THE WOOLHOPE NATURALISTS' FIELD CLUB

(ARCHAEOLOGY RESEARCH PAPERS)

RESEARCHING THE LEOMINSTER CANAL

Paper 1 : PREVIEW

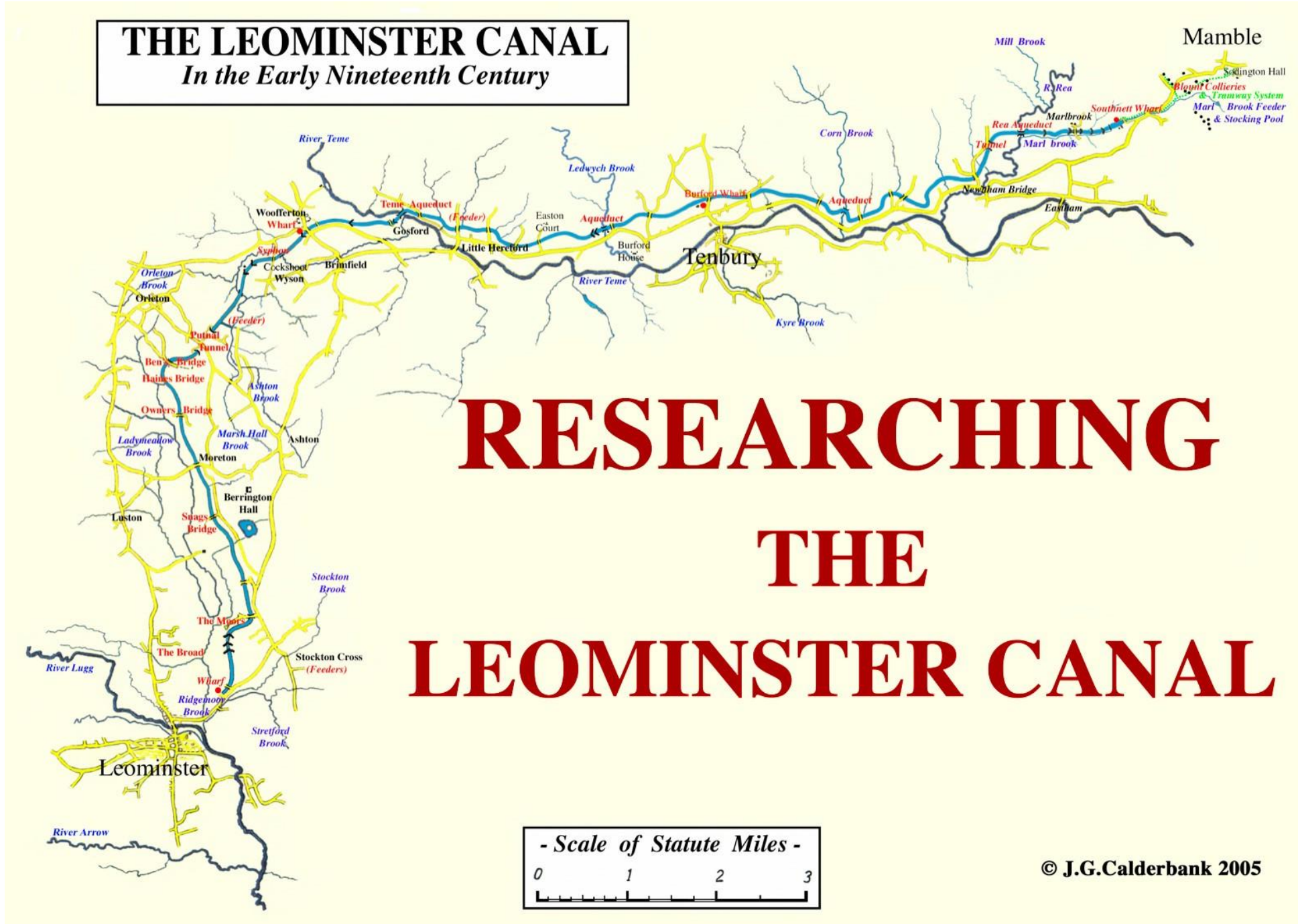
(A Herefordshire 'Coal Canal')

Recalling the Survey of 1789

by

Thomas Dadford Junior

(revisited with Gerry Calderbank)


THE LEOMINSTER CANAL
In the Early Nineteenth Century
Mamble
Mill Brook
Soldington Hall
R. Rea
Blount Collieries & Tramway System
Marl Brook Feeder & Stocking Pool
Southnett Wharf
Marlbrook
Rea Aqueduct
Tunnel
Marl brook
Corn Brook
River Teme
Ledwych Brook
Burford Wharf
Aqueduct
Newnham Bridge
Eastham
Teme Aqueduct
(Feeder)
Easton Court
Aqueduct
Woofferton
Wharf
Gosford
Little Hereford
Burford House
Tenbury
Syphon
Cockshoot
Wyson
Brimfield
River Teme
Kyre Brook
Orleton Brook
Orleton
(Feeder)
Putnal Tunnel
Ben's Bridge
Haines Bridge
Ashton Brook
Owners Bridge
Marsh Hall Brook
Ashton
Ladymeadow Brook
Moreton
Berrington Hall
Luston
Snags Bridge
Stockton Brook
The Moors
The Broad
Stockton Cross
(Feeders)
River Lugg
Wharf
Ridgemoor Brook
Stretford Brook
Leominster
River Arrow
- Scale of Statute Miles -
0
1
2
3
RESEARCHING
THE
LEOMINSTER CANAL
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A CHRONOLOGY OF THE LEOMINSTER CANAL

1777 Three navigation proposals; including Hereford to Stourport via Leominster, are all viewed by Robert Whitworth : Report (20.12.77) appeared to favour Woofferton - Tenbury - Newnham route.

1778 Meeting in London (08.04.78) directed Whitworth to make an actual survey. Whitworth reported (07.08.78) on an incomplete survey which mentions Little Hereford and Stockton (on Teme?) with a proposed tunnel of 1,528 yds.

1789 Two or more public meetings and an announcement (16.09.89) of an application for a Parliamentary Bill : December - T. Dadford Jnr. reported his proposed route and plan for a 31 mile canal with three tunnels at Pensax - Southnett - Putnal Field.

1790 Alternative plan proposed (20.01.90) for a canal from Leominster to join intended Hereford - Gloucester canal near the Lugg Bridge, Hereford. Public meeting (04.01.90) decided to proceed with Stourport project and £18,000 initially subscribed. Public meeting at Kington (14.04.90) requested survey to Leominster : and the two schemes united to give a total length of 46 miles.

1791 Dadford's proposals and estimates approved (27.01.91) at a combined meeting : "combined" Act passed : July - report of "spirited subscription" : Construction begins, sometime after July 1791. 'Canal Mania' : so 'Faden' proposals for rival scheme/s

1792 Dadford appointed Engineer of Monmouthshire Canal in July - "on condition that he didn't give more than one quarter of his time to the Leominster Canal".

1793 Boat named *"Royal George"* launched at Tenbury Wharf (May).

Abortive proposal by John Dadford to build a linking canal from Garthmyl on the Montgomery Canal - 40.25 miles - to Leominster via Montgomery, Chirbury, Bishops Castle, Hopesay, Onibury, Ludlow and Middleton, to a junction using the Gosford (Teme) Aqueduct.

1794 Canal opened from just above Marlbrook to Woofferton (20.10.94?) with seven boat-loads of Sir Walter Blount's coal: Difficulties reported with Putnal Tunnel.

1795 February - 'Great Flood' destroys Lugg and Wyson Aqueducts: Canal extended from Woofferton to N. end of Putnal Tunnel and portion cut from Leominster to S. end of Putnal Tunnel : Special meeting re. Putnal Tunnel (07.04.95) which remained uncompleted by December : Partial collapse of new, but unused, Southnet Tunnel and continuing difficulties with Putnal Tunnel led to consultation with John Rennie : December - his report highly critical of design, workmanship, and supervision.

1796 Second Parl. Act passed in April authorizing a further £180,000 capital : July saw completion of Putnal Tunnel : December brought completion of entire section between Leominster and Marlbrook wharves : 14 boat loads of Sir W. Blount's coal halved the wharf-price at Leominster on first day.

1797 Ceremonial cutting of first sod (01.06.97 - at Areley?) opposite Stourport at the site of the proposed Severn junction basin.

1798 Money troubles evident - several meetings later in year.

1799 Meetings continue - intention to seek further Act/s.

1800 Petition of claimants and creditors (for Bill authorizing payment of their debts) urged by Canal Company. Disaffected (*S.&.W.C. and other)* shareholders organise Parl.Petition against tramways and other proposed Statutory measures - but to no avail.

1801 Intention repeated, plus suggestion of Parl. powers to permit raising of tonnage dues when Areley basin is operational.

Death of Thomas Dadford Junior.

