Central Wales RIGS Group Site Record

General	Central Wales
Site Name: Pont Duhonw, Llanddewi'r Cwm	**File Number**: CWPStrat 26
RIGS Number: 370	**Surveyed by**: W.R. Fitches
Grid Reference: SO 03624885	**Date of visit**: 24.10.2006
RIGS Category: Educational, Historic & Scientific	**Date Registered**: Owner: 6.07.2007 Planning Authority: 6.07.2007
Earth Science Category: Silurian (Ludlow) Stratigraphy & Structure	
Unitary Authority: Powys County Council	**Documentation prepared by**: W.R. Fitches
Site Nature: ED Disused quarry EW Stream section	**Documentation last revised**: 30.10.2006
1:50,000: O.S. Sheet 147, Elan Valley & Builth Wells	**Photographic record**: CD
1:10,000: SO 04NW	
1:50,000: BGS Sheet 196, Builth Wells	

RIGS Statement of Interest: This RIGS is situated a short distance (c. 2.5 km, 1.5 miles) south of Builth Wells town centre. It comprises two parts, one a short cliff section in the south bank of the Duhonw river and the other a small abandoned quarry above the north bank. Both are easily accessed from the river bridge. The marine sedimentary rocks, belonging to the upper part of the Silurian system, are well exposed. The locality was first brought to attention about 70 years ago by Straw (1937), who recorded and illustrated with drawings and photographs the spectacular folds and shears produced by slumping and sliding of the sediments on the seafloor while still not fully consolidated. Straw also noted that he was persuaded by the famous O.T. Jones, during a field visit together, that these are soft-sediment deformation structures and not the result of thrusting of consolidated rock by orogenic processes. The site is given prominence in the 1993 Powys field guide and has important educational potential.

Geological setting: The Lower Palaeozoic rocks of Wales were deposited in a small sea, the Welsh Basin, during the time interval of 520 to 410 million years ago. This marine basin and the Midland Platform on its SE side were situated on the north western margin of Avalonia, a tectonic plate that became joined to the Baltica plate in the late Ordovician (e.g., Woodcock, 2000; Cherns et al., 2006). Throughout the Ordovician and Silurian periods, the Iapetus Ocean separating Avalonia and Baltica from Laurentia (N. America and Scotland) was narrowing as a result of plate subduction, and by late Silurian and early Devonian times, about 415 to 390 million years ago, the continents were colliding with each other. That collision resulted in the uplift and draining of the Welsh Basin during the Caledonian (or Acadian) tectonic event. The rocks that had accumulated in the basin were folded, cleaved and faulted during this event.

The rocks exposed at this RIGS belong to the Pterinea Beds of the Irfon Formation and were deposited in the sea some 419 million years ago during the Gorstonian Stage (*scanicus – incipiens* graptolite biozones*)* of the Ludlow Epoch in the Silurian Period of the Lower Palaeozoic Era. They were described by Straw (1937), who gave a detailed account, and were mapped and described in outline by Schofield et al. (2004); Bassett (1993) summarised Straw's observations and interpretations, reproducing one of Straw's line drawings.

The rocks in the RIGS comprise grey mudstone and siltstone, which are thinly bedded or laminated. The package as a whole is nearly horizontal, although in detail bedding is severely disturbed as described and discussed below; about 15 m of strata are exposed.

The mud and silt accumulated on the slope between the Midland Platform coast and deeper parts of the Welsh Basin to the west. They are turbidites, formed of fine rock and mineral particles that were transported from the basin margin areas to the east or south by fast-moving submarine turbidity currents. They are probably D_i and D_{ii} turbidites, as described and explained, for example, by Davies et al. (1997). Hemipelagites are also present, composed of fine laminated sediment that settled through the water column in the quiet interludes between the influxes of turbidites. Straw (1937) recorded various shelly fossils in some layers, carried in by the currents, particularly *Pterinea tenuistriata* that gives its name to these beds, but noted that generally fossils are rather scarce; none was found during this survey.

