I coloured a map: Darwin's attempts at geological mapping in 1831

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ABSTRACT: In his autobiography describing his geology of 1831 Darwin wrote, “on my return to Shropshire I coloured a map of parts around Shrewsbury.” There are four extant maps in the Cambridge University Library, which fit this description. Two, at a scale of ¾ inch to 1 mile, are of Anglesey and Llanymynech and are hand-drawn copies of Evan’s map of North Wales, and are without geological annotation. The other two of Shrewsbury and Kinnerley have a scale of 1 inch to 1 mile and are copied from Baugh’s Map of Shropshire (1808). These contain orange shading to the west of Shrewsbury indicating New Red Sandstone, but make no allowance for drift. The Shrewsbury map includes some attempted stratigraphic boundaries and marks four sites; A, B, C and D. These maps demonstrate Darwin’s grasp of geology before his Welsh tour with Sedgwick in August 1831. They show his realisation of the need of a topographic base map, an acquaintance of the conventions of geological mapping in shading and the marking of boundaries. These maps form an early part of Darwin’s considerable geological activity in the summer of 1831.

KEY WORDS: history of geology – Shropshire – Anglesey – Adam Sedgwick

INTRODUCTION

One of the first things a student geologist has long had to do as part of his training is to make a geological map. For most geologists, the present author included, the first attempt is best forgotten and probably destroyed! For many the learning process is more by error than anything else. In the course of learning to make a geological map, the aspirant geologist has to grasp geologists’ conventions about shading or colouring a map to indicate rock types, ways of indicating boundaries and faults and also dip and strike. Recently some early maps of Charles Darwin have come to light at Cambridge University Library, having been transferred recently from the archive at Downe House. These four maps of Shropshire and North Wales show Darwin’s earliest attempts at field geology and plans for future work. They indicate his awareness for the need of a basic topographic map as he proceeded to make them himself, copying off available maps. As they were made in the early summer of 1831 before his field trip with Adam Sedgwick they shed light both on Darwin’s origin as a geologist and on the state of geology in 1831.

As he recorded in his autobiography, Darwin’s first attempt at field geology in late June and early July 1831 was to attempt to make a geological map, “Therefore on my return to Shropshire I examined sections and COLOURED A MAP of parts round Shrewsbury” (de Beer, 1983: 39). This seems to be his only attempt to produce a geological map with a large scale (about 1 mile to 1 inch). Charles Darwin’s later published works on geology are marked by the absence of geological maps as discussed by Stoddart (1995: 7). Instead Darwin produced a large number of geological sections in both his notes and published works. As Stoddart points out this is because of the absence of contoured maps. Maps of any kind were virtually non-existent for South America and those of Britain were devoid of
indications of altitude, including hachuring.

Darwin’s geological mapping took place sometime after his return to Shrewsbury in mid-June and before the arrival of Sedgwick on 2 August. From a consideration of his visit to Llanymynech and absence of dip and strike on his maps, it is most likely that the maps were made before Darwin received his clinometer on 10 July. Shortly afterwards, he visited first Llanymynech on his own and then in August went round North Wales accompanying Sedgwick as far as Bethesda, if not Holyhead. He then continued to Barmouth on foot on his own (Barrett, 1974; Roberts, 1996, 1998; Secord, 1991). Though Sedgwick made a geological map and Darwin claimed to have helped him when he returned from a parallel traverse when he was asked “to mark the stratification on a map” (de Beer, 1983: 39), none of Darwin’s maps from these field trips appear to be extant, at least in the Darwin archives in Cambridge University Library.

At Cambridge University Library there are four maps of Shropshire and North Wales, which are hand-drawn copies at a scale mostly of about 1 inch to 1 mile. Three are overlapping maps of the areas around Shrewsbury, Kinnerley and Knockin, and Llanymynech, and the fourth is a larger one of Anglesey. The first two are partly coloured in brownish orange signifying New Red Sandstone. There appear to be no extant geological notes which refer to these maps, and thus a description of these maps is largely inferential from reminiscences in his autobiography and the two separate sets of notes he made at Llanymynech and on the Welsh trip with Sedgwick in July and August 1831 respectively.

