THE SEDIMENTOLOGY OF CARBONIFEROUS FLUVIAL AND DELTAIC SEQUENCES;
THE ROACHES GRIT GROUP OF THE SOUTH-WEST PENNINES
AND THE PENNANT SANDSTONE OF THE RHONDDA VALLEYS

Colin Michael Jones, BA

Thesis for the degree of Doctor of Philosophy

of the University of Keele

1977

Volume II : Figures and Plates

List of Figures

Section I

Section II

List of Plates

Section II - Roaches Grit Group

56. <u>Bergaueria</u> and <u>Cochlichnus</u>, Dane Bridge.

57. Cigar shaped trace fossil, Burbage.

58. <u>Cochlichnus</u>, Barthomley Bottoms.

59. Discontinuous sole trail.

60. Cochlichnus within B division of LF 4, Bridgehouse Farm.

61. Pipe shaped trace fossil, Upper Hulme.

62. Rounded sole trail, Burbage.

63. Simple vertical pipes.

<u>Section III. Pennant Measures</u>.

64. Tabular Cross-bedding, Cynmer.

65. Trough Cross-bedding, Cynmer.

66. Trough Cross-bedding, Cynmer.

67. Trough Cross-bedding, Earlswood Roundabout.

68. LF 3, Blaenrhondda.

69. LF 3, Blaenrhondda.

70. LF 4, Blaenrhondda.

71. X-radiograph of LF 5.

72. LF 5 filling in channel, Taff Vale.

73. LF 5 with irregular erosive base, Cynmer.

74. Large log, Quarry in Taff Vale.

75. LF 7 Conglomerate, Cynmer.

76. Conglomerate without plant material.

77. S shaped lamination in siltstone.

78. Seat-earth and coal. Earlswood roadcutting.

79. LF 10 Ripple-laminated Siltstone and fine Sandstone, Blaenrhondda.

80. LF 11 Laminated Silty Sandstone.

81. Association B in the Llynfi Beds, Nant y Gwair.

82. Channels in Taff Vale Quarry.

83. Flat channel base overlying siltstone, Blaenrhondda road cutting.

84. Dune profile preserved by siltstone.

85. Trough filled in with siltstone, Blaenrhondda road cutting.

86. Alternation of siltstone with ripple laminated and trough-cross-bedded sandstone, Blaenrhondda road cutting.

87. As Plate 86, same locality.

88. As Plate 87, sequence cut out by a siltstone filled channel, same locality.

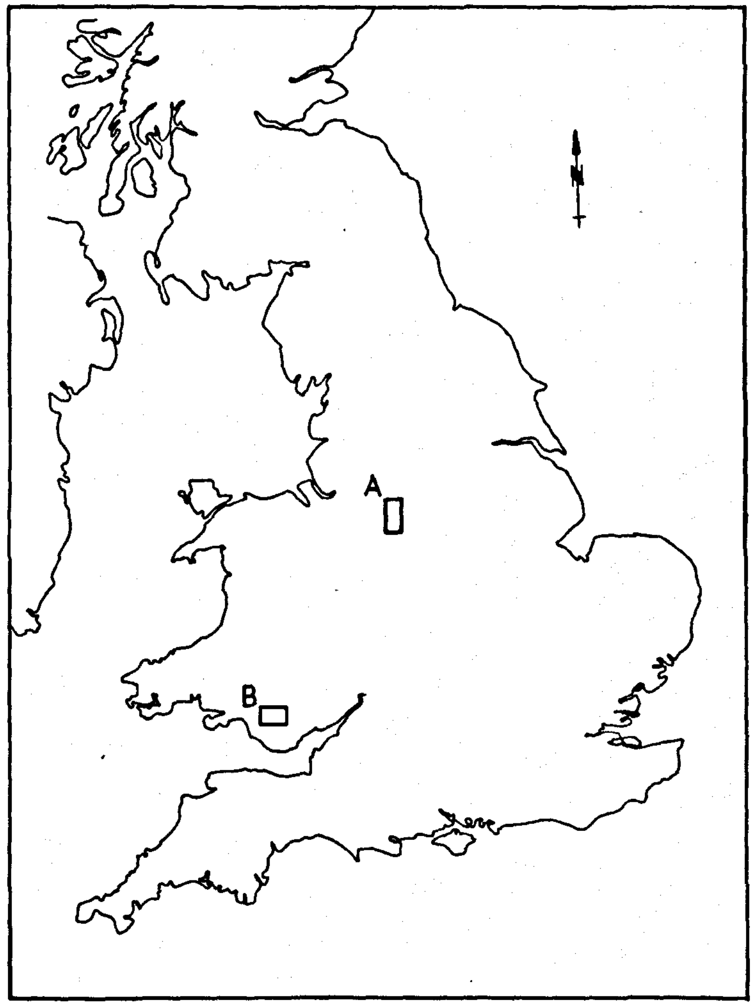
SECTION I Figs

Fig. 1. Location of research areas:

A. The Roaches Grit Group.

B. The Lower Pennant Measures.

Fig.2. Definition of bedform types commonly discussed in the text.


N
A
B

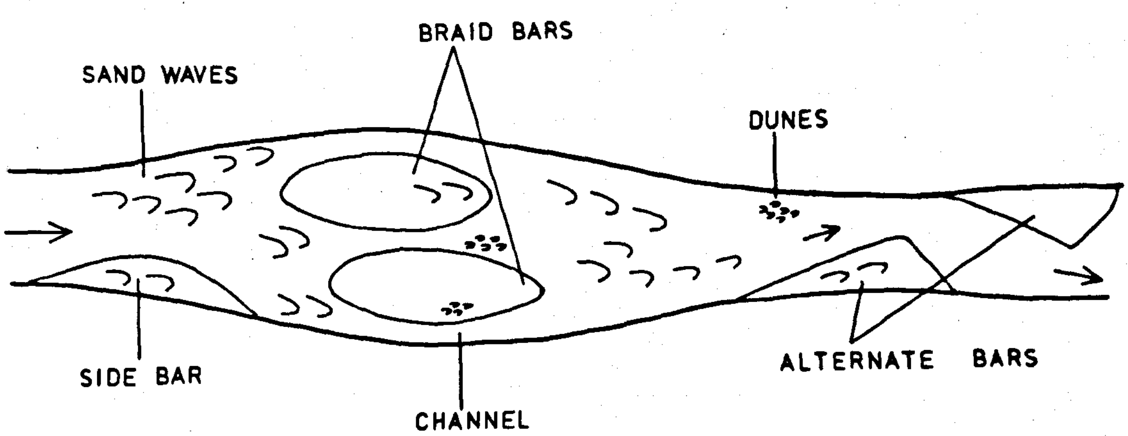

BRAID BARS
SAND WAVES
DUNES
SIDE BAR
CHANNEL
ALTERNATE BARS

Fig.3. Main types of non-meandering river channels.

A. Straight channel At high stage the thalweg meanders between side bars or alternate bars. At low stage the thalweg has a smaller wavelength and the side bars are eroded.

B. Braided channel At high stage there is only one channel covered with linguoid sand waves. At low stage the sandwaves are emergent, splitting the flow into many smaller components.

C. Multiple channel braided river At high stage the flow is split into two or more separate channels by islands or braid bars.

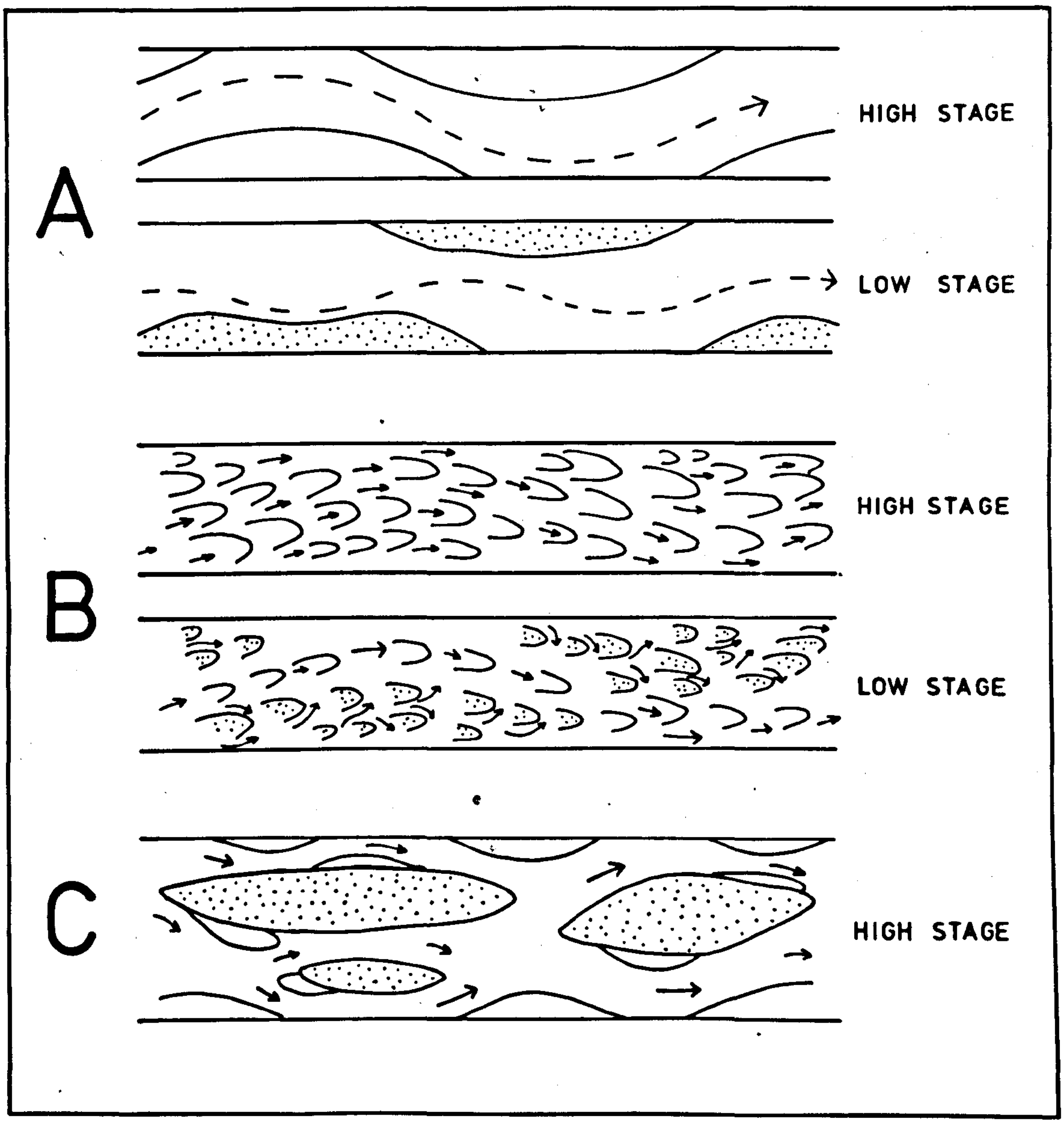

A
HIGH STAGE
LOW STAGE
B
HIGH STAGE
LOW STAGE
C
HIGH STAGE

Fig.4. Annual discharge hydrographs of the Platte, Tannai and Brahmaputra Rivers. After Smith (1974) Norges Vassdrags-og Elektrigitetsvesen (1958), and Coleman (1969).

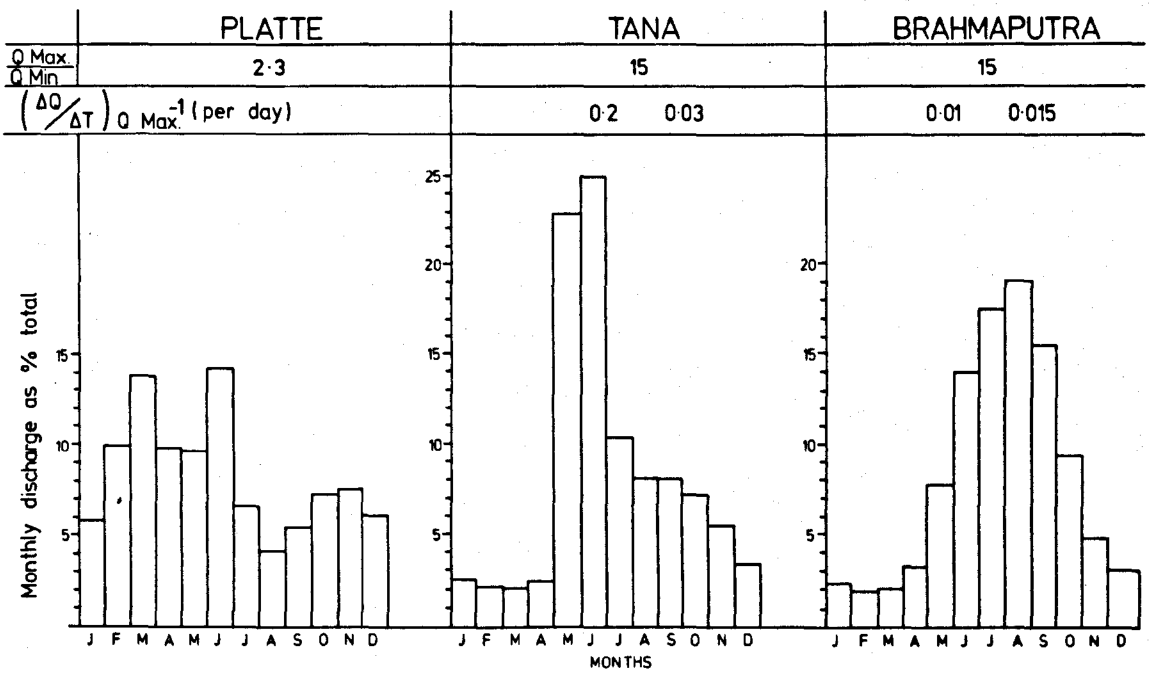
Fig.5. Possible sedimentary responses for dunes with different rates of fall of discharge.

A. Very slow rate of fall. Large dunes are replaced by smaller ones, producing a thinning upwards coset.

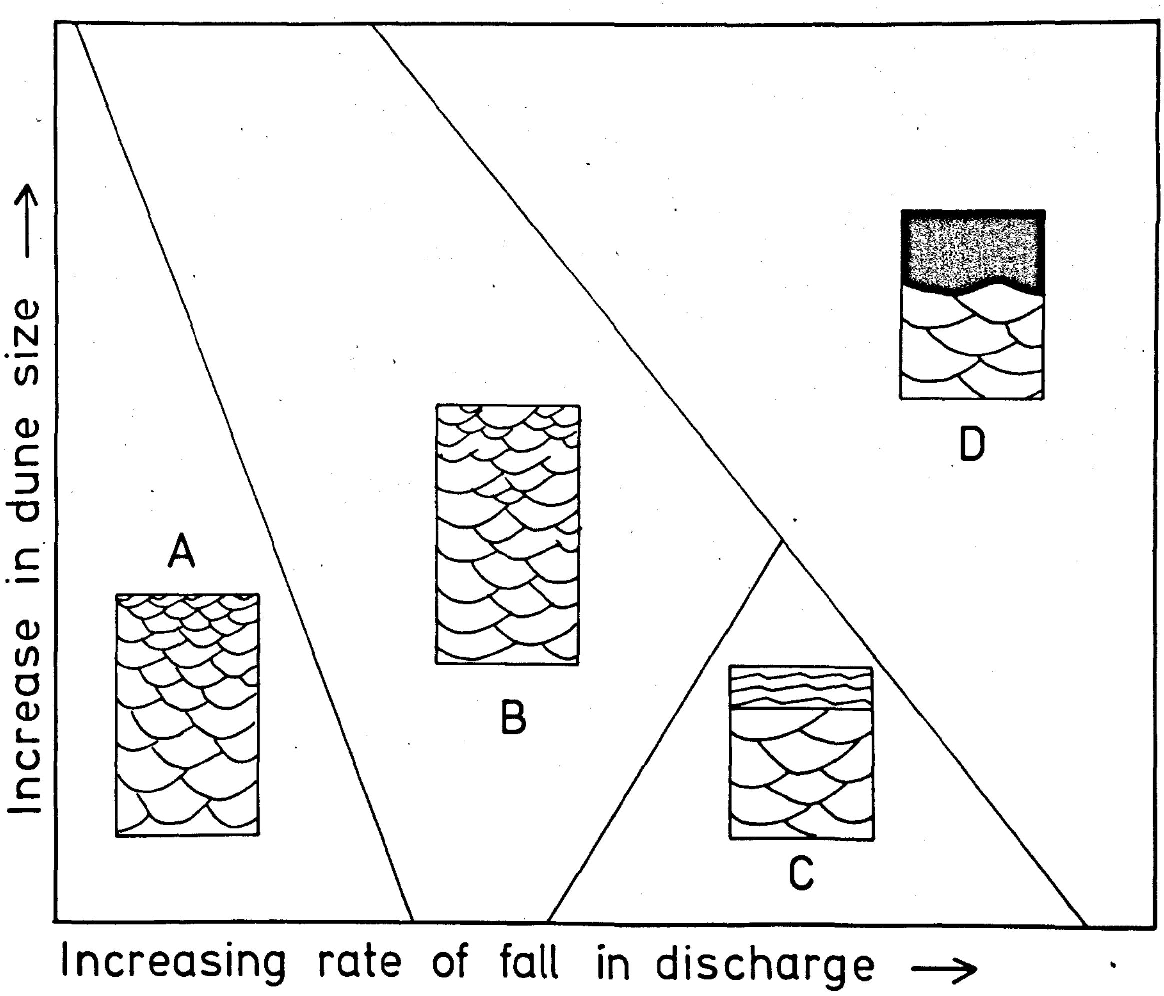
B. Slow rate of fall. Newly formed dunes are smaller producing a mixed population. With net sedimentation some sets in the upper part of the sequence are smaller.

C. Moderate rate of fall. Dunes are washed out and replaced by ripples. Coset of ripple lamination overlies a coset of trough cross-bedding.

D. Rapid rate of fall. Dunes become inactive but their shapes are preserved. These are covered with mud during low stage.



PLATTE
TANA
BRAHMAPUTRA
Q Max. / Q Min
2·3
15
15
(ΔQ/ΔT) Q Max.⁻¹ (per day)
0·2 0·03
0·01 0·015
Monthly discharge as % total
J F M A M J J A S O N D
MONTHS



Increase in dune size →
A
B
C
D
Increasing rate of fall in discharge →

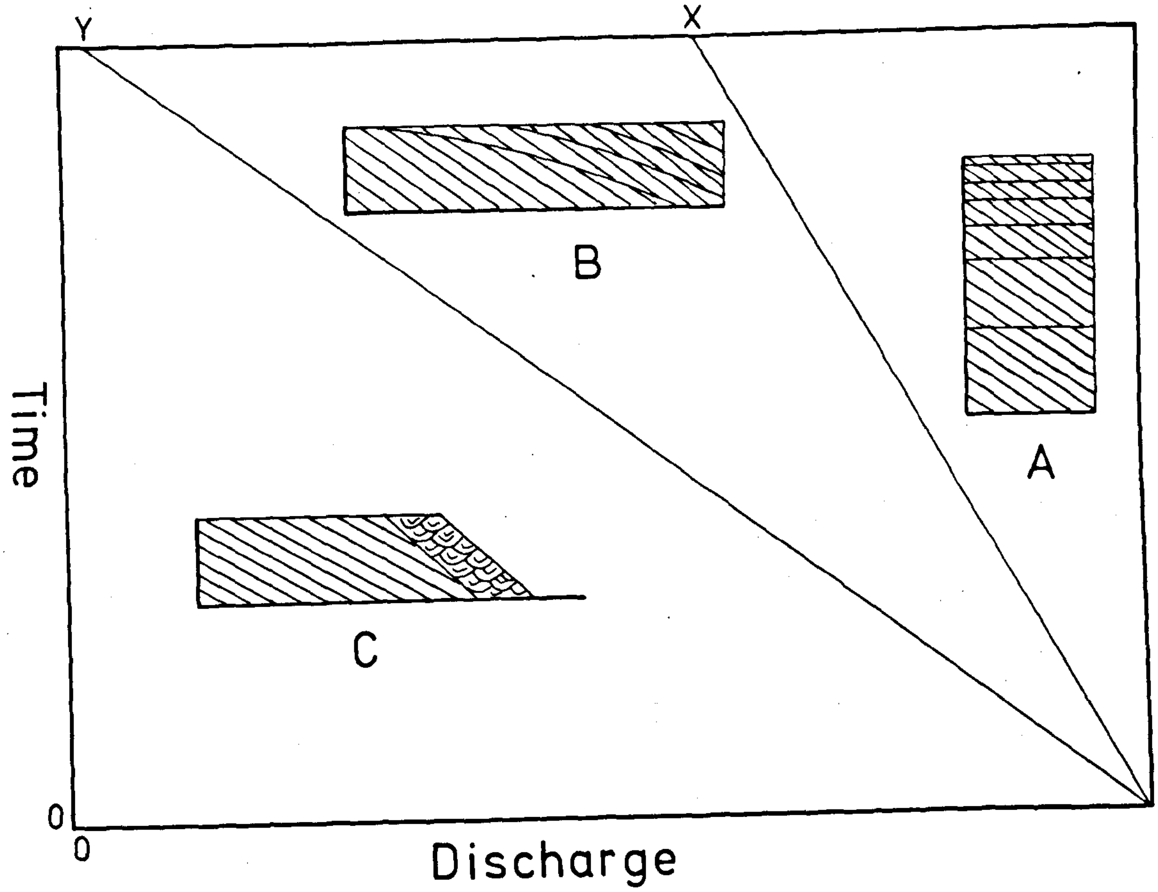
Fig.6. Possible sedimentary responses for sandwaves with different rates of fall of discharge.

A. Slow rate of fall. Large sandwaves are replaced by smaller ones producing a thinning upwards coset.

B. Moderate rate of fall. Smaller sandwaves are superimposed on the now inactive large ones. Multiple convex up erosion surfaces are produced within the foresets of the larger bedform.

C. Rapid rate of fall. Flow around the front of the bedform erodes the slip face and deposits a coset of small trough cross-bedding or ripple-lamination.

Fig.7. Vertical section through the bed of the Frazer River during a flood showing the increase in the size of the bedforms and superimposition during falling stage. Length of reach about 670m. After Pretious and Blench (1951).


Y
X
B
A
Time
C
0
0
Discharge

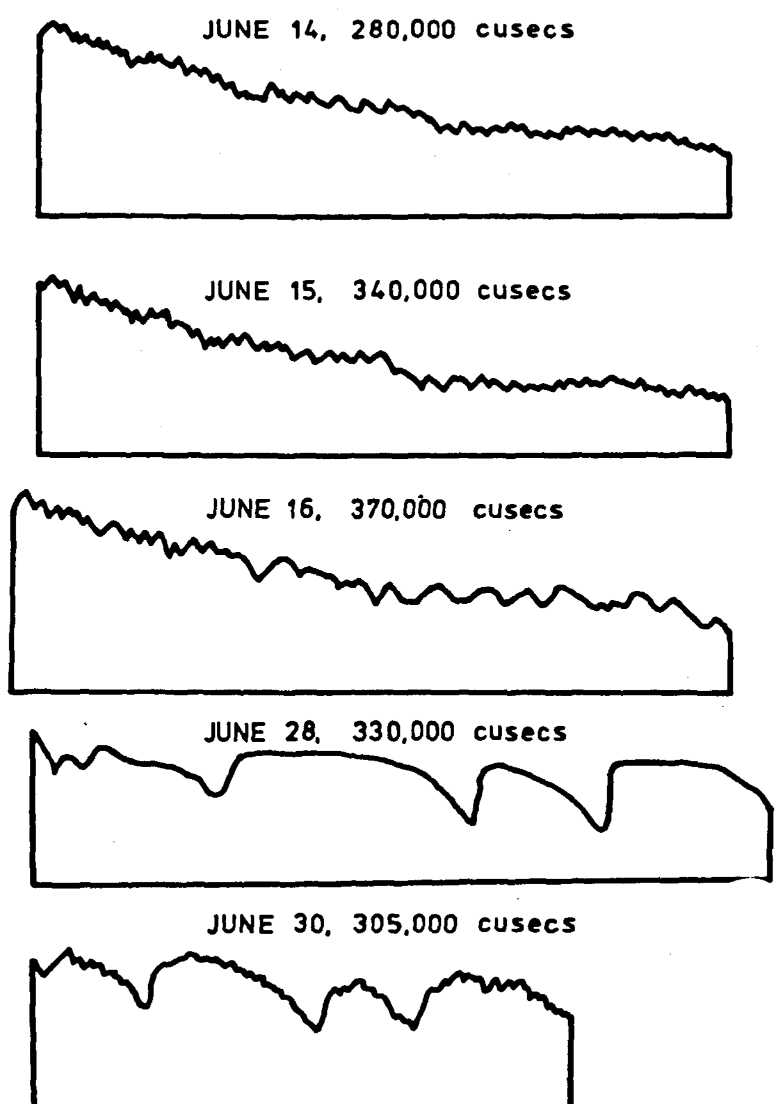

JUNE 14, 280,000 cusecs
JUNE 15, 340,000 cusecs
JUNE 16, 370,000 cusecs
JUNE 28, 330,000 cusecs
JUNE 30, 305,000 cusecs

Fig.8. The formation of convex upwards erosion surfaces in flume experiments with an artifical delta and superimposed ripples.

a. Ripple approaching the delta crest.

b. The same ripple moving down the delta slope and being washed out by the separation flow in front of the succeeding ripple.

c. The same process further advanced.

d. The ripple has now been completely removed and the next ripple is beginning to descend the delta slope. The separation flow in front of this has cut a convex up erosion surface.

e. This ripple is now being eroded by the separation flow in front of a third ripple. The lower part of the convex up erosion surface will be preserved. (After McCabe and Jones, 1977)

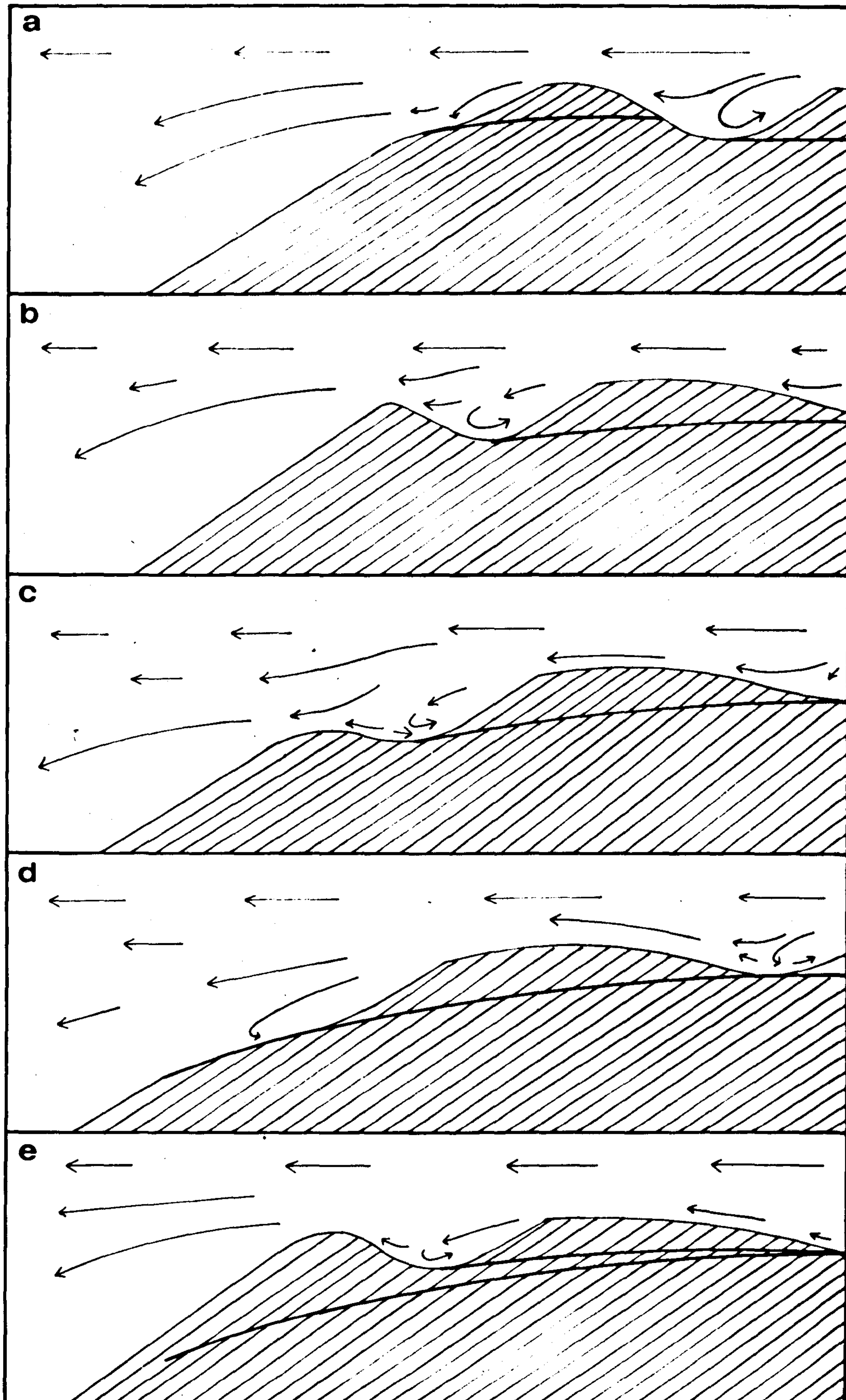

a
b
c
d
e

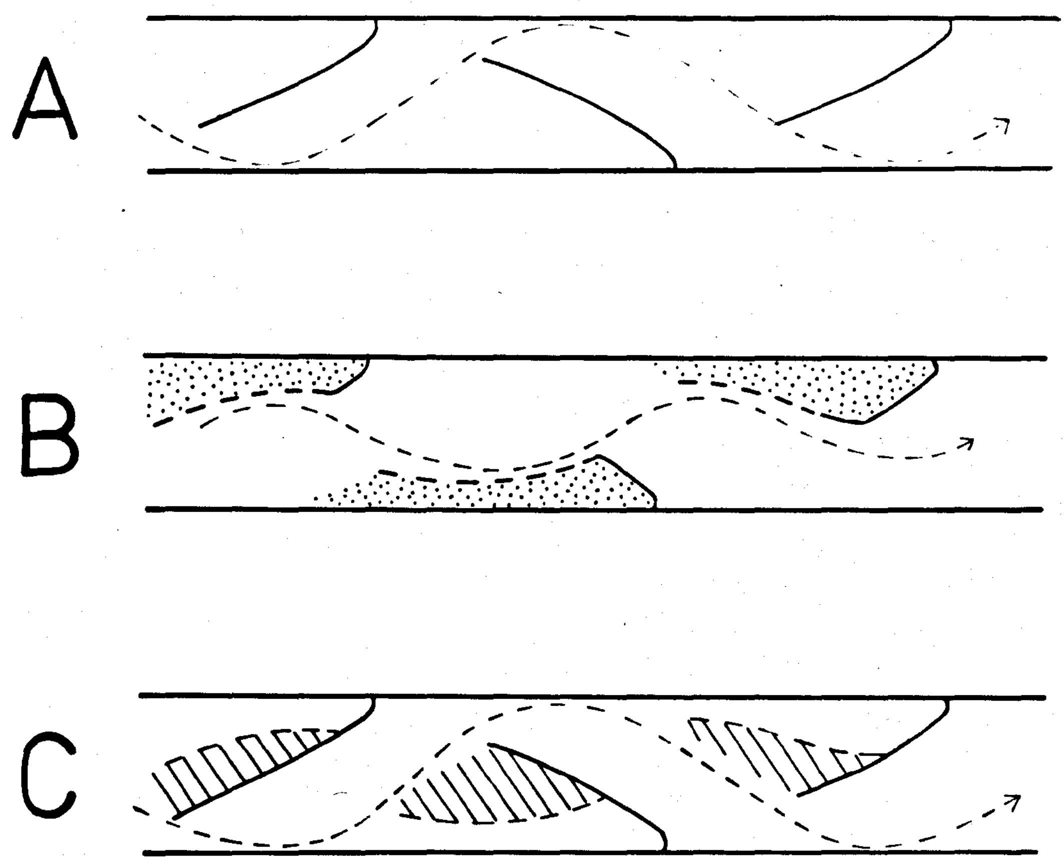
Fig.9. Plan view of a straight channel with alternate bars:

A - At high stage.

B - During falling stage. With less water in the channel the thalweg has a smaller wavelength and the alternate bars are eroded.

C - During the succeeding high stage the bars are reactivated.

Fig.10. Section through an alternate bar, showing erosion and reactivation of the bar during the three stages shown in Fig.9.


A
B
C

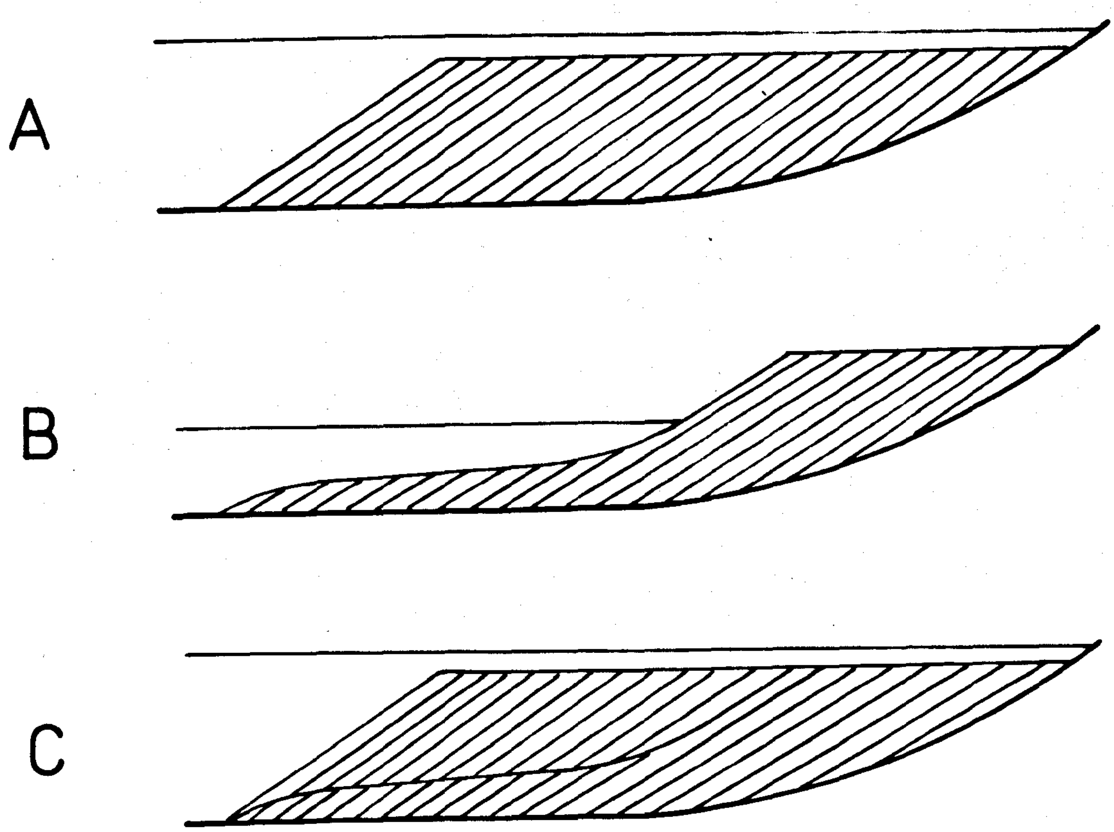
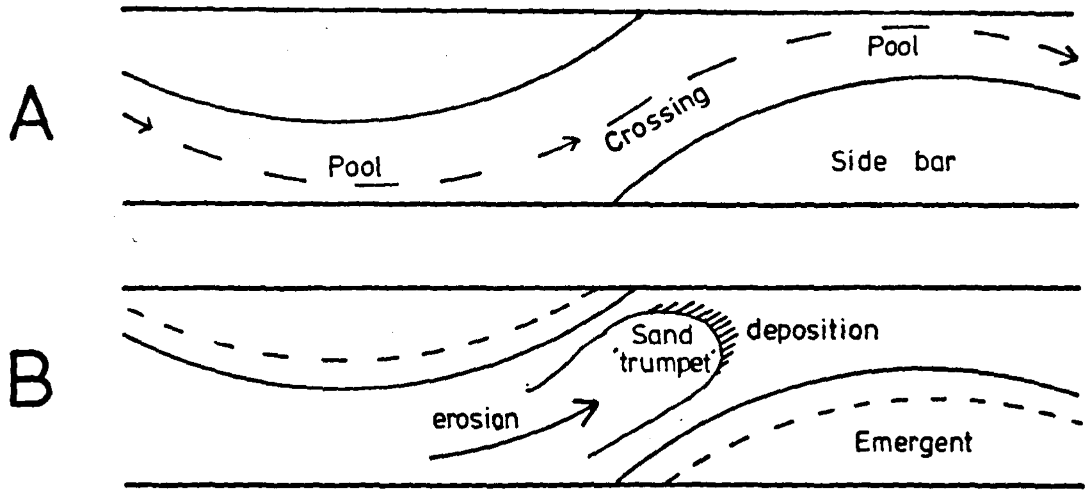

A
B
C

Fig.11. The construction of a 'sand trumpet' during falling stage, after Nedeco (1959).

Fig.12. The process of channel abandonment in braided rivers with semi-permanent islands. The flow splits into two components forming an island in the middle (1). The main thalweg flows along one channel (2), but this is blocked off by a side bar moving down the river diverting the main flow into the hitherto minor channel (3). A permanent shift in the course of the river preserves the channel abandonment sequence (4).


A
Pool
Crossing
Pool
Side bar
B
Sand
'trumpet'
deposition
erosion
Emergent

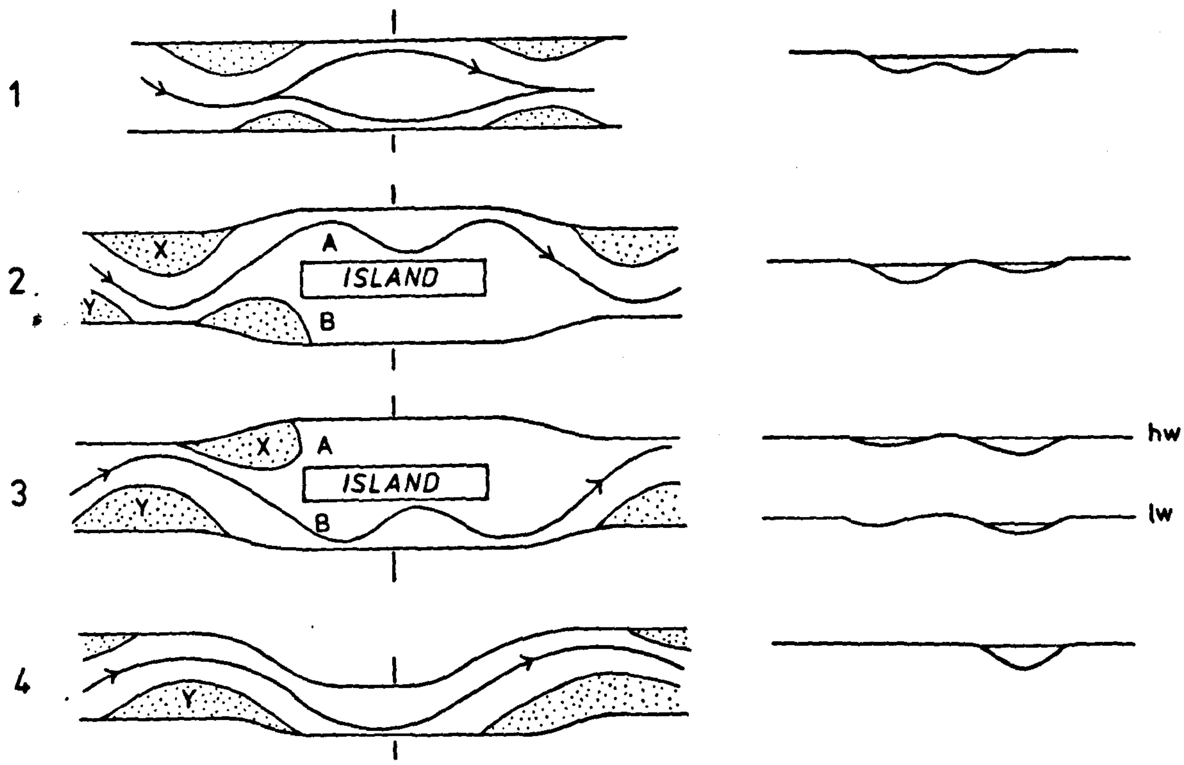

1
2.
X
A
ISLAND
Y
B
3
X
A
ISLAND
Y
B
hw
lw
4
Y

Fig.13. River bed scour during floods in A, the Colorado River and B, the Yellow River. After Leopold, Wolman and Miller (1964), and Freeman (1922).

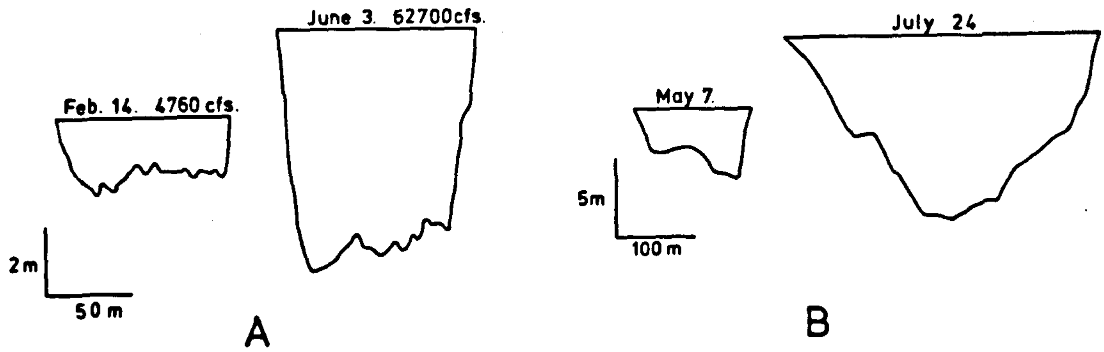
Fig.14. Geological map of northern England showing location of research area covering the Roaches Grit Group.

S - Stoke

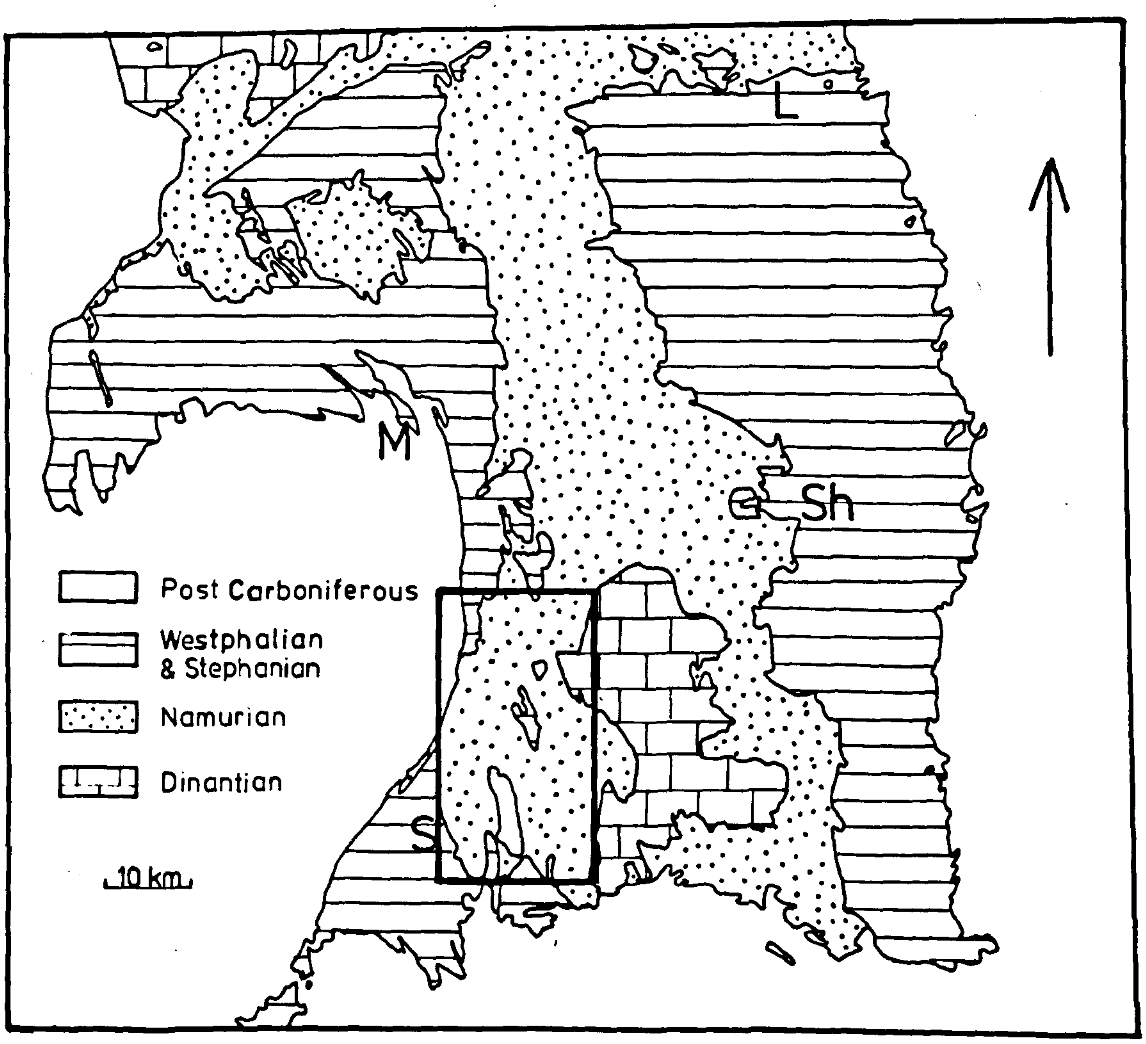
Sh - Sheffield

M - Manchester

L - Leeds



Feb. 14. 4760 cfs.
June 3. 62700cfs.
2m
50 m
A
May 7.
July 24
5m
100 m
B



L
M
Sh
S
Post Carboniferous
Westphalian & Stephanian
Namurian
Dinantian
10 km

SECTION II Figs

Fig.15. Detailed geological map of the research area showing the outcrop of the sandstones in the Roaches Grit Group. (Pullout at end of thesis).

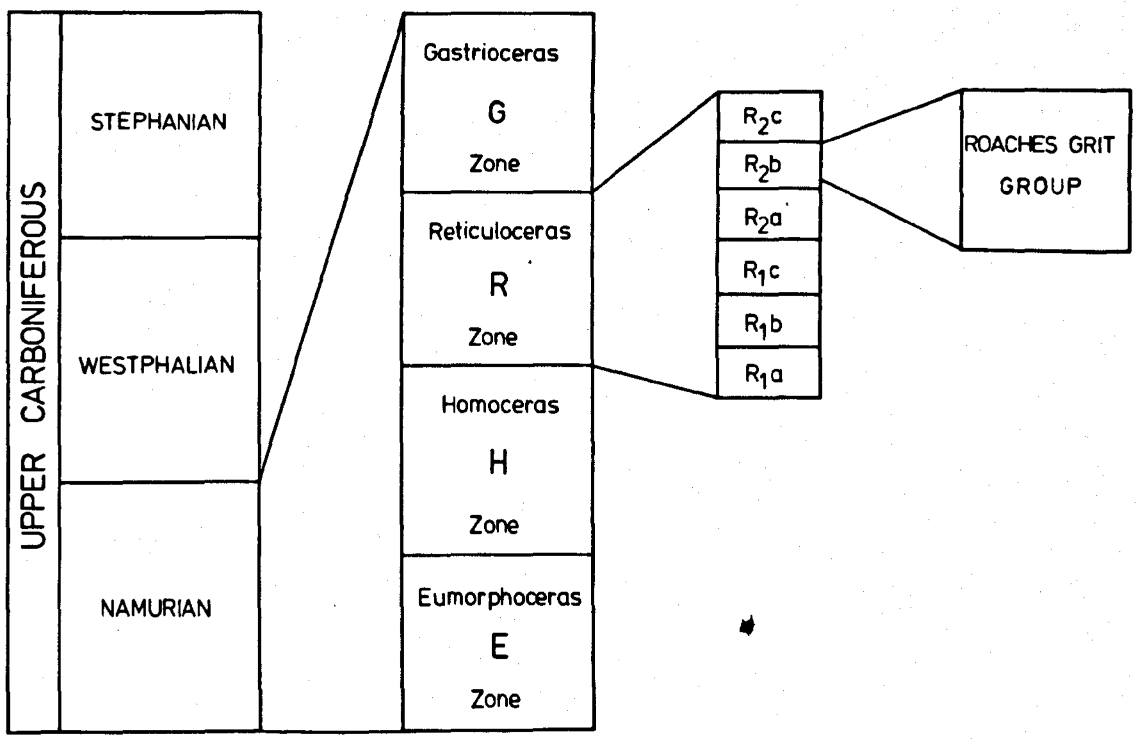
Fig.16. Stratigraphical position of the Roaches Grit Group.

Fig.17. Palaeocurrents in turbidites.

A. Bottom structures, directions known.

B. Ripples.

C. Bottom structures, direction unknown.


UPPER CARBONIFEROUS
STEPHANIAN
WESTPHALIAN
NAMURIAN
Gastrioceras
G
Zone
Reticuloceras
R
Zone
Homoceras
H
Zone
Eumorphoceras
E
Zone
R2c
R2b
R2a
R1c
R1b
R1a
ROACHES GRIT
GROUP

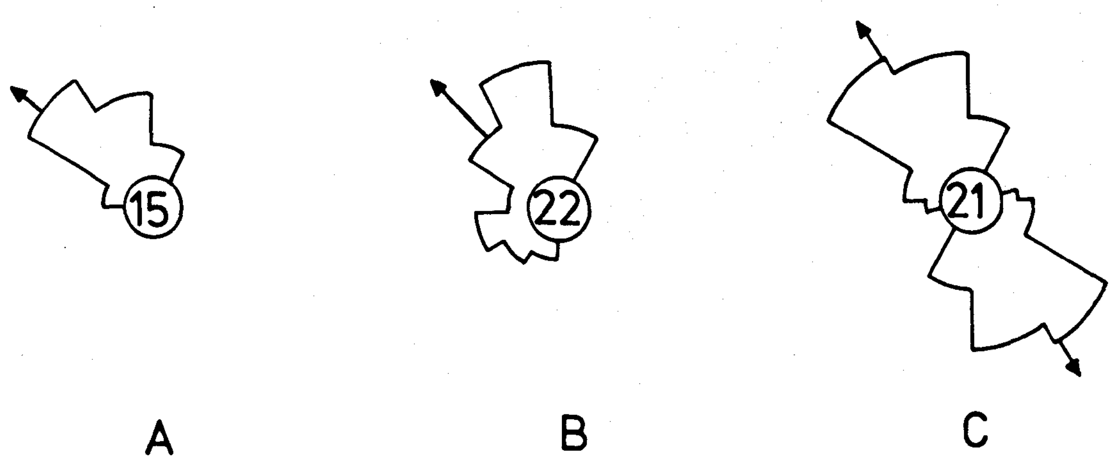

15
22
21
A
B
C

Fig.18. Major vertical sections in the Roaches Grit Group.

