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THE STRUCTURE OF THE SILURIAN ROCKS OF THE
MALVERN AND ABBERLEY HILLS, WORCESTERSHIRE.

A Thesis submitted for the Degree
of Doctor of Philosophy at the
University of Birmingham.

V O L II : ILLUSTRATIONS AND MAPS.

September, 1953.

F.A.E. Reeve, B.Sc., A.R.S.M.

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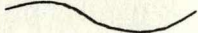
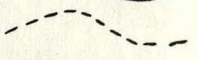









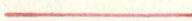

GEOLOGICAL MAPS AND SECTIONS.

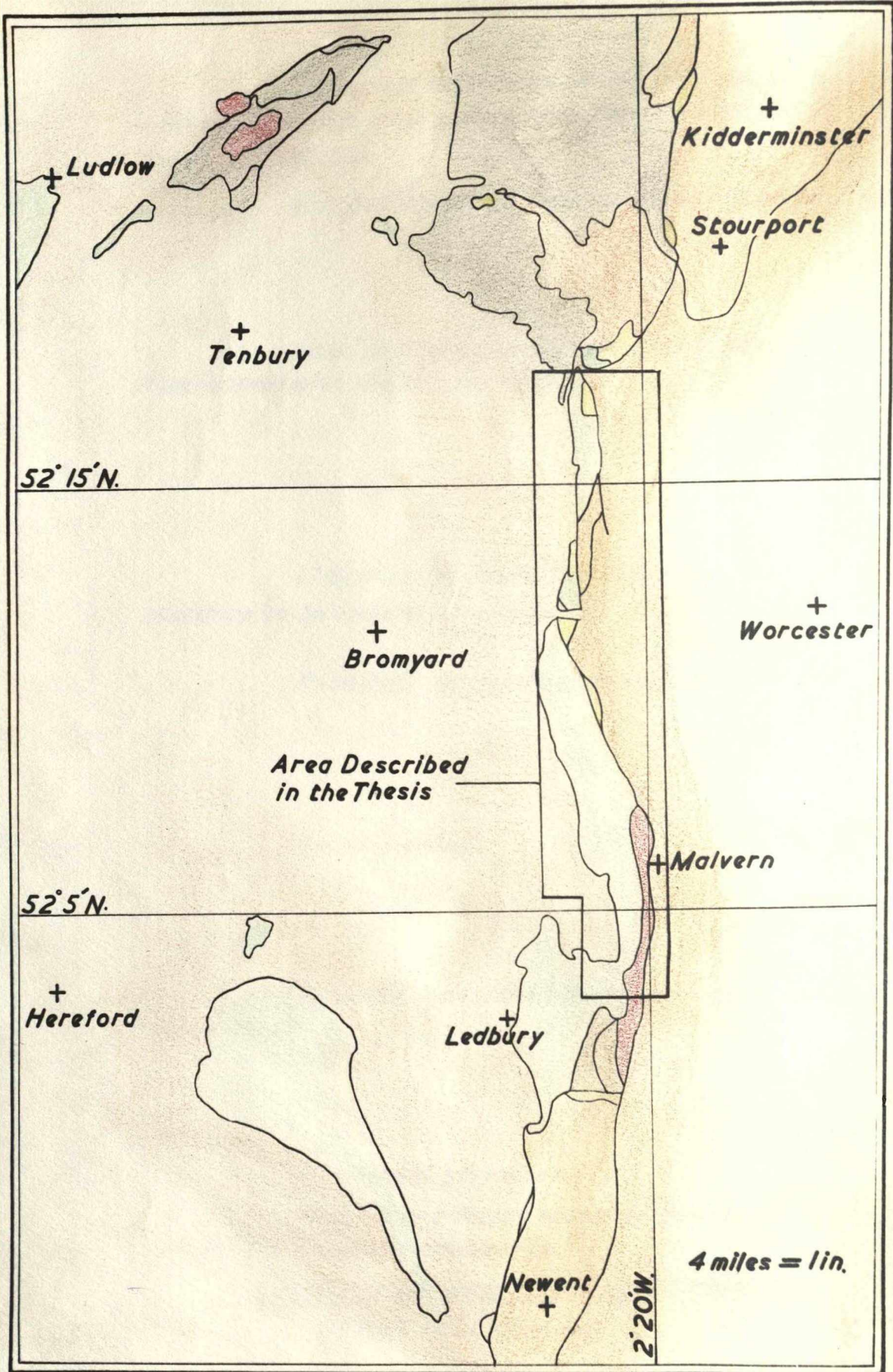
The maps and sections included in this volume are to help the reader understand the text of Volume One. The geology portrayed at depth in many of the sections is meant to show the possible structure rather than that which is true; this is particularly true in the sections north of the River Teme in the Woodbury Anticline district. Owing to the incompetency of the shales and the probability of several unobserved minor thrusts, the correct positioning of many of the beds below the surface is made practically impossible.

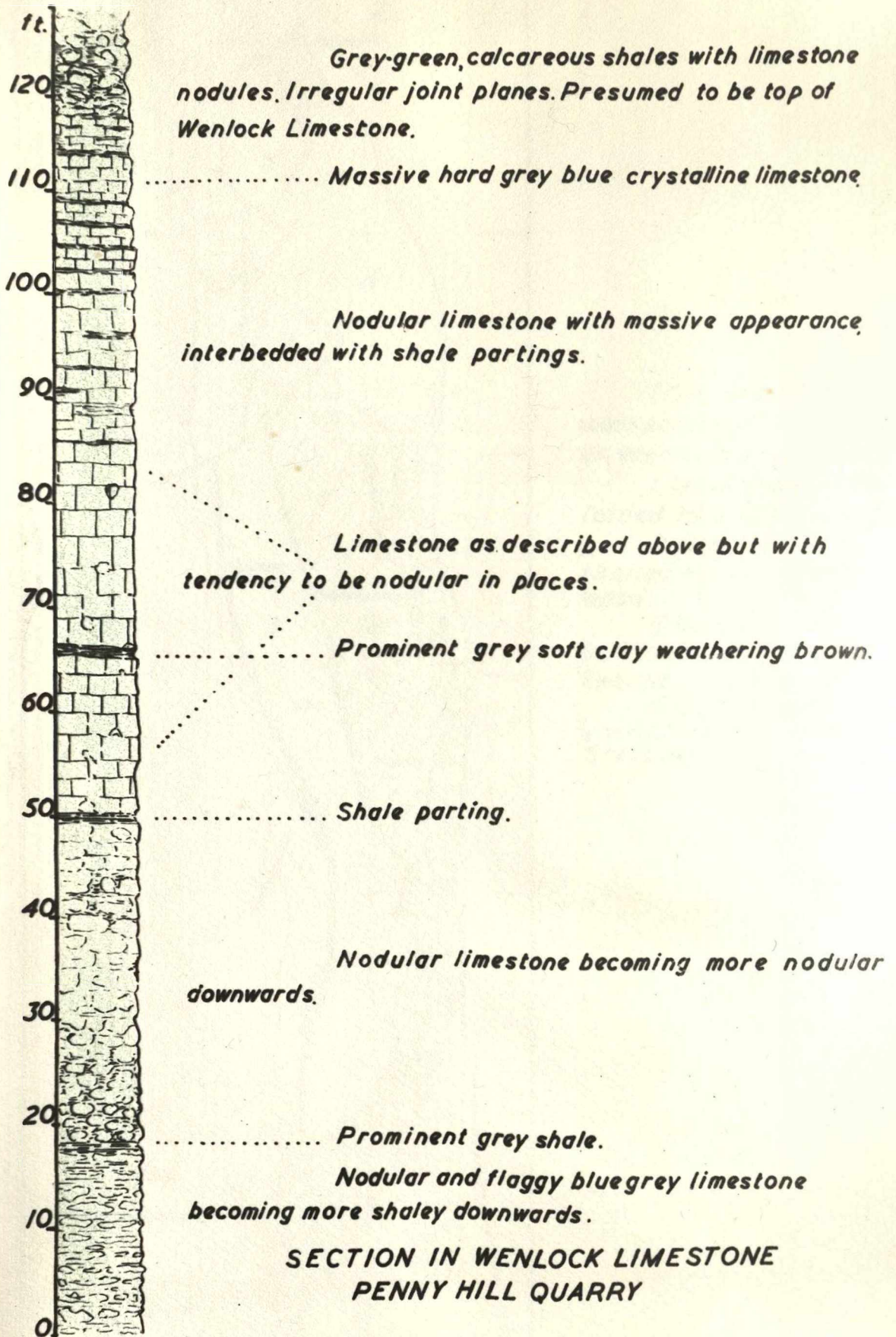
Abbreviations used on these maps and sections are adopted where possible from "Standard Legend, Geological Department" of the Shell Petroleum Company. A summary of the abbreviations and symbols used is given below:

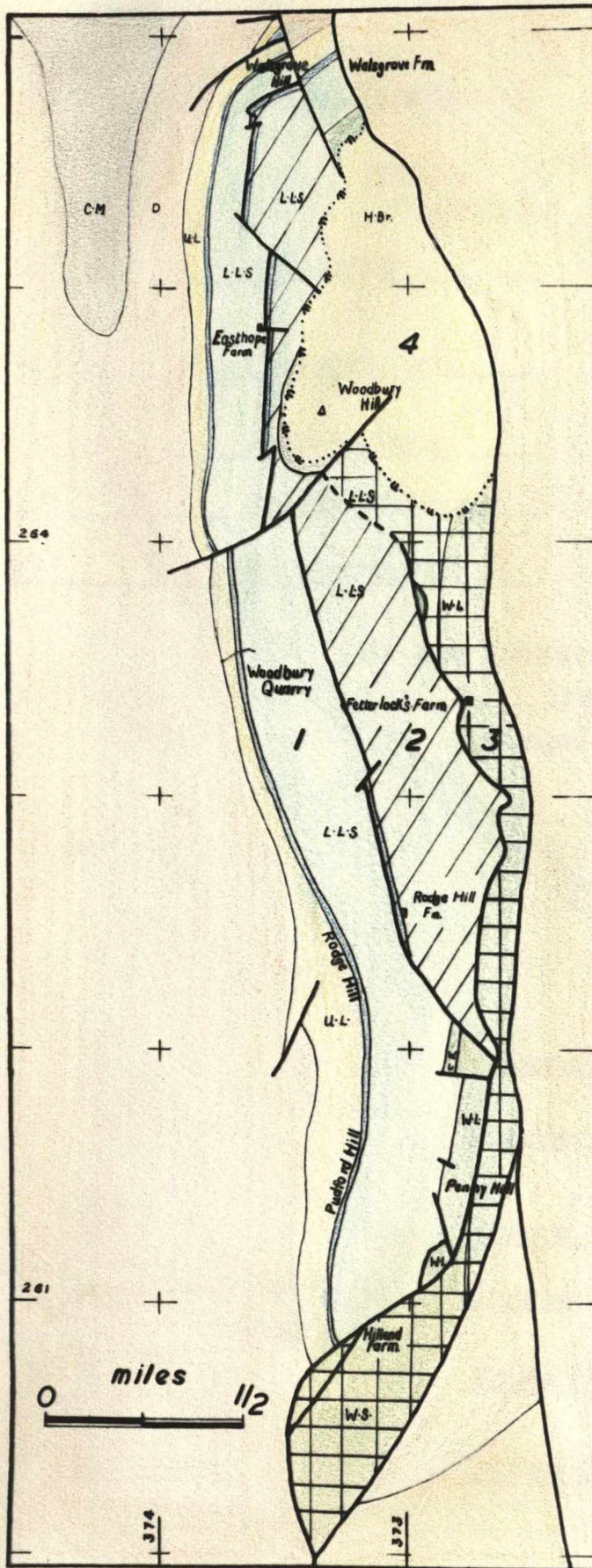
Alluvium	
Keuper Marl	k.m.
Keuper Sandstone	k.s.
Triassic	tr.
Haffield Breccia	h.b.
Coal Measures	c.m.
Downtonian	downt.
Upper Ludlow	u.l.
Aymestry Limestone	a.l.
Lower Ludlow Shales	l.l.s.

Wenlock Limestone	w.l.
Wenlock Shale	w.s.
Woolhope Limestone	w.l.
Llandovery	llan.
Silurian	sil.
Cambrian	cam.
Pre-Cambrian	p.c.

Formation Boundary ascertained	
" " conjectural	
Disconformityd.....d.....
Unconformityu.....u,.....
Dip Determined	
Dip vertical	
Dip Horizontal	
Strike only known.	
Dip Approximate	
Anticlinal Axis, pitching to W.	
Anticline with overturned N. flank	
Anticline, asymmetrical (shortest arrow points to steepest limb).	
Synclinal axis with pitching	
Fault ascertained	
" conjectural.	







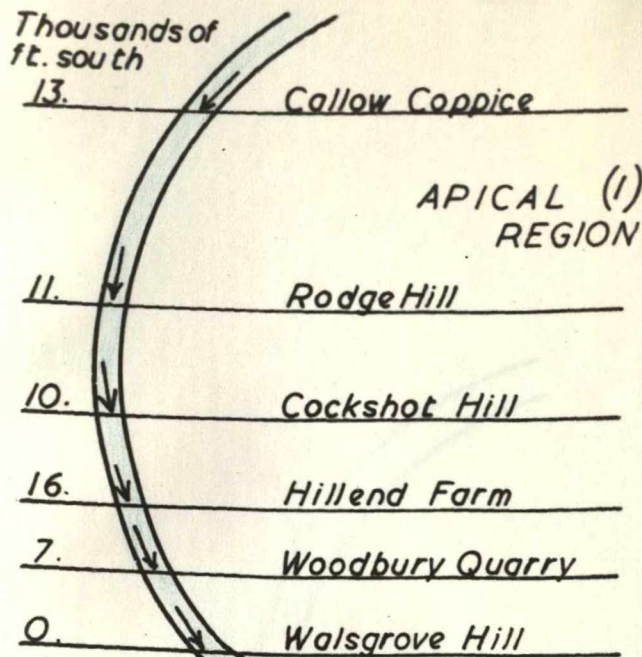
This map shows the main structural features of Woodbury Anticline

1. Unshaded — The folded foreland.

2. Diagonally shaded — First thrust mass.

3. Vertical and horizontal shading. — Second thrust mass.

4. Unshaded. — Unconformable Hatfield Breccia



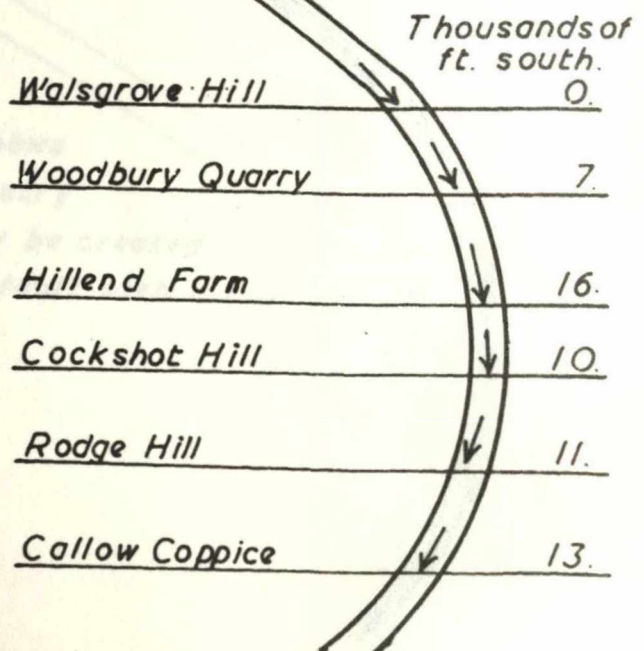
of the limestone outcrop.

The anticline, if it pitches, plunges to the south.

W.

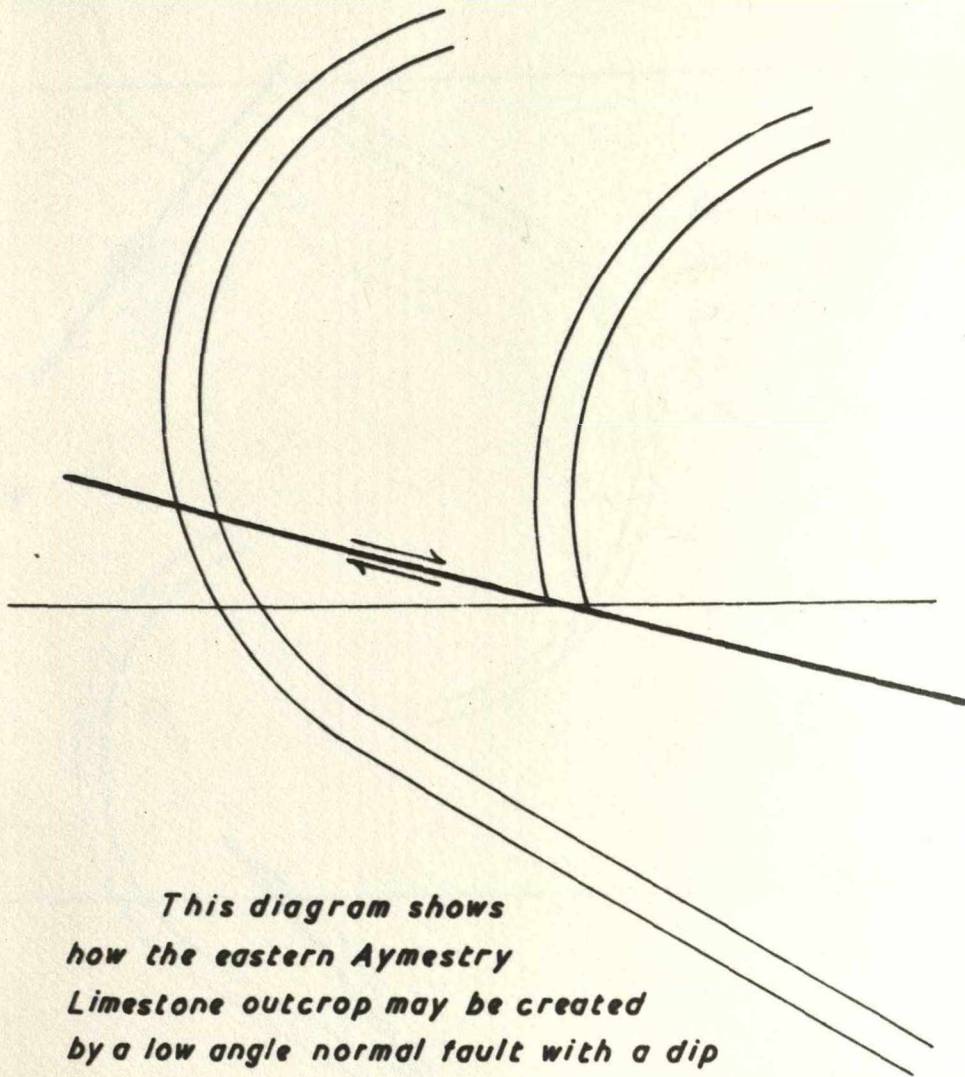
E.

**SYNCLINAL (2)
REGION**

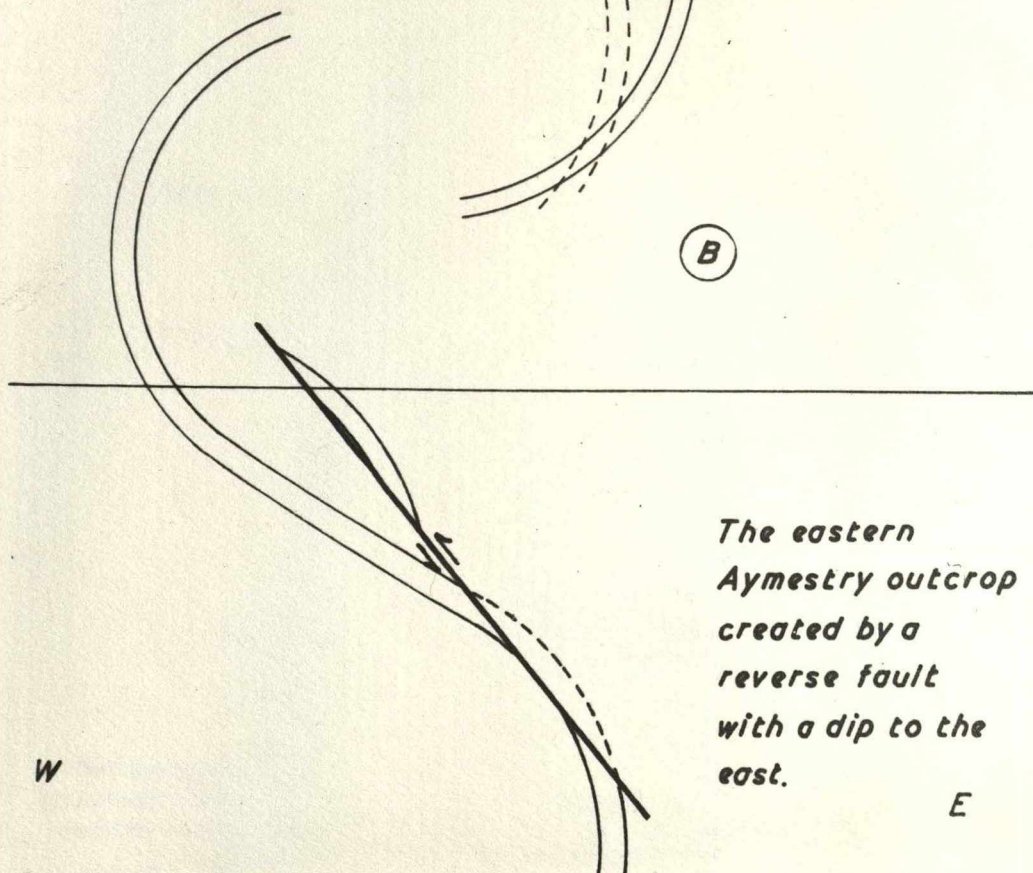
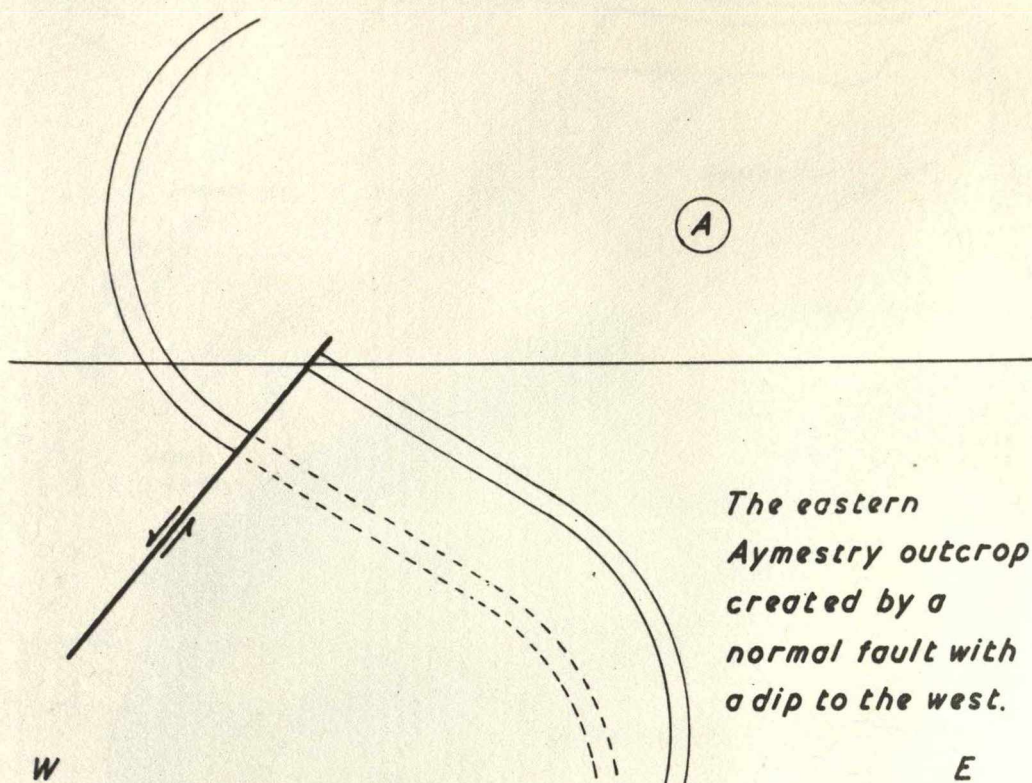


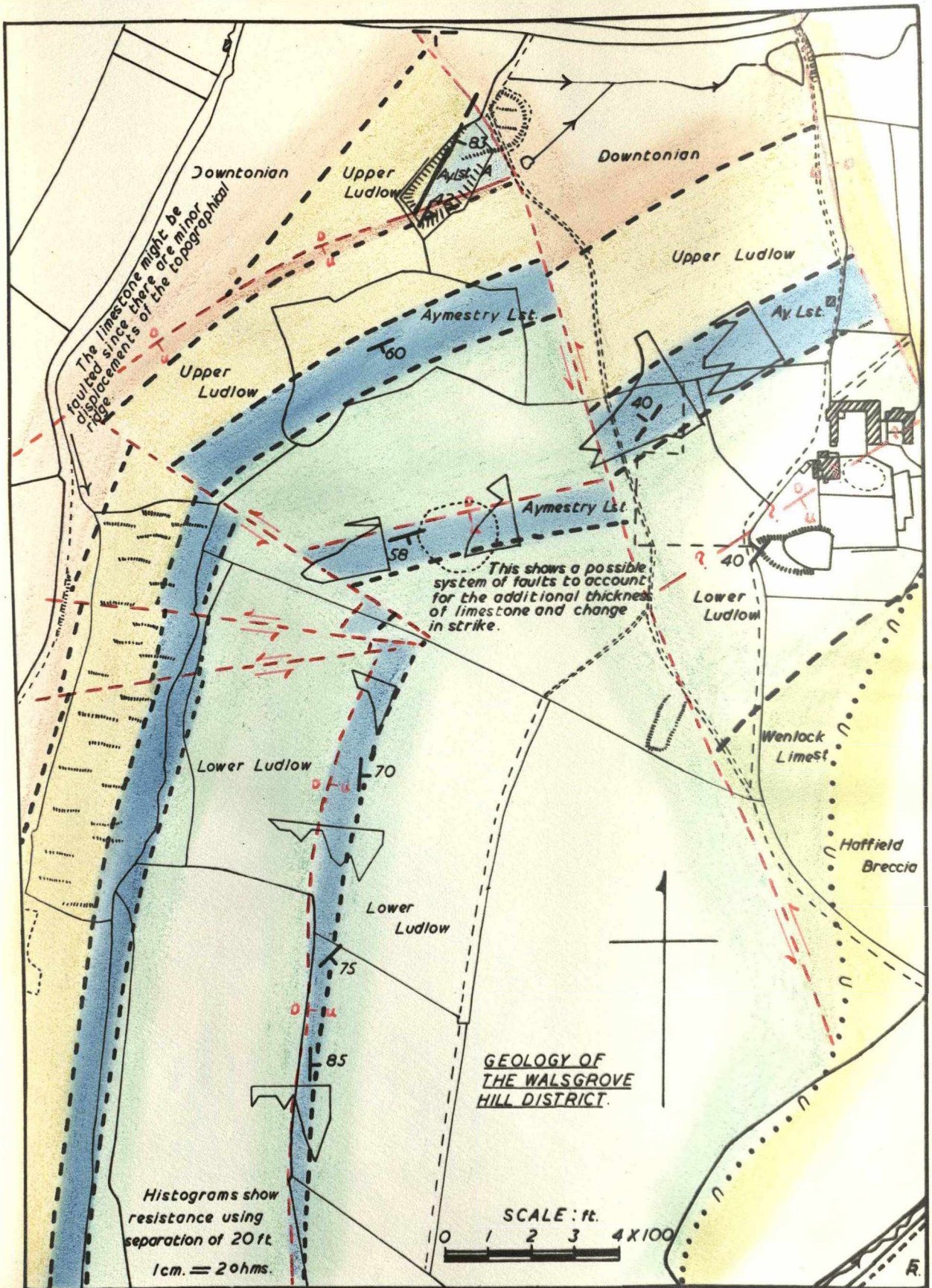
This diagram shows how various sections through the Aymestry Limestone of the western limb of Woodbury Anticline reveal that the fold is possible pitching.

The apical region (1) must be the portion of the fold involved in the present day erosion surface, since the synclinal portion creates a reversed plan view



*This diagram shows
how the eastern Aymestry
Limestone outcrop may be created
by a low angle normal fault with a dip
to the east.*



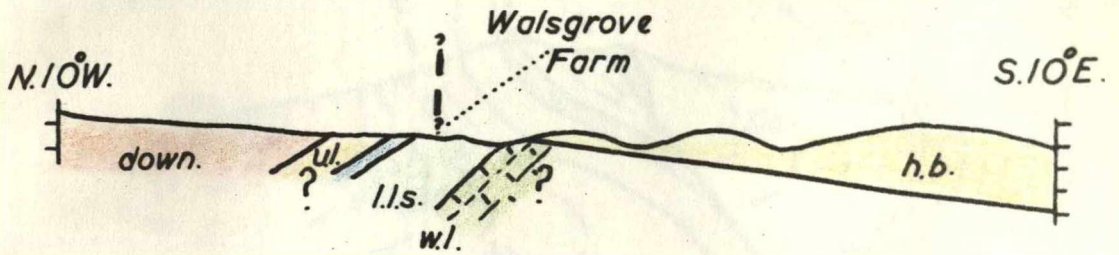


GEOLOGY OF THE WALSGROVE HILL DISTRICT.

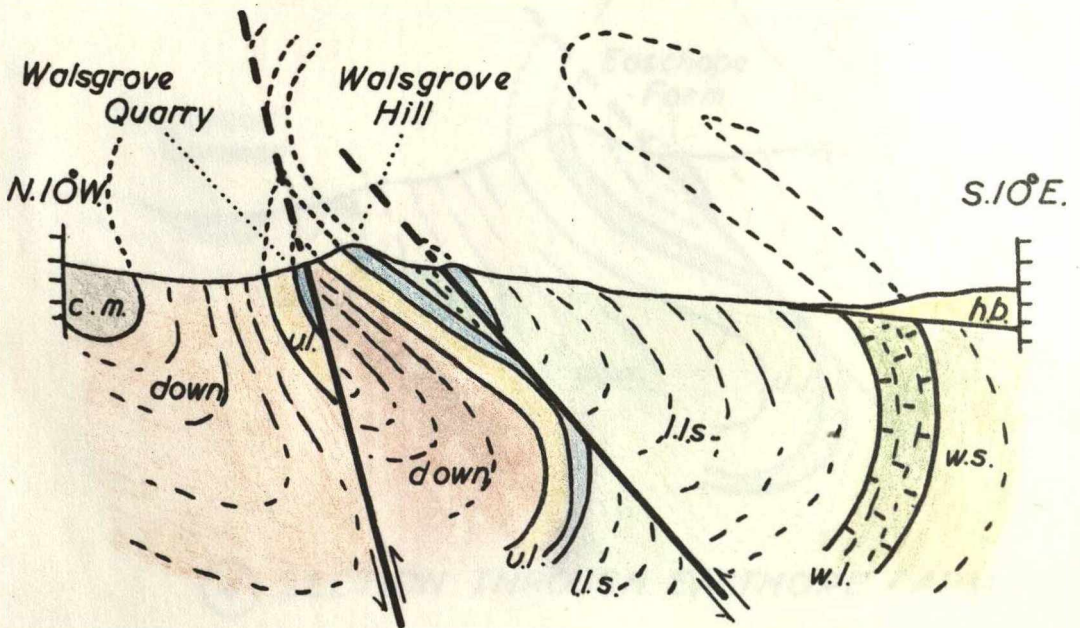
SCALE: ft.



Histograms show resistance using separation of 20 ft.
1 cm. = 2 ohms.

