REVIEWS

Glacial and Pre-Glacial deposits at Welton-le-Wold, Lincolnshire, by Allan Straw, 2005, privately published: Exeter. iv + 39pp. £3.95 (£4.90 p&p) from David Robinson, The Museum, 4 Broadbank, Louth LN11 4AB

Welton-le-Wold is a small village set within the chalk country of the Lincolnshire Wolds some 6 km west of Louth. In the vicinity of the village are extensive Pleistocene deposits in part occupying a paleo-valley, and these have sustained an aggregate working dating back into the nineteenth century, but it was World War Two which stimulated significant excavation. From 1954 through to 1973, when the quarrying was abandoned due to excessive overburden, Allan Straw as a geomorphologist at the University of Sheffield, was a regular visitor, and it is through his sustained energy that we now have a very detailed knowledge of the stratigraphy. This new monograph, with a range of figures (including colour photographs), presents his findings in an integrated manner and interprets them from a present day perspective.

The site came into national prominence when, in 1969-1973, a sparse vertebrate fauna and three derived hand axes plus a worked flake were discovered. With the exception of the classic Kirmington site in north Lincolnshire, Welton is undoubtedly the most important Quaternary location in the county. Unlike much of the county there is a well-established lithostratigraphy with the main package of sediments being divisible into a tripartite Welton Gravels, Welton Till and Calcethorpe Till succession. The flint dominated Welton gravels are surprisingly chalk free and contain a sand component derived from inliers of the sub-chalk succession lying in the valley heads. The two tills are quite different in character, with the lower one having similarities with the Basement Till of the east Yorkshire coast, whereas the upper is very rich in chalk. Remarkably, the outer north-south trending limit of a subsequent glaciation occurs at Welton, and this deposited the Marsh Till over the eastern sector. On the basis of extensive geomorphological field work Straw has divided this later glaciation into 2 phases, ‘early’ and ‘late’ each with meltwater channels of contrasting freshness. It is the early phase which Straw sees as being responsible for the Marsh Till at Welton and an associated meltwater channel and gives it an age of c40 ka, which by national definition has to be Middle Devensian. This chronology is anomalous since it is not in accord with the known stratigraphic evidence elsewhere.

Naturally a key issue which arises is where within the regional picture does the sequence at Welton lie? The answer is inevitably dependent upon the individual’s perception of the known stratigraphic framework. Since in situ biogenic evidence is conspicuous by its absence, judgements have to be placed on mainly lithological and geomorphological extrapolations. The reality is that interpretations of the sequences identified in eastern England are currently in a state of flux especially when it comes to defining the number of glacial stages and attendant ice advances. Straw takes the view that there is no evidence of the Anglian glaciation at Welton and prefers to interpret the main glacigenic succession as post Anglian but pre Last Glacial in age. In the earlier literature this glacial event was assigned to the Wolstonian but since the type site of the latter has convincingly been shown as being of Anglian age the term has to be abandoned. Of late the practice has been to assign divisions of the marine stable isotope record to terrestrial stratigraphy and utilising this approach Straw suggests that the main Welton succession as a product of glacial and periglacial processes in MOI Stage 8.

We clearly do not have unanimity over the Welton chronology. But that is the spice of working on the sequence of Quaternary glaciations in our country. However, we now have a clear description of the entire sedimentary record at Welton by the only observer capable of producing it. For this we must be very grateful to Professor Straw and for his initiative in publishing it for posterity. He has also set a fine example by depositing archive material in the museum at Lincoln.

Peter Worsley

A Geological Walk around Cliffe Hill Quarry (28 pp, 38 figs, ISBN 085272485-3); **A Geological Walk around Bradgate Park and Swithland Wood** (32 pp, 60 figs, ISBN 085272486-1); both by Annette McGrath, 2005, British Geological Survey, for the Leicestershire and Rutland Geodiversity Action Plan, £2.50 each.