Purple. Deep Water Association.

Green. Delta Slope Association.

Orange. Upper Slope and Delta Top Association.

Red. Delta Margin Association.

The inset shows the location of the sections and the main regional variations which are explained in the text. (Pull out at end of thesis)

Fig.19. Detailed vertical sections in turbidites.

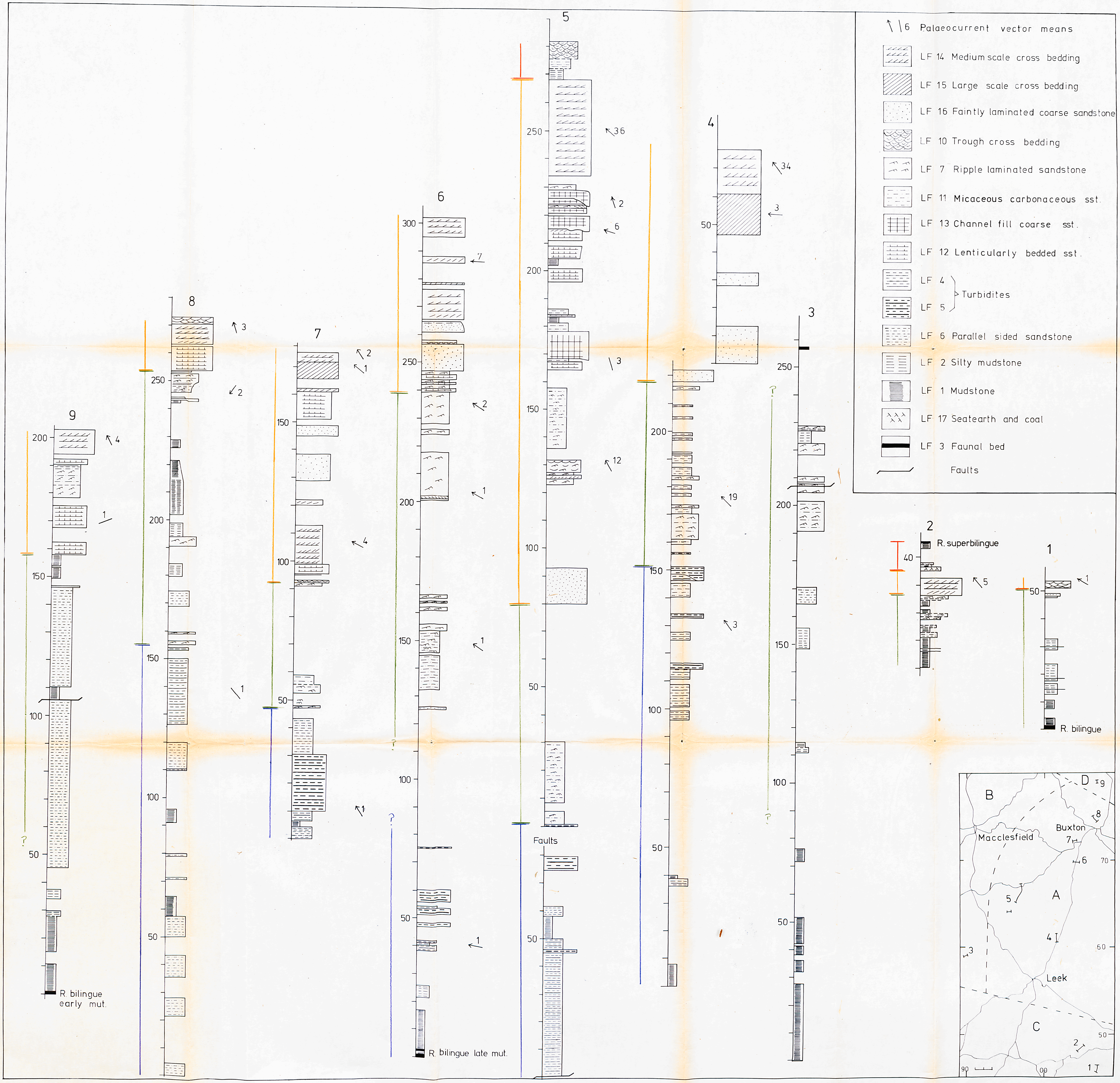
A. Quarry near Bridgehouse Farm (SK 0368 7200).

B. Stream section below Upper Hulme (SK 012 609).

C. Walker Barn Quarry (SJ 952 736).

Individual sandstone beds are shown in white, and lines of mudstone flakes are shown as black dots. Mudstones and siltstones are shown in black.

Vertical scales in metres.



Palaeocurrent vector means
LF 14 Medium scale cross bedding
LF 15 Large scale cross bedding
LF 16 Faintly laminated coarse sandstone
LF 10 Trough cross bedding
LF 7 Ripple laminated sandstone
LF 11 Micaceous carbonaceous sst.
LF 13 Channel fill coarse sst.
LF 12 Lenticularly bedded sst.
LF 4
LF 5
Turbidites
LF 6 Parallel sided sandstone
LF 2 Silty mudstone
LF 1 Mudstone
LF 17 Seatearth and coal
LF 3 Faunal bed
Faults
R. superbilingue
R. bilingue
R. bilingue early mut.
R. bilingue late mut.
Faults
Macclesfield
Buxton
Leek

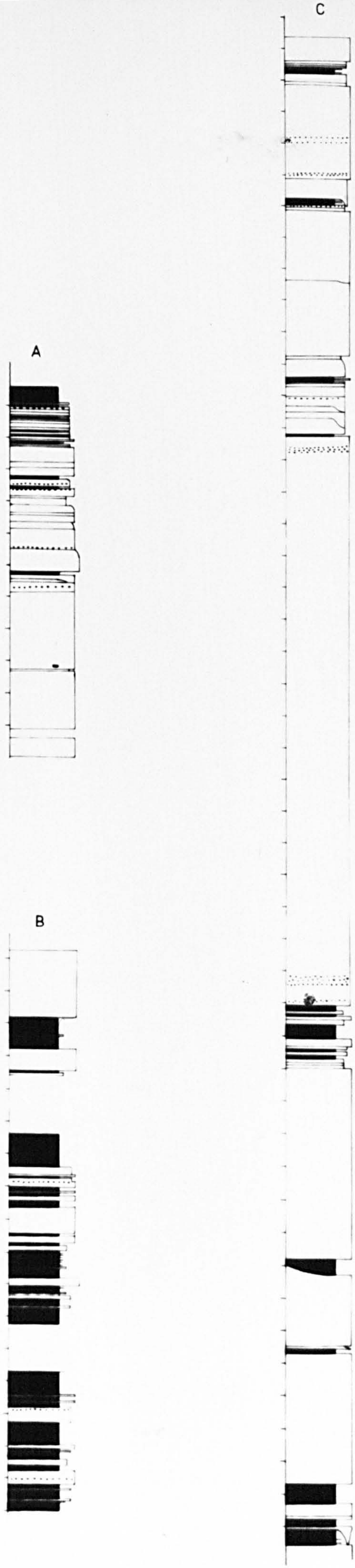
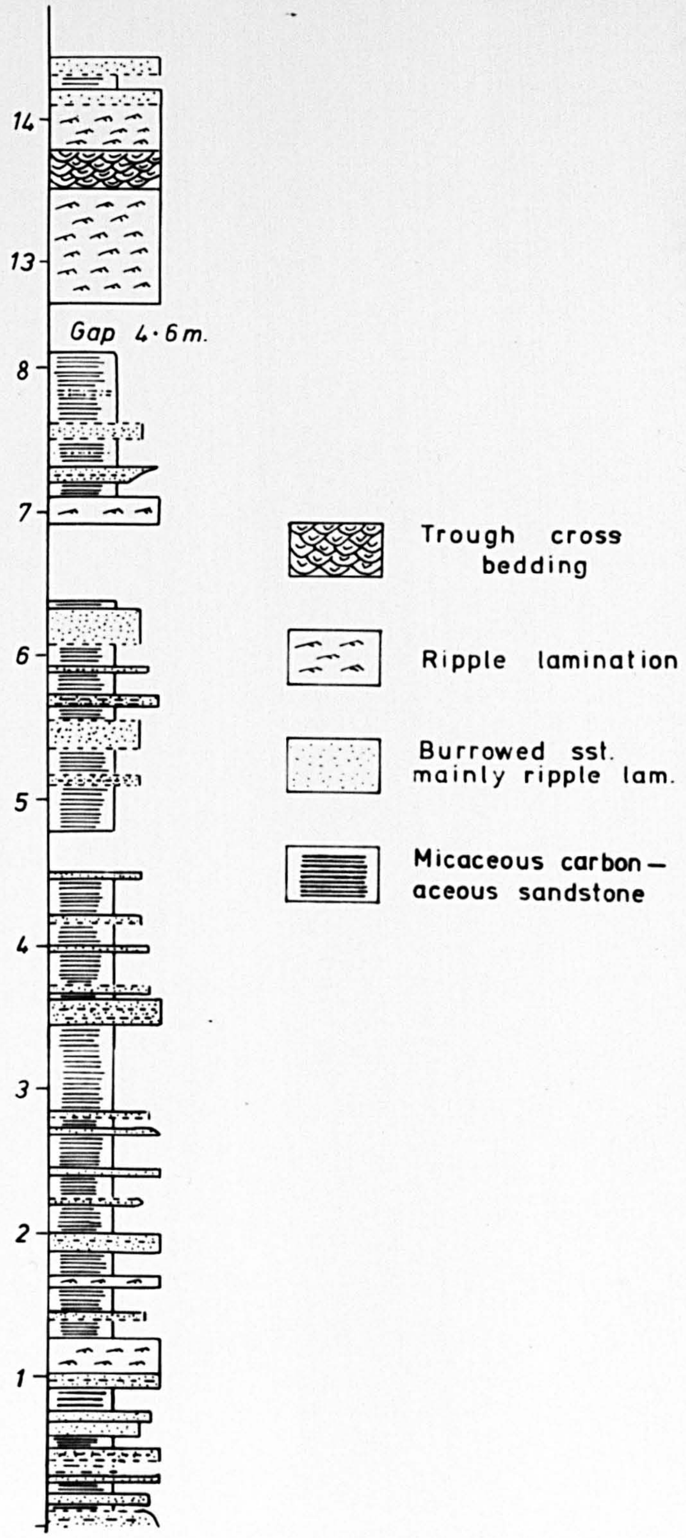

C
A
B

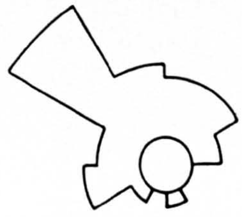
Fig.19a. Detailed vertical sequence in the main Delta Slope Association, showing the typical alteration of LF 7 Ripple-laminated Sandstone and LF 8, Micaceous, Carbonaceous Sandstone.

Bosley (SJ 911 649)

Vertical scale in metres.

Fig.20. Palaeocurrents from LF 7 Ripple-laminated Sandstone in the main Delta Slope Association.


14
13
Gap 4·6m.
8
7
6
5
4
3
2
1
Trough cross bedding
Ripple lamination
Burrowed sst. mainly ripple lam.
Micaceous carbon-aceous sandstone



n = 35

Fig.21. Detailed vertical sections in the Upper Slope Assemblage of Association C.

A. River Dane SJ 9706 6622 - SJ 9711 6645.

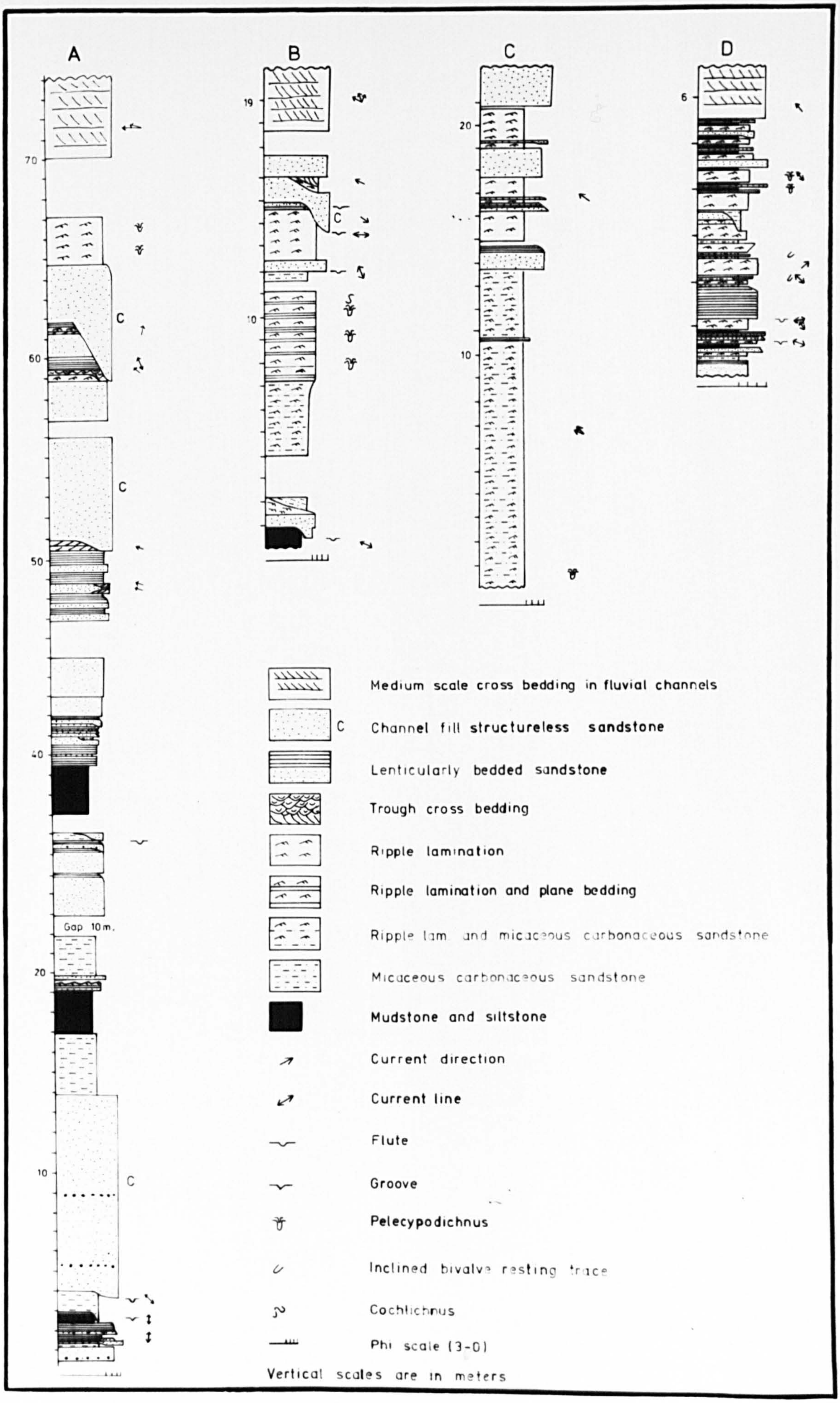
B. Hogshaw Brook SK 0547 7490 - SK 0543 7498

C. Cisterns Clough SK 032 698

D. Chapel Station Quarry SK 0558 7932

Fig.22. Old quarry near Folly Mill (SJ 9708 6641) showing LF 12 Lenticularly-bedded Sandstone with interbedded trough cross bedded and ripple laminated sandstone.

The upper part of the section is cut out by a channel filled with coarse grained structureless sandstone of LF 13. (Pullout at end of thesis.)



A
B
C
D
Gap 10 m.
Medium scale cross bedding in fluvial channels
Channel fill structureless sandstone
Lenticularly bedded sandstone
Trough cross bedding
Ripple lamination
Ripple lamination and plane bedding
Ripple lam. and micaceous carbonaceous sandstone
Micaceous carbonaceous sandstone
Mudstone and siltstone
Current direction
Current line
Flute
Groove
Pelecypodichnus
Inclined bivalve resting trace
Cochlichnus
Phi scale (3-0)
Vertical scales are in meters

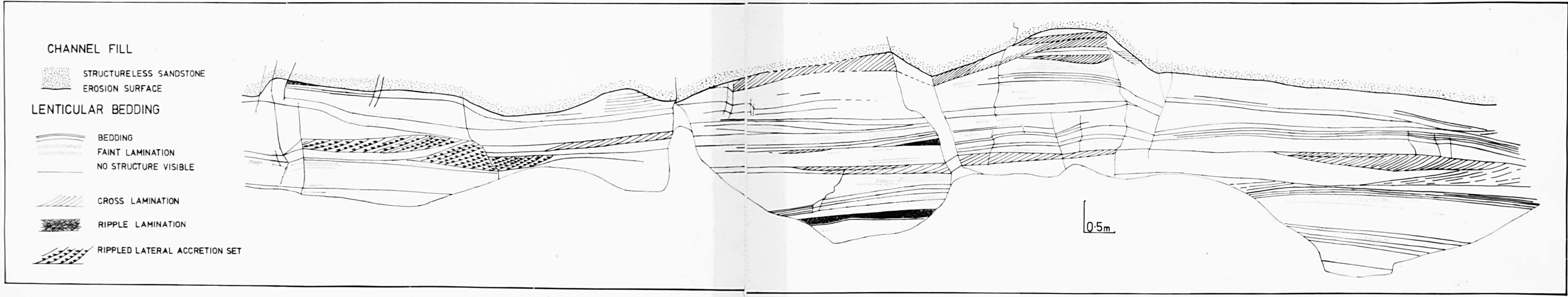
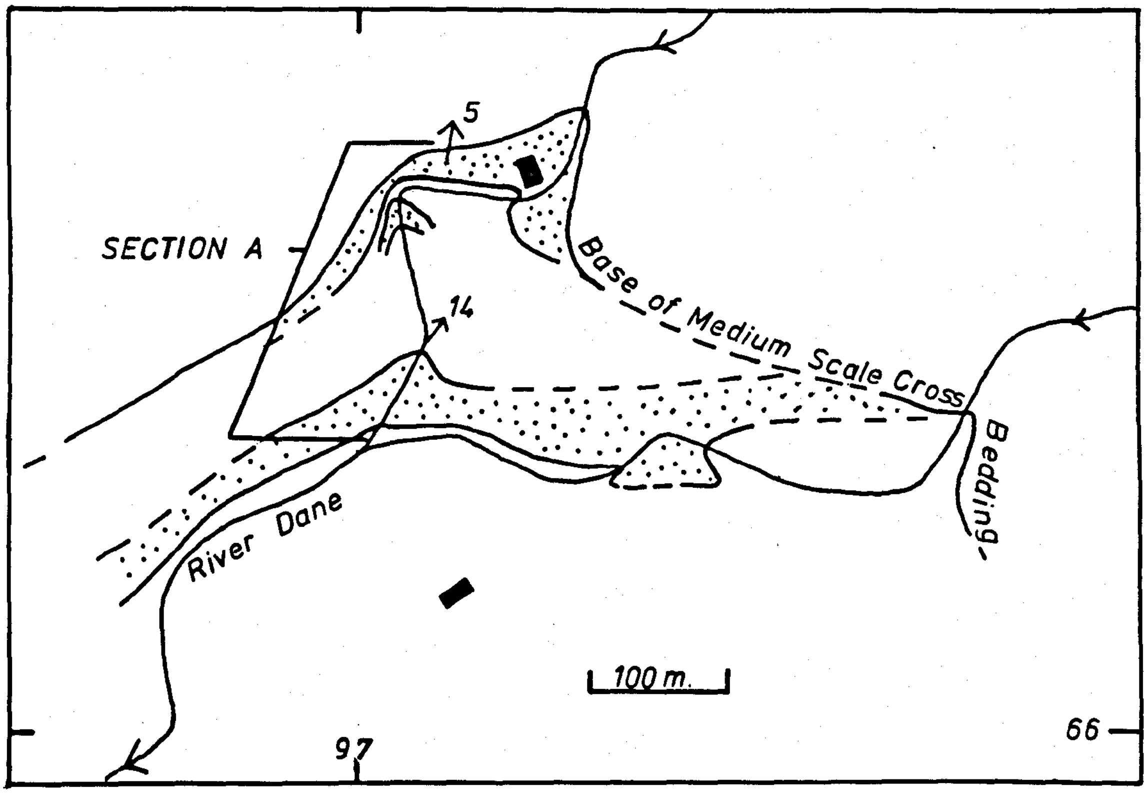

CHANNEL FILL
STRUCTURELESS SANDSTONE
EROSION SURFACE
LENTICULAR BEDDING
BEDDING
FAINT LAMINATION
NO STRUCTURE VISIBLE
CROSS LAMINATION
RIPPLE LAMINATION
RIPPLED LATERAL ACCRETION SET
0·5m

Fig.23. Geological map of the River Dane between Bartomley Bottoms and Gibbons Cliff showing the cut out off the sequence shown in Fig.22A by the overlying coset of Medium Scale Cross-bedding.

Fig.24. Palaeocurrents for Ripple-lamination. Primary Current Lineation and Bottom Structures in the Upper Slope Assemblage of Association C.

A. Directions known.

B. Directions unknown.


5
SECTION A
14
Base of Medium Scale Cross Bedding
River Dane
100 m.
97
66

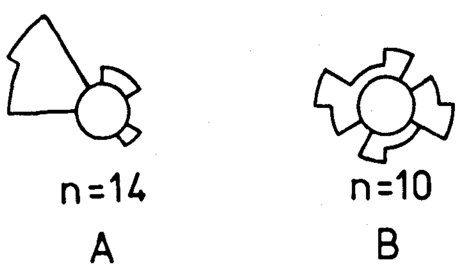
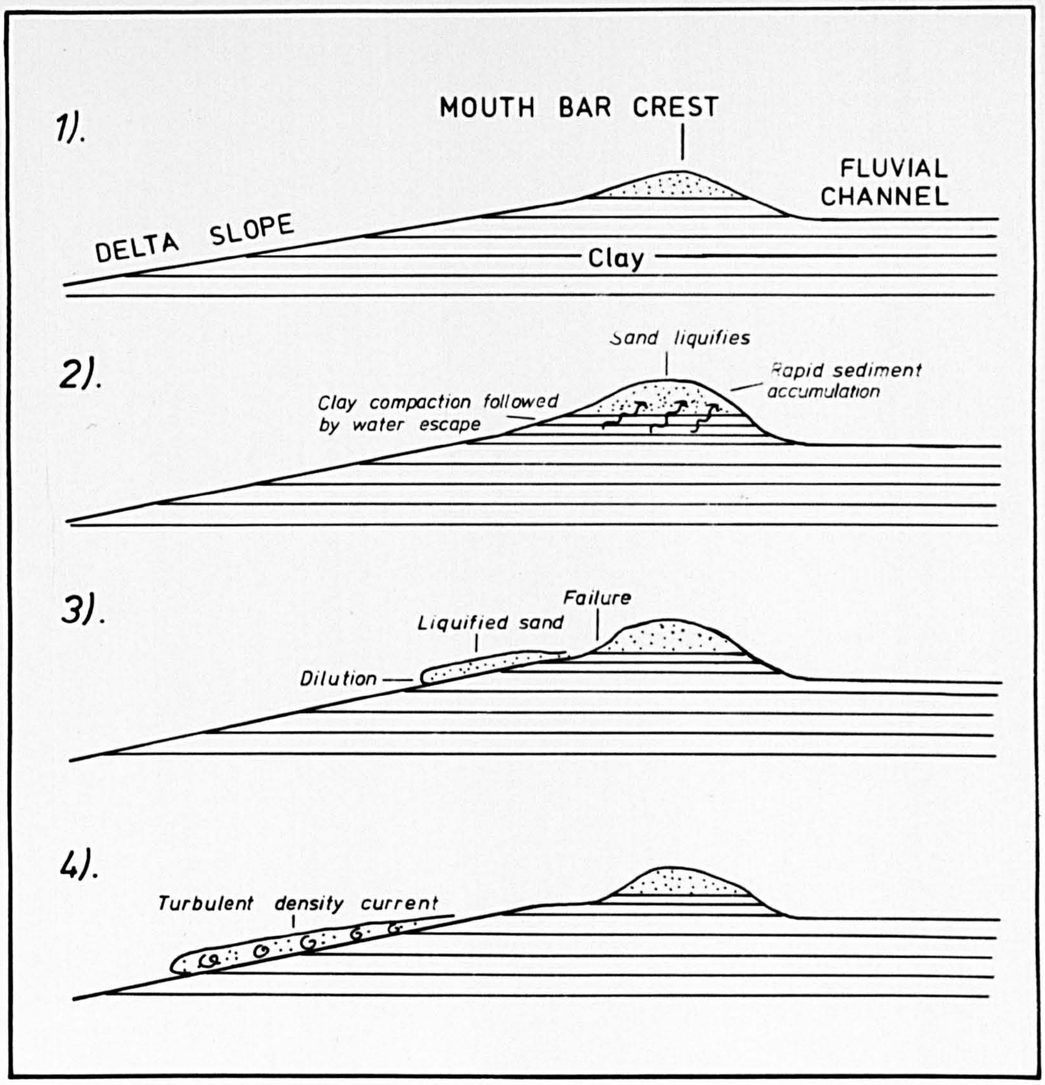

n=14
A
n=10
B

Fig.25. Possible mode of generation of turbidity currents on the upper part of the slope. Rapid accumulation of sand at the mouth bar crest compacts the underlying finer sediment on the upper slope. Water escapes and liquifies the sand (2). This moves down slope as a liquified flow (3). Dilution of the sediment eventually forms a turbidity current (4).

Fig.26. Summary of processes operating on the delta slope and adjacent basin floor.


1).
MOUTH BAR CREST
FLUVIAL CHANNEL
DELTA SLOPE
Clay
2).
Sand liquifies
Rapid sediment accumulation
Clay compaction followed by water escape
3).
Failure
Liquified sand
Dilution
4).
Turbulent density current

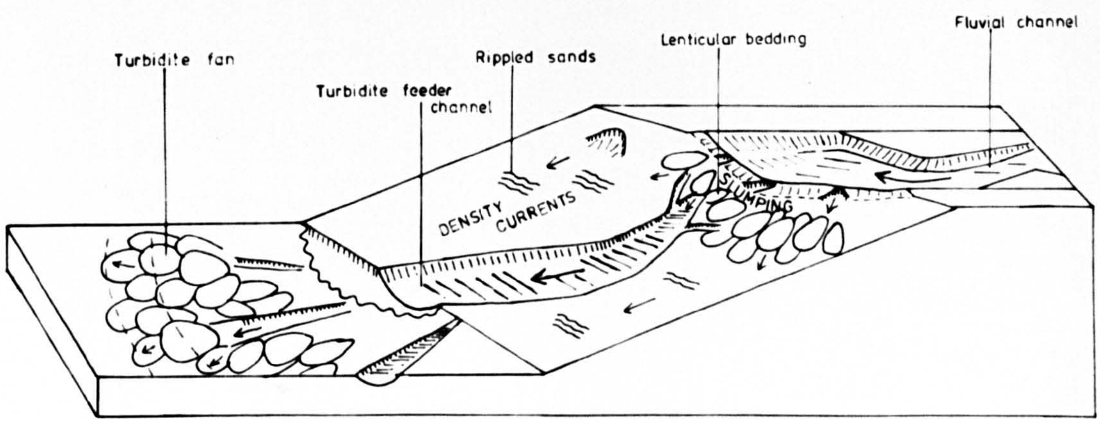

Turbidite fan
Rippled sands
Lenticular bedding
Fluvial channel
Turbidite feeder channel
DENSITY CURRENTS
SLUMPING

Fig.27. Types of foresets in LF 14 Medium Scale Cross-bedding with the type of leeside eddy responsible.

A. Angular foresets, weak eddy.

B. Tangential foresets with intrasets directed away from the main foresets.

C. Tangential foresets with intrasets directed towards the main fore foresets.

D. Angular foresets with bottomsets.

In B, C and D the reattachment point is progressively further away from the crestline of the main bedforms.

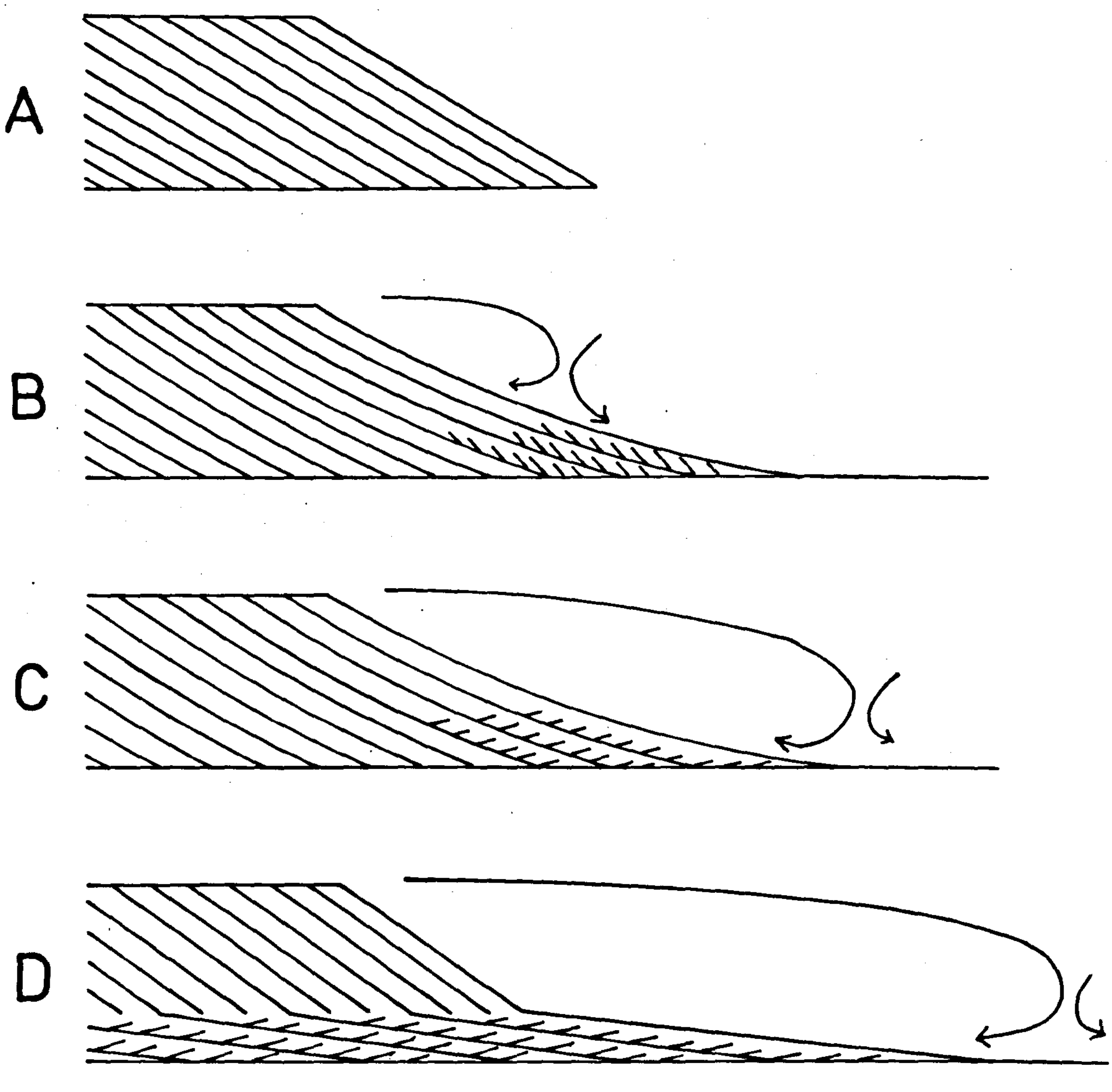
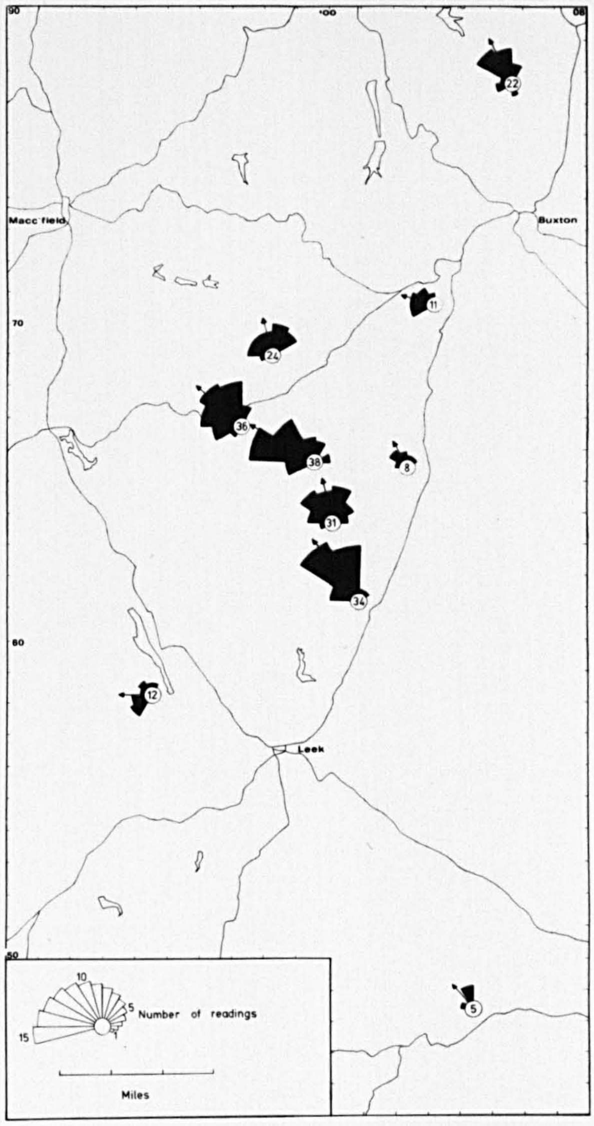
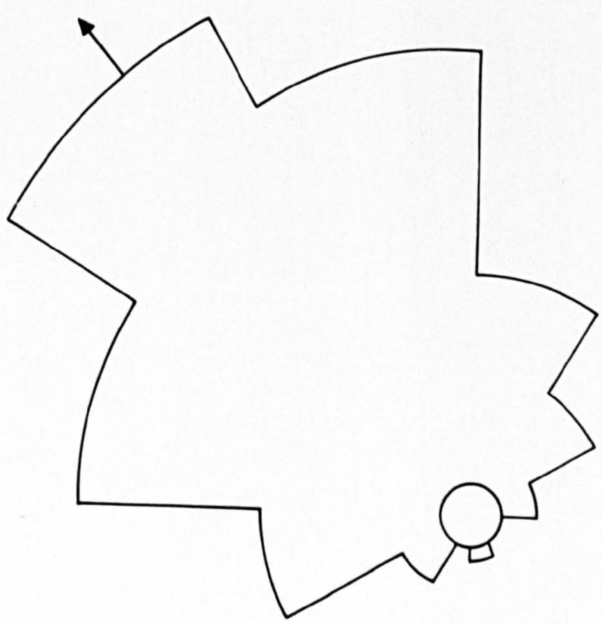

A
B
C
D

Fig.28. Vector directions from LF 14 MSXB in different areas.

Fig.29. Total pattern of vector directions in LF 14 MSXB.



90
00
08
Macc'field
Buxton
70
60
50
Leek
22
11
24
36
38
8
31
34
12
5
10
5
15
1
Number of readings
Miles



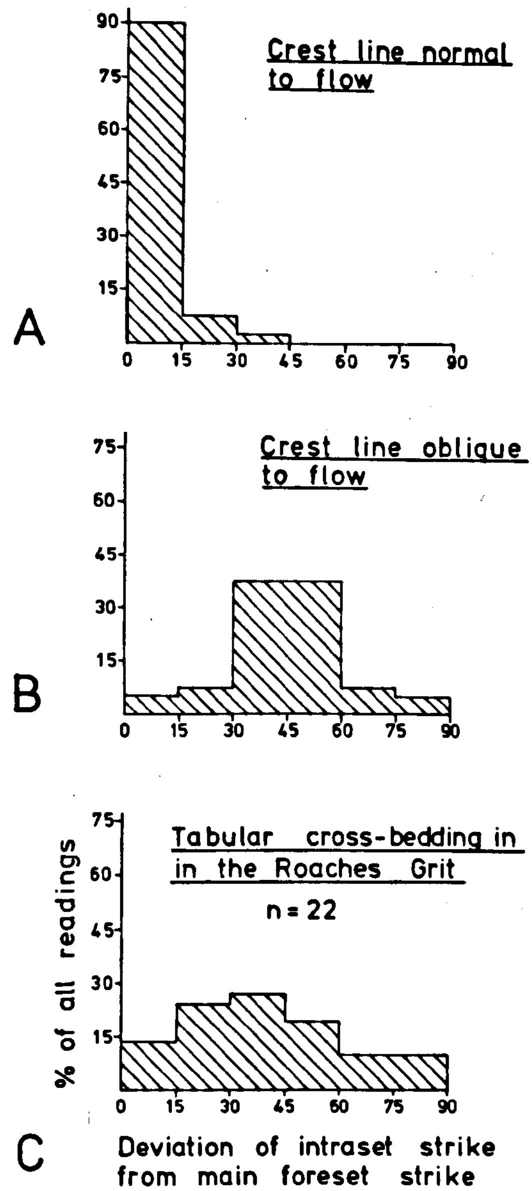
N = 220

Fig.30. A. Probable orientations of intraset strike with respect to main foreset strike, where the crest line of the major bedform is normal to the mean local flow direction.

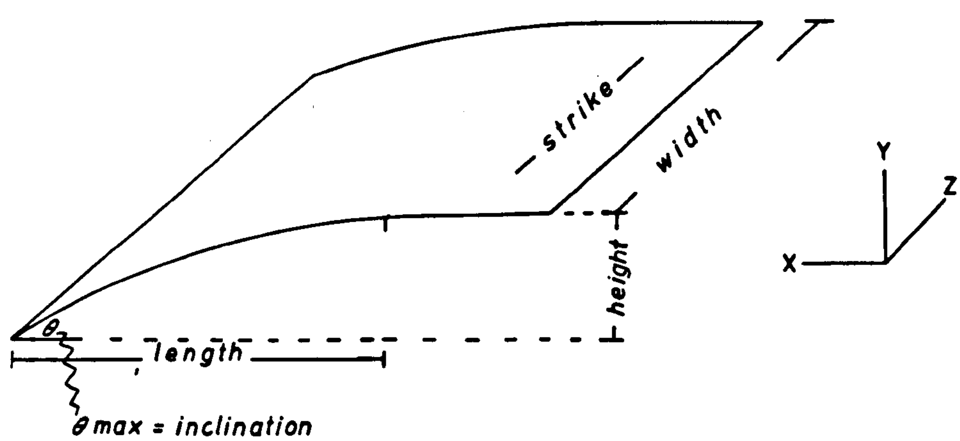
B. Probable orientations of intraset strike with respect to main foreset strike where the crest line of the major bedform is oblique to the mean local flow direction.

C. Orientation of intraset strike with respect to main foreset strike in LF 14, MSXB, in the Roaches Grit Group.

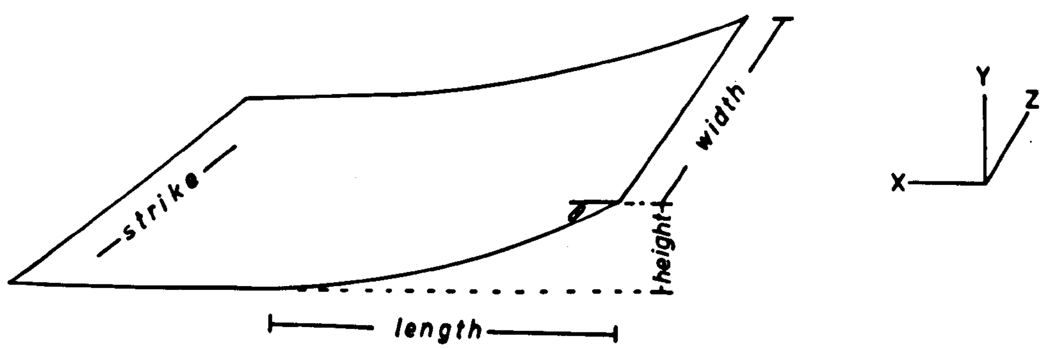
Fig.31. Descriptive terminology for concave and convex internal erosion surfaces in LF 14 and LF 15.



A
Crest line normal to flow
90
75
60
45
30
15
0 15 30 45 60 75 90
B
Crest line oblique to flow
75
60
45
30
15
0 15 30 45 60 75 90
C
Tabular cross-bedding in in the Roaches Grit
n = 22
% of all readings
75
60
45
30
15
0 15 30 45 60 75 90
Deviation of intraset strike from main foreset strike



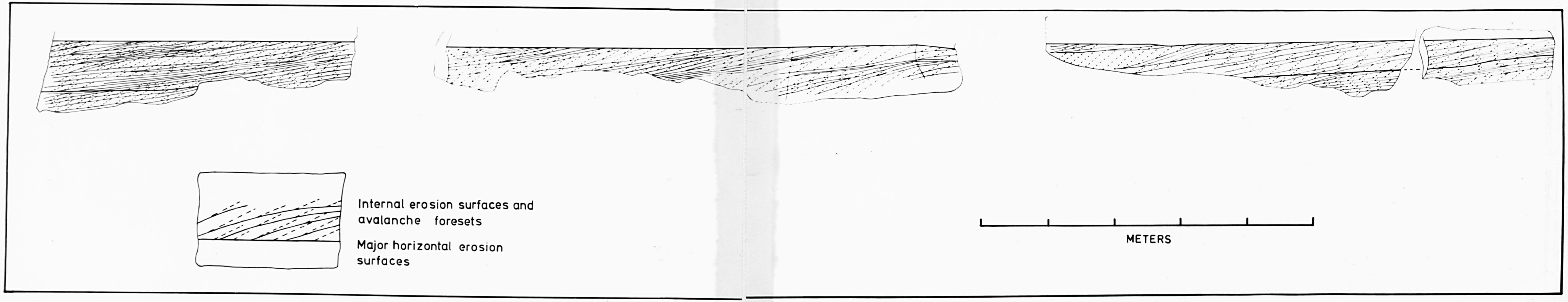
strike
width
height
length
θ
θ max = inclination
Y
Z
X



strike
width
height
length
θ
Y
Z
X

Fig.32. Details of convex upwards internal erosion surfaces in LF 14 MSXB, showing alternations of short, steep inclination types with long, low inclination types. (A photograph of the central section is shown in Plate 31.) Northern end of the Roaches (SJ 9999 6410) (Pull out at back of thesis)

Fig.33. Details of convex upwqrds erosion surfaces in LF 14, MSXB showing an increase in length and decrease in inclination down the XY plane. (SK 0003 6380) (Pull out at back of thesis)


Internal erosion surfaces and avalanche foresets
Major horizontal erosion surfaces
METERS

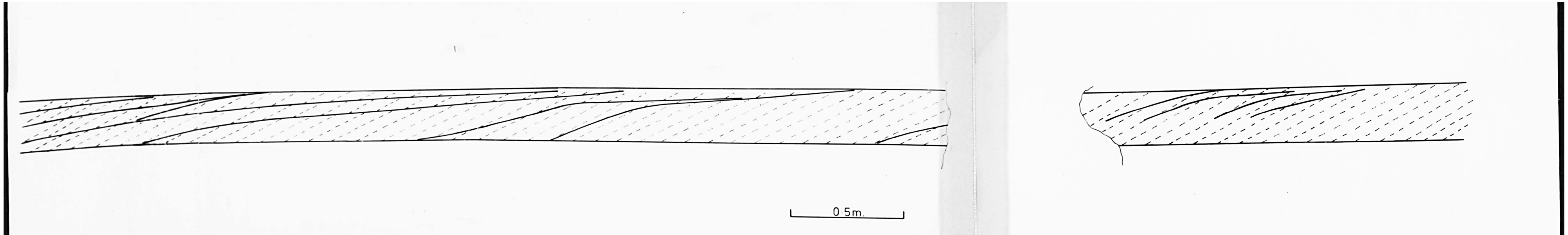

0.5m.

Fig.34. Types of concave upwards erosion surfaces in LF 14 MSXB. For detailed explanation see text.

Bar is 1m in length.

A. Tangential foresets followed by angular foresets.

B. Erosion surface truncating the foresets and covered by a coset of small scale trough cross bedding. This is succeeded by another group of foresets.

C. Concave erosion surface which levels out down the XY plane.

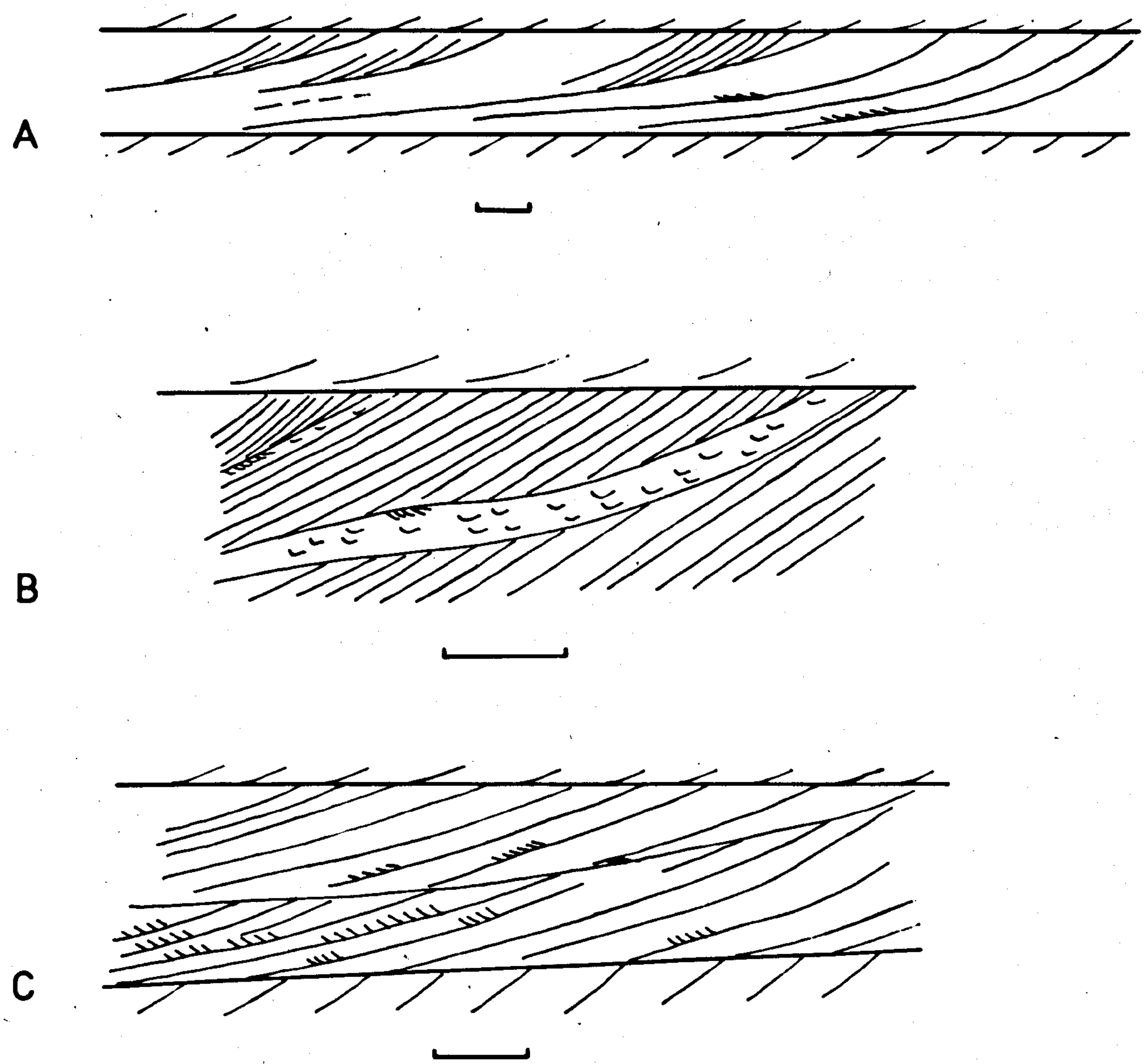

A
B
C

Fig.35. Different possible processes of formation of the various types of concave erosion surfaces found in LF 14, MSXB.

A. Erosion during falling stage by currents flowing around the front of the bar, after Collinson 1970.

B. Formation of a new bedform, after Allen 1973.

C. Changes in the strength of the leeside eddy.
Upper diagram, decrease in eddy strength.
Lower diagram, increase in eddy strength erodes the previously deposited foresets.

For detailed explanation see text.

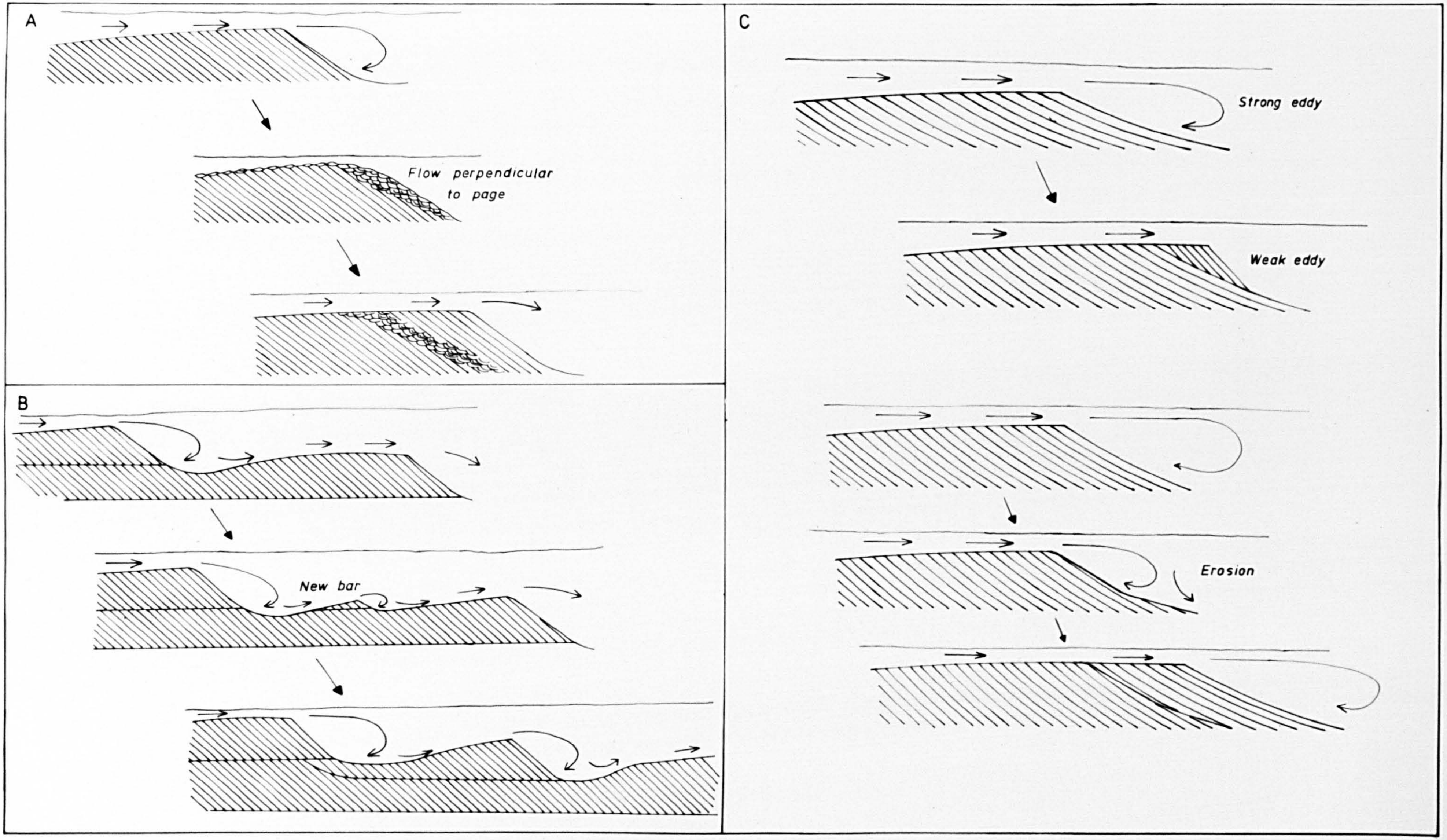
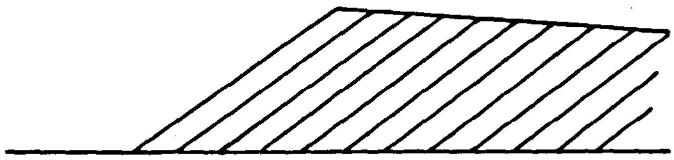

A
Flow perpendicular
to page
B
New bar
C
Strong eddy
Weak eddy
Erosion

Fig.36. Types of foresets in LF 15 LSXB and possible types of separation eddy responsible. For detailed explanation see text.