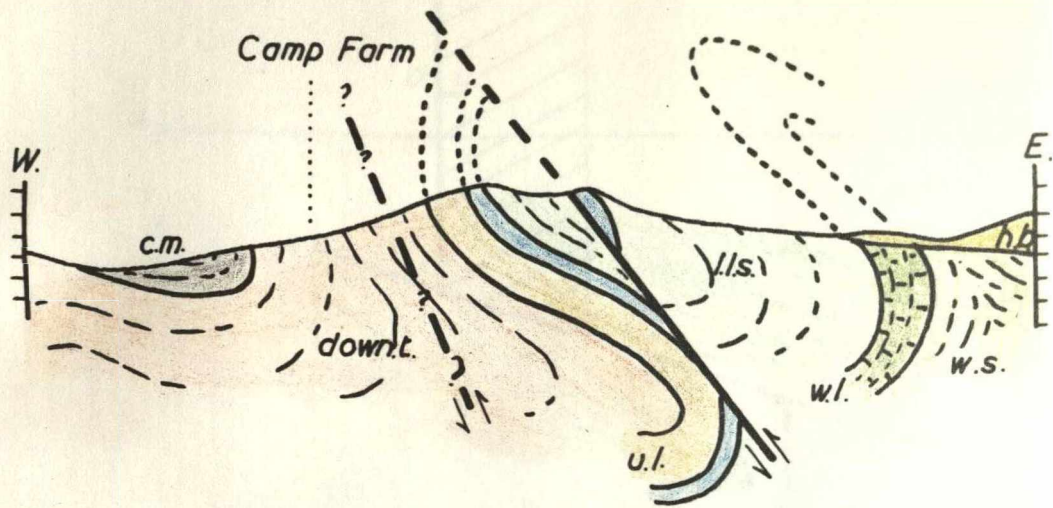


① SECTION THROUGH WALSGROVE FARM

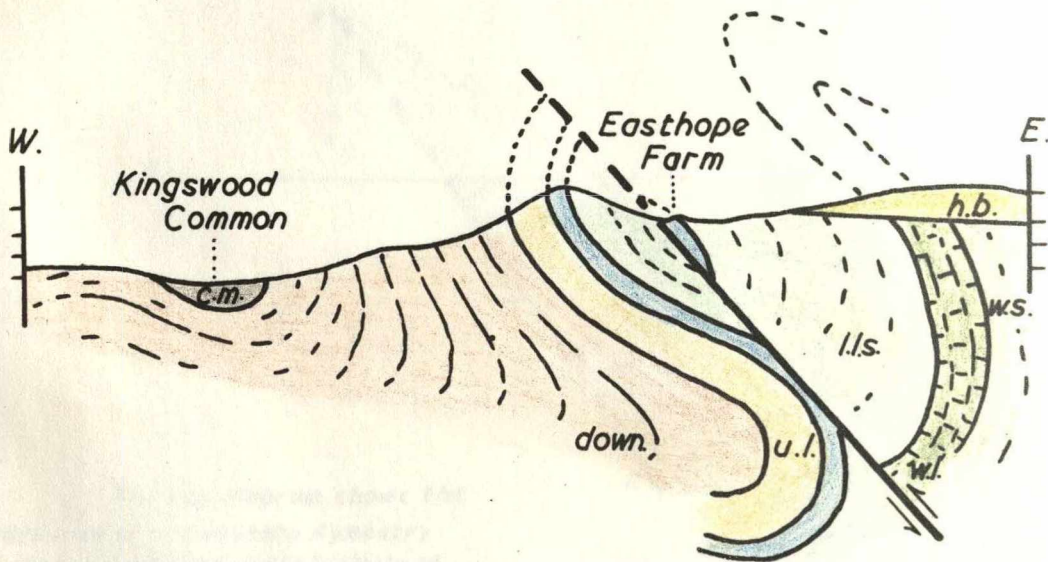


② SECTION THROUGH WALSGROVE FARM

Horzt. & Vert. Scales. 6 ins = 1 mile.

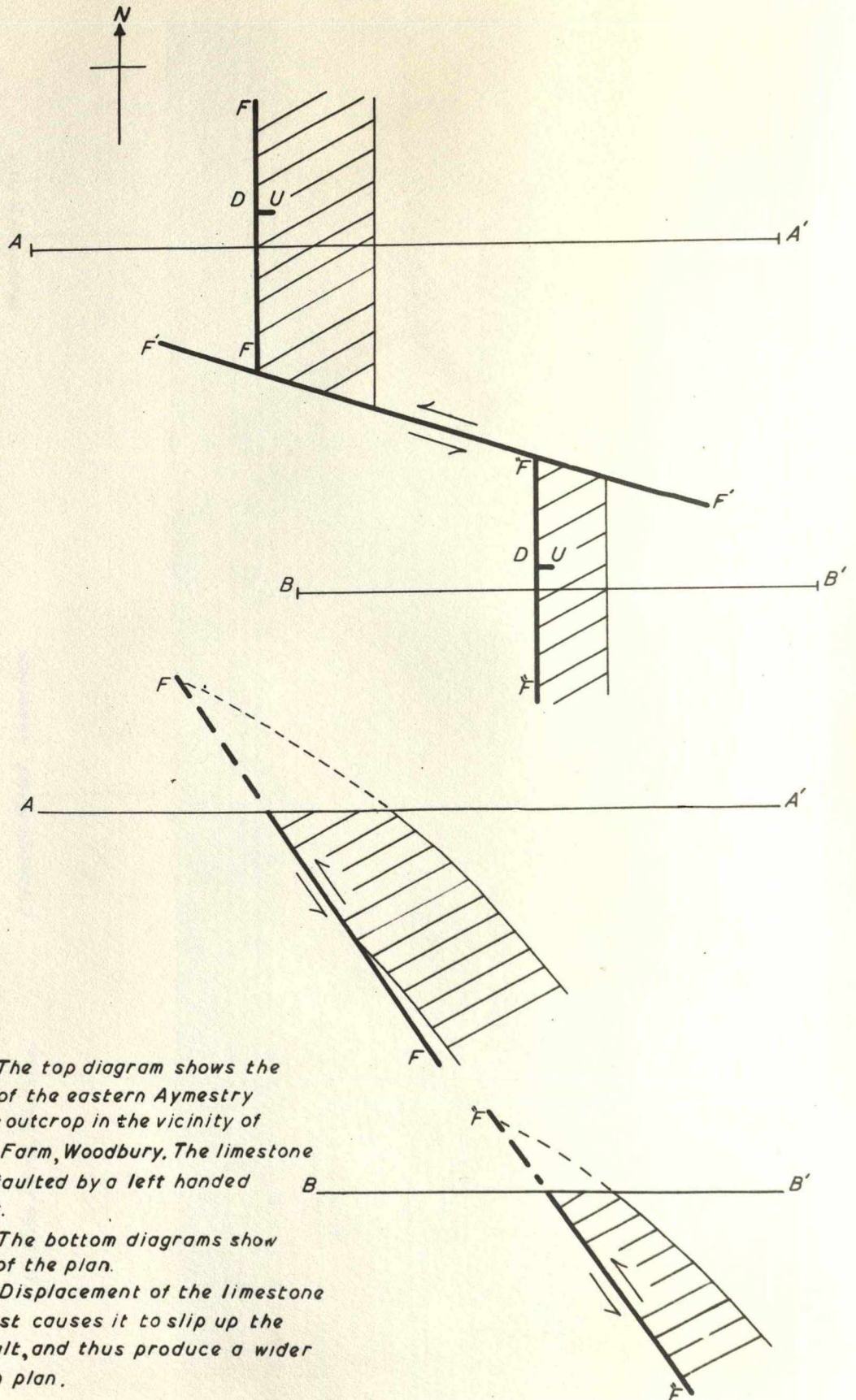


③ SECTION THROUGH CAMP FARM



④ SECTION THROUGH EASTHOPE FARM

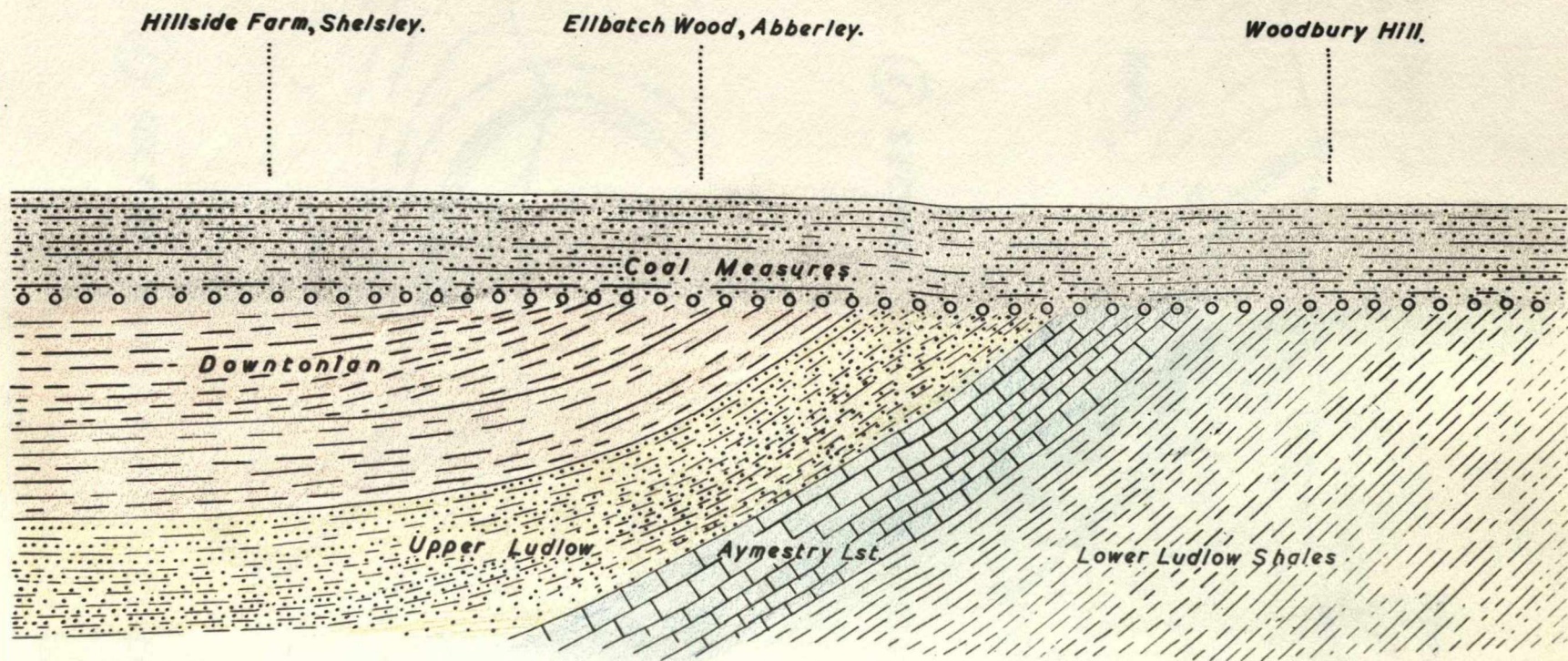
Hortz. & Vert. Scales
6 ins = 1 mile



The top diagram shows the plan view of the eastern Aymestry Limestone outcrop in the vicinity of Easthope Farm, Woodbury. The limestone has been faulted by a left handed

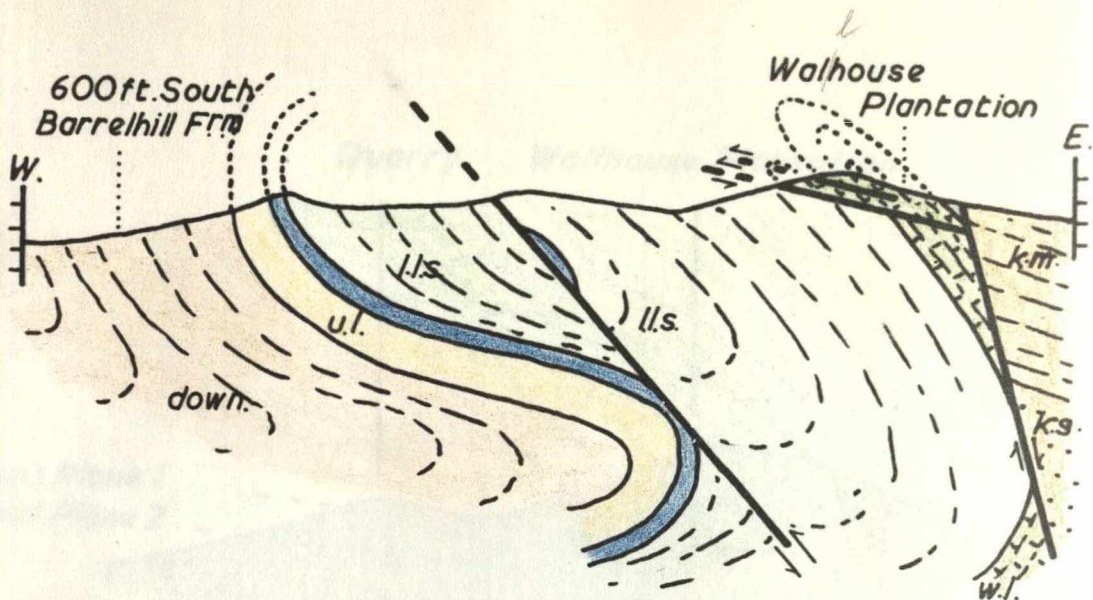
The bottom diagrams show sections of the plan.

Displacement of the limestone to the west causes it to slip up the strike fault, and thus produce a wider outcrop in plan.

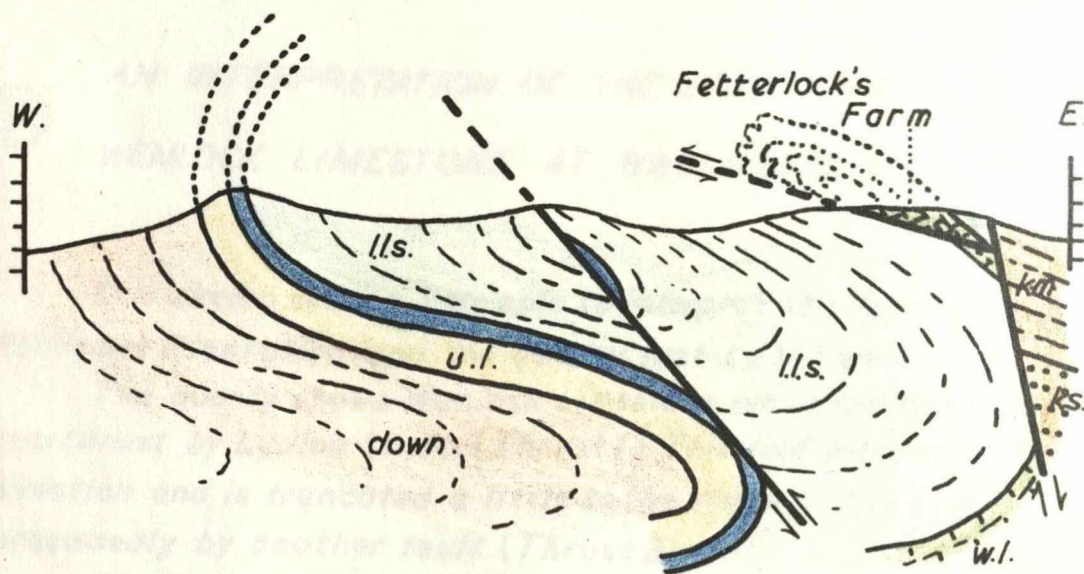


This diagram shows how the Coal Measures were possible deposited.

Further earth movements folded the whole into their present structure.

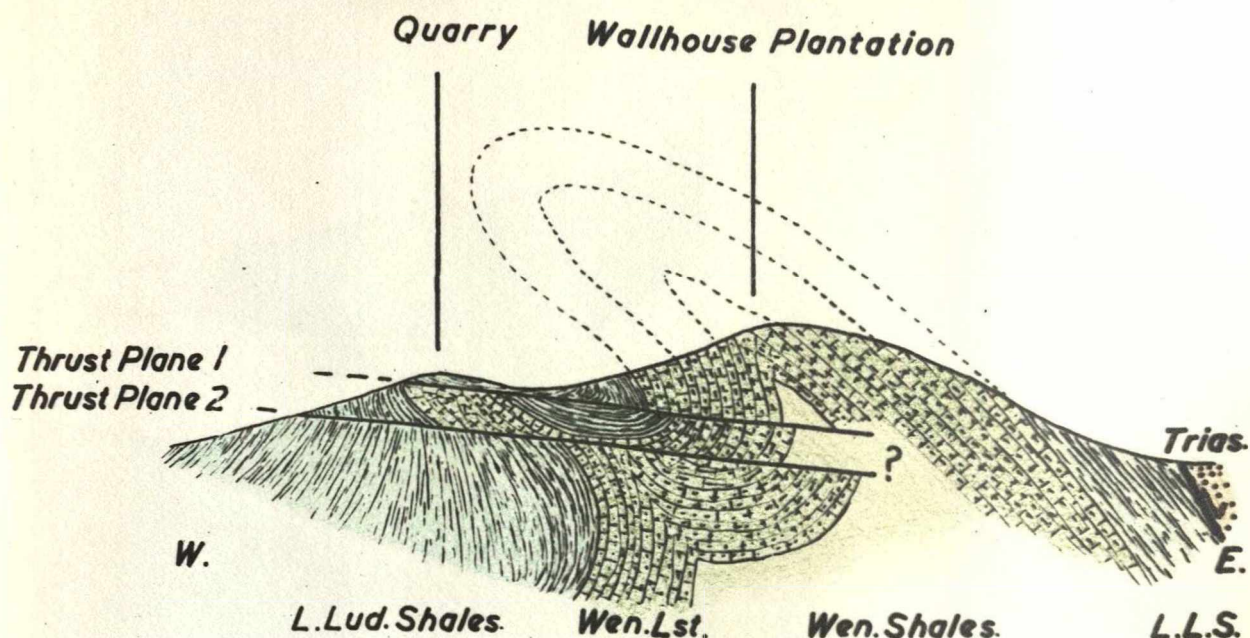


⑤ SECTION THROUGH WALHOUSE PLANTATION



⑥ SECTION THROUGH FETTERLOCKS FARM

Hortz. & Vert. Scales. 6 ins = 1 mile



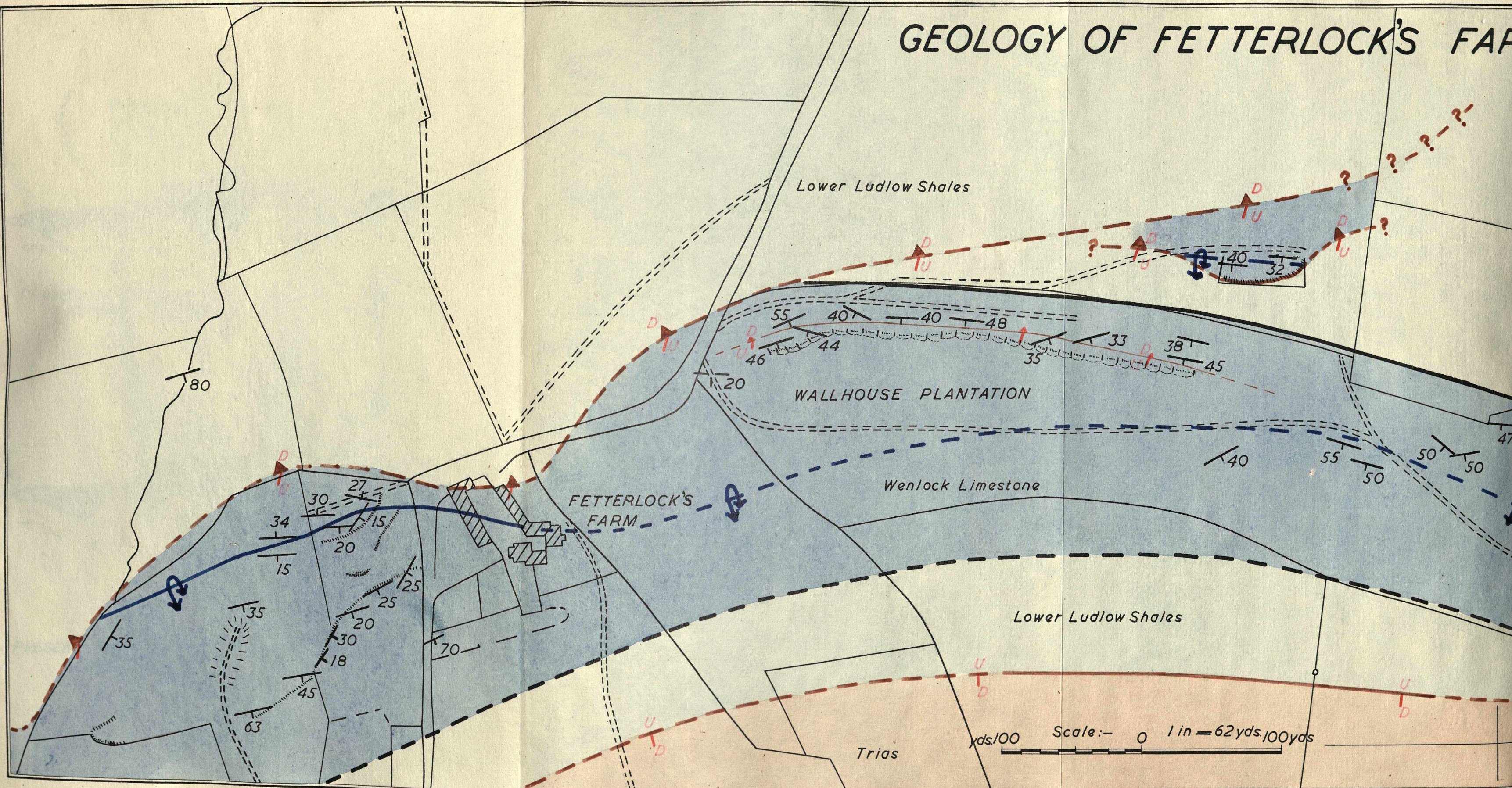
⑦ **AN INTERPRETATION OF THE STRUCTURE OF THE
WENLOCK LIMESTONE AT WALLHOUSE PLANTATION.**

The sketch section attempts to interpret the facts seen in Wallhouse Plantation and the quarry just to the west.

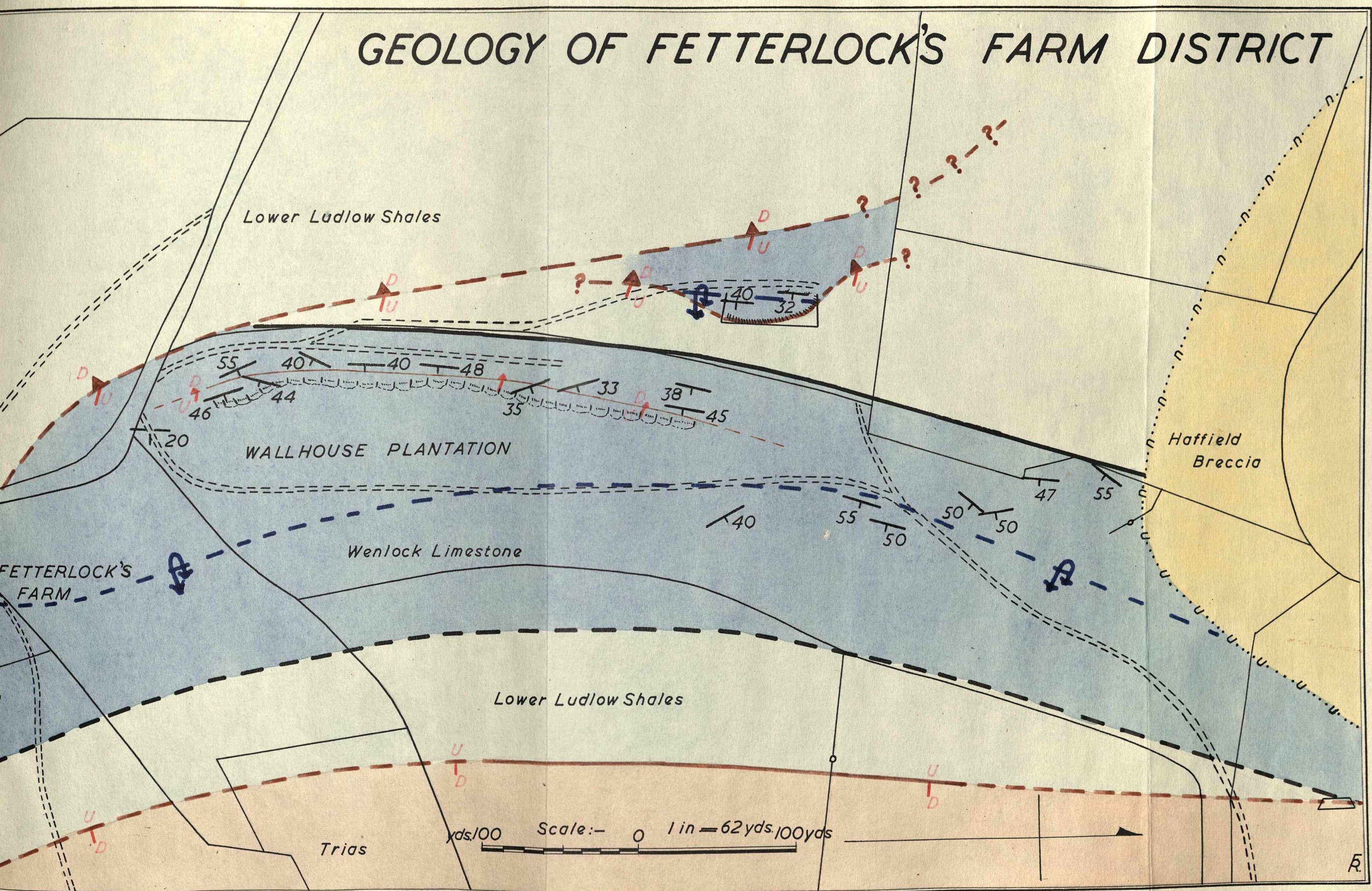
The quarry shows Weniock Limestone recumbently folded overthrust by Ludlow Shales (Thrust 1). This fold pitches in a N.N.E. direction and is truncated a little to the south of the quarry presumably by another fault (Thrust 2)

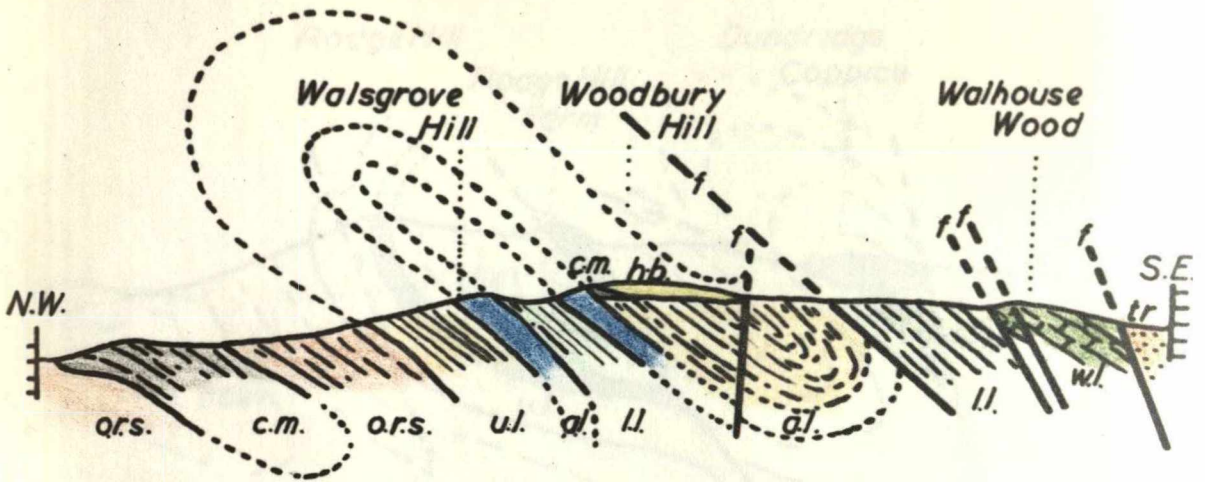
The Wallhouse quarries show inverted Wenlock Limestone dipping at approximately 50 deg. to the east. To the east again L. Ludlow Shales are found faulted against purple Keuper Marl.

GEOLOGY OF FETTERLOCK'S FARM

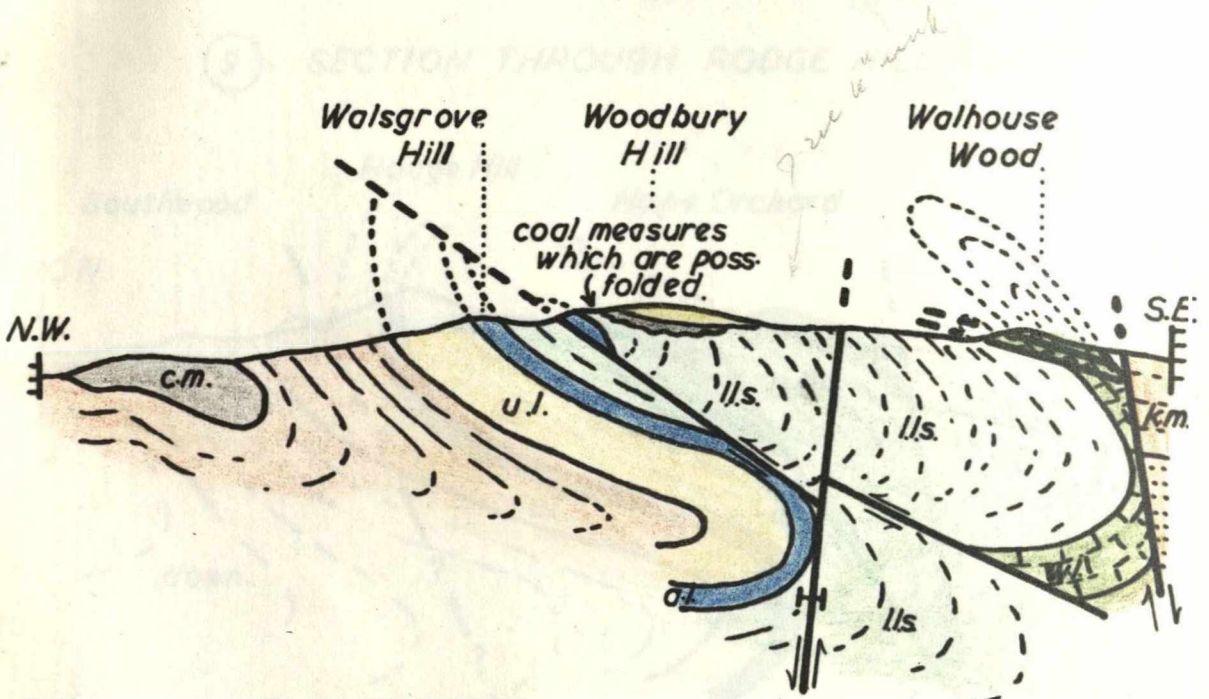


GEOLOGY OF FETTERLOCK'S FARM DISTRICT



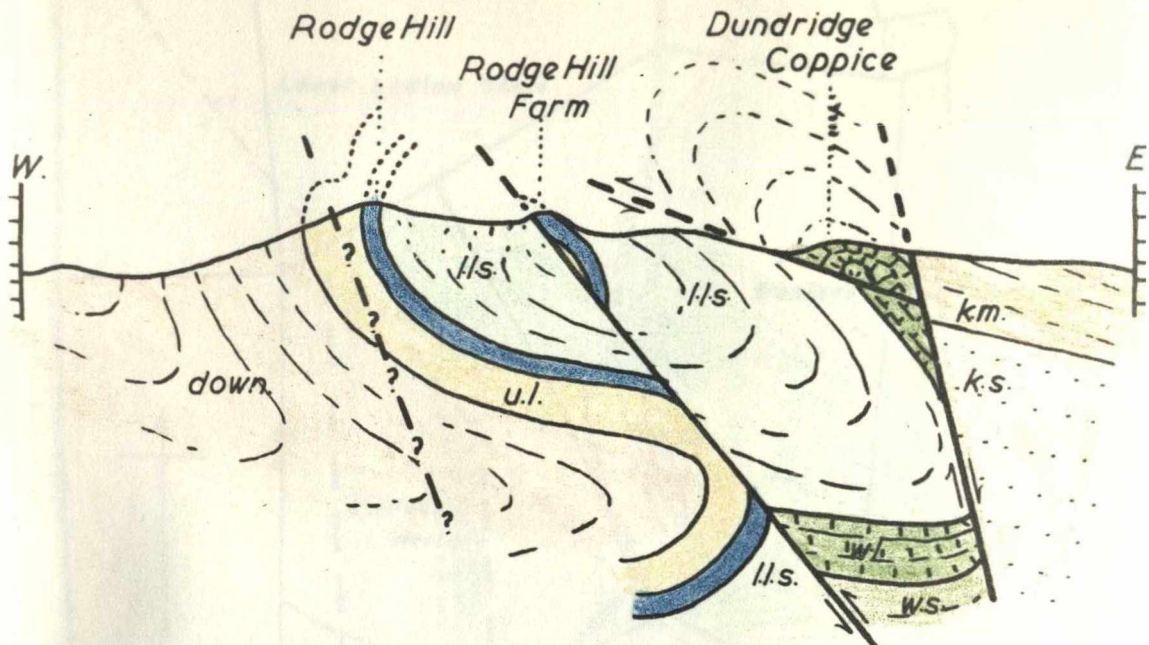


T.T. GROOMS INTERPRETATION OF THE SECTION ACROSS WALSGROVE AND WOODBURY HILLS.