1803 Funds exhausted with little or no signs of any work E. beyond the Dumbleton Farm fragment : John Hodgkinson Pamphlet - when consulted (May) he favoured tramways from Southnet to Stourport and Leominster to Kingsland Field : August - Act of authorization obtained but subscriptions not forthcoming, there being little Leominster support.

1805 Proposals to open *new* coal and iron workings in Pensax area with possibly tramways to feed canal.

1810 Proposal for tramway from Clee Hill collieries to the canal.

1811 Decision (29.07.11) to continue line of canal as far as Kingsland.

1812 Second Hodgkinson Consultation, Survey and Report: Leominster Canal Company advertised intention (August) of canal or tramway via Martley to join Worcester & Birmingham Canal at Worcester.

1820 Opening of Kington Tramroad from Brecon via Hay (01.05.20) killed off any real future prospects of extensions beyond Leominster towards Kington

1824 Discussions on "Reorganisation" and extension towards Stourport.

1826 Act passed authorizing further capital, but not effective.

1833 Proposal revived for railroad between Stourport and Rea Aqueduct and surveyed by the engineer, Edward Powell.

1834 Survey and various routes suggested by John U.Raistrick - Engineer to Staffs & Worcs. Canal Co. - for rail link to R.Severn. He also suggested the total conversion of the whole route into a railroad.

1837 Survey by Stephen Ballard (Engineer to Gloucester Canal) of possible connection with Gloucester involving canalization of, or navigational improvement to, R.Lugg.

1838 Leominster Co. offered to help in making Hereford link, but Gloucester Co. finances did not permit such further commitment.

1841 Tenders invited for construction of new aqueduct over "R.Letwych" near Burford.

1845 Meeting to consider sale of canal to grandiose (and abortive) Welsh Midland Railway. First overtures from proprietors of Shrewsbury and Herefordshire* Railway. *(* original title)*

1846 Two rival companies formed for proposed railway route linking Hereford and Shrewsbury : negotiations opened with Shrewsbury and Herefordshire Railway Company re. sale of canal for £12,000.

1847 Act obtained authorizing sale of canal.

1852 Apparent acceptance by railway company after much delay (and pressure from canal company!) : railway company *seemed* to be in favour of extending a branch line towards Tenbury Wells.

1855 Pressure from a deputation of the canal company for completion of the sale (June) : Board of railway company resolved that the sale be left in the hands of the person who had been dealing with the matter - Mr.J.J.Peele, Solicitor.

1856 In January, Peele reported that a 'Bill in Chancery' had been filed against them for a specific performance of the alleged agreement to purchase - which was answered in March : the canal company's bill sought payment of £12,000 - *with interest from 01.01.47!* The Bill was dismissed - on a mere technicality; that two Directors of the railway hadn't signed the agreement - but the canal company threatened to appeal, and the S.& H.R. was later shamed into completion of the original deal (£12,000 sale figure, *without interest*, was eventually agreed).

1857 S.& H.R. had little use for main alignment between Leominster and Woofferton which was to be disposed of, but Mr.Peele approached Sir Edward Blount re. possible increase in coal production at Mamble - without satisfaction - as reported to his railway company (24.11.57) : this dissuaded them from thoughts of further development of Teme valley section.

1858 Completion of sale on 25th March : public notices advertised first the acquisition of, and then the intention to discontinue, the canal as from 19.06.58 : early sale of that part between Leominster and Woofferton decided in June.

1859 Arrangements to let off water and pay off residual staff by June : Some land sold to Lord Rodney of Berrington Park in July.

1860 Tenbury and Bewdley Railway made a bid for a portion of canal between Burford and Newnham Bridge - £548 paid for this.

1861 Last *written* record of a sale of land to a Mrs.Carless, but verbal accounts of other disposals, such as the fishponds at Marlbrook.

PRINCIPAL SOURCES : Cohen & Hadfield - see Bibliography.

This Chronology derives from an idea by the late Frank Noble.

- FACT-FILE -

'THE COMPANY OF PROPRIETORS OF THE LEOMINSTER CANAL NAVIGATION'

This is the legal title of the Company; all references to Stourport and Kington being spurious, according to law. Although it was acceptable to refer to the 'Leominster Canal Navigation' or simply to the 'Leominster Canal' - in both legal and common usage - there was no subsequent enactment changing or varying the original Company title.

THE ORIGINAL SHAREHOLDERS . . . *alphabetically re-arranged from the 1791 Act:*

Thomas Alban, John Baker, James Barnes, John Barrow, Lord Bateman, William Beaven, John Bedford, Mary Beesly, Charles Berington, Thomas Bernard, Sir Edward Blount, George Blount, Walter Blount, Edward Boundford, James Brasier, Thomas Brayden, James Bull, Edmund Cheese, Edmund Cheese Jnr., Thomas Clifford, Thomas Clutton, Thomas Coates, Francis Coke, Edward Coleman, Thomas Coleman, James Colt, James Crummer, John Dale, Somerset Davies, James Davis, Tobias Davis, Philip Davis Jnr., Thomas Dean, John Ellis Troughton, William Evans, George Evans, Richard Evans, Edward Ford, Nicholas Geary, George Gibson, Ann Granger, Muriel Granger, Jonathan Green, William Greenly, Joseph Guest, William Hare, Rt.Hon.Thomas Harley, John Harris, Richard Hayling, Jane Hoper, James Ingram, Francis Ivingham, Charles James, Thomas James, Thomas Johnes, Charles Jones, John Jones, William Jones, Esther Jordan, James King, Thomas King, James Kinnersley, James Kinnersley Jnr., Theophilus Knowles, Henry Lewis, John Lewis, Sir Edward Littleton, James Lloyd Harris, John Lodge, James Macmichael, Bridgwater Meredith, Charles Meredith, John Meredith, Mary Milbourne, Thomas Morgan, John Morris, Richard Morris, William Neve, Thomas Nicholls, Thomas Pitt, Hugh Powell, Joseph Powell, John Price, Richard Price, William Price, John Prichard, Jonathan Pytts, Ann Roberts, Henry Rogers, William Rogers, William Scandrett, Edward Seward, Joseph Seward, John Sherbourn, John Southall, Thomas Stephens, Henry Stone, Henry Taylor, Ann Taylor, John Taylor Stephens, Benjamin Thomas, Sarah Toldervy, Richard Turberville, Philip Turner, William Vale, Moreton Walhouse, John Wall, John Went, Francis West, William Wheeler, Richard Whitcombe, Sarah Whitcombe, John Woodhouse, Joseph Wyke, Zacheus Wyke, Ann Young.

THE FIRST COMMITTEE . . . *as listed in the concise version of the same Act of 1791:*

Rt.Hon.Thomas Harley *(President)*, Sir Walter Blount, Thomas King, Rev.Jonathan Green, D.D., William Greenly, John Dale (Clerk), Richard Dansey, James Ingram (Clerk), Richard Hayling, Thomas Clutton, Philip Davis Jnr. *(Treasurer)*, Charles Berington, James Kinnersley Jnr. *(Solicitor)*. [Thomas Waring Jnr. *(Clerk to the Company)*]

LEGISLATION:

1791 - *An Act for Making and Maintaining a Navigable Canal from **Kington**, in the County of **Hereford**, by or through **Leominster**, to join the River **Severn**, near **Stour-port Bridge**, in the County of **Worcester**.*

1796 - *An Act to enable the Company of Proprietors of the **Leominster** Canal Navigation to finish and complete the same.*

1803 - *An Act for Enabling the Company of Proprietors of the **Leominster** Canal to discharge their Debts, and to complete the Canal, and for explaining and amending the Acts for making and maintaining the said Canal, and for granting the said Company further and other Powers.*

1826 - *An Act for enabling the Company of Proprietors of the **Leominster** Canal to raise further Sums of Money to discharge their Debts and to complete the Canal, and for granting to the said Company further and other Powers.*

1847 - *An Act for authorizing the Sale of the **Leominster** Canal, and other Property of the Proprietors of the **Leominster** Canal Navigation, and for winding up and adjusting the Concerns of the same Company.*

ENGINEERING:

Thomas Dadford Jnr. (1761-1801) was appointed engineer responsible for surveying, designing, and supervising construction of the *Leominster Canal* - in accordance with the (Brindley) narrow gauge.