Darwin gave no indication on the maps from where he made the copies. In 1831 the Ordnance Survey was well under way with its preparation for the publication of its first edition, which appeared in the 1830s. Sheet 32 for Llangollen was published in 1837, Sheet 78 for Bangor in 1840 and Sheet 77 for Holyhead in 1841. The leading surveyor was Robert Dawson who Sedgwick had arranged to meet on 5 August 1831 at the beginning of the Sedgwick-Darwin tour. The best and only maps available in 1831 were Baugh’s Map of Shropshire (1808) at a scale of 1 inch to 1 mile (1:63,360), and Evans’s Map of the six counties of North Wales (1795) at a scale of about ½ inch to 1 mile (approx. 1:80,000). As these are the respective scales of Darwin’s maps, which have every appearance of being traced by hand complete with the milestones on the Shropshire maps, it would be perverse to doubt that Darwin used these maps.

Both Baugh and Evans (North et al., 1949: 154) lived at Llanymynech near Oswestry, which was then an important industrial centre. Baugh began his cartography as Evans’s assistant (Dodd, 1990) and engraved the small-scale Map of North Wales for Evans in 1775. Evans lived at Llwynygros to the east of Llanymynech. Baugh was born in 1748 and baptised at Llanymynech in 1749, and lived at Llwytidman, a tiny hamlet 2km east of Llanymynech, with his wife Catherine and family. As Leighton (1917: v) wrote, “Baugh was a copperplate engraver ... He worked in conjunction with the great engineers, Telford and Stephenson, and assisted in the surveys for the Holyhead Road and the aqueduct at Pontcysylltau ... He did not neglect local responsibilities ... He filled the office of Parish Clerk, and for some years was Church Warden.” By the standards of the first Ordnance Survey map, Baugh’s Map of Shropshire was slightly inaccurate in places. However it is an admirable piece of work in clarity, detail and accuracy. There was also available a smaller-scale Map of North Wales, at 1 inch to 3.6 miles (1:17,600), produced by J. and A. Walker (1824). Sedgwick used both maps in 1831 and recorded that below Efidir Fawr one “small lake represented in Walker but omitted by Evans” demonstrating the unreliability of the maps. Darwin used Walker’s map on his 1842 glacial trip to Snowdonia.
comparison of scales one may safely conclude that the two 1 inch to 1 mile maps of the area around Shrewsbury were traced from Baugh’s map, while the maps of Anglesey and Llanymynech were traced from Evans’ map.

PARTLY COLOURED MAPS OF SHREWSBURY

These two maps\(^{3}\) are of a 1 inch to 1 mile scale (1:63,000), one of the area west of Shrewardine, and the other centred on Shrewsbury. The maps slightly overlap. From a comparison with Baugh’s map of 1808 they include all milestones and also minor inaccuracies in the courses of the River Severn and the Rea Brook found in Baugh’s map, which differ from recent maps. A large area on Darwin’s two copied maps, from Meole Brace (written as Brace Meole) 1½ miles (2.4km) south of Shrewsbury town centre to Kinnerley in the west, is coloured orange indicating New Red Sandstone. On the Shrewsbury map\(^{6}\) are four locations marked A, B, C, and D. There seem to be no extant notes for these sites.

The first three sites occur between 2km and 4km south of Shrewsbury town centre in the Meole Brace area, marked by both Baugh and Darwin as Brace Meole. These sites lie on the old Bishop’s Castle road through Nobold and Longden. (The present road to Bishop’s Castle (A488) through Minsterley was authorised only in 1834.) The area is of drift underlain by the uppermost Carboniferous. There are a large number of gravel pits in the vicinity and in 1837 and 1838 Darwin visited several of these.\(^{7}\)

Site A (GR 482108) is now the site of a school. No outcrops are visible and it appears to be landscaped land on the northeast side of the crossroads. Sometime in the 1840s and probably 1841 according to the editors of Darwin’s correspondence (Burkhardt and Smith, 1986: 294–295), Darwin visited the gravel pit at GR 474478 and on a sketch map he sent to Leightons marked an old coal pit to the south west of the turnpike. Thus A may refer to Coal Measures found in this pit, which were somewhat red and thus ascribed to the New Red Sandstone. It is also the site of a turnpike gate marked on Baugh’s map.