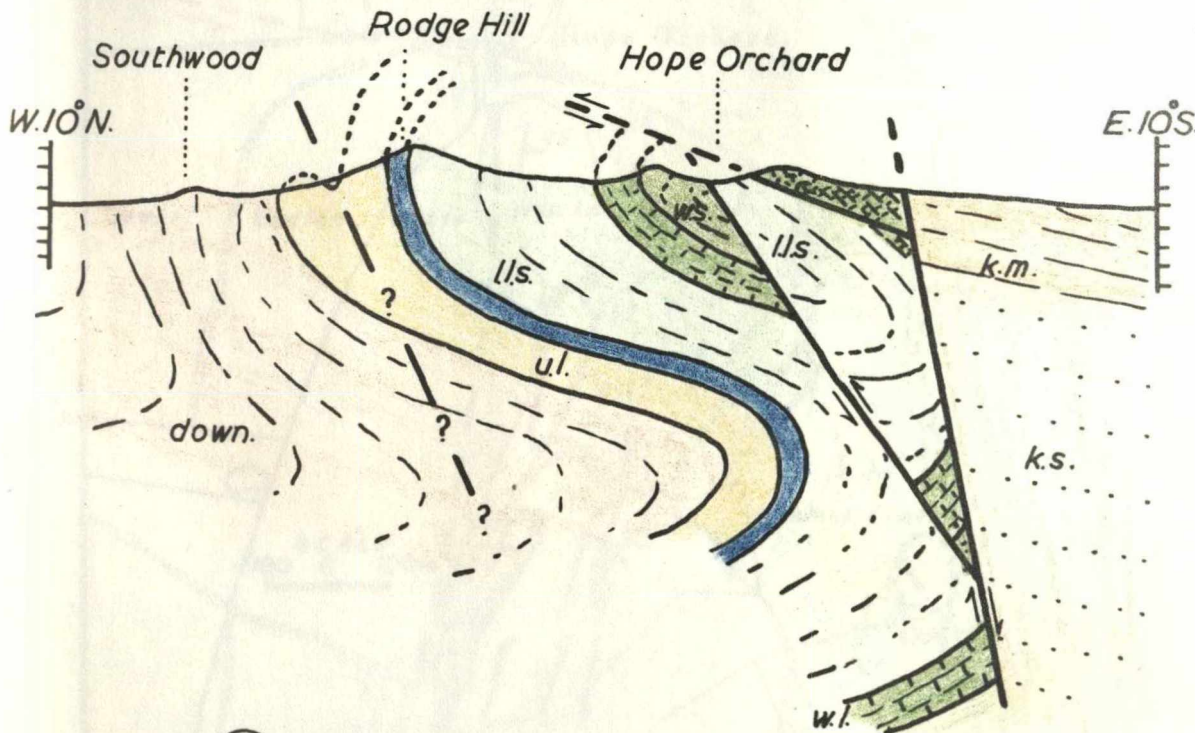


(B) PRESENT AUTHOR'S INTERPRETATION OF THE SECTION ACROSS WALSGROVE AND WOODBURY HILLS.

Hortz. & Vert. Scales 4 ins = 1 mile

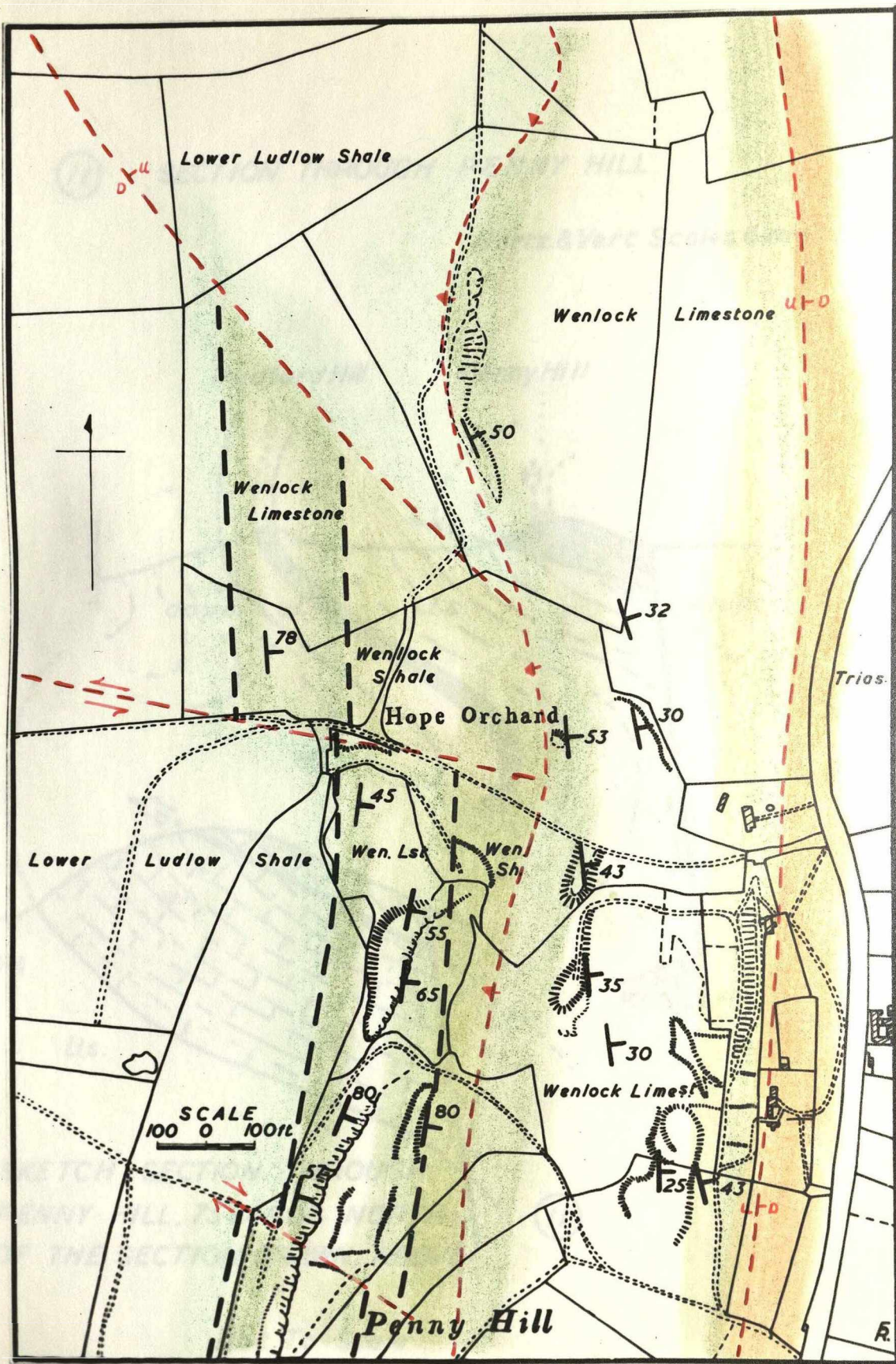


9 SECTION THROUGH RODGE HILL FARM



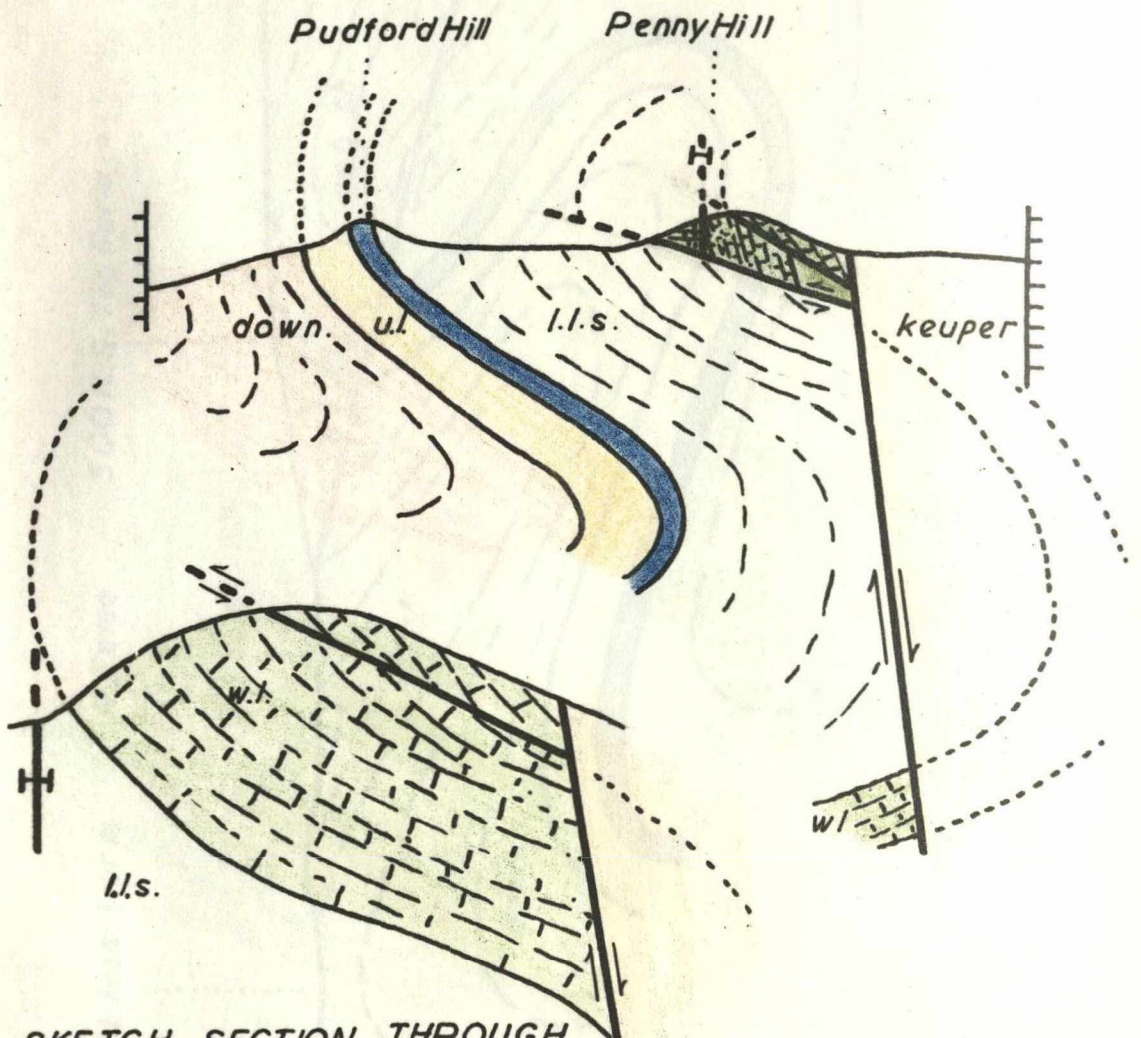
10 SECTION THROUGH HOPE ORCHARD

Hortz. & Vert. Scales 6 ins = 1 mile



(11) SECTION THROUGH PENNY HILL

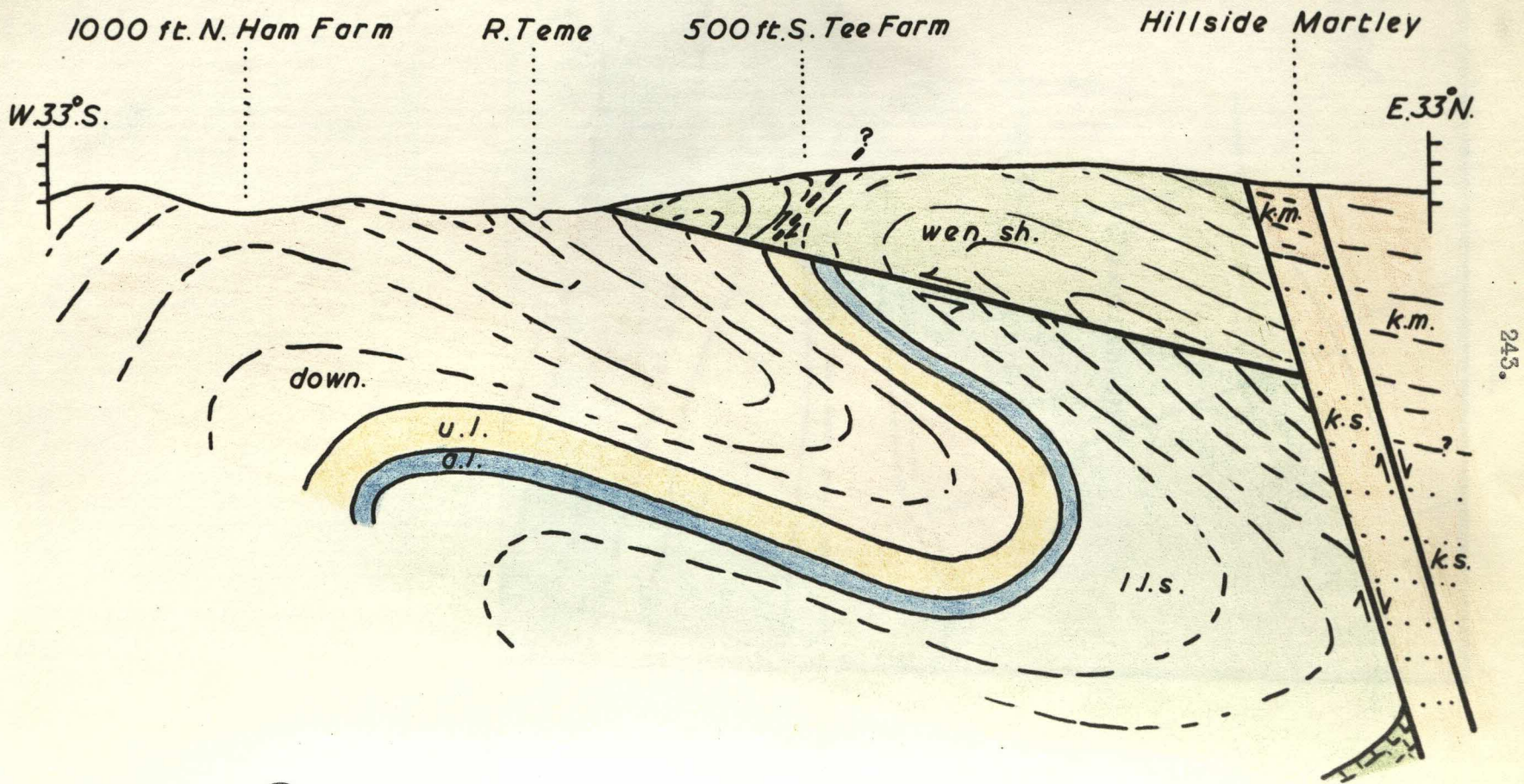
Hortz. & Vert Scales, 6 ins = 1 mile



SKETCH SECTION THROUGH
PENNY HILL, 75 YARDS NORTH
OF THE SECTION DRAWN ABOVE

(11)

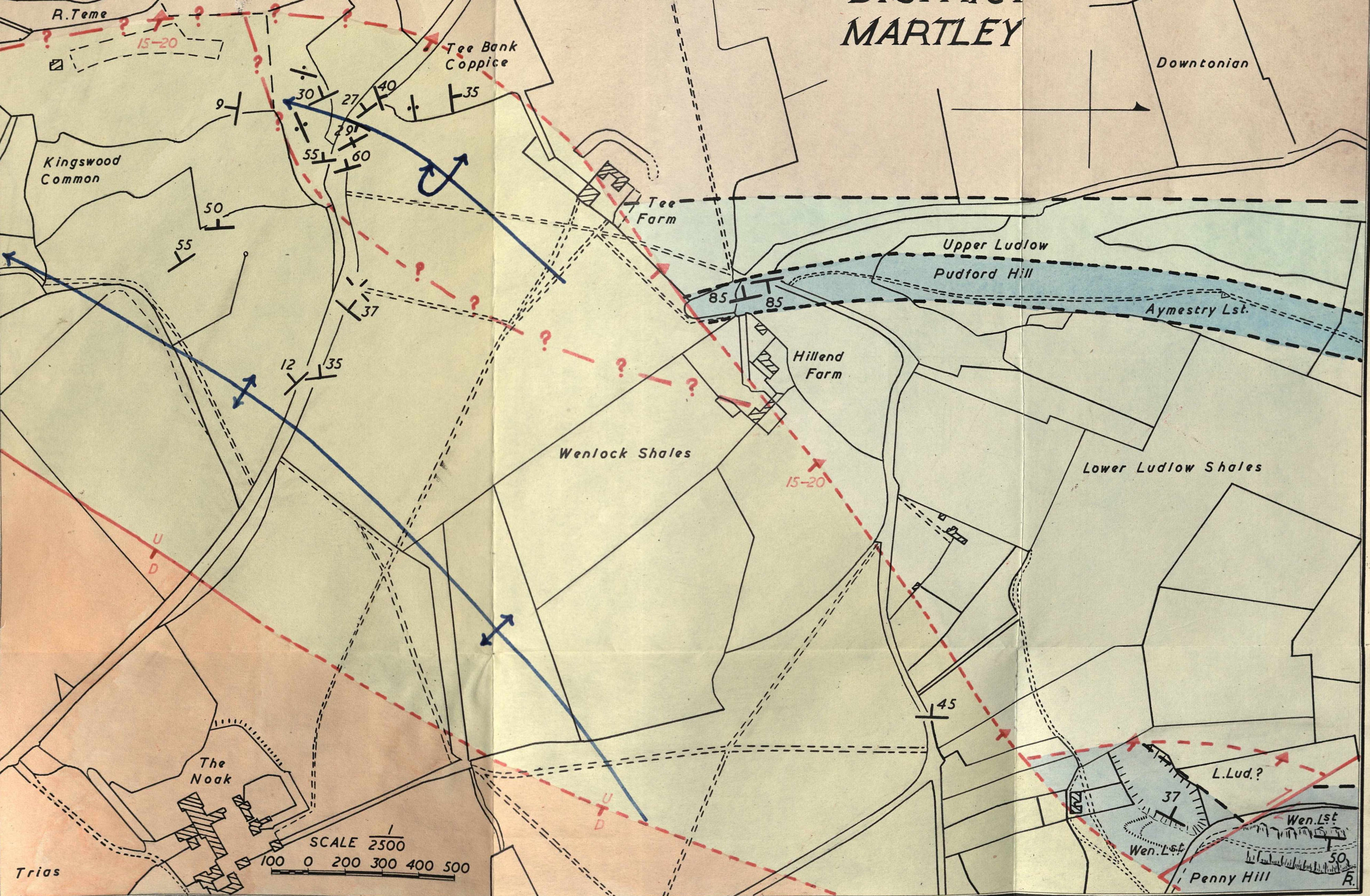
Not To Scale



⑫ SECTION THROUGH HILLEND MARTLEY

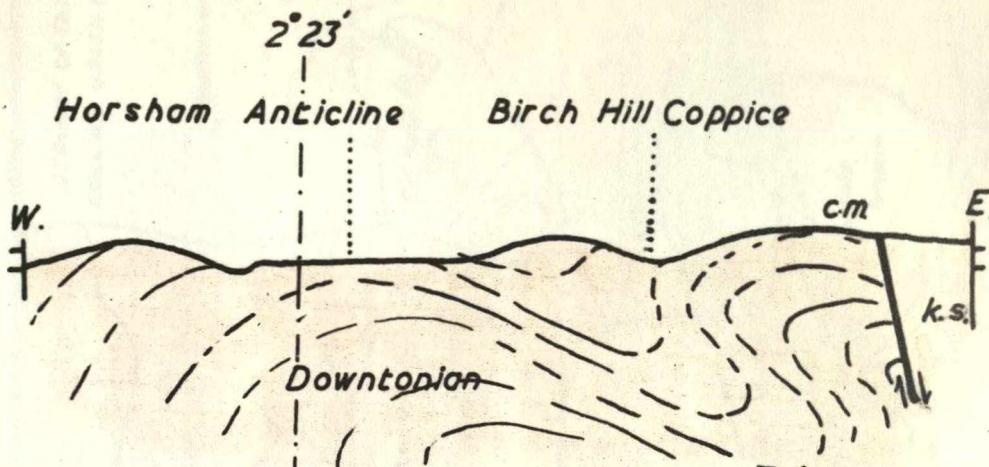
Hortz. & Vert. Scales. 6 ins = 1 mile.

HILLEND FARM DISTRICT MARTLEY

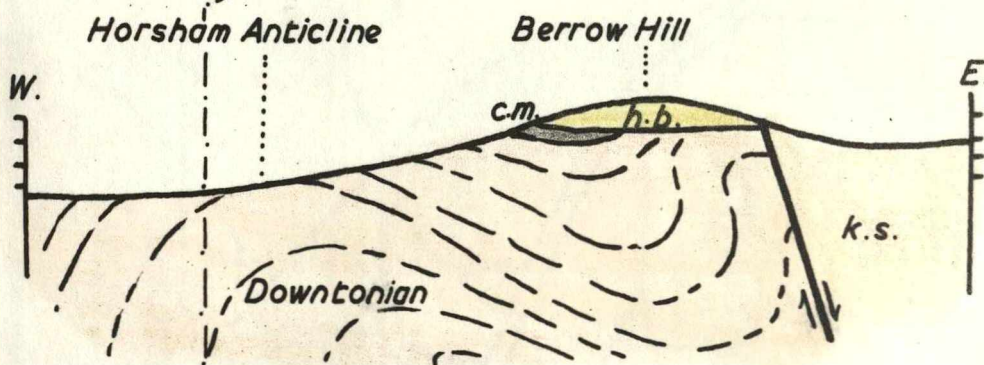


Trias

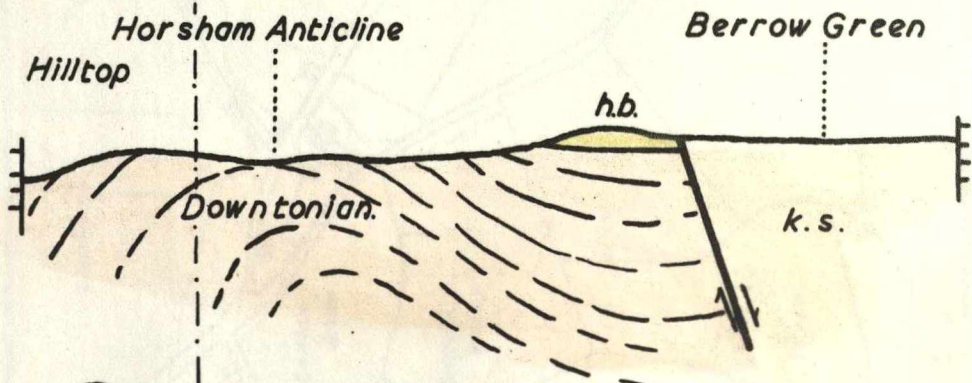
Penny Hill R.



(13) SECTION THROUGH BIRCH HILL COPPICE



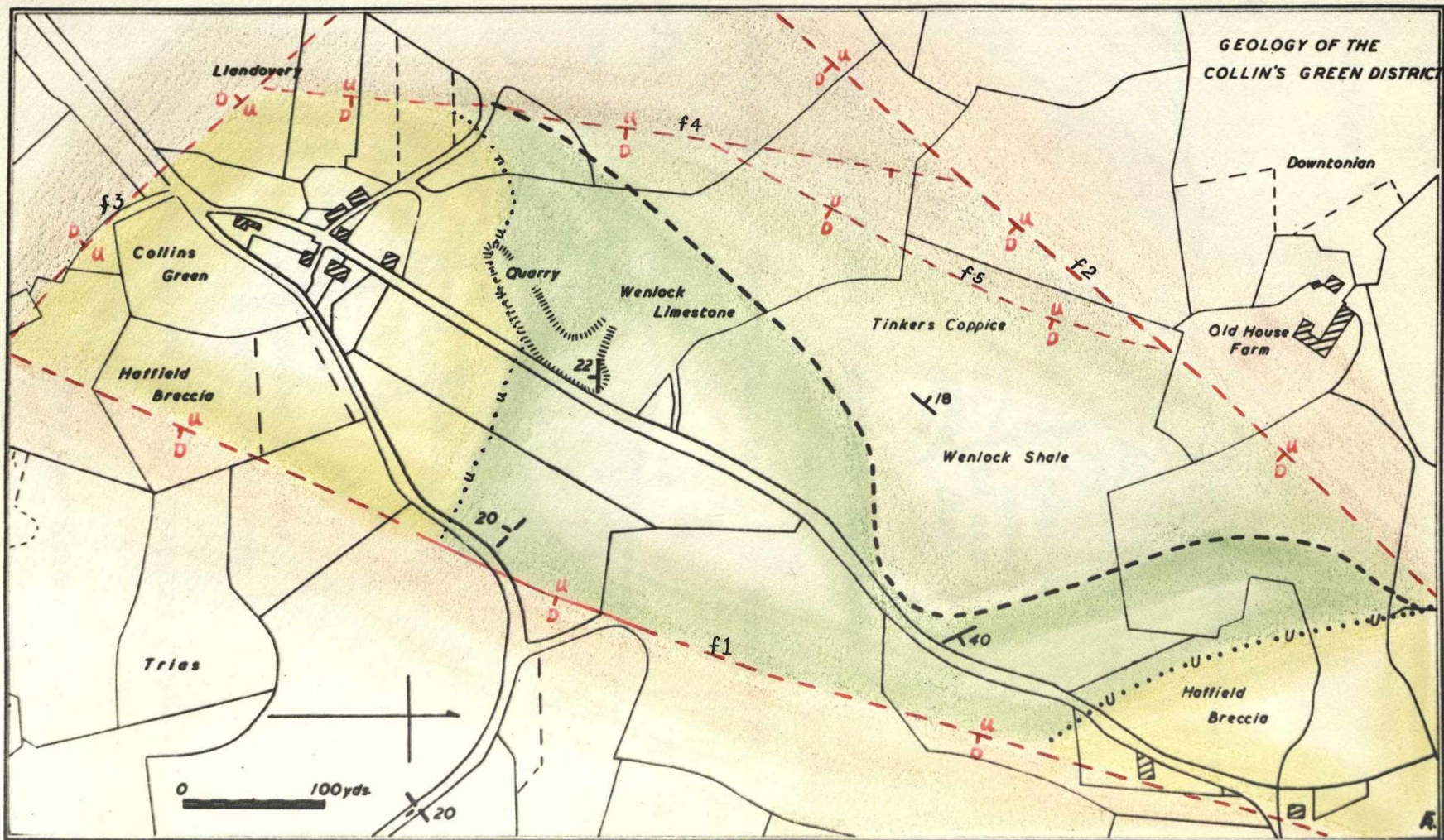
(14) SECTION THROUGH BERROW HILL

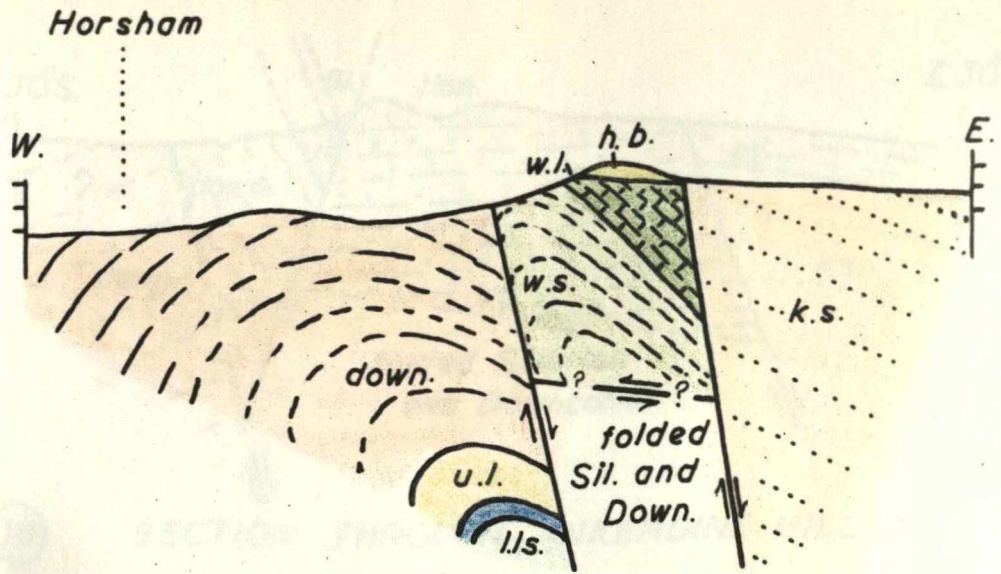


(15) SECTION THROUGH HILLTOP

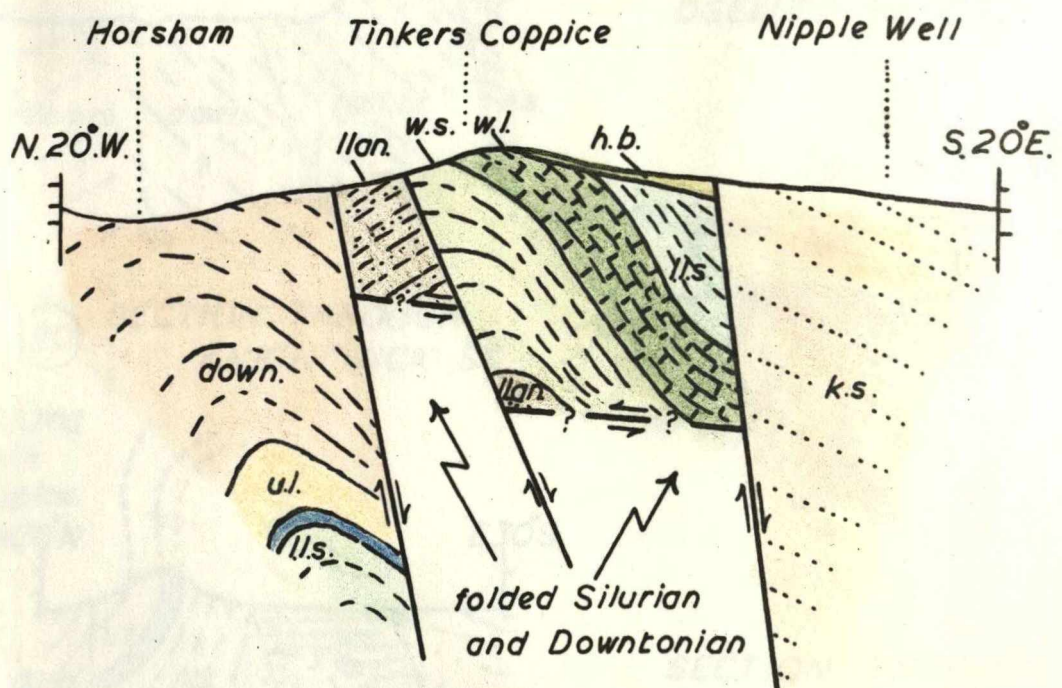
Hortz. & Vert Scales 6 ins = 1 mile

GEOLOGY OF THE
COLLINS GREEN DISTRICT





(16) SECTION THROUGH HORSHAM

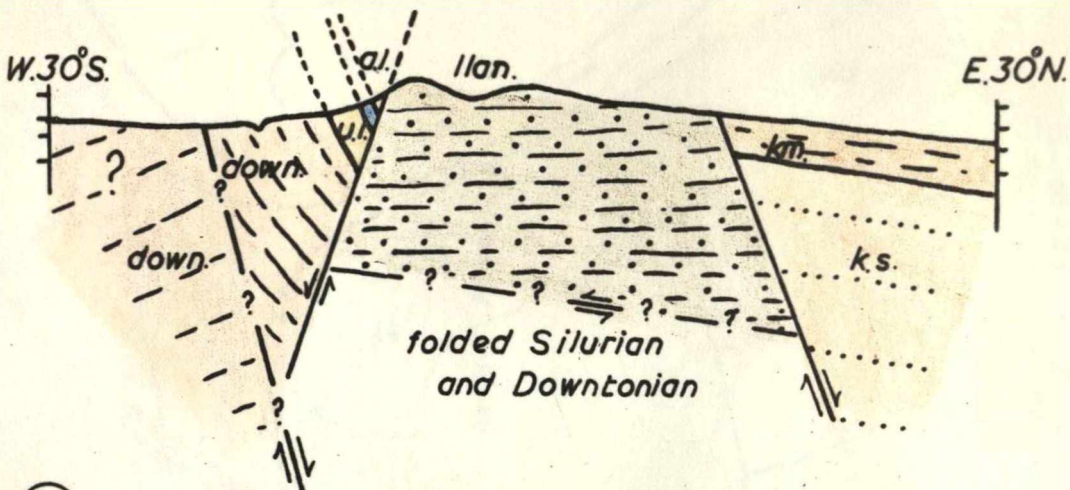


(17) SECTION THROUGH TINKERS COPPICE

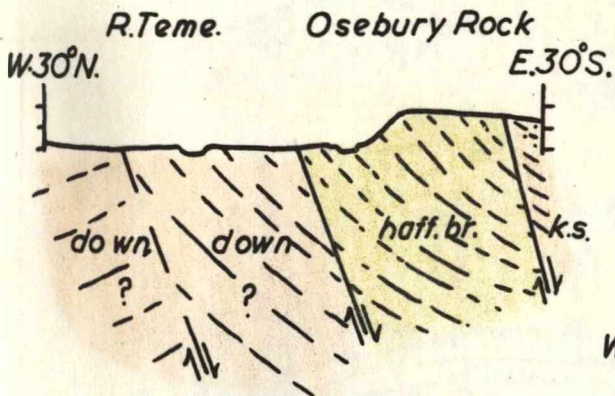
Hortz & Vert Scales 6 ins = 1 mile

R.

