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FIG.1



Location of the Thesis Area

Relief and Drainage

Fig 2

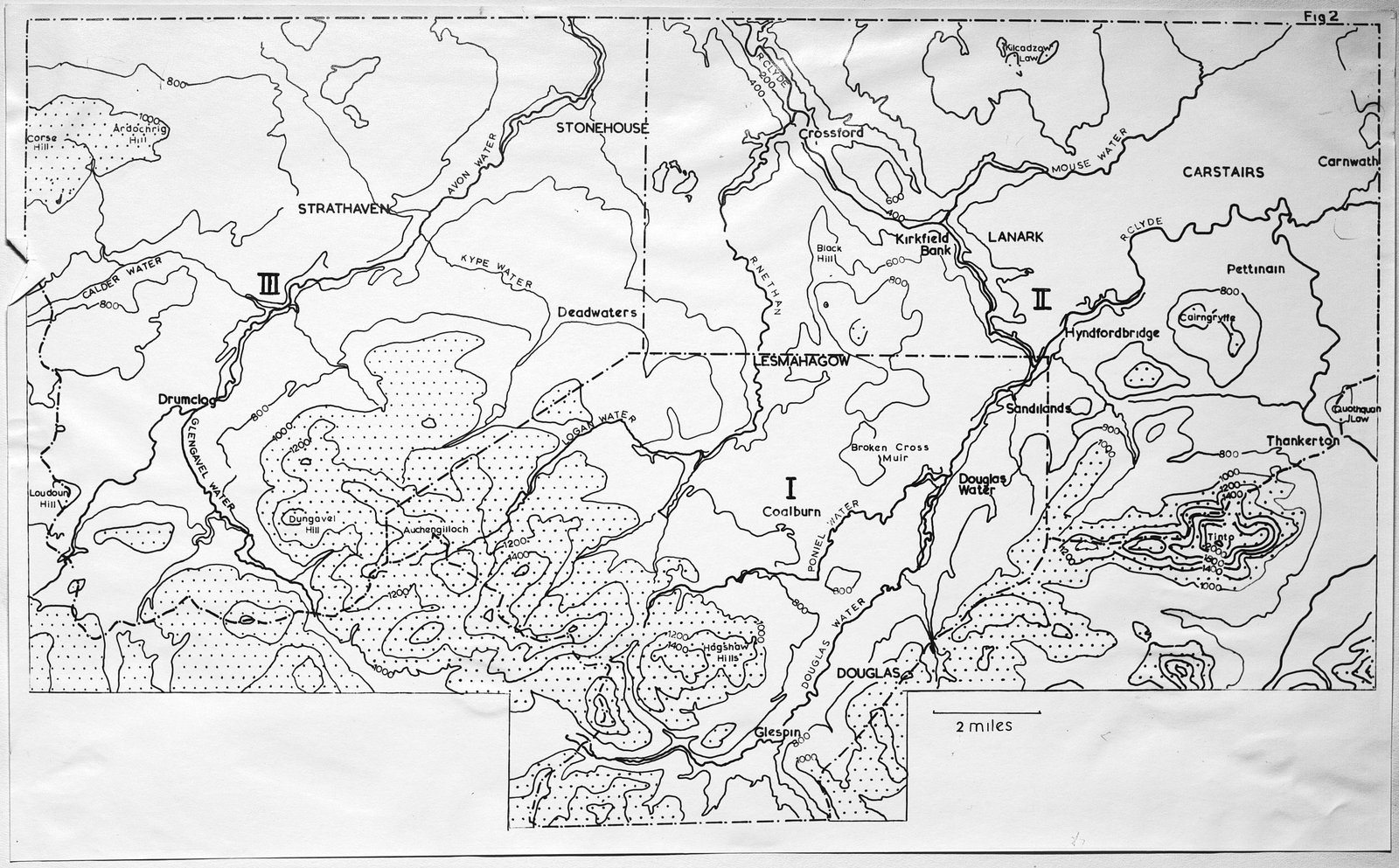
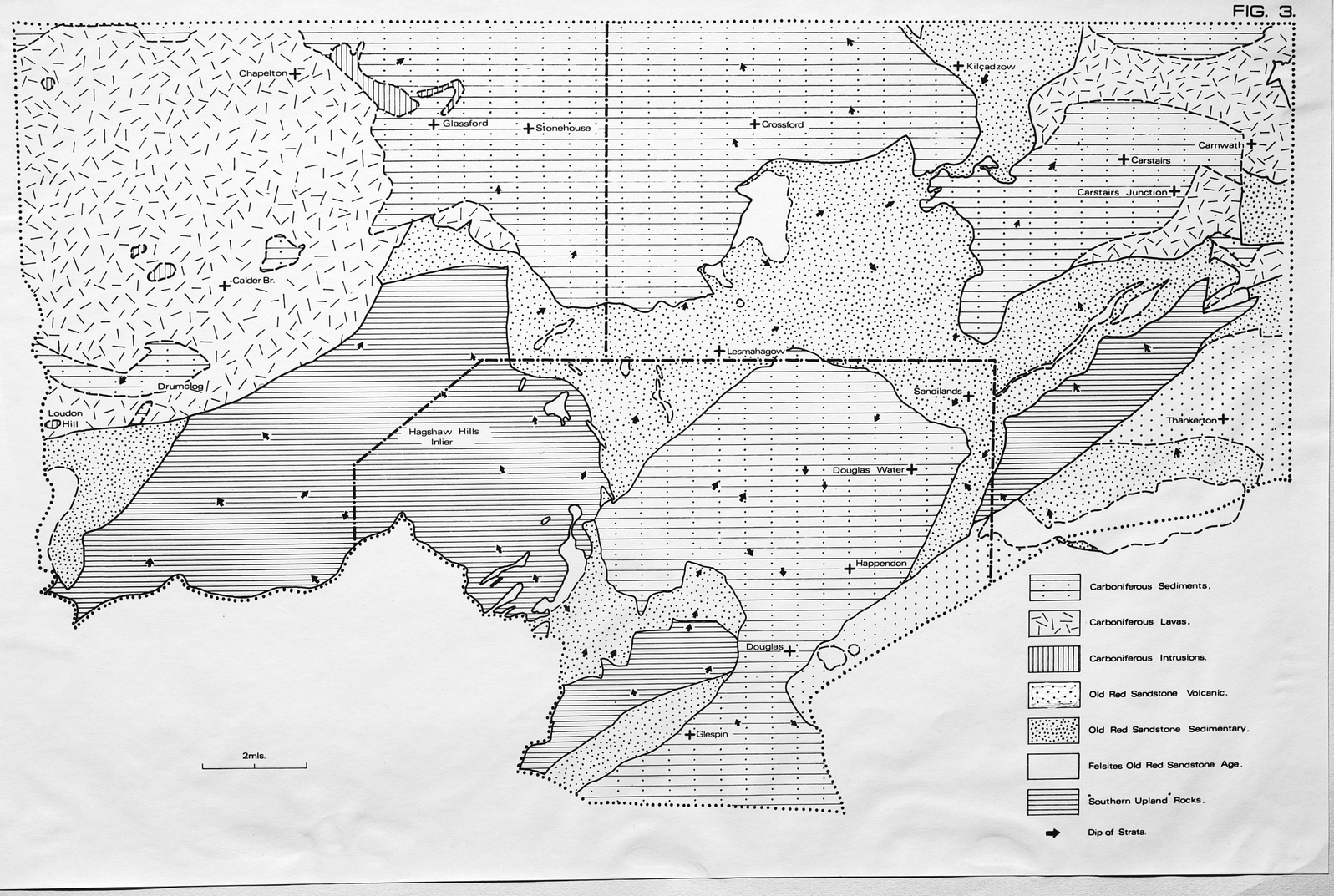
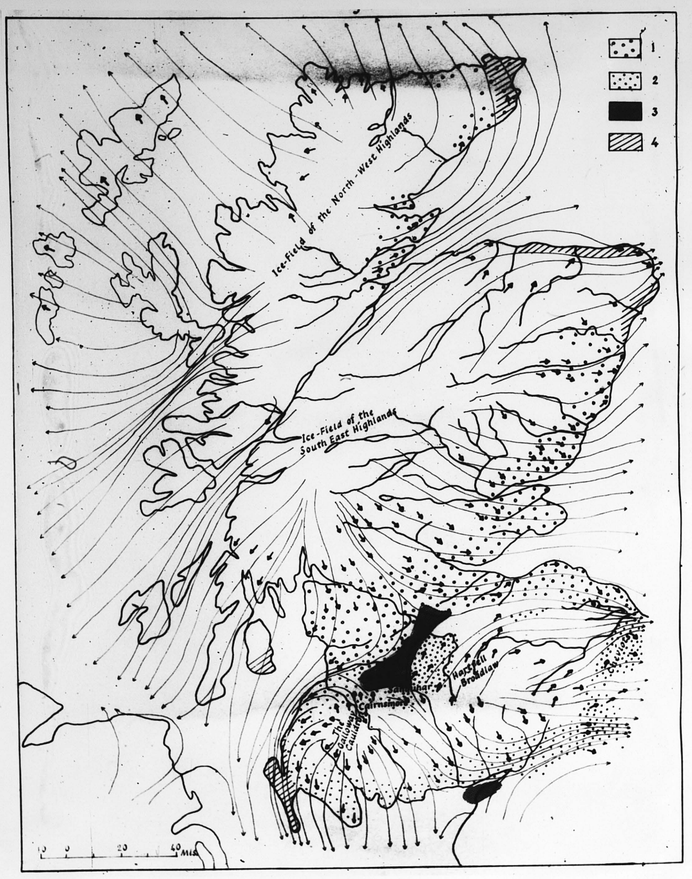