	- 1789 Plan & Sect.-	- 1794 Dadford & Waring Report -	- 1796 Rennie's Report -	- 1843 Col. Page's Report -
ROUTE MILEAGE	. 45 miles, 1 furlong, 5 chains *	20 miles of cutting, Kingsland to Southnett	as 1794 - operational, Putnal to Southnett . . .	17 miles - 3 furlongs, operational *
NET GRADIENT	. 448' descent - Kington to Stourport	(no discussion of data)	(no discussion of data)	13' - 4" net fall, Southnett to Leominster
AQUEDUCTS & CULVERTS	. not detailed at this (planning) stage	8 aqueducts + 30 culverts, Kingsland to Southnett. . . .	(discussed, but not itemised)	(no discussion)
BRIDGES	. not systematically detailed.	25 arched + 7 swivel, Kingsland to Southnett	(discussed, but not itemised)	(no discussion)
DRAIN TRUNKS	. not detailed at this (planning) stage	9 drain trunks - Leominster to Southnett	not discussed separately from 'waste-weirs' . .	(no discussion)
LOCKS	. provisionally outlined, but not in detail . .	2 of 8' - 6" and 16 of 6' rise - Kingsland to Southnett. . .	(discussed, but not itemised)	16 operational & 22 (intended) to Areley
TUNNELS : PUTNAL	. 330 yds. proposed	"332 yards of tunnelling, arched"	"...there are now only 98 yds. to tunnel ..." . .	(no discussion)
NEWNHAM	. c.100 yds. - not originally planned	(this work included with the Putnal construction)	c. 80 yds. - and needing improvements	(no discussion)
SOUTHNETT	. 1,250 yds. proposed	450 yds. arched + 30 yds. heading - 8 shafts started . . .	c. 450 yds. - but failed arch-work reported . . .	(no discussion)
PENSAX	. 3,850 yds. proposed	80 yds. arched + 60 yds. heading - 7 shafts started	(no discussion - other than tunnel mouth). . . .	(no discussion)
FEEDERS	. statutory provision not shown	(not mentioned)	(passing reference - at Wyson)	(no discussion)

- W.A.R.S. SURVEY NOTES -

1. Data: all the above engineers used Imperial Measure - miles, furlongs, chains, yards & inches. Prior to metrication, the W.A.R.S. observed the (then) customary archaeological criteria; including 'decimalised' Imperial measurement in feet for *vertical* levels *(rounded off to one decimal place)* and with feet and inches *(not normally yards)* retained for the horizontal dimensions - as measured with 100' linen tapes. For comparative purposes, some W.A.R.S. data was later converted; either by decimalisation of the Imperial dimensions, or by metrication - depending upon the application.
2. Dadford's data was for an *intended* route; whilst (from the internal evidence) Rennie seems *not* to have taken any independent measurements. Although Col.Page allegedly surveyed the Canal (?) his mileage* is anomalous.
3. When surveyed by the W.A.R.S. (1972) Putnal Tunnel was found to have been extended to approx. 1,380' - to counteract the slumping in the approach cuttings - as later confirmed from the Rennie and Hodgkinson Reports.
4. If completed, Pensax Tunnel would have been the *second longest* British canal tunnel in history, surpassed only by the *(recently reopened)* trans-Pennine Standedge Tunnel (5,415 yds.) - which took *16 years* to complete!
5. It is thought that Dadford may have been experimenting with an (unsuccessful) tunnel profile, criticised by Rennie as *". . . too flat in the reins"* and this, together with inadequate brickwork, resulted in failure of the arching.
6. John Hodgkinson *did* make certain proposals (1812) to improve the feed-water supplies to the Putnal summit level, but these were not implemented - whereas, at Mamble, the Stockingpool was clearly found to be essential.
7. The W.A.R.S. Survey discovered several feeders - at least five having been utilised at times for the operational Canal between Leominster and Southnett - whilst others were possibly contemplated elsewhere.
8. Wyson Top Lock chamber - the sole partially surviving example - measured 70' x 6-10" when surveyed in 1972.

PREAMBLE . . . *and research background*

We're considering the remains of a canal that's been defunct for a century and a half, so there's not much of it left to actually see! Furthermore, there are no Company Minutes, so neither are the historical records very prolific. Nevertheless, the Woolhope Club has been responsible for two investigations, starting with Israel Cohen's pioneering work (published in the 1957 Transactions) and the Club's Archaeological Research Section survey made during my chairmanship in 1968. Issy Cohen's deeply researched paper is still highly regarded as both the standard account and also the essential starting point for all subsequent research.

The following concentrates on our WARS Survey (1968-74) which was a series of field investigations using the (then newfangled) techniques of *'Industrial Archaeology'* - albeit since supplemented with tithe-map and other historical evidence that gradually come to hand. We were especially grateful to the late WNFC members, Patricia Cross for supplying most of the relevant tithe-map information (and for her helpful observations) and to her husband Dr.Peter Cross who kindly read my research notes, with particular reference to their geological content - and they both urged us to complete and eventually publish a definitive book, in succession to the draft accounts – from which notes this guide derives.

The geology (in this case, mostly superficial) is basic to an understanding of any canal, road or railway route and, for this, we had been using Peter Cross's Woolhope papers for some years past. We were of course delighted when he proffered much of his own research material during the course of writing up our WARS account. His interpretation of the 'Proto Teme-Onny & Rea' river terraces is fascinating in its own right - as now adopted but simplified by the BGS cartographers - and this has proved invaluable to our comprehension as regards some of Dadford's Teme Valley canal route. Since Peter's day, there have been several re-interpretations *(still ongoing)* of his proto-drainage theory, whereas detailed research (Cross & Hodgkinson) into the Teme/Onny river terraces - and the Orleton district sediments - still seems unquestioned.

We were also grateful to the Institution of Civil Engineers for access to their Westminster archives; and in particular, to Archivist Carol Morgan, but also to Peter Cross-Rudkin of their Historic Engineering Group who had a long-standing interest in our project and contributed valuable documentary sources.

From the 'Factfile' *(below)* it's obvious that we're initially dealing with only a short portion of what was an incomplete canal route. There were sporadic works attempted between the Kingsland area and Leominster town (viewed by the WARS) but these have practically disappeared; and furthermore, they were neither completed nor functional whereas the section here under review was part of a fully operational canal.

Since the end of the WARS Survey even more of the Canal has disappeared - an inevitable result of neglect, building development, and changing agricultural practice - but efforts are sometimes made by *The Friends of the Leominster Canal* (FoLC) to conserve the most threatened remains as and when practicable.

Suggested Itinerary. . . *for a first acquaintance?*

1. It is usual to park and view the 'The Moors' canal route from the A49 Endale lay-by (SO 510 615) where a nearby track and footpath (with stile) allows access to the old lock sites. If time permits, a pleasant stroll, although neither the former lock-keeper's cottage nor much trace of the lock sites remain.

2. Aquick visit to the nearby **Stockton Cross** complex (**bridge weir**, & **dam)** is worthwhile. The former sluice, launder abutments and water-meadow features are long gone since we recorded them. *(see below)*

3. Car shuttle to **Wyson Fishpond** - then possibly leave maximum number of vehicles and return <u>*on foot*</u> or, alternatively, <u>*drive*</u> back to Tunnel Lane**, Putnal.** *The through route is a six mile walk - either way - whereas all the sites can otherwise be visited by much shorter walks (at either end) from parked vehicles.*

4. From **Tunnel Lane**, use the horse over-path to view **Putnal Tunnel** N portal, canal feeder, culvert & pilot channel. The through walk crosses Wyson Common (drainage culverts), visiting Wyson Top Lock site, then under the railway past the drain trunk and Multiple Syphon and former cutting to Wooferton Cross.