R Teme Ankerdine Hill Darby Green

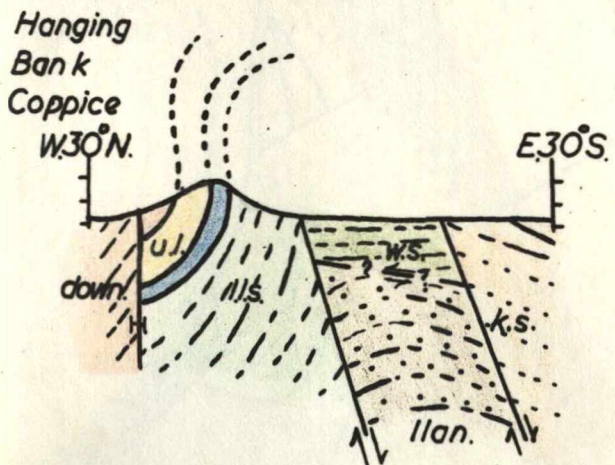
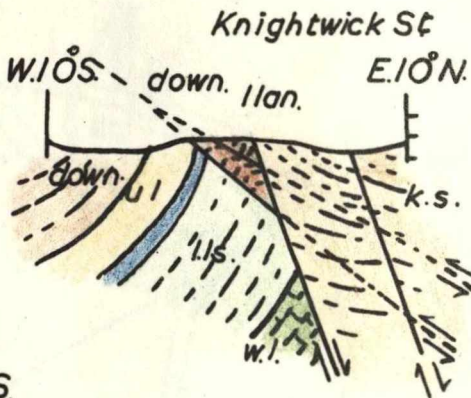


(18) SECTION THROUGH ANKERDINE HILL



(19) SECTION THROUGH OSEBURY ROCK

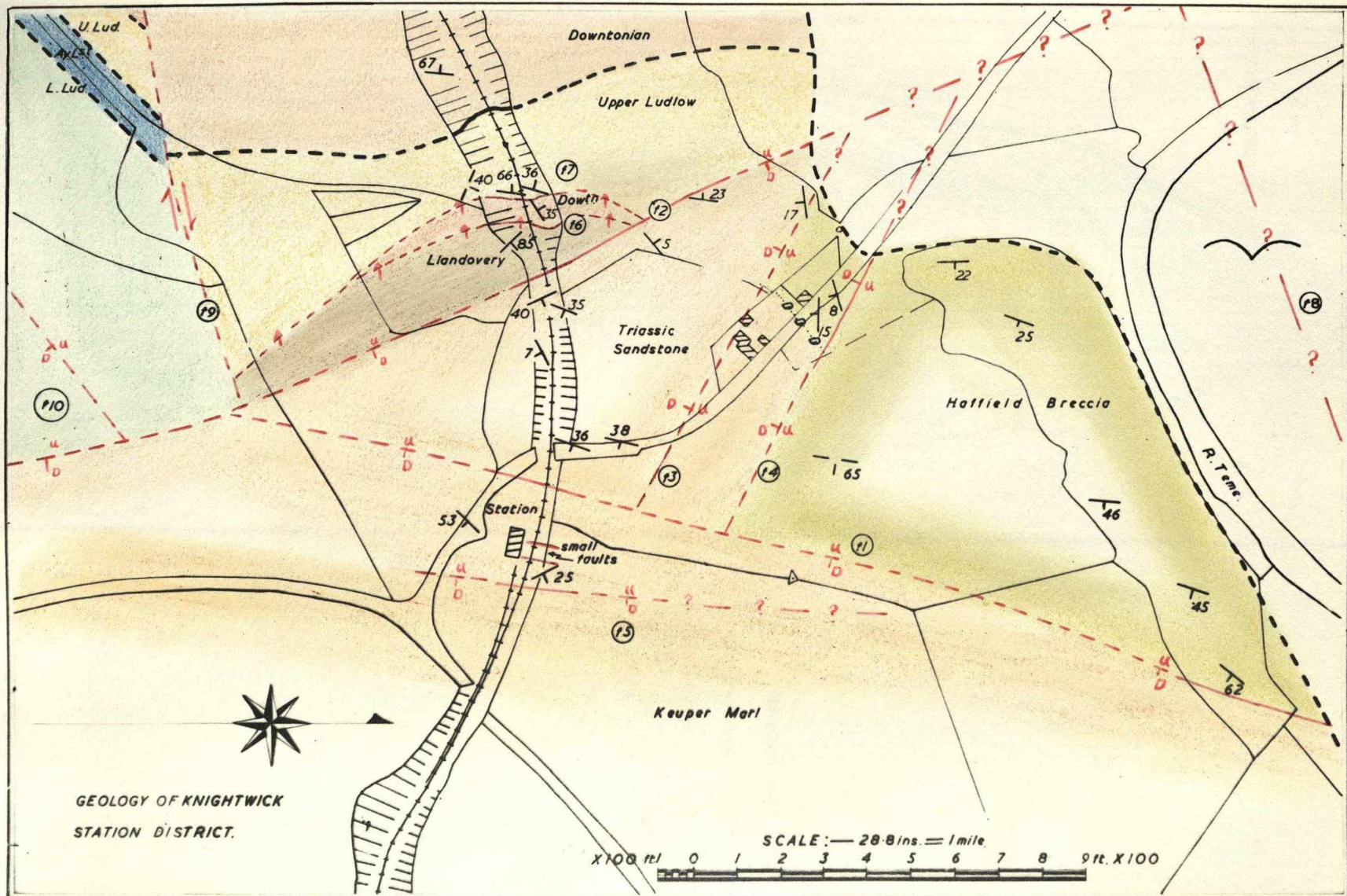
(20) SECTION THROUGH KNIGHTWICK ST.

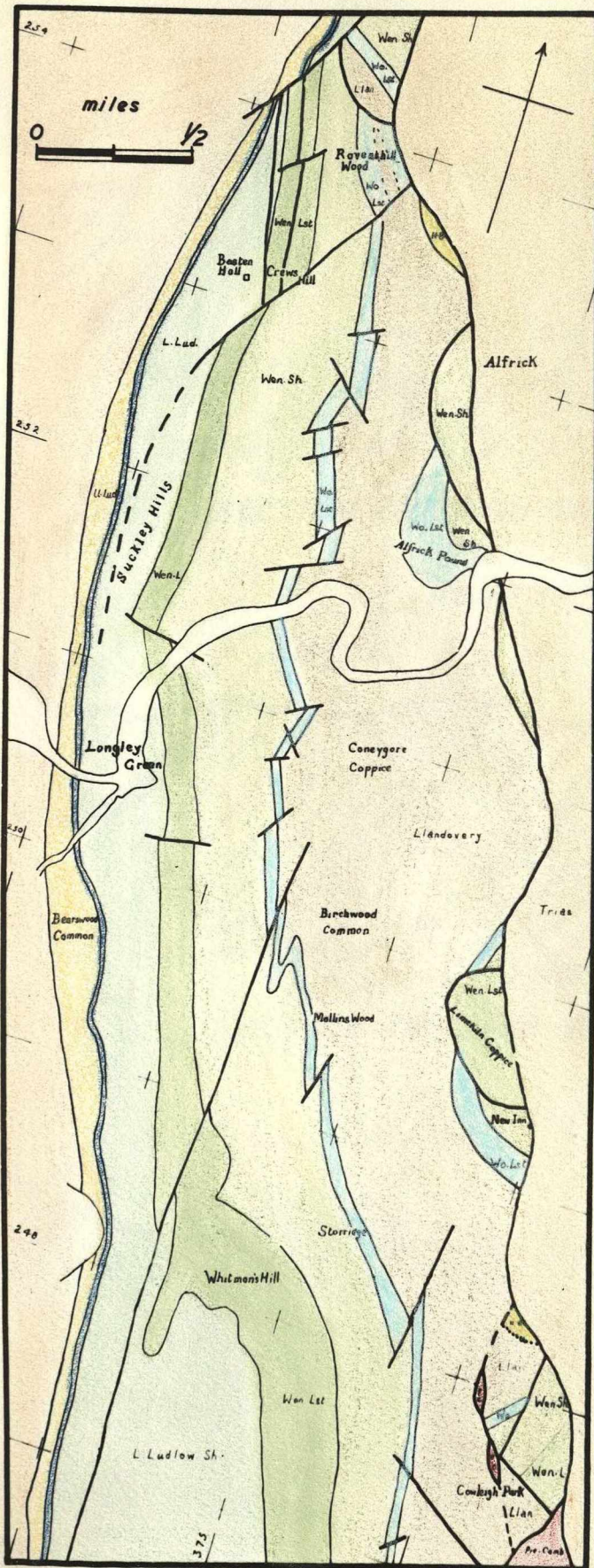


(21) SECTION THROUGH HANGING BANK COPPICE

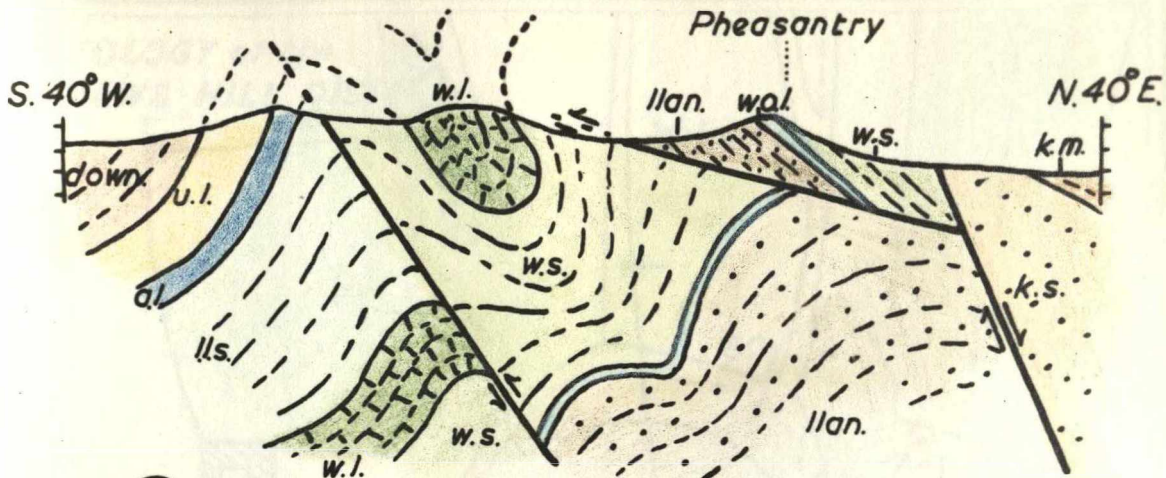
Hortz. & Vert. Scales 6ins.=1 mile

R.

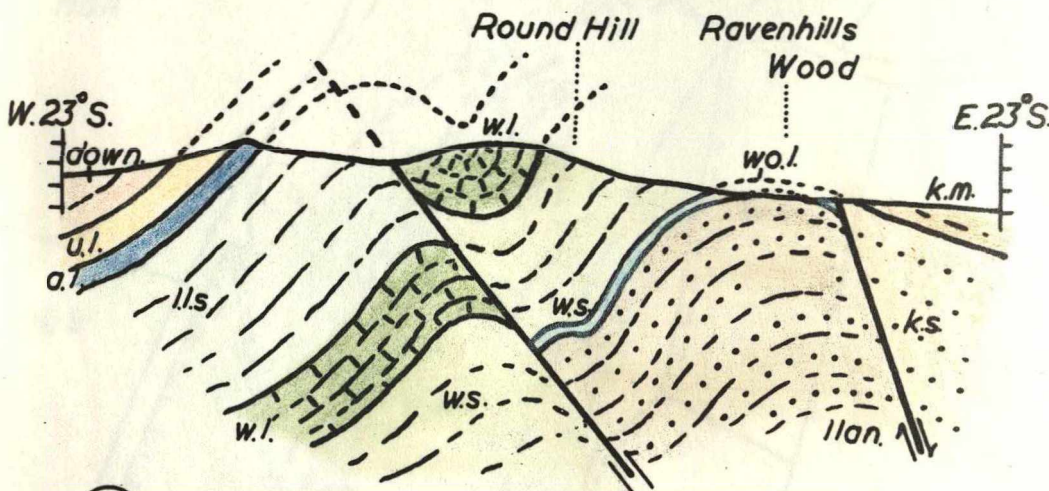




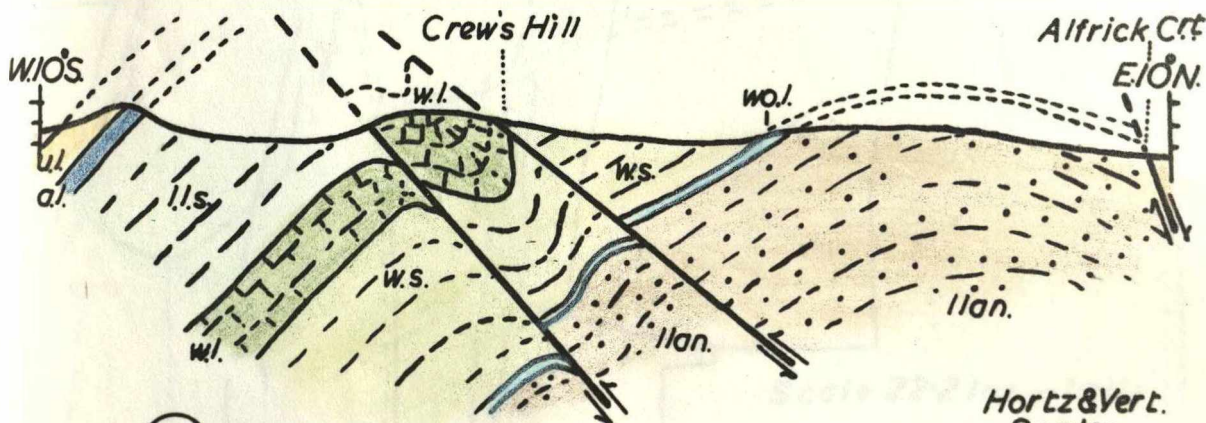
Sketch map showing the geology of Storridge Anticline.



22. SECTION THROUGH THE PHEASANTRY

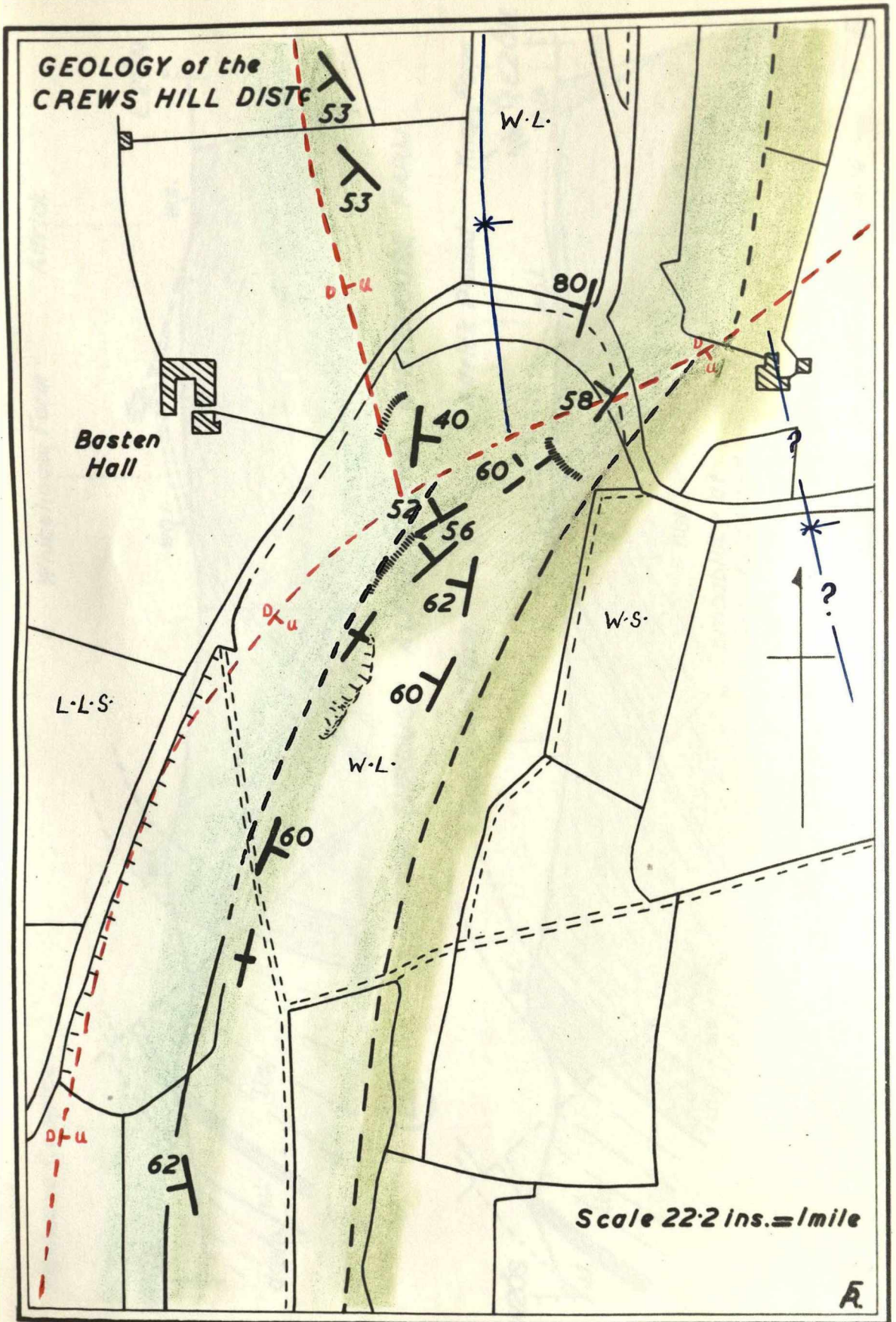


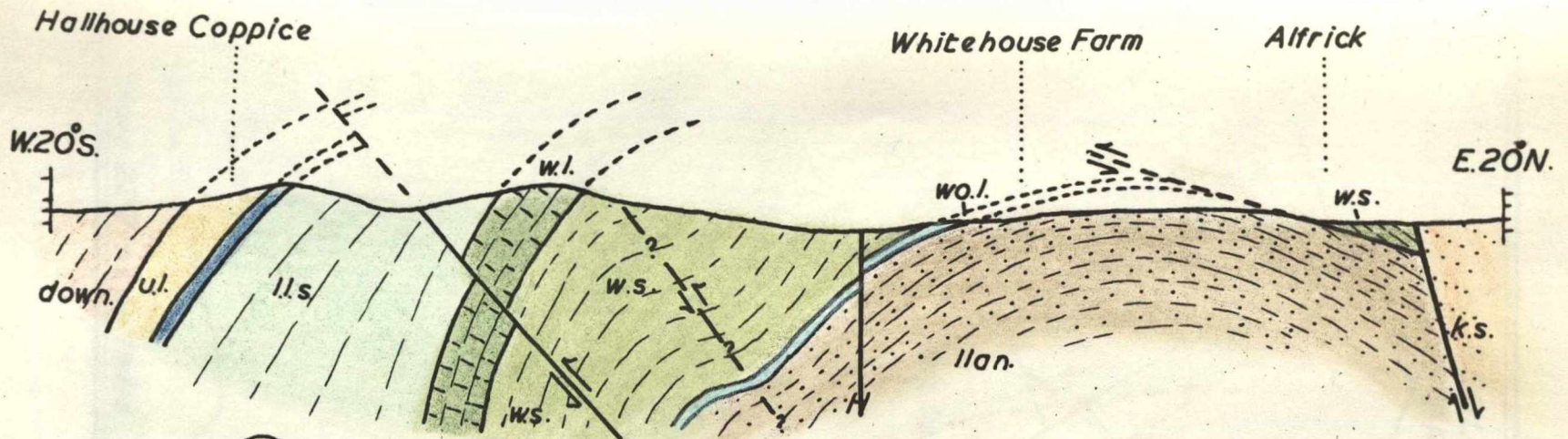
23. SECTION THROUGH ROUND HILL



24. SECTION THROUGH CREW'S HILL

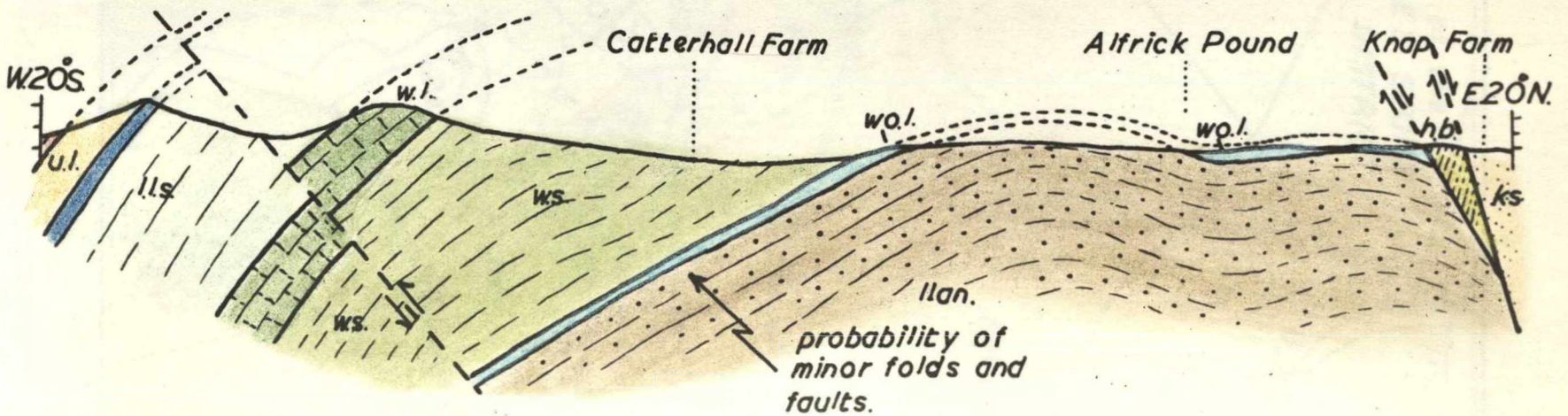
Hortz & Vert. Scales
 6 ins = 1 mile
 R.





(25)

SECTION THROUGH ALFRICK AND WHITEHOUSE FARM.



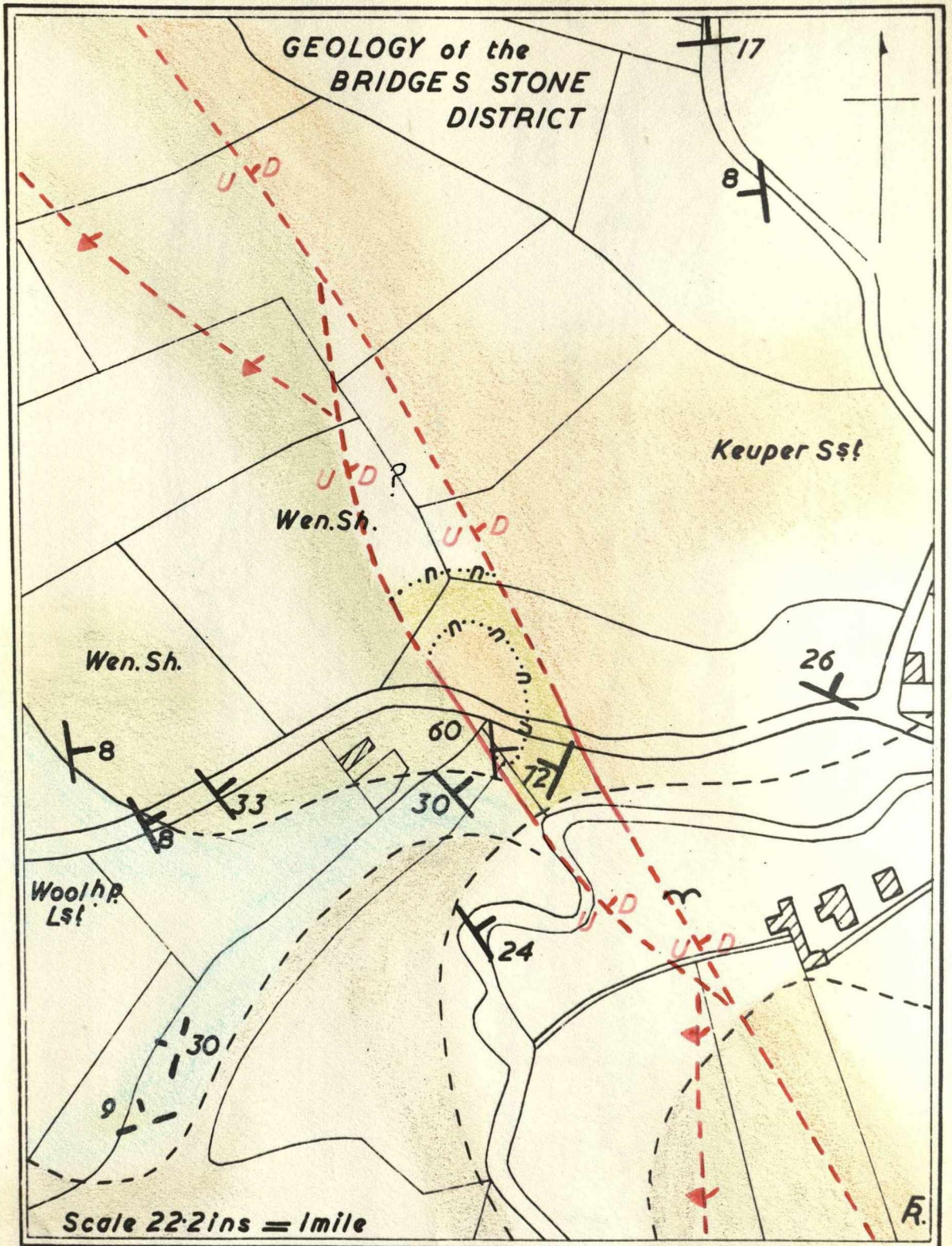
(26)

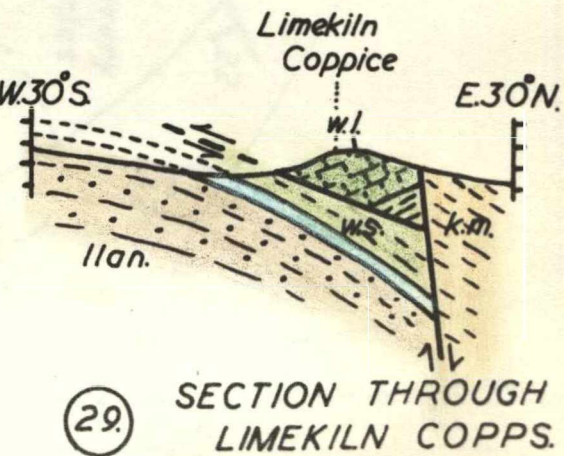
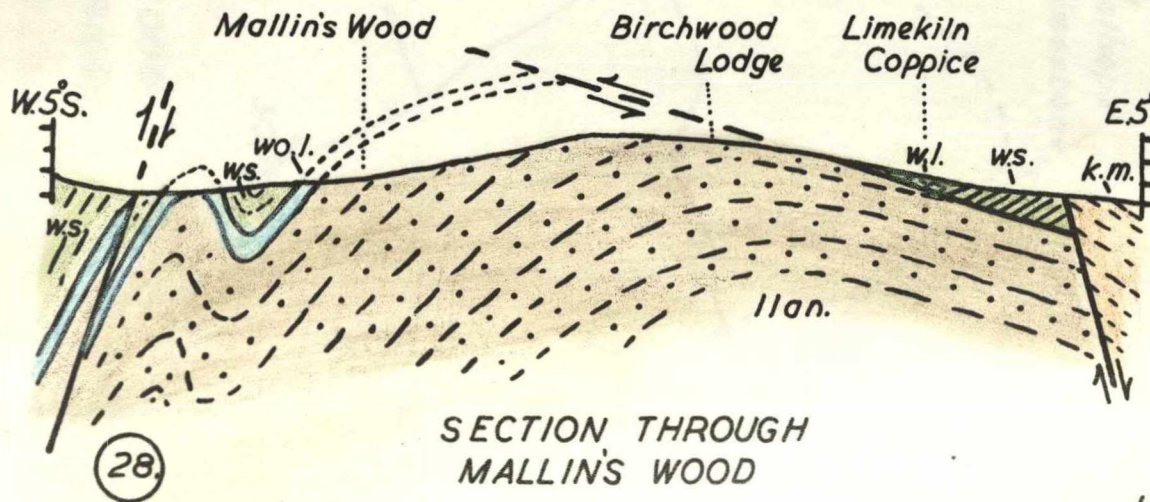
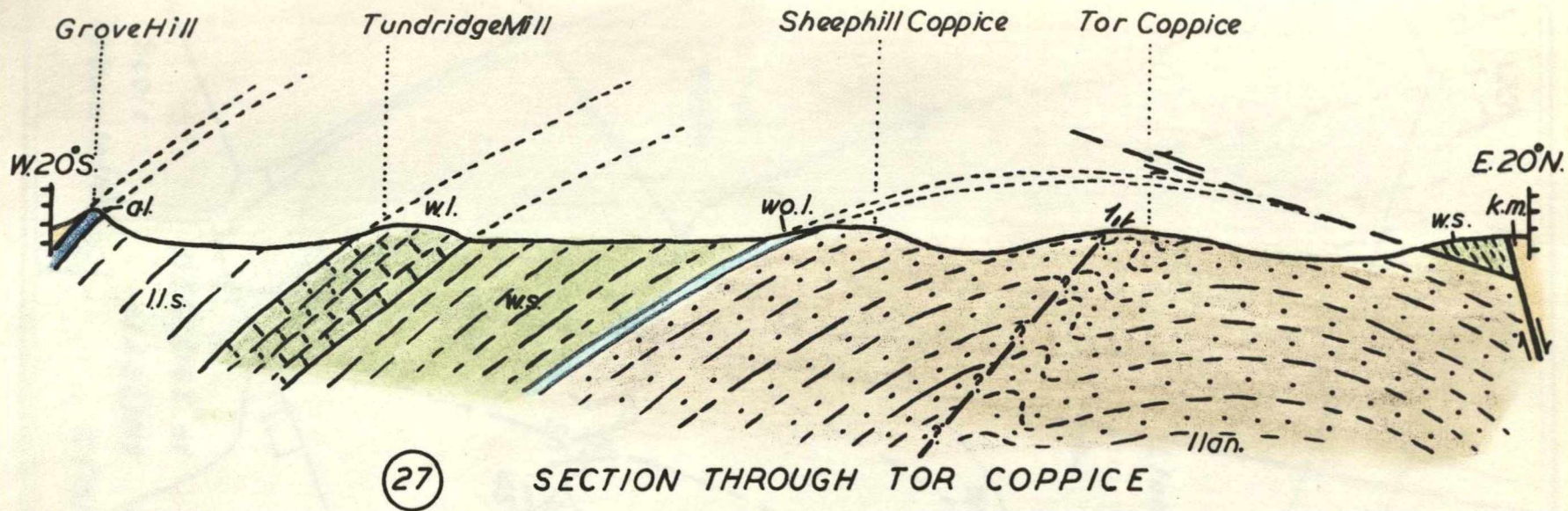
SECTION THROUGH ALFRICK POUND

probability of
minor folds and
faults.

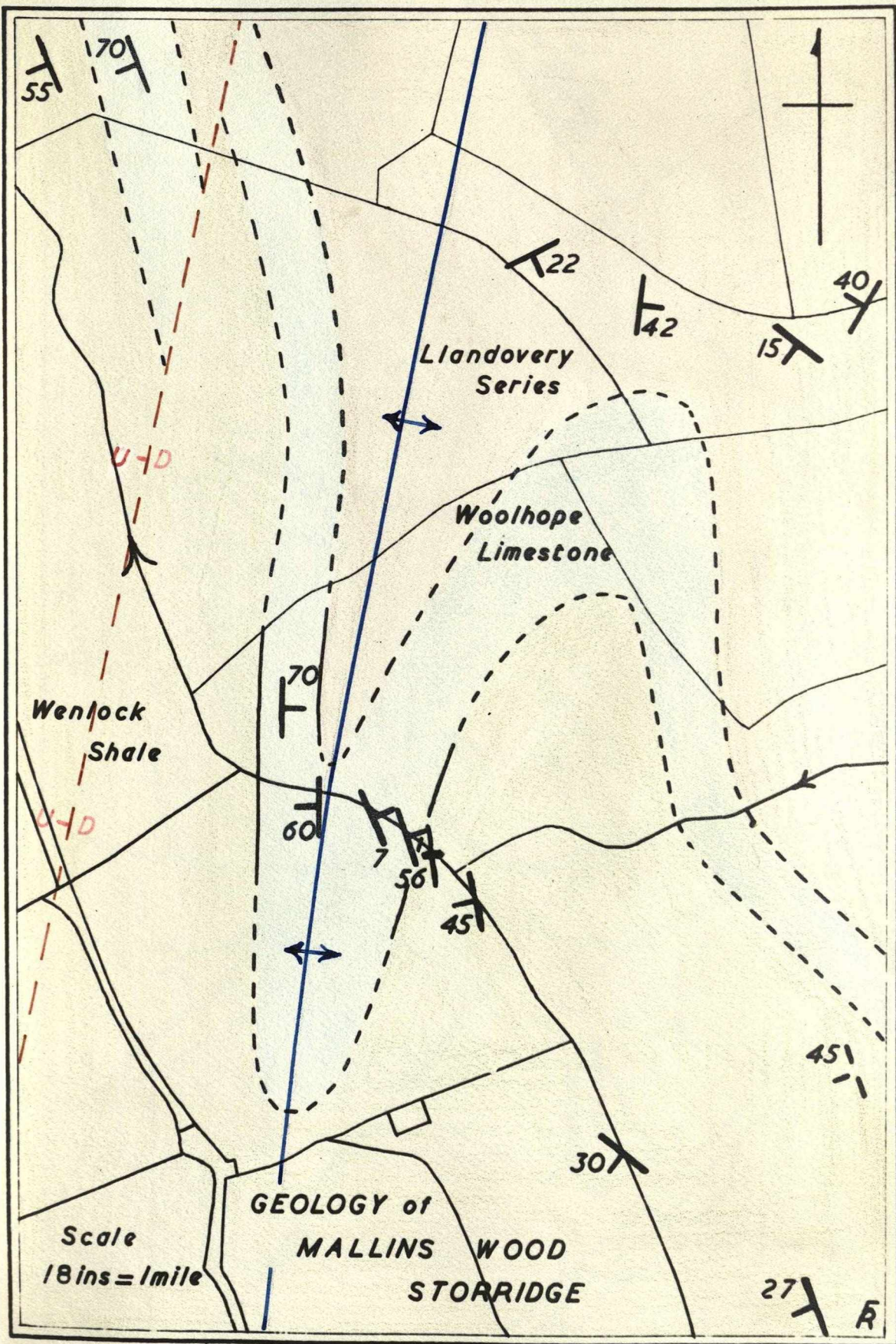
Horiz. & Vert. Scales 6 ins = 1 mile.