FIG. 3.



Geology

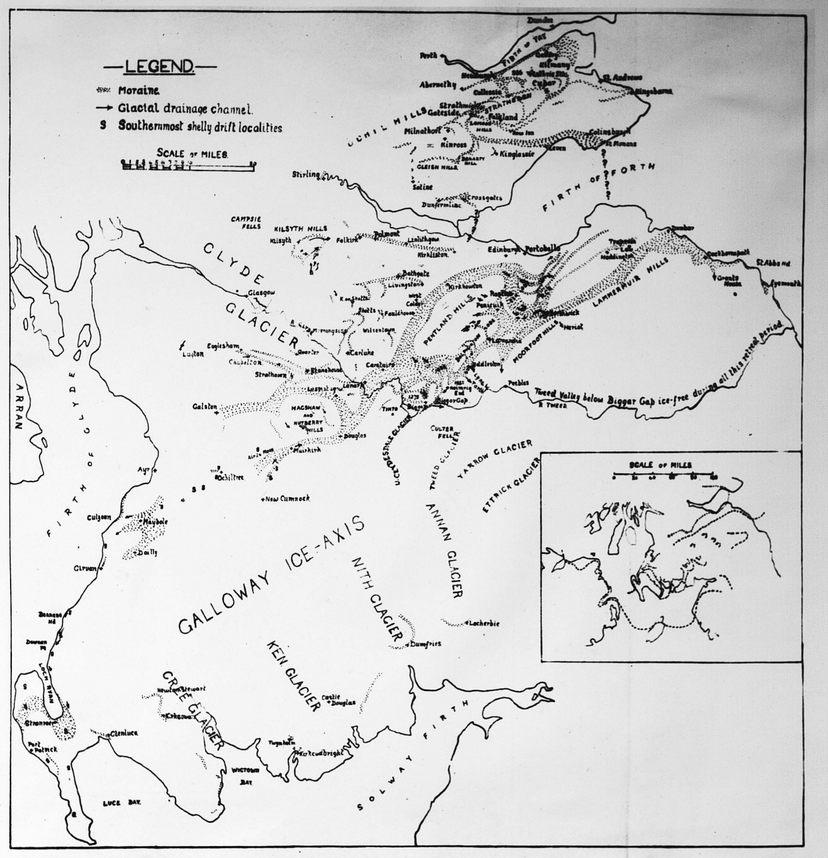
4



1 Highland Erratics.
2. Southern Upland Erratics
3. Debatable Ground
4. Shelly Till
→ Striae

after Geikie 1894

5



MAP SHOWING SUCCESSIVE POSITIONS OF THE ICE FRONT IN THE CENTRAL VALLEY OF SCOTLAND

after Charlesworth 1926

7

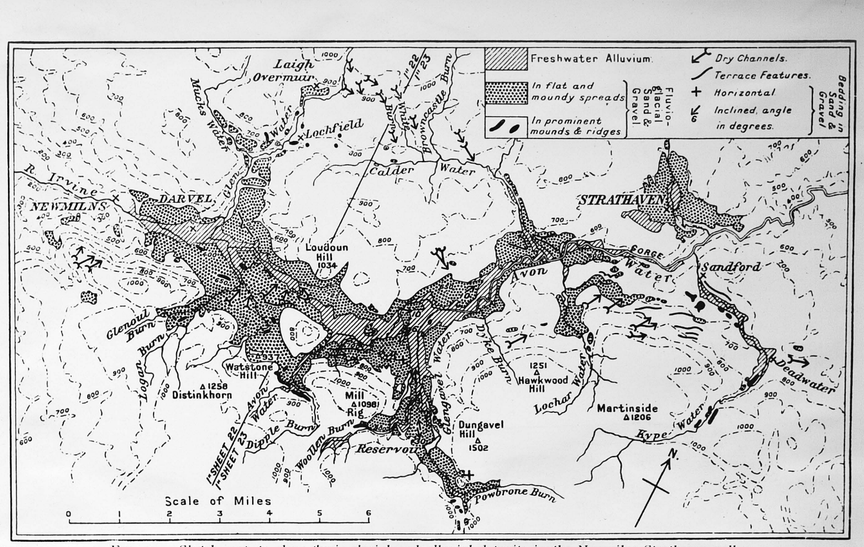


FIG. 11.—*Sketch map to show fluvio-glacial and alluvial deposits in the Newmilns-Strathaven valley.*