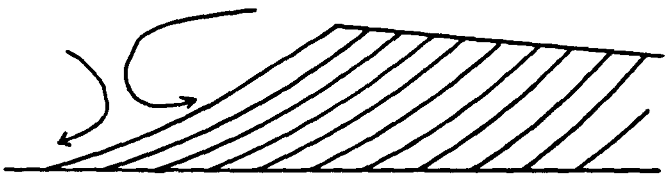
I ANGULAR FORESETS. Thin toesets



Weak separation eddy, slow avalanching

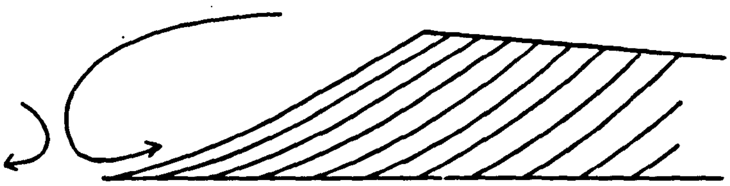
II TANGENTIAL FORESETS

a) Downdipping intrasets



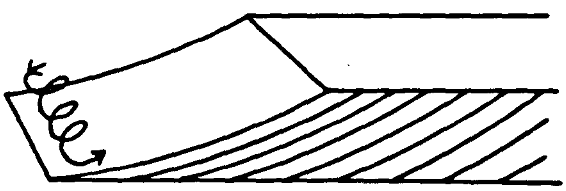
Powerful separation eddy
reattachment on leeside slope

b) Updipping intrasets



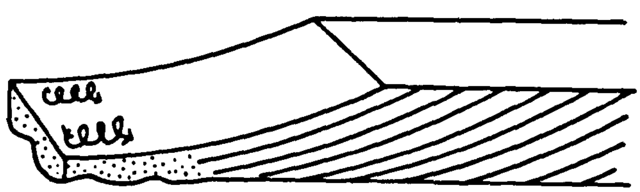
Reattachment in front of leeside slope

c) Obliquely orientated intrasets



Spiral eddy

II DOWNDIP PASSAGE INTO FAINTLY LAMINATED COARSE SANDSTONE



Local intense turbulent cells, probably short lived,
possible corkscrew shape

Fig.37. Main face at Hen Cloud (SK 008 616) showing the detailed structure in LF 15 LSXB.

For detailed explanation see text.

Pull out at end of thesis.

Fig.38. Types of internal erosion surfaces in LF 15 LSXB.

For detailed explanation see text.

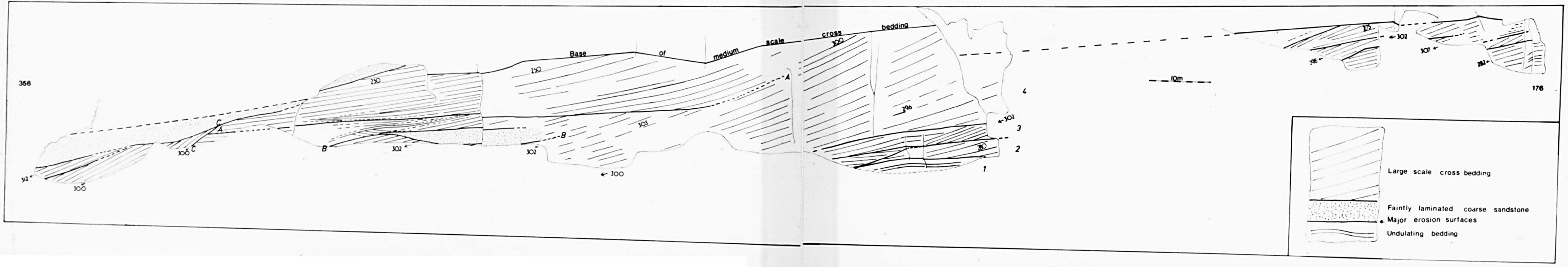
1. Convex upward.

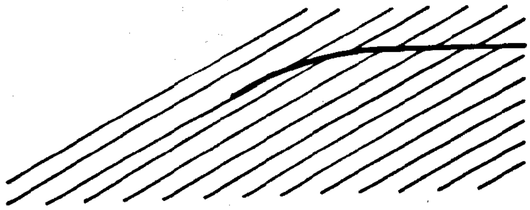
2a. Concave upward.

2b. Concave upward overlain by a bed of LF 16 FLCS.

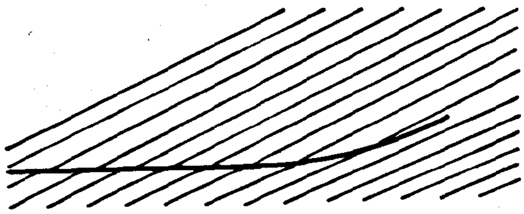
2c. Concave upward passing into convex upward.

2d. Concave upward where the two groups of foresets differ substantially in orientation.

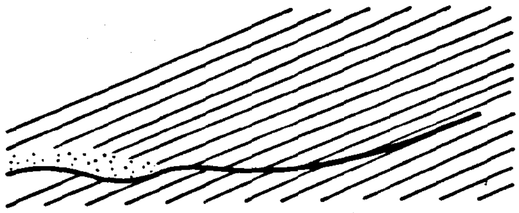

356
Base of medium scale cross bedding
250
250
300
303
296
302
302
300
312
300
302
302
300
10m
176
302
307
4
3
2
1
A
B
C
Large scale cross bedding
Faintly laminated coarse sandstone
Major erosion surfaces
Undulating bedding



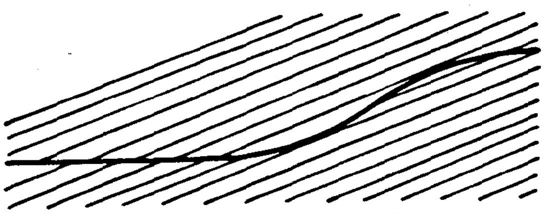
1



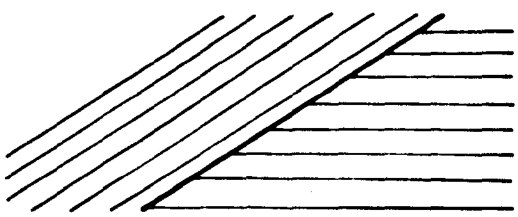
2a



2b



2c



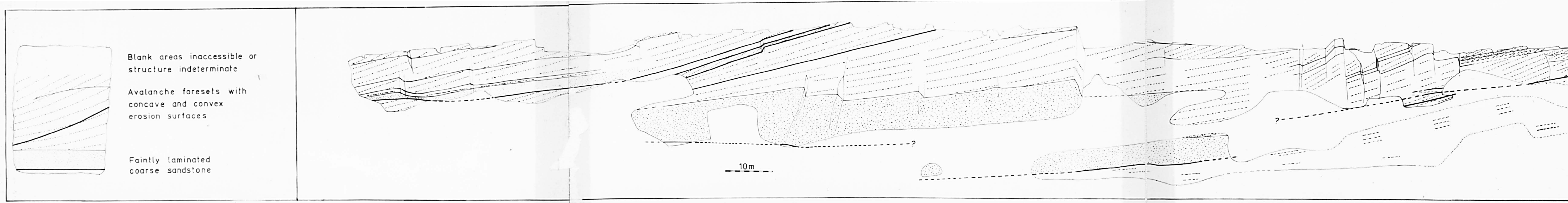
2d

Fig.39. LF 15 Large Scale Cross-bedding at the Roaches (SK 0045 6270) in the XY plane showing multiple convex upwards internal erosion surfaces within angular foresets. Concave erosion surfaces also occur within the set at the northern end of the outcrop.
Right hand side of diagram overlaps with Fig.45.
Left hand side of diagram overlaps with Fig.40.
For detailed explanation see text.
Pull out at end of thesis.

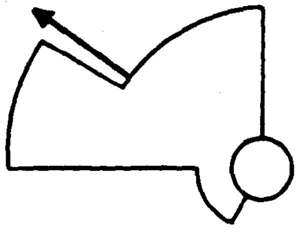
Fig.40. LF 15, Large Scale Cross-bedding at the Roaches. (SK 0040 6275), northerly continuation of Fig.39. The large sets are mainly tangential and are cut by a series of concave erosion surfaces. Some sets pass down current into LF 16, Faintly-laminated Coarse Sandstone. For detailed explanation see text.
Pull out at end of thesis.

Fig.41. Vector directions for LF 15 Large Scale Cross-bedding.

Large Scale Cross Bedding comprising multiple descending cross sets
Erosion surface at the side and base of channel
Medium Scale Cross Bedding
5m
Blank areas inaccessible or structure indeterminate
Convex erosion surfaces
Concave erosion surfaces
Poorly bedded coarse sandstone



Blank areas inaccessible or structure indeterminate
Avalanche foresets with concave and convex erosion surfaces
Faintly laminated coarse sandstone
10m



N = 17

Fig.42. Sets of LF 15, Large Scale Cross-bedding, seen in the YZ plane overlain by beds of LF 16 Faintly-laminated Coarse Sandstone with very irregular and erosive bases. Ramshaw Rocks (SK 0188 6300)

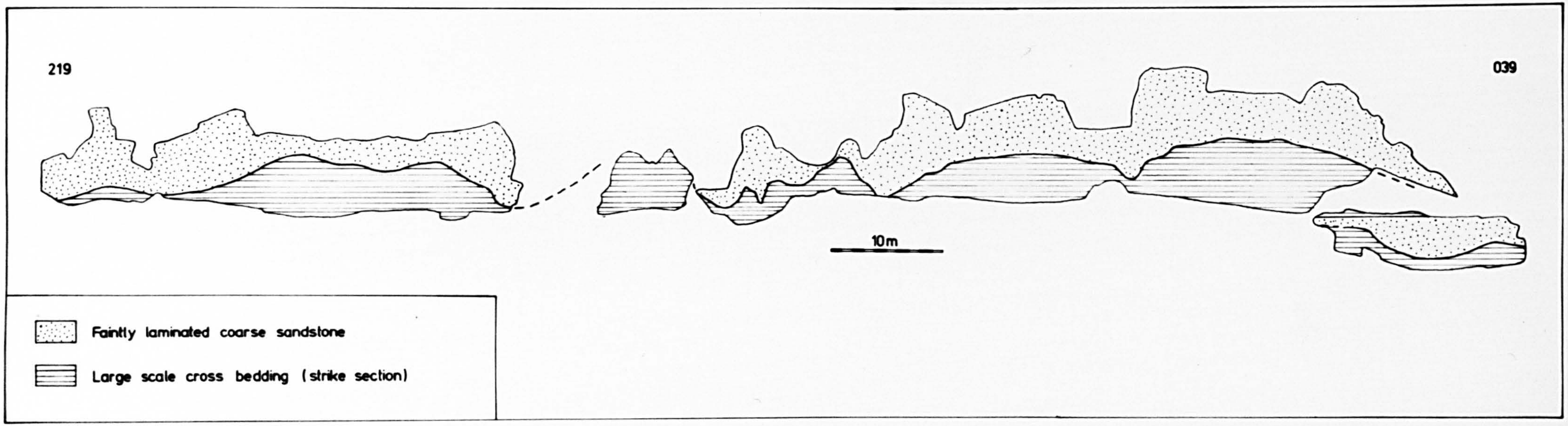
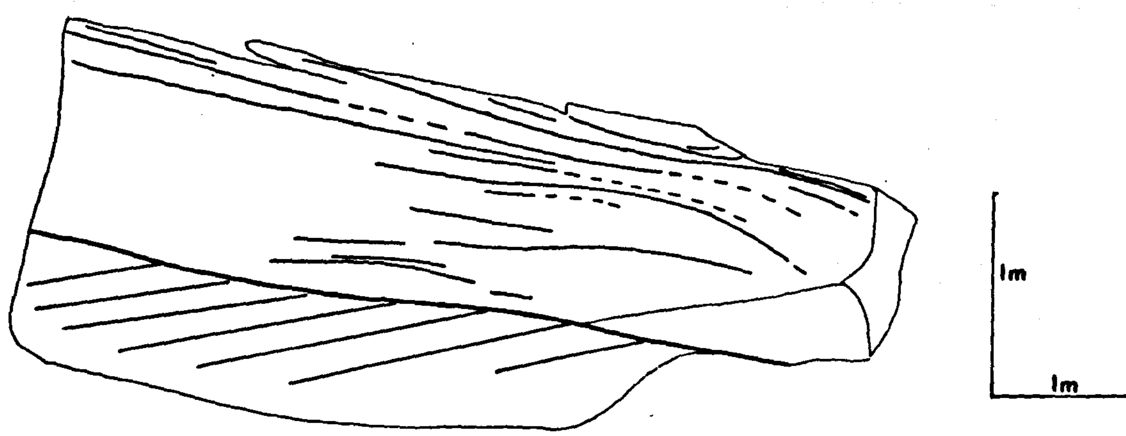
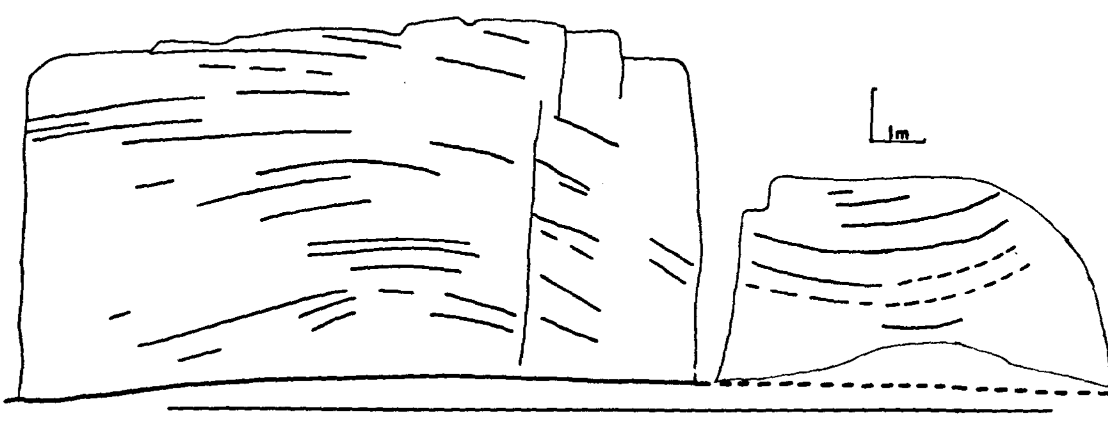

219
039
10m
Faintly laminated coarse sandstone
Large scale cross bedding (strike section)

Fig.43. a, b, c.

Structures in LF 16, Faintly-laminated Coarse Sandstone.

See also Plates 43 and 44.


1m
1m


1m

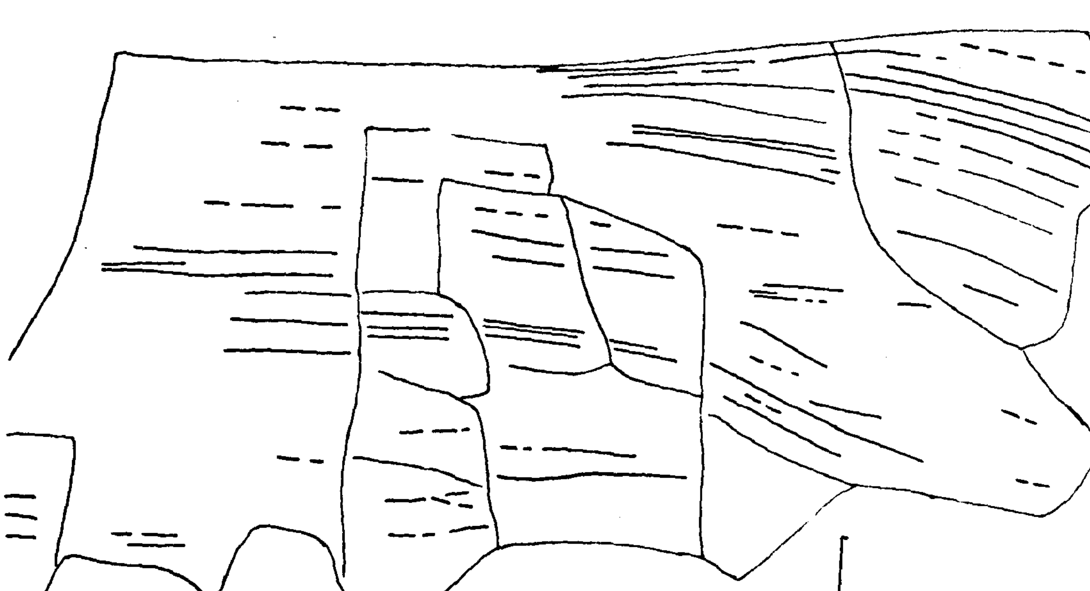
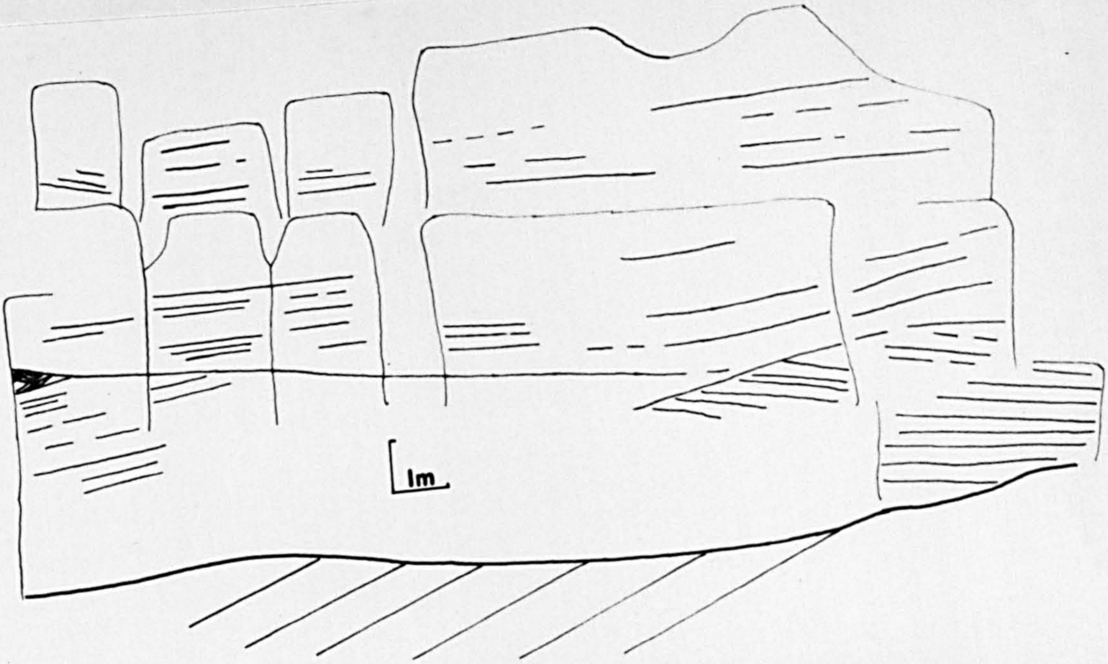

1m

Fig.43. d, e.

Structures in LF 16, Faintly-laminated Coarse Sandstone.

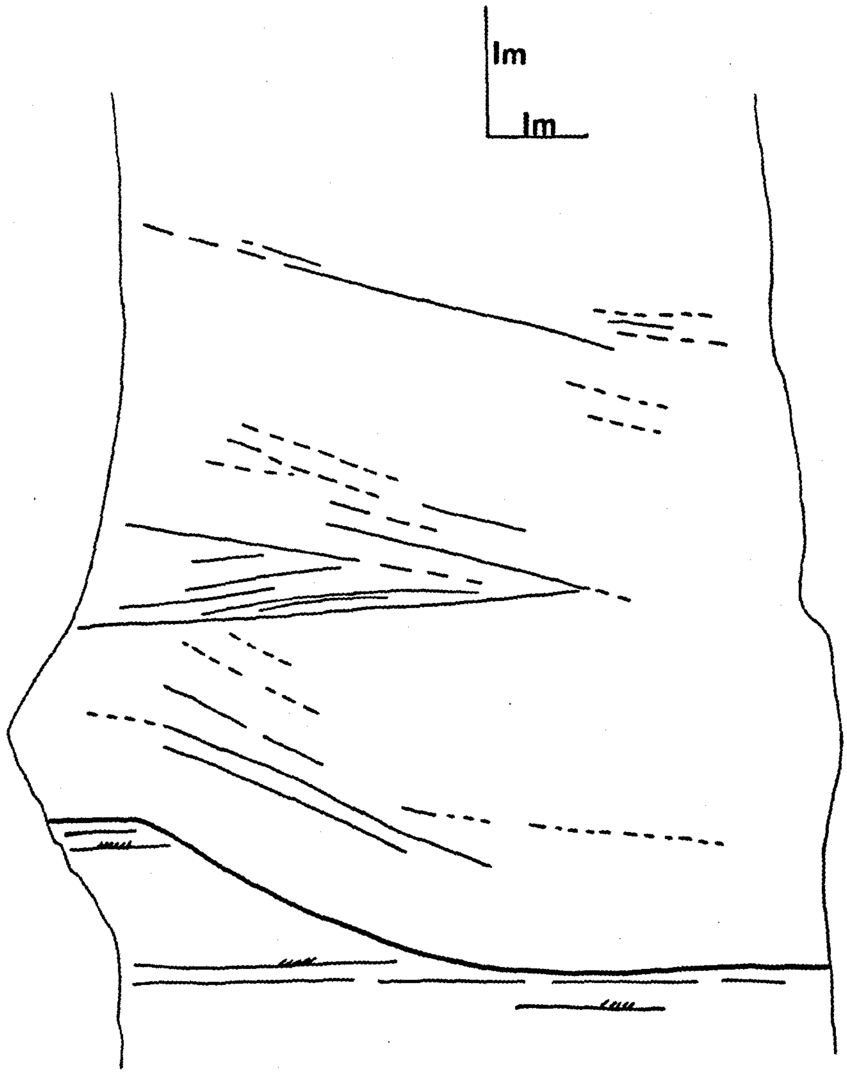
See also Plate 45.


1m


1m

Fig.43. f, g.

Structures in LF 16, Faintly-laminated Coarse Sandstone.


1m
1m

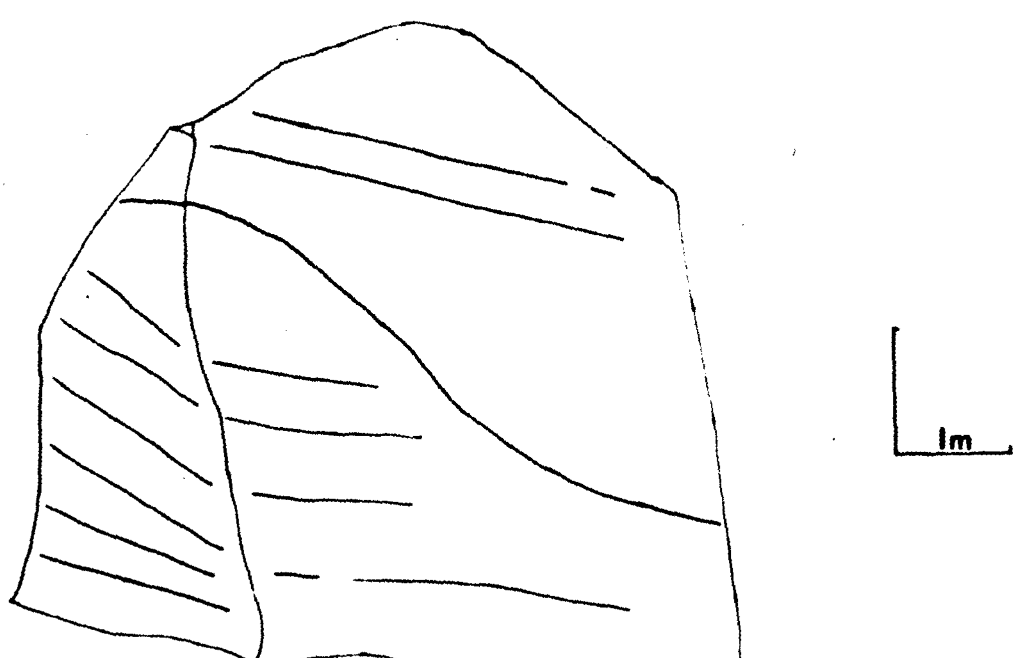
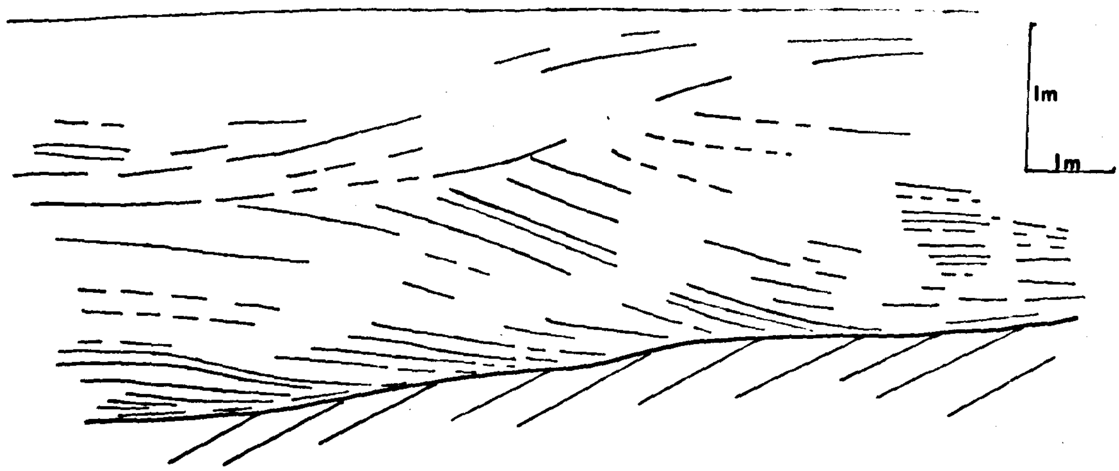

1m

Fig.43.h. Structures in LF 16, Faintly-laminated Coarse Sandstone.

See also Plate 46.

Key to Fig.43.


1m
1m

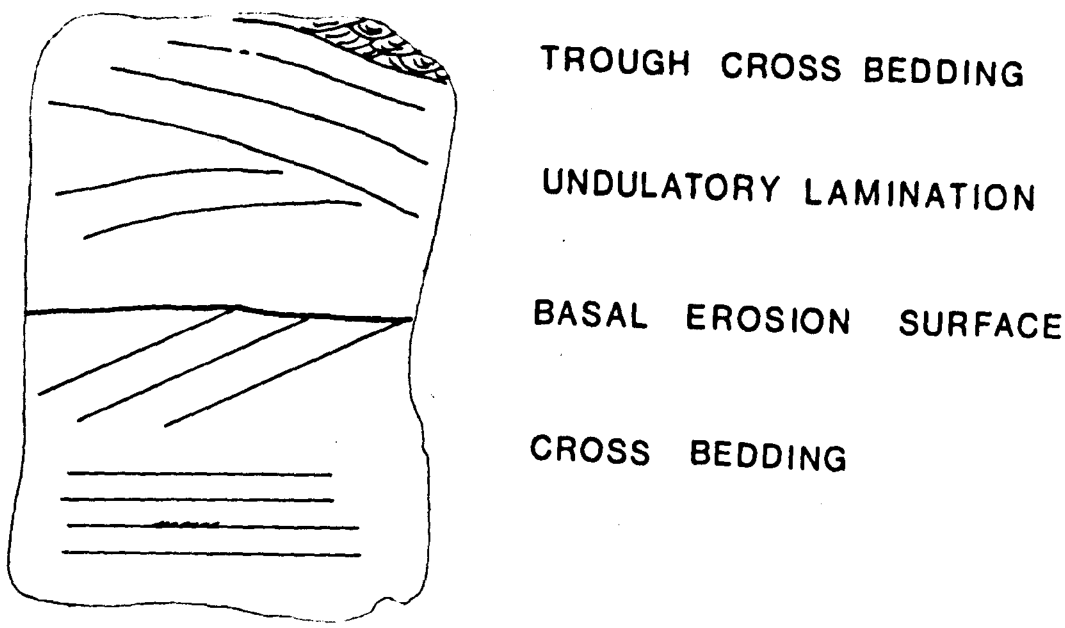

TROUGH CROSS BEDDING
UNDULATORY LAMINATION
BASAL EROSION SURFACE
CROSS BEDDING

Fig.44. Field sketch of a coset of LF 10 Trough Cross-bedded Sandstone seen in the XY plane, backfilling an eroded hollow cut into a bed of LF 16, FLCS.

Ramshaw Rocks (SK 0196 6228)

Fig.45. Part of the main escarpment at the Roaches showing the sheet sandstone of the Roaches Grit composed of four separate mutually erosive channel fills. In two of the channels, sets of LF 15, LSXB build out obliquely from steep channel sides.

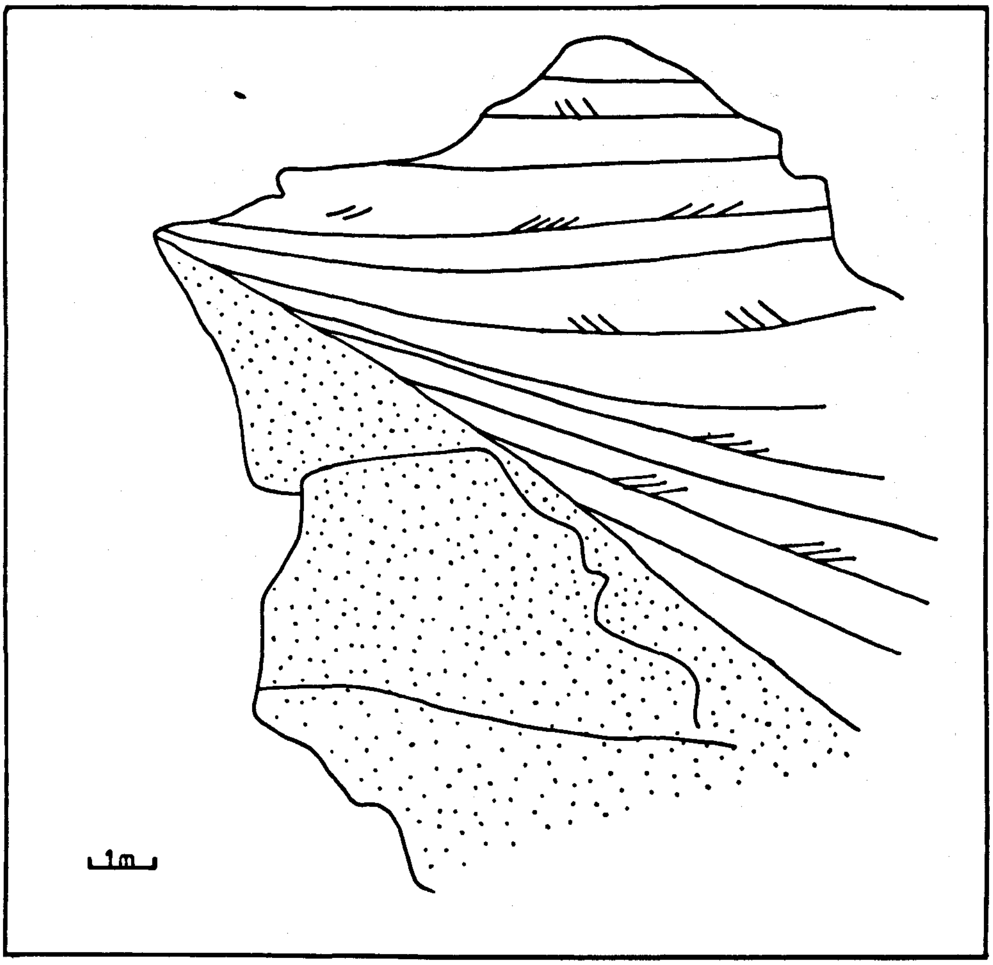
Inset A shows the relationship in Channel IV,

Inset B shows the relationship in Channel 11.

Left hand side of diagram overlaps with Fig.39.

(SK 0055 6250)

(Pull out at back of thesis)


1m


NNW
SSE
IV
III
II
I
5m
Medium scale cross bedding
Large scale cross bedding
Trough cross bedding
Flat laminated sandstone
Faintly laminated coarse sandstone
Erosion surface at channel edge
A
B

Fig.46. Summary of the main types of lithofacies relationships observed in the channel fill sediments of the Roaches Grit.

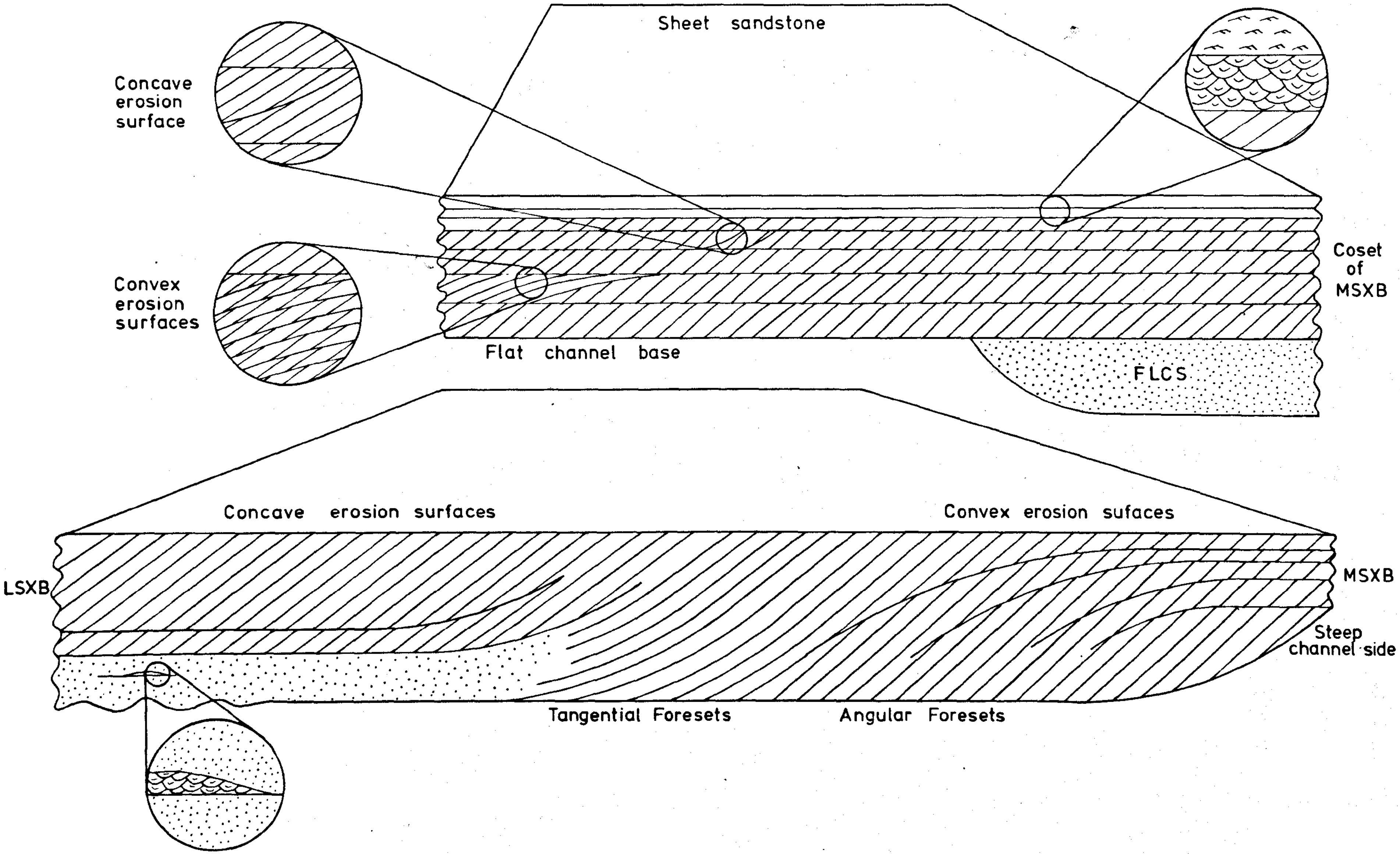

Sheet sandstone
Concave erosion surface
Convex erosion surfaces
Coset of MSXB
Flat channel base
FLCS
Concave erosion surfaces
Convex erosion sufaces
LSXB
MSXB
Steep channel side
Tangential Foresets
Angular Foresets

Fig.47. Alternative models to explain the lithofaces relationships in the Roaches Grit.

Sandwave Model During rising stage the sandwaves increase in size, becoming very large at peak discharges. These are responsible for the large sets of LF 15. During falling stage they are dissected. Smaller superimposed sandwaves produce multiple convex up erosion surfaces.

Alternate bar models

a. Straight River.

1. Alternate bars with superimposed sandwaves are formed at the same time during high stage.
2. Alternate bars are formed at high stage, and then dissected during falling stage. At a lower stage smaller superimposed sandwaves produce multiple convex upwards erosion surfaces.

b. Braided River.

The alternate bars form at high stage in narrow deep channels of a braided river. Smaller sandwaves develop at high stage in shallower wider parts of the river. Lateral migration of the wider channels at a later date results in a coset of medium scale cross bedding overlying these solitary sets of large scale cross-bedding.

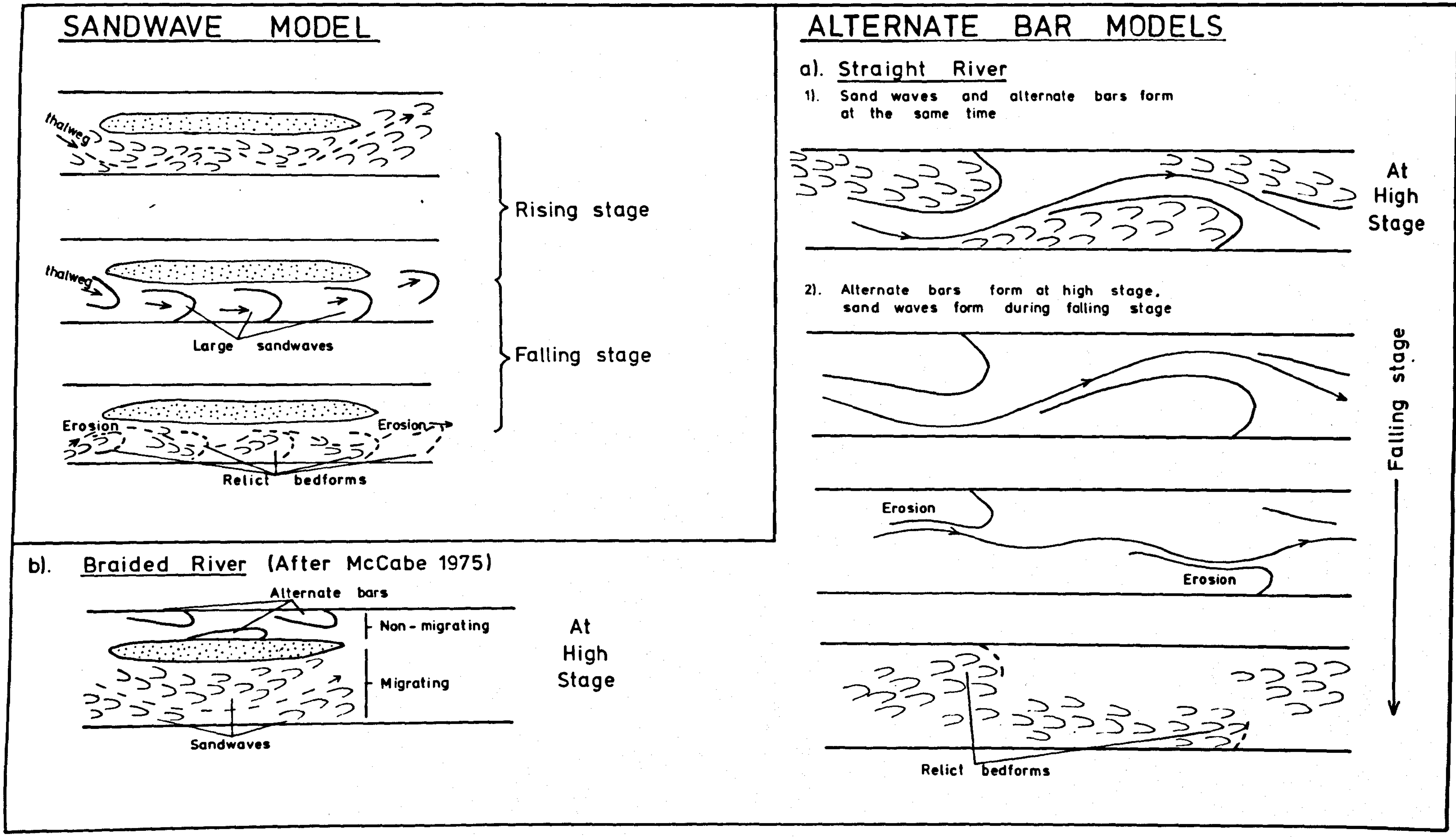

SANDWAVE MODEL
thalweg
Rising stage
thalweg
Large sandwaves
Falling stage
Erosion
Erosion
Relict bedforms
b). Braided River (After McCabe 1975)
Alternate bars
Non - migrating
Migrating
Sandwaves
At High Stage
ALTERNATE BAR MODELS
a). Straight River
1). Sand waves and alternate bars form at the same time
At High Stage
2). Alternate bars form at high stage, sand waves form during falling stage
Falling stage
Erosion
Erosion
Relict bedforms

Fig.48. Explanation of the down dip changes in LF 15, LSXB shown in Figs. 39 and 40.

A. Line of outcrop showing foreset dip directions and foreset shape in relation to LSXB shown in Figs. 39 and 40.

B. Explanation of the changes seen assuming the down channel passage of an alternate bar with approximate dimensions as shown.

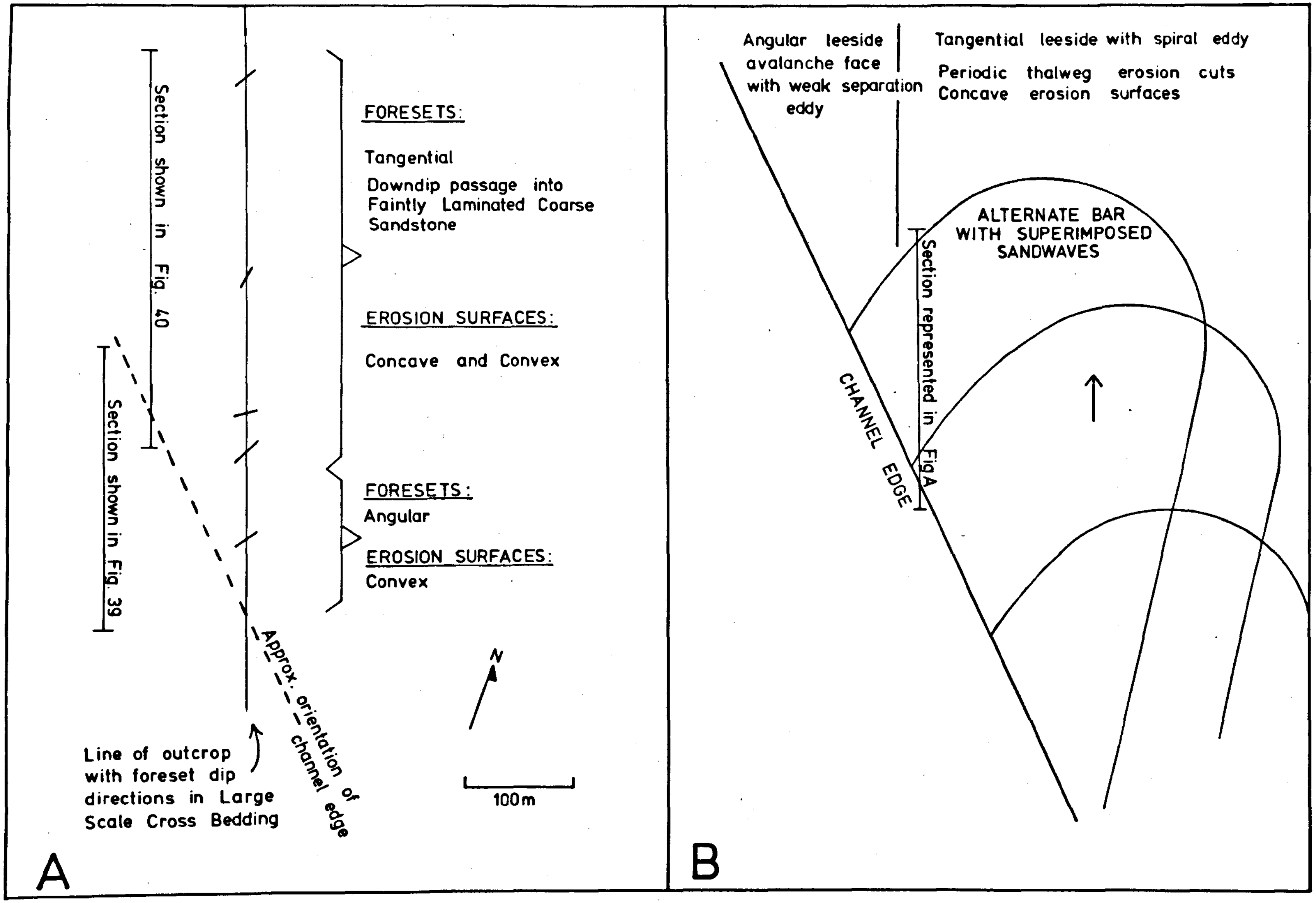
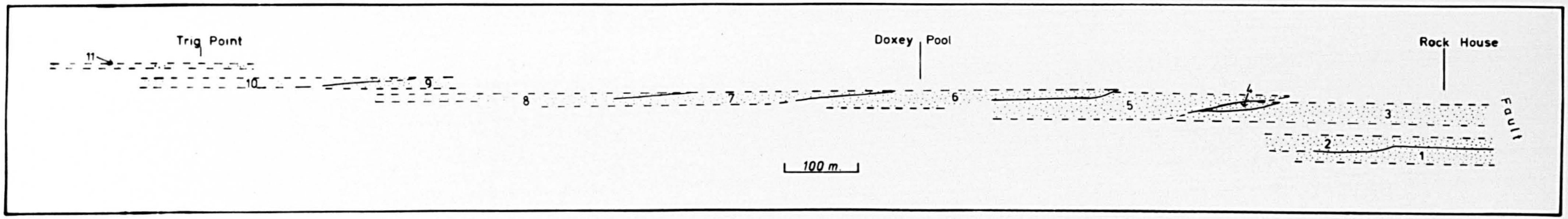

Section shown in Fig. 40
Section shown in Fig. 39
FORESETS:
Tangential
Downdip passage into Faintly Laminated Coarse Sandstone
EROSION SURFACES:
Concave and Convex
FORESETS:
Angular
EROSION SURFACES:
Convex
Approx. orientation of channel edge
Line of outcrop with foreset dip directions in Large Scale Cross Bedding
N
100m
A
Angular leeside avalanche face with weak separation eddy
Tangential leeside with spiral eddy
Periodic thalweg erosion cuts
Concave erosion surfaces
ALTERNATE BAR WITH SUPERIMPOSED SANDWAVES
Section represented in Fig A
CHANNEL EDGE
B

Fig.49. Diagram of the Roaches looking east, drawn from oblique aerial photographs, showing the relationship of the major channel fills. These become progressively younger towards the north and occur at successively higher levels in the sequence.



Trig Point
Doxey Pool
Rock House
Fault
11
10
9
8
7
6
5
4
3
2
1
100 m.

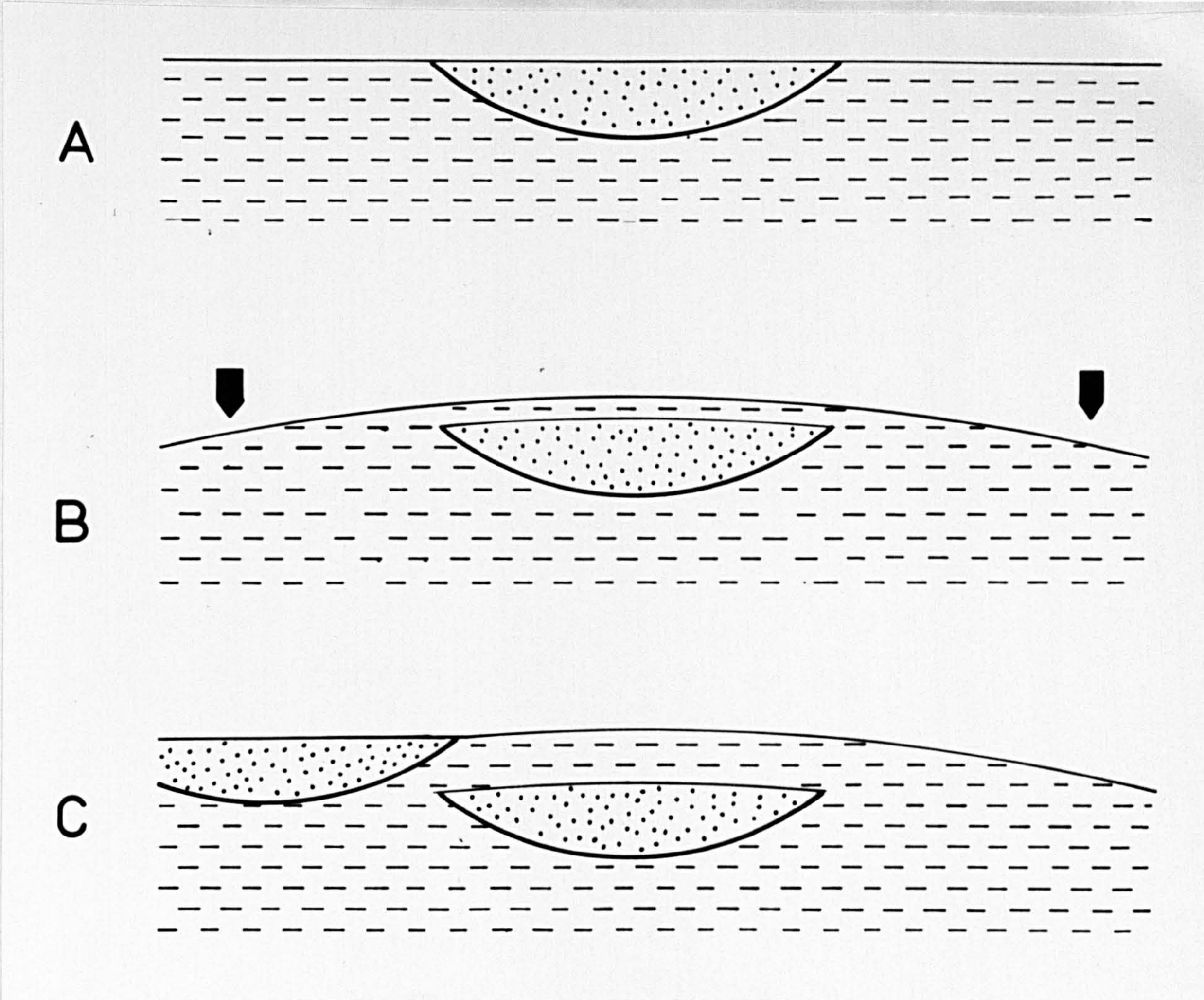
Fig. 50. Offsetting of successive channel fills because of differential compaction between the previous channel fill and the surrounding finer grained sediment.