Site B (GR 469096) is aptly by Red Hill Lane and is a long 15ft (4.6m) high outcrop of red flaggy sandstone, dipping at a shallow angle to the north. The beds were identified by Darwin as New Red Sandstone, and are, in fact, the Keele Beds of the Upper Carboniferous. These are variably purple and reddish-brown mudstones, marls, and sandstones (Toghill, 1990:131). These late Carboniferous “red beds” are the earliest development of the New Red Sandstone facies, and are, thus, rightfully marked as New Red Sandstone.

Site C (GR 465093) lies just to the south of Rea Brook at Hook-a-Gate. Today there are no obvious exposures visible. From the “coal pits” marked on Baugh’s map I conclude the Darwin was probably noting the strata of these and marked in the boundary of the New Red Sandstone (which included the Keele Beds) and the Coal Measures, but never got round to colouring in the Coal Measures. These are the Coed-yr-Allt group of the Shrewsbury Coalfield which lies to the south of Shrewsbury.

The fourth site, D, is marked on the map close to Great Ness. There are no outcrops in the vicinity and it may be that Darwin incorrectly marked the location, as 2 miles (3.2km) away at Nesscliffe there are excellent exposures in cliffs of New Red Sandstone. These are Wilmslow Sandstone (Upper Mottled Sandstone) and are deep red in colour and have been extensively quarried for building stone.

Most of the area coloured in to indicate New Red Sandstone is clearly just that, as any exposures jutting through the drift are Permo-Triassic or Uppermost Carboniferous.
Figure 1. Darwin’s map of the Shrewsbury area traced from Baugh’s map of Shropshire (1808) (CUL DAR 265, DH/GPD 10; iv). On the original the shaded area was coloured orange to signify New Red Sandstone. A, B, C, and D are sites marked by Darwin. The scale of the original map was 1 inch to 1 mile and is here reduced. Milestones are recorded. (Reproduced by permission of the Syndics of Cambridge University Library.)
Figure 2. Portion of Darwin’s map of Shrewsbury (CUL DAR 265, DH/GPD 10; iv). The shaded area on the original was coloured orange to signify New Red Sandstone. A, B, C, and D are sites marked by Darwin. The quarry where the volute shell was found was 500m west of site A (lower right). The scale of the original map was 1 inch to 1 mile, and the milestones are recorded on most roads. (Reproduced by permission of the Syndics of Cambridge University Library.)
However, as recent geological maps show, the area is almost entirely covered by Pleistocene boulder clay, sands and gravels, which are of a distinctively red hue. Actual exposures of New Red Sandstone tend to be on higher ground as at Nesscliffe. One suspects that Darwin was not being very discriminating in the use of his orange crayon. However a Solid rather than a Drift map would indicate only Permo-Triassic rocks.

In his autobiography Darwin wrote: “Therefore on my return to Shropshire I examined sections and coloured a map of parts round Shrewsbury” (de Beer, 1983: 39). These two maps are clearly those maps and the sections probably include his later visit to Llanymynech (Roberts, 1996). Later in the same paragraph Darwin tells of Sedgwick dismissing his finding of a volute shell. There is simply insufficient evidence to locate the gravel pit precisely and it could be any one of many which lie on the south side of the River Severn, many of which Darwin subsequently visited in 1837 and 1838, where he found further shells. A possible, and tentatively the most likely, location is the large gravel quarry near the turnpike on the old Bishop’s Castle road (GR 474478). This was probably the largest pit in the area and was visited by Darwin in the 1840s when he found weld (Reseda luteola) and probably the rarer form of houndstongue (Cynoglossum sylvaticum). Darwin visited this quarry while working on the gravels around Shrewsbury in 1837 and 1838. On the second occasion he recognised the existence of glaciers in an estuarine environment, meaning icebergs. As a result I conclude that this is the most probable site of the famous volute shell.

