2009; Davies et al., (2010, 2011). The exposed coarsening-upwards prograde sequences can be matched with those identified in these other areas, but the more muddy Troedrhifelen succession reflects accumulation in a deeper, more distal setting close to the distal reach of these events. The flooding events which followed each of these progradations are shown to have reintroduced more muddy offshore facies, but also newly evolved graptolite and microfossil assemblages. These Troedrhifelen discoveries, allied to the results of the broader research effort in the Type Llandovery area, allow these deepening events to be correlated more widely, including internationally, and to test current models which suggest they were the product of sea level movements which were of global reach.

References:

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SECTION B

PRACTICAL CONSIDERATIONS:

Please score Accessibility and Safety Red Amber or Green

Accessibility:



Comment: Access on foot from Troedrhifelen Farm; permission also needed from Gwernfelen Farm for access to the eastern part of the section

Safety:



Comment: Steep-sided dingle requiring care to be taken when traversing the section; high stream water levels following periods of heavy rain may obscure much of the stream bed exposure. Need to be aware of farm operations.

Conservation status:

There are no known conservation designations of this RIGS

OWNERSHIP/PLANNING CONTROL:

Owner/tenant: Troedrhifelen Farm (western part) and Gwernfelen Farm (eastern part)

Planning Authority: Carmarthenshire County Council and BBNP

Planning status/constraints/opportunities:

There are no known planning constraints or opportunities

CONDITION, USE & MANAGEMENT:

Present use: Abandoned farm quarry

Site condition: Good; some vegetation obscures lower levels of section

Potential threats: May become overgrown; risk of infill by farmer

Site Management: Needs be maintained in present condition and infill prevented

SITE DEVELOPMENT:

Potential use (general):

Potential use (educational): Academically useful site

Other comments:

Photographic Record



Photograph 1. Entrance to Troedrhiwfelen stream section [SN 7858 3420]



Photograph 2. Lower (north-western) part Troedrhiwfelen dingle where the stream bed provides almost unbroken exposure in the Chwefri Mudstones Formation (strata dip steeply downstream, but are structurally inverted and young towards the south-east) [SN 7852 3420]



Photograph 3. Disused quarry on the north side of Troedrhiwfelen stream exposing green, burrow-mottled sandy mudstones of the Trefawr Formation [SN 7861 3414]



Photograph 4. Contact between tabular-bedded, burrowed sandstones of the Cefngarreg Sandstone Formation and overlying (to right) Chwefri Formation mudstones exposed in the Troedrhiwfelen stream bed (strata dip steeply downstream, but are structurally inverted and young towards the south-east) [SN 7884 3400]



Photograph 5. Well bedded Chwefri Formation mudstones and siltstones exposed in the Troedrhifelen stream bed which, at this locality, contain fragments of upper *convolutus* Biozone graptolites [SN 7885 3400]