after Phemister 1925

8

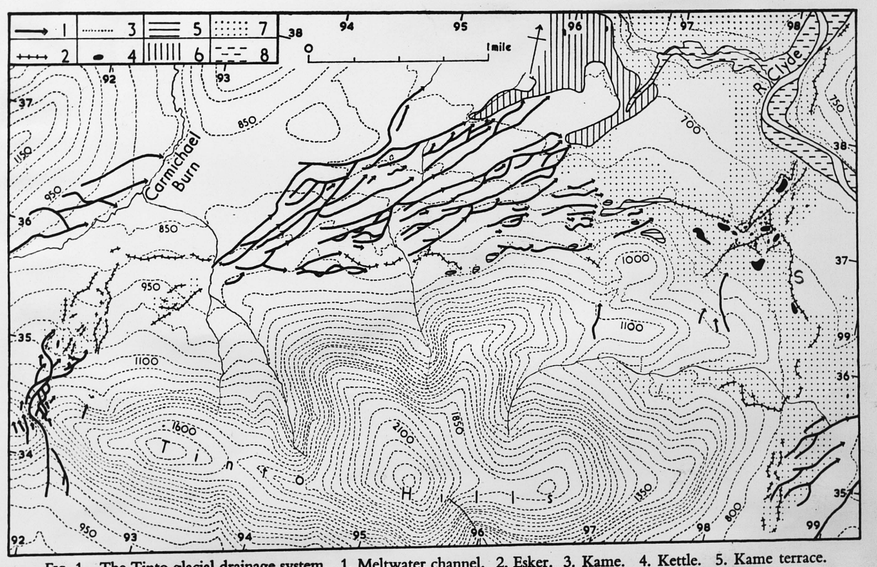
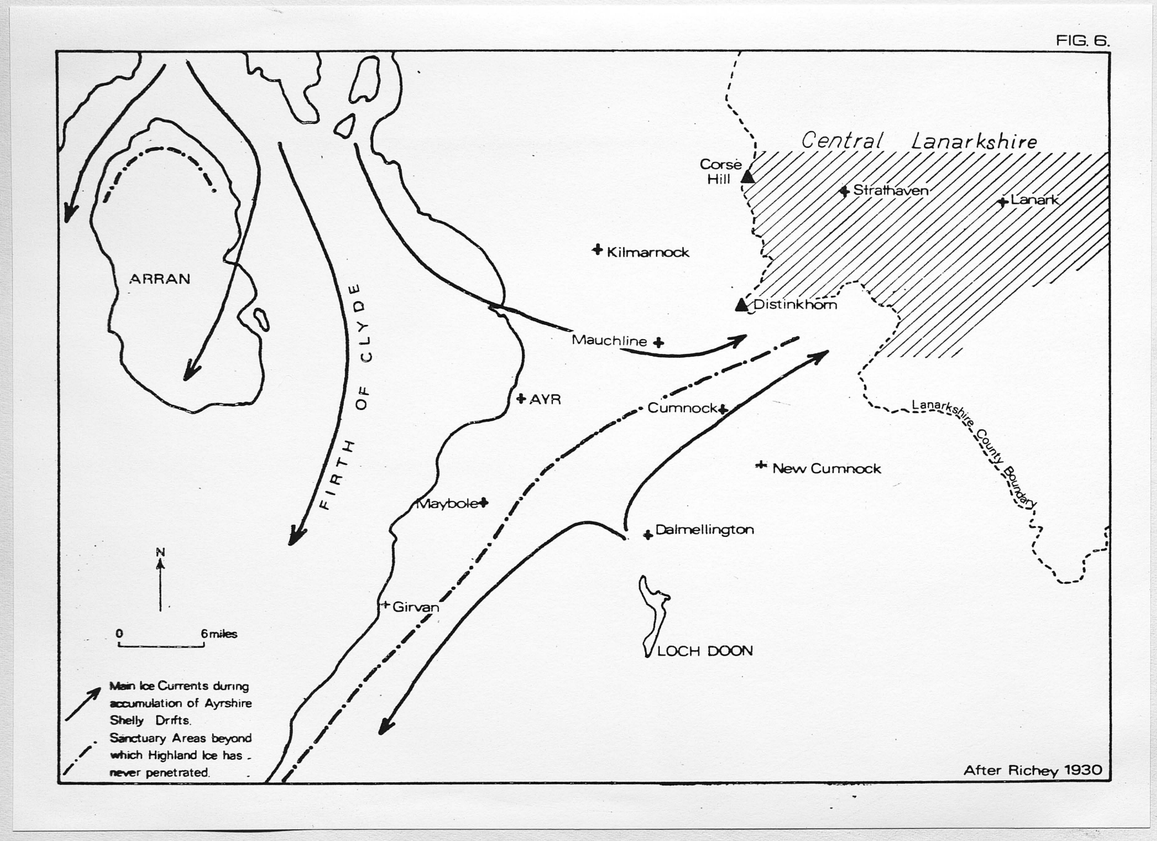