Fig. 51. Vertical sequences in Association D.

A. Cumberland Brook (SJ 995 699)

B. Allgreave. (SJ 9699 6740)

C. Shirley Hollow. (SK 0380 4810)


A
B
C

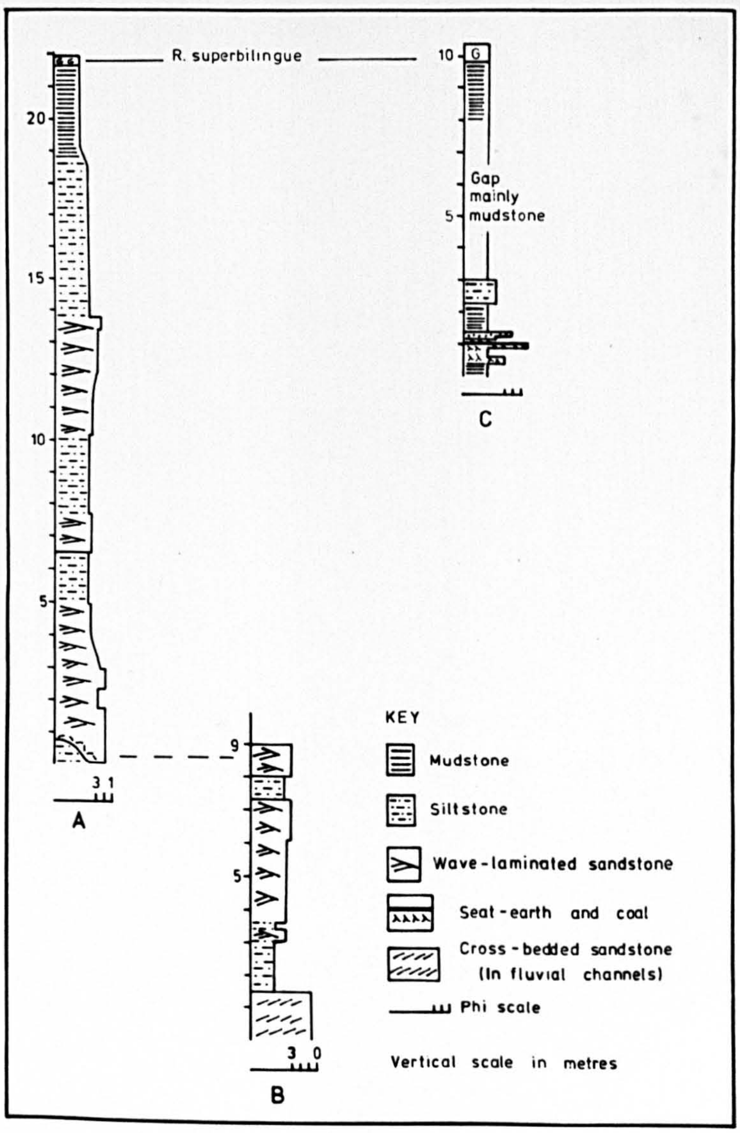
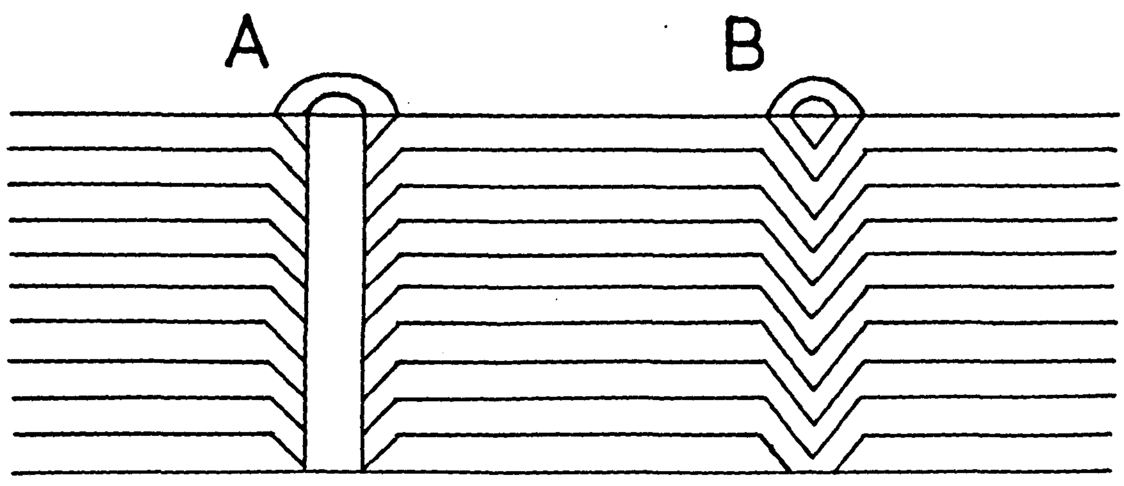

R. superbilingue
20
15
10
5
3 1
A
10
G
Gap
mainly
mudstone
5
C
9
5
3 0
B
KEY
Mudstone
Siltstone
Wave-laminated sandstone
Seat-earth and coal
Cross-bedded sandstone
(In fluvial channels)
Phi scale
Vertical scale in metres

Fig.52. Section through a laminated rock showing the effects of

A. a lined burrow.

B. a resting trace.

Fig.53. Location of the study area in relation to the main structural elements operative in northern England during the Namurian.


A
B

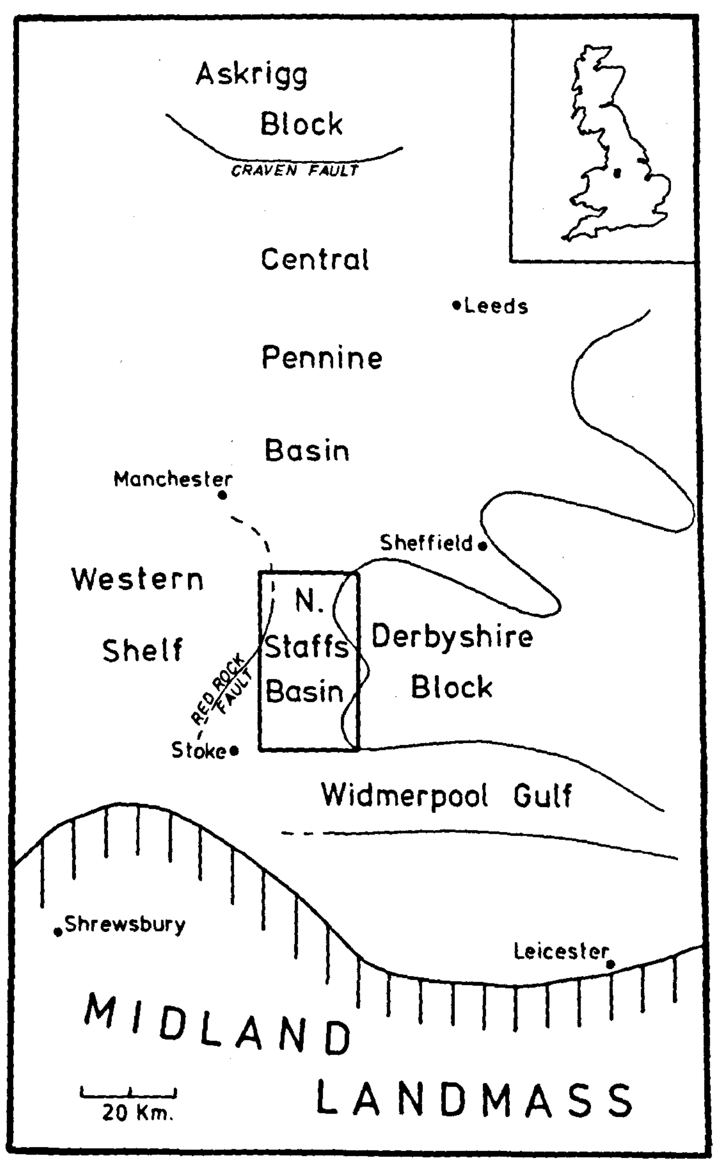
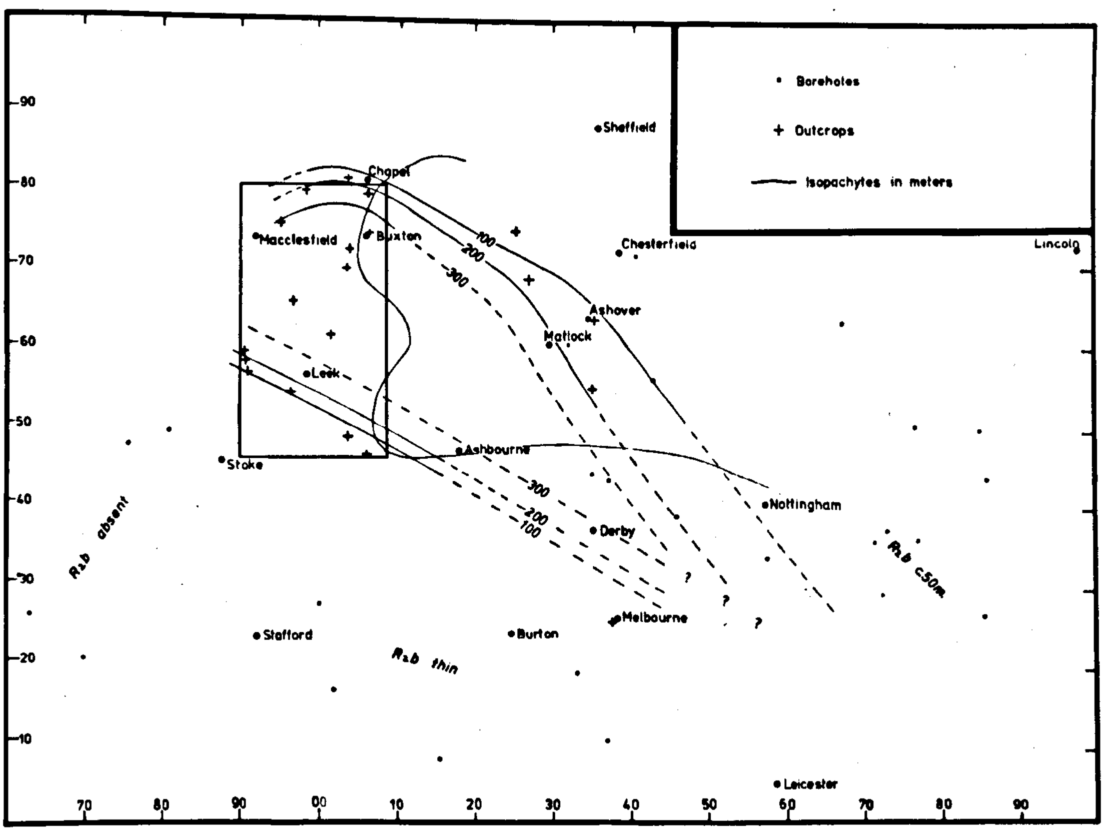
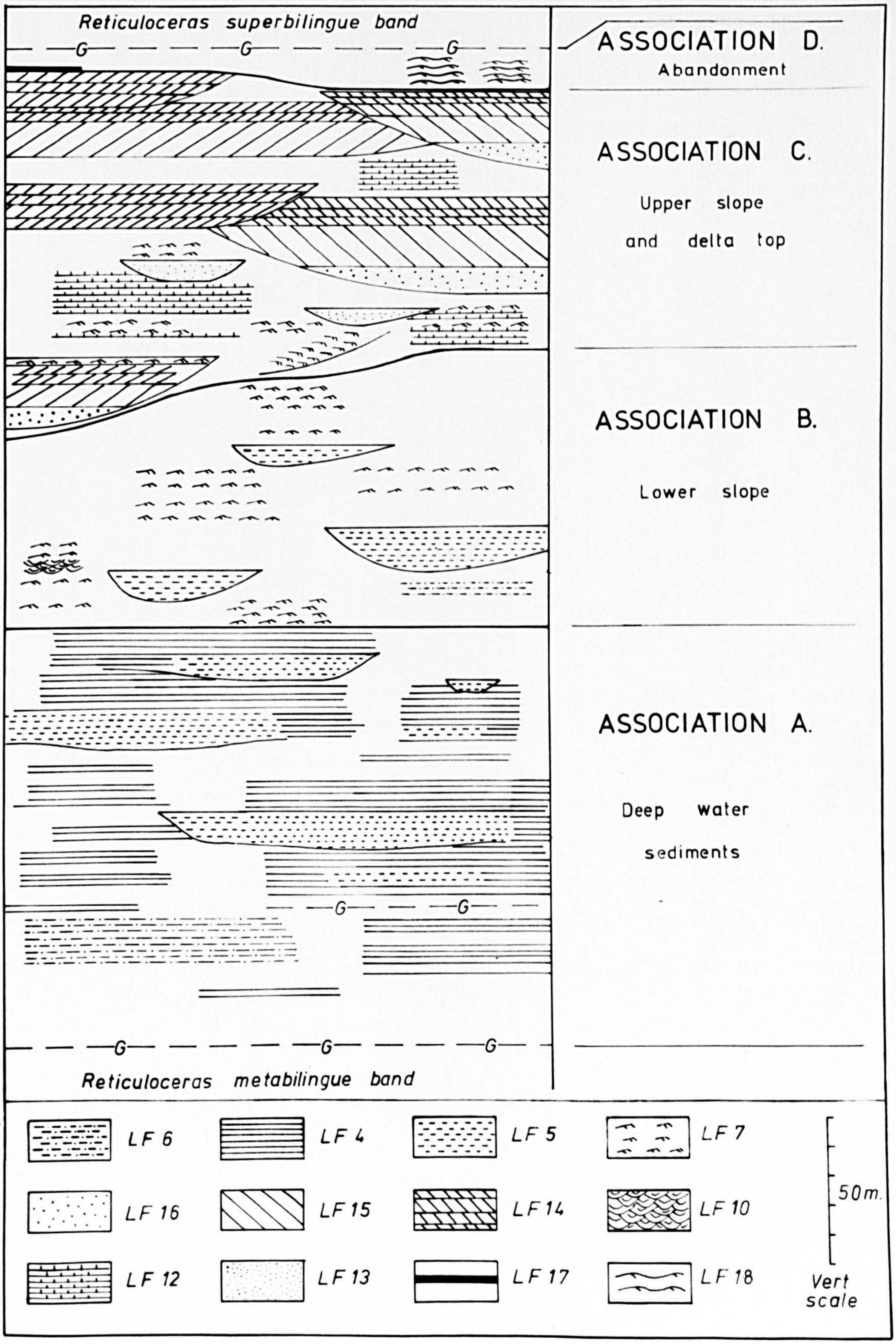

Askrigg
Block
CRAVEN FAULT
Central
Pennine
Basin
Leeds
Manchester
Sheffield
Western
Shelf
N.
Staffs
Basin
Derbyshire
Block
RED ROCK FAULT
Stoke
Widmerpool Gulf
Shrewsbury
Leicester
MIDLAND
LANDMASS
20 Km.

Fig.54. Isopachytes for the interval R. bilingue or R. metabilingue and R. superbilingue in the southern Pennines. The rectangle shows the study area. The outline of the Derbyshire Block is also shown.



Boreholes
Outcrops
Isopachytes in meters
Sheffield
Chapel
Macclesfield
Buxton
Chesterfield
Lincoln
Ashover
Matlock
Leek
Stoke
Ashbourne
Nottingham
Derby
Melbourne
Stafford
Burton
Leicester
100
200
300
R₂b absent
R₂b thin
R₂b c50m

Fig.55. Generalised vertical section showing the full sequence in the Roaches Grit Group at its thickest development.



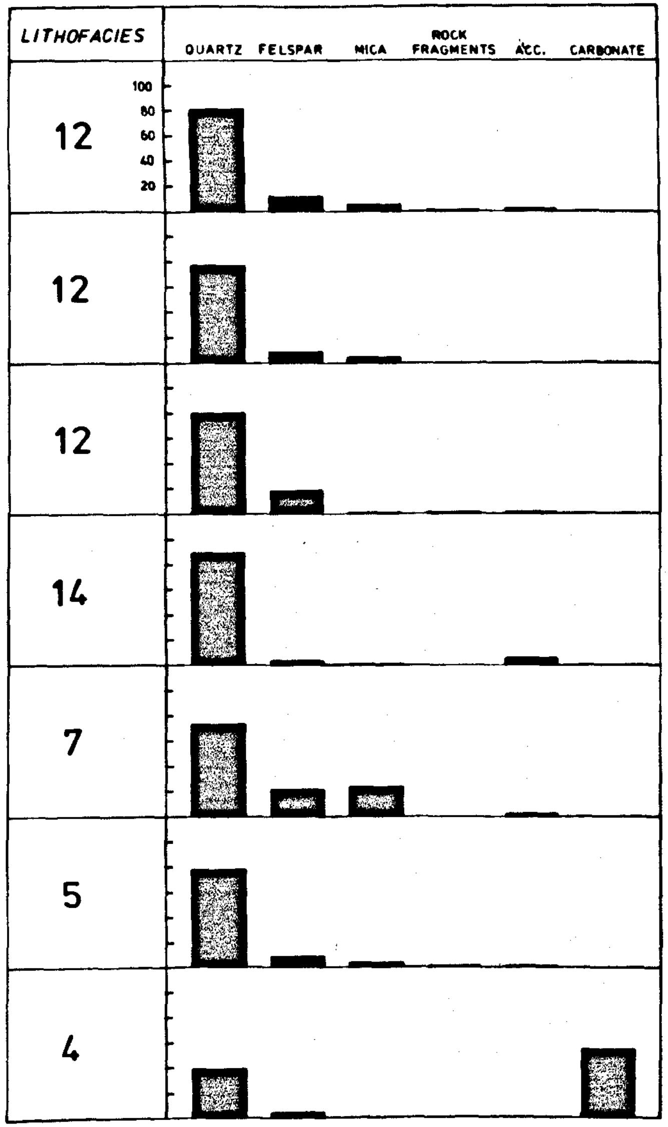
Reticuloceras superbilingue band
G
ASSOCIATION D.
Abandonment
ASSOCIATION C.
Upper slope
and delta top
ASSOCIATION B.
Lower slope
ASSOCIATION A.
Deep water
sediments
Reticuloceras metabilingue band
LF 6
LF 4
LF 5
LF 7
LF 16
LF 15
LF 14
LF 10
LF 12
LF 13
LF 17
LF 18
50m.
Vert
scale

Fig.56. a. Petrology of various lithofacies of the Roaches Grit Group, based on point counts of 300.

b. Petrology of 'protoquartzite lithofacies' sandstones from the E, H, and R Zones of the north Staffs Namurian.

Upper section after Trewin 1969.

Lower section after Evans et.al. 1968.


LITHOFACIES
QUARTZ
FELSPAR
MICA
ROCK FRAGMENTS
ACC.
CARBONATE
100
80
60
40
20
12
12
12
14
7
5
4

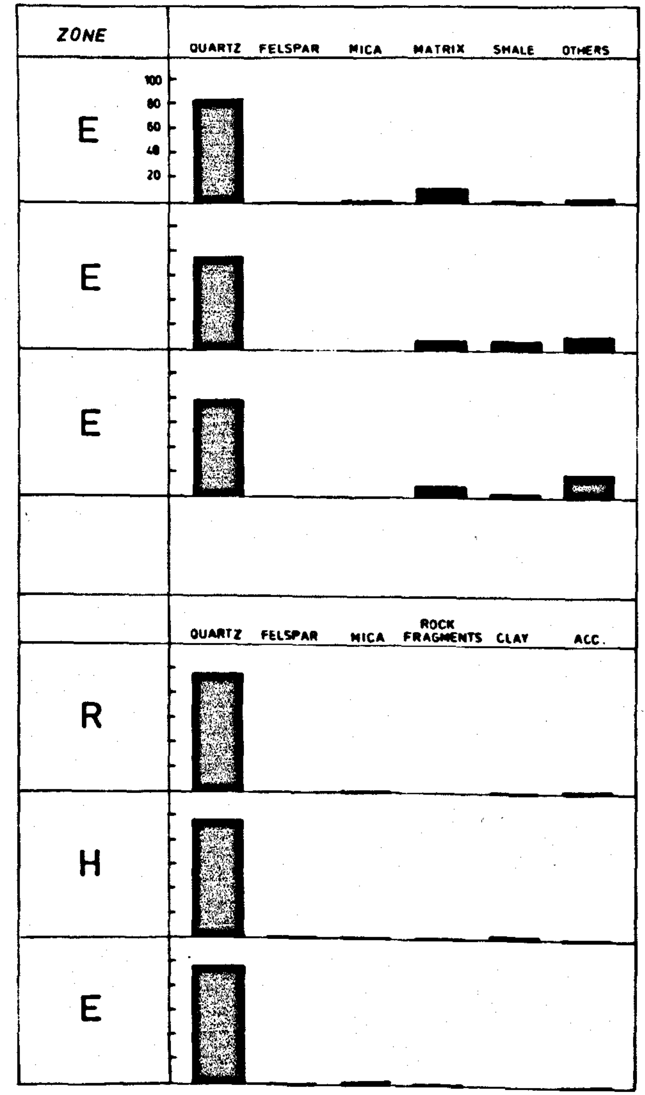
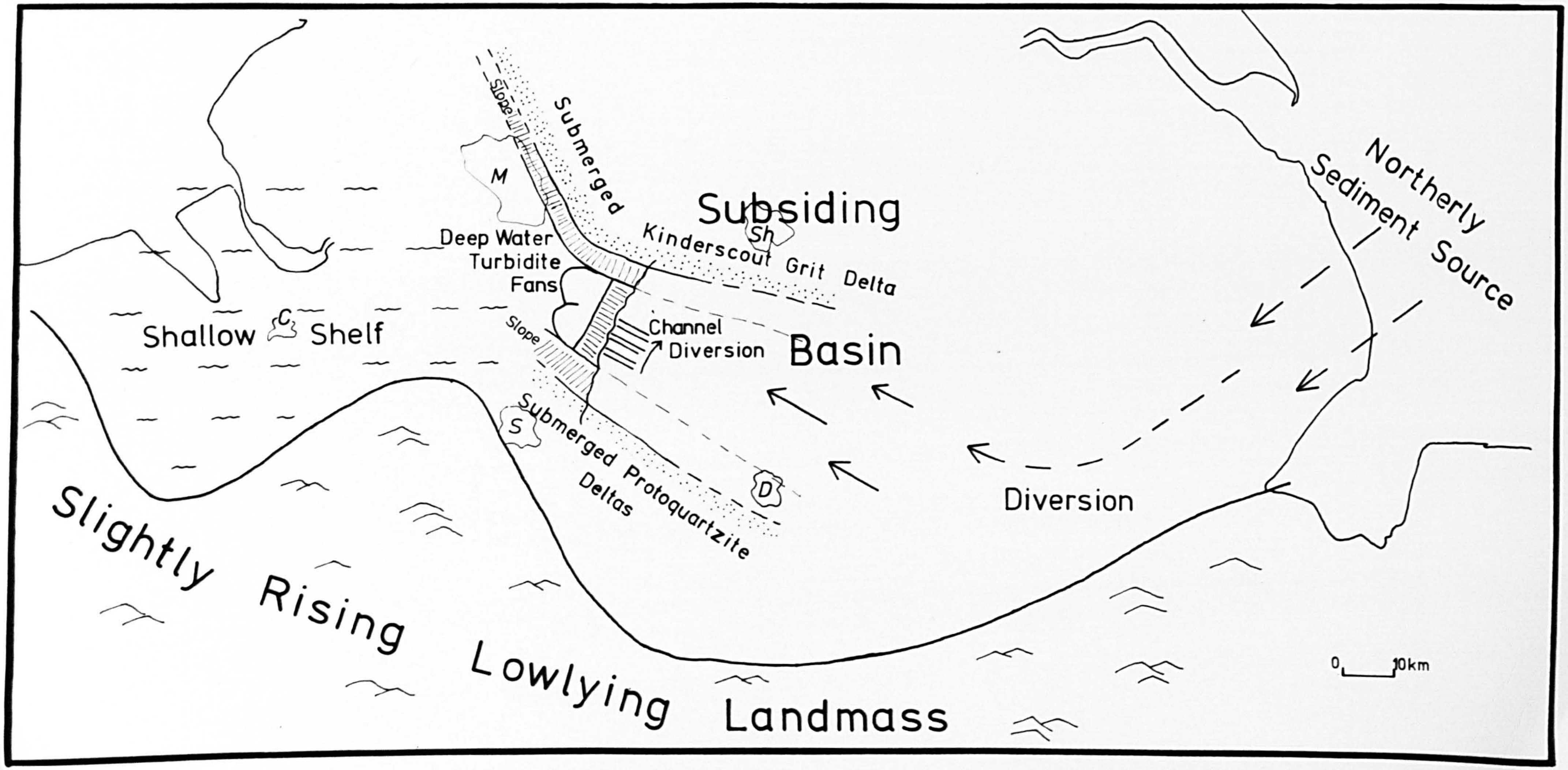
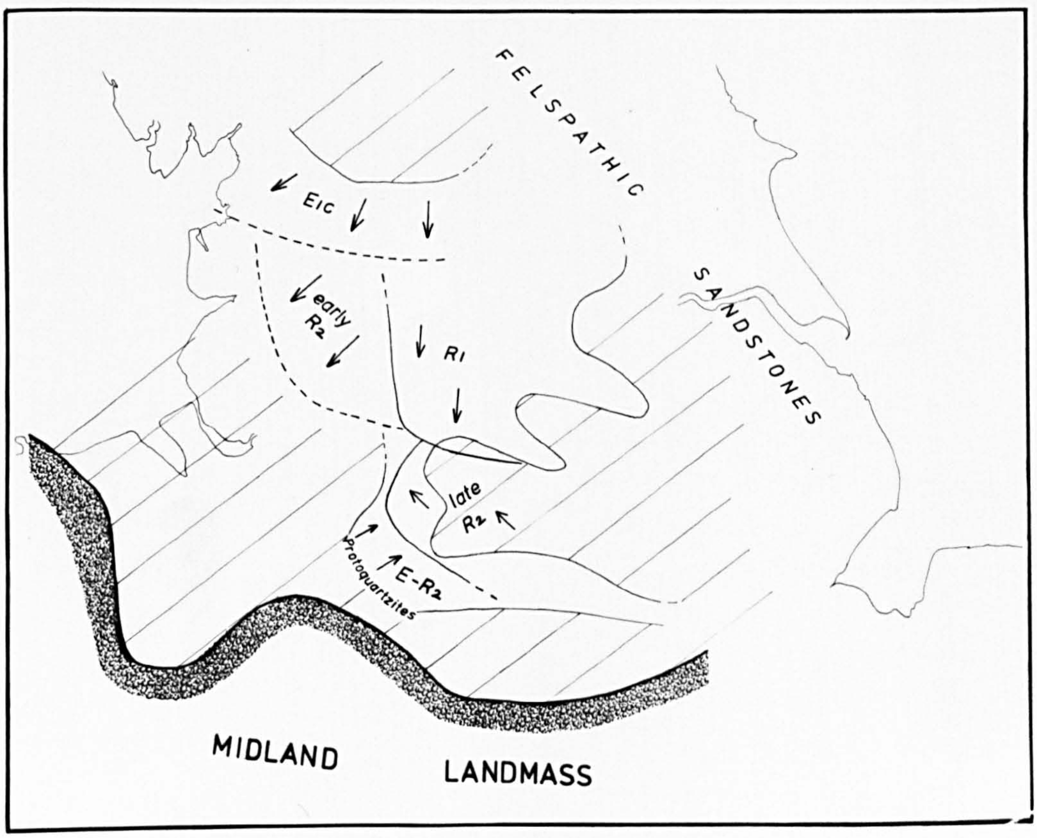

ZONE
QUARTZ
FELSPAR
MICA
MATRIX
SHALE
OTHERS
100
80
60
40
20
E
E
E
QUARTZ
FELSPAR
MICA
ROCK FRAGMENTS
CLAY
ACC.
R
H
E

Fig. 57. Palaeogeography and major controls on sedimentation during the deposition of the Roaches Grit Group, immediately prior to the cut off of the sediment supply.



Northerly Sediment Source
Subsiding
Basin
Submerged Kinderscout Grit Delta
Slope
M
Sh
Deep Water Turbidite Fans
Channel Diversion
Slope
Shallow
C
Shelf
S
D
Submerged Protoquartzite Deltas
Diversion
0
10km
Slightly Rising Lowlying Landmass

Fig.58. The major phases of fill of the Namurian Central Province Basin. 'Block' and 'Shelf' areas in the lower Namurian are marked by diagonal shading, 'Basin' areas in the lower Namurian are left blank.



FELSPATHIC
SANDSTONES
E1c
early R2
R1
late R2
E-R2
Protoquartzites
MIDLAND
LANDMASS

SECTION III Figs

Fig. 59. Location of research areas.

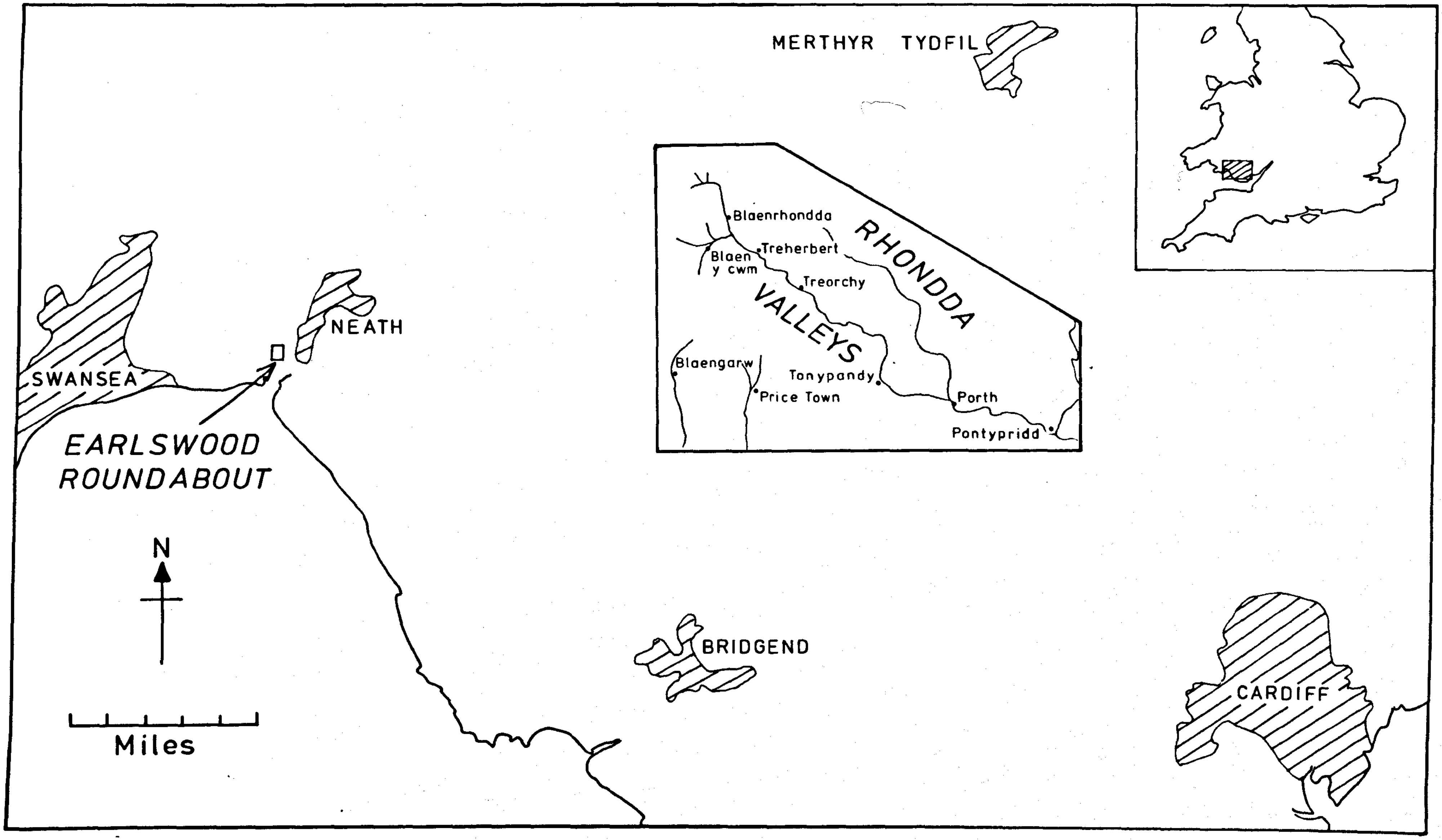

MERTHYR TYDFIL
RHONDDA
VALLEYS
Blaenrhondda
Treherbert
Blaen y cwm
Treorchy
Blaengarw
Tonypandy
Price Town
Porth
Pontypridd
NEATH
SWANSEA
EARLSWOOD ROUNDABOUT
N
Miles
BRIDGEND
CARDIFF

Fig.60. Stratigraphic position of the Lower Pennant Measures, and main sedimentological features of the succession.

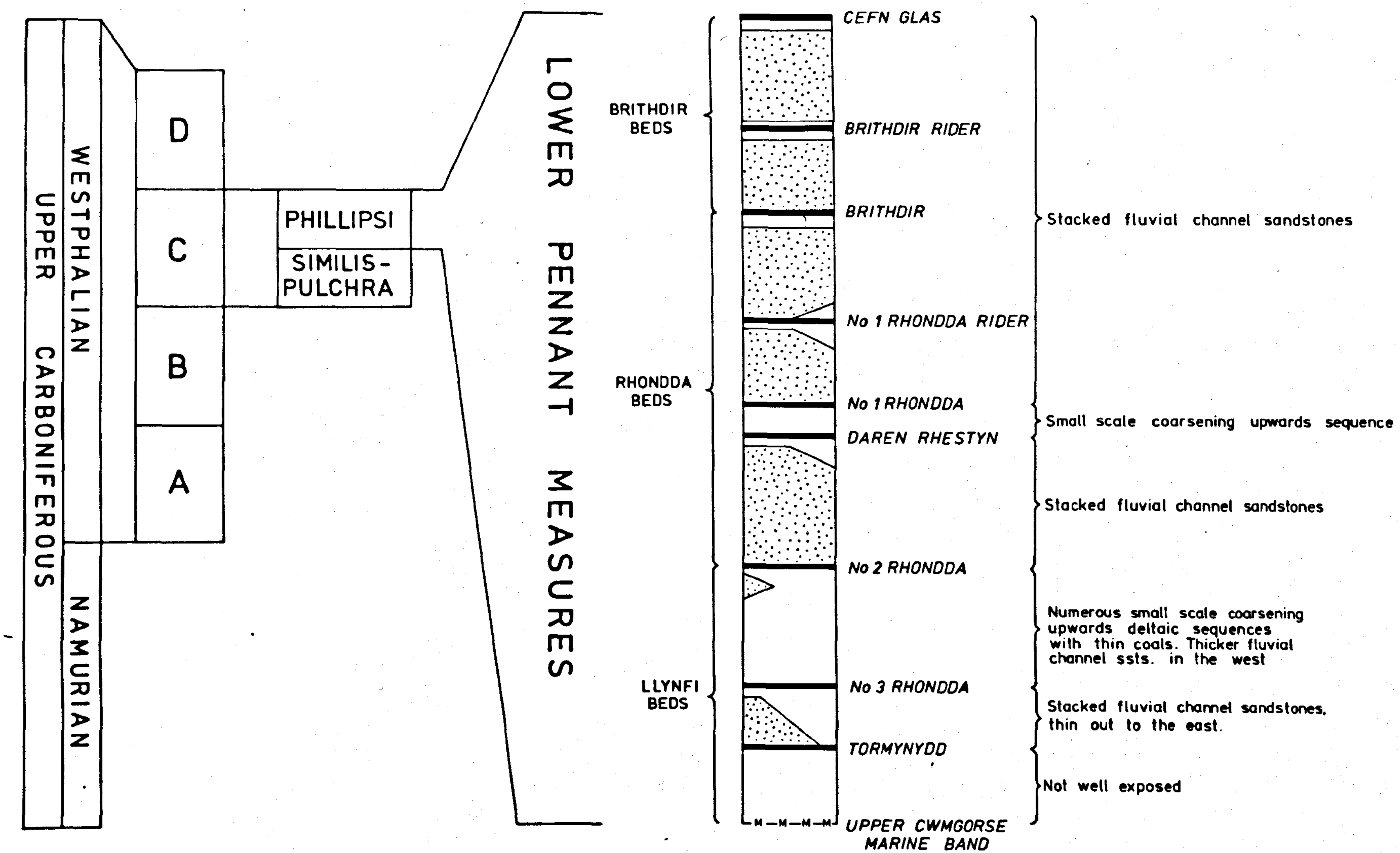

UPPER CARBONIFEROUS
WESTPHALIAN
NAMURIAN
D
C
B
A
PHILLIPSI
SIMILIS-PULCHRA
LOWER PENNANT MEASURES
BRITHDIR BEDS
RHONDDA BEDS
LLYNFI BEDS
CEFN GLAS
BRITHDIR RIDER
BRITHDIR
No 1 RHONDDA RIDER
No 1 RHONDDA
DAREN RHESTYN
No 2 RHONDDA
No 3 RHONDDA
TORMYNYDD
UPPER CWMGORSE MARINE BAND
Stacked fluvial channel sandstones
Small scale coarsening upwards sequence
Stacked fluvial channel sandstones
Numerous small scale coarsening upwards deltaic sequences with thin coals. Thicker fluvial channel ssts. in the west
Stacked fluvial channel sandstones, thin out to the east.
Not well exposed

Fig. 61. Types of cross bedding in the Lower Pennant Measures.

A. Lithofacies 1, Tabular Cross Bedding.

B. Lithofacies 3, Cross Bedding with undulating basal erosion surfaces.

C. Lithofacies 2, Trough Cross Bedding.

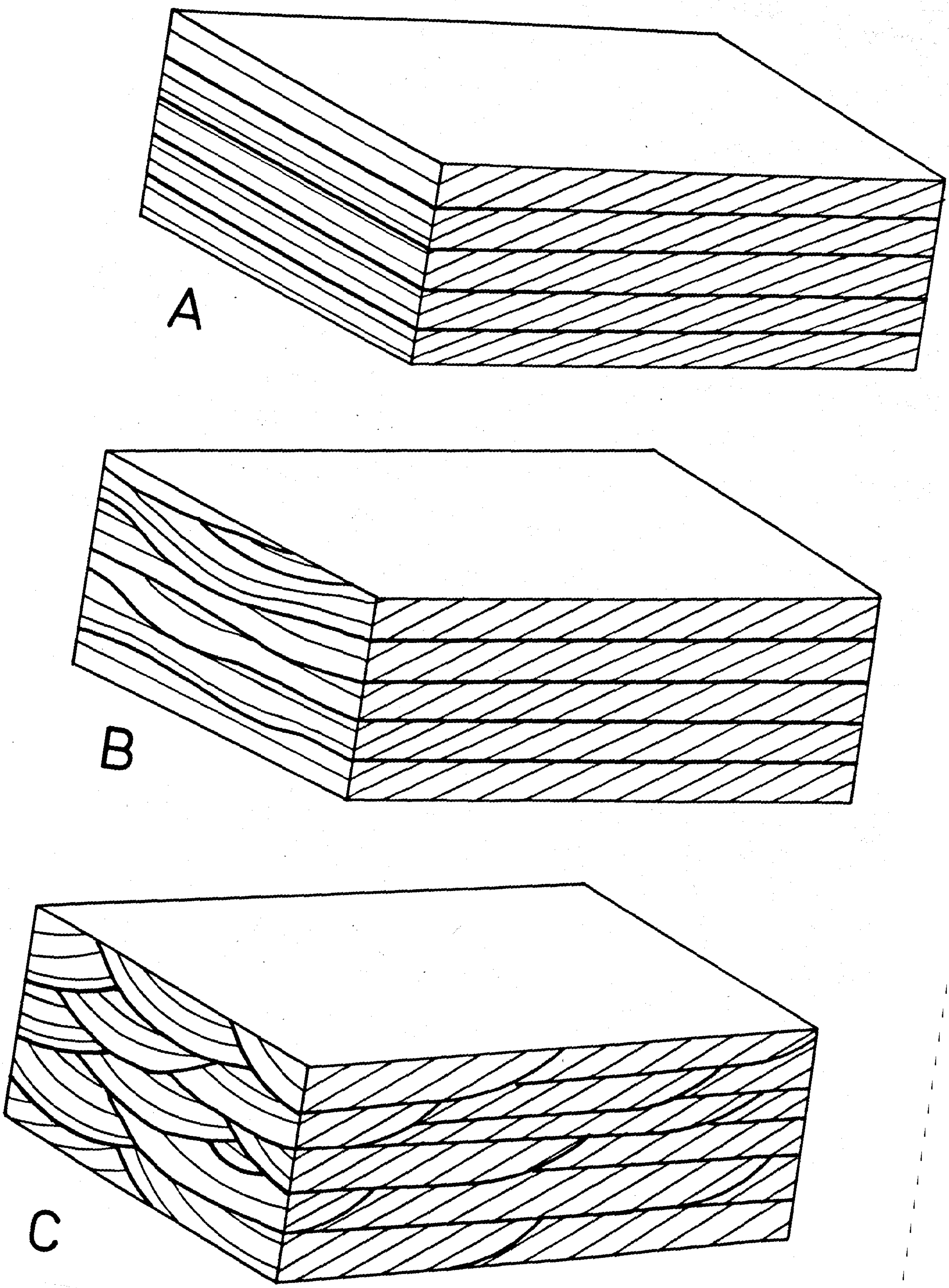

A
B
C

Fig. 62. Field sketch of LF 3 in XY and YZ planes. Outcrop west of Blaenrhondda (SN 9309 0051).

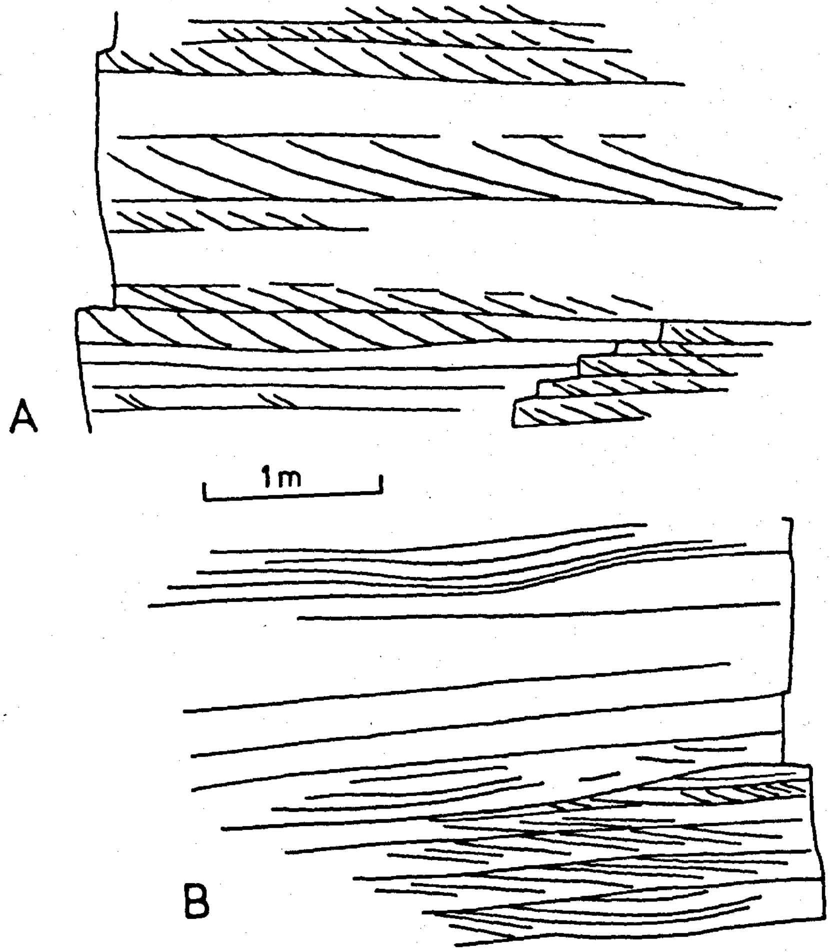

A
1m
B

Fig. 63. Vertical sections in Association B from the Llynfi Beds.

Scale in metres.

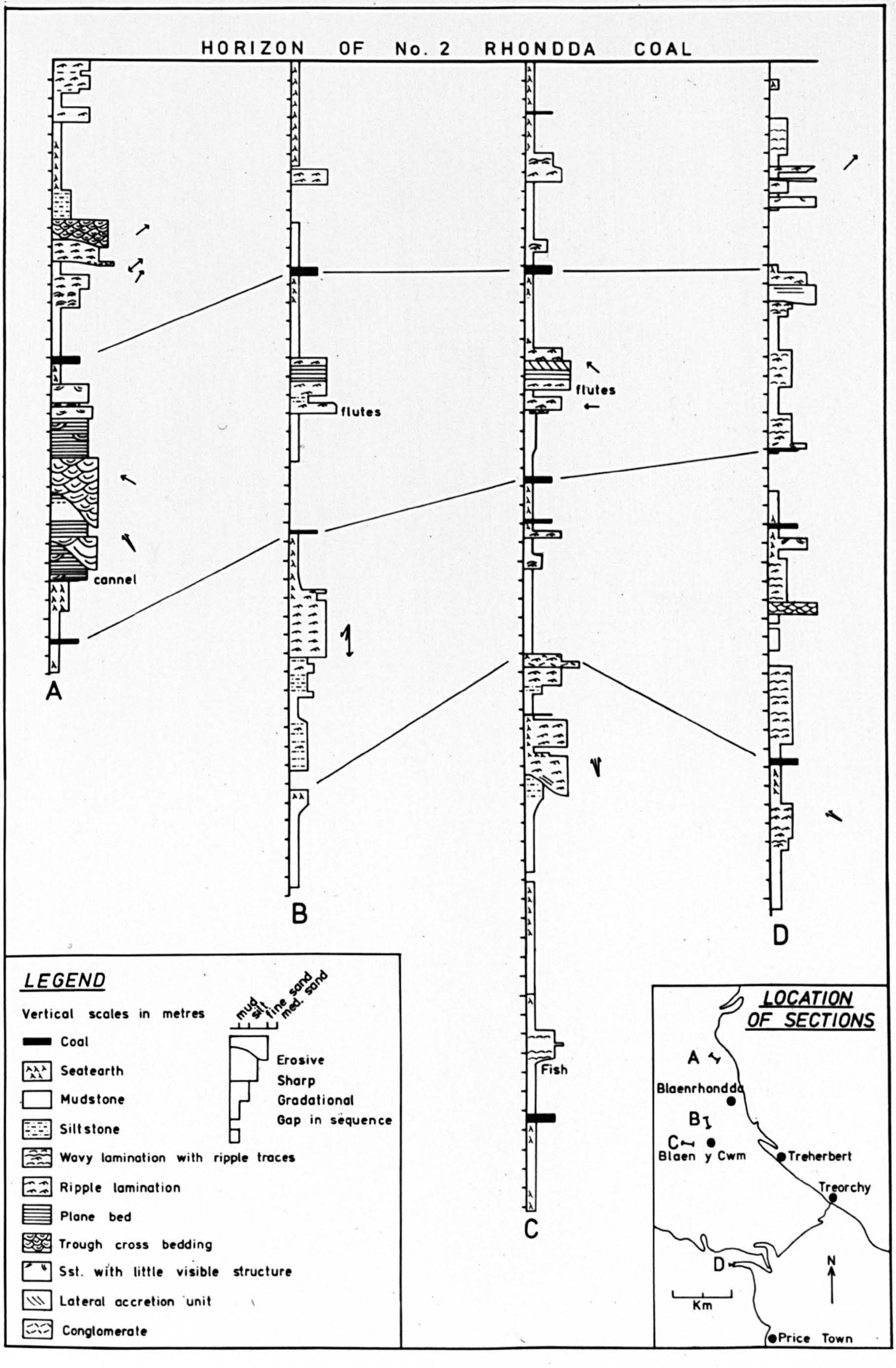

HORIZON OF No. 2 RHONDDA COAL
cannel
flutes
flutes
Fish
A
B
C
D
LEGEND
Vertical scales in metres
Coal
Seatearth
Mudstone
Siltstone
Wavy lamination with ripple traces
Ripple lamination
Plane bed
Trough cross bedding
Sst. with little visible structure
Lateral accretion unit
Conglomerate
mud
silt
fine sand
med. sand
Erosive
Sharp
Gradational
Gap in sequence
LOCATION OF SECTIONS
Blaenrhondda
Blaen y Cwm
Treherbert
Treorchy
Price Town
Km
N

Fig.64. Vertical section through the sandstones at A, Earlswood Roadcutting (SS 729 944 - SS 727 945) and B in Nant y Gwair (SS 9111 9875 - SS 9089 9879).

Key as for Fig. 69. Dots is LF 6, Structureless Sandstone, black is LF 9, Coal.

Vertical scales in metres.