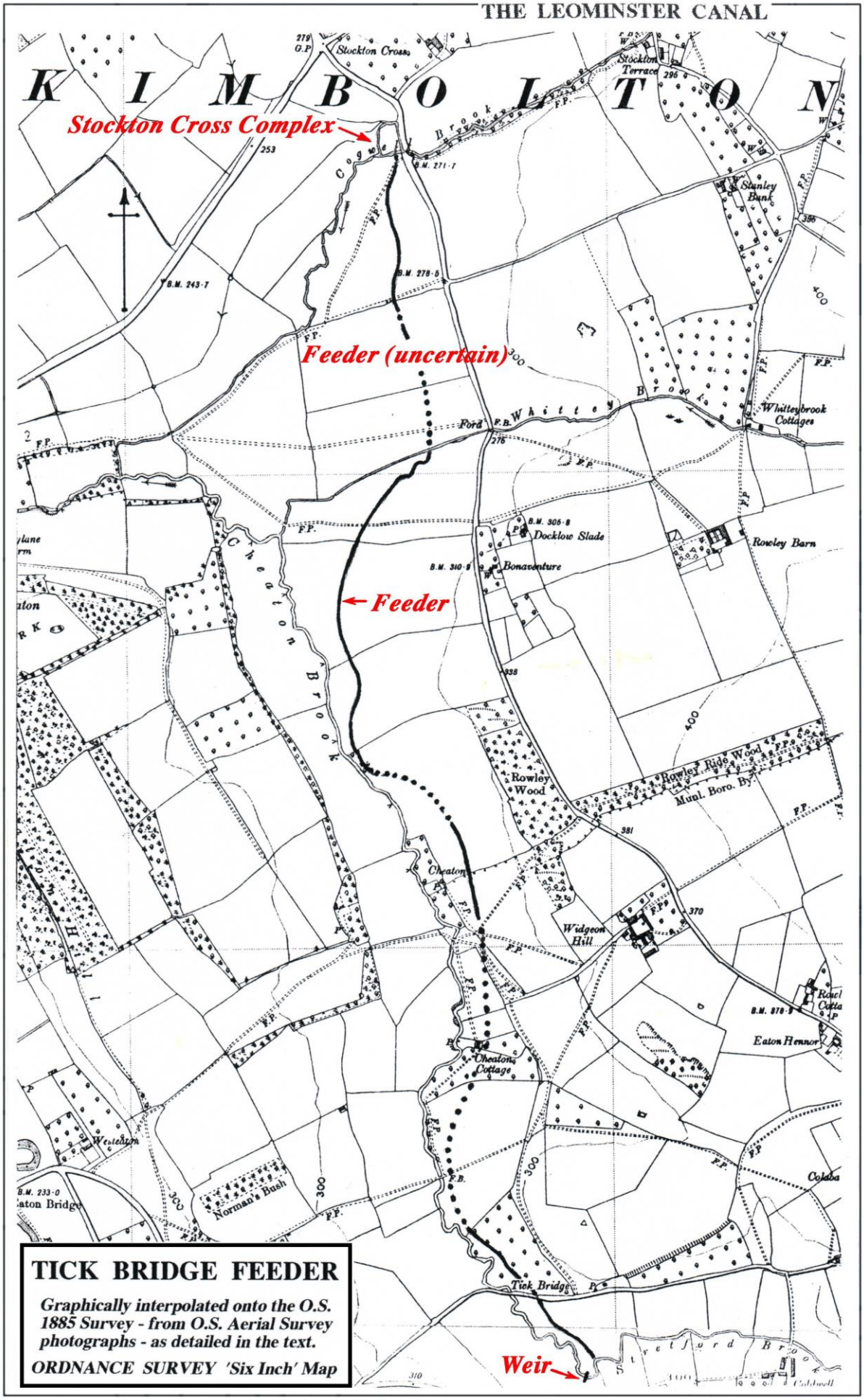
5. **Picnic lunch could be taken somewhere en route** - or perhaps visit a (now reopened) coffee-stop adjacent to the Salwey Arms A49/B4362 road intersection. Under the previous ownership, this cafe had formerly been used for both parking and refreshment in lieu of the fishpond *(but request parking permission!)*

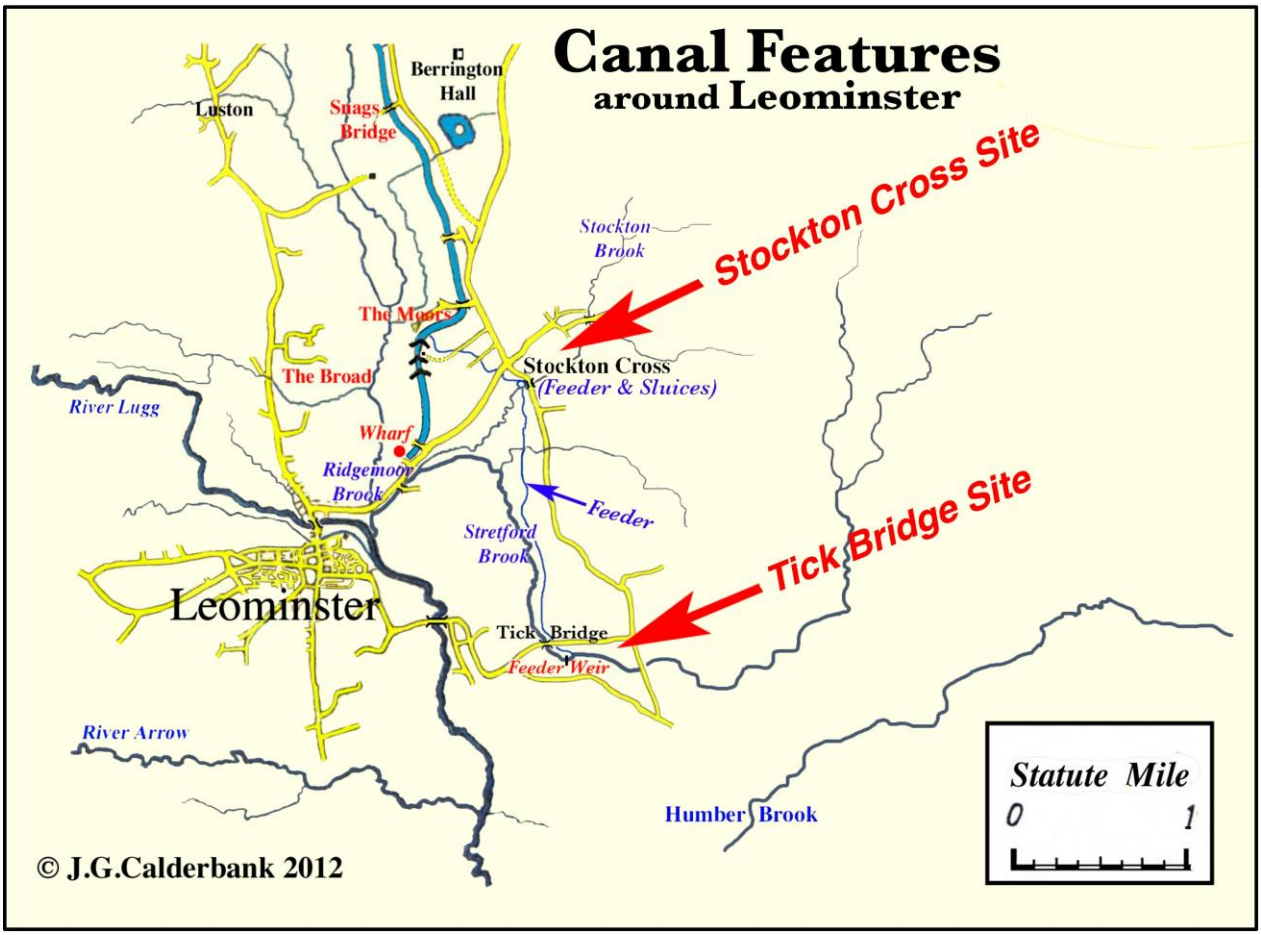
6. Take the **A456** to Gosford Bridge, then walk to the Teme Aqueduct and retrace steps.

7. Continue via Little Hereford to the **Easton Court** accommodation bridge - if permissible? - but making a detour en route to view the Bleathwood Brook supplementary feeder. The L bank abutment of the Gosford Aqueduct can also be reached by footpath and canal bed from Little Hereford.

Possible Extension . . . *time permitting?*

8. Tick Bridge Weir, Watery Lane - (SO 520 581) - assuming there's time to spare. Otherwise, it is more rewardingly visited in conjunction with itinerary item **2. (Stockton Brook)** - as a separate excursion.


THE LEOMINSTER CANAL
KIMBOLTON
Stockton Cross Complex
Feeder (uncertain)
Feeder
Weir
Stockton Cross
Stockton Terrace
Stanley Bank
Whitleybrook Cottages
Docklow Slade
Bonaventure
Rowley Barn
Rowley Wood
Rowley Ride Wood
Cheaton
Cheaton Cottage
Widgeon Hill
Eaton Hennor
Norman's Bush
Tick Bridge
Coldea
Cheaton Brook
Whitley Brook
Stretford Brook
TICK BRIDGE FEEDER
Graphically interpolated onto the O.S. 1885 Survey - from O.S. Aerial Survey photographs - as detailed in the text.
ORDNANCE SURVEY 'Six Inch' Map