The work on these maps represents several days in the field and one can safely assume that he travelled on horseback, or possibly on foot to the area south of Shrewsbury. Darwin also visited Cardeston, as indicated in his notes for 6 August for Penstryt Quarry, near Denbigh; he compares the lime-rich fault breccia on the west side of the fault with the strata at Cardeston. A visit to Cardeston indicates that Darwin was probably referring to a quarry, now partially filled in, ½ mile (0.8km) west of Cardeston itself, and marked on Baugh’s map as lime rock. This part of the Alberbury Breccia or Cardeston Stone, ascribed by the Geological Survey map of 1932 as uppermost Carboniferous and by Toghill and recent British Geological Survey maps as Permian, consists of angular purple and brown breccias with fragments of Carboniferous limestone (Toghill, 1990: 141–143). This has a general visual similarity to the fault breccia at Penstryt quarry made up of Carboniferous Limestone and New Red Sandstone, despite the one being tectonic in origin and the other sedimentary. This has to be inference as Darwin did not record anything on his map at Cardeston and the only reference is what he wrote at Ruthin on 6 August. However it is more probable that Darwin visited Cardeston on 3 August with Sedgwick.

MAP OF THE LLANYMNECH AREA

This map covers the area from Shelve and Chirbury in the south to Oswestry in the north, and is at a scale of 1 inch to 1 mile (1:80,000). Just from the scale alone it is clear that Darwin did not use Baugh’s map as a base map, but Evans’s map. It is clearly incomplete as the roads around Llanymynech are not connected up. Incidentally Woodhouse is marked, despite the fact that that is a country house rather than a village. Its interest to Darwin was that it was the home of Fanny Mostyn Owen whom Darwin described as “the prettiest, plumpest charming personage that Shropshire possesses”.

However, not one geological detail is transcribed onto the map, despite Darwin visiting Llanymynech Hill in the latter half of July (Roberts, 1996). This lack of information on
Figure 3. Darwin's map of the Kinnerley area traced from Baugh's map of Shropshire (1808) (CUL DAR 265, DH/GPD 10; ii). On the original the shaded area was coloured orange to signify New Red Sandstone. The scale of the original map was 1 inch to 1 mile and is here reduced. Milestones are recorded. (Reproduced by permission of the Syndics of Cambridge University Library.)
the map is probably an indication that Darwin went to Llanymynech after attempting to produce the maps around Shrewsbury and did not have time to colour in the map before Sedgwick arrived on 2 August.

MAP OF ANGLESEY

This map is at a scale of ⅛ inch to 1 mile (1:80,000) and is probably based on Evans’ map. The locations of most of the larger villages are indicated; typically Welsh names as Llandegfan were always written as “L-degfan”.

The most likely explanation of why for North Wales there are maps of Anglesey but none for the intervening area between Anglesey and Llangollen is probably to be found in Darwin’s friendship with Henslow. Henslow had written an early paper on the geology of Anglesey (Henslow, 1822) and presumably Darwin wished to visit Anglesey armed with his mentor’s article as part of his geological preparation for his visit to Tenerife. With easy access to Anglesey from Shrewsbury by the London-Holyhead road, this would have made a straightforward expedition for Darwin to improve his geology with Henslow in absentia as his guide. This is probably what Darwin meant when he wrote to Whitley on 12 July: “I am at present mad about Geology & daresay I shall put a plan which I am now hatching, into execution sometime into August, viz of riding through Wales & staying a few days at Barmouth on my road”. However at Henslow’s suggestion Sedgwick took Darwin round part of North Wales and thus in August 1831 Darwin passed within 7 miles (11 km) at the very most of the suspension bridge from the mainland to Anglesey. A study of Darwin’s notes taken on that field trip, compared with Sedgwick’s notes, gives the very strong impression that Darwin made no diversion to Anglesey as the notes for Cwm Idwal follow immediately after those made at Bethesda slate quarry; he simply continued directly to Barmouth after leaving Sedgwick near Bethesda but no more travelled in a straight line than did Belloc’s drunkard travelling to Birmingham by way of Beachy Head (Roberts, 1998). In Barmouth in mid-August he met up with Whitley and others. However the notes Darwin made on Quail Island on his first day’s fieldwork on the Beagle voyage liken the conglomerates found there to those on Anglesey: “I could have scarcely credited that rocks nearly as hard as the conglomerates of older formation (viz of red-sandstone formation Anglesey) could daily be increasing under my own eyes”. There are two main possibilities to explain Darwin’s reference to Old Red Sandstone in his Quail Island notes. The first, favoured by Secord, is that Darwin was simply referring to Henslow’s paper on Anglesey much is the same way as he referred to the Temple of Serapis on Sao Tiago shortly afterwards (cited Herbert, 1991: 170). The alternative is that Darwin crossed Anglesey with Sedgwick. On 12 August Sedgwick travelled to Holyhead, recording limestone at Llangefn and “O.R.” (Old Red Sandstone), which in fact is of Ordovician rather than Devonian age, further on, probably to the northeast of Llanfihangel yn Nhowyn. As far as time constraints are concerned Darwin could easily have gone to Holyhead and then returned to Cwm Idwal before travelling to Barmouth.