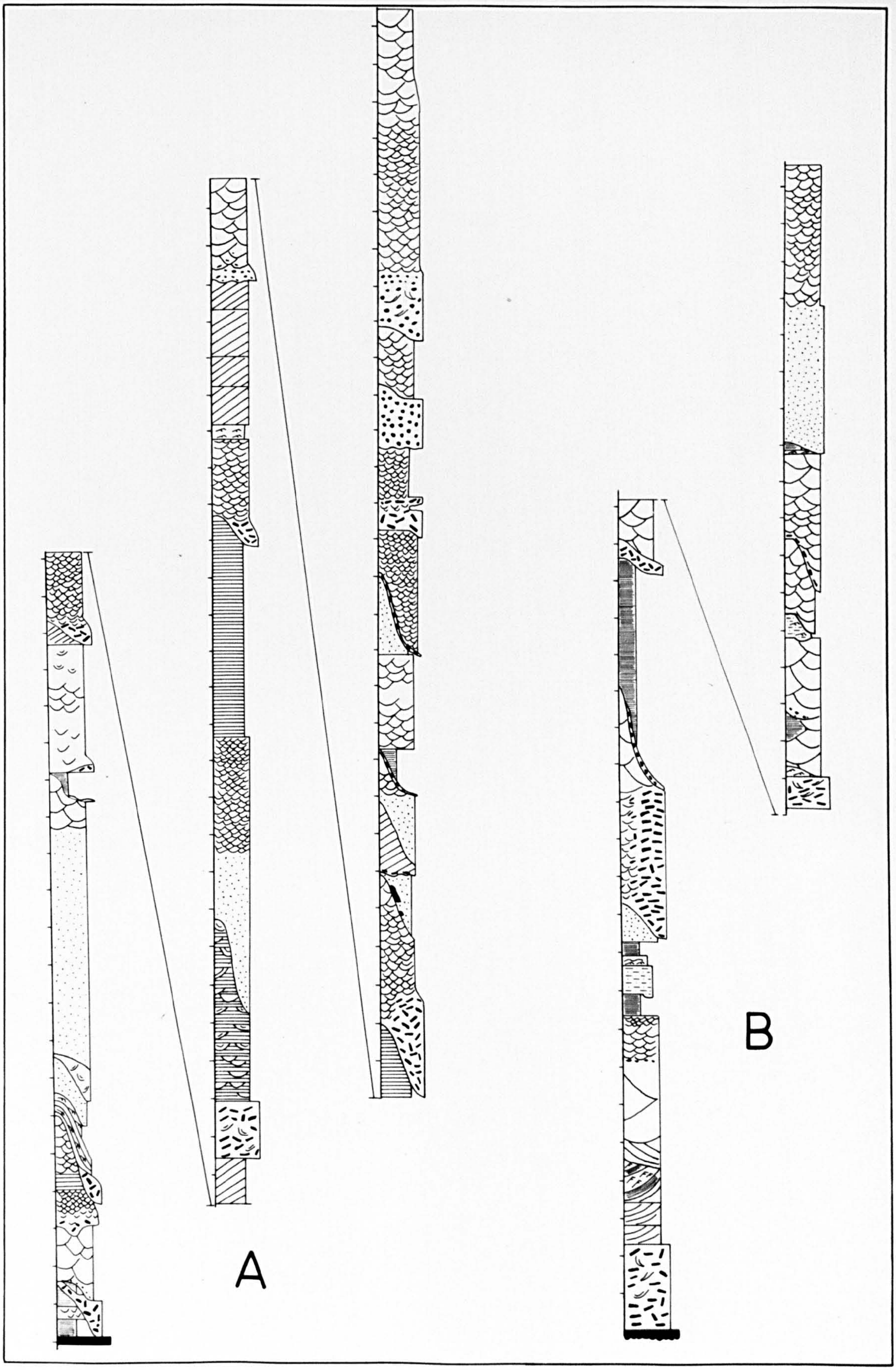
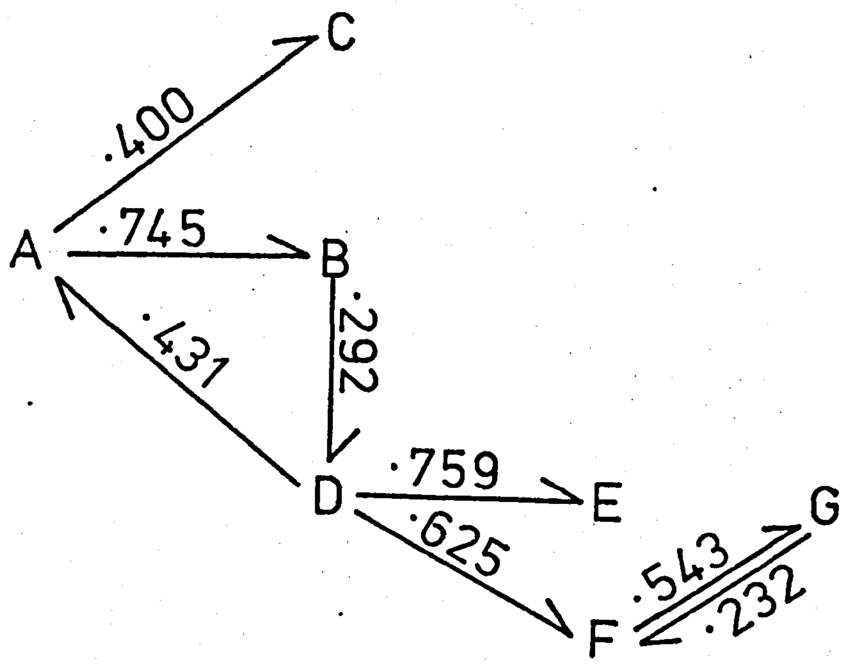

A
B

Fig.65. Prior deposition transition tree diagram for all measured sections in Association A.

Fig.66. Transition probability matrix tree diagram for all sections.


C
·400
A
·745
B
·431
·292
D
·759
E
·625
G
·543
·232
F

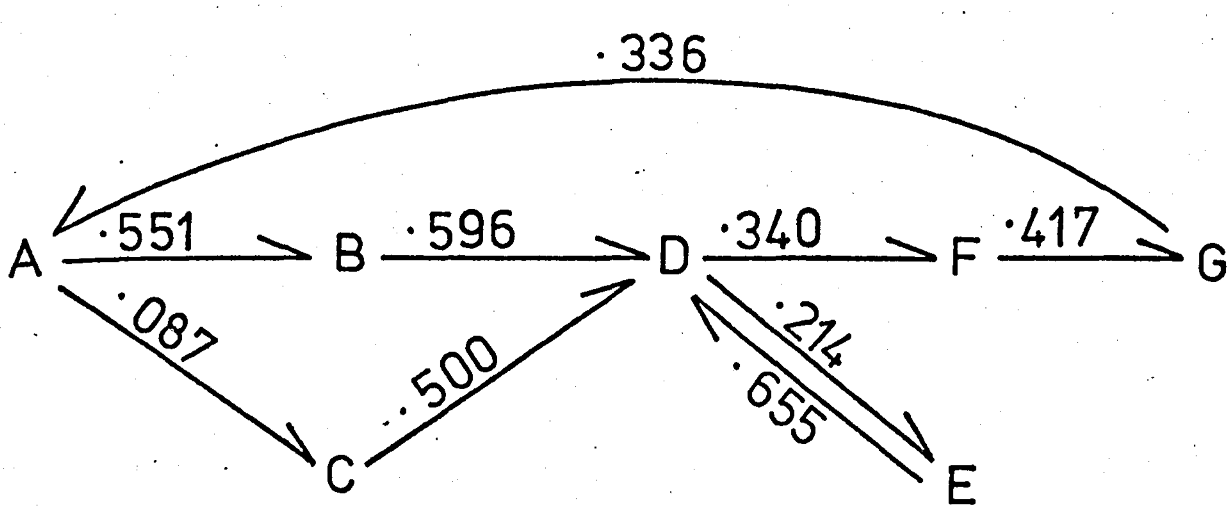
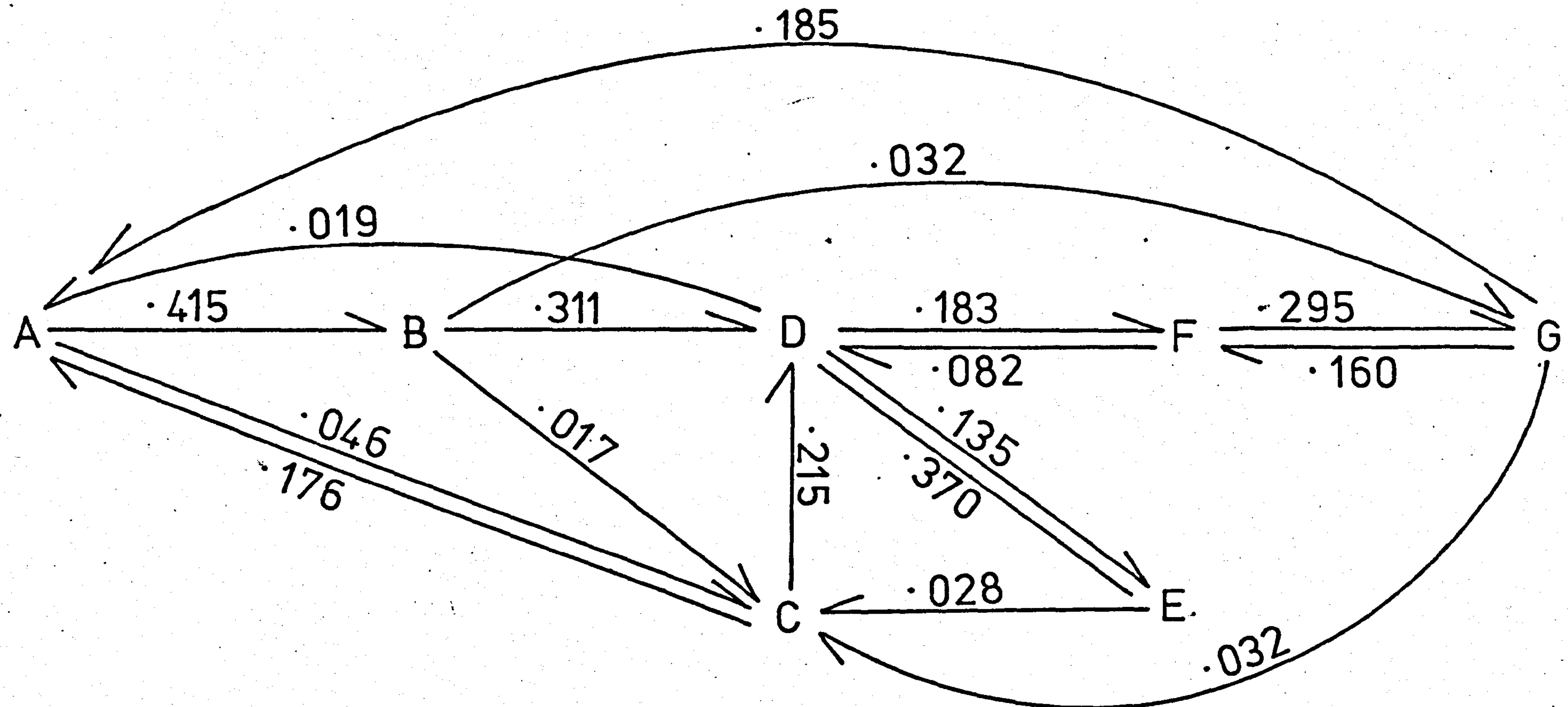

·336
A
·551
B
·596
D
·340
F
·417
G
·087
·500
·214
·655
C
E

Fig.67. Free diagram of transitions occurring with greater than random frequency.



A
B
D
F
G
C
E
·185
·032
·019
·415
·311
·183
·295
·082
·160
·046
·176
·017
·215
·135
·370
·028
·032

Fig.68. Channel fill showing several phases of erosion.

Blaenrhondda Roadcutting (SN 928 013)

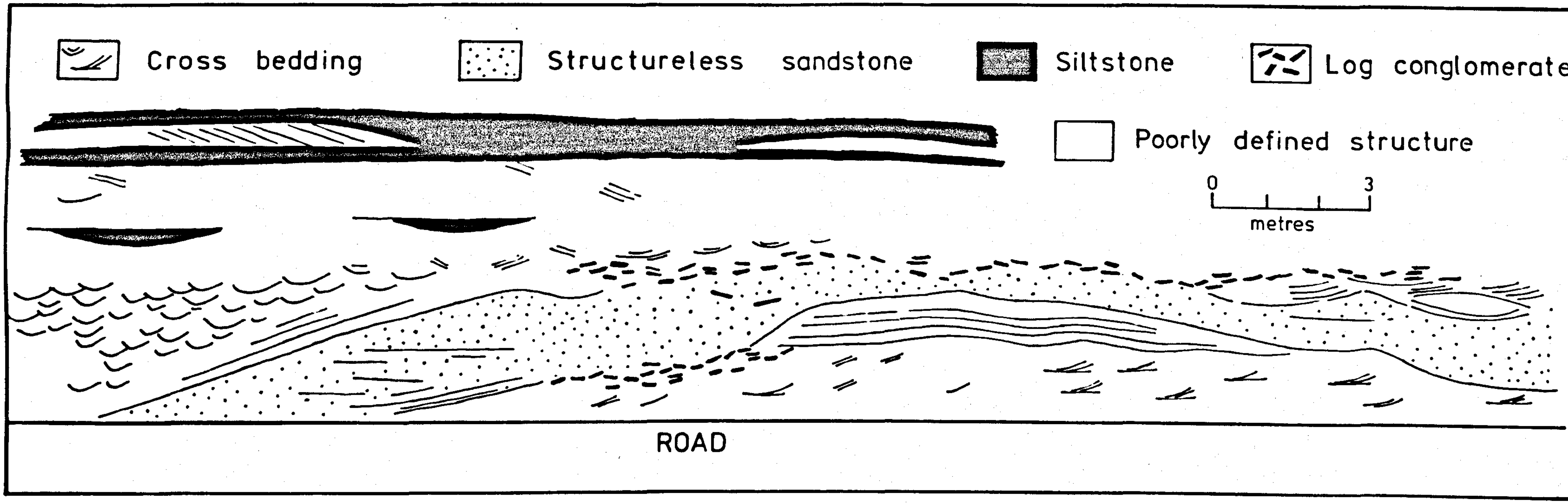

Cross bedding
Structureless sandstone
Siltstone
Log conglomerate
Poorly defined structure
0
3
metres
ROAD

Fig.69. Key sequences in Association A sections:

A. Blaenrhondda Roadcutting (SN 9288 0134)

B. Earlswood Roundabout, lower section (SS 729 944)

C. Quarry above Blaengawr (SS 8991 9386)

D. Blaenrhondda Roadcutting (SN 929 012)

E. Outcrop west of Blaenrhondda (SN 9309 0051)

F. Blaenrhondda Roadcutting (SN 9310 0065)

G. Roadcutting below Craig Ogw (SS 938 945)

H. Blaenrhondda Roadcutting (SN 929 012)

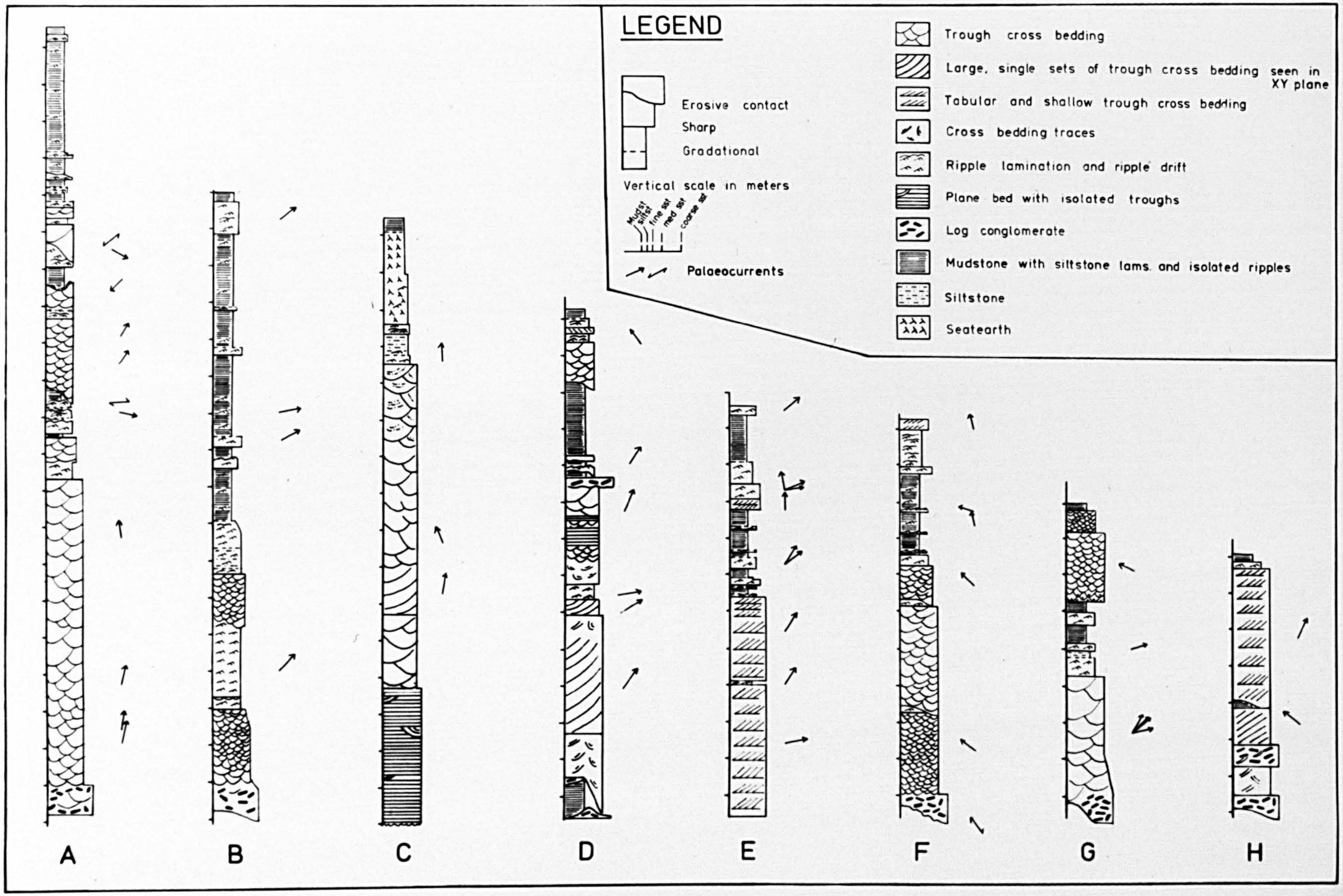
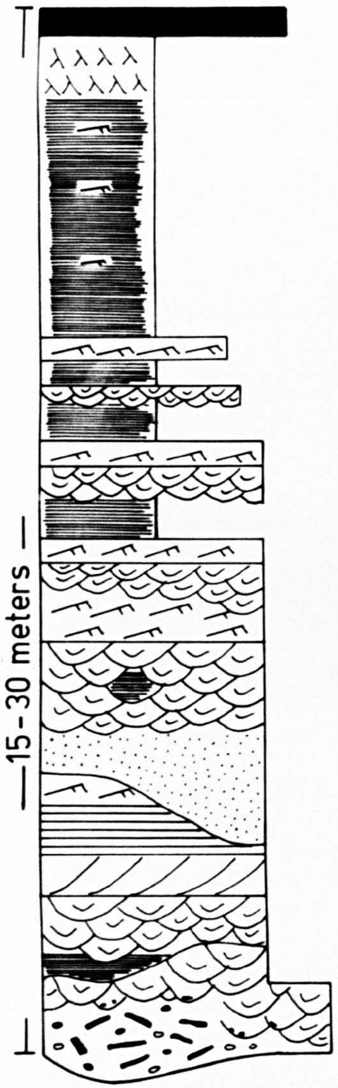

LEGEND
Erosive contact
Sharp
Gradational
Vertical scale in meters
Mudst
siltst
fine sst
med sst
coarse sst
Palaeocurrents
Trough cross bedding
Large, single sets of trough cross bedding seen in XY plane
Tabular and shallow trough cross bedding
Cross bedding traces
Ripple lamination and ripple drift
Plane bed with isolated troughs
Log conglomerate
Mudstone with siltstone lams. and isolated ripples
Siltstone
Seatearth
A
B
C
D
E
F
G
H

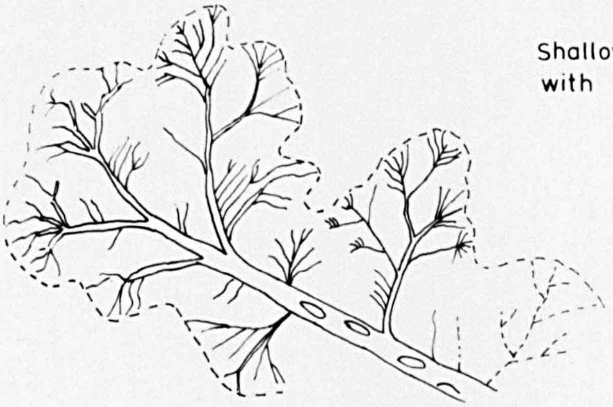
Fig. 70. Composite sequence in the fluvial channel association.



MAIN FEATURES	INTERPRETATION
Seatearth and Coal	Vegetation established when sediment input reduced as active channel moves away.
Siltstone Laminated siltstone, often with small ripple form sets.	Suspension sedimentation in abandoned channel and floodplain.
Alternating Beds Cosets of small scale trough cross bedding and ripple lamination alternating with siltstone. Sandstones fine upwards. Cross bedding variance moderate.	Progressive channel abandonment. Sandstones deposited in active channel during high stage. Channel cut off during low stage when silts are deposited in ponded water.
Main Sandstone Erosively based cosets of cross-bedding, ripple lamination; sometimes parallel lamination and rarely structureless sandstone. Siltstone sometimes occurs in shallow channels near the base, and may also fill in some cross-bedding troughs. Grain size only slightly variable with no upwards decrease. Cross sets do not become smaller upwards. Sequences show very low order. Cross bedding variance low.	Main channel fill. Sequences generated by discharge changes. Dunes and sandwaves often washed out during falling stage. Periodic erosion of previously deposited sediment. Siltstones deposited in ponded water at low stage.
Conglomerate Contains large logs, rolled ironstone and quartz pebbles. Passes laterally and upwards into trough cross bedding.	Collection of coarsest bedload in deepest part of channel.
Major Erosion Surface Shows channel morphology with relief up to several meters. Often rests directly on underlying coal.	

Fig. 71. Evolution of the Pennant Cyclothems.

1). Progradation of lobate deltas or crevasse deltas



2). Reworking by large migrating braided river

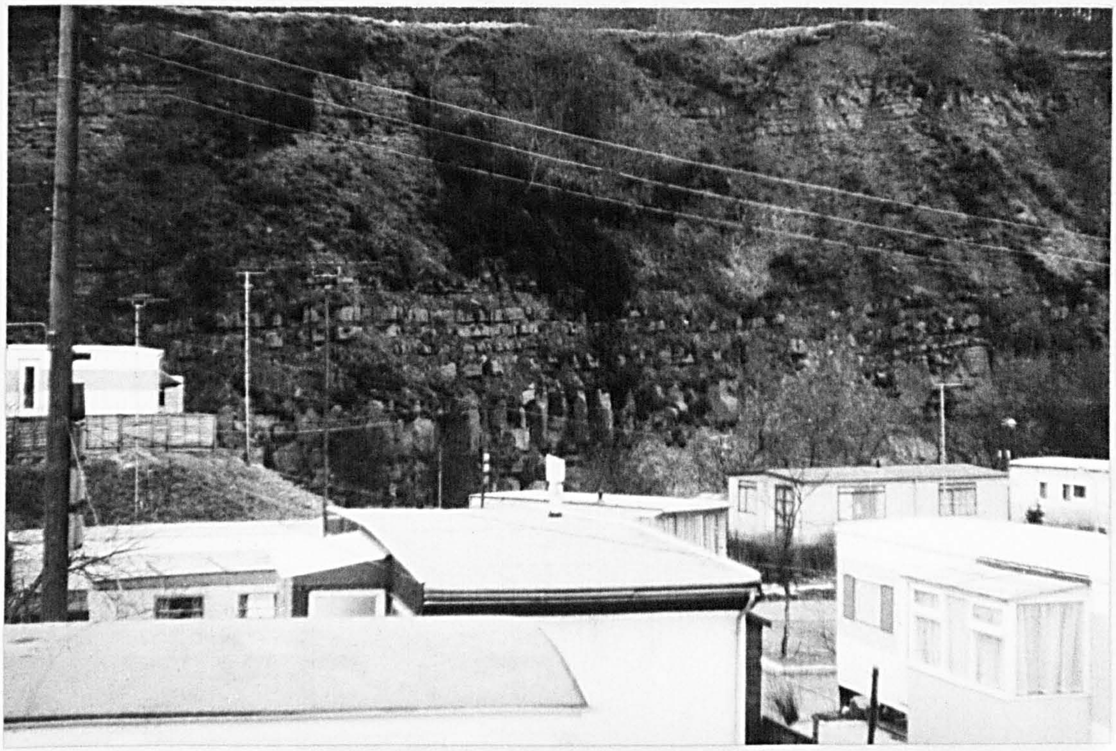
3). Cut off of sediment supply. Coal forests established across the basin

4). Transgression and establishment of bivalve fauna

SECTION II Plates

Plate 1. Lithofacies 5, Thick Sandstones overlain by Lithofacies 4, Thin-bedded Turbidites, in the Deep Water Association at Corbar Caravan Park, Buxton, (SK 051 740). The sandstones form a thinning upwards sequence. Individual beds are laterally persistant across the quarry.

Plate 2. Close up of the general view shown in Plate 1. Lithofacies 5, Thick Sandstones are overlain by Lithofacies 4, Thin-bedded-Turbidites with sharp bases.



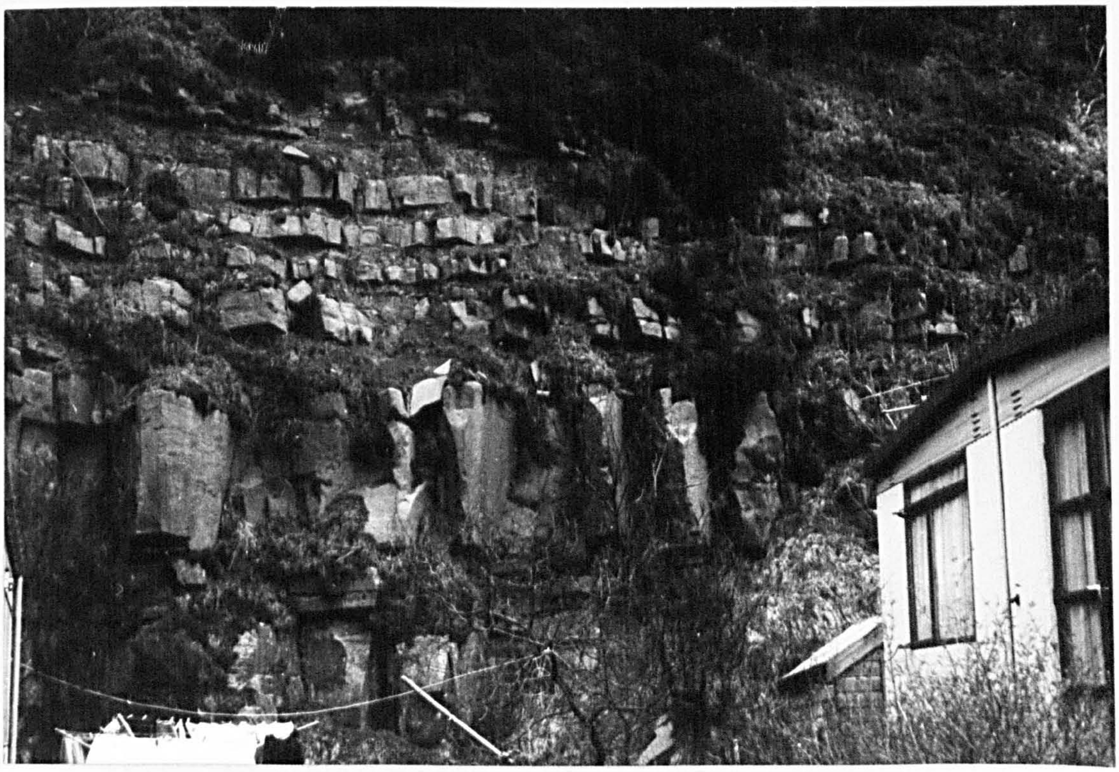
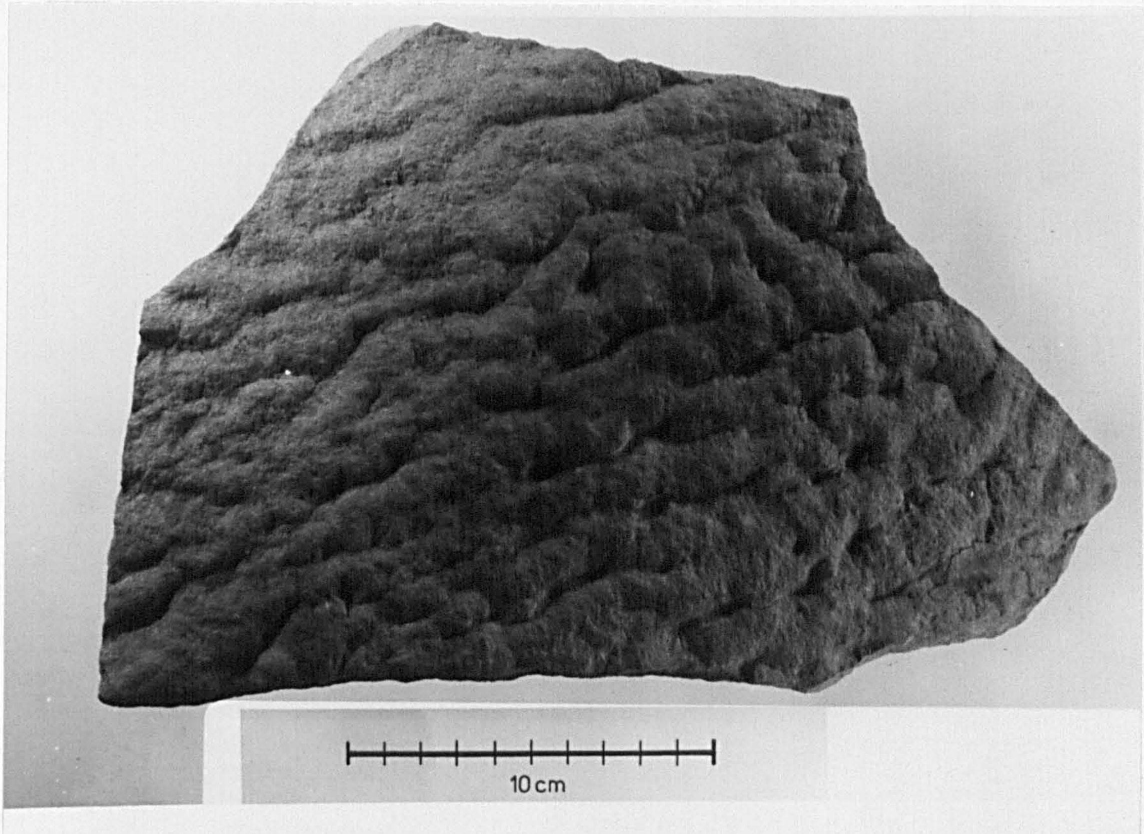


Plate 3. Load casts arranged in rows, possibly deforming earlier flutes or furrows. Base of a Thin-bedded Turbidite from Walker Barn Quarry (SJ 952 736).

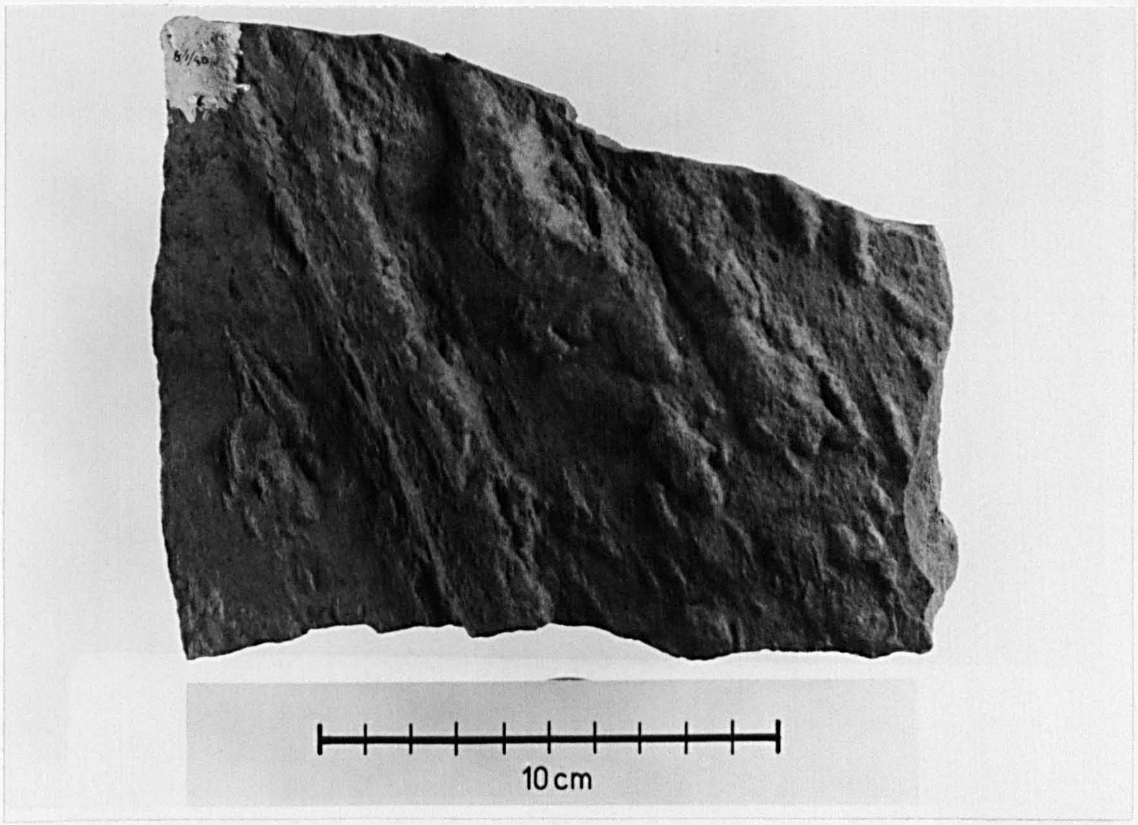
Plate 4. Furrows on the base of a Thin-bedded Turbidite. Specimen from stream section below Upper Hulme (SK 0123 6092).


10 cm


10 cm

Plate 5. Groove and prod casts slightly modified by later bioturbation. Base of Thin-bedded turbidite from a quarry near Bridgehouse Farm (SK 0368 7200).

Plate 6. Impression of large plant stem at the base of a Thin-bedded Turbidite. From stream section below Upper Hulme. (SK 0123 6092).


10 cm

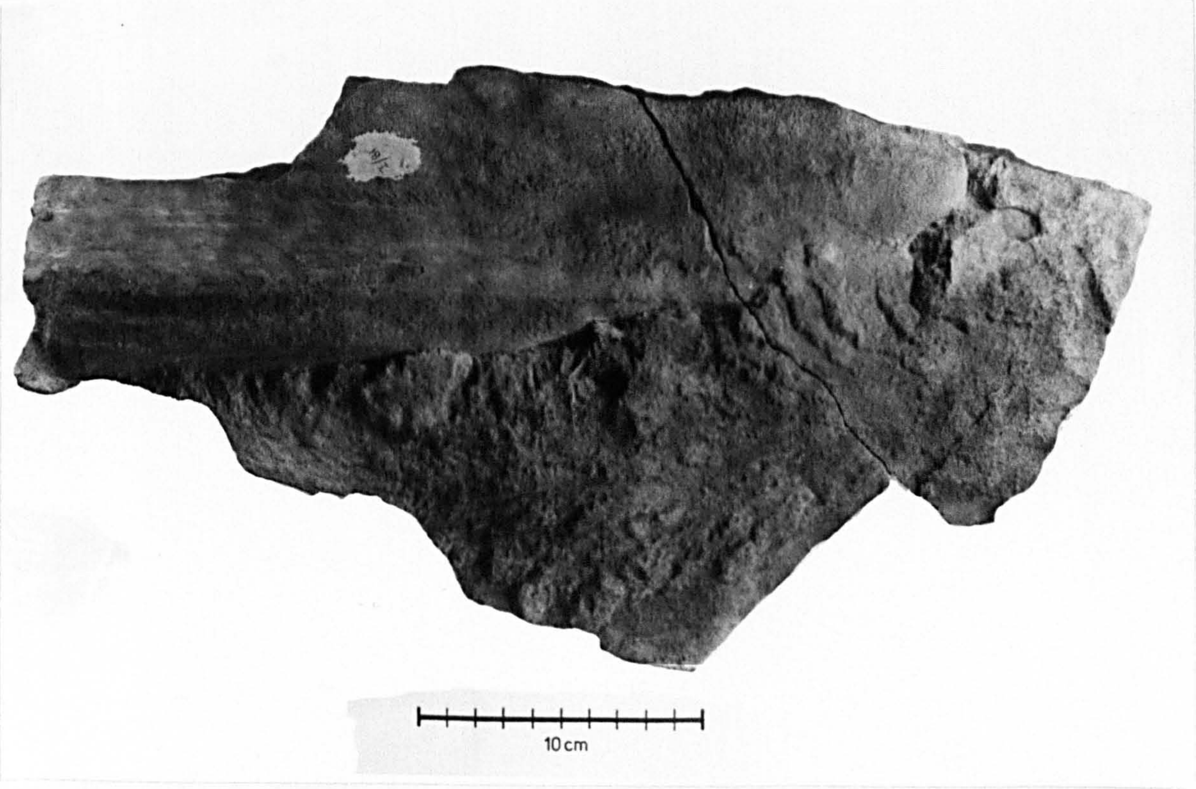

10 cm

Plate 7. Lithofacies 5. Thick Sandstones at Walker Barn Quarry (SJ 952 736). Individual units become more recognisable towards the top of the section. Height of quarry face about 30m.

Plate 8. Lithofacies 5. Thick Sandstones at Walker Barn Quarry. Large Carbonate concretions up to 3m in diameter are visible in this photograph.

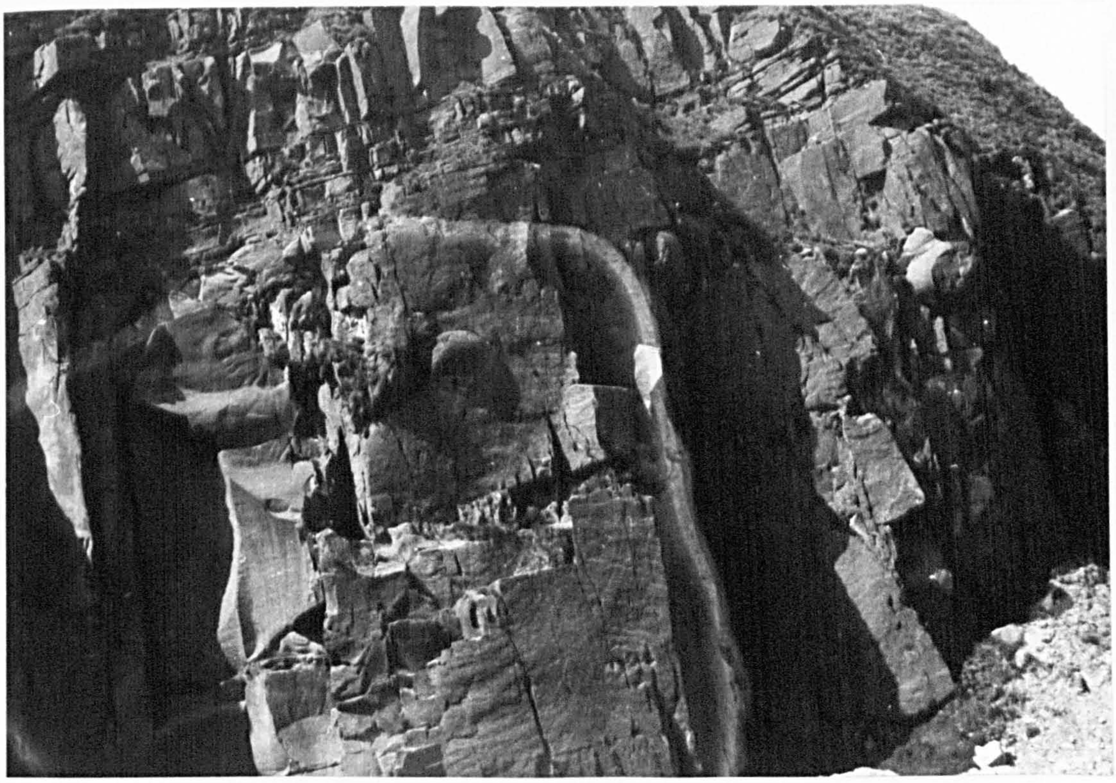


Plate 9. Amalgamation of two beds in Lithofacies 5.

Thick Sandstones marked by a shale flake conglomerate.

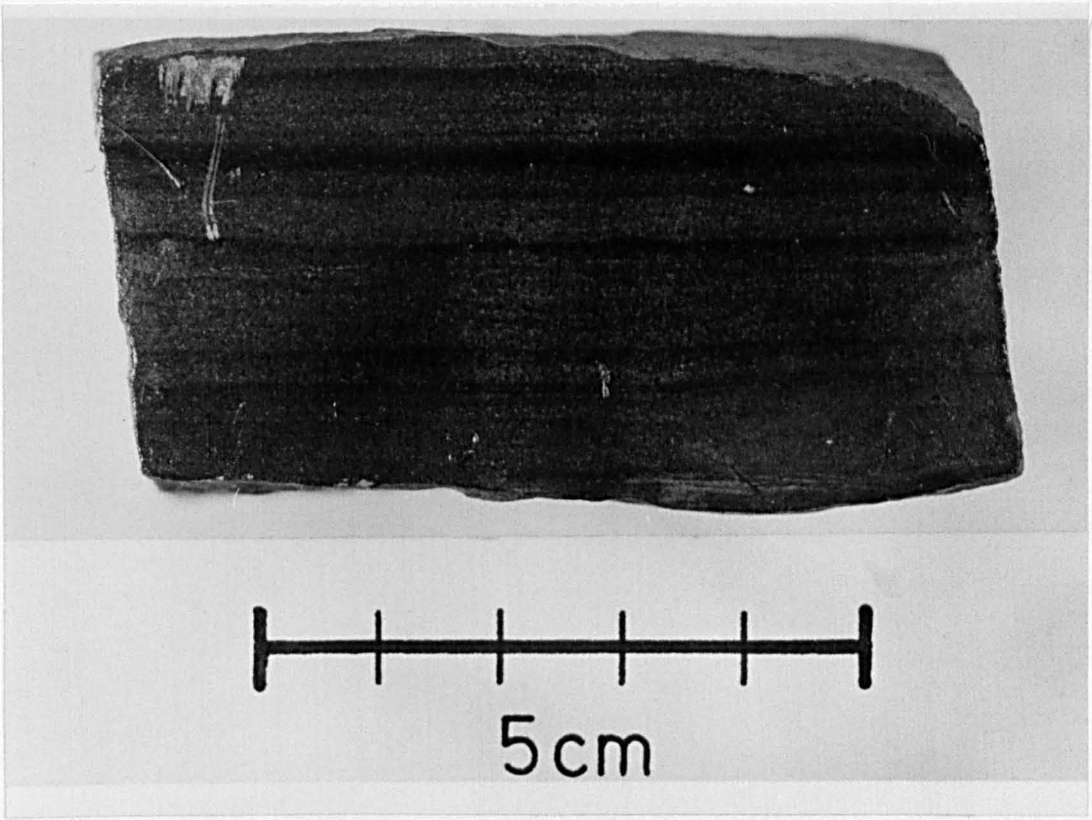
Quarry near the Five Clouds (SK 0035 6236).

Plate 10. Channelised base to a unit in Lithofacies 5.

Thick Sandstones. Walker Barn Quarry. (SJ 952 736).

Plate 11. Lithofacies 6. Parallel-sided Sandstone, showing the gradational lamination and irregular coarse-fine alternation. Association A. Specimen from Hogshaw Brook, Buxton (SK 059 743).

Plate 12. Lithofacies 6. Parallel-sided Sandstone.


5cm

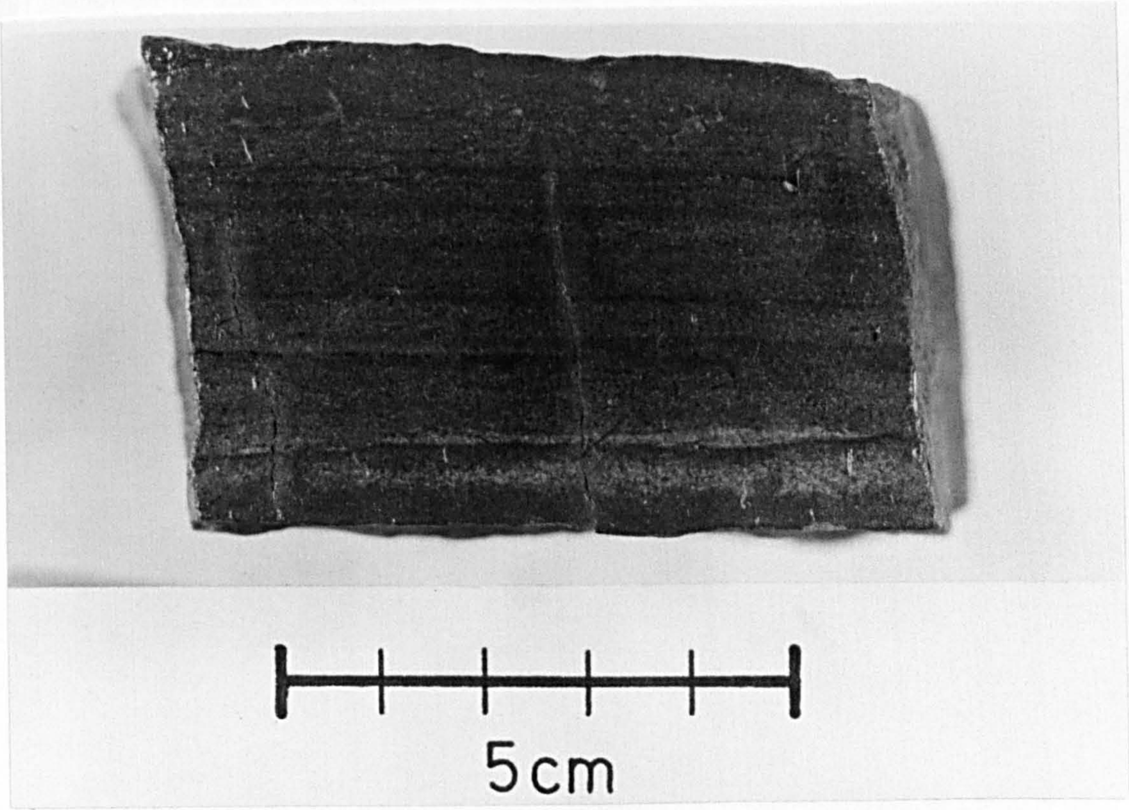

5cm

Plate 13. Lithofacies 7. Ripple-laminated Sandstone, with beds of LF 8, Micaceous, Carbonaceous Sandstone above and below. This is part of a laterally continuous parallel-sided bed. Note the absence of a preserved ripple morphology at the top and the traces of bioturbation.
Association B. Upper Hulme.

Plate 14. Lithofacies 7. Ripple-laminated Sandstone in parallel sided beds interbedded with Lithofacies 8. Micaceous + Carbonaceous Sandstone in less resistant beds which weather back. Association B. River Dane at Danbridge. (SJ 9657 6517).

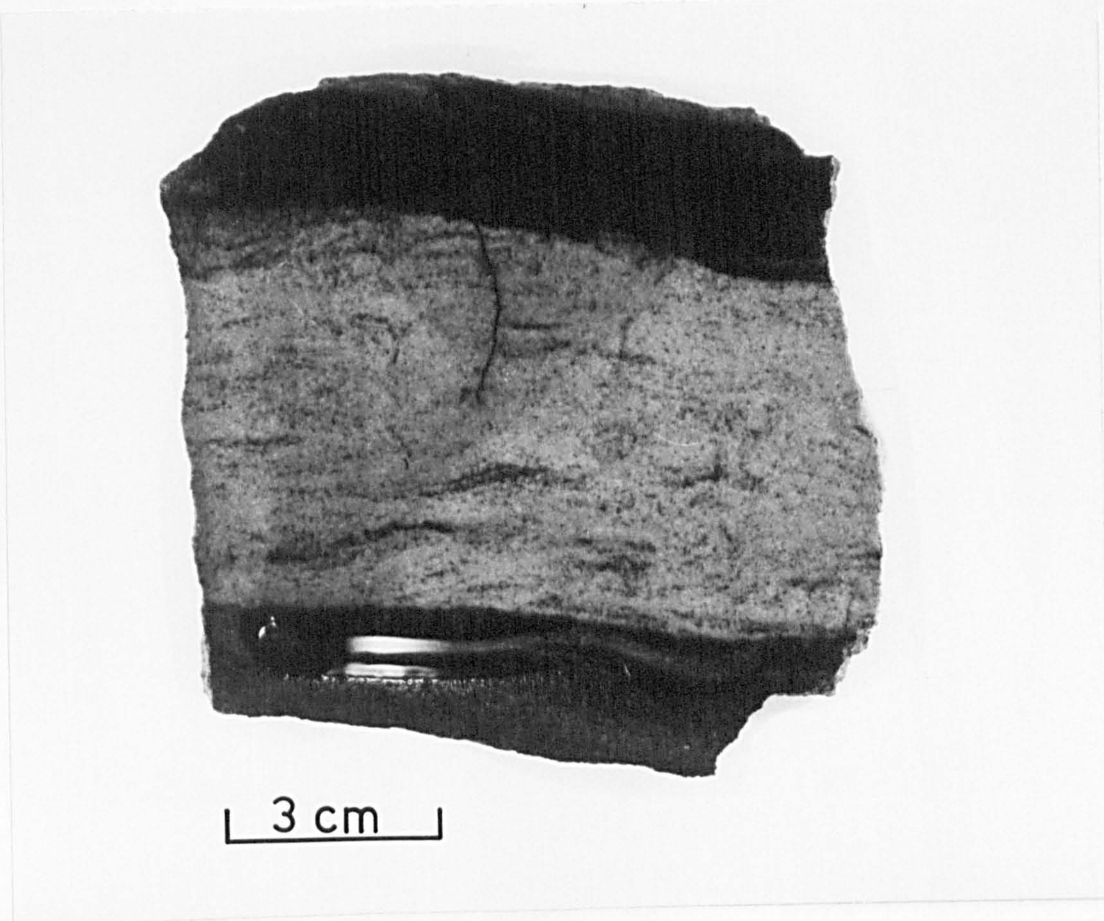

3 cm


Plate 15. Section through a parallel-sided bed of LF 7 Ripple-laminated Sandstone. Note the irregular alternation of light coloured quartz sand and darker carbonaceous sand. Pelecypodichnus traces have destroyed most of the original cross-lamination.

Loose block. Bosley Mill stream section.

Plate 16. Lithofacies 12. Lenticularly-bedded Sandstone overlain by Lithofacies 13. Channel-fill Coarse Sandstone.

Association C. River Dane, (SJ 9706 6622)


5 cm

Plate 17. Lenticularly-bedded Sandstone interbedded with Ripple-laminated Sandstones and Silty Mudstones. The thick bed of LF 12 marked by the hammer shows parallel lamination and thins out towards the right. Quarry near Chapel-en-le-Frith Railway Station. Association C. (SK 0559 7932).