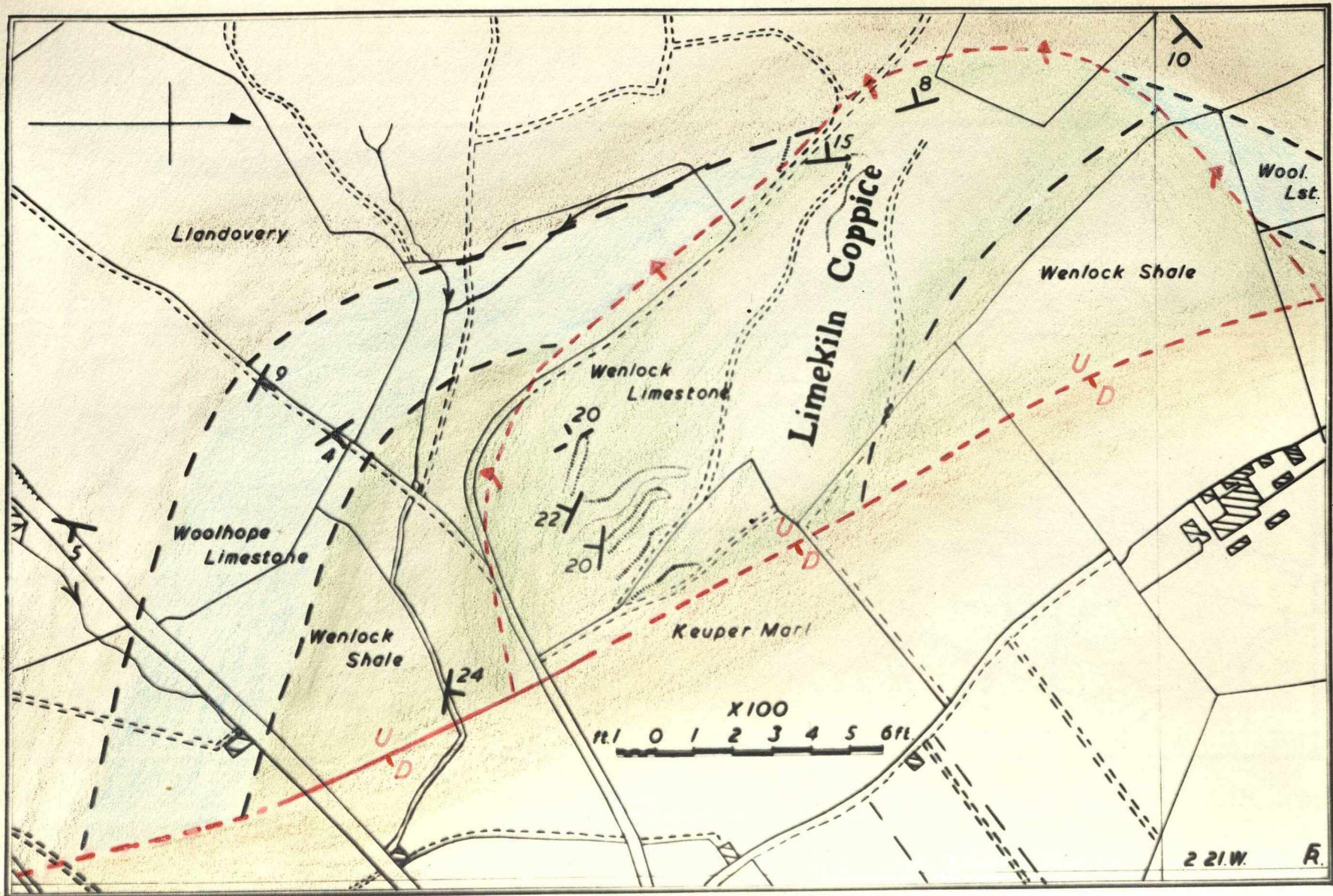
R.

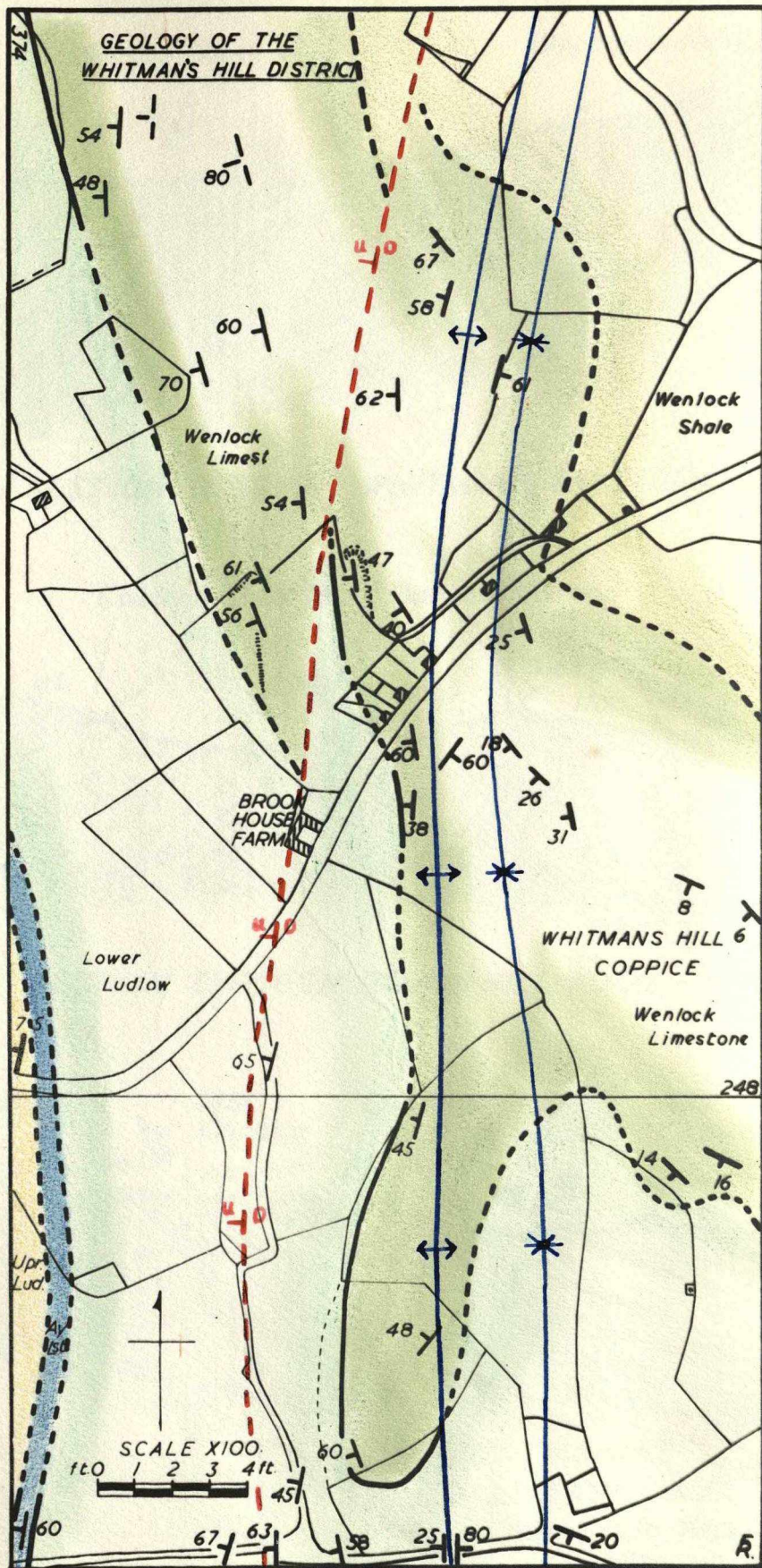


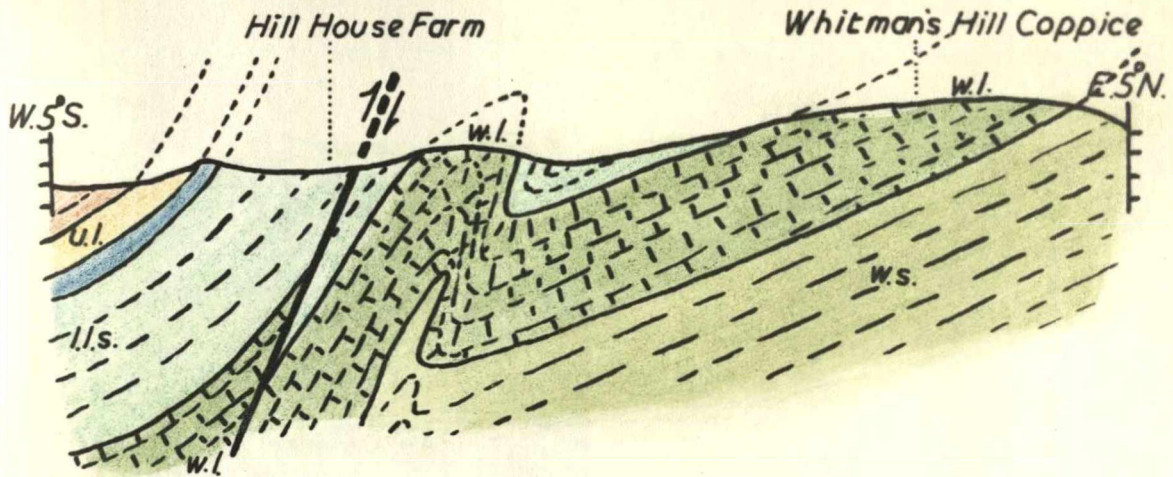


Hortz. & Vert. Scales 6 ins = 1 mile R.

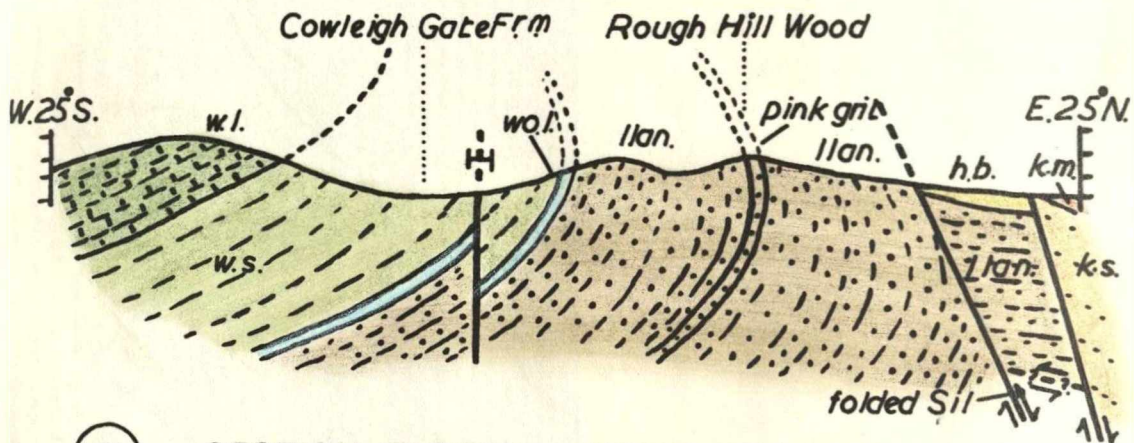




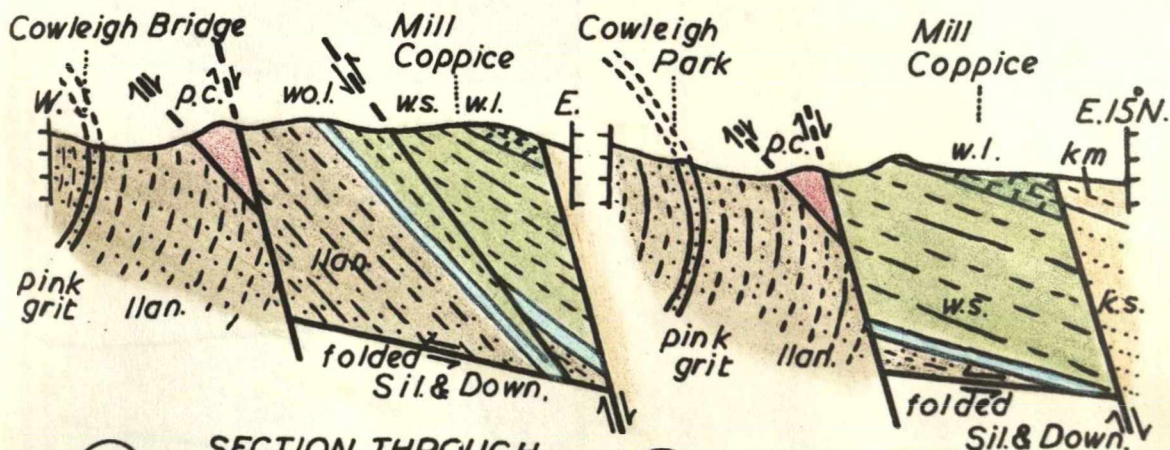




30. SECTION THROUGH WHITMAN'S HILL COPPICE



31. SECTION THROUGH ROUGH HILL WOOD

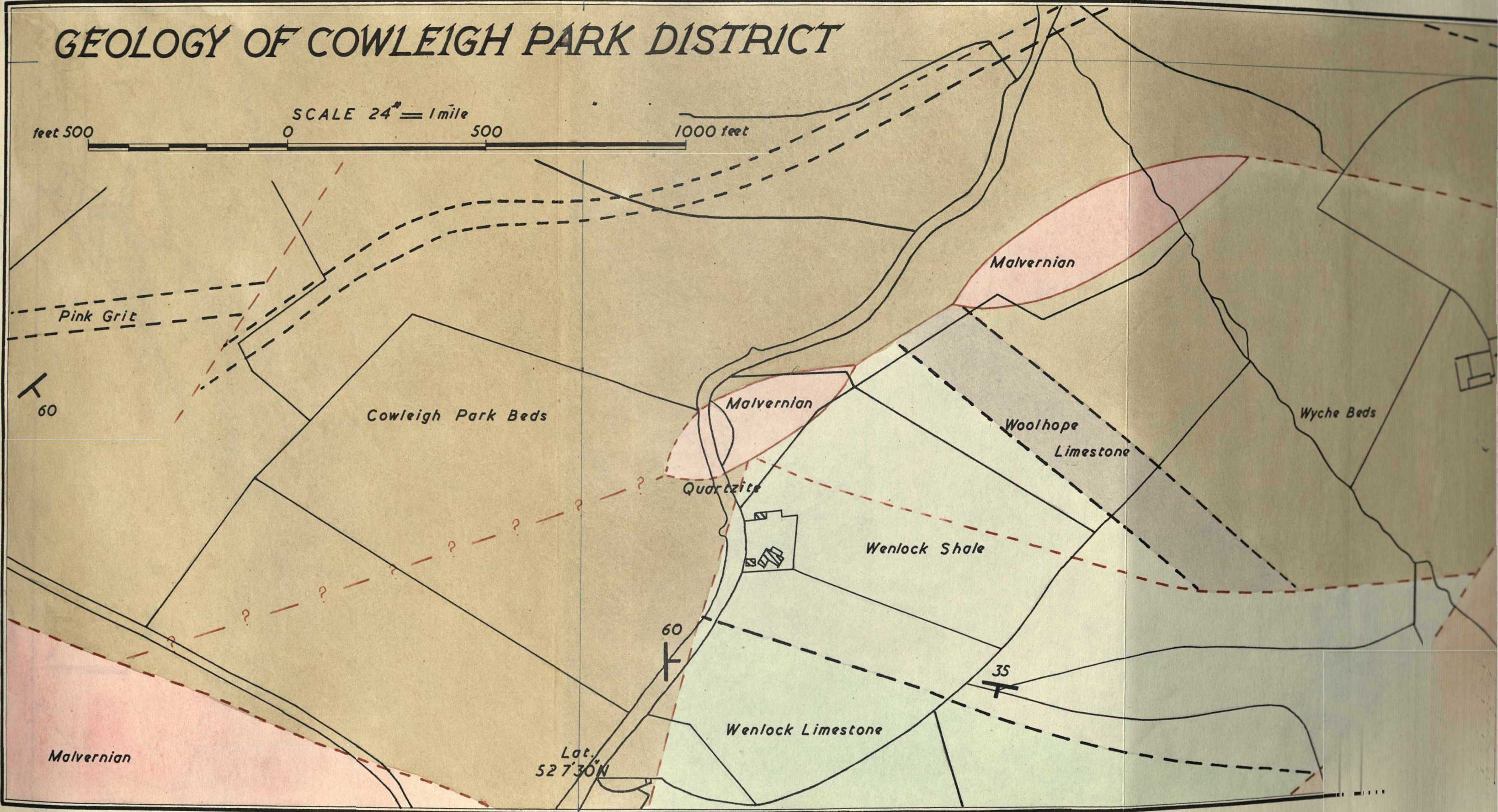


32. SECTION THROUGH MILL COPPICE

33. SECTION THROUGH COWLEIGH PARK
Hertz. Vert. Scales 6" = 1 m.

GEOLOGY OF COWLEIGH PARK DISTRICT

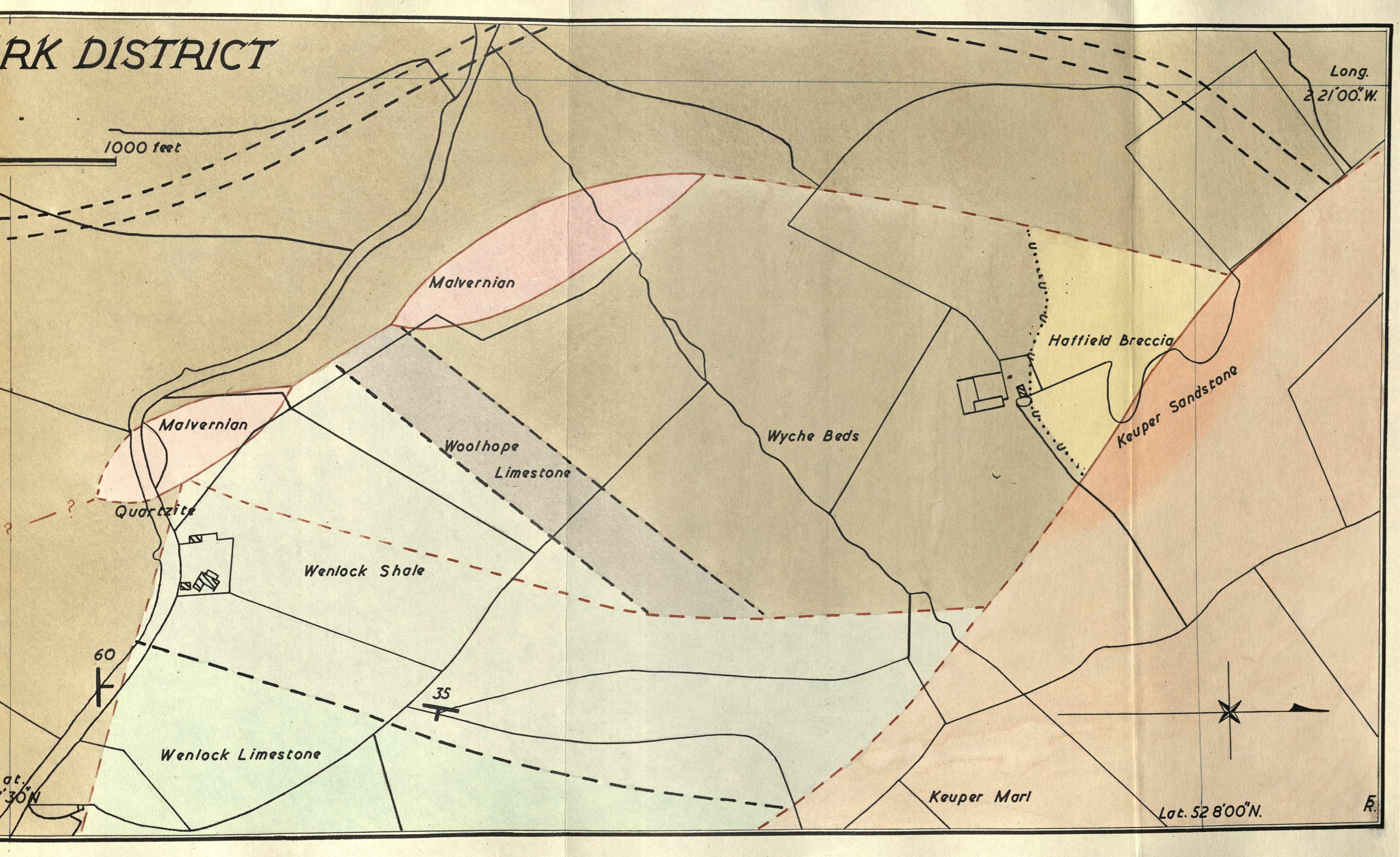
SCALE 24" = 1 mile
feet 500 0 500 1000 feet



ARK DISTRICT

Long. 221°00'W.

1000 feet



Malvernian

Malvernian

Woolhope
Limestone

Wyche Beds

Haffield Breccia

Keuper Sandstone

Quartzite

Wenlock Shale

60

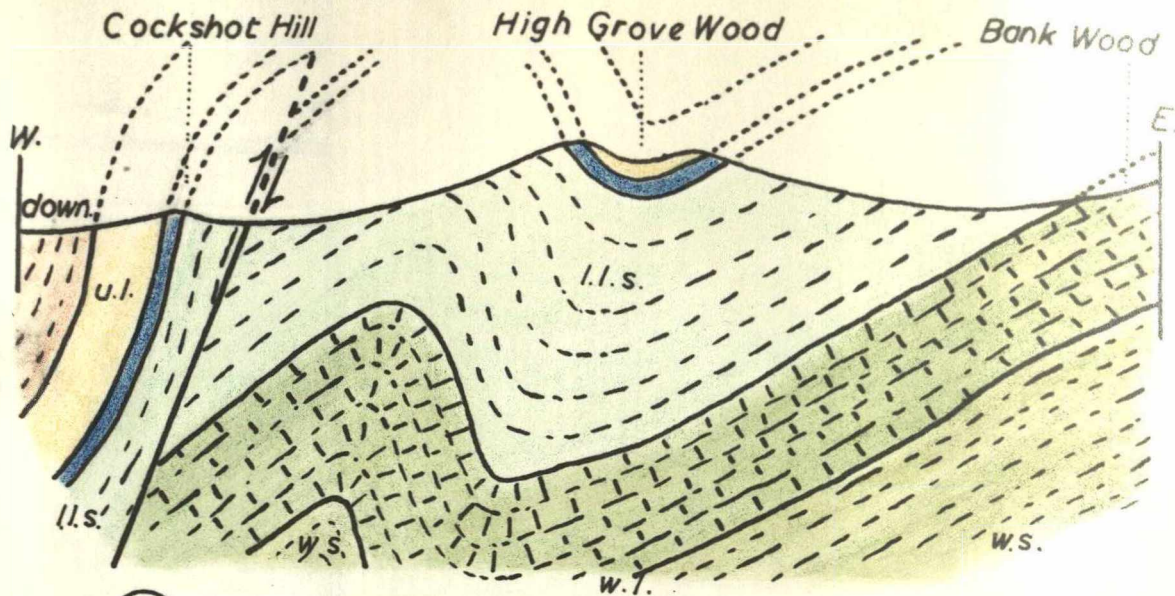
35

Wenlock Limestone

Keuper Marl

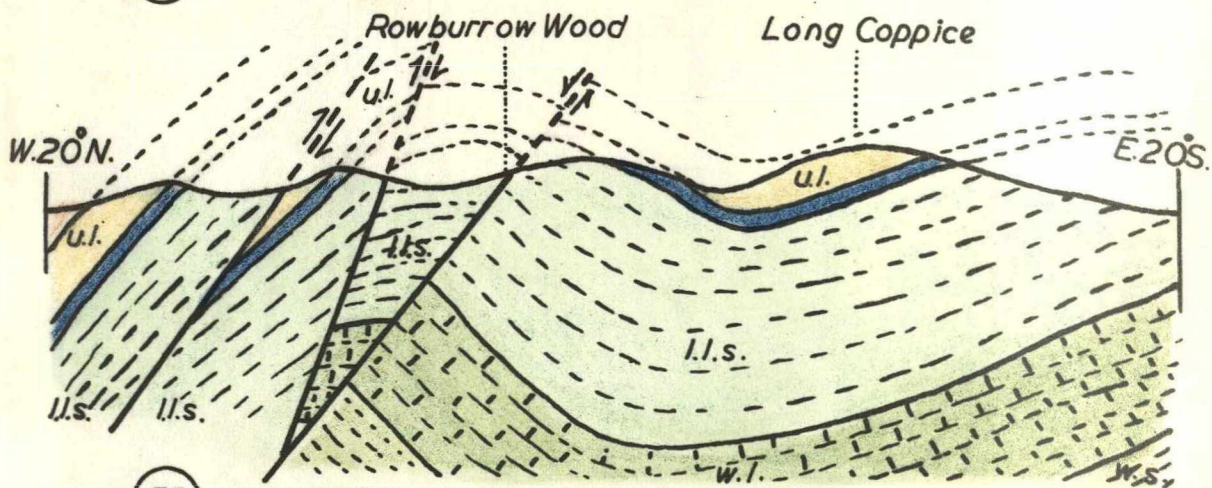
Lat. 52°30'N.

R.



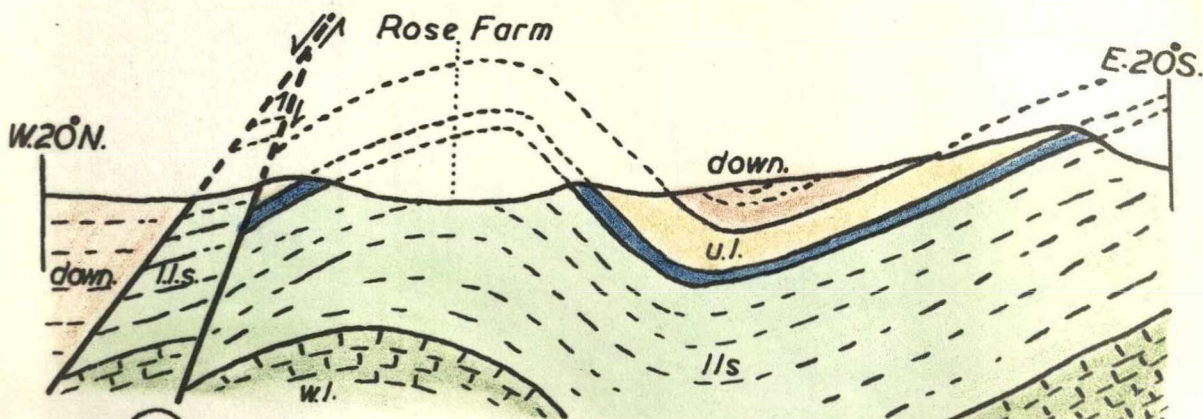
34.

SECTION THROUGH HIGH GROVE WOOD



35.

SECTION THROUGH LONG COPPICE

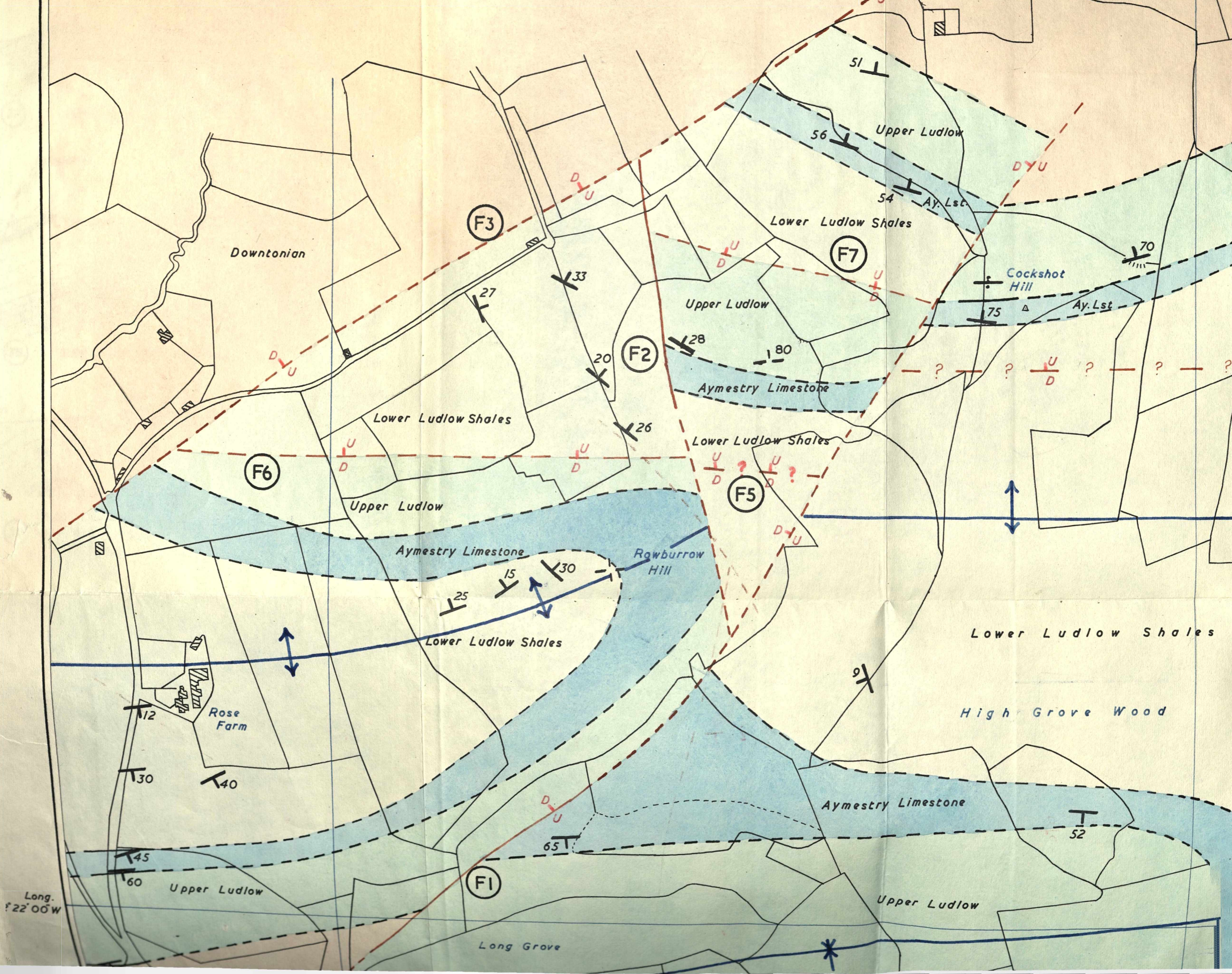


36.