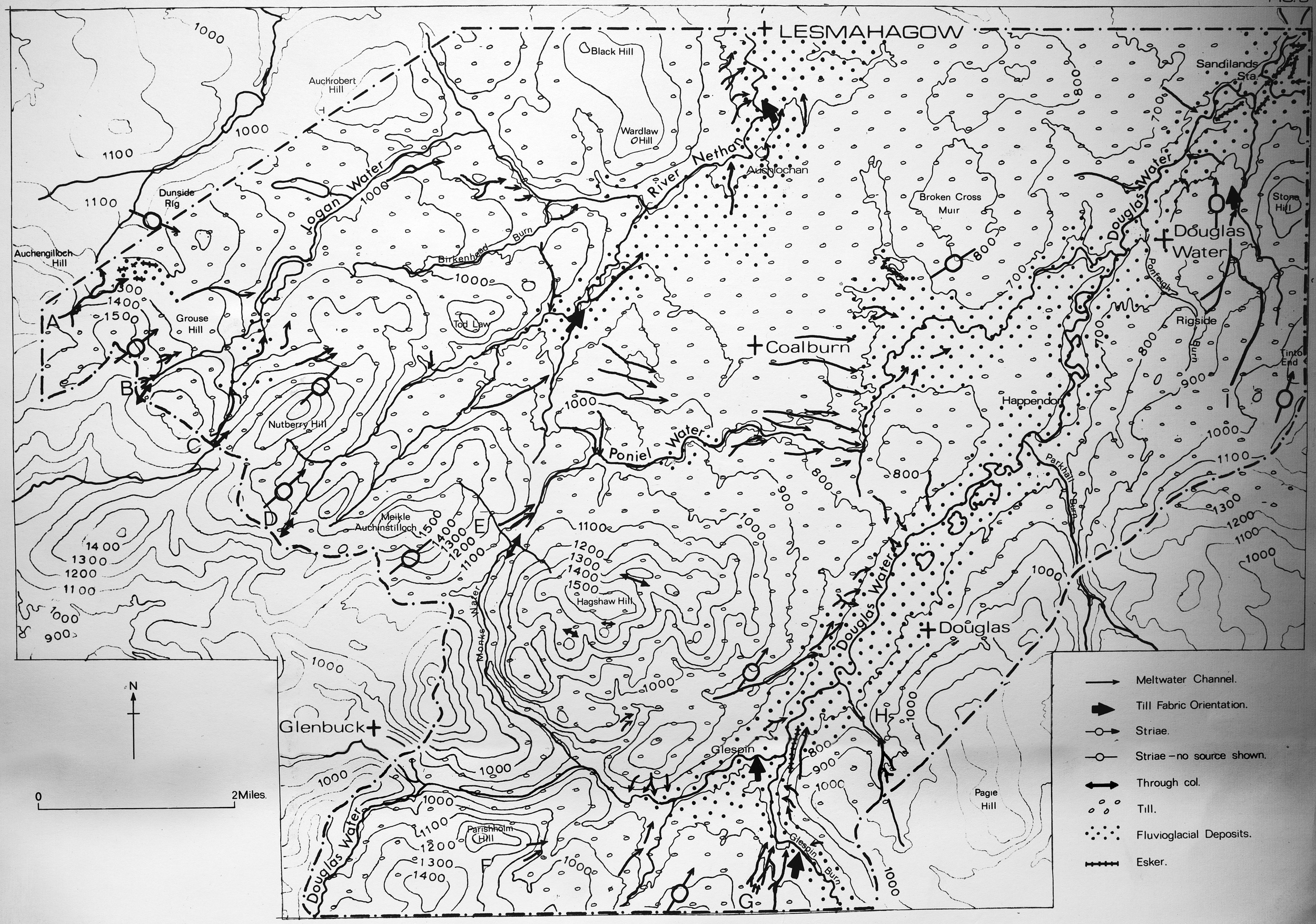
FIG. 1. The Tinto glacial drainage system. 1. Meltwater channel. 2. Esker. 3. Kame. 4. Kettle. 5. Kame terrace. 6. Flat spread of fluvioglacial sand and gravel. 7. Other areas of fluvioglacial sand and gravel. 8. Alluvium.

after Sissons 1961



AREA I

FIG. 9


LESMAHAGOW
Black Hill
Auchrobert Hill
Wardlaw Hill
Logan Water
River Nethan
Auchlochan
Dunside Rig
Auchengilloch Hill
Birkenhead Burn
Broken Cross Muir
Sandilands Sta.
Douglas Water
Douglas Water
Stone Hill
Douglas Water
Ponfeigh
Rigside
Burn
Tinto End
Grouse Hill
Tod Law
Coalburn
Happendon
Nutberry Hill
Poniel Water
Parkhall Burn
Meikle Auchinstilloch
Hagshaw Hill
Monks Water
Douglas Water
Douglas
Glenbuck
Glespin
Pagie Hill
Parishholm Hill
Douglas Water
Glespin Burn
A
B
C
D
E
F
G
H
N
0
2Miles.
Meltwater Channel.
Till Fabric Orientation.
Striae.
Striae – no source shown.
Through col.
Till.
Fluvioglacial Deposits.
Esker.

Crossprofiles of the Logan, Nethan, Poniel and Douglas Valleys.