Plate 18. Lithofacies 13. Channel-fill Coarse Sandstone with erosive base (arrow). The undulating top is filled in by a mainly ripple-laminated lateral accretion unit forming the Waterfall. Hogshaw Brook, Buxton. Association C. (SK 0546 7497)

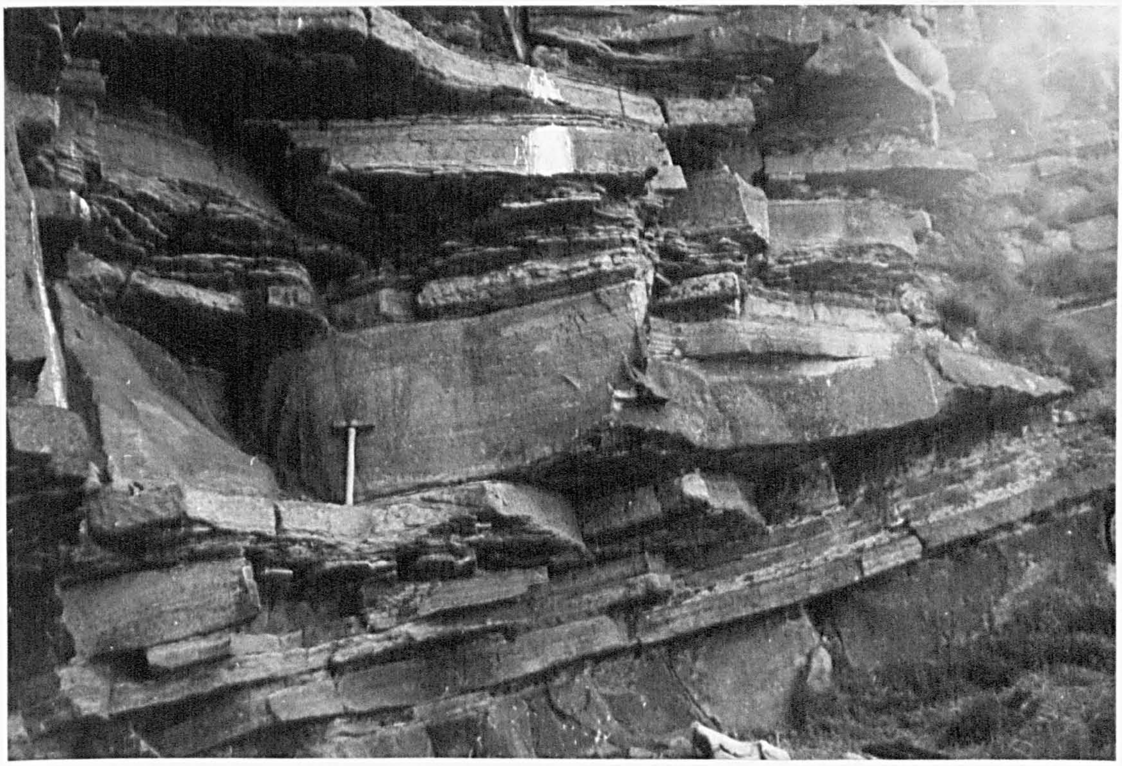


Plate 19. Stepped flutes at the base of LF 13. Channel-fill Coarse Sandstone shown in Plate 16. River Dane, (SJ 9706 6622).

Plate 20. Lithofacies 7, Ripple-laminated Sandstone with *Pelecypodichnus*. Association C. Upper Slope, near Folly Mill. (SJ 9699 6635).

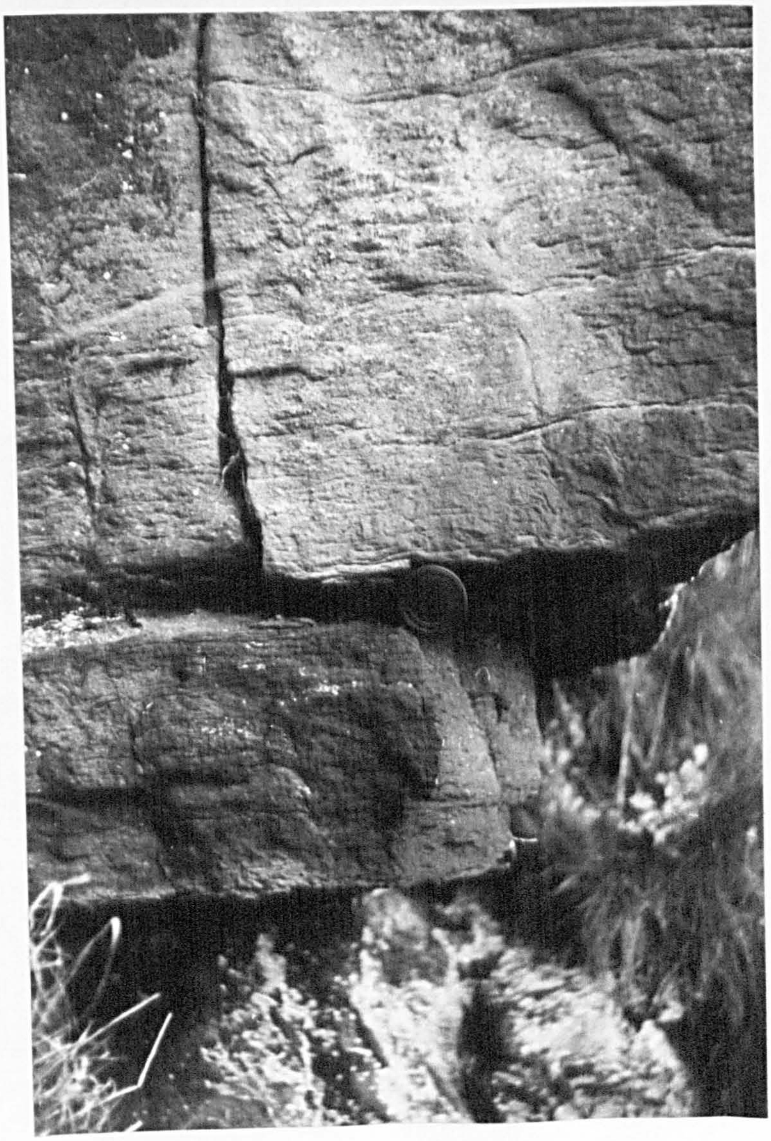


Plate 21. Lithofacies 12. Lenticularly-bedded Sandstone with a sharp, strongly fluted base overlain by a lateral accretion unit with Lithofacies 7 Ripple-laminated Sandstone. Association C. Upper Slope. Hogshaw Brook, Buxton. (SK 0546 7489).

Plate 22. Inclined bedding in coarse sandstone with traces of ripple-lamination overlain by an irregularly based channel filled with structureless coarse sandstone. Association C. Upper Slope; landslip scar above Holehouse Bank (SK 9669 6546). The 'waves' in the corrugated sheet are 6cm across.

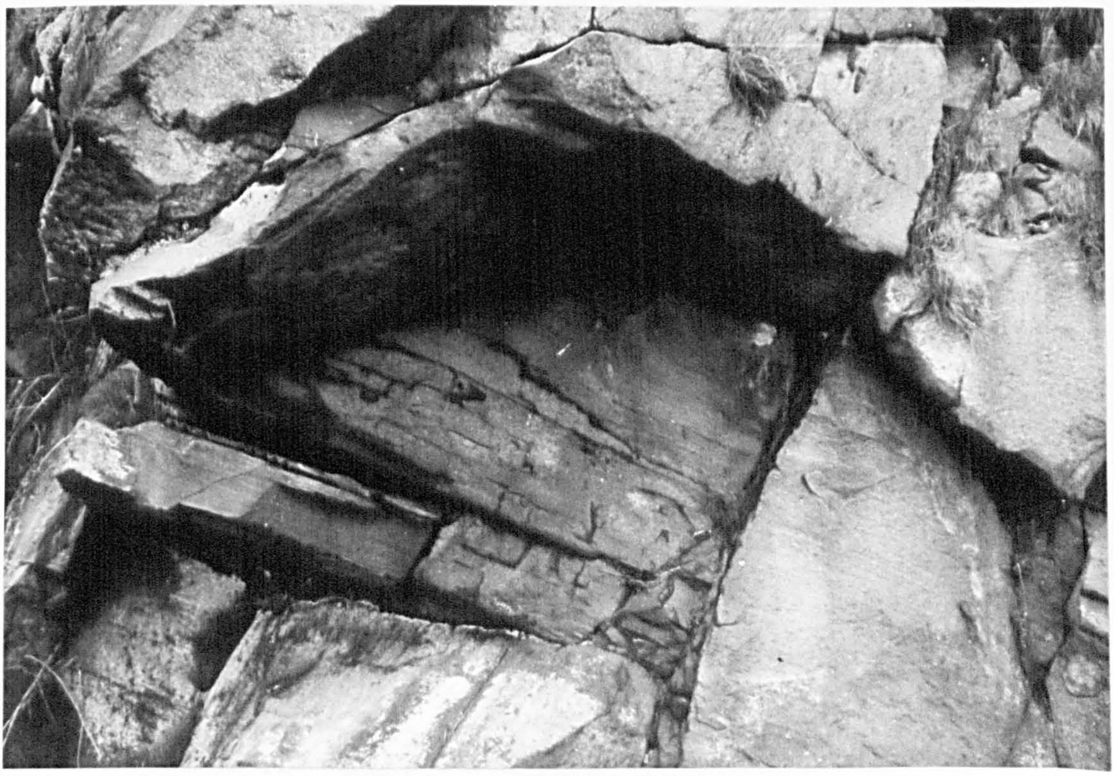
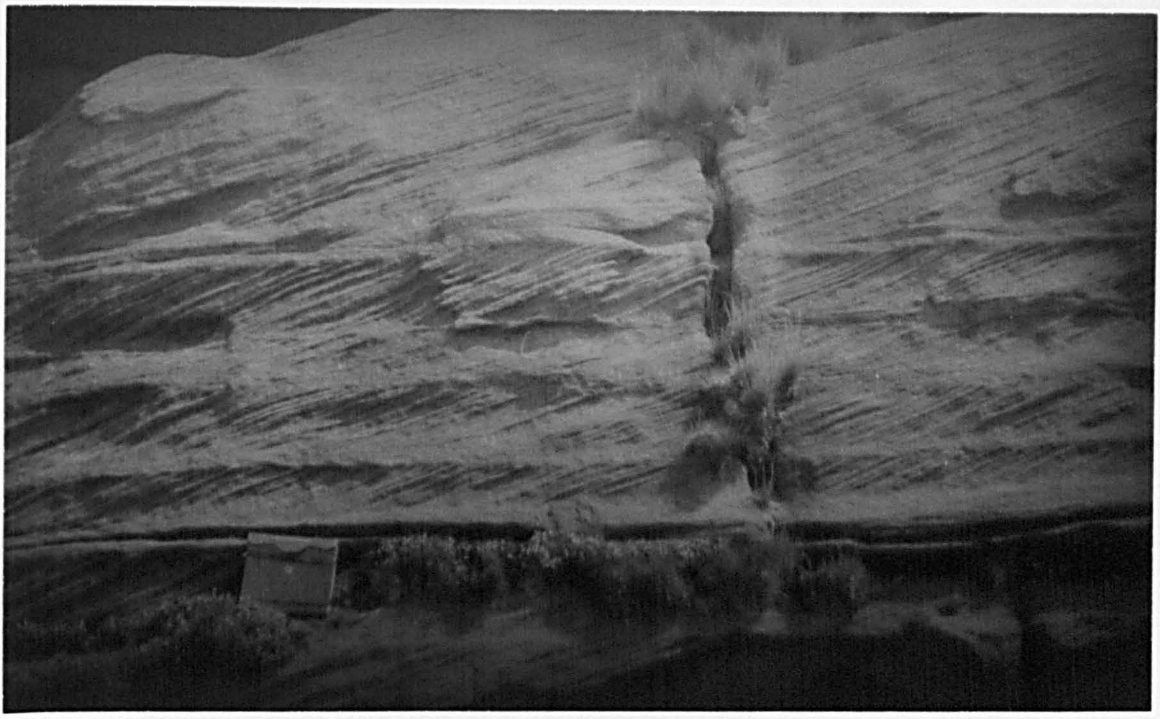


Plate 23. Coset of LF 14 Medium-Scale Cross-bedding. Most sets have angular bases, but some show traces of regressive intrasets. Lag deposits of coarse grained structureless sand occur at the bases of the sets.

The Roaches.

Plate 24. Coset of LF 14, Medium Scale Cross-bedding. Some sets have angular bases, others are tangential.

Hen Cloud.



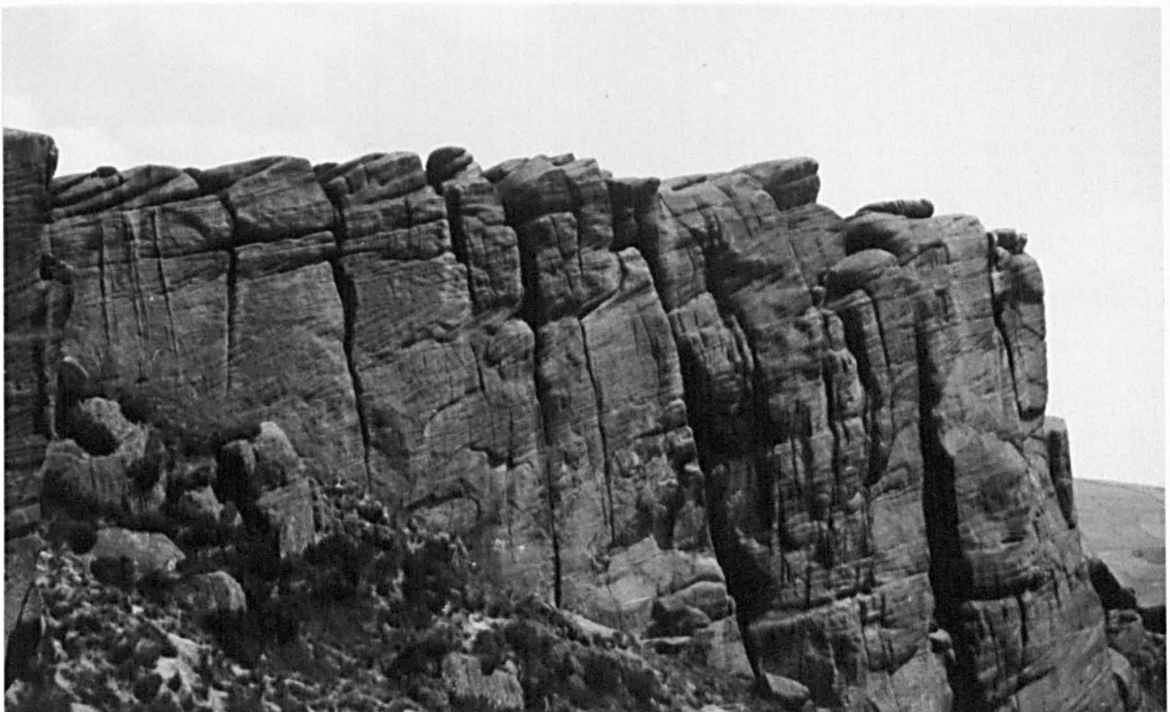
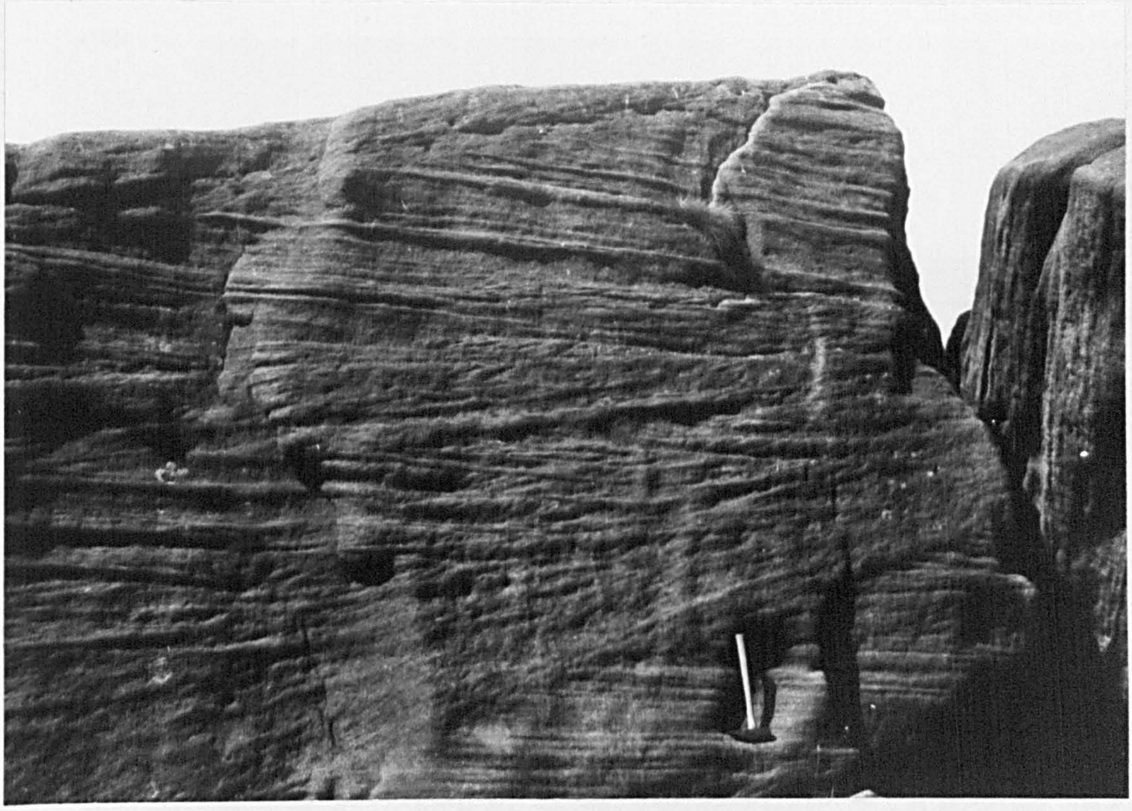


Plate 25. LF 14 Medium Scale Cross-bedding with interfingering foresets and regressive intrasets. The Roaches. (SK 006 622).

Plate 26. Coset of LF 14 Medium Scale Cross-bedding. Sets have regressive intrasets. In the lower set there is a sharp angular contact between the foresets, most of which have been removed by erosion and the intrasets. The Roaches. (SJ 999 641)



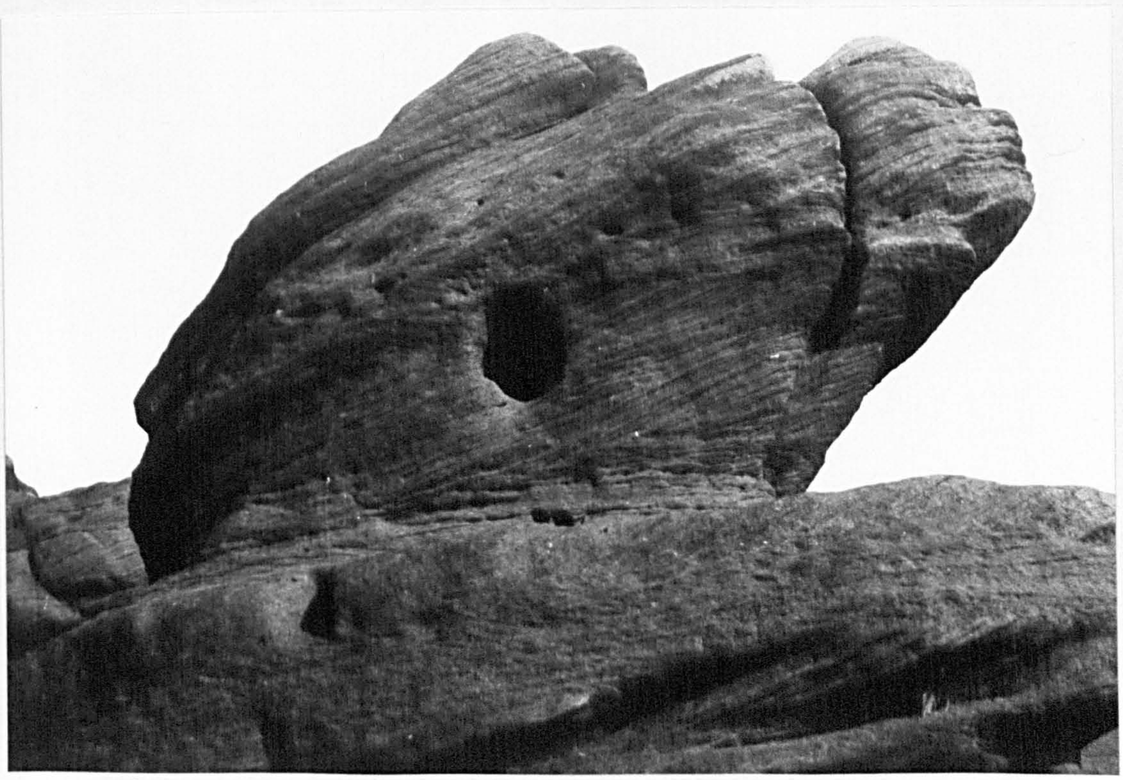


Plate 27. LF 14 Medium Scale Cross-bedding. Avalanche foresets have a sharp angular junction with toesets.
The Roaches. (SK 006 622)

Plate 28. LF 14 Medium Scale Cross-bedding showing details of the very well sorted foreset lamination.
The Roaches.

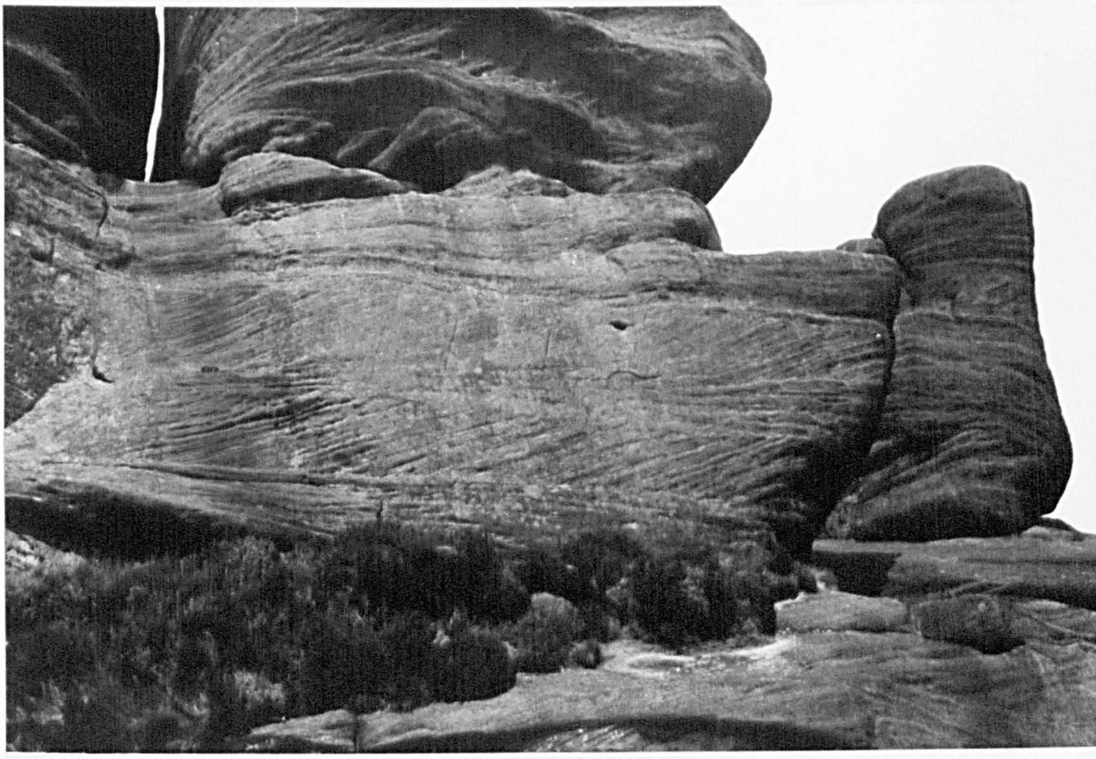
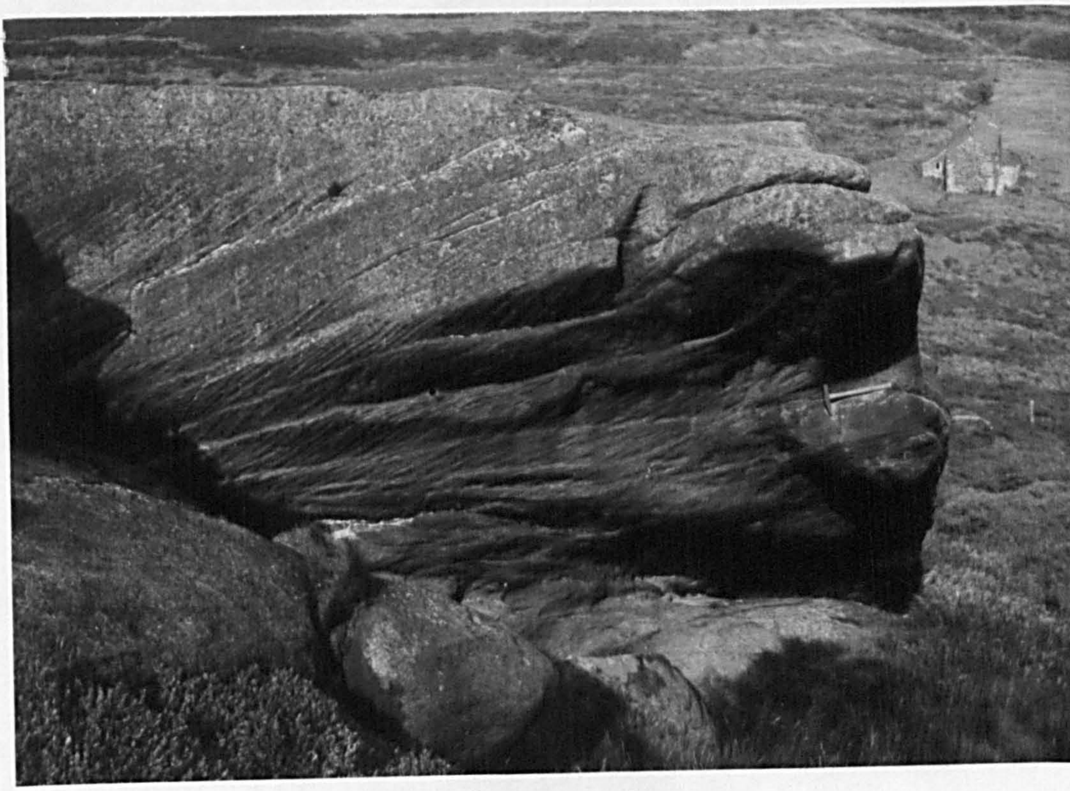


Plate 29. LF 14 Medium Scale Cross-bedding with multiple convex upwards internal erosion surfaces. These are fairly evenly spaced, and show a marked increase in inclination down the XY plane. They extend right to the base of the major set.

The Roaches (SK 006 623)

Plate 30. View of multiple convex upwards erosion surfaces in the YZ plane showing the essentially tabular nature of the sub sets.

The Roaches. (SK 999 641)



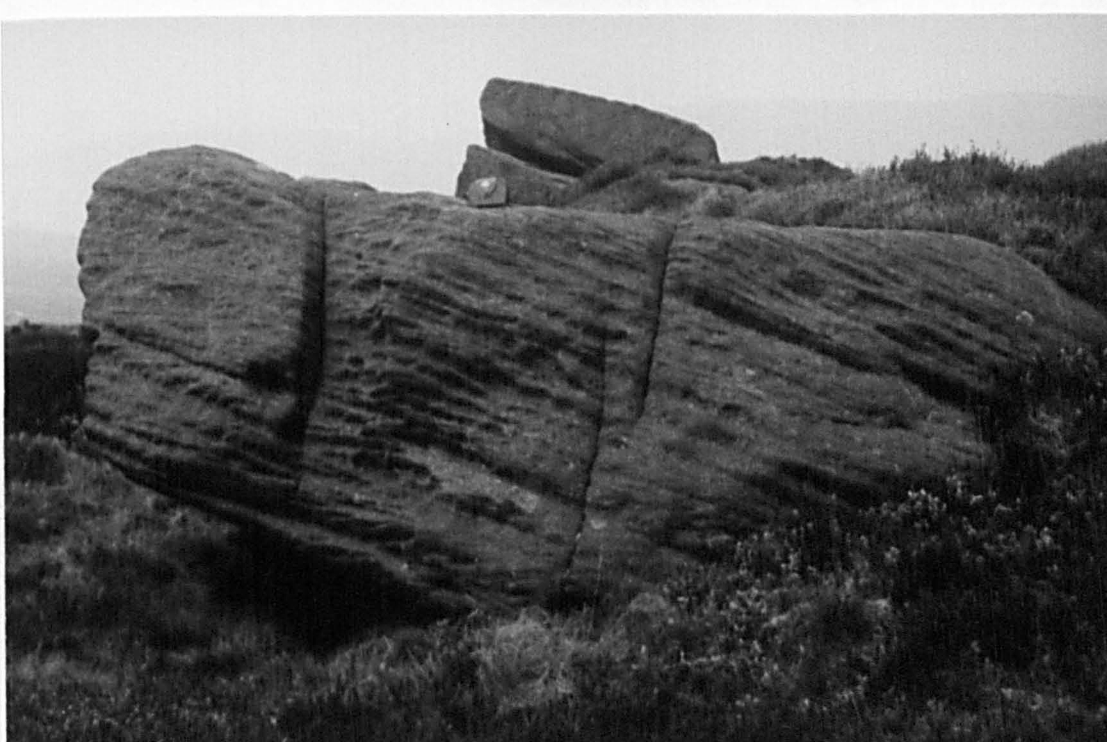


Plate 31. Multiple convex erosion surfaces. Low angle surfaces dipping at 8 - 10° alternate with steeper surfaces dipping at 15 - 20°. Horizontal given by the flat erosion surface (arrowed) at the base of the overlying set. Lithofacies 14.

This photograph is of the central panel in Fig.32.

The Roaches. (SJ 9999 6410)

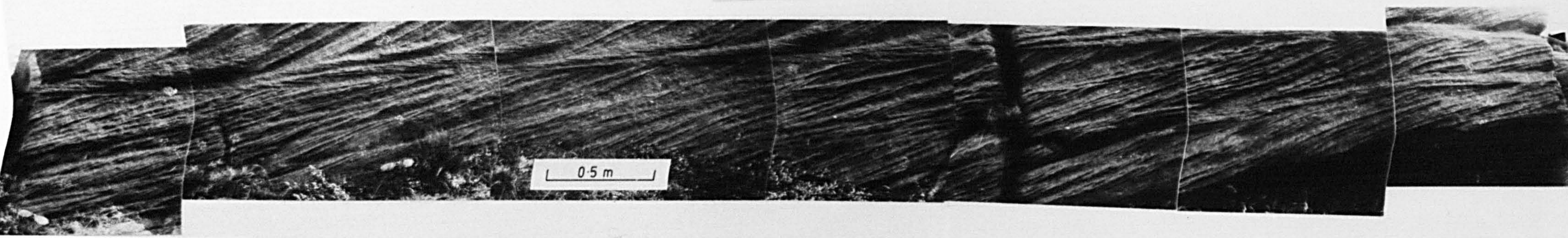
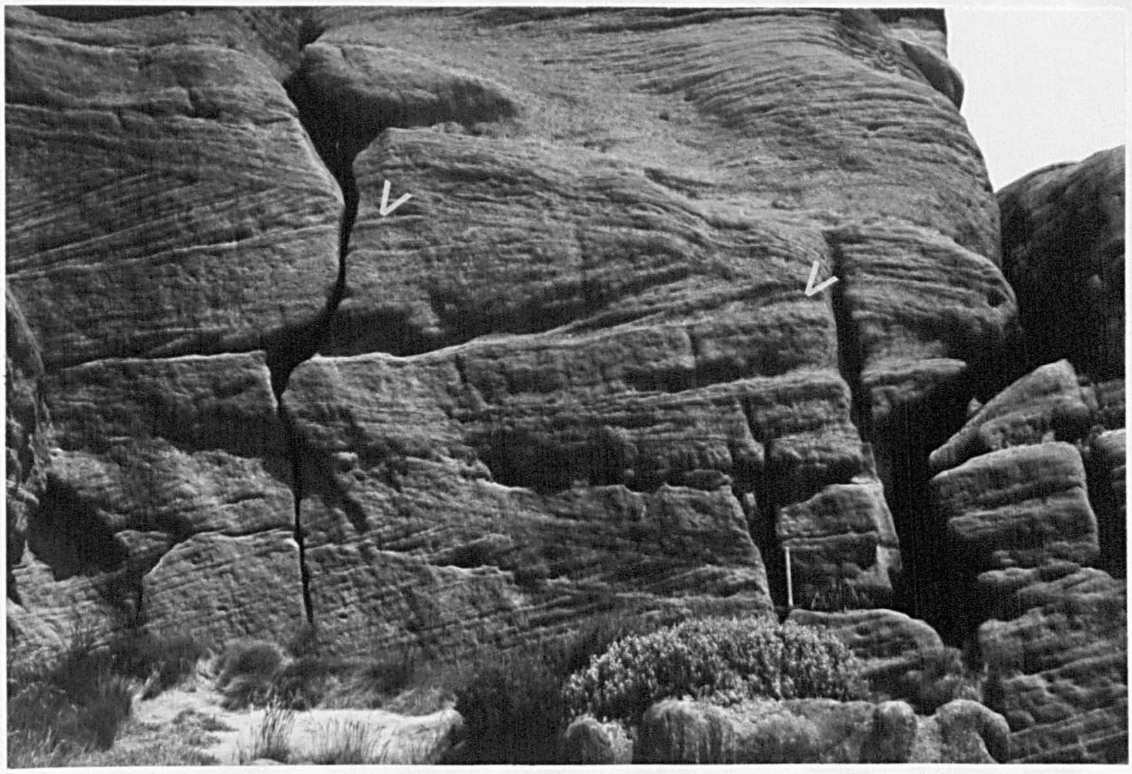

0·5 m

Plate 32. Type (a) concave erosion surfaces, arrowed, in LF 14. The Roaches (SK 007 622)

Plate 33. Concave erosion surface, arrowed, overlain by a coset of small scale trough cross bedding. Field sketch of this example given in Fig.34b. Lithofacies 14. The Roaches at Doxey Pool. (SK 0039 6285)



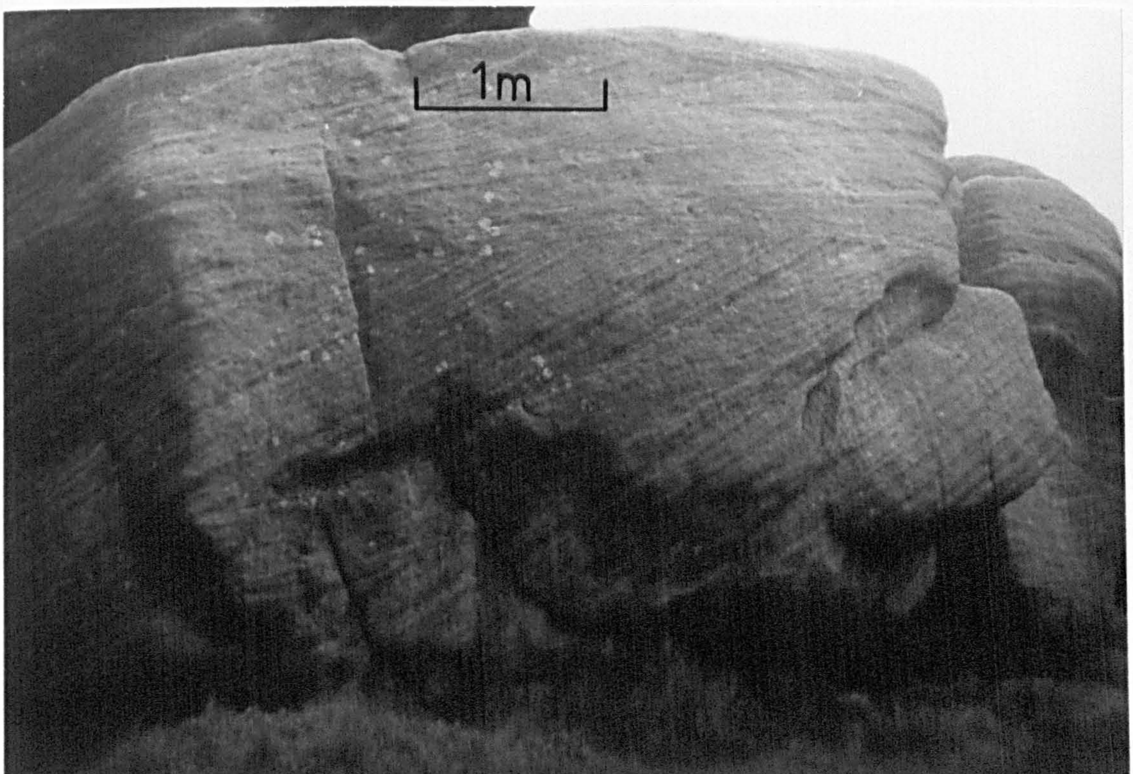
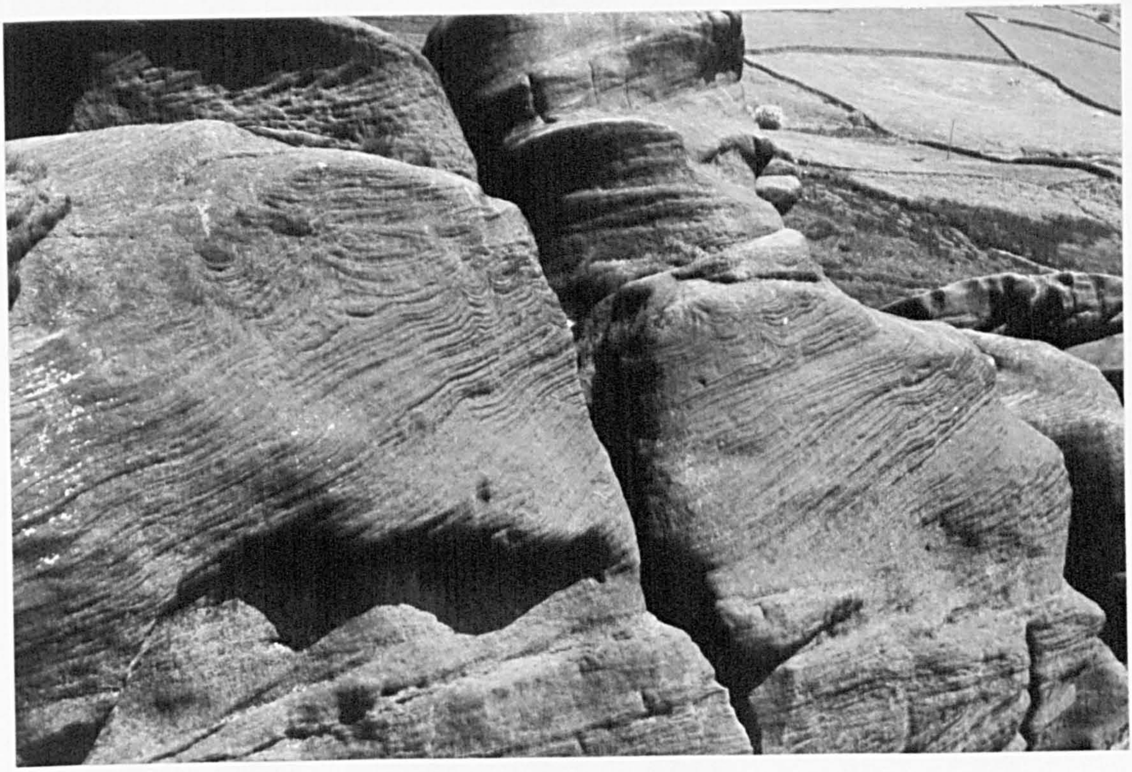

1m

Plate 34. Disturbances of the foreset lamination in LF 14 Medium Scale Cross-bedding. The disturbances appear in the upper part of the set.
The Roaches.

Plate 35. Severe disturbance in LF 14 Medium Scale Cross-bedding, with the lamination bent over.
The Roaches.



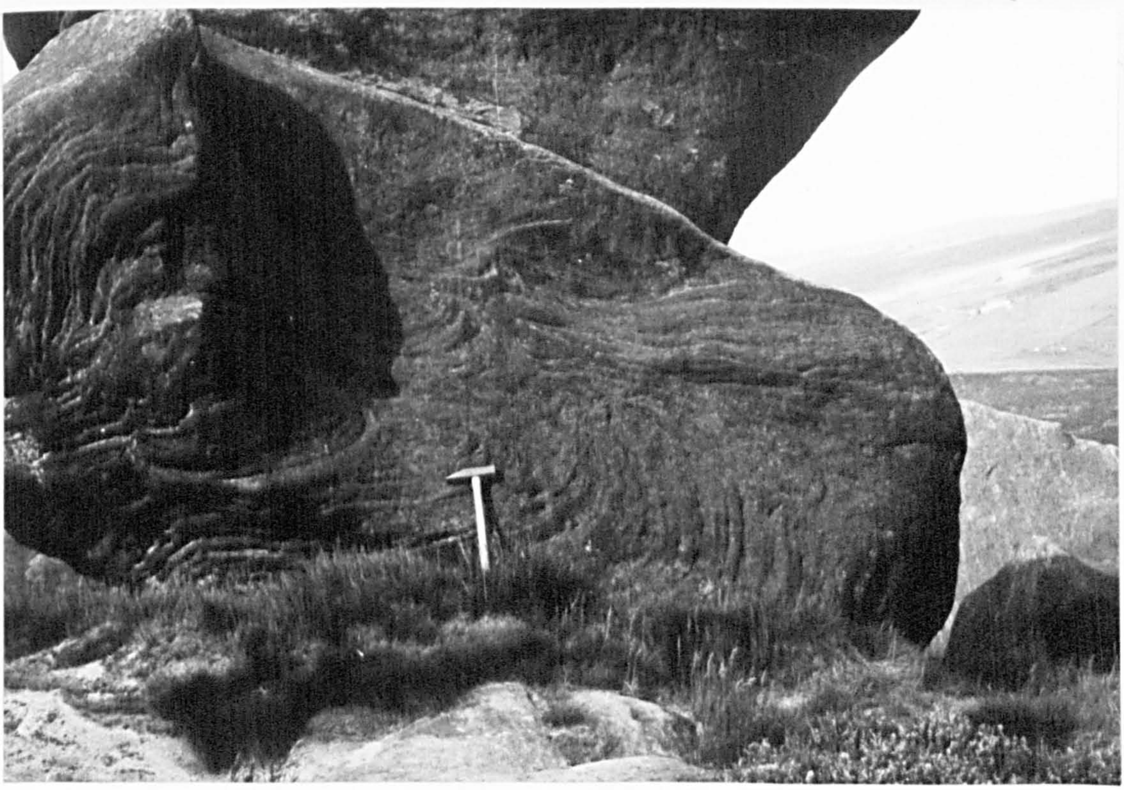
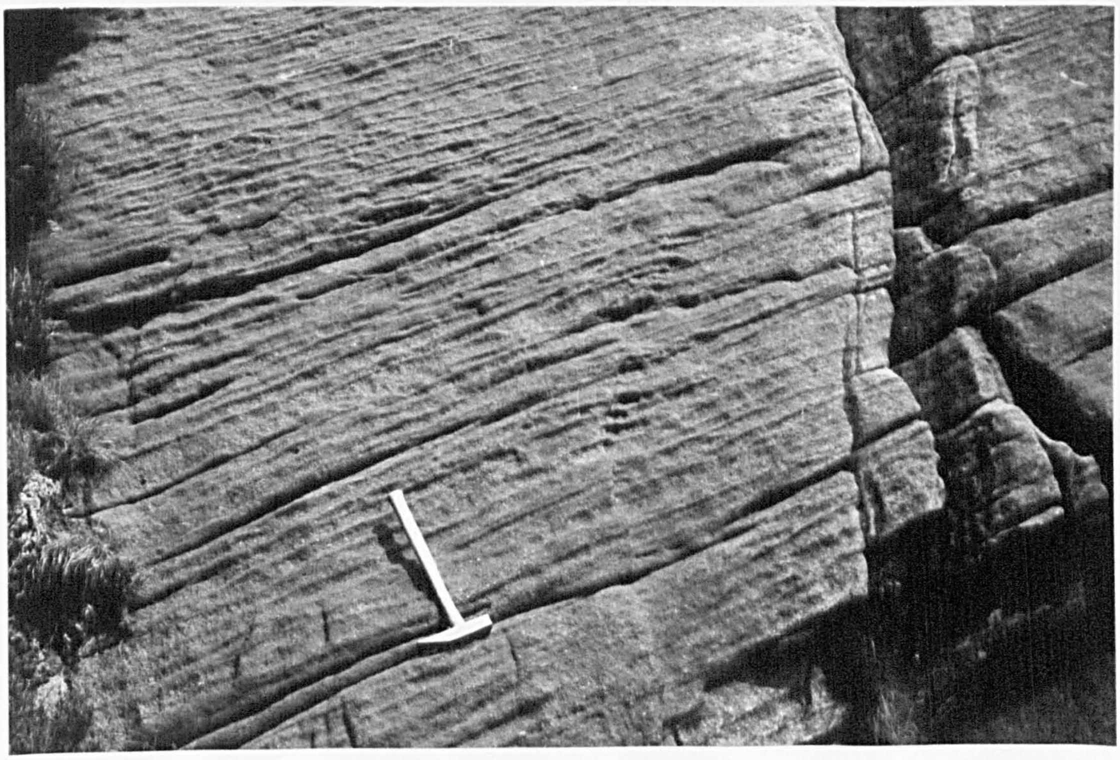


Plate 36. Details of the avalanche foresets in a set of LF 15 Large Scale Cross-bedding. The main set is 9m high with toesets only developed in the basal 0.5m. The individual foresets are here very thin and well sorted. Many do not extend for more than 1m.

The Roaches.

Plate 37. Large Scale Cross-bedding at Hen Cloud. Note the tangentially bedded foresets. Photo shows the middle part of the set in Fig.37.



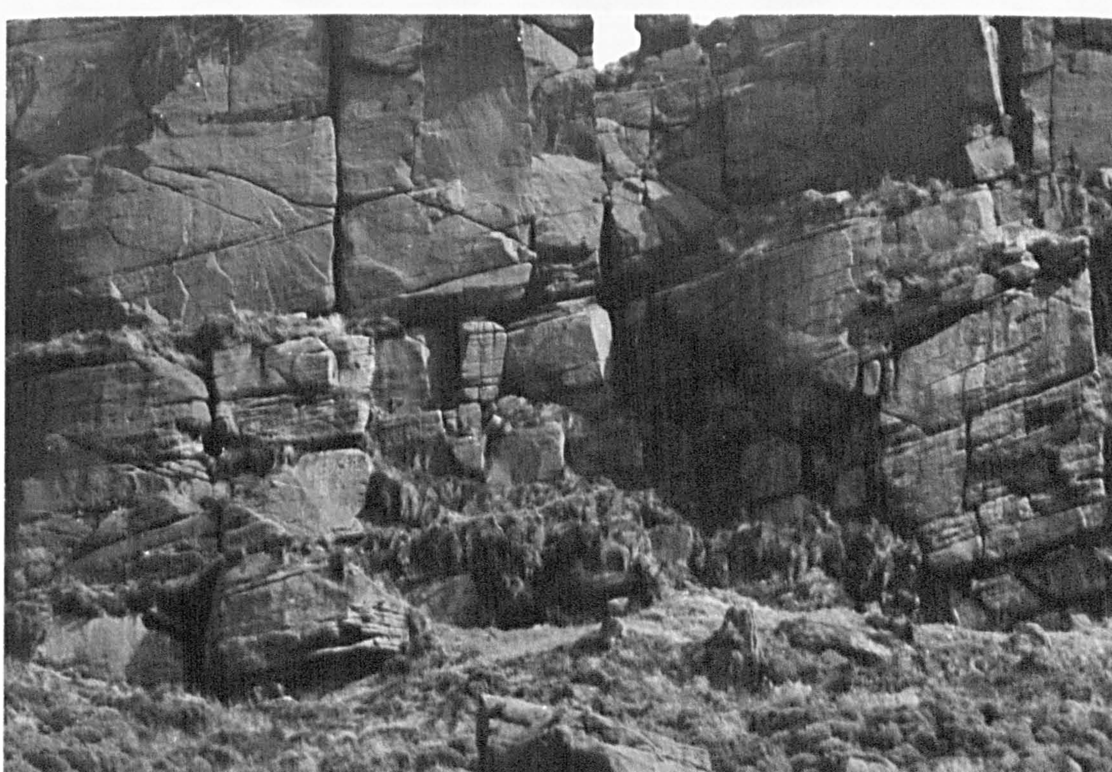
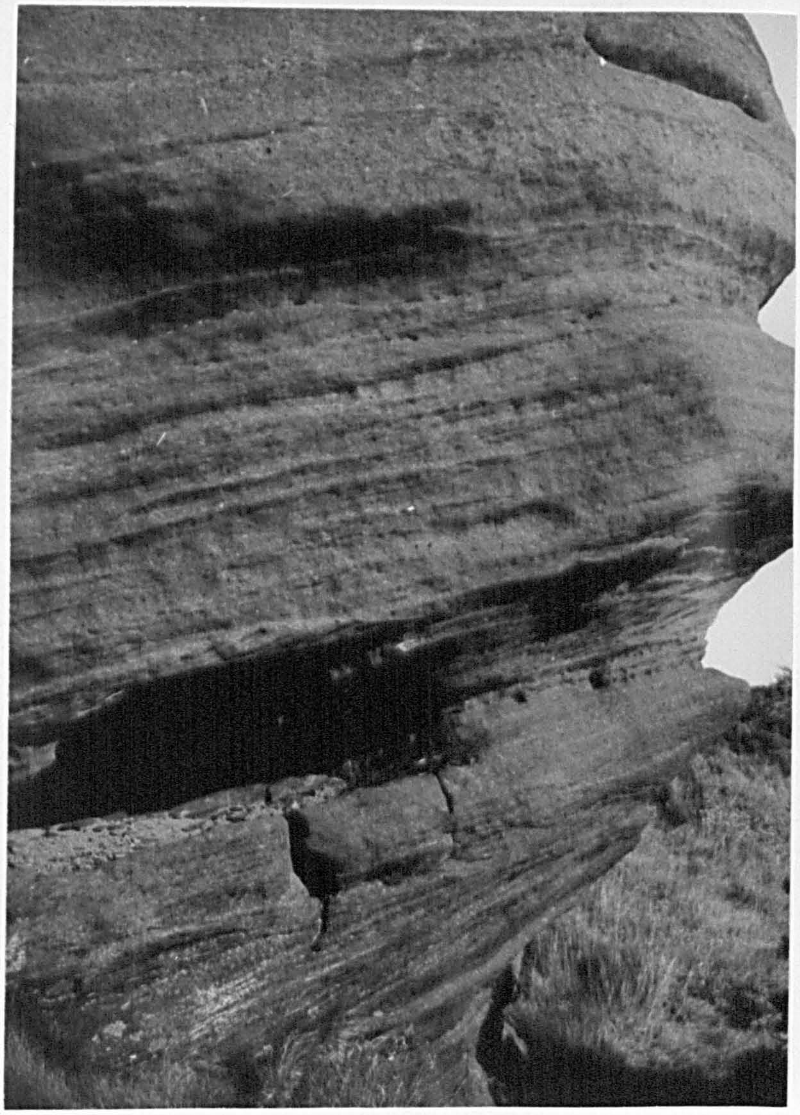


Plate 38. LF 15 Large Scale Cross-bedding with numerous smaller 'intrasets'.