SECTION THROUGH ROSE FARM

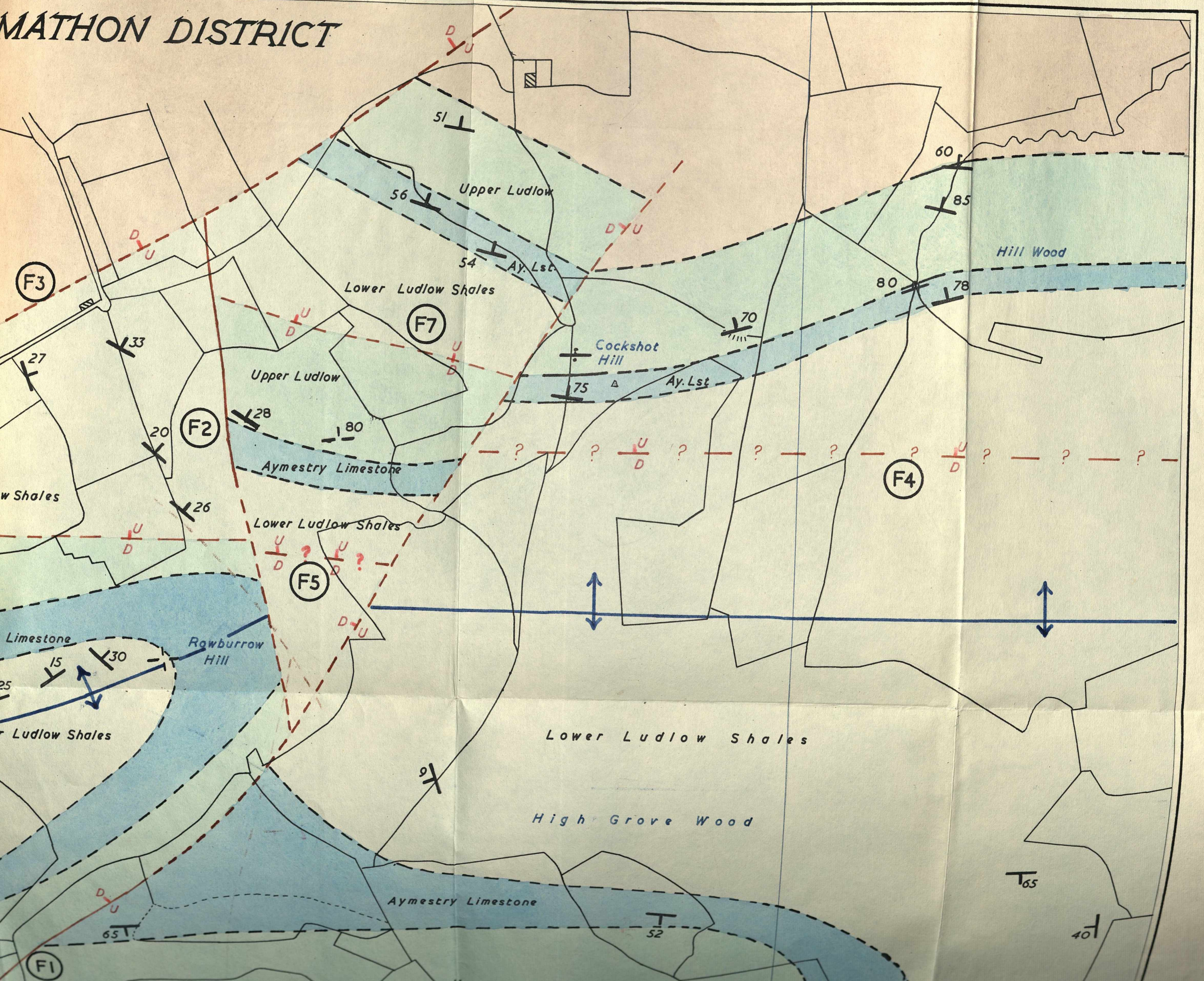
Hortz. & Vert Scales 6 ins = 1 mile

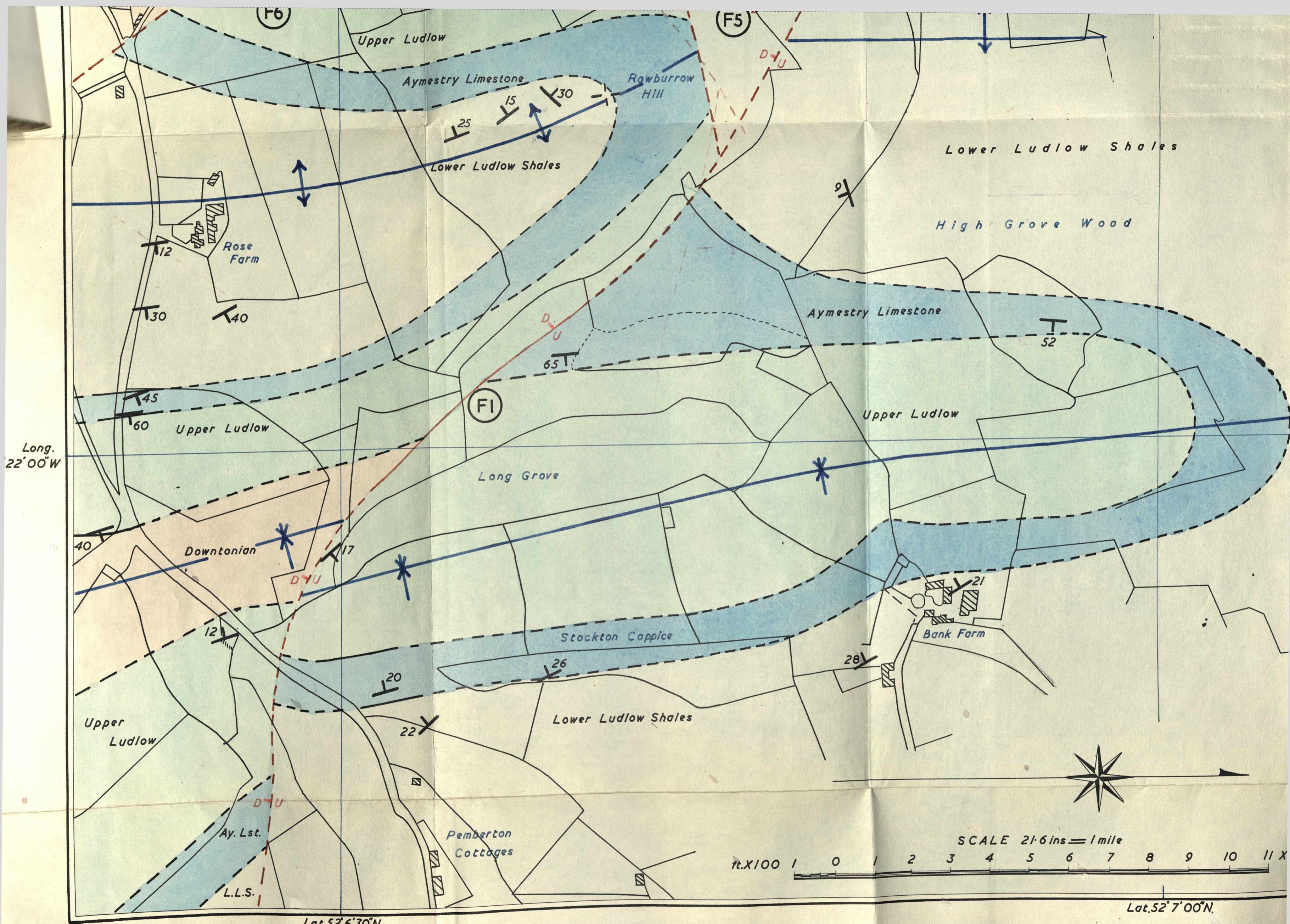
GEOLOGY OF THE MATHON DISTRICT



Lat 52° 7' 00" N

MATHON DISTRICT

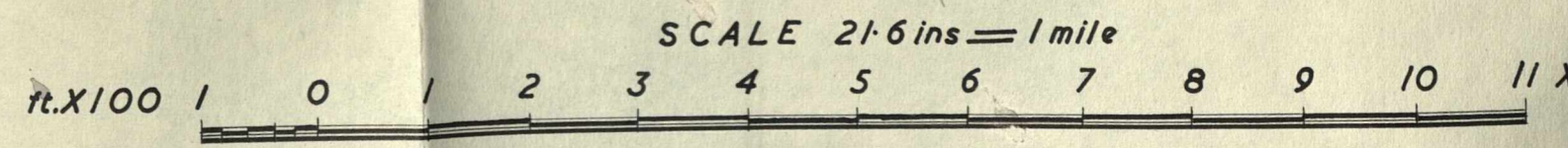




Long. 22° 00' W

Lat. 52° 6' 30" N

Lat. 52° 7' 00" N



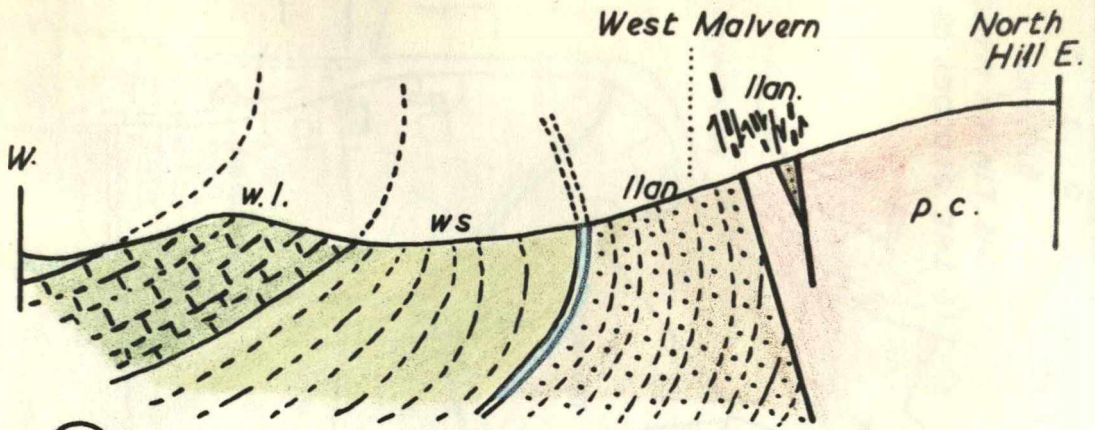


Long.
2° 22' 00" W

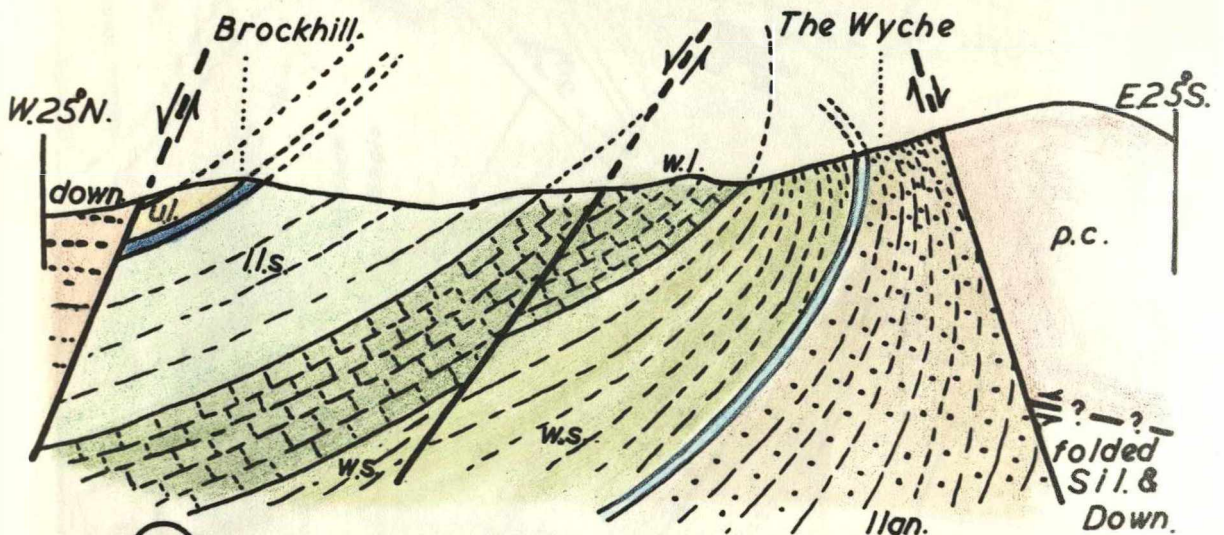
30" N

Lat. 52° 7' 00" N.

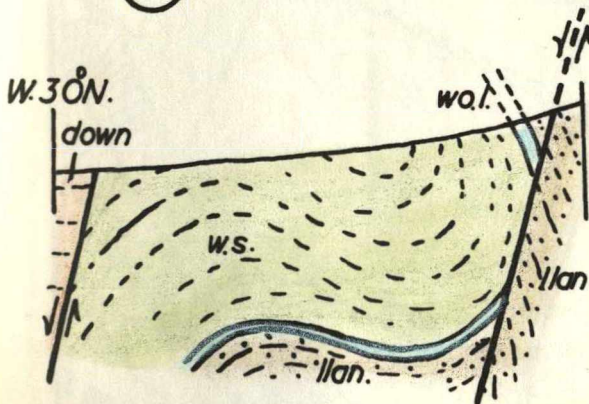
R.



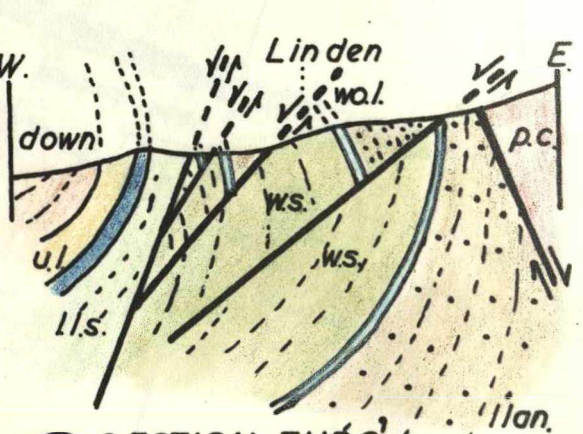
(37) SECTION THROUGH WEST MALVERN



(38) SECTION THROUGH THE WYCHE

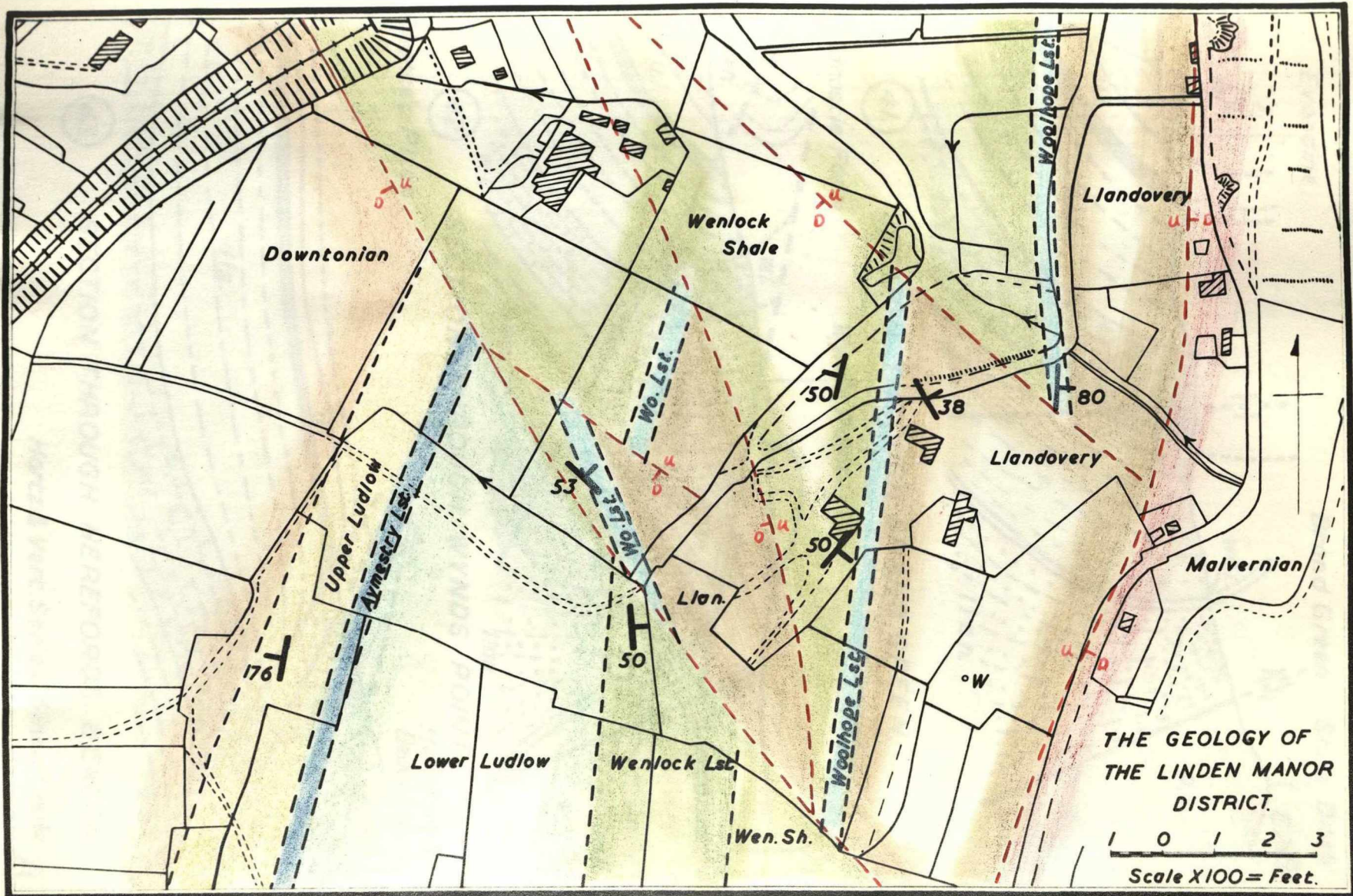


(39) SECTION ALONG RAILWAY TUNNEL COLWALL.

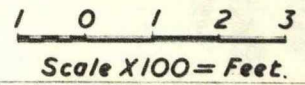


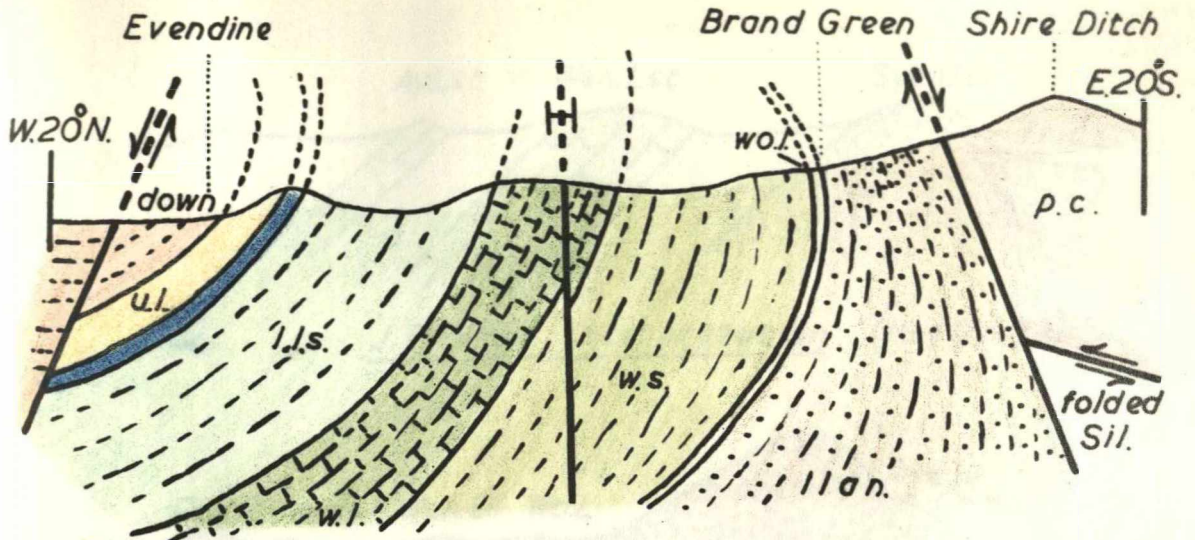
(40) SECTION THRO LINDEN MANOR

Hortz. & Vert. Scales 6 ins = 1 mile.

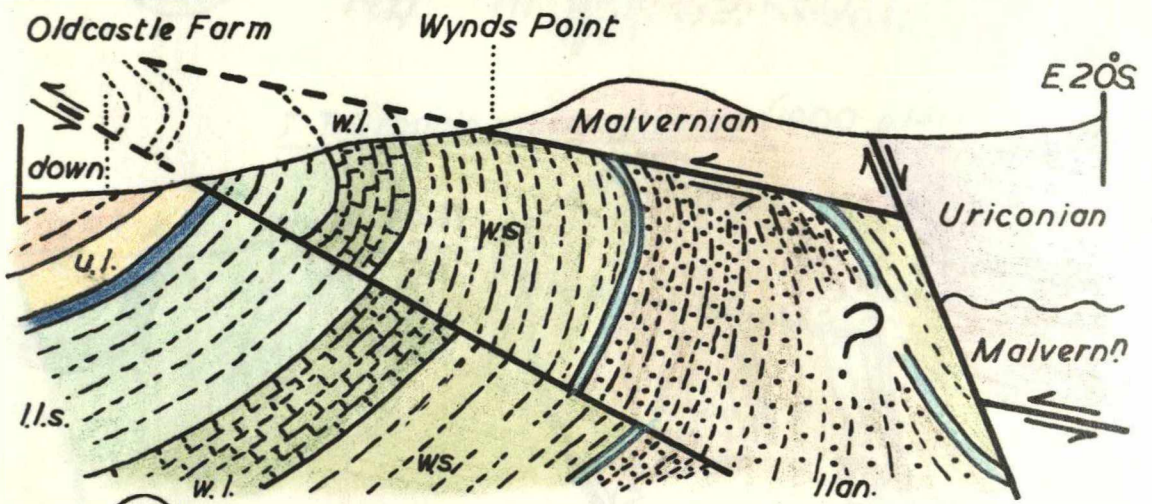


THE GEOLOGY OF
THE LINDEN MANOR
DISTRICT.

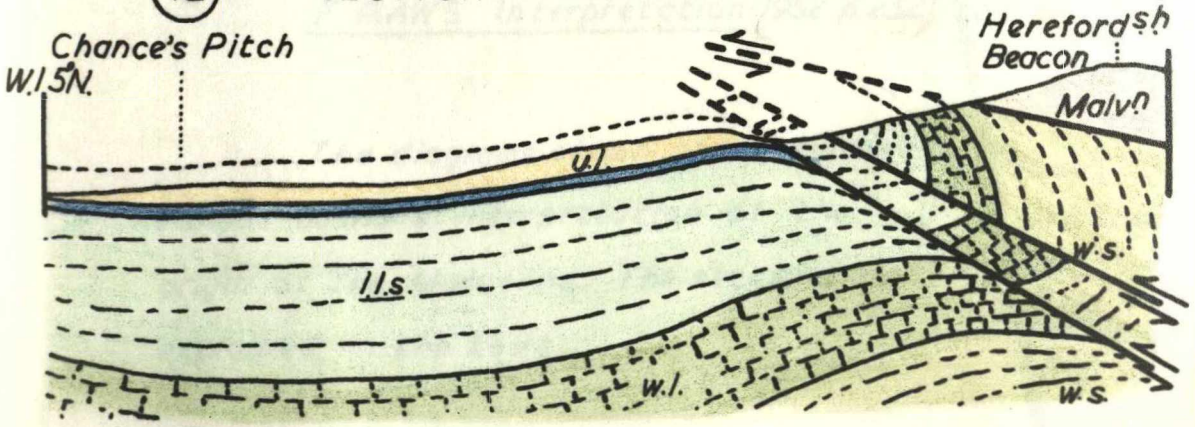




41. SECTION THROUGH BRAND GREEN.

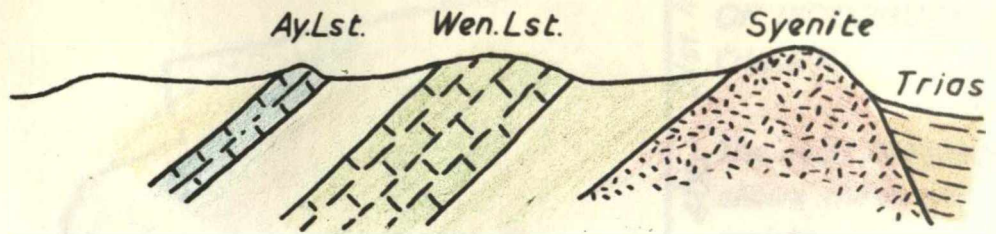


42. SECTION THROUGH WYND'S POINT



43. SECTION THROUGH HEREFORDS. BEACON.

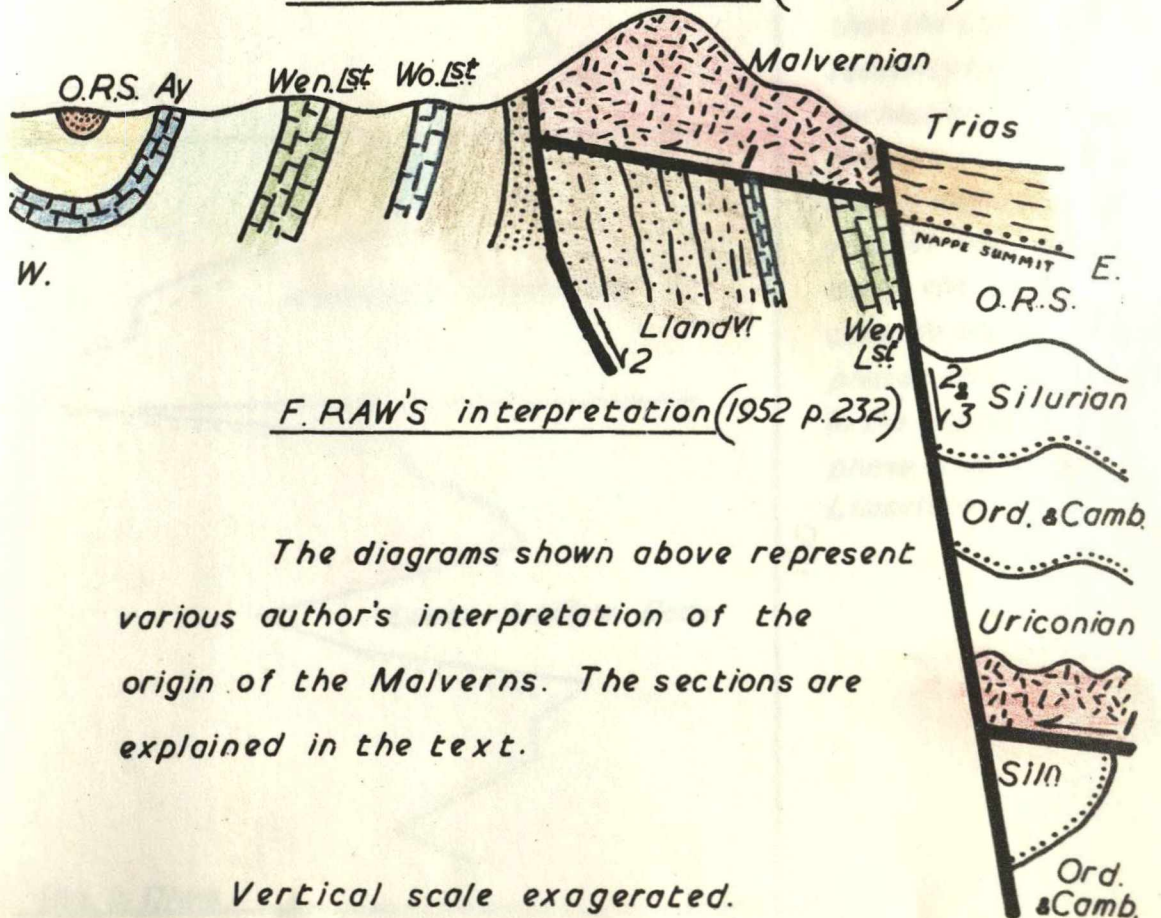
Hortz. & Vert. Scales: 6 ins = 1 mile. R.



J. Phillip's interpretation (1848 p.82)



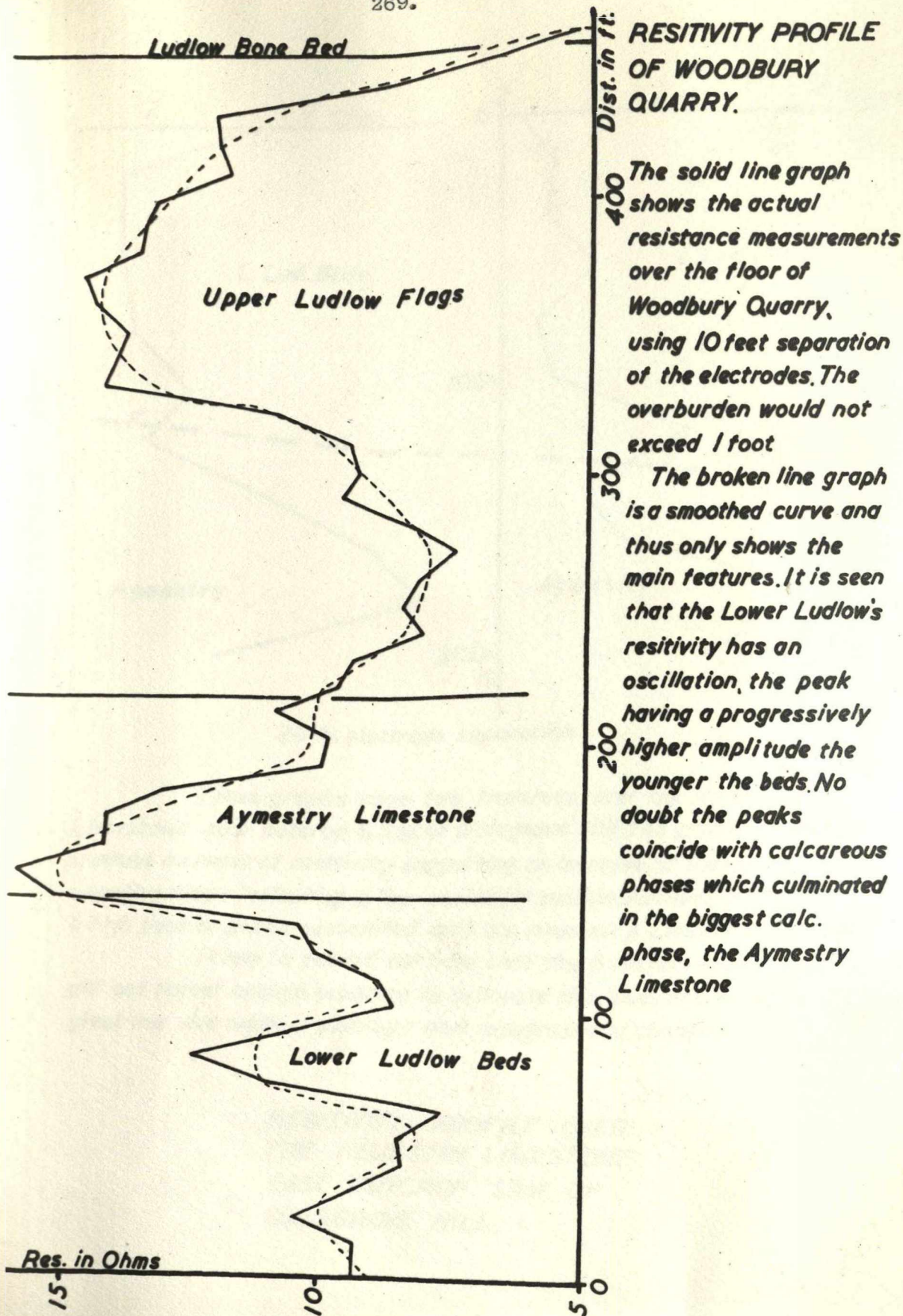
T. T. Groom's interpretation (1900 p.141)

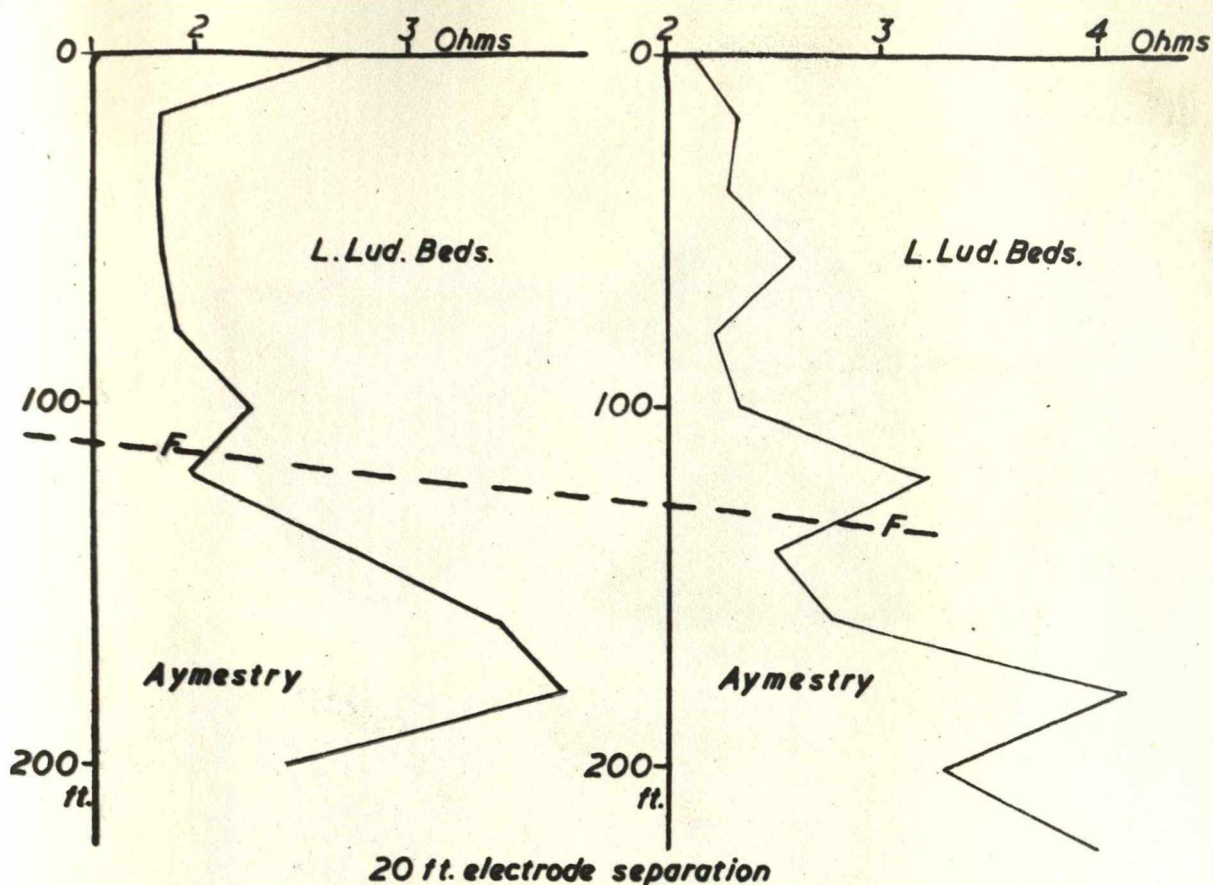


F. RAW'S interpretation (1952 p.232)

The diagrams shown above represent various author's interpretation of the origin of the Malverns. The sections are explained in the text.