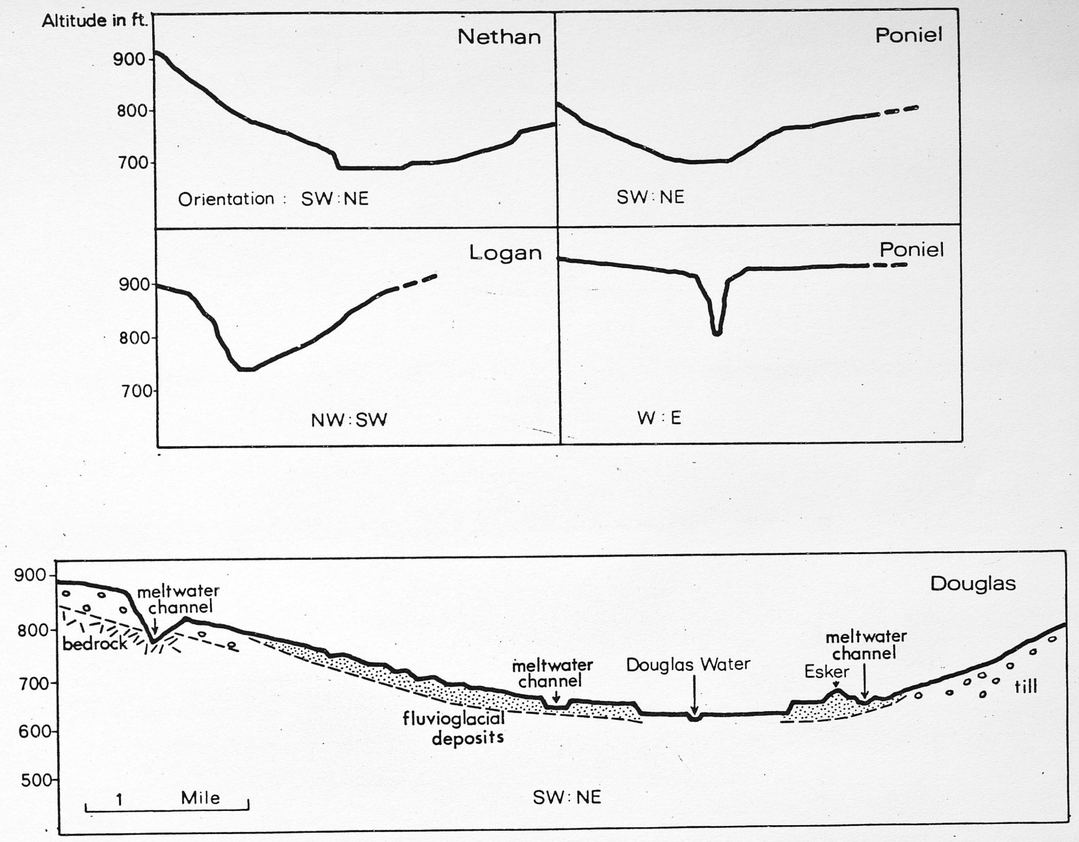
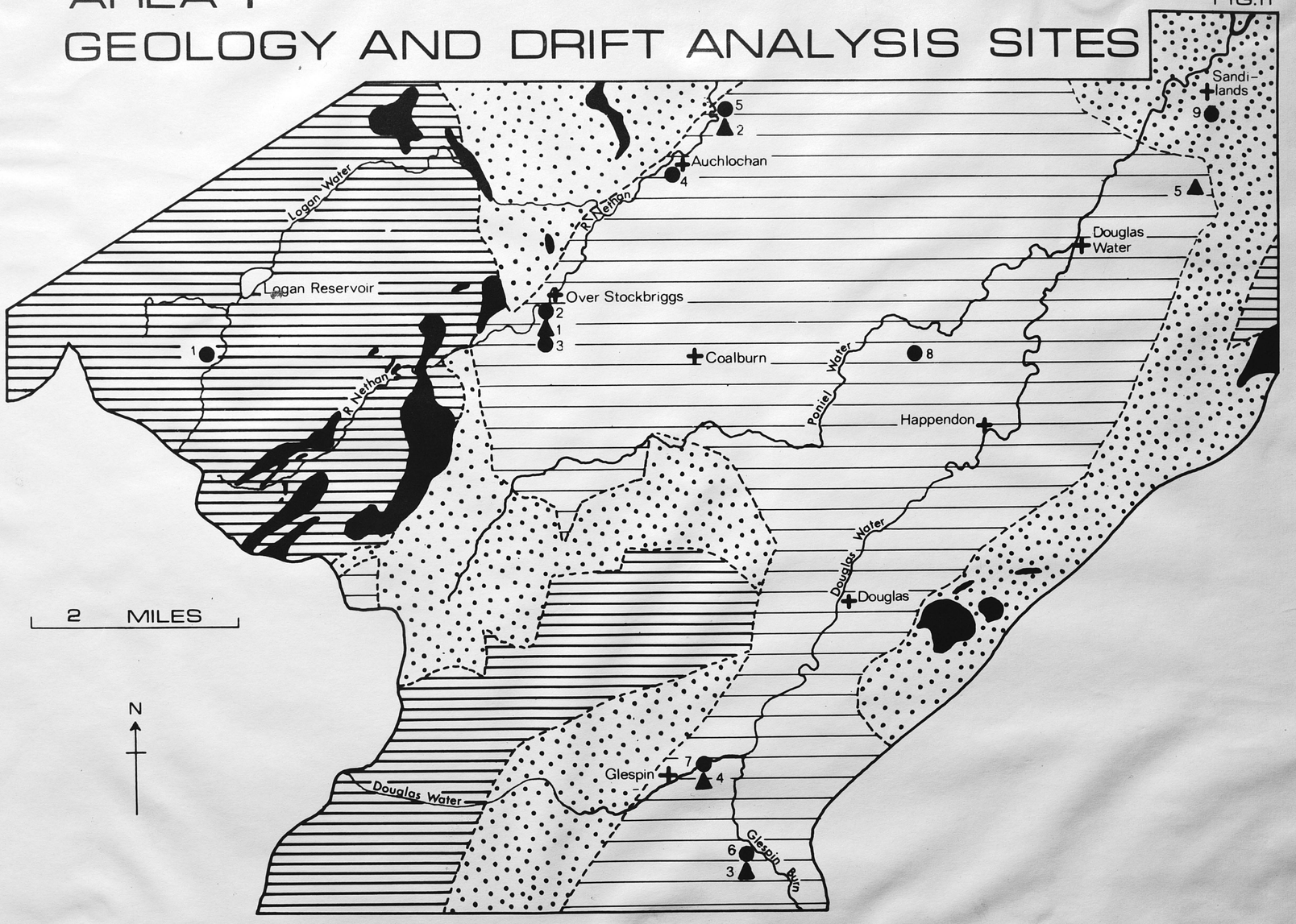