Hangingstone. (SJ 9743 6540)

Plate 39. A steep concave shaped erosion surface at the base of a bed of LF 16 Faintly-laminated Coarse Sandstone cut into Large Scale Cross-bedding. Very faint lamination parallel to the erosion surface is visible.

Ramshaw Rocks (SK 0195 6225)



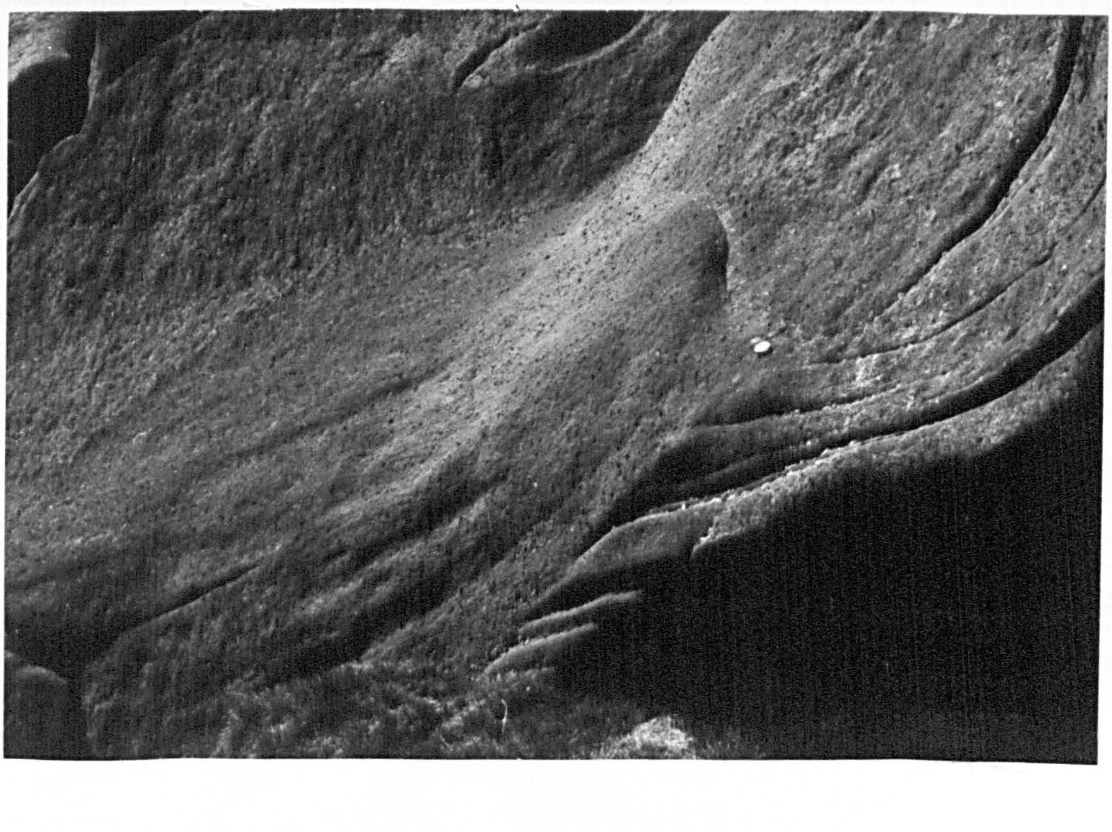


Plate 40. A very steep erosion surface at the base of a bed of LF 16 Faintly-laminated Coarse Sandstone. It dips westwards, downcurrent as determined from the underlying and overlying Large Scale Cross-bedding.
Ramshaw Rocks. (SK 0198 6229)

Plate 41. A concave shaped erosion surface cut into LF 15 Large Scale Cross-bedding. The overlying bed of LF 16 Faintly-laminated Coarse Sandstone shows very faint lamination parallel to the erosion surface, which flattens towards the top of the bed.
This is the lower bed of FLCS shown in Fig.42.
It is very impersistant and thins out laterally.
Ramshaw Rocks (SK 0189 6204)

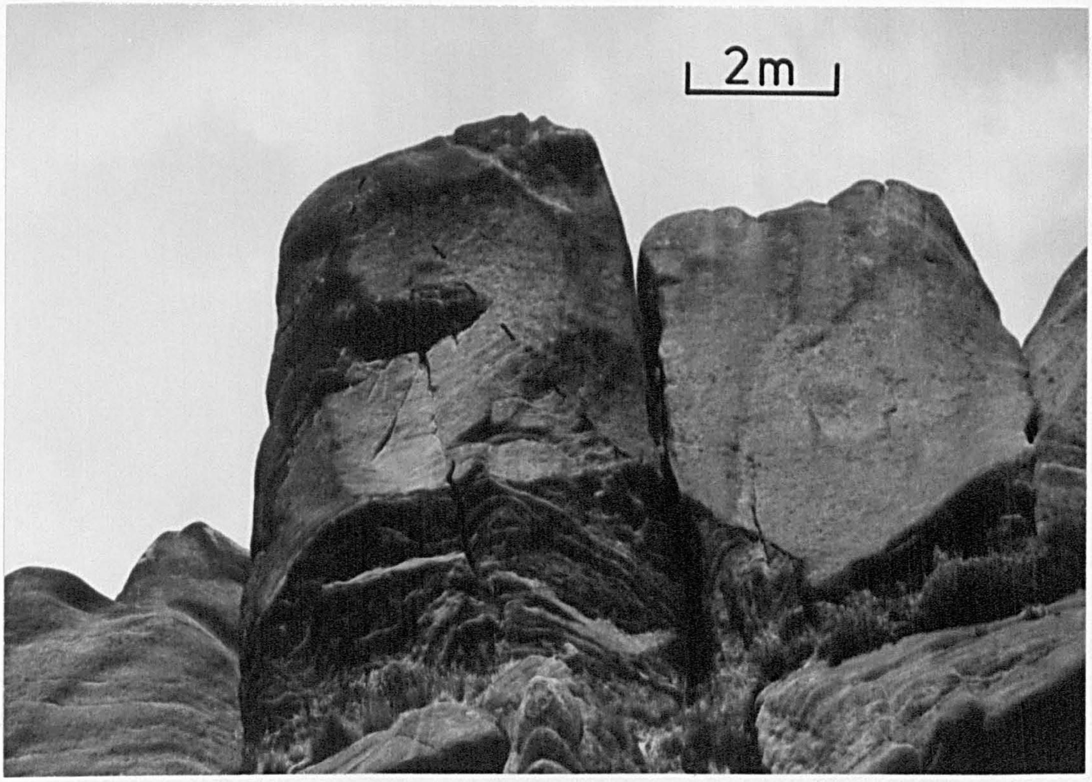

2m

Plate 42. Two intersecting erosion surfaces in LF 16 FLCS, cut into Large Scale Cross-bedding. The bed overlying the earlier surface contains more pebbles and this is clearly cut out by the later bed.

Ramshaw Rocks (SK 0194 6222)

Plate 43. Small amplitude undulatory lamination in LF 16. See also Fig.41a.

The Roaches. (SK 0003 6367)

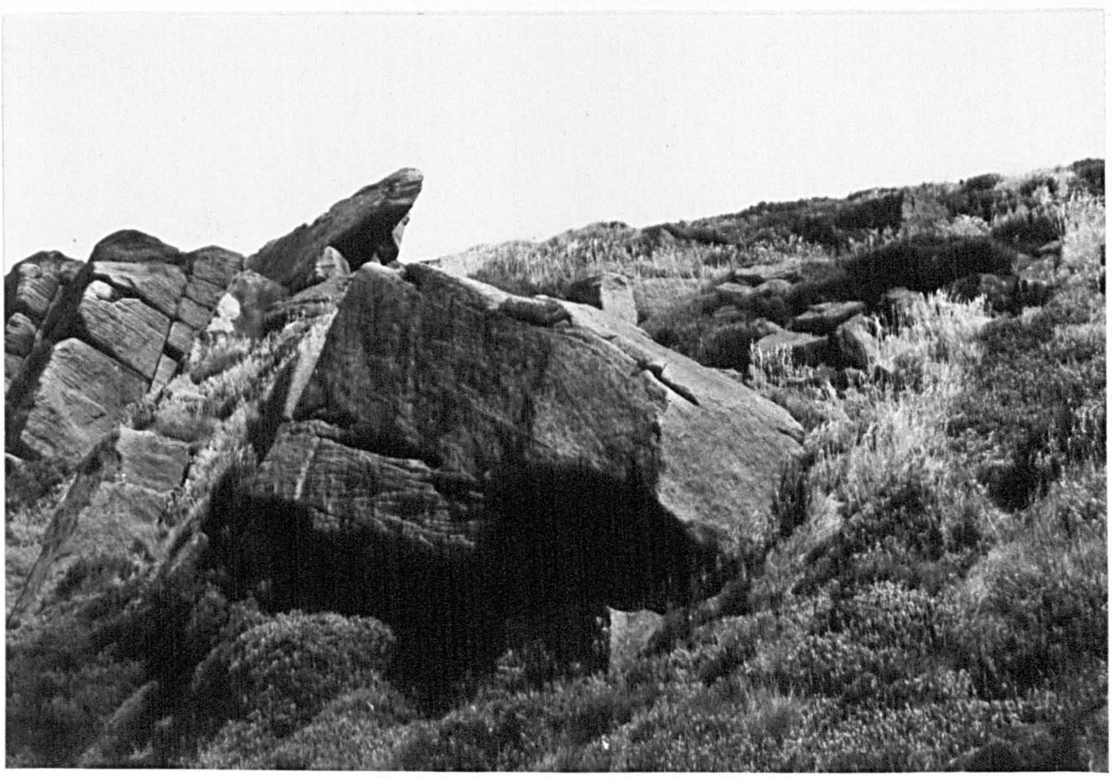


Plate 44. Large scale undulatory lamination in LF 16.

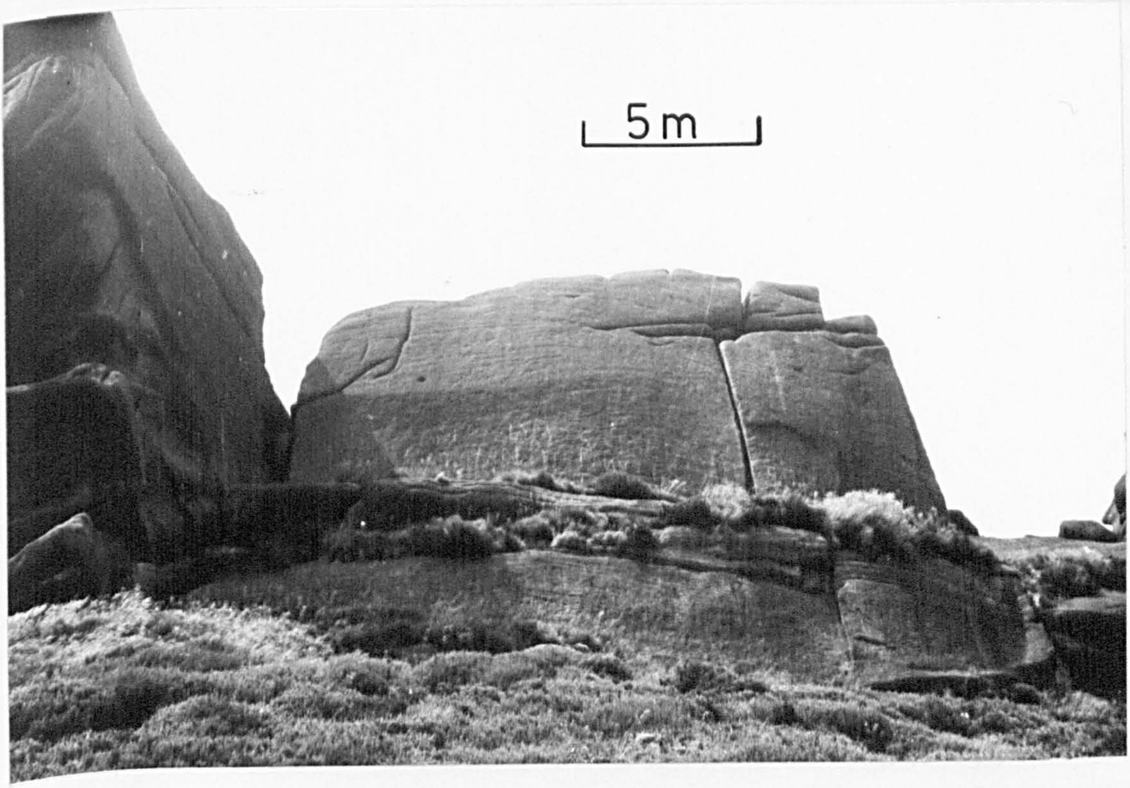
See also Fig.41b.

Ramshaw Rocks. (SK 0187 6204)

Plate 45. Faint undulatory lamination in LF 16. An erosion surface truncates one set of lamination and is succeeded conformably by another set. The block on the right has moved upwards relative to the block on the left.

Reconstructed in Fig.41e.

The Roaches.


5m

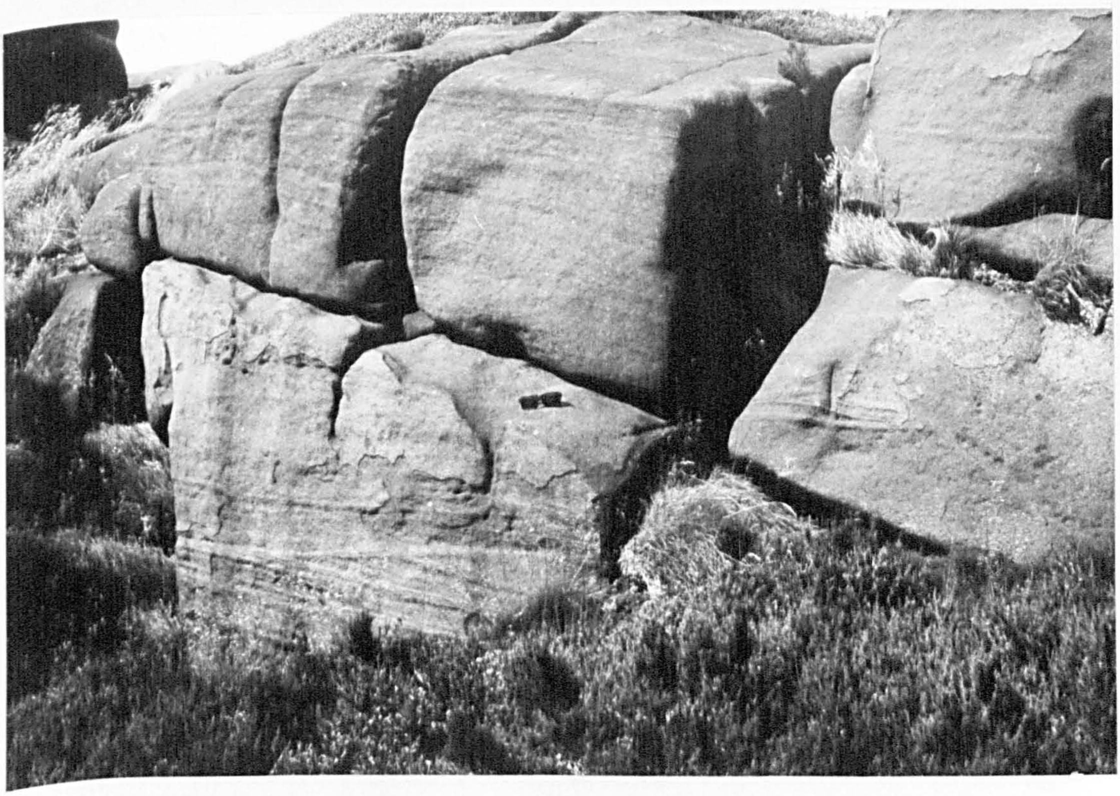


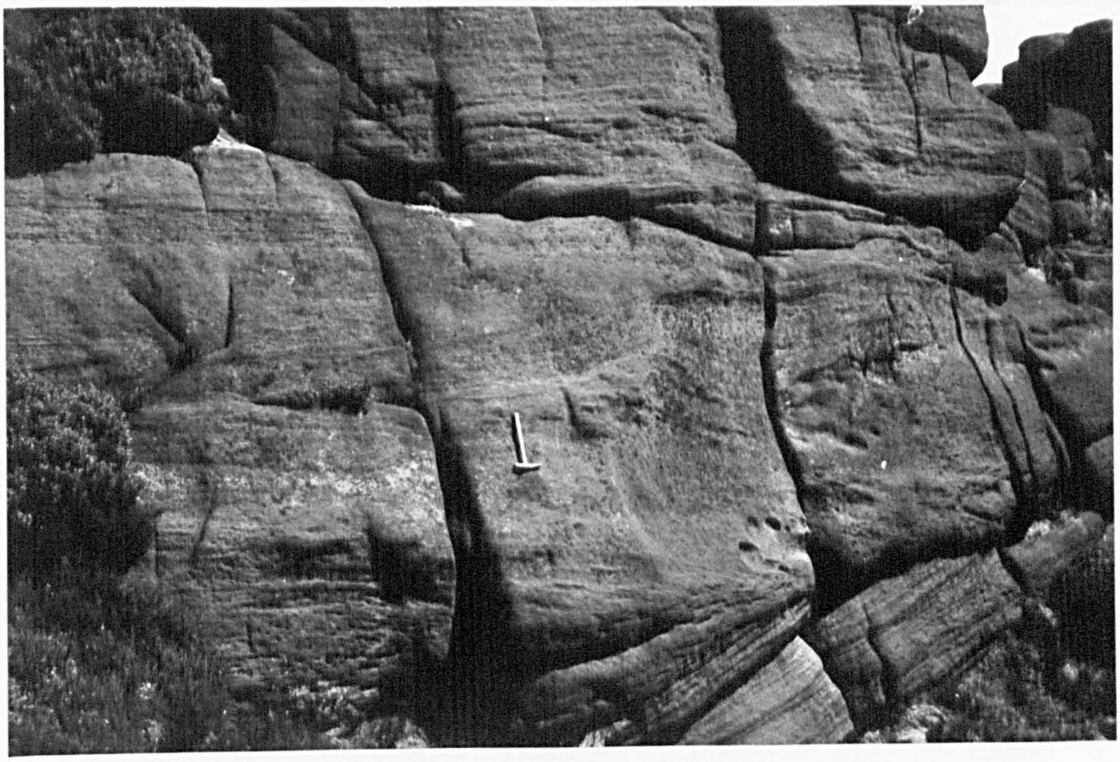
Plate 46. Bed of LF 16 FLCS, erosively overlying a set of Large Scale Cross-bedding. This bed contains two sets of faint lamination, the younger set truncating the older set. (See also Fig.43f)

This bed passes to the right into the foresets of another set of LSXB.

The Roaches (SK 0035 6284)

Plate 47. Alternation of structureless or faintly laminated sandstone of LF 16 with small sets and cosets of LF 10 Trough Cross-bedded Sandstone.

The Roaches.



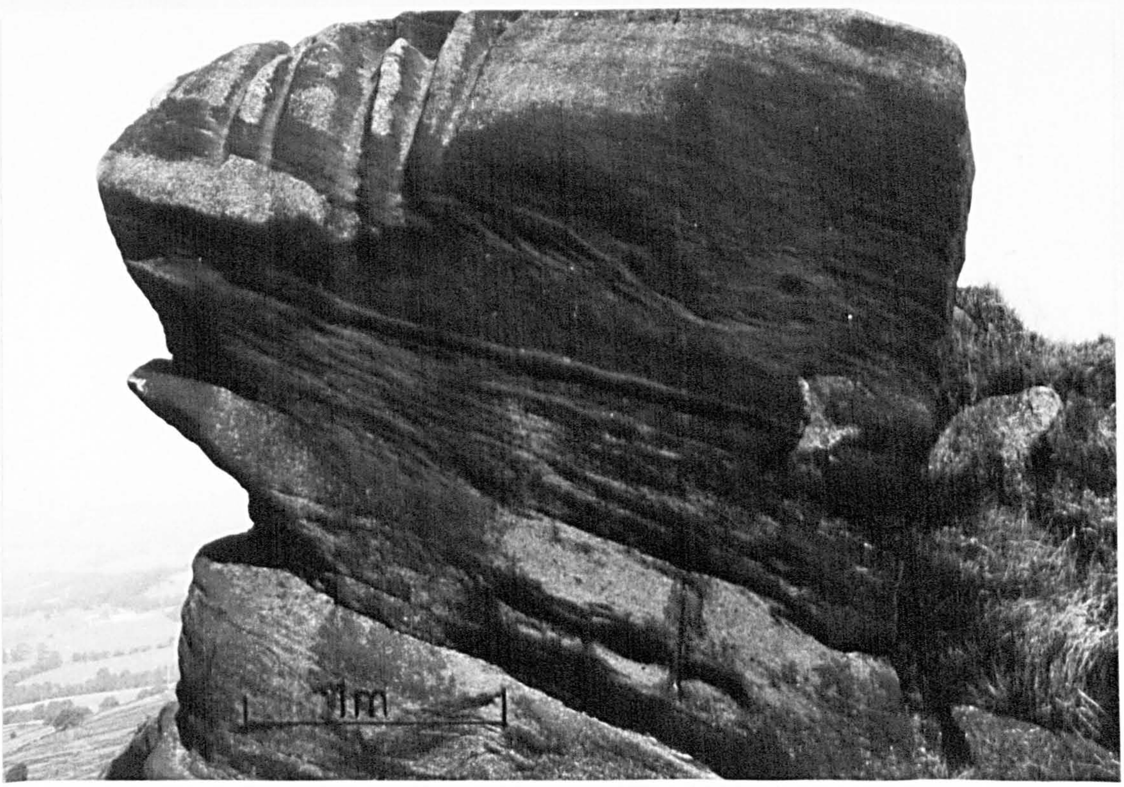

1m

Plate 48. Coset of LF 10 Trough Cross-bedded Sandstone overlying a bed of LF 16 Faintly-laminated Coarse Sandstone. The Roaches.

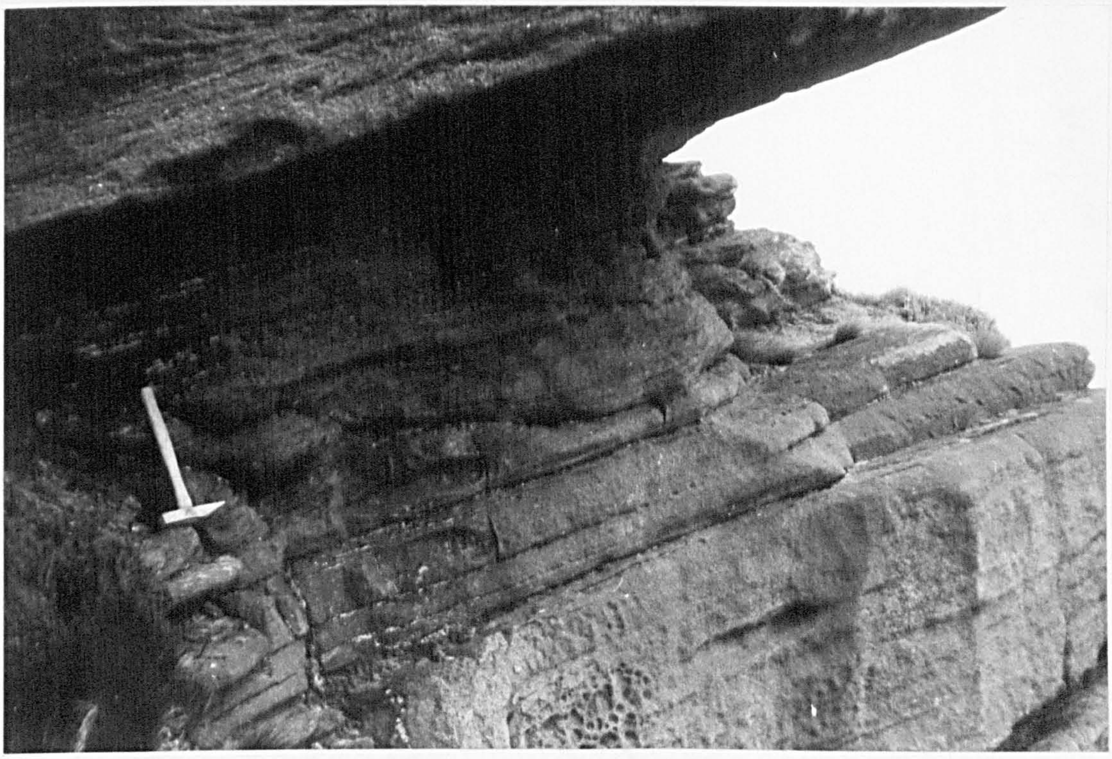


Plate 49. Oblique aerial photograph of the northern end of the Roaches, showing the upper delta slope and delta top. Three channel fills forming features appear at successively higher levels in the sequence towards the north, (left).

The main delta slope sequence is not exposed. In the lower right hand corner of the photograph a large asymmetrical turbidite filled channel is cut into the slope sequence.

See also Fig.49.

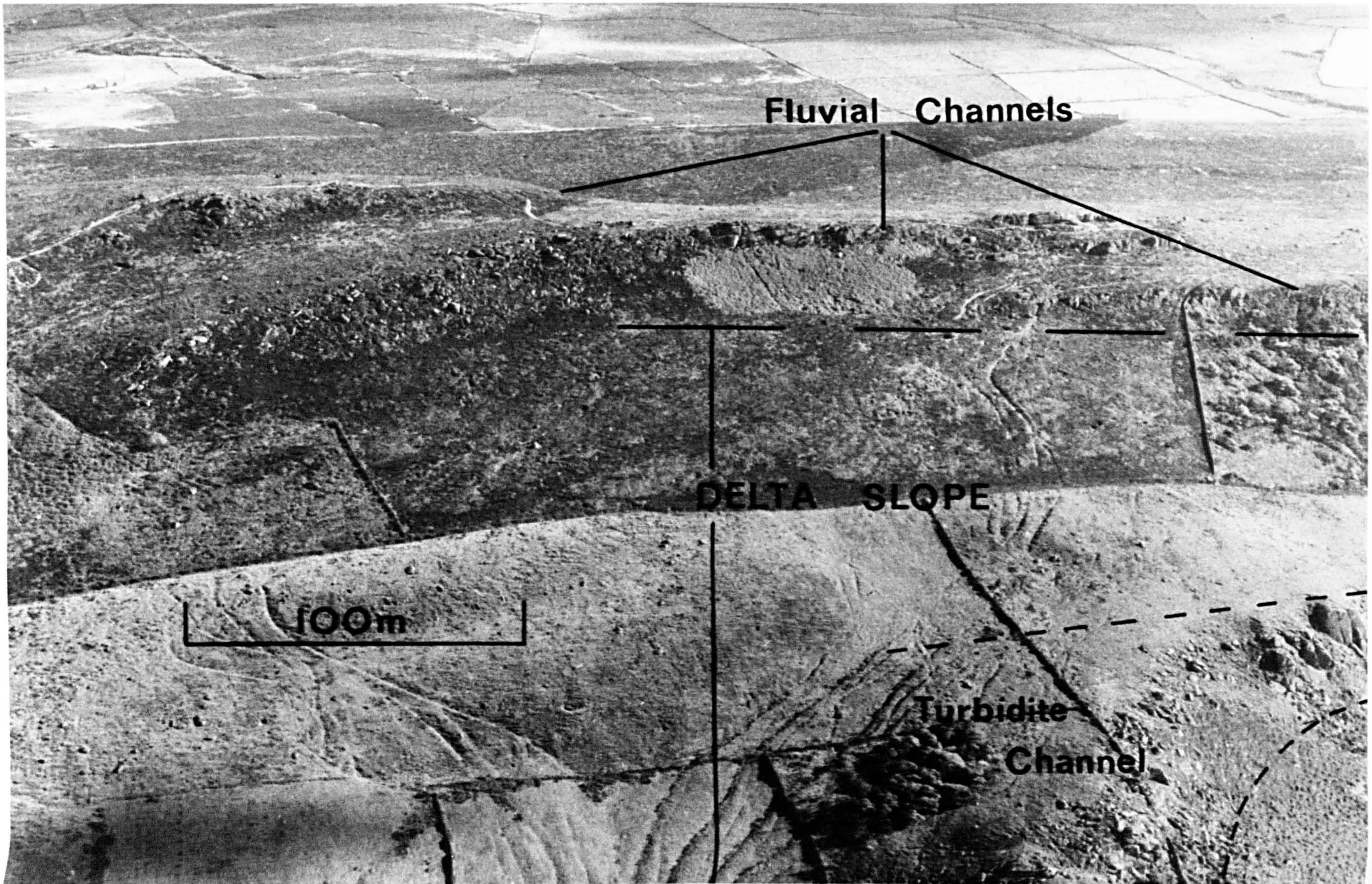
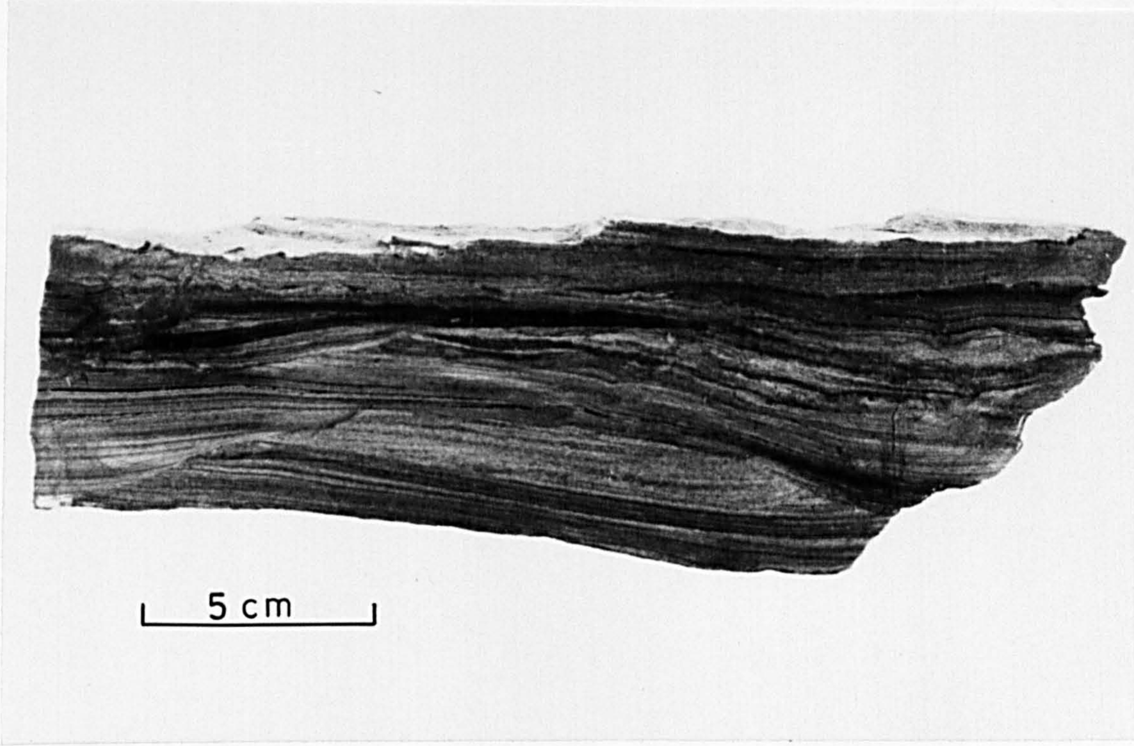

Fluvial Channels
DELTA SLOPE
100m
Turbidite Channel

Plate 50. Lithofacies 18, Wave-laminated Sandstone.
Cumberland Brook (SS 993 698).

Plate 51. Lithofacies 18, Wave-laminated Sandstone,
Cumberland Brook (SS 993 698).


5 cm

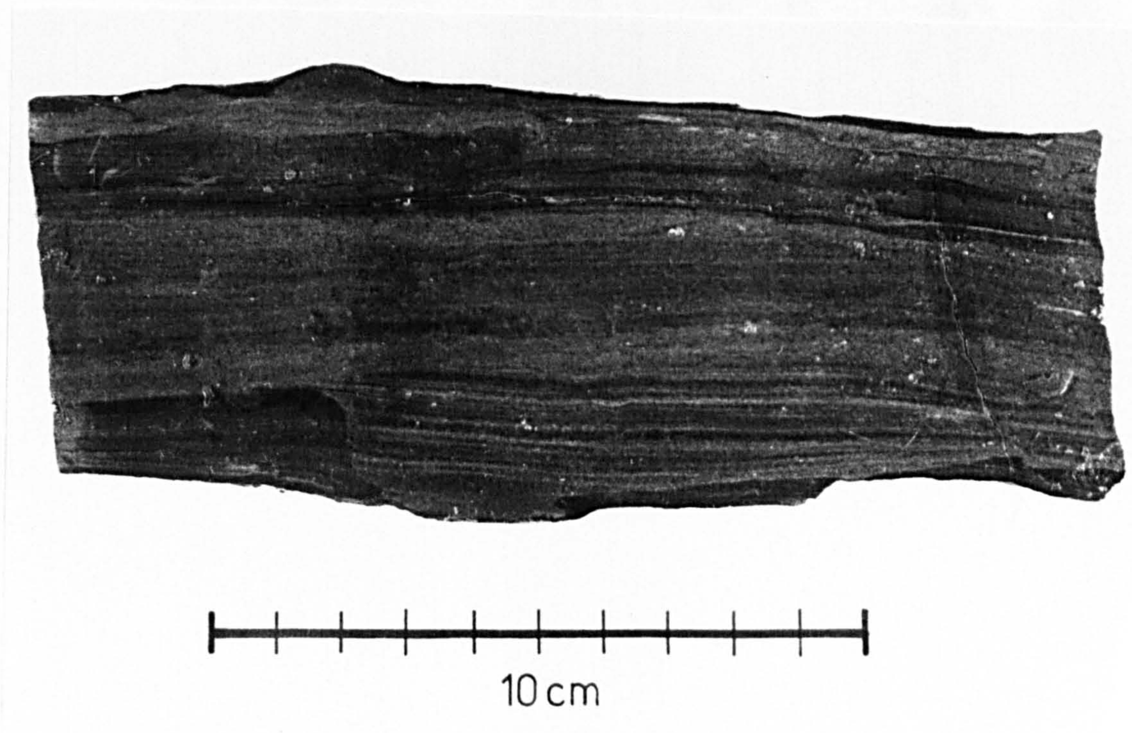

10 cm

Plate 52. Lithofacies 18, Wave-laminated Sandstone.

Most of the lamination has been destroyed by bioturbation. Traces of a *Rhizocorallid* burrow occur on the far right. Cumberland Brook (SS 993 698)

Plate 53. Coarsening upwards sequence in Association D.

The grassy ledge at the base of the photograph marks the top of a fluvial channel fill. Above this the sequence coarsens up through Silty Mudstone into Wave-laminated Sandstone. Stream section north of Allgreave Bridge (SJ 9699 6739)

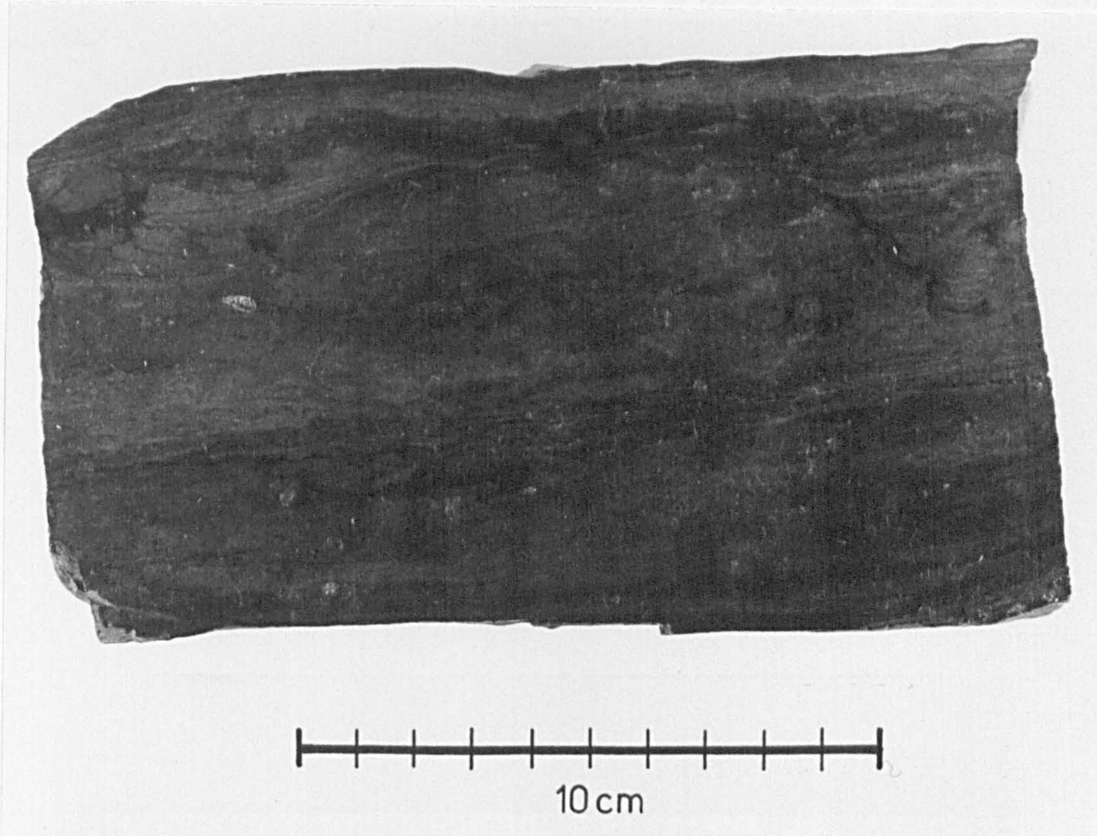
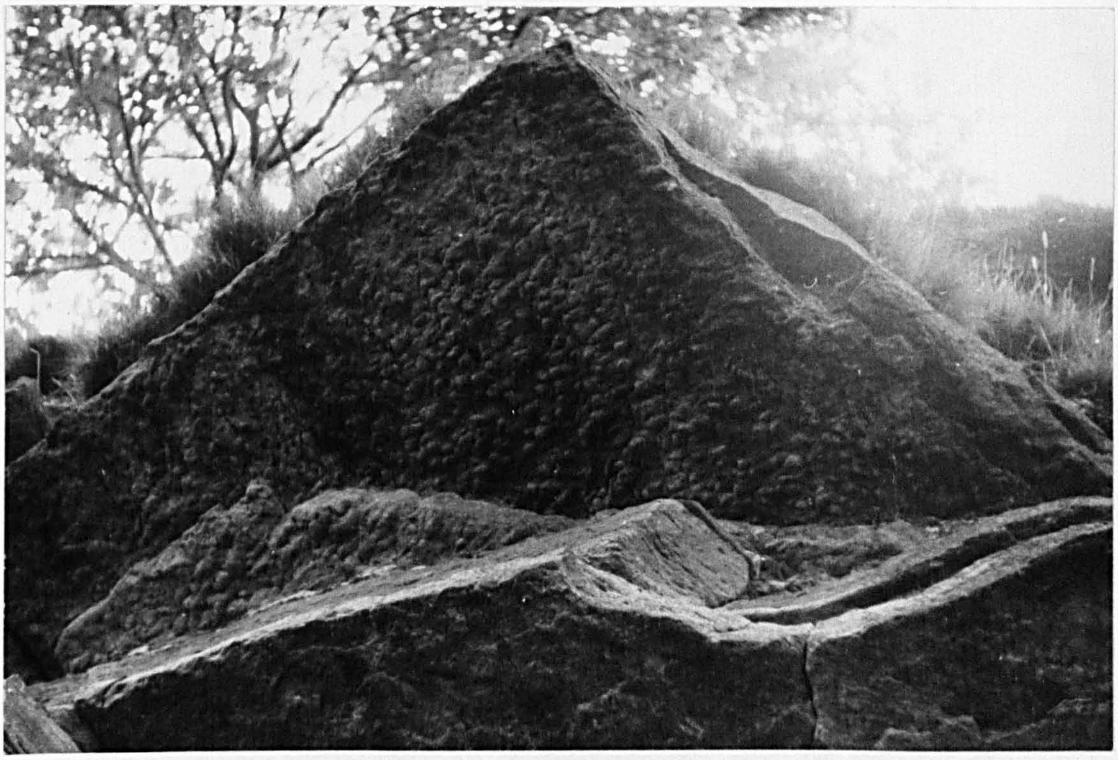

10 cm

Plate 54. *Pelecypodichnus*, closely spaced with a good preferred orientation. Base of Ripple-laminated Sandstone. Chapel Station Quarry (SK 0559 7931).

Plate 55. *Pelecypodichnus*, endichnial trace, showing V shaped lamination passing down into a structureless plug.



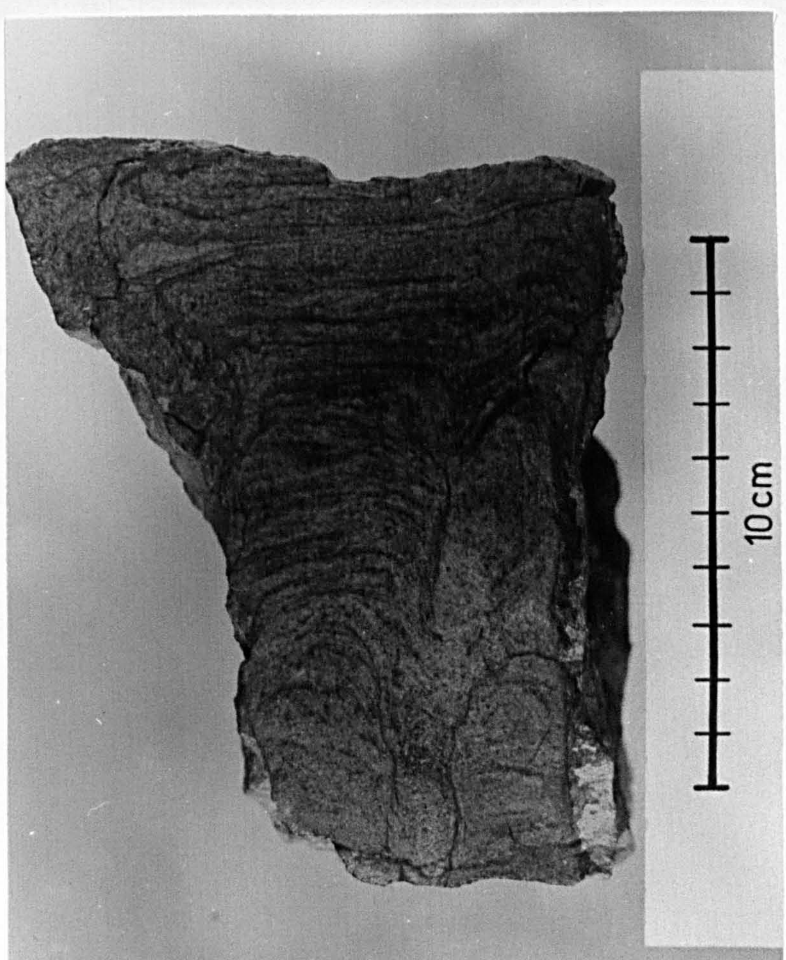
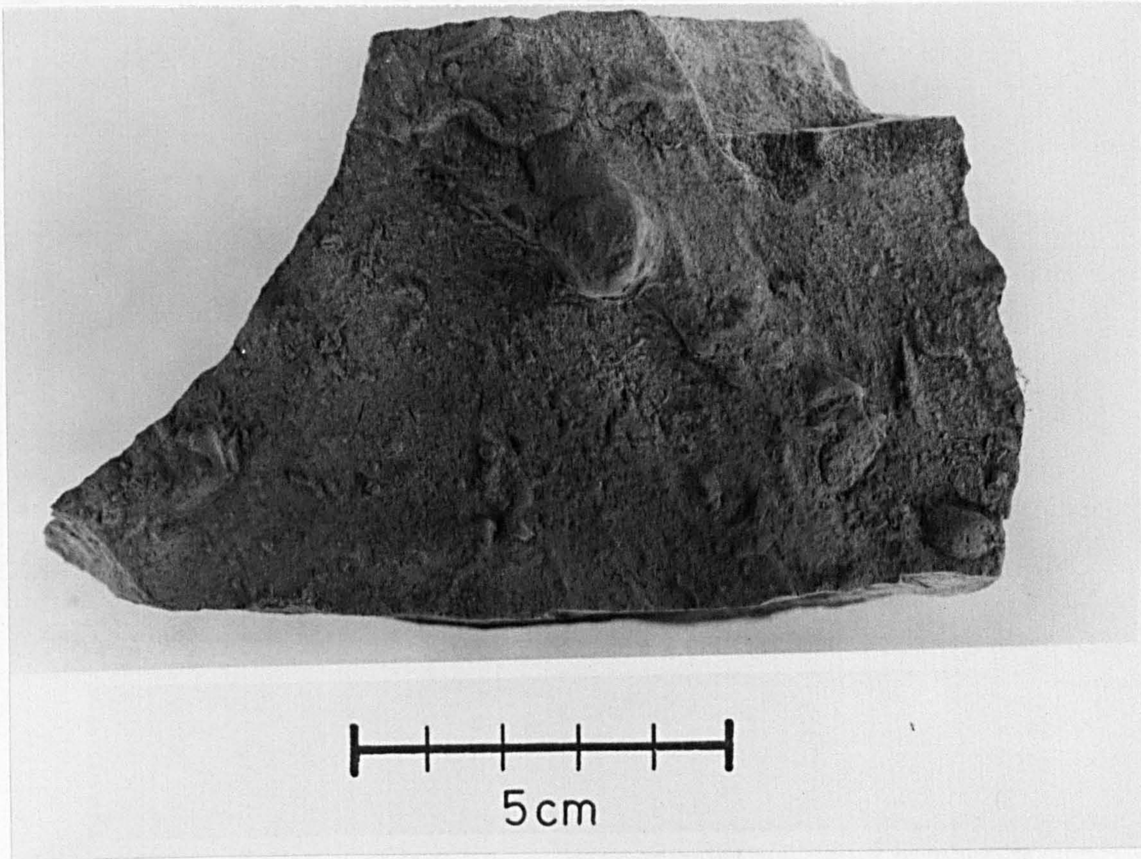

10 cm

Plate 56. *Bergaueria* and *Cochlichnus*, hypichnial traces, Association B. Dane Bridge (SJ 9661 6521).

Plate 57. Cigar shaped Ridge and Small Simple Pipes, Hypichnial traces on the base of LF Turbidites. Association A, Burbage Reservoir (SK 0346 7216).


5 cm

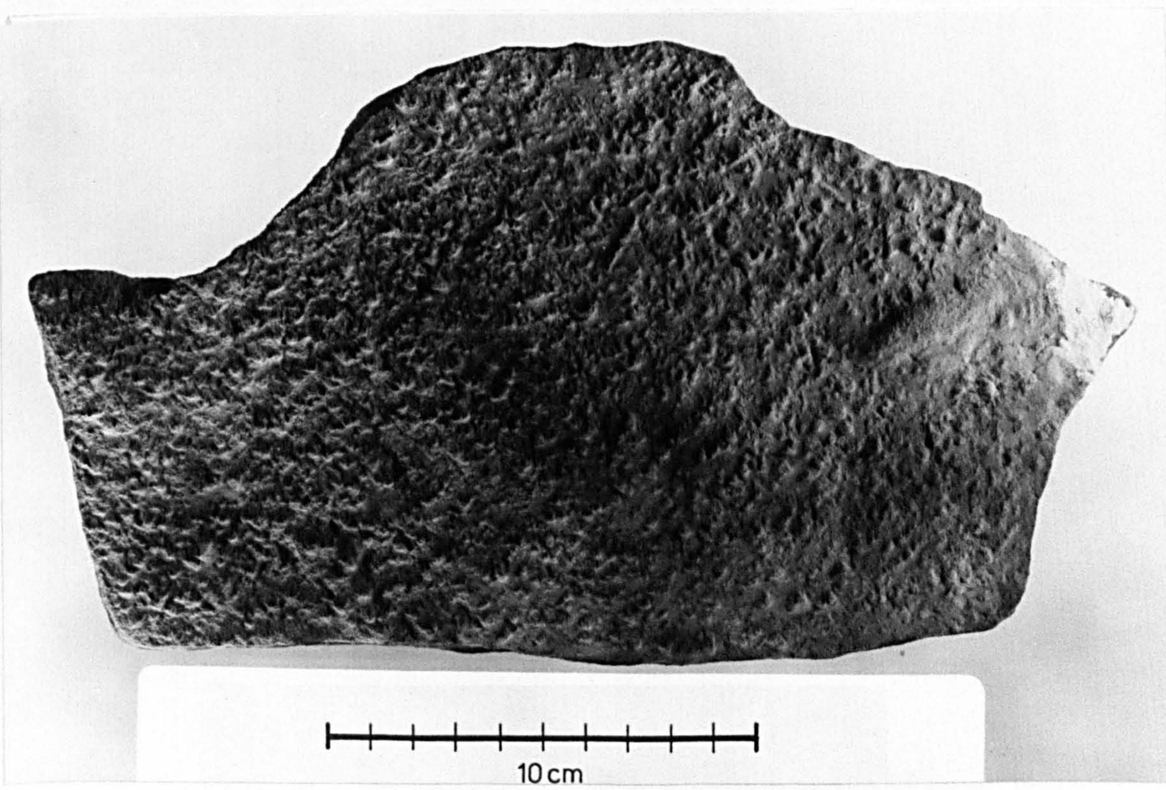
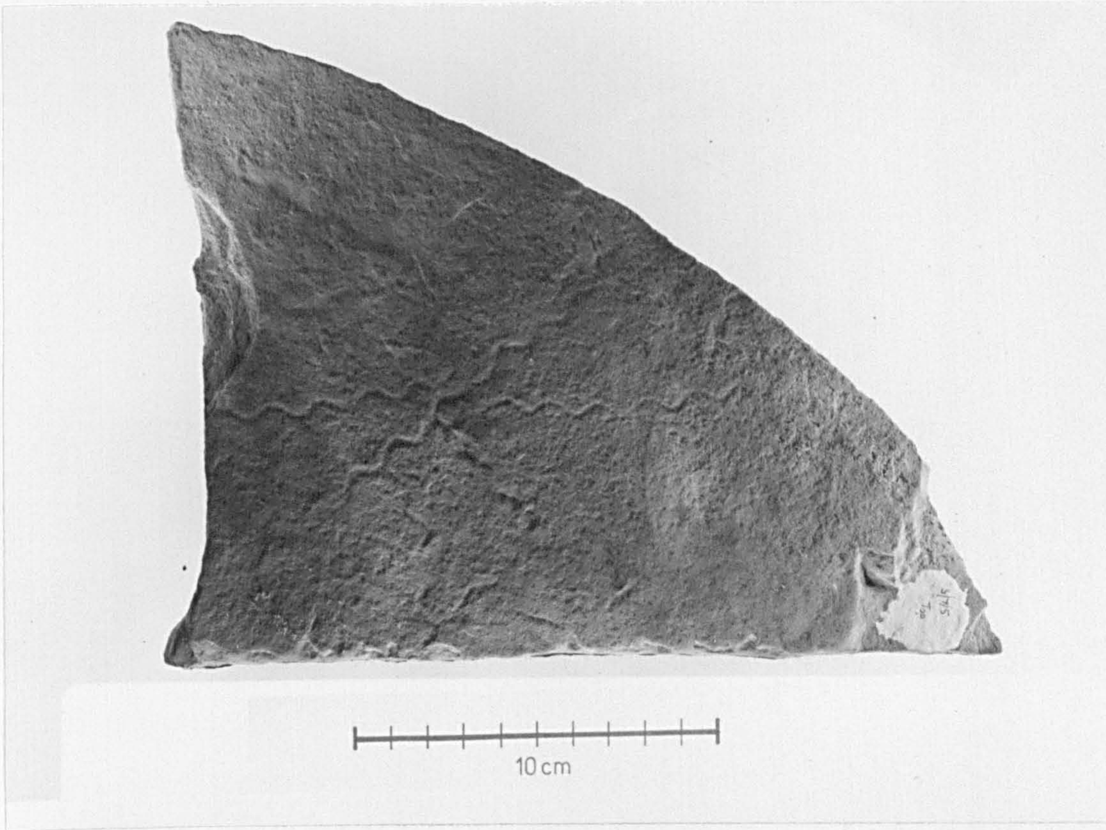

10 cm

Plate 58. _Cochlichnus_, several trails criss-cross the area. Association C, Upper Slope Assemblage, River Dane near Barthomley Bottoms, (SJ 9686 6606).