Vertical scale exaggerated.

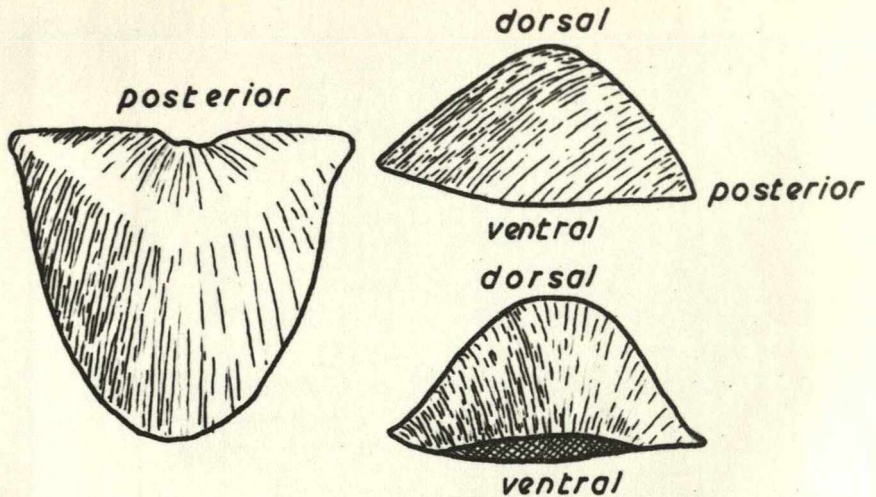




These graphs show two traverses over the Aymestry Limestone east outcrop S.S.W. of Walsgrove Hill. The profiles show a gradual increase of resistivity suggesting an increase of lime, a sudden negative slope indicating a low resistivity medium, followed finally by a high peak or peaks associated with the Aymestry Limestone outcrop.

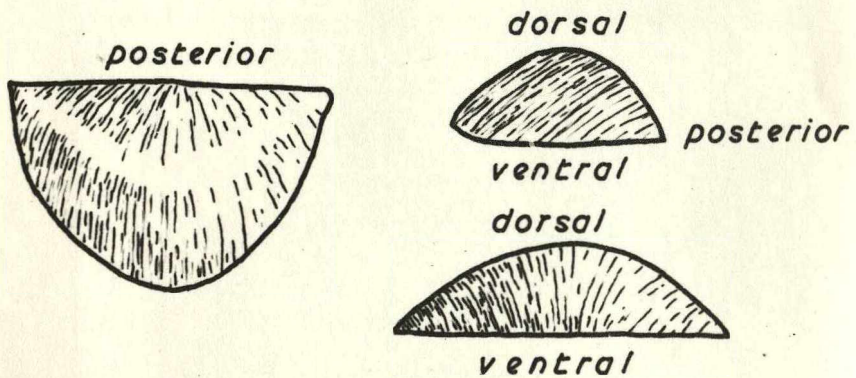
It may be pointed out here that the traverses themselves did not reveal enough evidence to delineate this limestone band, but great use was made of outcrops and topographical changes.

**RESITIVITY PROFILE OVER
THE AYMESTRY LIMESTONE
EAST OUTCROP S.S.W. OF
WALSGROVE HILL.**



XI

1. Ludlow Shales.



XI

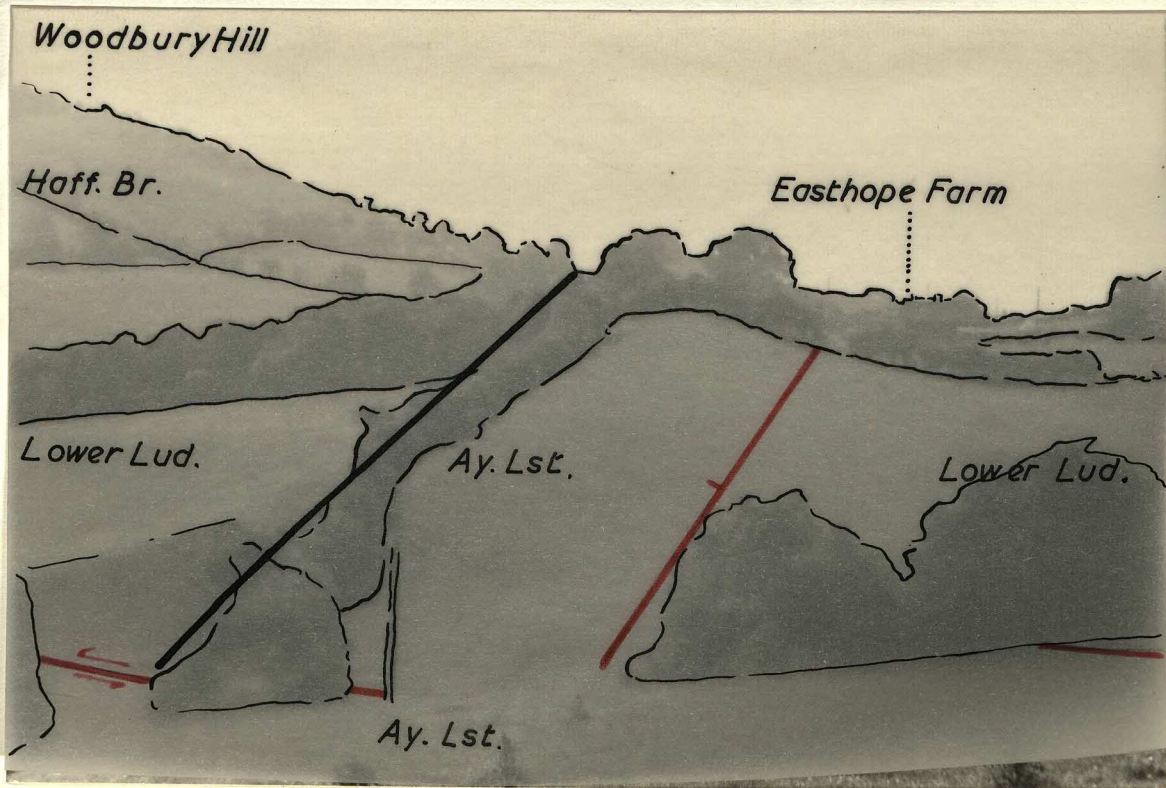
2. Wenlock Shales.

VARIETIES OF STROPHONELLA EUGLYPHA

Photographer's Position:- 870 yards N.N.W.
of Woodbury Hill.
(32/743653).

Direction:- 170°

Description:- The inverted Aymestry eastern
outcrop and the unconformable
cover of Haffield Breccia of
Woodbury Hill.



Haft Bl.

Easthope Farm

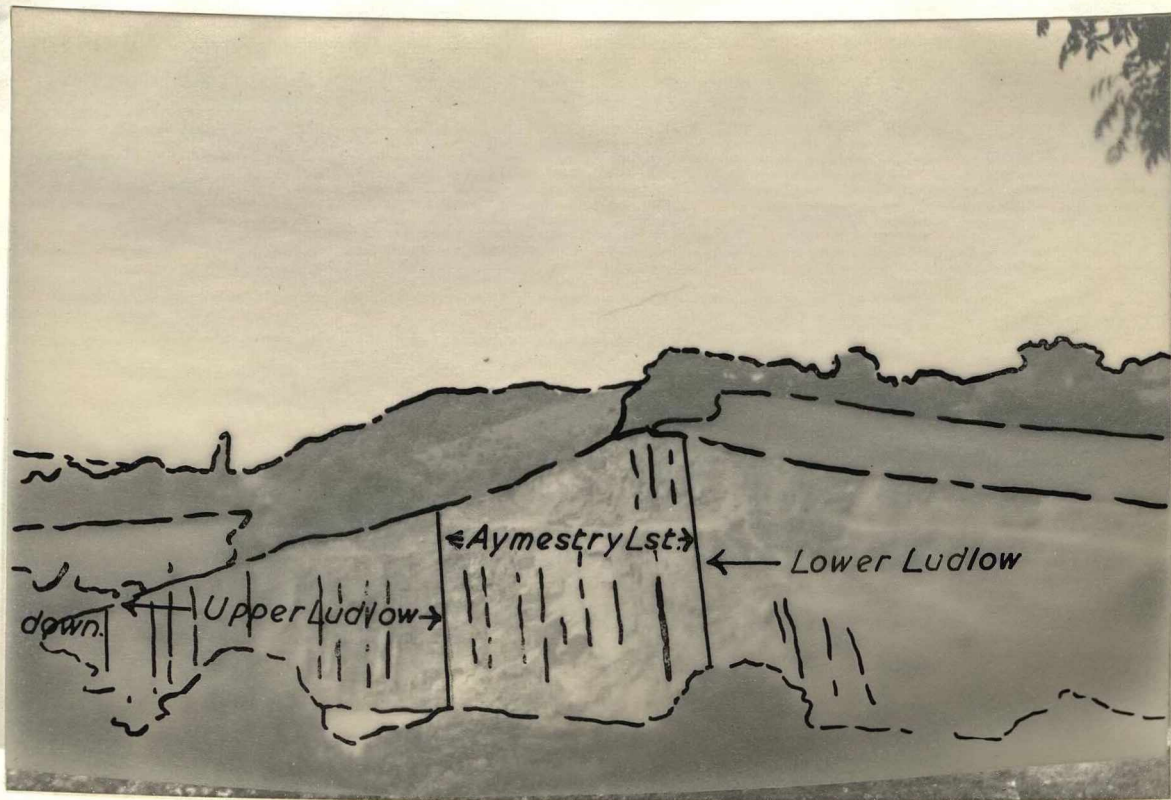
Moorside Hill



Photographer's Position:- South of Woodbury
Quarry (32/743639).

Direction:- 000°

Description:- Woodbury Quarry.

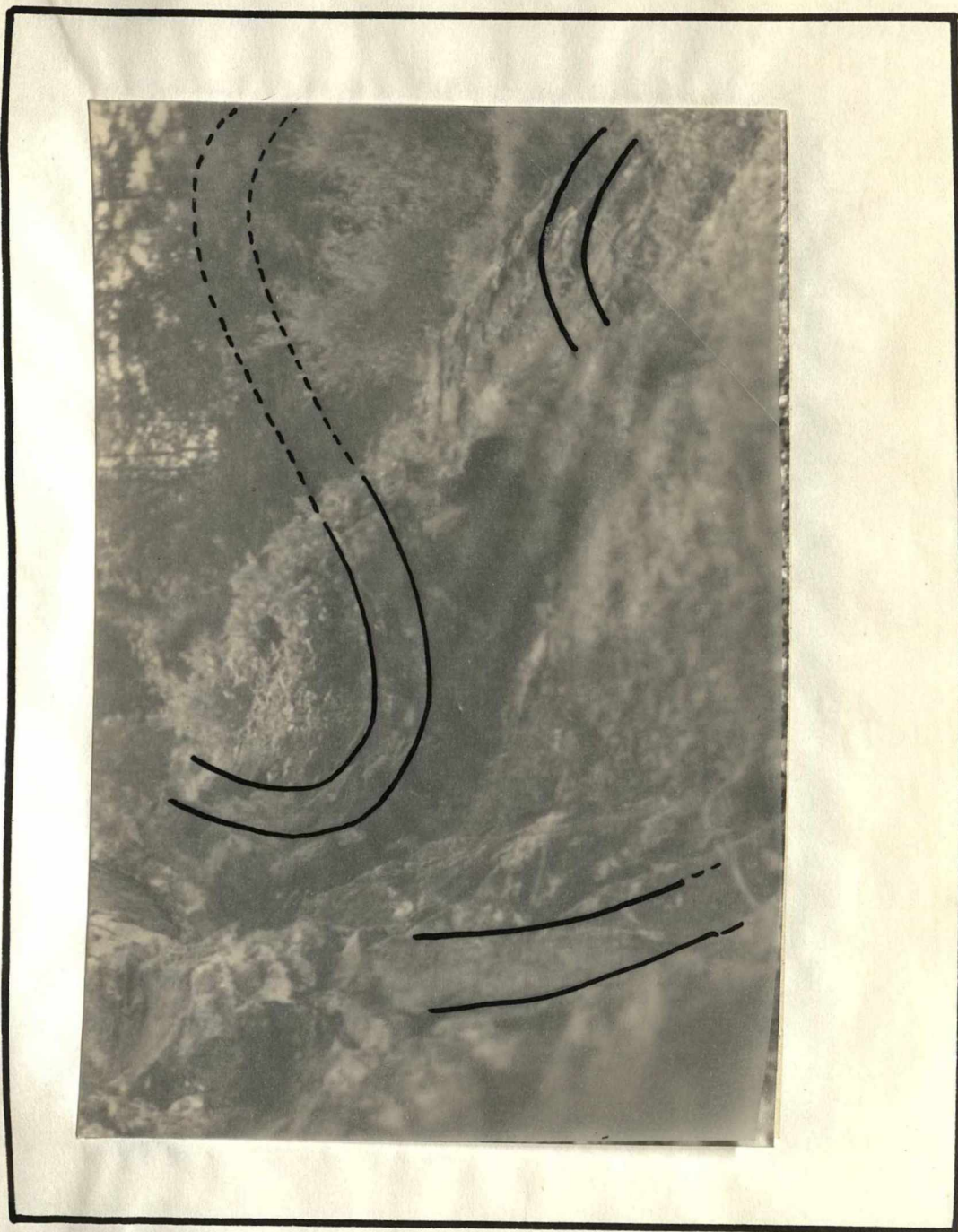


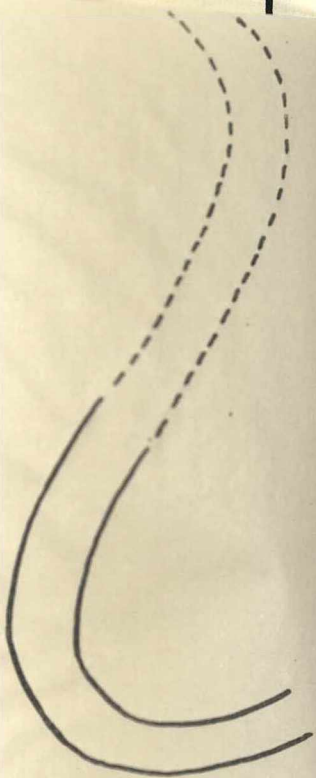


Photographer's Position:- Quarries south of
Fetterlocks Farm,
Woodbury. (32/753632).

Direction:- 185°.

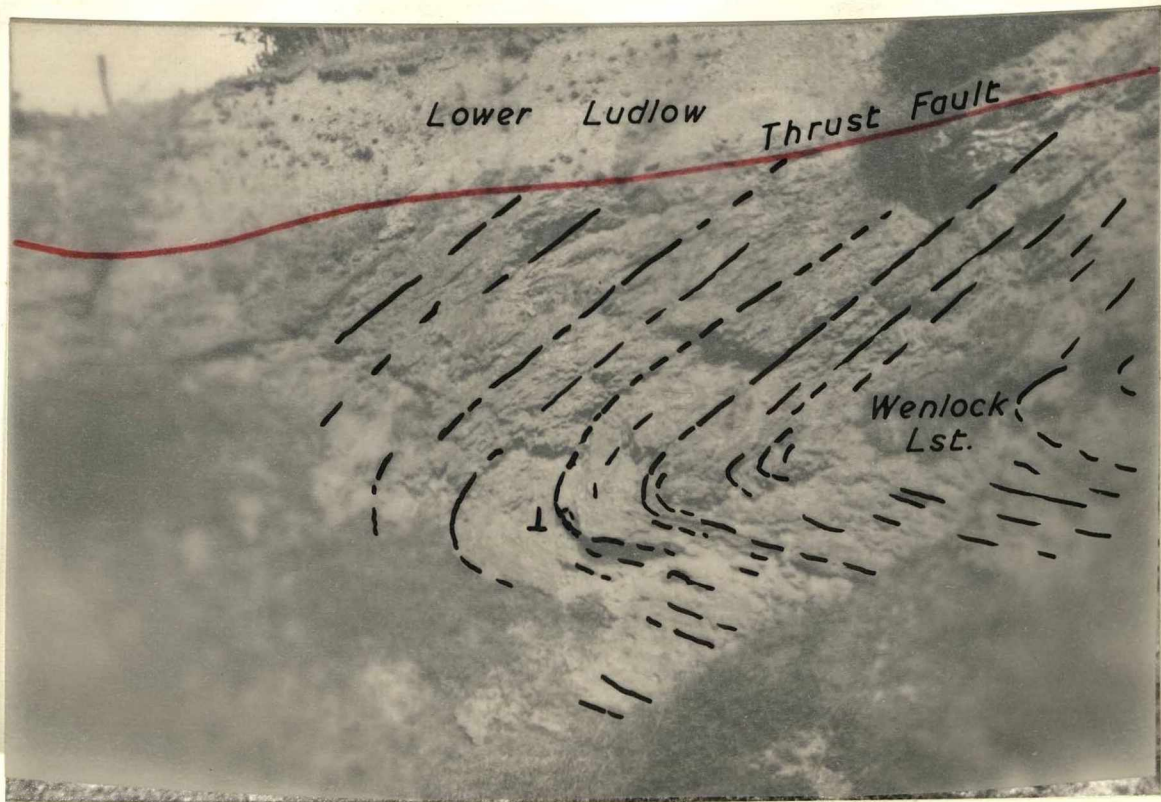
Description:- Wenlock Limestone which has been
folded into brow folds at the edge
of an overthrust mass.

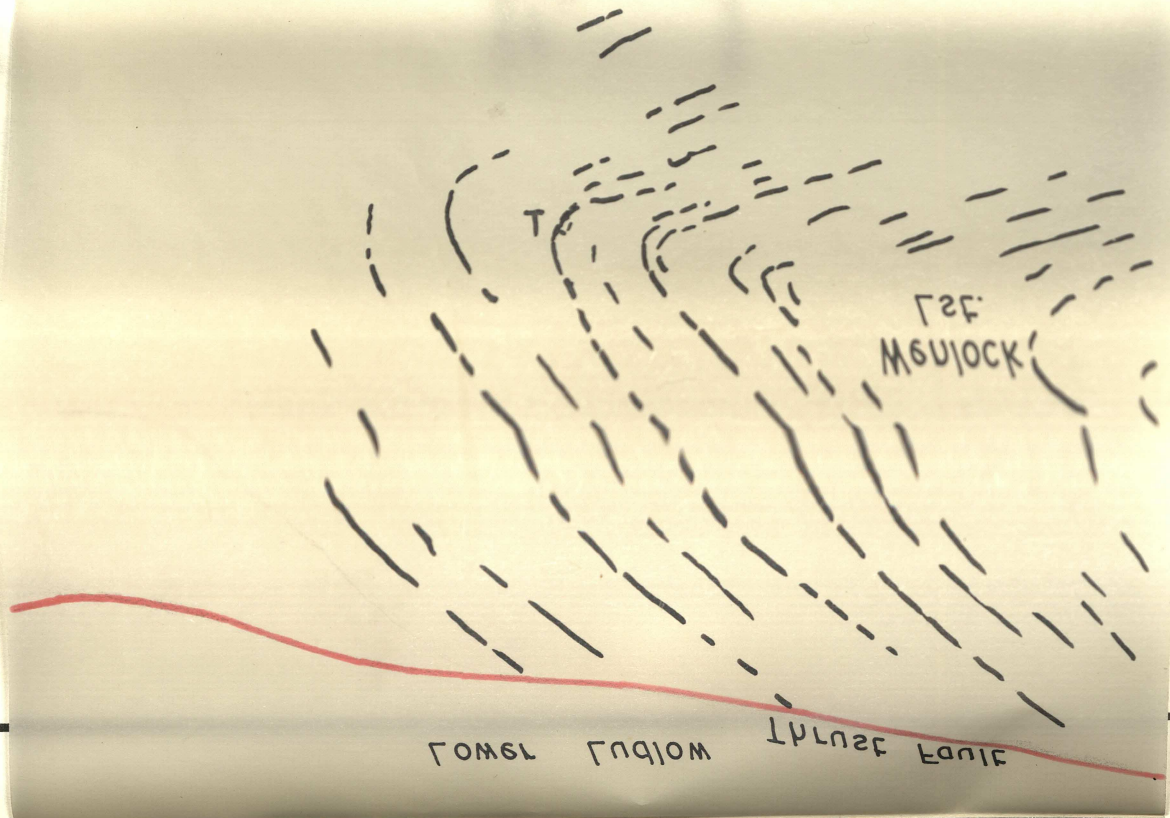




Photographer's Position:- Quarry west of
Wallhouse Plantation.
(32/751638)

Description:- This photograph shows Wenlock
Limestone folded recumbently and
overthrust by Lower Ludlow Shales.

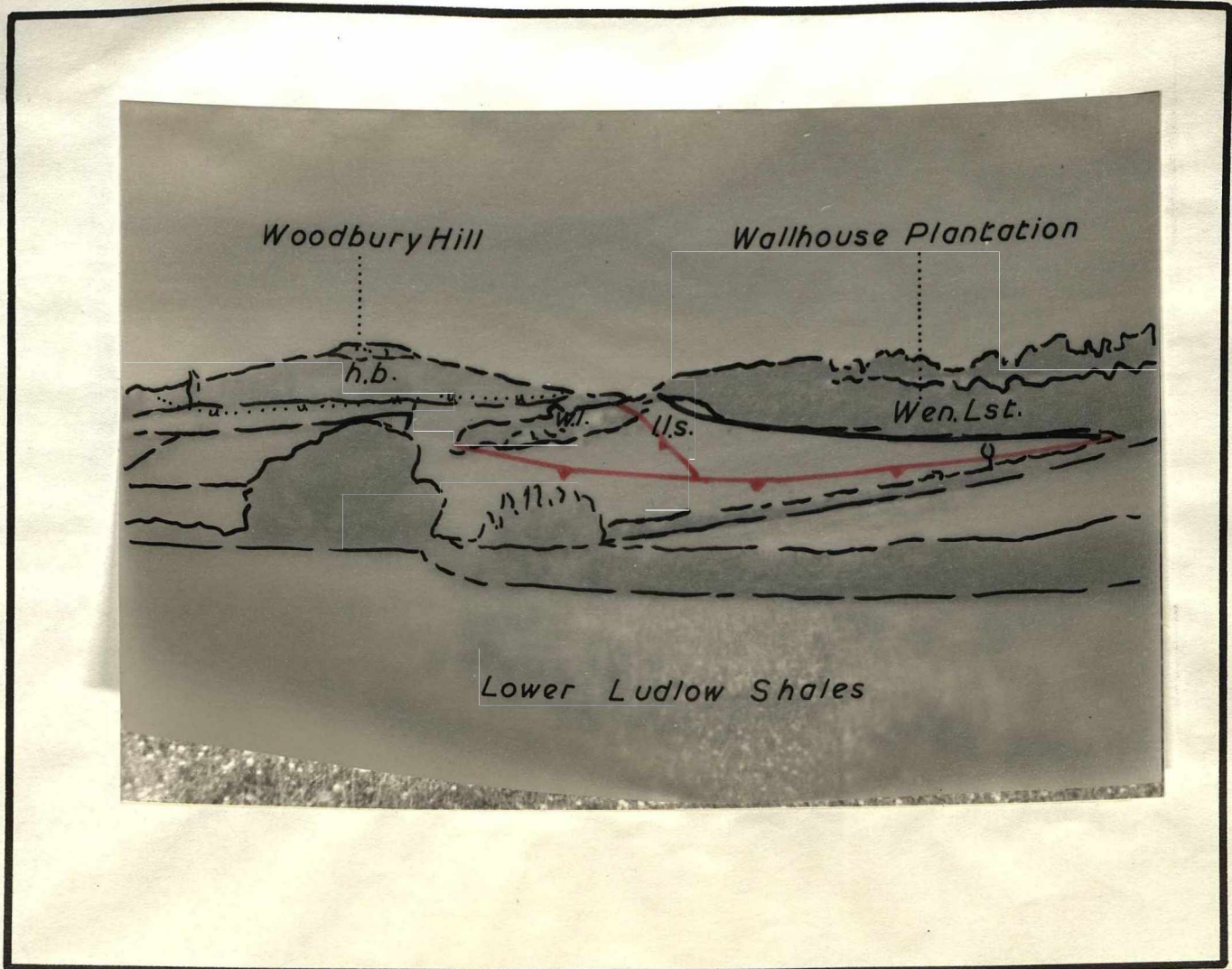


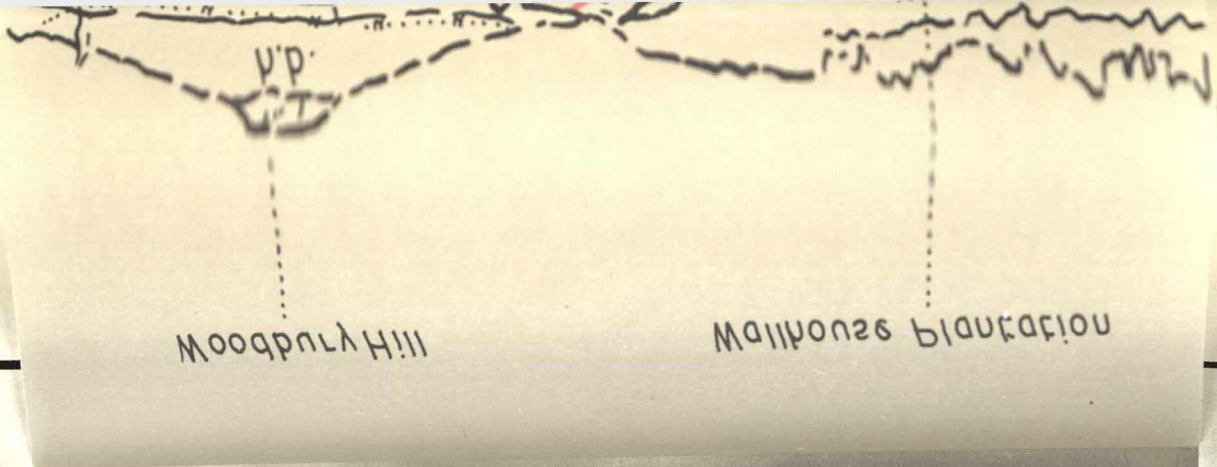


Photographer's Position:- 1400 yards S.S.E. of
Woodbury Hill
(32/759633).

Direction:- 020°

Description:- The overthrust Wenlock Limestone of
Wallhouse Plantation and the minor
thrust mass of limestone in the
quarry west of the Plantation and
the unconformable cover of
Haffield Breccia on Woodbury Hill.





Photographer's Position:- Penny Hill Quarry,
Martley (32/752612).

Direction:- 355°.

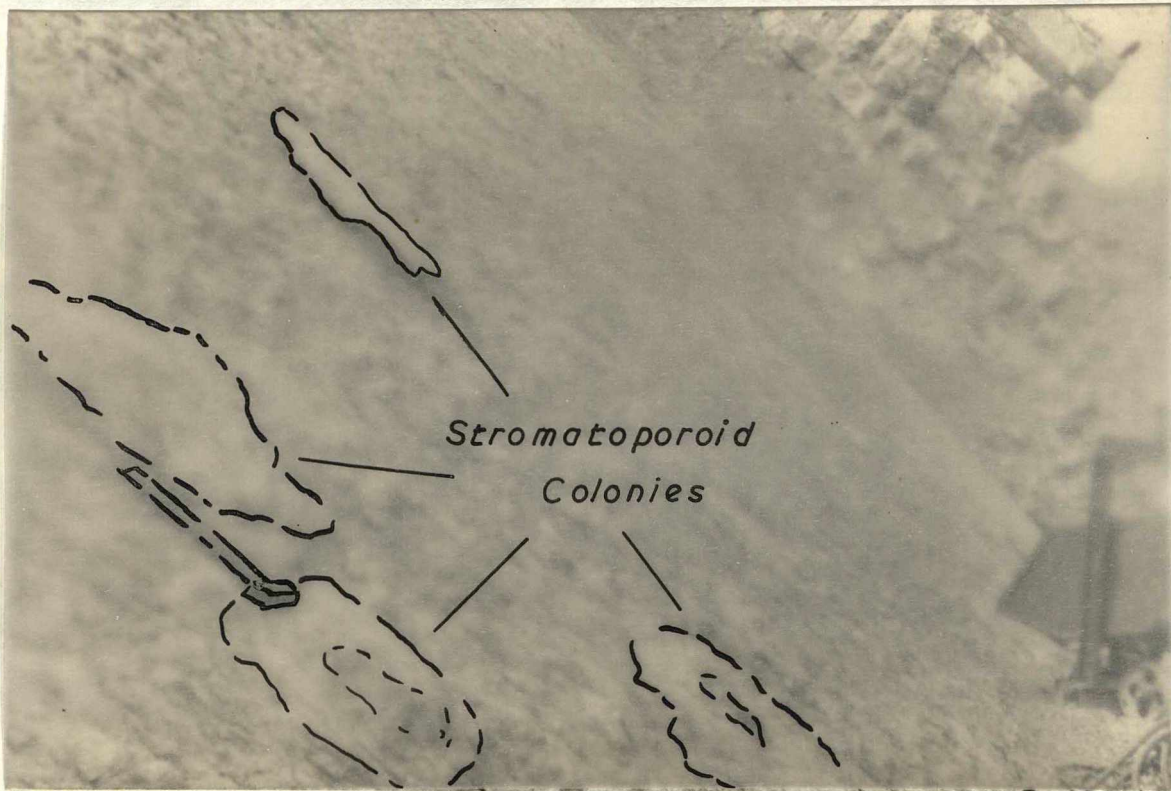
Description:- Inverted Wenlock Limestone.



Photographer's Position:- Penny Hill Quarry,
Martley (32/752612).

Direction:- 000°

Description:- An inverted bedding plane of
Wenlock Limestone, showing the
base of overturned Stromatoporoid
colonies.

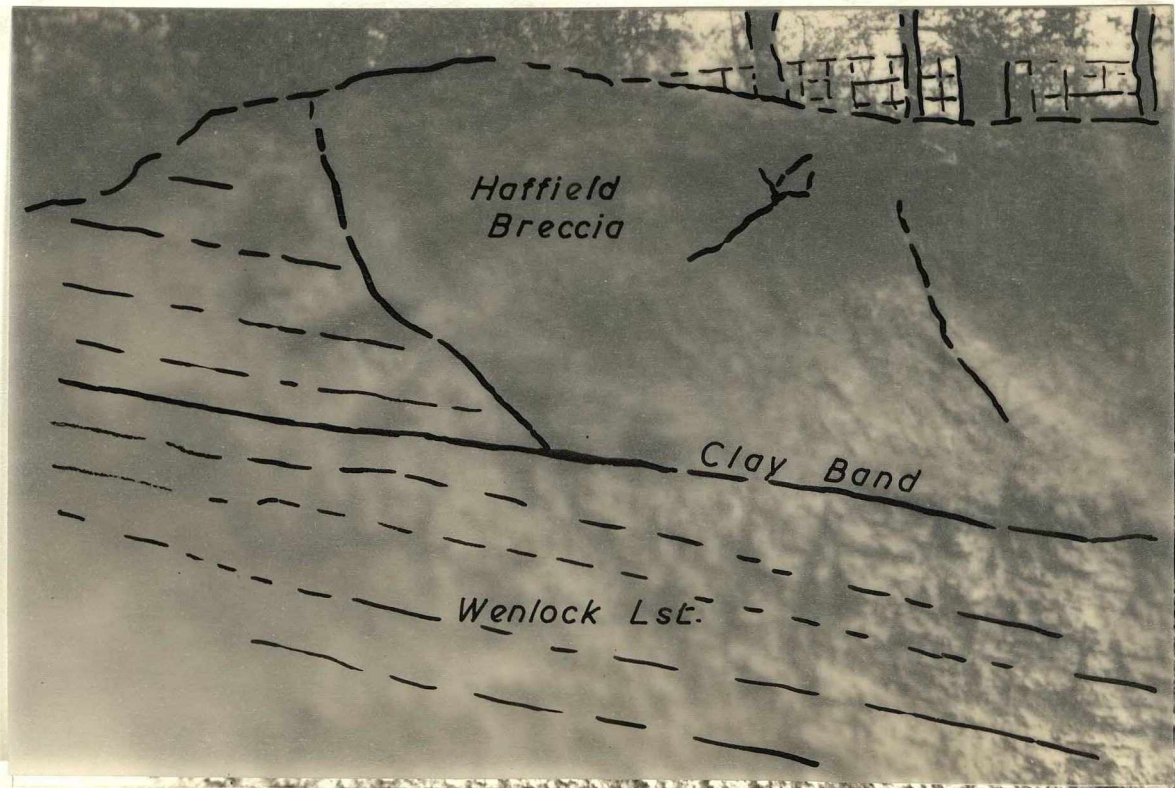




Photographer's Position:- Collin's Green Quarry.
(32/742575).

Direction:- 110°

Description:- The photograph shows Haffield
Breccia upon Wenlock Limestone
separated by a thin clay band.