FIG. 10

AREA 1
GEOLOGY AND DRIFT ANALYSIS SITES

FIG.11



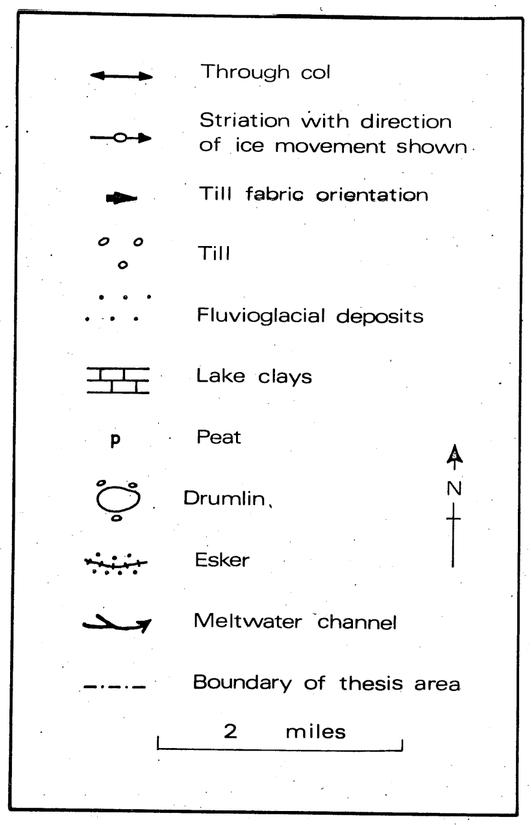
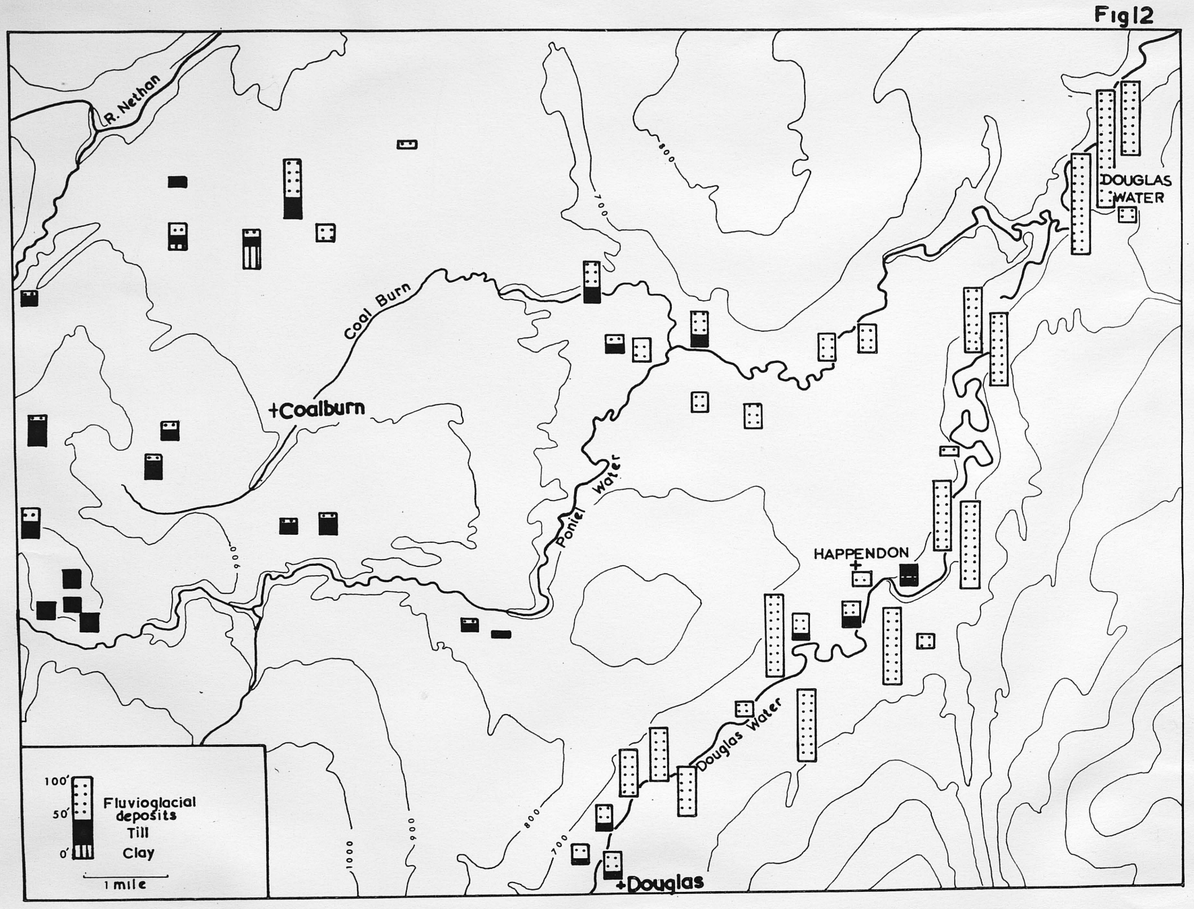
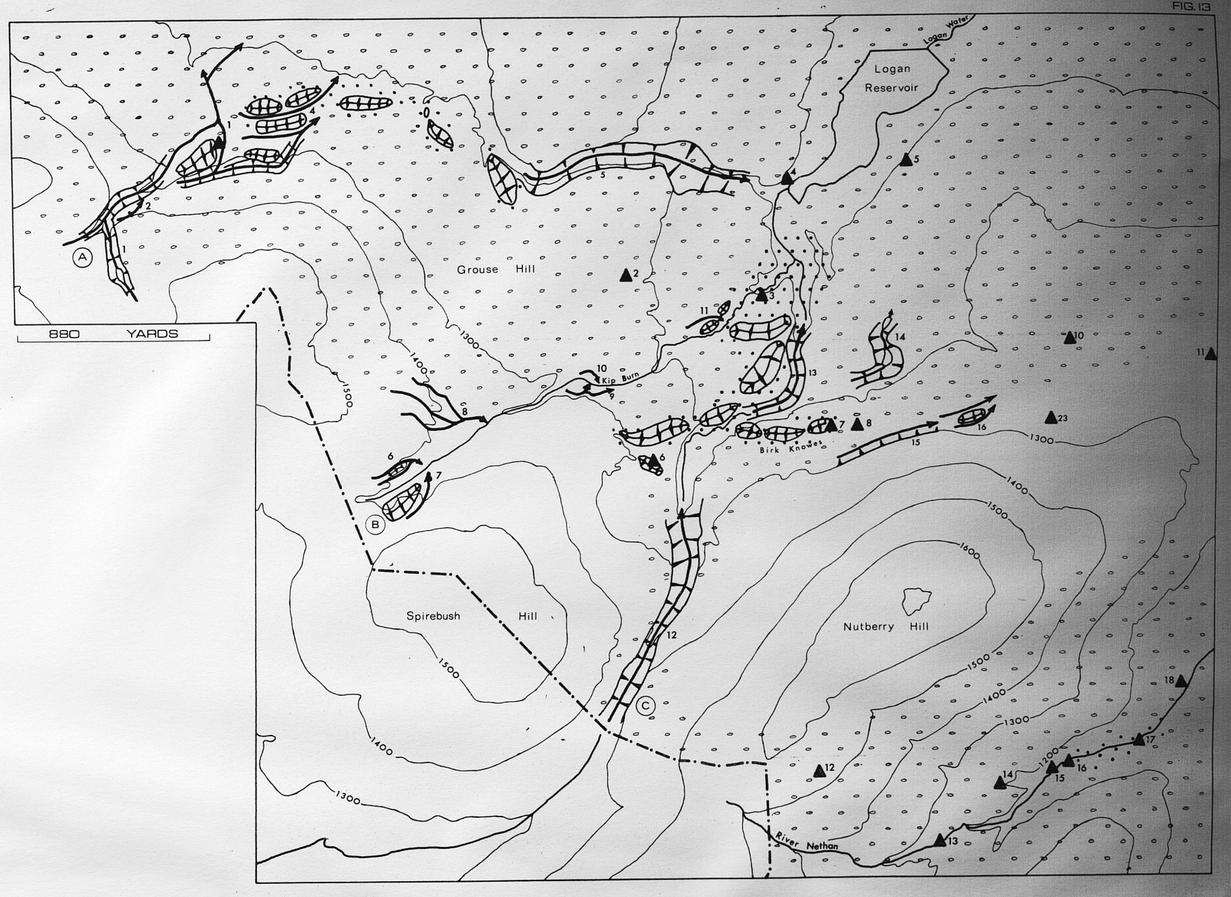

Through col
Striation with direction of ice movement shown
Till fabric orientation
Till
Fluvioglacial deposits
Lake clays
p
Peat
Drumlin
Esker
Meltwater channel
Boundary of thesis area
N
2 miles