There is a possibility that Darwin took notes on Anglesey as his notes indicate that a page has been cut out and removed immediately after his notes on Bethesda. Further the notes Darwin made on Quail Island cited above give the distinct impression that Darwin had actually seen and felt the strata on Anglesey, which are extremely hard. There is no evidence how far Darwin actually accompanied Sedgwick, but from the absence of any
reference to his visiting Ireland one may conclude that he returned to Bethesda as Sedgwick boarded the ferry. It would have been a straightforward journey by stagecoach. Darwin may well have stayed at the coaching inn at Tyn y Maes, between Bethesda and Llyn Ogwen. From there it was a short walk to Cwm Idwal.

CONCLUSION

These four maps show Darwin’s earliest attempts at field geology and plans for future work. They indicate his awareness for the need of a basic topographic map as he proceeded to make them himself, copying from available maps.

His work around Shrewsbury is an uncompleted attempt at fieldwork and his topographic map of Anglesey probably indicates his future plans, which were swallowed up, first by his accompanying Sedgwick in August, and then the invitation to join the Beagle. In themselves they tell us nothing about the development of geology, but show us the first attempts of a keen young naturalist to teach himself geology in 1831. Their interest is twofold. Firstly, they illustrate the geological development of Darwin in those months before he was invited to join the Beagle. Secondly, they give an insight into how a moderately informed beginner in geology set about the task of practising field geology in the early 1830s. On one level these maps can be seen as simply the indifferent attempts of a beginner, and were it not for this beginner’s later importance, would attract little attention. As well as the personal interest in helping to understand the early development of one of the leading nineteenth century scientists, Darwin’s attempts show that in 1831 a total beginner would be aware of basic principles of geological mapping. He was aware of the need for a base map, as well as knowing the conventions of using particular colours for each rock-type. Darwin did not find it easy as he admitted to his cousin, W. D. Fox, on 9 August: “I am trying to make a map of Shrops: but dont find it so easy as I expected”.20 However he found it interesting, unlike Spanish which he thought stupid. His visit to Llanymynech is another attempt which reflects his limited grasp of geology and he needed the guidance of a competent field geologist to set him on the right road. This he found in Adam Sedgwick.

ACKNOWLEDGMENTS

This paper would not have been possible without Adam Perkins of Cambridge University Library informing me of these maps during a visit to the library. The Darwin manuscripts (DAR) are quoted with permission of the Syndics of Cambridge University Library. Thanks to David Pannet and Peter Toghill who advised me on old maps of Shrewsbury and the local geology respectively, and whose local knowledge prevented several errors. Thanks also to Neville Herdsman of Chirk Bank for the loan of several books on local history. Also to Dr J. Secord whose critical comments, whether in conversation or as referee, have been most constructive. This research has been supported by the Isla Johnston Trust (administered by the Church in Wales).