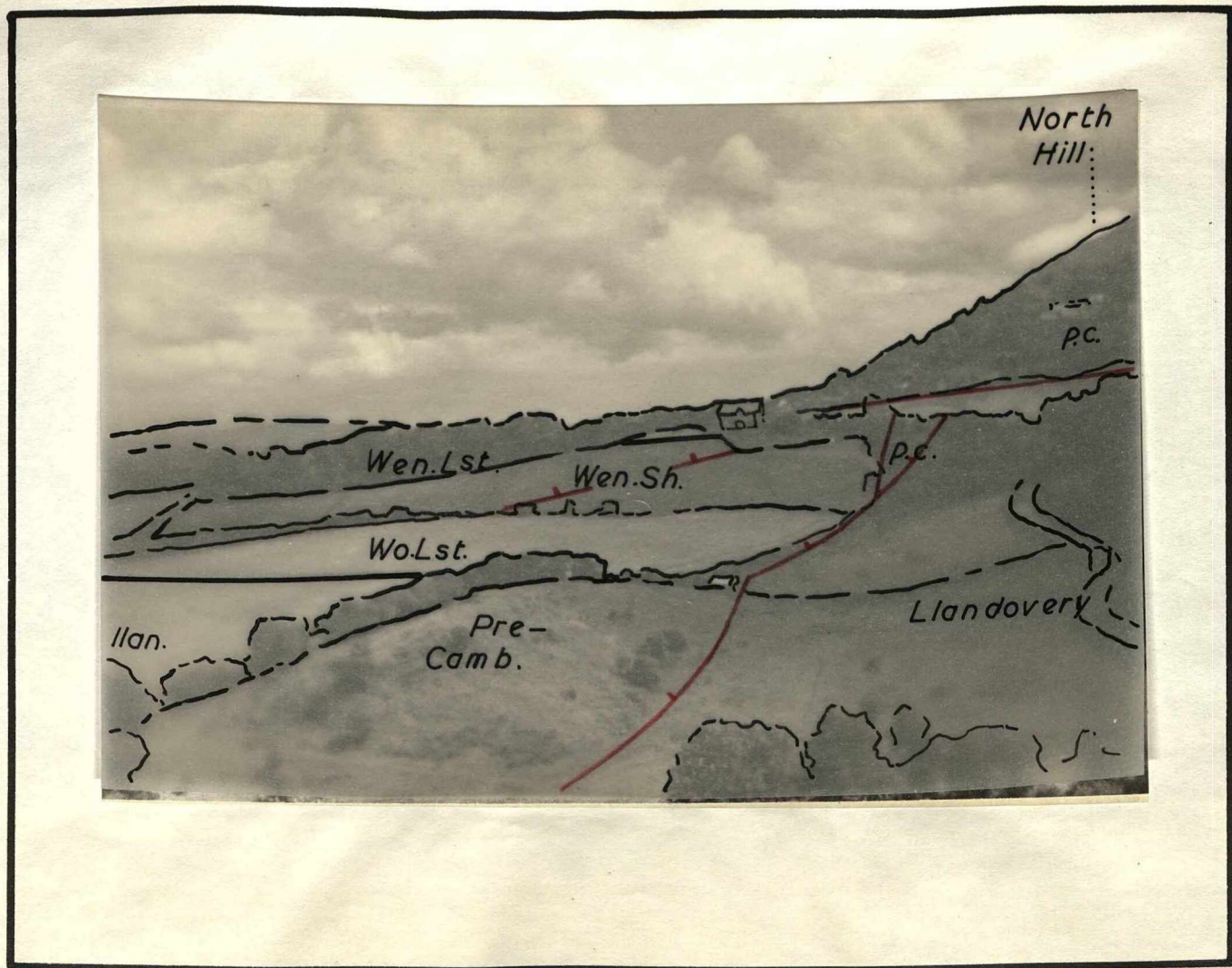
BLECCIA
Hattisig

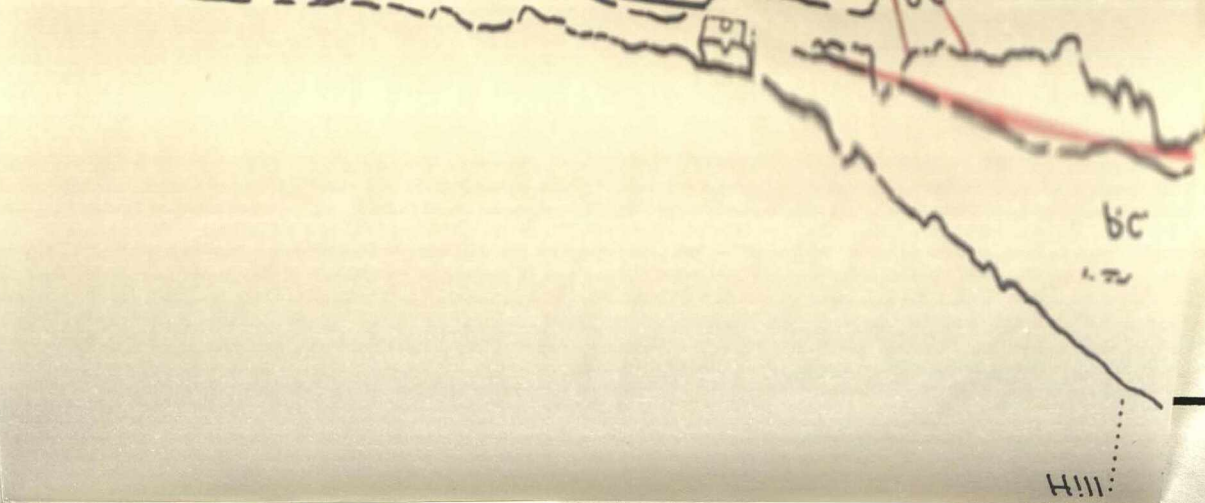


Photographer's Position:- 200 yards N. of
Cowleigh Bridge.
(32/760480).

Direction:- 120°

Description:- The complex of Cowleigh Park
and Mill Coppice, showing the
pre-Cambrian masses and S.E.
dipping Wenlock beds.

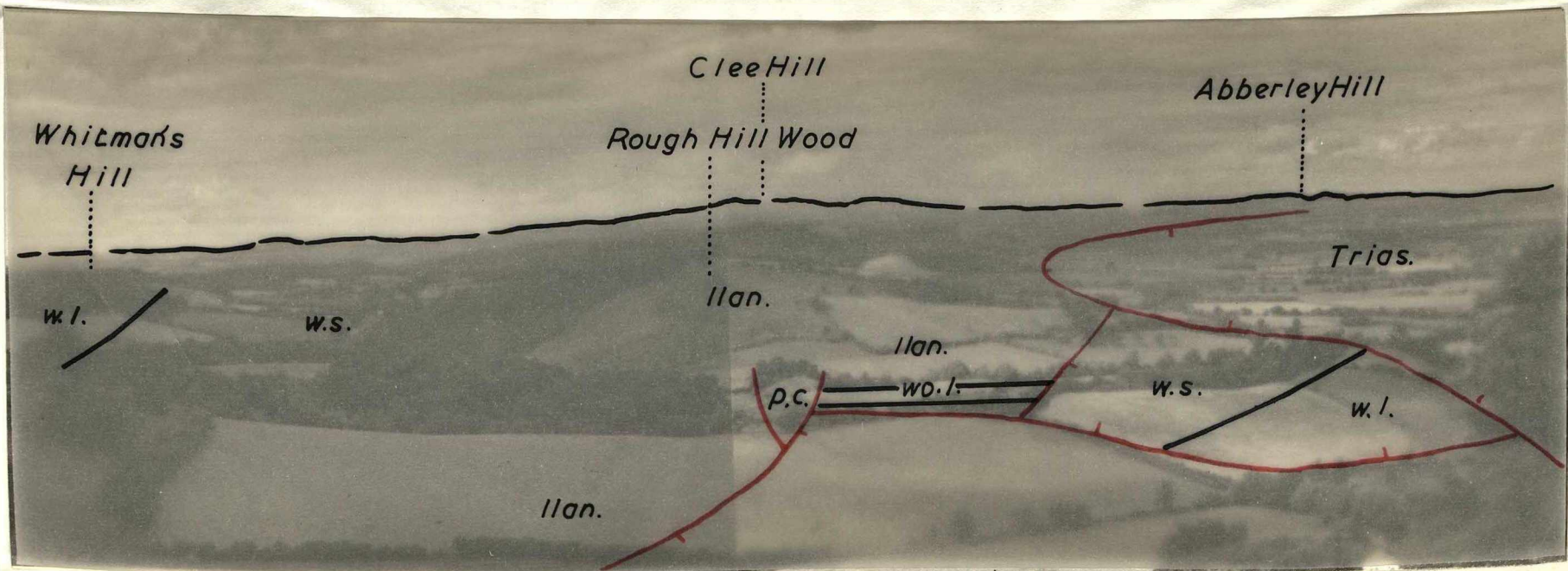


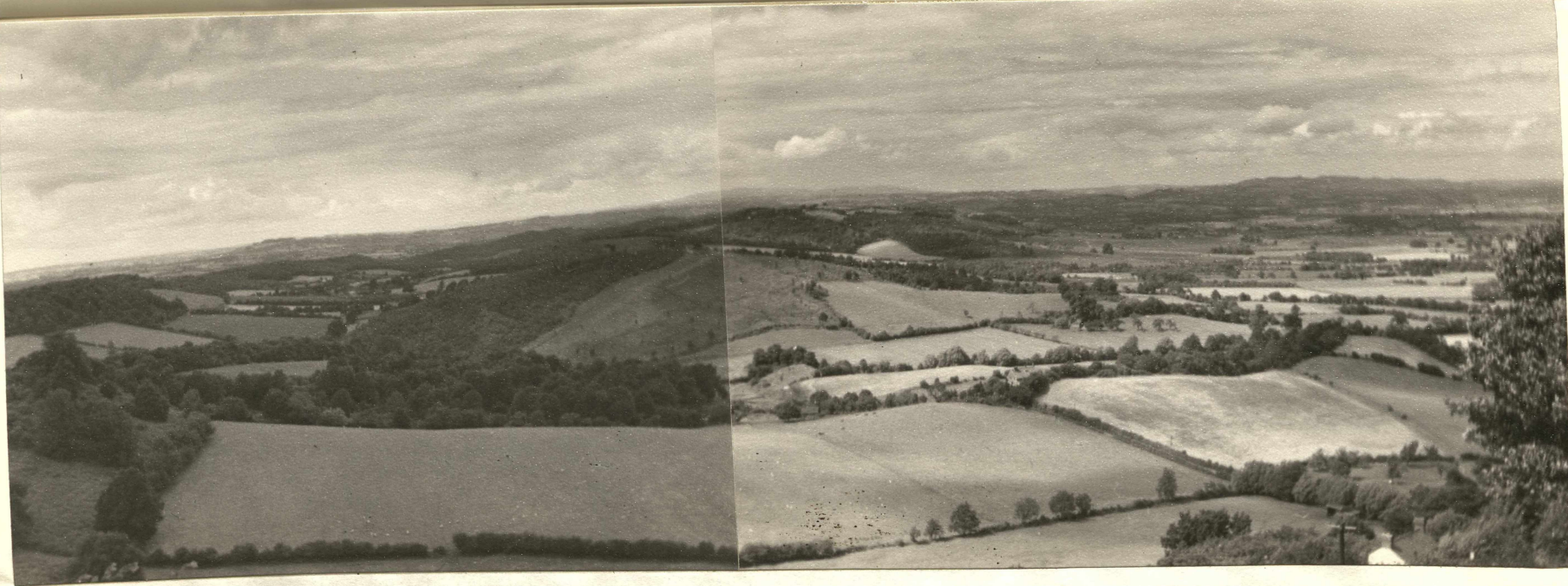
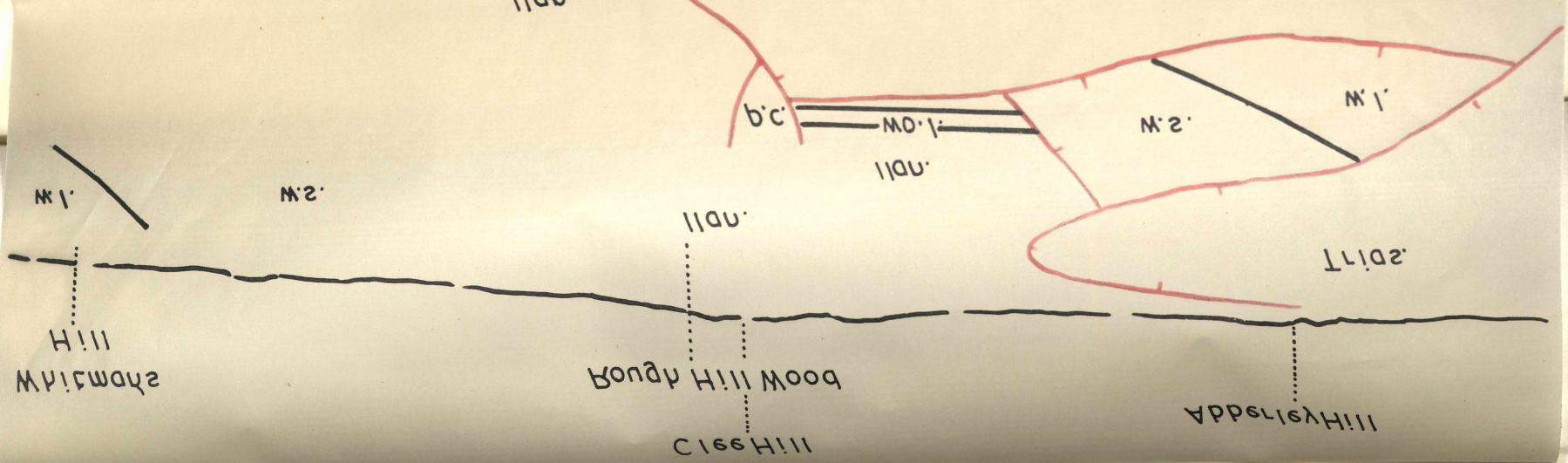


Photographer's Position:- 1050 yards N. 5° W. of
North Hill. (32/766473)

Direction:- Right photograph 355°
Left photograph 335°

Description:- Showing the line of the Malvern
Boundary Fault, the Cowleigh Park
Complex and the core of Storridge
Anticline.

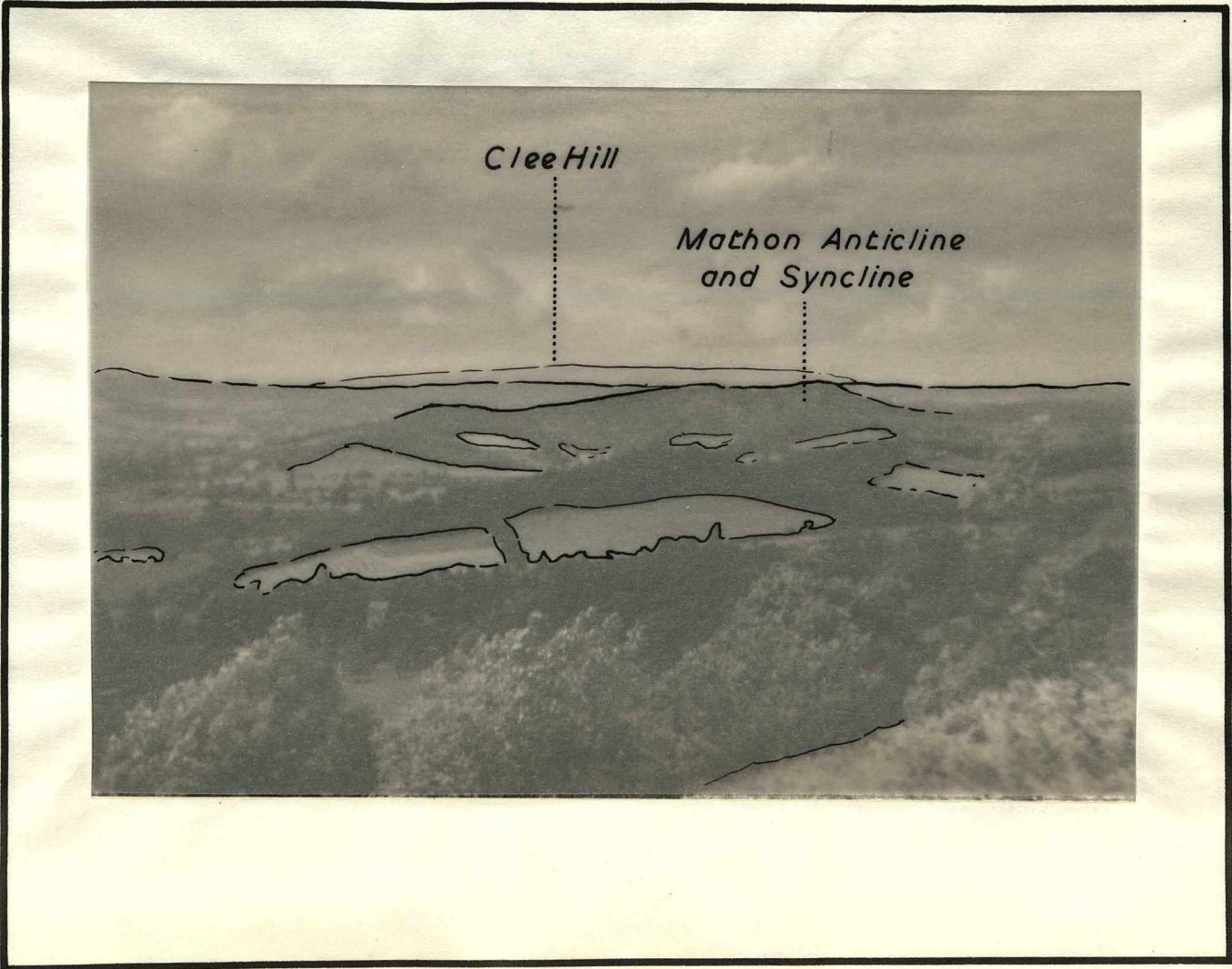




Photographer's Position:- 1200 yards S.S.W. of
Worcestershire Beacon.
(32/764453).

Direction:- 290°

Description:- The Aymestry Limestone ridges
of the Mathon Anticline and
Syncline.



Clee Hill

*Mathon Anticline
and Syncline*

and Glycine
Machou Anticline

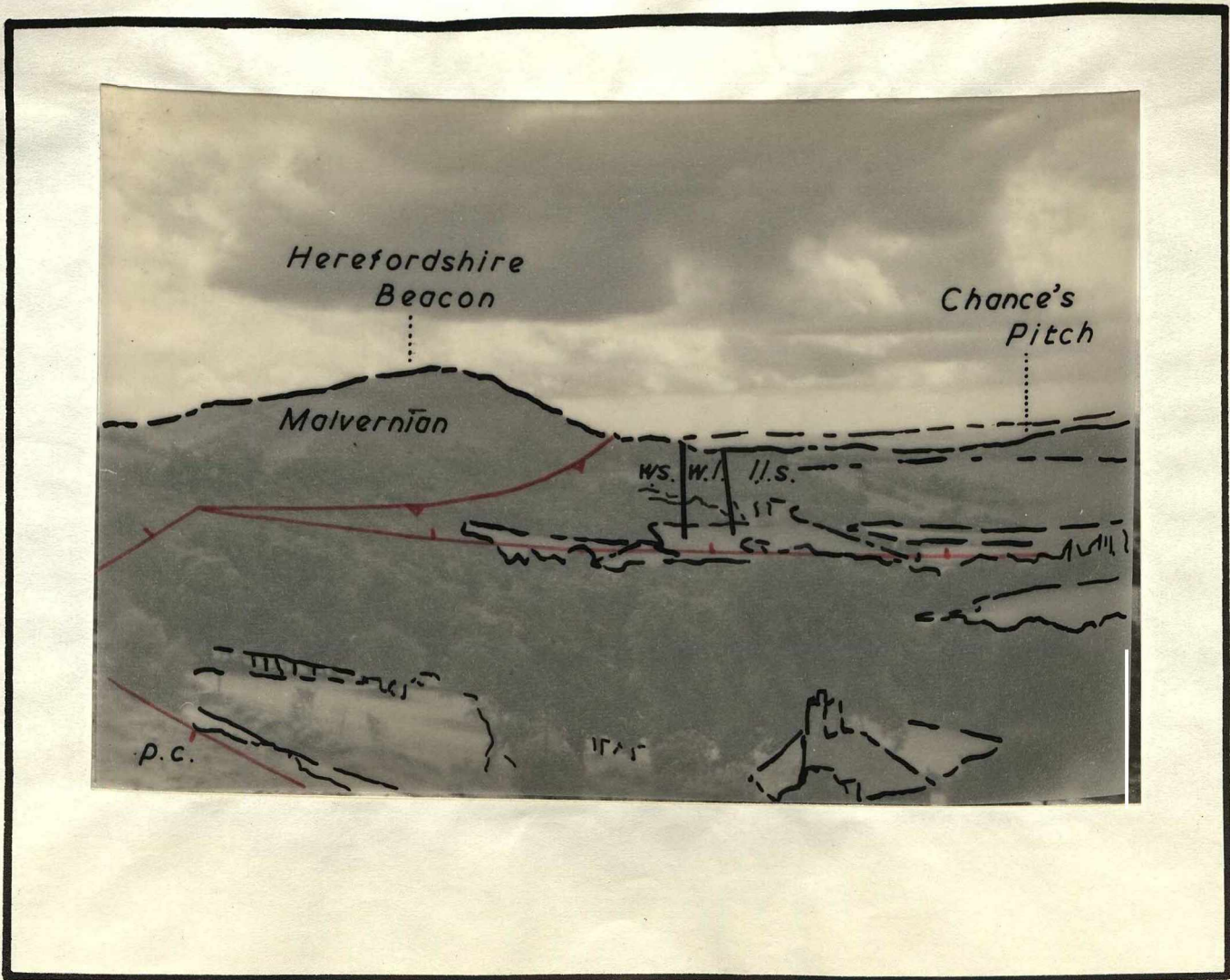
C166 Hill

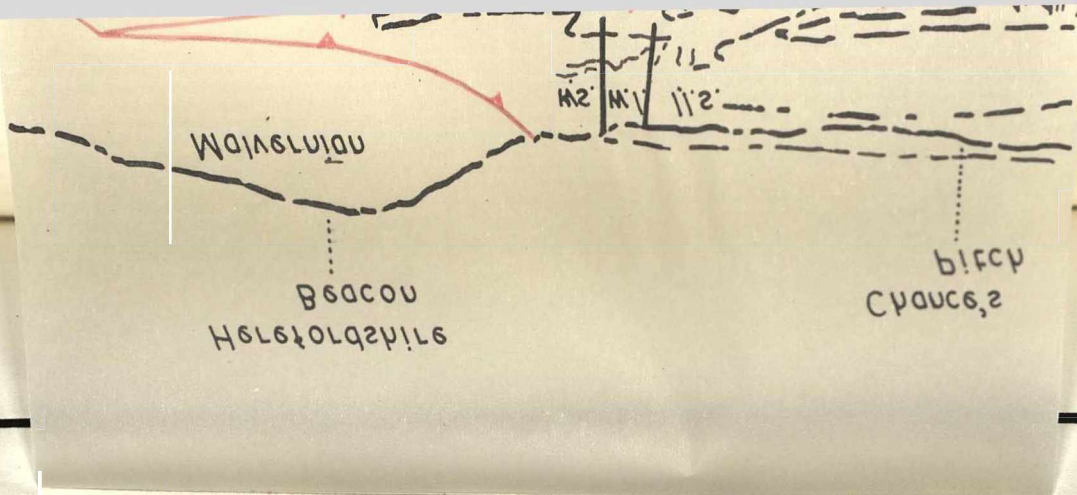


Photographer's Position:- Brand Lodge, Evendine.
(32/767414).

Direction:- 190°

Description:- The overthrust mass of pre-Cambrian which comprises Hereford Beacon.

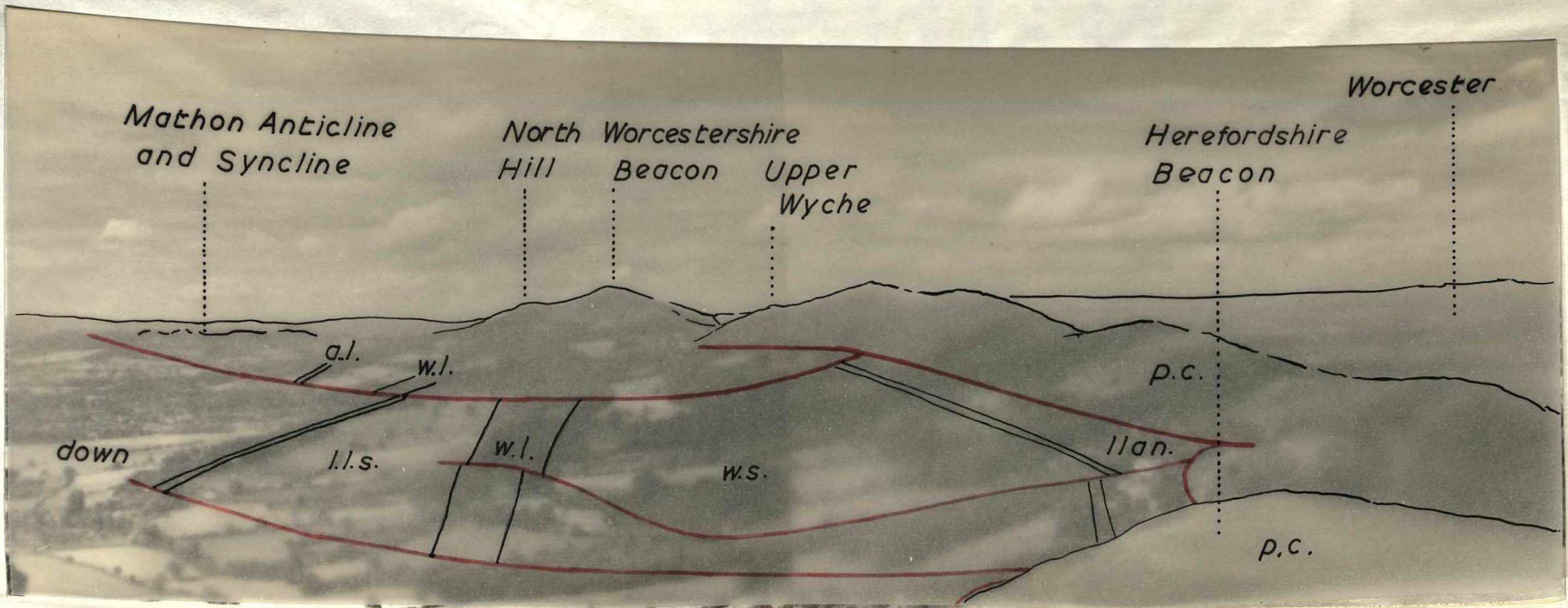


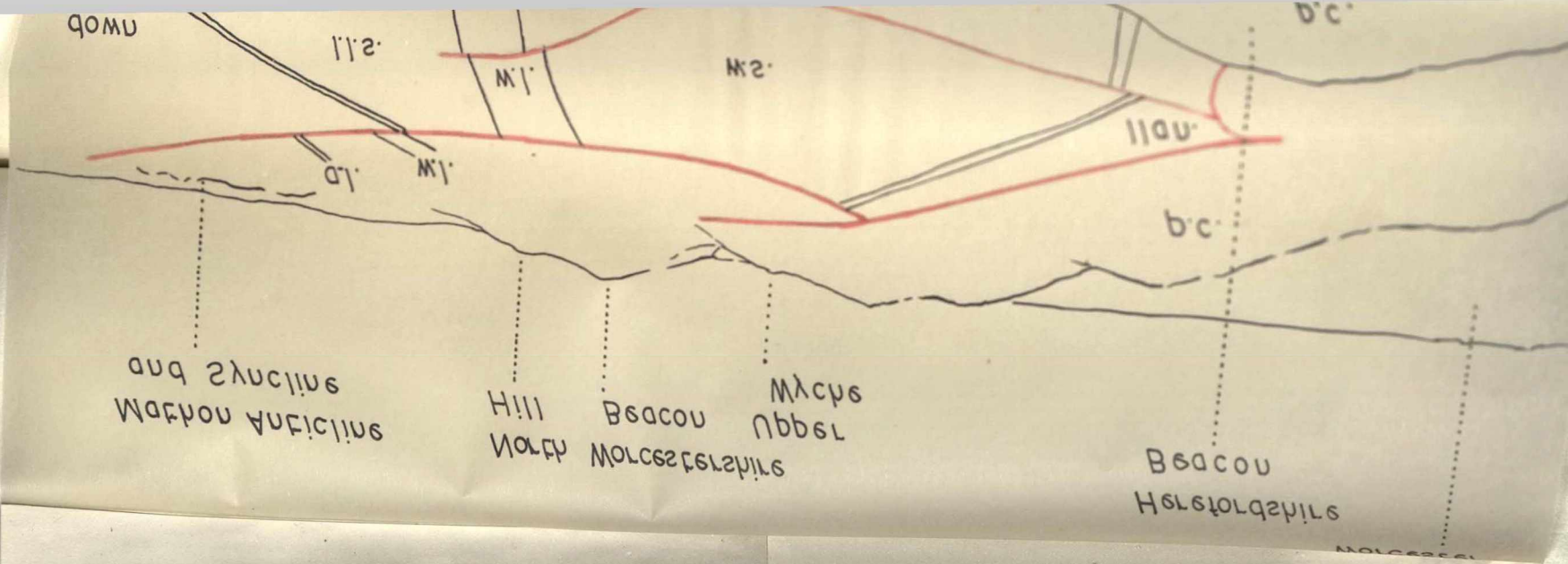


Photographer's Position:- Herefordshire Beacon.
(32/760400).

Direction:- Right photograph 020°
Left photograph 005°

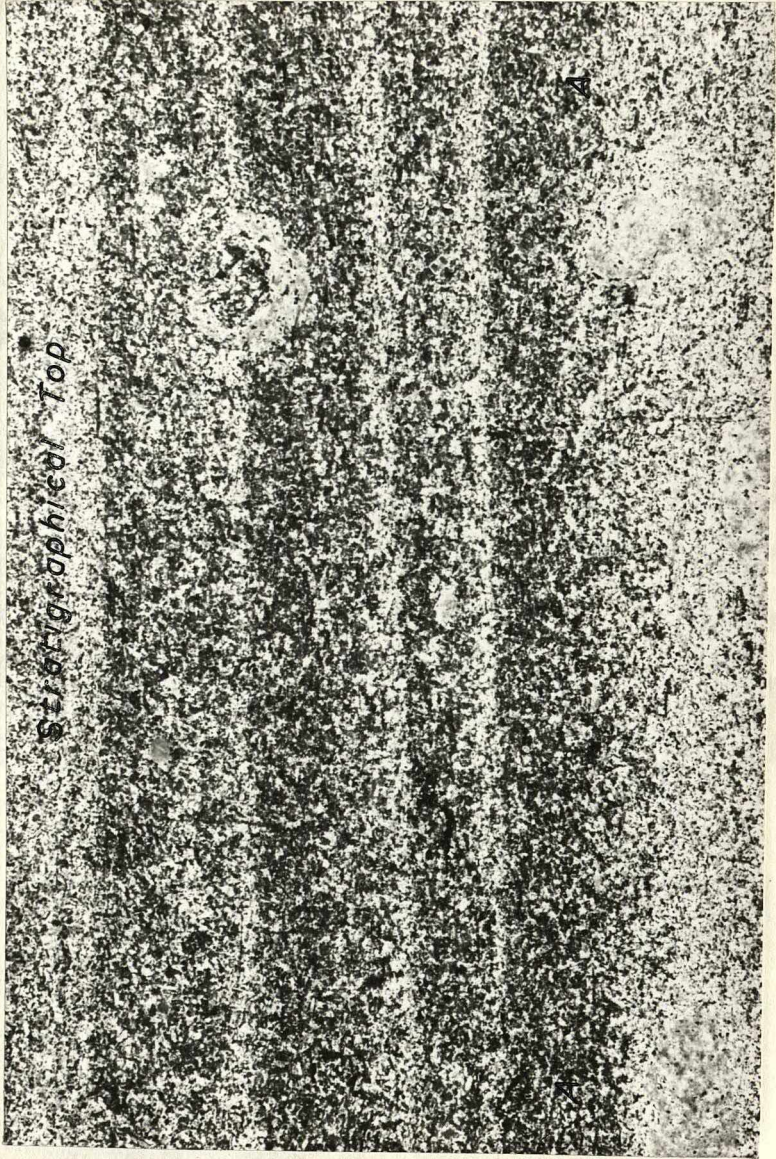
Description:- This photograph shows the line of Malvern Hills composed of pre-Cambrian rising out of the Triassic Worcestershire plain to the east and right, and the folded Silurian and Downtonian to the west and left. The immediate foreground is the pre-Cambrian of Herefordshire Beacon which has been thrust westwards from the main Malvern axis.





This photomicrograph is a ground acid etched surface across the bedding planes of a piece of Wenlock Limestone. The rhythm displayed shows a gradual increase of silt material followed by its sudden disappearance. In the photograph the black specks represent the silt with a lighter calcium carbonate matrix. The colour contrasts between the two constituents have made the photograph difficult to render, but band A shows the rhythm at its best.

X 14.



The photomicrograph is of a ground surface of a piece of Upper Ludlow Flags obtained from the quarry east of the Talbot Hotel, Knightsford Bridge by the Worcester-Bromyard road. It shows good current bedding denoting that the beds here are inverted, since the bottom of the photograph represents the tectonic top of the beds.

X 8.