Canal Features
around Leominster
Berrington Hall
Luston
Snags Bridge
Stockton Brook
Stockton Cross Site
The Moors
The Broad
Stockton Cross
(Feeder & Sluices)
River Lugg
Wharf
Ridgemoor Brook
Feeder
Stretford Brook
Tick Bridge Site
Leominster
Tick Bridge
Feeder Weir
River Arrow
Humber Brook
Statute Mile
0
1
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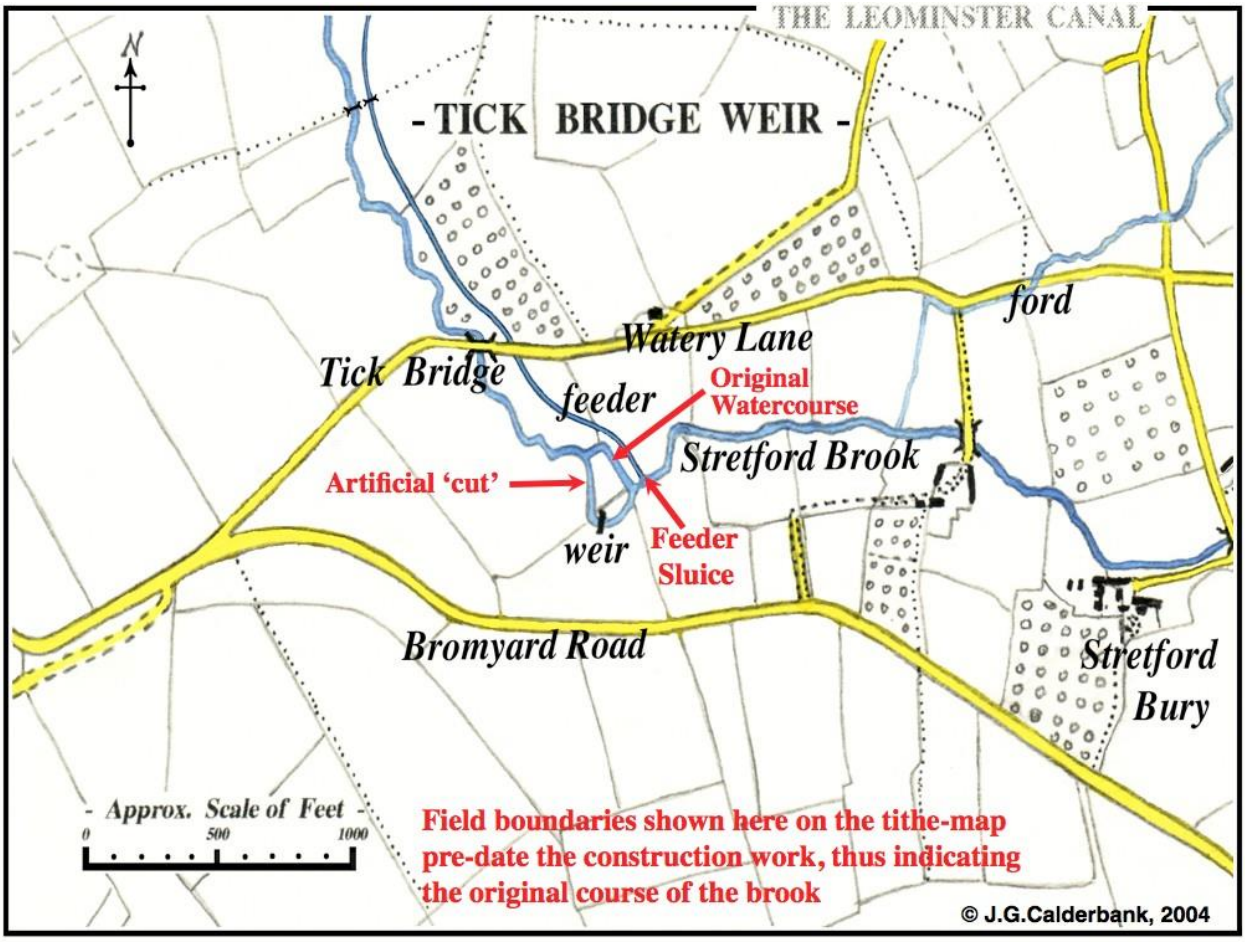
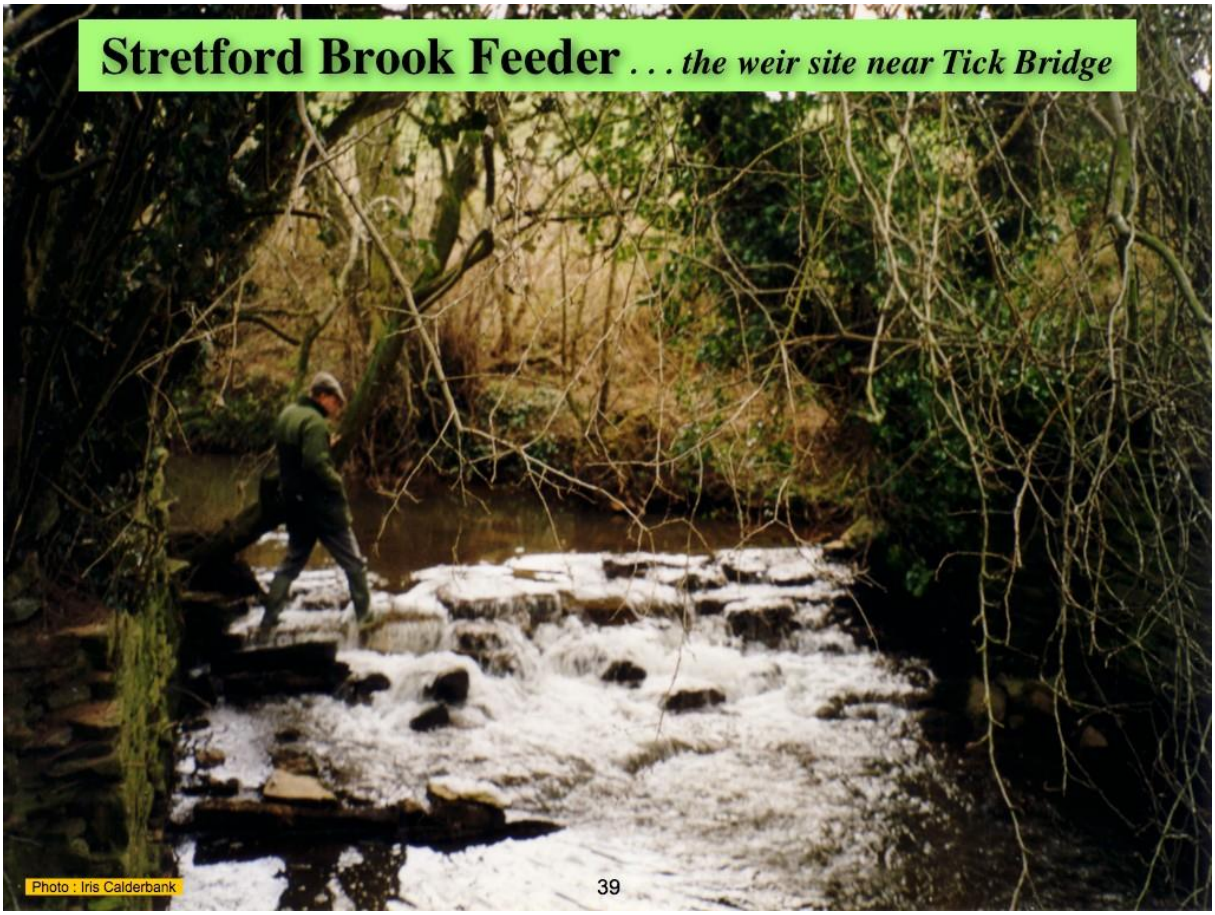
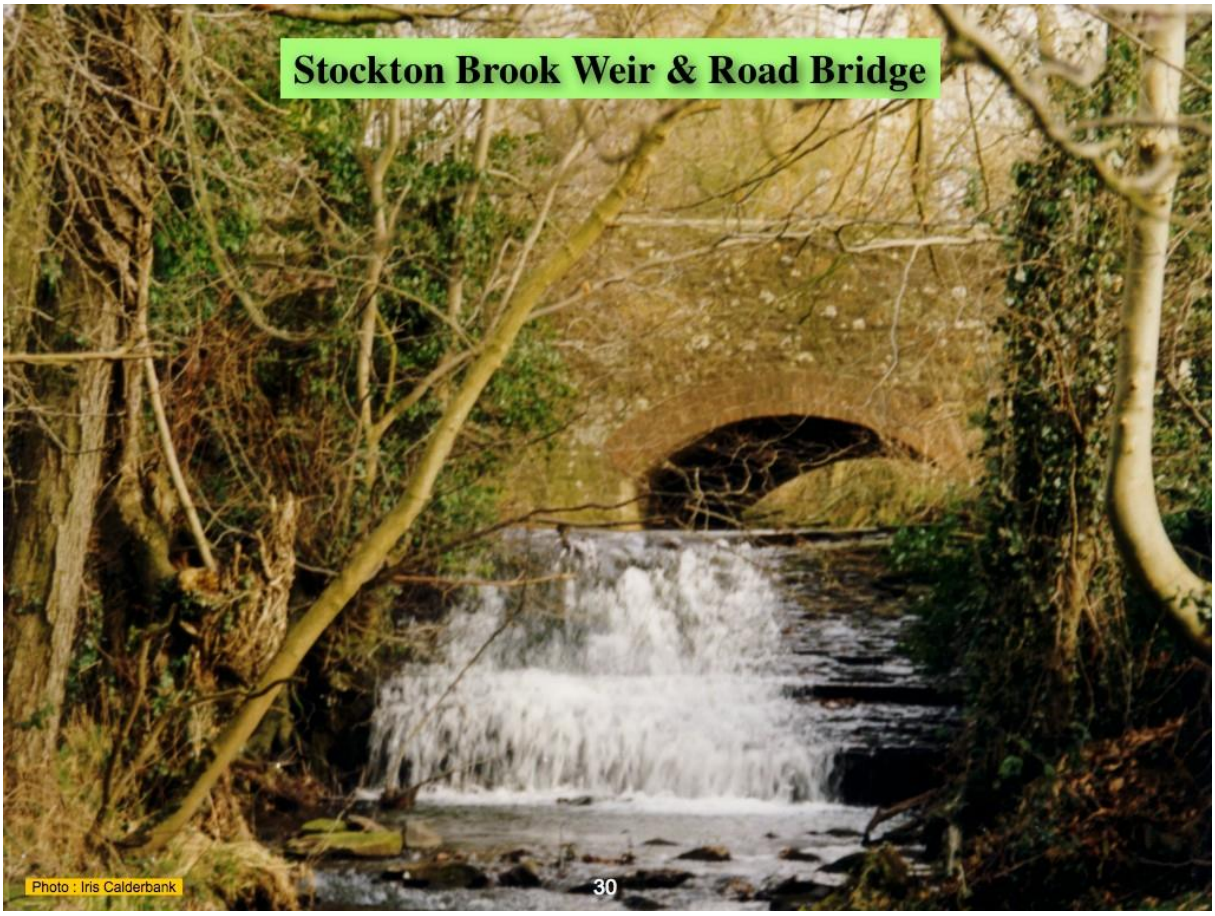
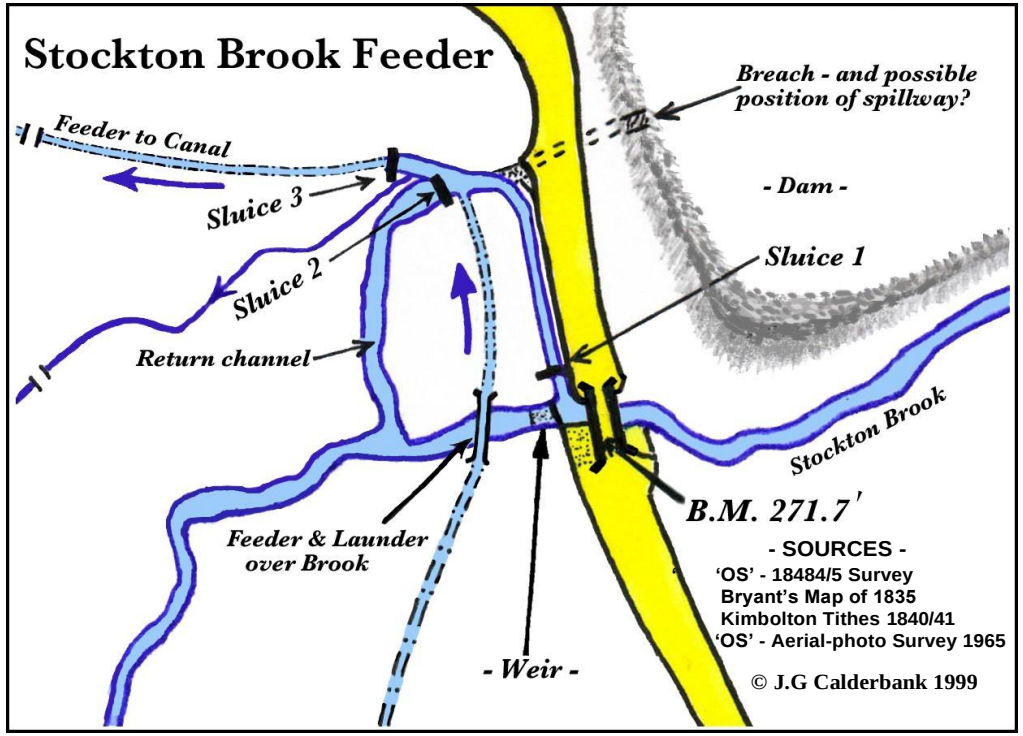