NOTES

1 CUL DAR (Cambridge University Library; Darwin Manuscripts.) 265, DH/GPD 10; Maps drawn by Charles Darwin:
  i. Anglesey, 1 large map.
  ii. North Wales (in fact of area from Cardleston in the east to Llansantffraid (-ym-Mechain) in the west).
  iii. North Oswestry (actually of area from Oswestry in the north and Shelve in the south).
iv. Shrewsbury district.
Map ii will be referred as the Kinnerley Map and Map iii as the Llanymynech Map.
2 CUL DAR 5 (series 2), 1–2.
3 CUL DAR 5 fols 5–14. There are 20 sheets, the first being numbered 5 and those are referred to here as 12i, 12ii, 13i etc., fols 10i and 11i.
5 CUL DAR 265, DH/GPD 10; iv & ii.
6 CUL DAR 265, DH/GPD 10; iv 7 ii.
7 CUL, DAR 5 fols 19–29.
9 See note 11.
10 CUL, DAR 5 fol. 6 i.
11 Adam Sedgwick, entries for 3 August, Sedgwick’s journal, No. XXI (1831), Sedgwick Museum, Cambridge.
12 CUL DAR 265, DH/GPD 10; iii.
13 Darwin to Fox, 24 December 1828 (Burkhardt and Smith, 1985: 72).
14 CUL DAR 265, DH/GPD 10; i.
15 Darwin to Whitley, 12 July 1831 (Burkhardt and Smith, 1991: 466).
16 Darwin to Whitley, 9 September 1831 (Burkhardt and Smith, 1985: 151).
17 CUL DAR 34 (i) fol. 19.
19 CUL DAR 5 fol. 10; ii. A page appears to have been excised.
20 Darwin to Fox, 9 July 1831 (see Burkhardt and Smith, 1985: 124).

REFERENCES

EVANS, J., 1795 Map of the six counties of North Wales. (Inscribed to Sir Watkin Williams-Wynn of Wynnstay Hall, Ruabon, 1 June 1795.) Liverpool and London.

[Received 2 January 1998: Accepted: 28 October 1998]
Short notes

Charles Darwin’s notes on his 1831 geological map of Shrewsbury

As a young geologist Charles Darwin made use of hand-drawn maps and sections (Herbert, 1991; Rhodes, 1991; Secord, 1991; Stoddart, 1995; Roberts, 2000). One of his early maps (reproduced in Roberts, 2000), made in 1831 during the interval between the completion of his university education and his departure on the voyage of HMS Beagle, is of the environs around his home in Shrewsbury. On this map Darwin noted four sites, which he labelled A, B, C and D. We offer here a transcription of notes kept by Darwin relating to these four sites. Roberts (2000: 71) pointed out that a school presently occupies site A, and no outcrop is visible. Site B is a long outcrop of red flaggy sandstone (5–6 metres high by 80 metres long), which has probably been quarried. In present-day terms, these late Carboniferous “red beds” are the earliest development of the New Red Sandstone facies, and are, thus, appropriately marked as New Red Sandstone. Site C has no obvious exposures visible today. Site D was mismarked on Darwin’s map (see Roberts, 2000: 71). Darwin’s notes confirm that he was indeed at Nesscliffe, one mile to the northwest of Great Ness, and, importantly, where, in an area covered by pine and deciduous woodland, there are excellent exposures of cliffs of New Red Sandstone. In his notes Darwin also remarked on the appearance of the sandstone. For example, he described its curious nature at Hopton.

Darwin’s notes to his Shrewsbury map show him using a clinometer for angular measurements of dip of strata (as at site B). This helps to date Darwin’s map and his notes, for on 11 July 1831 Darwin wrote to his mentor J. S. Henslow that he had recently purchased a clinometer (Burkhardt and Smith, 1985: 125). Another sign of the date of the notes is that in them Darwin employed the term “direction” rather than the term “strike” that he began to use after his excursion with Adam Sedgwick in August 1831 (Barrett, 1974: 155). Thus these notes were likely produced sometime between mid-July and the first week of August 1831 when Darwin departed with Sedgwick on a geological excursion through North Wales (Roberts, 1998, 2001; Lucas, 2002). These notes are thus roughly contemporary with Darwin’s notes on Llanymynech in Wales (Roberts, 1996). Finally, the notes in their inclusion of comments and queries oriented towards theory (as in the last sentence for site D) suggest a continuity with Darwin’s later note-taking style (Herbert, 1987).