Fig12



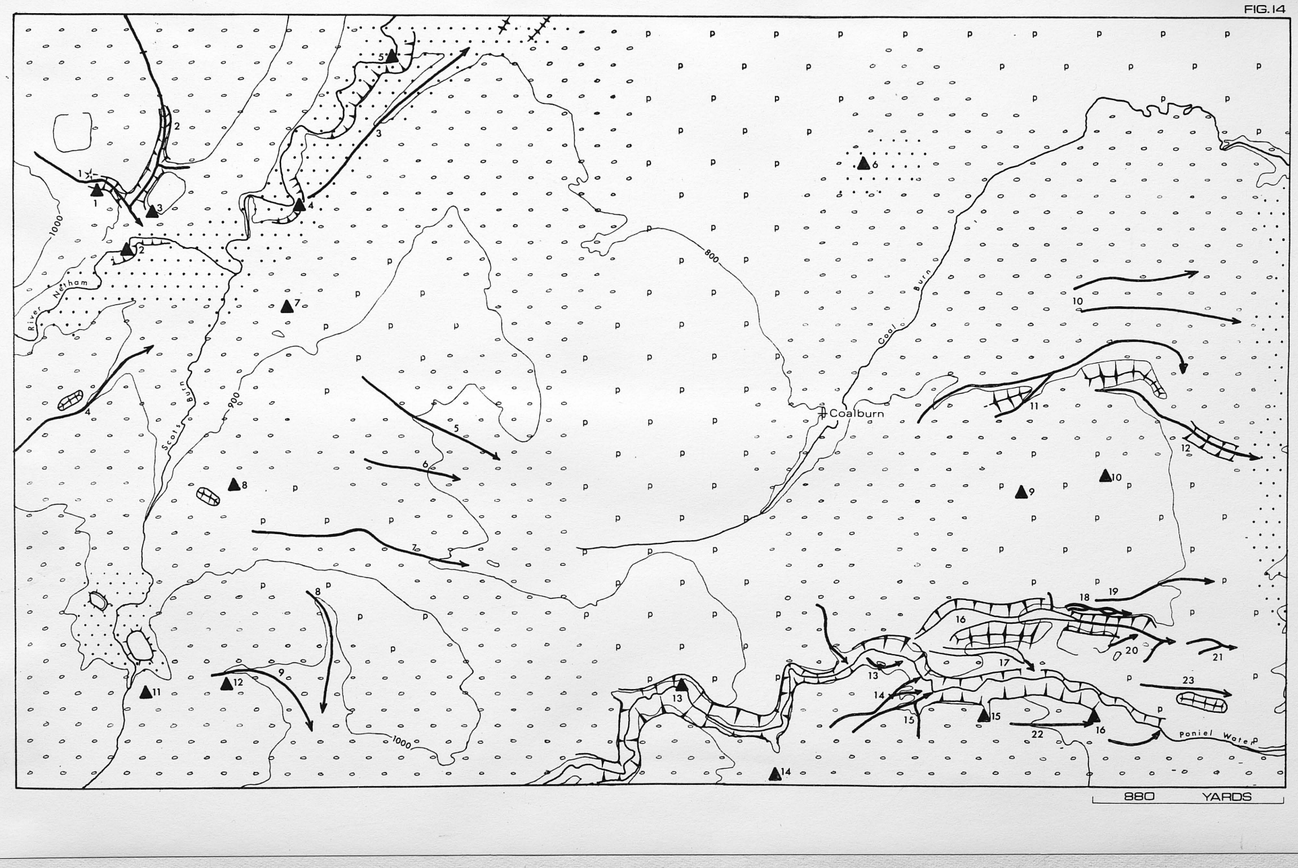
Coalburn / Douglas Area - Boreholes

FIG.13

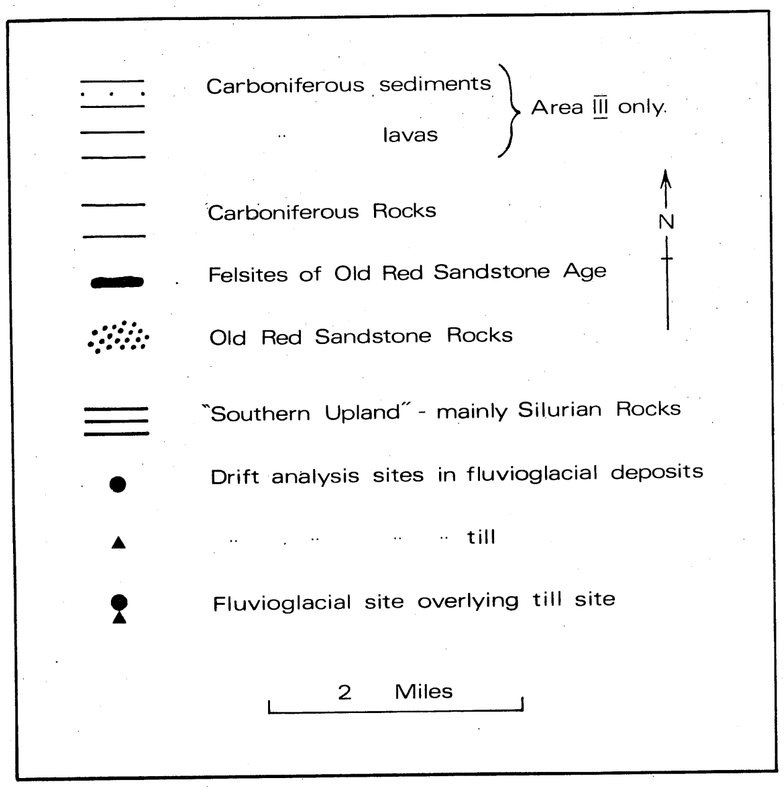


Logan District.