The RIGS is has been selected on the basis of its spectacular folds and shears that severely disturbed the bedding. Typically, the folds are flat-lying, extremely tight and several tens of centimetres to a few metres in amplitude. Some folds are inclined or upright, and some have been refolded, giving a chaotic appearance at outcrop. The shear planes, recognised where they offset bedding, have displacements of a few centimetres and possibly much more. They are commonly

shear *zones* rather than clean breaks, a sign that they formed in soft, ductile sediment rather than hard, brittle rocks.

Straw (1937) recorded that Murchison and others in the 19th Century believed these structures to be concretions, formed by chemical migration during and after consolidation. He dismissed that interpretation, however, because the contortions are not concentric and they have no centres as seen in many concretions. He also considered, but dismissed, the possibility that the folds and shears were produced by tectonic processes, by implication after consolidation. He concluded instead that the structures were probably caused by submarine sliding down a gentle slope before sediment consolidation – a perceptive interpretation and early entry into the now well-known problem of distinguishing pre- and post-lithification structures. Also well-ahead of his time, he used the orientation of the folds to determine the direction of sea-floor slope. He considered that the general direction of movement appears to have been from a south-easterly direction as most fold axes trend NE-SW and crests of overfolded structures face NW. His methodology and interpretations are similar to those of Woodcock (1976), also working on the Ludlow rocks of SE Wales.

It was O.T. Jones who, during a field trip in 1933, demonstrated to Straw that the structures formed on the sea-floor and are not a result of thrust tectonics. The evidence, according to Straw (1937, p.443), comes from the quarry face, in which there are three slumped units separated by 7.5 to 15 cm thick of undisturbed interbeds. The upper surface of the lowest unit shows indications of erosion: it is irregular and the shale laminae end abruptly against the slopes of the hollows in the surface; and the lowest layers of the undisturbed shales are distinctly sandy and fill the pockets in the erosion surface, successive laminae overlapping until the pockets are filled and the succeeding layers become continuous.

This evidence was not observed during the present survey, probably because the quarry face is no longer as clean and accessible. Straw's fold and shear plane, illustrated in his Figure 5 line-drawing, and reproduced by Bassett (1993, Fig. 8), is nevertheless still easily visible near the foot of the face. It might be noted that Bassett (1993) seems to imply that the three units and erosional hollows are to be found in the river bank rather than the quarry; possibly there are *several* such layers with hollows.

Network context of the site: The RIGS of stratigraphic interest in Central Wales are assigned to one or more of the following Networks.

1. Stratigraphic period (Cambrian, Ordovician, Silurian, etc.).
2. Stratigraphic importance (type section, reference section, etc.).
3. Sedimentological and palaeoenvironmental significance.
4. Examples of sedimentary structures.
5. Palaeontological importance (e.g., presence of biozonal fossils).

6. Sequence stratigraphic position (e.g., relationships with global sea level changes, climate changes and plate tectonic events).
7. Diagenetic history.

This RIGS belongs in several of these networks. The rocks are late Silurian (Network 1); they are fine-grained turbidites and hemipelagites that accumulated in easterly parts of the Welsh Basin (3); they show good examples of mud-silt turbidite sedimentary structures (4); and the structures in the disturbed beds give information about the palaeogeography of this part of the Welsh Basin (6).

Four separate networks have been selected to illustrate the Structural Geology of the Central Wales RIGS. They are as follows.
1. Age of deformation: Precambrian; early Palaeozoic (Caledonian/Acadian); late Palaeozoic (Variscan); and Mesozoic-Recent.
2. Type of rock deformation: brittle faults and fractures; ductile folds, cleavage.
3. State of lithification: pre-lithification, post-lithification.
4. Ductile strain markers.

This RIGS shows a weak, steep cleavage associated with the late Caledonian deformation that was related to plate collision processes (Network 1). Its most important attributes, however, are the ductile folds and shears caused by movement on a submarine slope before the sediments became lithified (2, 3).