THE LEOMINSTER CANAL
N
- TICK BRIDGE WEIR -
ford
Watery Lane
Tick Bridge
feeder
Original Watercourse
Stretford Brook
Artificial 'cut'
weir
Feeder Sluice
Bromyard Road
Stretford Bury
- Approx. Scale of Feet -
0
500
1000
Field boundaries shown here on the tithe-map pre-date the construction work, thus indicating the original course of the brook
© J.G.Calderbank, 2004


Stretford Brook Feeder . . . the weir site near Tick Bridge
Photo : Iris Calderbank
39


Stockton Brook Weir & Road Bridge
Photo : Iris Calderbank
30



According to the Parliamentary Act of 1791, this was the site of a feed-water supply to the Leominster/Wyson summit - one of three such summit levels intended between Kington and the Severn at Areley Kings. Two of these summits required *"double lockage"* which was the contemporary parlance for crossing a watershed or a sump-level.

The first summit - at Kington - presented no such difficulties since it would have been supplied with sufficient water from the Back Brook, and there was also the potential for several other (auxiliary) feeders *en route* to Leominster. However, that section of the Canal was never to be built and remained, instead, a diminishing pipe-dream until eventually superseded by the arrival of a tramway connection - *The Kington Railway* - which then (1820) supplied the town with S.Wales coal.

History reveals that, in practice, the local Leominster water resources proved inadequate, certainly during the summer season, for supplying the intermediate summit. This might very well account for the complexity of the ultimate feeder arrangements - since there are indications that remedial measures may have been required. Indeed, such action was specifically recommended on occasion, as evidenced from report issued by the consulting engineer, John Hodgkinson when summoned to advise the ailing Canal company.

Field work proved that the Tick Bridge feeder drew water from the Stretford Brook as the main source of supply for the Leominster summit; that the Stockton Brook was probably auxiliary to this provision; and that the same Leominster summit pound was further supplied from the Ashton Brook north of the watershed - which is to say, beyond the Putnal Tunnel in the Wyson direction. From the evidence within the Act of Authorisation (1791) it seems possible that the roadside sluice predates the feeder arrangements, since the wording of *Section 4* tends to suggest this:

> ***"Provided also, and be it further Enacted, That nothing in this Act contained shall restrain or prevent the Right honourable Thomas Harley, his Heirs and Assigns, or his or their Tenants, from diverting the Course of and taking the Whole of the Water of a certain Brook, in the County of Hereford, called Stockton Brook, for and during such Time and Times as he or they shall think proper, not exceeding Forty-eight Hours in any One Week, for the Purpose of flooding or watering his or their Lands, or for any other Purpose he or they may think proper."***

The neighbouring Stockton Bury dam is sometimes assumed to be a canal reservoir; quite possibly it was adapted from a mediaeval (monastic) fishpond that formerly existed in this area, which was originally a Leominster Priory grange. However, the dam has not been dated with any certainty and, as a canal-related feature (if any) then the sequential phase is, as yet, unknown: assuming relevance, then the dam could possibly have been a later provision to counter the chronic water shortages reported by John Hodgkinson.

THE SLUICES . . . *modus operandi*

SLUICE 1 . . . Open, feeds canal during authorised periods – SLUICE 2 Shut . . . likewise – SLUICE 3 Open . . . likewise

SLUICE 1 . . . Shut, stops all feed-water supply *(canal or water meadow)* –

SLUICE 3 . . . Shut, stops canal feed-water supply

SLUICE 1 . . . Open, and with SLUICES 2 & 3 shut, feeds water meadow

GEOLOGICAL SETTING . . . *to the Leominster Canal*

There's a certain parallel between the solid geology and the purely topographical aspect of the canal: from Kington, they both start out simply - and uniformly in the case of the solid geology - but things become more complicated as we trace the proposed course of the canal eastwards. Dadford's route was intended to descend, a series of locks, from its feed-point on the Back Brook at Kington to a sump level at Leominster – whereafter several complications were encountered with the engineering geology.

Thereafter, the most significant problems en route are attributable to the awkward topography caused, in turn, by superficial deposits of glacial origin forming a low watershed - the Orleton Moraine - at Putnal and, much further eastwards, by the requirement to cross a decidedly more formidable watershed that barred the route from the Teme/Rea valleys to Stourport. Both watersheds required tunnelling. with each problematical, and only the Putnal Tunnel was eventually completed: the trouble was largely attributable to a combination of difficult geology and inadequate funding. However, in the opinion of John Rennie, who recognised both of these factors, some of the failure was also attributable to Dadford's (allegedly) deficient design.

In recent years our understanding of the earth's past has been revolutionised since geologists are nowadays free to accept the hypothesis of Alfred Lothar Wegener (1880-1930) that he postulated in his writings from 1912 onwards. Wegener suggested that formerly, during the Palaeozoic Era, the earth possessed just one enormous supercontinent - which he termed 'Pangaea' - but that later, in Mesozoic times, the various modern continents somehow separated and started to drift apart. This extraordinary process he termed 'continental drift' but the concept was roundly dismissed by most geophysicists of his day, many of whom asserted that such movements were both a mechanical and a physical impossibility, given the rigidity of the earth's crust, since no mechanism could then be imagined that might permit such peculiar happenings.

Arthur Holmes (1890-1965) was the first geologist to suggest a possible way forward, in his influential textbook: *"Principles of Physical Geology"* - although conclusive proof would await the evidence from palaeomagnetism, and ocean floor spreading. But once accepted, the rest was (earth) history, so that even school pupils now learn about 'Plate Tectonics', together with much that follows on from this: certainly, it has led to a much better understanding of the earth and represents, quite possibly, the greatest single advance in geology since the beginning of the nineteenth century.