The notes transcribed here are contained in a bound, vellum-covered notebook now catalogued as DAR 210.11.37 (formerly DAR 210.17) in the collection of Darwin manuscripts housed at Cambridge University Library. The notebook seems to have been originally the property of Albert Way (1805–1874), a fellow student with Darwin at the university. The cover is inscribed “AV. Trin. Coll.” (the “V” suggests the direction of Way’s interests, the classical Latin alphabet having no W). Possibly Darwin had in mind returning Way’s notebook to him, for in the letter to Henslow, previously quoted, he asked “Do you know A. Ways direction?” In any event, the notebook remained with Darwin.

ACKNOWLEDGEMENTS

The authors are grateful to the Syndics of Cambridge University Library for permission to publish the manuscript. One of us (S. Herbert) thanks Marsha Richmond for having drawn her attention to these notes some years ago, and we both thank Sheila Ann Dean for proofreading the transcription.
REFERENCES


TRANSCRIPTION OF DARWIN'S TEXT

Following the editorial conventions used in Barrett et alii (1987), in this transcription Darwin's deletions are indicated by «» and his insertions by «». Square brackets enclose the present authors' insertions.

(A)
A Large gravel pit. worked for mending the roads: the lower beds chiefly sand: under which is a red marl. — The gravel like that of the rest of Shropshire, consists of various sorts of rocks. — Limestone. Trap. Clay Slate. Grey Wacke[.] Quartz. Granite. In the gravel there are numerous balls of sandstone, dark red and almost spherical. — I have not observed them in other pits. —

(B)
An escarpments of sandstone, which follows the course of Meole Brook. — Within a few yards on the other side «of the stream» are old coal pits. — Its direction is W.N.W. & E S.E. — dipping at an D of 20° to N.N.E. The sandstone is much stratified & of a very hard consistence: — is covered on parts of its face by a stalactite: —

(C)
On the Southern bank of brook, strata of Slate clay appear; they are irregularly stratified & full of bits of shining coal. —

(D)
The Nessclif hills <consisting of red Sandstone> begin=ning= about 1/4 of mile south of Great Ness & run=ning= in a N E by N direction towards Boreatton Park. In this range I include the hills called Clive & Hopton. — Their escarpment generally bears W.S.W. facing the plain. which lies between the Breddin & Llanemynech [Llanymynech]. The escarpment in different portions of the range appears to vary. sometimes it is even N.E. — The direction of the Strata very difficult to be ascertained. The best observation I made was on the top of hill
called Hopton, where the sandstone is more distinctly stratified. of a darker colour, much harder but carious. — here the D was N by W & S by E dipping at 8° to E by N. — Nearer to Nesscliff the D is more Western being W.N.W — Again in other places W S W & E N E & S W & N E [] Generally speaking the Strata are nearly horizontal; but both the inclination & direction is difficult to be ascertained owing to the number of fissures or seams which run through the whole bed of rock. These are generally horizontal but occasionally vertical, & divide the rock into beds of various thickness generally about 6 feet. — The stone is soft, but used for inferior buildings, it is generally red. dappled with white; but occasionally altogether white. — The surface is in many places <is> honeycombed, & or rather corroded into holes of various sizes; when a piece is broken off. there may be observed patches of a darker hue: it is apparently from the easier decomposition of the blacker spots. that the surface takes the described appearance. — The stone is very little covered with Lichens. The general red colour, abrupt escarpment & wooded top of these hills gives much picturesque beauty to that part of Shropshire. — The most curious thing I observed in this rock were numerous veins of a harder sandstone running in straight lines often quite through the main bed of rock. From their resisting decomposition longer than the surrounding stone they project outwards & are very visible. — These veins are about a line in thickness. are generally vertical, but sometimes oblique & occasionally curved. — They are more numerous in the upper beds. & these frequently cut each other. But what is most important they[y] cut pass through the seams or stratifications in the rock. This indeed first led me to suppose that most of the regular lines of apparent stratifications were not really such. but merely fissures caused by some force after-wards their deposition. These veins of harder sandstone I do not think could be formed by cracks afterwards filled up by infiltration[,] their remarkable uniformity in thickness occasionally. appearance. together with the manner in which they cut each appear to me to preclude this idea. — It is on this supposition that I think the continuity of the veins through the seams in the rock, prove that [they] were caused by some force & not by a succession of depositions. —

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Received: 2 March 2001. Accepted: 13 May 2001.