These two booklets emerge from a team at BGS, many of whose members have contributed to EMGS publications, and have led field trips to various Leicestershire localities for Society members. We can, therefore, be confident that the geological information is both accurate and up to date.

There is good information on finding the location of the start of the walks, car parking, comfort and refreshment stops, and locations are marked on OS maps reproduced in the booklets. Appropriate conservation information is given.

The Bradgate Park booklet is the first we have come across that suggests that you might like to take a kite with you! However one soon gets used to the bouncy, let's-have-a-great-day-out style of both booklets, to find that the content is very sound geology, pitched at a level which is accessible and informative to Society members.

Both titles share almost common geological introductions to describe the geological events and processes of the Precambrian, Cambrian and Triassic eras that formed the rocks visited on the itineraries.

The Bradgate Park walk is largely similar to Excursion #1 in the Society's *The Geology of the East Midlands*, though explanations are more expansive and pitched at a lower expectation of the reader's knowledge. All localities are easily found from the text description. Anyone who has followed a geological trail will know that finding a particular small scale feature can be quite difficult, even for the reasonably experienced. Here, photographs and sketches of features in the outcrops aid location and identification.

We would suggest, however, that anyone using this booklet ignores the low-level, low-energy, non-geological part of the route back to the Hunts Hill car park, and instead climbs via the memorial, as this passes some of the most striking and interesting rocks in the Park.

The Cliffe Hill Quarry walks were visited in the height of summer, when some of the exposures on Billa Barra Hill were difficult to see through the verdant undergrowth. Similarly, due to the intensive tree planting as part of the National Forest project, the recommended views back to Barden Hill are obscured. However, these minor inconveniences were fully compensated by the abundance of birds and butterflies. The really outstanding feature is the panoramic view of the Triassic wadi channel sitting unconformably on the Pre-Cambrian Diorite in the New Cliffe Quarry: a classic indeed. The section on Hill Hole Quarry, refers to "various new footpaths into the quarry from the car park" at Hill Lane. After a couple of false starts, we found that there are only two entrances into the quarry (which is now a nature reserve), one from near the church in nearby Markfield, and one from a little way down Hill Lane from the carpark itself.

The booklets are available at the Bradgate Park Visitors Centre, and are cheaper that the car park fee!

Alan Filmer and Tony Morris

Structure and Evolution of the Southwest Pennine basin and Adjacent Area: a Subsurface Memoir, by N.J.P. Smith, G.A. Kirby and T.C. Pharaoh, 2005; British Geological Survey: Keyworth. 129 pp, ISBN 085272518-3, £40.

The Southwest Pennine basin is here interpreted rather widely as covering the area from the Vale of Clwyd to Sheffield in the north, and from the Longmynd to Charnwood Forest in the south. Thus it includes the Cheshire basin and the northern part of the Welsh Borderlands, the Peak District, most of the Trent Valley and the Midland Coalfields. It covers the Millstone Grit country but excludes the Derbyshire-

Nottinghamshire Coalfield. The theme is a summary of the findings of 800 seismic reflection profiles (or do they mean 800 *km* of profiles?) and numerous boreholes in the largely unsuccessful search for oil and gas resources. Fifteen of the profiles are shown.

The arrangement is stratigraphical, providing an account of the subsurface distribution of each system in turn, with discussions of sedimentary facies and structural features accompanied by palaeogeographic maps. The scattered Precambrian outcrops are regarded as resulting from large scale lateral shifting of terrains to explain their disparate nature and difficulty of correlation. Deposition of the Lower Palaeozoic strata is shown to have been controlled by a sequence of different tectonic events collectively called the Caledonian orogeny, through which the plate collision caused by the closure of the Iapetus suture can be regarded as a sequence of tectonic events from mid-Ordovician to mid-Devonian, each affecting stratal distribution, structures and palaeogeography in turn.

