

## **Ludlovian wetlands of Wales**

### **Ludlow Research Group assesses evidence for a Ludlow-age wetland in the Old Red Sandstone of south central Wales**

*Jerry Davies<sup>♦</sup>, Rob Hillier\* and Dick Waters\* report on the Ludlow Research Group's field trip to central Wales, which focussed on a unique facies in the earliest Old Red Sandstone.*

As part of the Society's Bicentennial celebrations, the annual field meeting of the Ludlow Research Group (LRG) was held last September in Wales, under the umbrella of the Marches Festival of Geology to assess a new interpretation of the Ludlow sequence in the Myddfai Steep Belt by the National Museum of Wales and the British Geological Survey.

The first day concentrated on the Llandeilo area. Here, beneath the terrestrial Old Red Sandstone (ORS), the shallow marine Ludlow sequence is punctuated by the Trichrug Formation, a lenticular unit of predominantly red sandstones, up to 175 m thick. The formation has previously been interpreted as a red-bed deltaic sequence, but not included in the ORS.

Two key sections were visited, the Sawdde gorge and the Cennen road section. In the Sawdde gorge, the Trichrug Formation conformably overlies the Mynydd Myddfai Sandstone Formation (MMSF), which comprises a series of stacked, coarse-grained upward-thickening and –coarsening cycles interpreted as shoreface progrades, capping a shallowing upwards sequence. The transition is delineated by the development of coarse-grained pebbly sandstones with herringbone cross-stratification, mudstone draped foresets, mudstone-lined *Skolithos* and *Teichichnus* burrows interpreted as being deposited by tidal channels on the MMSF shoreline. The leaders argued that the succeeding Trichrug Formation should be regarded as the local base of the ORS in the region, being deposited in a wetland environment, unique, certainly in the Anglo-Welsh Basin. Their interpretation is based on a number of

observations. Firstly, like many other ORS deposits it is heterolithic, typically comprising muddy, red, medium to coarse-grained pebbly sandstones with numerous beds of parallel-sided quartzite. Bedding is of cm-dm scale thickness with diffuse bed boundaries and common massive internal fabric. Remnant “ghost” cross-stratification and planar-lamination is common. Desiccation cracks are rarely observed, as are vertisol calcretes typical of the post-Ludlow ORS succession. The majority of primary sedimentary structures appear to have been overprinted by bioturbation and pedoturbation fabrics. The former comprise unlined *Skolithos* burrows commonly in spectacular “pipe rock” colonies. Variations in oxidation/reduction of iron is common, with reduction mottling indicative of variations in primary water table position. Prolonged evidence of elevated water table development is given by more extensive, sheet-like gleyed intervals. Reduction mottling (pseudo-gleying) around burrow margins is well developed as are spectacular ferricrete soil profiles indicated by nodular and laminar alternations of purple to grey iron oxide. The ferricretes and gleyed horizons provide evidence of sustained, elevated water table height (a wetland environment) unlike the majority of ORS soils in the region that demonstrate development in dryland (warm with seasonal rainfall) conditions. It seems likely that this prolonged elevated water-table provided conditions opportune to the colonisation by the *Skolithos*-generating organism(s). Whilst *Skolithos* has been traditionally associated with shallow-marine environments, it is now generally accepted as a trace produced in a myriad of environments with shifting, high energy substrates from terrestrial lakes through to deep-marine environments. The lack of shelly faunas from the formation, other than some lingulid and orbiculoidean brachiopods from a well-defined grey mudstone interval, supports a terrestrial environment.

The leaders suggested that the Trichrug Formation developed as a shallow water wetland, possibly similar to that of the present Okovango Delta in Botswana. Here, across the surface of the internally-draining delta, shallow ponds are sustained throughout the year by a mixture of groundwater recharge and seasonal rainfall-related discharge. No deep water lacustrine conditions analogous to those of other ORS lakes (e.g. the Orcadian Basin) are interpreted due to the lack of observed fine grained facies.

In the Cennen road section, a thinner, but more proximal development of the Trichrug Formation contains thick beds of coarse, ill sorted, muddy exotic clast conglomerates interbedded with poorly sorted sandstones and ferricrete palaeosol profiles. The leaders argued that this association developed on debris-flow dominated alluvial fans shed off contemporaneous fault scarps located along the southern margin of the Welsh Basin and which interfingered with the shallow water wetland facies.

On the second day the trip visited the classic Ludlow section at Cwm Graig ddu near Builth Wells, some 40 km to the NE. Here, in contemporaneous distal shelf/ proximal ramp mudstones, there is surprisingly no obvious evidence of the lowstand event represented by the Trichrug Formation to the SW.

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#### *Footnote*

The LRG was established in 1952 to bring together those working in the UK on Silurian and early Devonian stratigraphy and biostratigraphy. Today its annual field meetings attract a wider geological audience. Anyone interested in attending the annual field trips should contact Mike Howe at [mhowe@bgs.ac.uk](mailto:mhowe@bgs.ac.uk). It also publishes an annual bulletin providing brief details of member's current research activities.

#### **Plate caption**

Poorly sorted conglomeratic sandstone overprinted by *Skolithos* burrows and purple iron oxide mottling (ferricrete pedogenesis). Both bioturbation and palaeosol development destroy most of the primary sedimentary structures in the Trichrug Formation.