- *SILURIAN & DEVONIAN BACKGROUND* -

Dadford's survey records an operational distance of 19 miles, preceded by a theoretical, but unbuilt, stretch of just over 13.25 miles from Kington to Leominster, much of which is underlain by rocks of Lower Old Red Sandstone (ORS) age. These succeed, apparently conformably (i.e. without major interruption) from the underlying rocks of Silurian age. The transition is marked by a bed of coarse, micaceous sandstone containing fish remains with some carbonaceous and phosphatic traces - known as the Ludlow Bone Beds - bedding that was considered by Dr.G.H.Mitchell, of the British Geological Survey, to mark the base of the Devonian System hereabouts. The stratigraphical classification - of the Lower Old Red Sandstone - has subsequently been altered so as to bridge the Silurian and Devonian systems but, since this is a somewhat complicated topic, it's probably best left to the specialists.

It is now known, in the light of plate tectonics, that when these beds were laid down Britain was part of a great continental block extending (in present day terms) an equivalent distance to that between Russia and N. America. This block is termed 'Laurasia', with our own locality then situated from 28˚ to 18˚ south of the equator; the climate was therefore very warm, although not uniformly arid. Many experts consider that there was intermittent, violent and heavy rainfall in the adjacent hills, since there is widespread evidence of flash flooding with extensive fluviatile deposits to support this. Our area had started to emerge from marine conditions during the Ludlow times (late Silurian) so that the Ludlow Bone Beds are consequently seen as representing very shallow seas where accumulated organic detritus was rolled around by strong currents. The gradual emergence to dry land (continental) conditions is thereby postulated.

It should not be thought that these Devonian rocks are monotonously uniform. There is considerable variety in their lithology, bedding, and colouration: they include siltstones, mudstones, sandstones, cornstones, conglomerates, marls, shales and limestones but, collectively, these sedimentary rocks form the underlying basis to almost the whole of the operational canal. They were formerly known as the 'Raglan Mudstone Formation' (now Moor Cliffs Fm.) and are detailed by the British Geological Survey in their various publications. They are succeeded by bedding of the 'St. Maughan's Formation' (now Freshwater West Fm.) which are generally harder and more resistant to weathering - and thus forming the prominent higher ground on the right flank of the canal between Leominster and Newnham (the East Herefordshire Plateau)but, although adjacent, the canal route doesn't actually impinge on these later rocks.

- CARBONIFEROUS BACKGROUND -

Returning to the plate-tectonic evidence, at the beginning of Carboniferous times our area would by then have drifted further north, albeit still south of the equator - ranging, approximately, from 20˚ S at the (present day) location of Land's End to about 10˚ S in the latitude of the Shetlands - and it was also rotating, very slightly, anticlockwise. By late Carboniferous times (the Silesian Subsystem) we would have drifted even further north, crossing the equator for the first time, so that 0˚ roughly coincided with what is now the Lizard Point and the latitude of the Shetlands was correspondingly at about 10˚ N - with the slight rotation also continuing.

This equatorial environment would have been correspondingly hot and humid, giving rise to immense swamps with the primitive vascular plants - lycopods, pteropsids and horsetails - fossil remains of which comprise the coal seams. These swamps endured regular fluctuations in relative water level, with the effect that there were repeated cycles of sedimentation when inundated, followed by a gradual re-emergence to swamp conditions. Sub-aerial and powerful water current ('washout') erosion then occurred, causing minor unconformities near to the land hereabout. This dry ground comprised a land-barrier between two adjacent uplands. Such cyclic swampy episodes are termed 'cyclothems' by the stratigrapher, being a feature of the Millstone Grit and, more markedly, of the Coal Measures.

In the region later under consideration (Mamble/Pensax coalfield area) there is a major unconformity since, locally, the Upper Old Red Sandstone, Lower Carboniferous and Millstone Grit sequence is entirely absent. It is assumed that the hiatus was due to the above-mentioned connection between two ancient landmasses known to geologists, respectively, as 'St.George's Land' and the 'Mercian Highlands'. The land bridge was an uplifted area that could nevertheless have been repeatedly subject to both sub-aerial erosion and partial submergence, on a cyclical basis (described above) as the sea advanced and retreated. The net result of this discontinuity is that we (locally) jump straight from the Lower ORS to rocks of the Middle and Lower Coal Measures in the Wyre Forest/West Worcestershire Coalfield.

Further south, the discontinuity is even more drastic with effect that the Upper Coal Measures (Bayton - Mamble - Abberley) rest directly upon Silurian rocks comprising the Upper Ludlow Shales. This contrasts with certain other areas of the British Isles that lay to the N and S of the 'Midland Barrier' bridging the two larger uplands. In some adjacent regions, such as S.Wales and Lancashire, or Yorkshire / N. Midlands, the succession was usually more continuous, prolonged and gradual, so that considerable coal basins - sometimes with quite massive coal seams - frequently resulted. A further (somewhat unwelcome) effect of the local depositional conditions was to be found in the chemical composition of the coal itself; there was a marked concentration of sulphur compounds present in all of the West Worcestershire and in most of the Wyre Forest coal seams from Bridgnorth southwards - comprising the notorious 'Sulphur Coal' described below.

ECONOMIC GEOLOGY

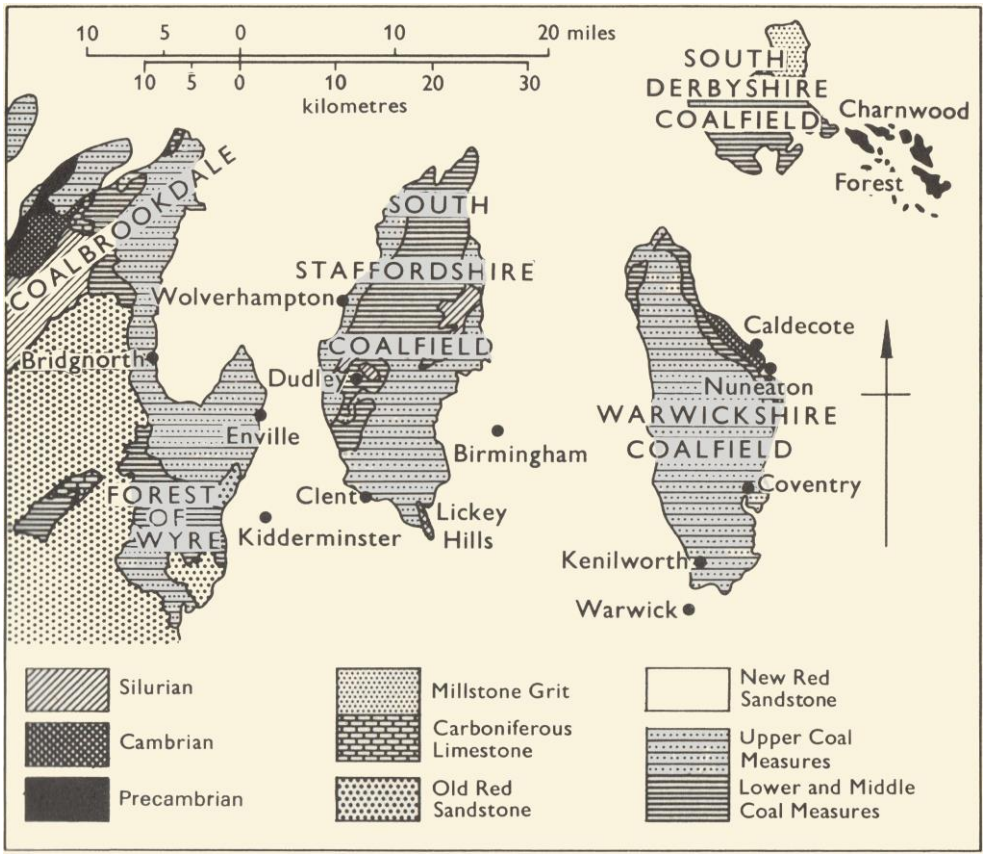
- COAL . . . the driving force for a canal -

Francis Egerton, Duke of Bridgewater, was frequently consulted about canals, coal and sometimes, also, about railroads following the completion and operation of his canal. He is famously remembered for certain of his comments, but of railroads he'd little to fear since the Worsley collieries shipped his coal almost from the coalface by underground waterways feeding straight into the canal. In later life, however, he was said to remark that canals would last his lifetime: *". . . but I see mischief in those damned tramroads".*

Clearly, the Duke foresaw future competition from the embryonic rail systems, and sensed that they would eventually develop from mere colliery feeders into a rival system, competing with the actual canals. When questioned as to the general viability of canal transport, Bridgewater was equally sagacious, and laid down the guideline that every successful canal should have: *". . . coal at the heel of it"* - but with the problem being that few coal owners and canal operators were quite so fortunate as the Duke in this juxtaposition of coal and canal! In fact, Herefordshire was very poorly situated in this respect, so the history of her waterways and early railways is largely a story of attempts to import this most precious commodity.