A tabulation of these events would have been helpful. The Midlands micro-craton is still invoked to explain tectonic lineations, but the authors now regard the basement beneath the White Peak as early Ordovician in both the Woo Dale and Eyam boreholes, in spite of previous arguments that the basement was at least partly Charnian. Apparently no evidence has been found that the Charnian massif extends north of the Trent Valley, though it may still be present beneath the Ordovician.

The bulk of the Memoir is concerned with the Carboniferous, subdivided herein into syn-rift (Dinantian) and post-rift (Silesian). The use of the term *rift* is misleading as I expected to find some argument for a major rift, but herein it refers to extensional stress tectonics creating a scatter of fault-bounded basins during Dinantian times. Some of the bounding faults ceased to move before the end of the Dinantian, so that they are masked by later Dinantian limestones and have little or no surface expression, e.g. the Bakewell and Alport Faults (the latter name apparently replaces the Edale Fault of some previous reports). The deltaic complex of Millstone Grit and the fluviatile Coal Measures forms a post-faulting, post-extensional blanket cover. The authors admit that the lack of seismic profiles across the White Peak leaves the interpretation of the Bakewell fault and associated tilt-blocks uncertain, but they prefer a north-down model with the Woo Dale borehole on an upthrown southern block. The Bonsall Fault is more enigmatic – the profiles through the adjacent Millstone Grit country suggest a major downthrow north, partly cancelled out by a later downthrow to the south: only the latter has been recognized by surface mapping of the Dinantian limestones west of Matlock.

There is a useful summary of Dinantian igneous activity but there is no comment in the text regarding the thick volcanic sequences found in the Hope Cement Works, Ashover and Duffield boreholes, even though these are shown on the map (Fig. 28). Also, on Fig. 28, for Cotton Hill, read Calton Hill.

The Silesian (Namurian and Westphalian) chapter is a competent stratigraphical summary, but is marred by several errors and omissions. Whaley Bridge is not in the Derwent Valley (page 57). Lognor appears several times (for Longnor); also the authors' colleague's name is mis-spelt several times (Chislholm for Chisholm). Fig. 31 shows the exposed coalfields, but surely the concealed extensions and prospects could have been indicated. The Variscan structural map (Fig. 36) has the Ashover anticline marked in two different positions, and presumably Coaldale should read Coalville. On page 80 surely the Western anticline in the Potteries coalfield is *west* of Stoke-on-Trent? Similarly the Ashby anticline is *west* of the Coalville syncline (page 83).

While the principal concealing cover strata of the region are Permo-Triassic, the Memoir briefly argues for a former extent of up to 2100m of Mesozoic cover over at least the South Pennines. Together with the thick Permo-Triassic of the Cheshire and other basins the total cover may have been 6000m by the end of the Mesozoic. The significance of this depth of burial to (and beyond?) the window for hydrocarbon generation is, however, only briefly mentioned without any real discussion of evidence and effects.

In a Memoir describing the region's structure and evolution, I expected to read a discussion of the Peak District's mineral vein pattern and the changing stress fields that may have affected it, but mineral deposits get only the briefest mention with no discussion of the implications for structural evolution. Indeed, what is meant on page 93 by Triassic, Dinantian and Longmyndian "reservoirs" in relation to the mineral deposits around the Cheshire basin? And in the last sentence (page 93) where are the fluorspar mines at Chance and Eckington? I have never heard of any such mines.

The Memoir concludes with a comprehensive bibliography, list of maps, memoirs and boreholes. Finally there is a series of ten coloured structure contour and isopach maps at five successive horizons–these would have been easier to understand with keys to the colour schemes and a few place names.

The Memoir as a whole is a valuable contribution to the knowledge of Midlands stratigraphy, structure and palaeogeography, but it is a pity that it is spoilt by so many errors and omissions. It does not come up to the standard we have come to expect in BGS publications: perhaps a revised second edition should be considered?

Trevor Ford

Guidance notes for contributors to *Mercian Geologist* are printed in the first issue of each volume.