Plate 59. Close up of a curved Discontinuous Sole Trail, Association A.


10 cm

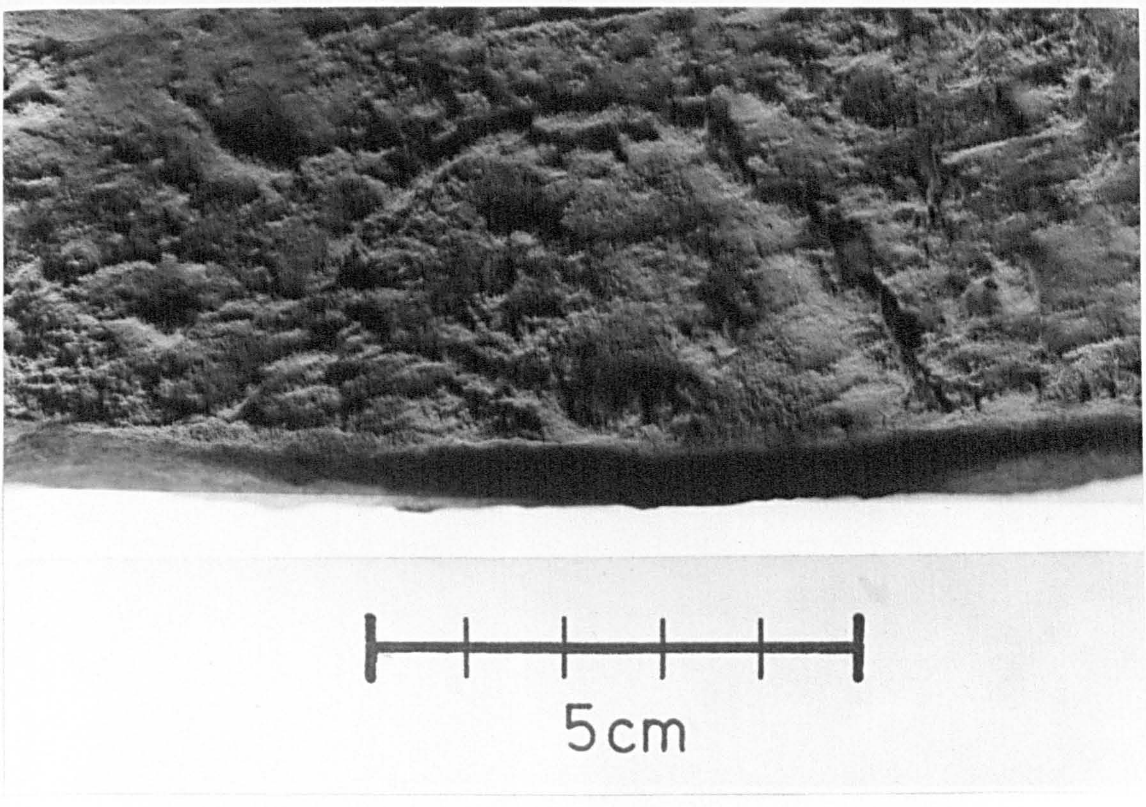
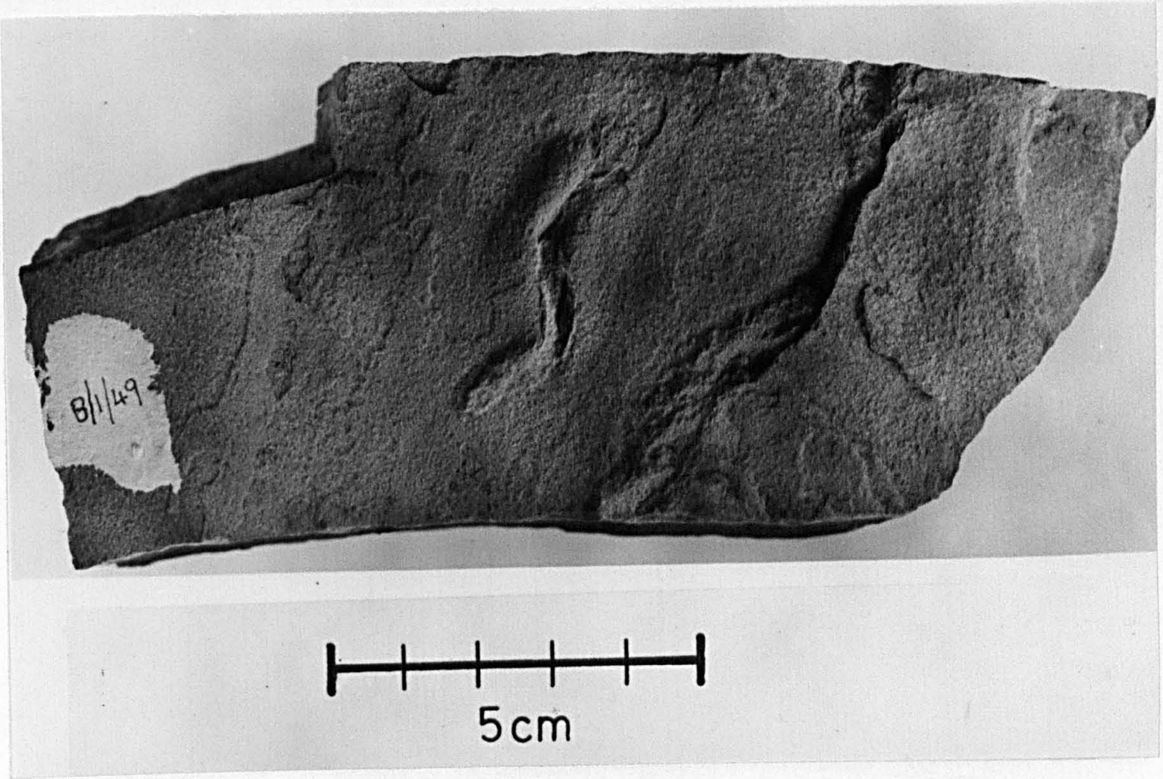

5 cm

Plate 60. *Cochlichnus* within the parallel-laminated division of a turbidite sandstone. Quarry near Bridgehouse Farm, (SK 0363 7200).

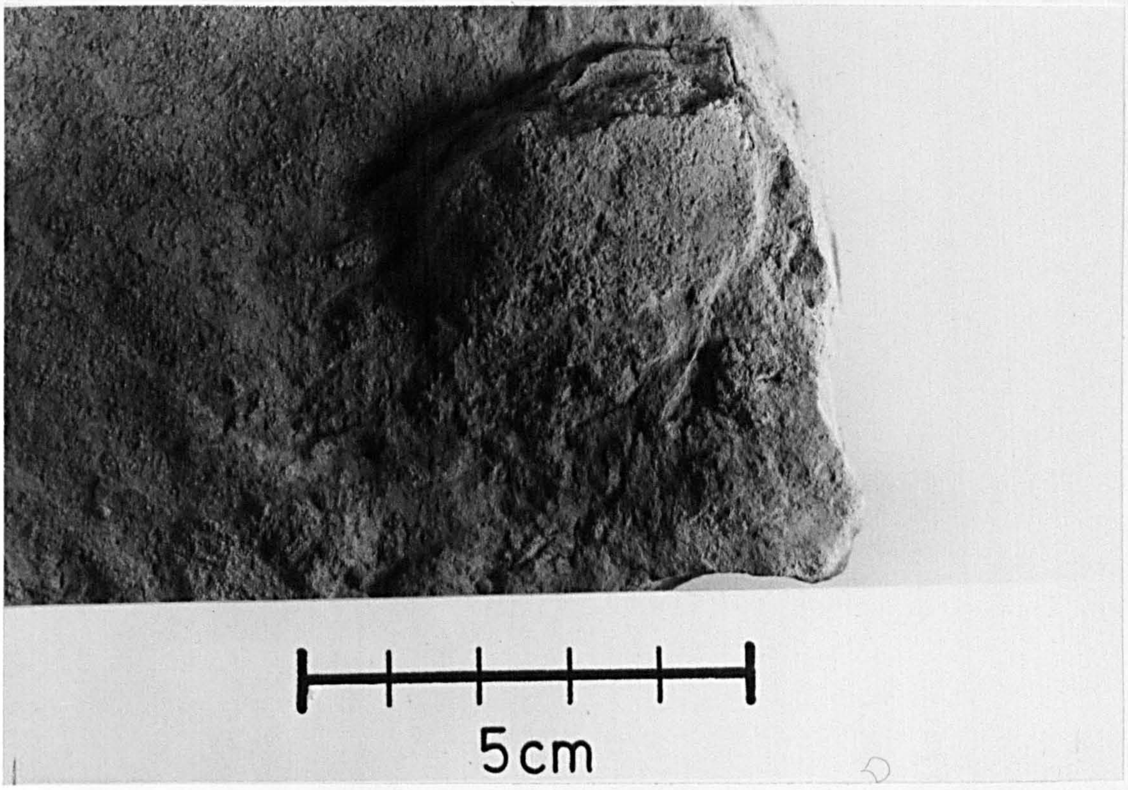
Plate 61. Large pipe shaped trace fossil on the base of a bed of LF 7 Ripple-laminated Sandstone. Association B, stream section above Upper Hulme (SJ 0125 6129)

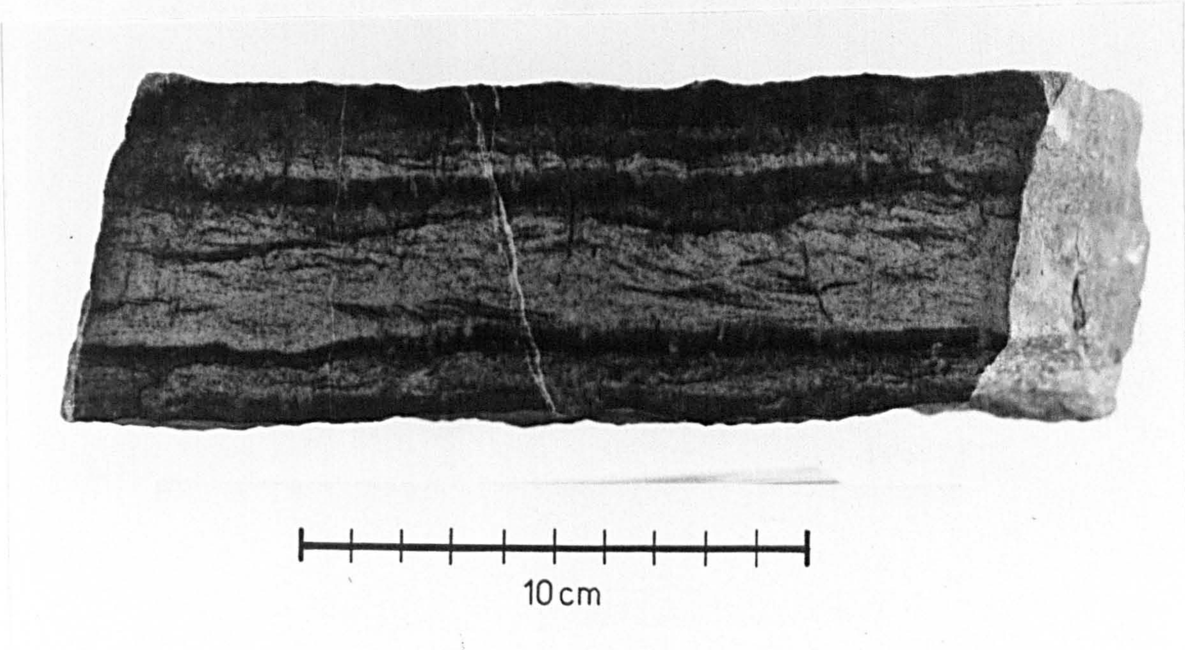

B/1/49
5cm


5cm

Plate 62. Rounded sole trail, base of a bed of LF 4 Turbidite. Stream section near Burbage Reservoir (SK 0346 7216).

Plate 63. Simple Vertical Pipes with LF 7. Ripple-laminated Sandstone. Note the slight downturning of the lamination Association B, Bosley.


5 cm


10 cm

SECTION III Plates

Plate 64. Lithofacies 1, Tabular Cross-bedding, Rhondda Beds.
Old quarry above Cymmer, (ST 0199 9096).

Plate 65. LF 2, Trough Cross-bedding, section in YZ plane showing large intersecting troughs. Hammer, bottom left, gives scale. Rhondda Beds.
Old quarry above Cymmer (ST 0198 9085)


DAI

Plate 66. Lithofacies 2. Trough Cross-bedding. View in XY plane at the coset shown in Plate 65.

Plate 67. Coset of LF 2 Trough Cross-bedding, showing the typical appearance of small sets in the XY plane. Rhondda Beds, Earlswood Roundabout. (SS 730 943)

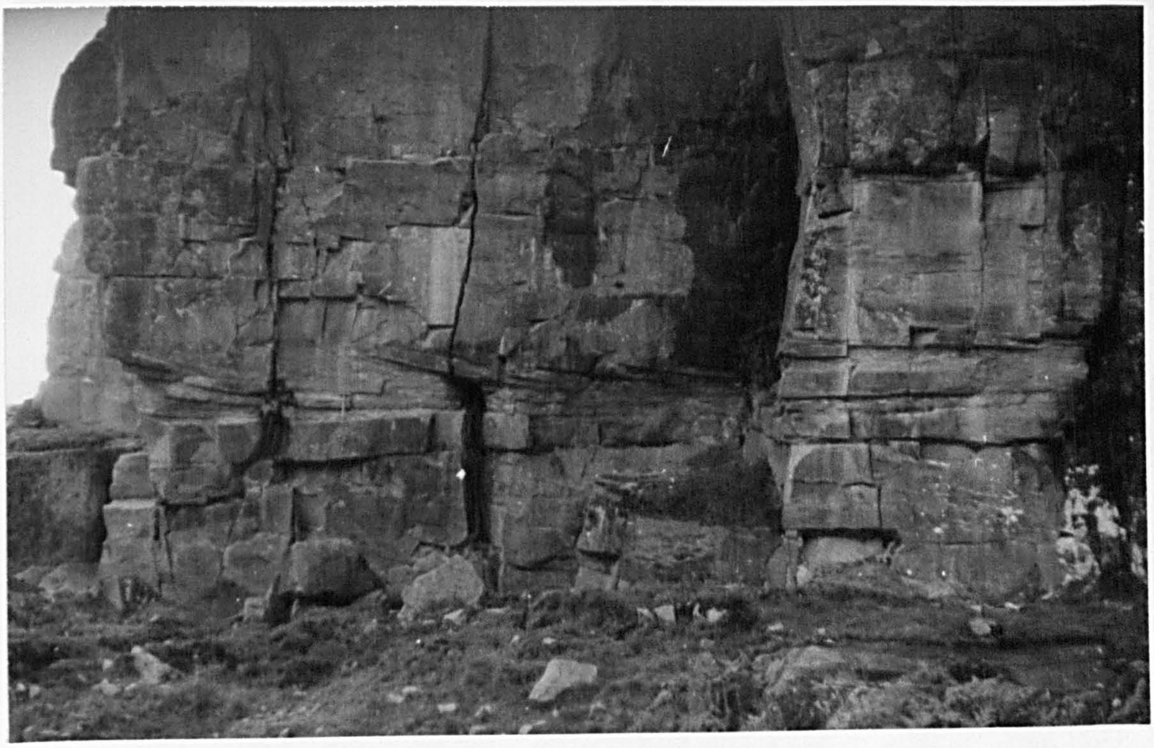


Plate 68. Lithofacies 3. Cross-bedding with undulating erosion surfaces. Section in the XY plane showing the flat erosion surfaces and long extent of the sets. See also Fig.62a. Outcrop west of Blaenrhondda, (SS 9208 9995) Rhondda Beds.

Plate 69. LF 3, view in YZ plane of the coset shown in Plate 68. Note the shallow troughs. See also Fig. 62b.

Plate 70. Lithofacies 4, Parallel-laminated Sandstone. Shallow troughs filled with cross-laminated sandstone cut into the upper part of the bed. Roadcutting east of Blaenrhondda (SN 928 011), Rhondda Beds.

Plate 71. X-radiograph of LF 5, Structureless Sandstone showing a poor alignment of the sand grains.

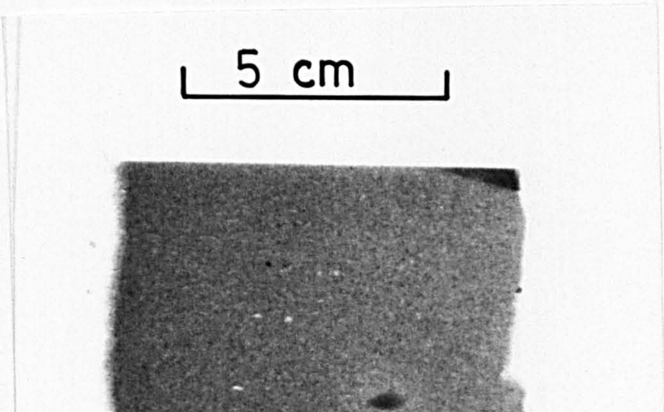

5 cm

Plate 72. LF 5 Structureless Sandstone filling in a large scoured channel. Height of face about 15m. Quarry in Taff Vale (ST 078 916), Brithdir Beds.

Plate 73. LF 5 Structureless Sandstone showing an irregular, erosive base with steep sides. Old Quarry above Cymmer, (ST 0196 9085), Rhondda Beds.

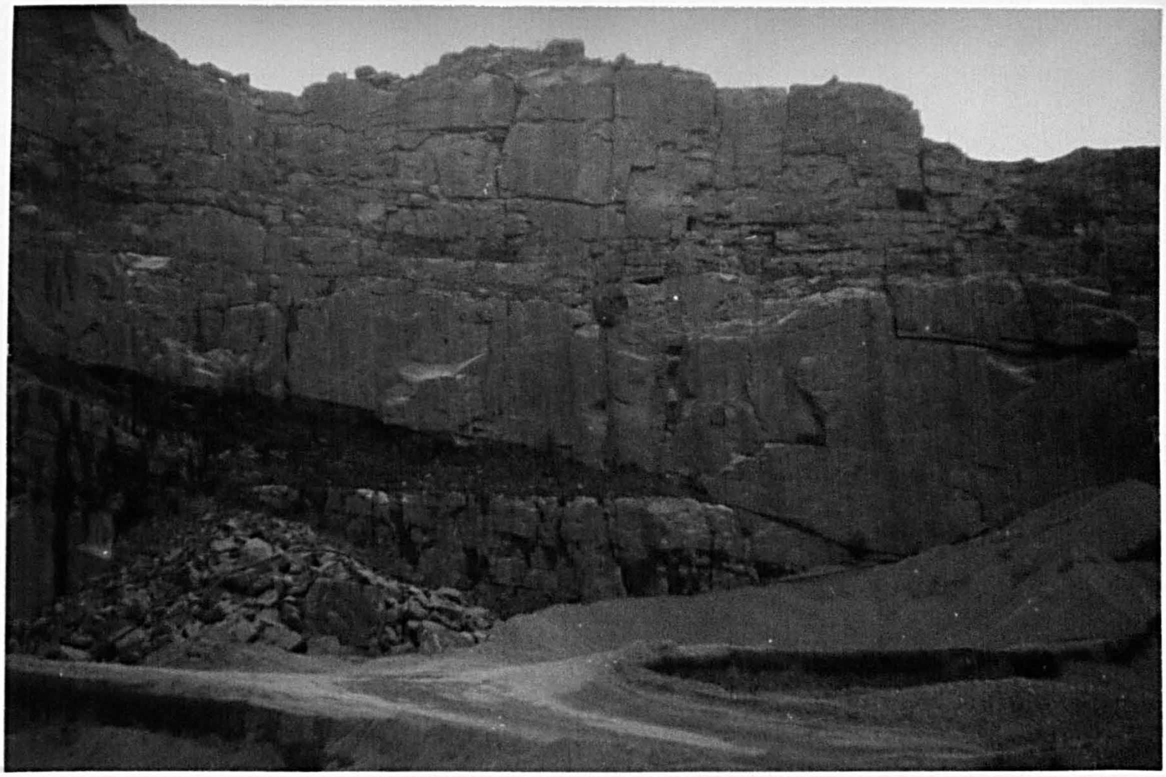


Plate 74. Large log within LF 7 Conglomerate.

Taff Vale Quarry (ST 078 916), Brithdir Beds.

Plate 75. LF 7 Conglomerate showing the typical irregular bedding.

Quarry above Cymmer (ST 019 909), Rhondda Beds.

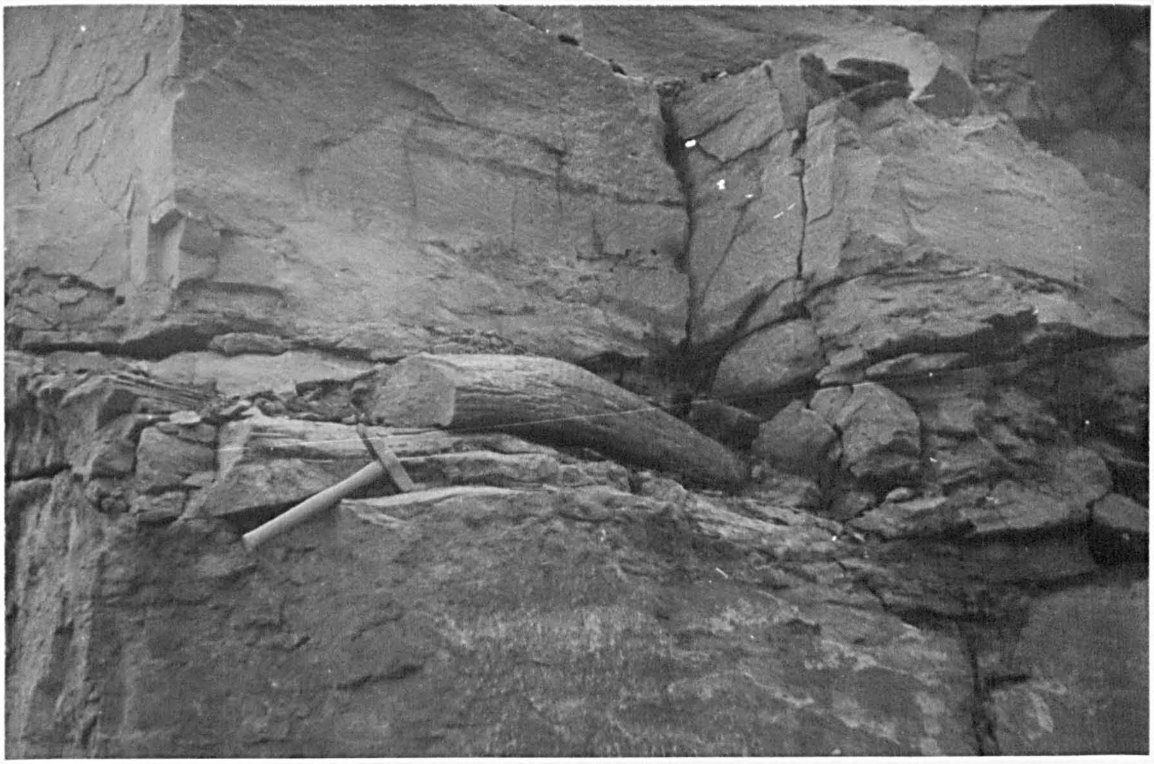


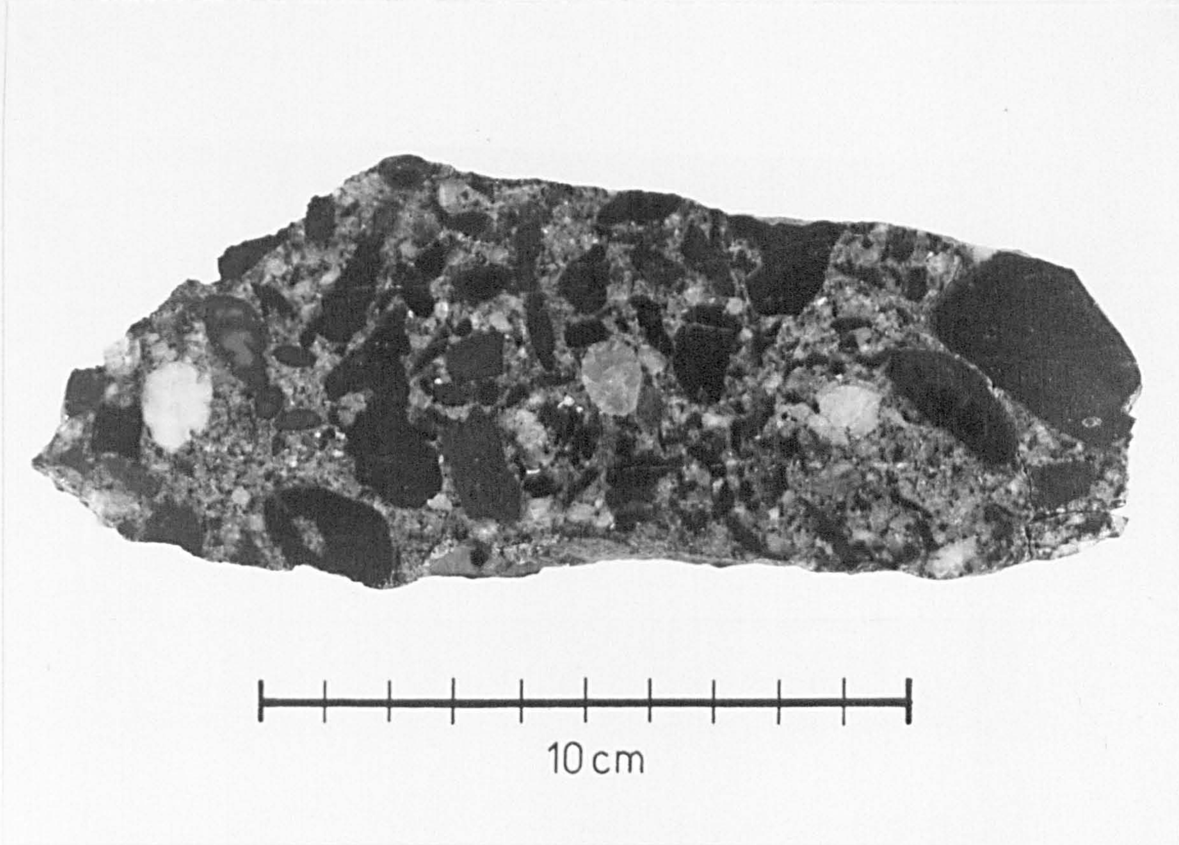
Plate 76. Conglomerate with sub-rounded pebbles of vein quartz, ironstone and mudstone,

From just above No.2 Rhondda Coal.

Plate 77. Disturbed S shaped lamination in siltstone probably caused by plant collapse in the underlying sediment.

Stream section north of Craig yr Hesg (SS 9232 0153).

Rhondda Beds just above No.2 Rhondda Coal.


10 cm

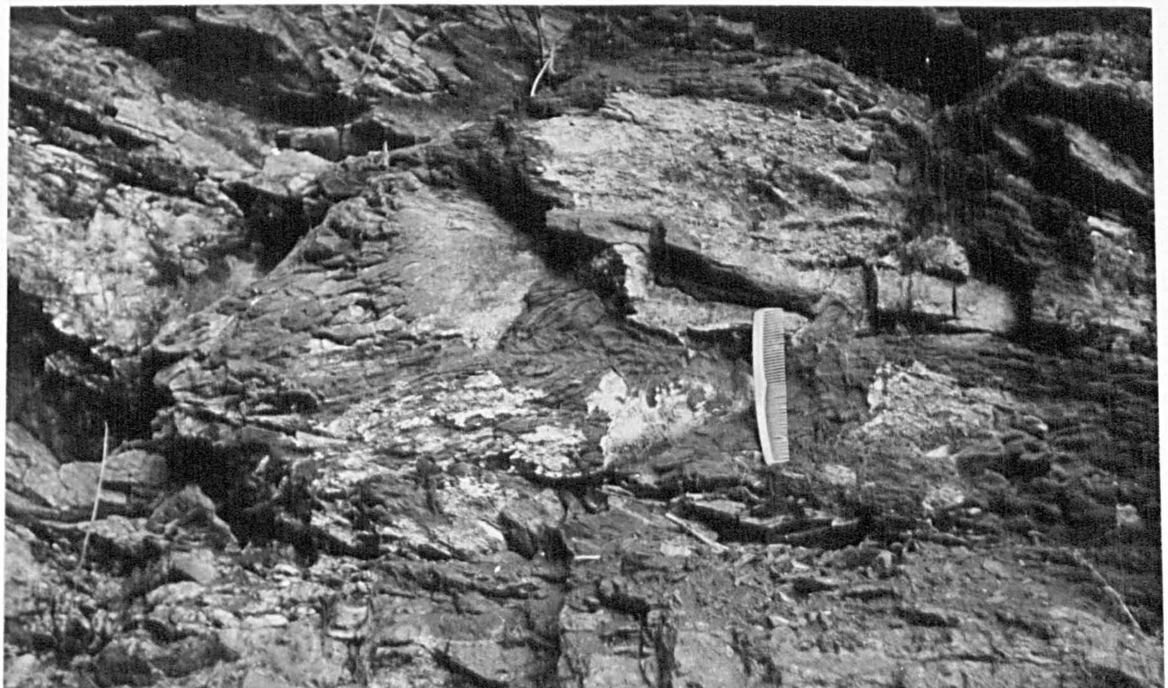


Plate 78. Seat-earth with thin coal. Earlswood Roundabout (SS 730 743) Rhondda Beds, The coal is immediately overlain by a channel sandstone forming the bottom of the sandstone member in Fig.64a.

Plate 79. LF 10 Ripple-laminated Siltstone and Fine Sandstone, showing large ripples developed in a silt laminated mudstone. Outcrop west of Blaenrhondda (SS 9203 9995)

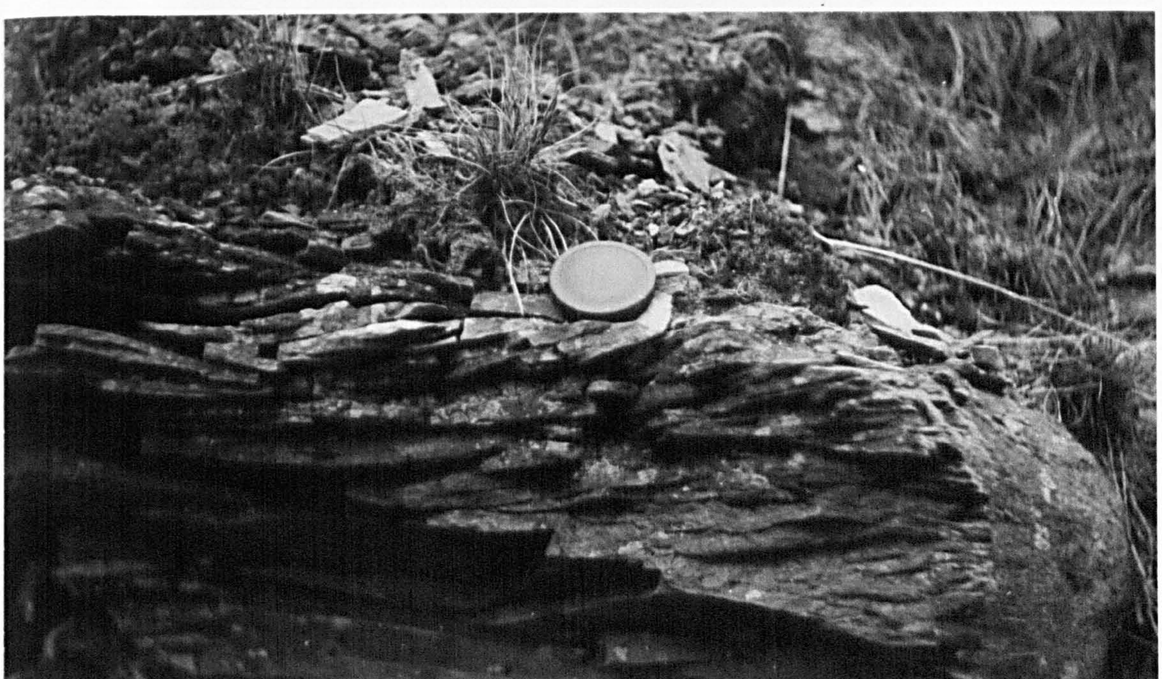


Plate 80. LF 11 Laminated Silty Sandstone.

Nant-y-Gwair, Llynfi Beds.

Plate 81. Small cycles in Association B, Llynfi Beds, Nant-y-Gwair. Photo shows the section between the 40m and 63m levels in Section C, Fig.63. A sharp based sandstone, probably a small distributary channel occurs at the bottom. Above this is found the typical corrugated sheeting weathering pattern in LF 11. The thick sandstone at the top of the photo lies above the No.2 Rhondda Coal which is unexposed.

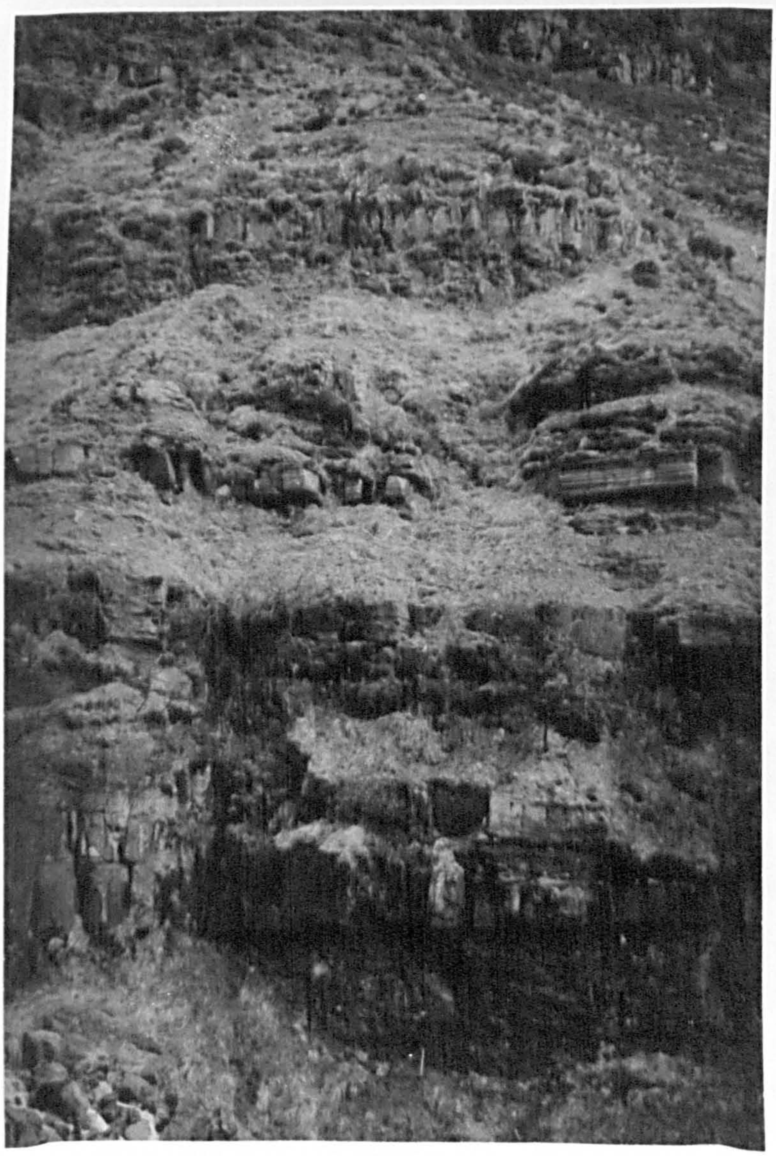
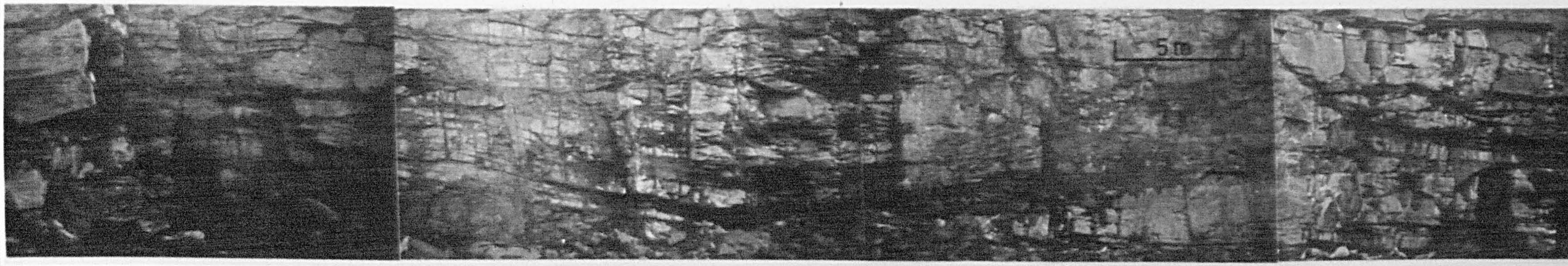


Plate 82. Three erosion surfaces within a thick sandstone.

For detailed explanation see text.

Association A, Brithdir Beds, Taff Vale Quarry.

(ST 078 916)


5m

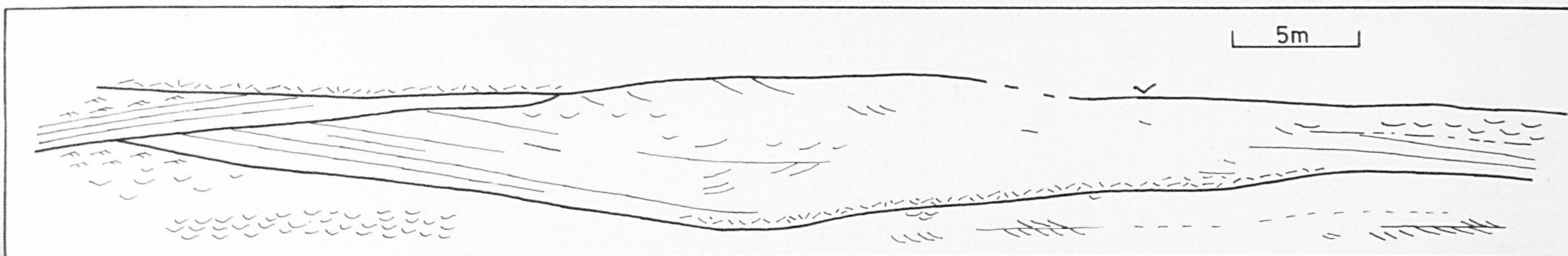

5m

Plate 83. Flat channel base overlying a Siltstone. About 60 m is visible on the photograph. Association A, Rhondda Beds. Roadcutting east of Blaenrhondda (SN 9304 0095)

Plate 84. Dune profile in LF 1 preserved by a Siltstone drape. Lower part of a fluvial channel fill sequence above the No.2 Rhondda Coal. Stream section north of Craig-yr-Hesg, (SS 9229 0153). Rhondda Beds.

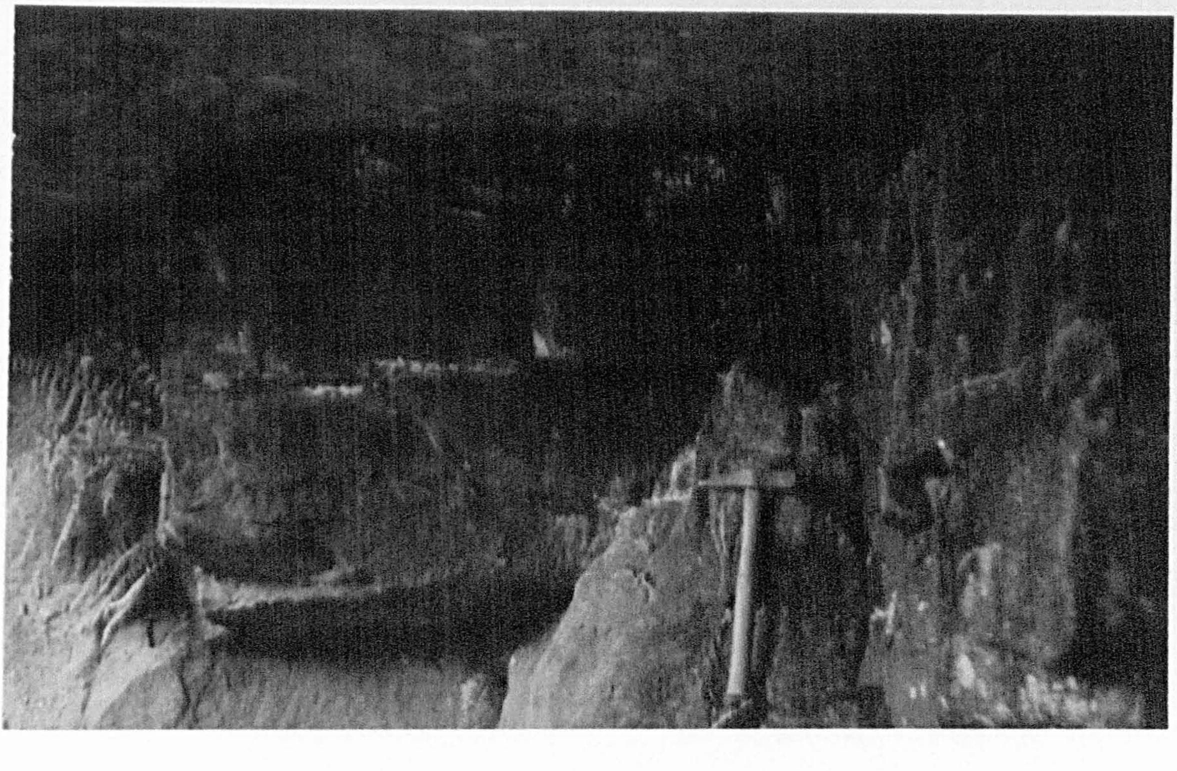


Plate 85. Trough in LF 1 filled with Siltstone.

Upper part of the channel sequence shown in Section A of Fig.64.

Roadcutting east of Blaenrhondda (SN 9310 0056).

Rhondda Beds.

Plate 86. Upper part of the channel fill sequence shown in Section A, Fig.64 showing an alternation of LF 1 Trough Cross-bedding and LF 5 Ripple-laminated Sandstone with LF 8 Laminated Siltstone. Locality as Plate 85.

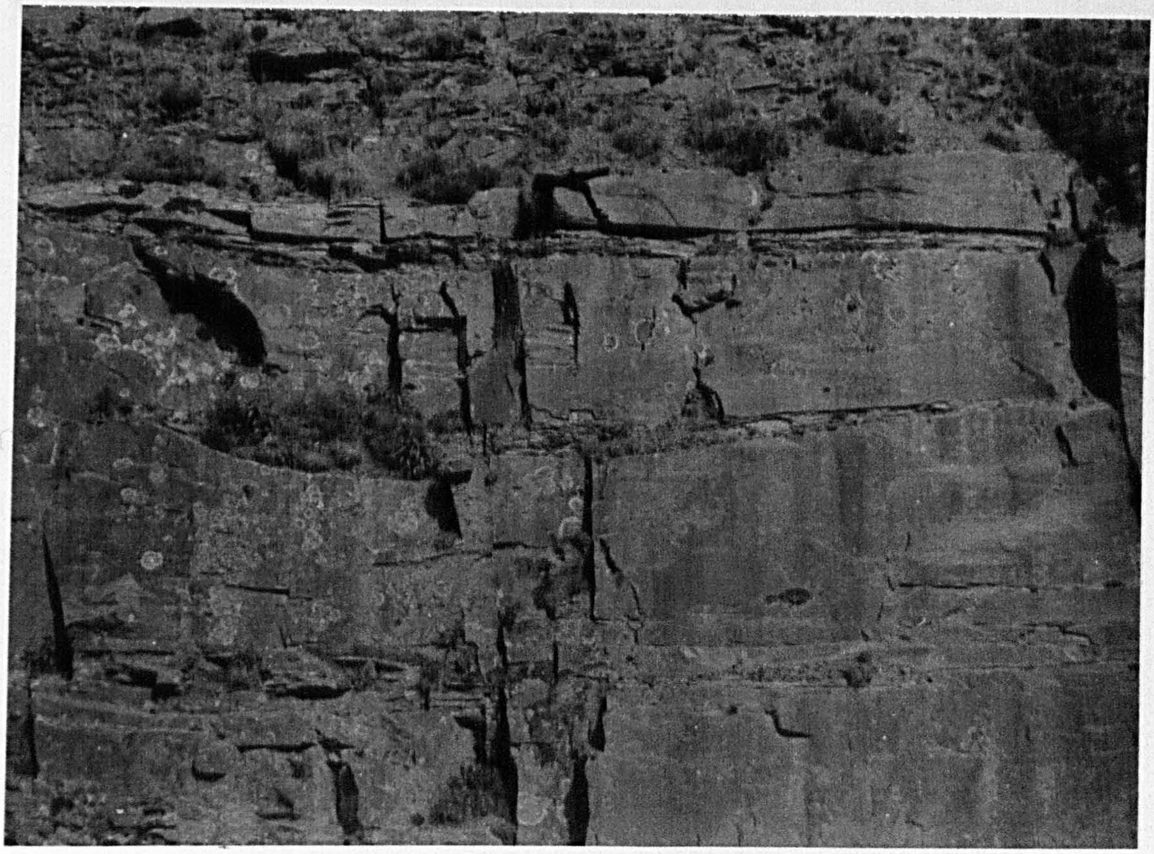
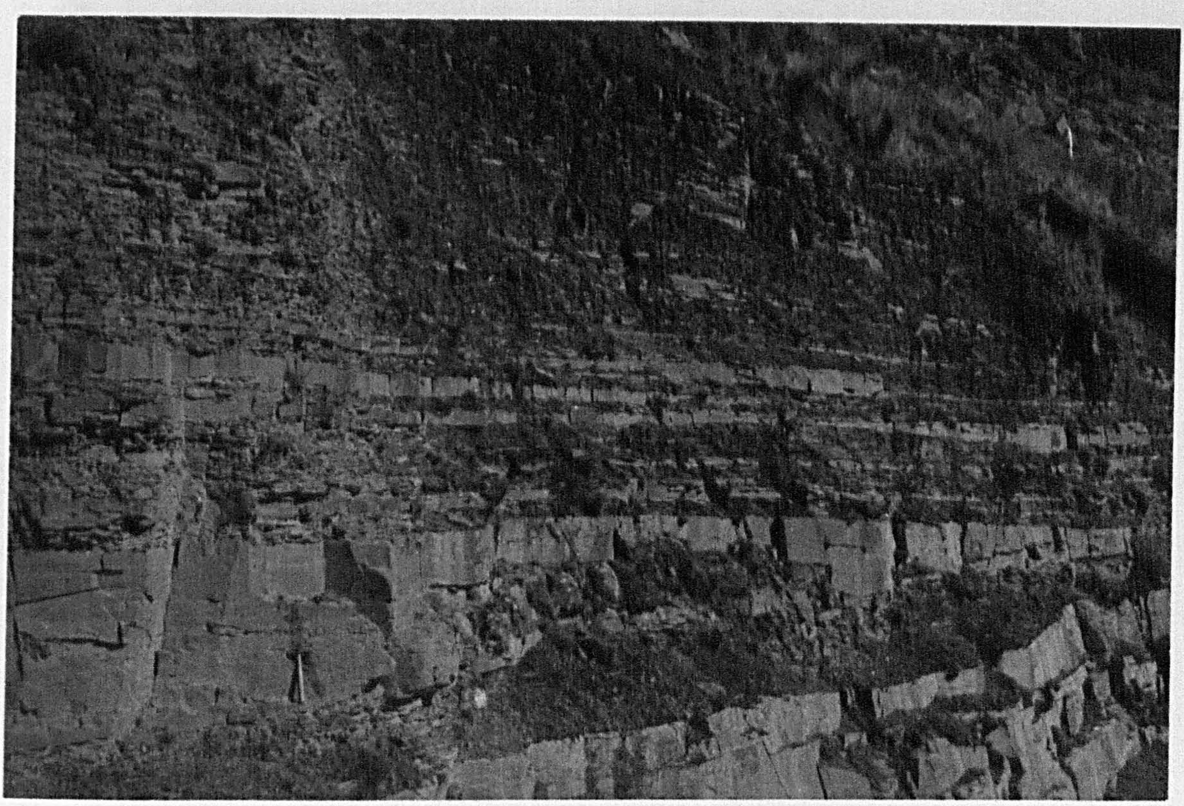


Plate 87. Top part of the channel fill sequence shown in Fig.64, A, showing a thinning upwards sequence with alternation of LF 5 and LF 8. Locality as Plate 85.

Plate 88. The same sequence as shown in Plate 87. To the right, part is cut out by a channel largely filled with Siltstone. Locality as Plate 85.



Chapel Station
Hogshaw Brook
Corbar Hill
BUXTON
M'FIELD
Walker Barn
Cisterns Clough
Wildboarclough
River Dane
Helmesley
Anne Roach
The Roaches
Five Clouds
Ramshaw Rocks
Hen Cloud
Upper Hulme
Rushton
Rudyard
LEEK
75
70
65
60


Wildboarclough
River Dane
Helmesley
Anne Roach
The Roaches
Ramshaw Rocks
Five Clouds
Hen Cloud
Upper Hulme
Rushton
Rudyard
LEEK
Shirley Hollow
Cotton
65
60
55
95
00
05
Triassic
Westphalian
Namurian
Roaches Grit Group
(Mainly fluvial sandstones)
(Mainly turbidite sandstones)
Visean