References:

BASSETT, M.G. (1993). The Silurian of the Newbridge – Builth - Eppynt area. In WOODCOCK, N.H. & BASSETT, M.G (eds) *Geological Excursions in Powys, Central Wales*. Geologists' Association, University of Wales Press, 281-300.

CHERNS, L., COCKS, L.R.M., DAVIES, J.R., HILLIER, R.D., WATERS, R.A. & WILLIAMS, M. (2006). Silurian: the influence of extensional tectonics and sea-level changes on sedimentation in the Welsh Basin and on the Midland Platform. In BRENCHLEY, P.J. & RAWSON, P.F. (eds). *The Geology of England and Wales (*2nd Edition), The Geological Society, London, 75-102.

DAVIES, J.R., FLETCHER, C.J.N., WATERS, R.A., WILSON, D., WOODHALL, D.G. & ZALASIEWICZ, J.A. (1997). *Geology of the country around Llanilar and Rhayader*. Memoir of the British Geological Survey (England and Wales), The Stationery Office, London. 267pp.

SCHOFIELD, D.I., DAVIES, J.R., WATERS, D.A., WILLIAMS, M. & WILSON, D. (2004). Geology of the Builth Wells district – a brief explanation of the geological map. *Sheet Explanation of the British Geological Survey*. 1:50,000 Sheet 196 Builth Wells (England and Wales), 35pp.

STRAW, S.H. (1937). Higher Ludlovian rocks of the Builth district. *Quarterly Journal of the Geological Society, London*, 93, 406-456.

WOODCOCK, N.H. (1976). Ludlow Series slumps and turbidites and the form of the Montgomery Trough, Powys, Wales. *Proceedings of the Geologists' Association, London*. 87, 169-182.

WOODCOCK, N.H. (2000). Introduction to the Silurian. In ALDRIDGE, R.J., SIVETER, D.J., SIVETER, D.J., LANE, P.D, PALMER, D. & WOODCOCK, N.H. *British Silurian Stratigraphy.* Geological Conservation Review Series, 19. Joint Nature Conservation Committee, Peterborough, 3-22.

PRACTICAL CONSIDERATIONS:

Accessibility: Pont Duhonw is a bridge on the B 4520 that connects Builth Wells in the north from Brecon in the south. The bridge, over the Duhonw river, is situated about 2.5 km (1.5 miles) from Builth Wells town centre and about 25 km (15 miles) from Brecon. It lies a few hundred metres north of Llanddewi'r Cwm hamlet.

Parking is difficult on this narrow, winding and sometimes busy road. 1-2 cars may be parked on the road side c. 150 m NE of the bridge or beside the telephone box in Llanddewi'r Cwm. There is a highways authority notice to `keep clear' of the small lay-by immediately north of the bridge.

The RIGS is in two parts. One part is the river cliff on the south bank of the Duhonw, immediately west (upstream) of the bridge, which is reached through a gap at the south end of the bridge. The cliff is up to 7 m in height and c. 25 m in length. The other part lies immediately north of the bridge, and is a nearly vertical rock face about 10 m in height and about 10 m wide at its base: this may have been a quarry face, judging from comments in Straw (1937).

Safety: The main hazard is road traffic on and near the bridge, which is situated at the foot of a steep hill and on a sharp bend: a high-visibility jacket is advisable. The river cliff is reachable even under mild flood conditions and appears to be stable. At the quarry face, there are indications of substantial rock falls from upper part, giving a debris cone at the foot, so particular care is required here and a safety helmet is recommended. Upper parts of the face are best avoided.

Conservation status: There are no other known conservation designations in the area covered by this RIGS.

OWNERSHIP/PLANNING CONTROL:

Owner: Unknown; the quarry may come under the Highways Authority.

Planning Authority: Powys County Council.

Planning status/constraints and opportunities: There are no known plans to develop or modify the area covered by this RIGS.