A close reading of the first Leominster Canal Act nevertheless indicates that Dadford and the promoters were fully aware of at least a *possibility* that their Canal might emulate the situation at Worsley; that two requisite tunnels through the Mamble-Abberley watershed would likely pass through the coal measures; and that coal might thereby be shipped directly from their workings. There's a specific clause *(Section 55)* dealing with just such a contingency in the event of finding coal, although nothing was reported at the time. Given hindsight, we now know that Southnett tunnel would have bored entirely through Old Red Sandstone beds, and so below the Coal Measures horizon. Pensax tunnel was a very different matter of course, since it's NW portal was adjacent to the local adit mining; but unfortunately, no chance of canal company exploitation was ever to materialise!

Possessing no major coal deposits of its own, the county was flanked by coalfields to the north, northeast, and to the southeast, but these were not readily accessible to towns such as Bromyard and Kington. On the other hand, Ross and Hereford city were relatively better served from the Forest of Dean collieries by the ancient Wye Navigation - although this was subject to the vagaries of drought and flood.



The Midlands Coalfields . . . ***a sketch map by Dorothy Rayner***

In the case of Leominster, considerable doubt exists as to the effectiveness of the R. Lugg throughout history, and this despite the statutory provision (1695) of locks and various bridge alterations intended to improve the navigability. Perhaps the very fact that a new canal was even contemplated would seem to question the viability of the river navigation in general, and particularly so with regard to the regular passage of heavy goods to Leominster. There can be little doubt that this hunger for coal was the driving force behind the Leominster Canal; that its fortunes would be bound up with the success or failure of the colliery management as regards its effective exploitation; and that an examination of this relationship – as between canal and coal resources - is vital to our comprehension. It was for this very reason, the subject of *"Canal, Coal, and Tramway"* had elsewhere been accorded our separate and more detailed attention.

OTHER PETROLOGICAL RESOURCES

It is undeniable that all the other natural resources pale into insignificance when compared to coal, although Dadford's map indicates an awareness of certain other potential freight, most of which was ideally suited to waterborne transport. There might have been little advantage in exporting some of these commodities, whereas the canal would have been potentially useful when shifting them within the county - on a short-haul basis. The obvious advantage of bulk transport - including agricultural resources and finished produce - by water - was generally well known, so the prospect of a canal would have been a commercial incentive to many eighteenth century Herefordians.

- MARL -

This was still an important commodity to the farming community of Dadford's day, and was undoubtedly carried on the canal. It was used, supposedly, to enrich the land and, together with lime, is almost certainly what was meant in the historical references to 'manure' - which is still a correct dictionary definition of course. Contemporary advocates of manuring included Arthur Young, William Marshall, J.Holt and H.E.Strickland. Per contra, the authors of the local Geological Survey: *Memoir* express considerable doubts and state that, despite the abundant evidence of former marl pits: *". . . Much, however, of the material dug was so slightly calcareous that it was more harmful than beneficial."* - although it must be said that no mechanical analysis, pH values, etc. are provided to support this assertion.

- LIMESTONE -

Dadford's map depicts limestone in several localities and we should remember that 'burnt limestone' was beginning to replace marl at about this time since it was both cheaper and more effective. Humphry Davy first lectured upon the science of agricultural chemistry in 1803 and his pioneering book: *"Elements of Agricultural Chemistry"* was published ten years later. The improved soils from this (relatively) novel and accelerated husbandry meant that new crops could be grown in localities previously considered to be unsuitable; for example, J. Duncomb in his: *"General View - Hereford"* (1805) probably had this in mind when he reported that potatoes were: *". . . gaining ground every year, near towns in particular"*.

Cereal crops were also greatly affected by these changes and were similarly grown in novel localities as a direct result of the improvements. Although not directly of geological relevance, the point to be made here is that such agricultural advances might now rely upon the redistribution of geological and other economic resources by greatly improved water transportation, in exactly the same way that coal could also be easily and cheaply provided to a much wider market.

BISHOPS FROME *('Psammosteus')* LIMESTONE: Formerly named after an extinct species of primitive fish (since renamed *Traquairaspis symondsi*) the limestone could <u>now</u> be said to have once borne a fossil name! It was much used for road-stone and lime burning, and there are extensive outcrops locally - some quite massive and up to about 12' in thickness, which in places form a prominent 30' escarpment on the western flank of the Teme valley. It was recently renamed - yet again! - and is now the Chapel Point Limestone.

CALCAREOUS TUFA: This remarkable limestone was present in considerable quantities fairly near to the intended route of the canal and could readily have been transported, should the Canal ever have reached the Pensax coal pits and beyond - as was originally intended. The tufa was precipitated from the overlying outcrops of the 'Bishops Frome Limestone' (now Chapel Point Limestone Fm.), in the vicinity of Hanley William, and could readily have been accessed via Orleton (Worcs.) and Stockton on Teme. It was valued for its lightness, coupled with ease of carving when fresh, and so it features in the vaulting of Worcester cathedral and some of the parish churches around the Teme valley.

- BUILDING STONE -

It is known, from former quarries, that there was once some local demand for the Dittonian Series sandstone, but rocks of this general age (Lwr. ORS) are notoriously variable as regards the cementation of their constituent grains; as a result, they can sometimes prove very friable in use, being then easily eroded. Variability is frequently on a very small (localised) scale and, in such cases, the durability of any masonry construction, whether in buildings or walling, can be most unpredictable – with the evidence of this differential erosion being only too obvious throughout the county. In the vicinity of Shelsley Walsh the local calcareous tufa was also (occasionally) used with general building construction.

- REFRACTORIES -

These are generally defined as materials capable of withstanding high temperatures without fusing or softening, being used to a large extent in furnace construction, and they should also possess certain additional thermal and physical properties, especially a low coefficient of expansion and contraction. They are further defined, according to their chemical properties, into acid, neutral, and basic materials. The acid category is high in silica content and includes 'Dinas rock', ganister, and most fire-clays: the latter ('seat earths') would be expected in the coal measures - possibly in commercially viable quantities, as in the case of the Mamble colliery. A ganister-type rock was noted from the Productive Coal Measures found in the western area of the Wyre Forest between Maxfields Coppice and Cleobury Mortimer Station; and it may be assumed that this hard white sandstone could have been ground down, mixed with clay, and formed into bricks as a liner for furnace hearths. (This was later to became standard practice in the coalfields of Lancashire, Yorkshire, and Derbyshire - principally to line Bessemer converters - after about 1860).

- BRICK & TILE CLAYS -

Bricks were nearly always made as locally as possible in the period when the canal was constructed, and the authors of the Geological Survey Memoir mentioned the suitability of the Downton and Ditton Series marls (of ORS age) for this purpose. We are told that these marls were easily dug, then mixed with loamy sand from the lower levels of the R.Teme terraces before firing, and that the deposits at Stanford Court were used in this fashion as late as 1914. Before the much later dominance of the Jurassic clays, and especially from the activities of the London Brick Company, there were many similar (ORS) workings dotted around the county, exemplified by the Linton Tile Works, near Bromyard, which operated until relatively recently. The Woolhope Field Names Survey records several 'brickfield related' names from the tithe maps.

- CARBONIFEROUS DOLERITE -

This was sometimes dubiously classified as ‘basalt’. Next to the coal, it was the second most important geological resource; being a highly prized road-stone in the age of horse-drawn traffic. This basic igneous rock caps both of the Clee Hills and, on Titterstone Clee in particular, the quarrying industry was formerly of great importance; the actual quarrying technique being of considerable interest. The rock face was drilled and blasted, whereupon the resultant blocks were laboriously hammered into a range of standardised ‘set-stones’ of various sizes. With the growth of urbanisation, the Clee Hill sets are said to have paved much of the rapidly developing ‘Black Country’ in the nineteenth century, whilst others were extensively used at Cardiff Docks.

Tramway links to the Canal were proposed at various times and thereby the potential for distribution by water - especially if the canal had been carried through to Stourport and the Severn - so there can be no doubting the great desirability of such an arrangement. Indeed, canal and tramway engineer, John Hodgkinson of Abergavenny recognised such potential in his consultant’s ‘Report’ submitted to the canal company proprietors but sadly this aim would never be achieved.

Instead, the quarrying had to wait until the railway network was sufficiently developed, and then a most extraordinary branch-line was engineered from Ludlow; including an inclined plane on the steepest pitch. This Ludlow and Clee Hill Railway was incorporated in 1861, opened in 1864, and jointly worked for a while by the G.W.R. and the L.&N.W.R. (under an agreement of 1877) before being permanently vested in these two companies - as a joint railway - by the Act of 1892.

Nowadays the branch railway has gone, but the rock is still (1998) extracted, broken up into road-stone aggregate, and removed by lorries; although few people would dispute that, in the first instance, it should ideally have been carried down a (gravity balanced) double incline - and then shipped by canal - as originally recommended by Hodgkinson in 1810.

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