CONDITION, USE & MANAGEMENT:

Present use: The river cliff is not utilised. The quarry may have been used to extract stone for bridge- and road-construction purposes.

Site condition: Both parts of the site are heavily shaded and partly obscured by trees. The rocks in the river bank are little weathered and mostly free of moss and lichen, probably because of intermittent scouring by floods. The rocks in the accessible, lower parts of the quarry face are covered by moss and lichen, but the key features of the site remain clearly visible since being described and illustrated by Straw (1937), some 70 years ago.

Potential threats: Trees are encroaching on both parts of the site. Alterations to the bridge, road or river bank could threaten both parts, but modifications are unlikely to be made in the near future.

Site management: Periodic partial clearing of trees would increase visibility, although care is needed not to expose the rocks to increased river erosion or the quarry face to weathering degradation.

SITE DEVELOPMENT:

Potential use (general): The soft-sediment deformation structures are so well displayed that they could be made the subject of a public awareness initiative, especially in view of their historical interpretation context. However, parking is difficult and the road is hazardous so visits by the public are best not encouraged. The site is mainly of interest to geologists researching marine sedimentation, soft-sediment deformation processes and the evolution of the Lower Palaeozoic Welsh Basin.

Potential use (educational): This site is of interest to undergraduate and postgraduate field classes focussing on marine sedimentation, soft-sediment deformation and the evolution of the Welsh Basin. However, careful planning would be needed to cope with the parking problem and traffic hazards.

Pont Duhonw
RIGS 370
CWPStrat 26

O.S. 1:50,000 Sheet 147, Elan Valley & Builth Wells
BGS 1:50,000 Sheet 196, Builth Wells
Grid Reference SO 037 488
W.R. Fitches 24.10.2006

Photo Name/Number	Caption
Pont Duhonw 1 & 2	Slump folds and fault, of Straw (1937) & Bassett (1993)
Pont Duhonw 3, 3A & 4	Slump folds, south bank of stream by bridge
Pont Duhonw 5	South bank of stream from bridge

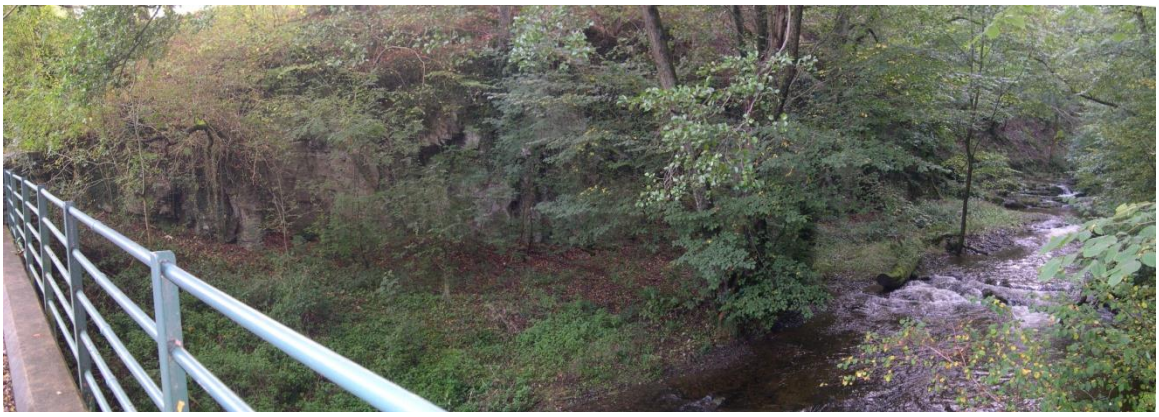
Slump folds and fault, of Straw (1937) & Bassett (1993)

Slump folds and fault, of Straw (1937) & Bassett (1993)

Slump folds, south bank of stream by bridge

Slump folds, south bank of stream by bridge

Slump folds, south bank of stream by bridge



South bank of stream from bridge