FIG.14

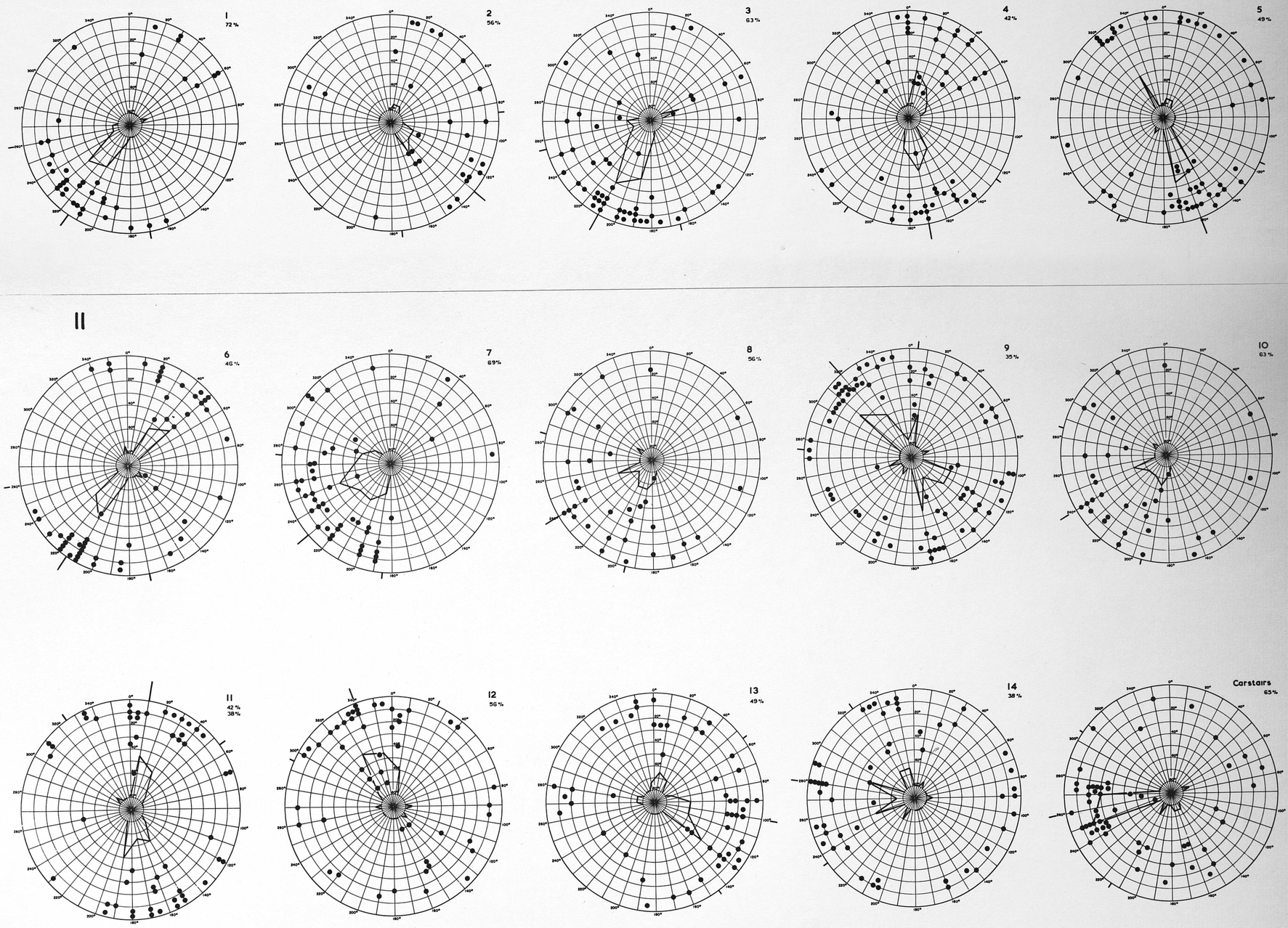


Coalburn District.

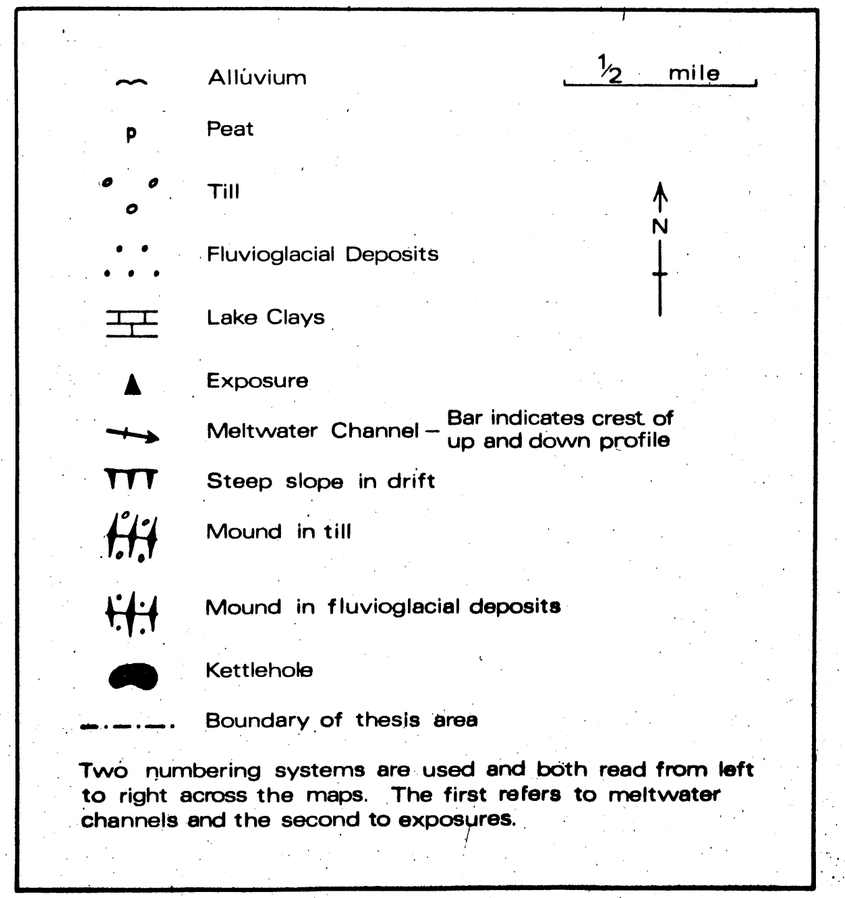

Carboniferous sediments
lavas
Area III only.
Carboniferous Rocks
Felsites of Old Red Sandstone Age
Old Red Sandstone Rocks
"Southern Upland" - mainly Silurian Rocks
Drift analysis sites in fluvioglacial deposits
till
Fluvioglacial site overlying till site
N
2 Miles

Area I

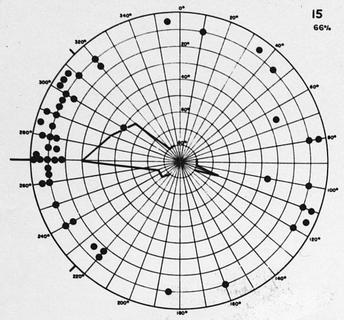
Fig 15

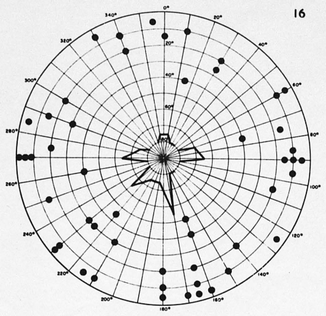


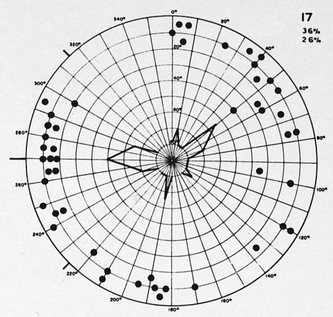
Till Fabric Diagrams.

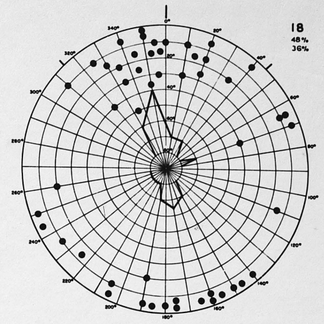

Allúvium
½ mile
p
Peat
Till
N
Fluvioglacial Deposits
Lake Clays
Exposure
Meltwater Channel – Bar indicates crest of up and down profile
Steep slope in drift
Mound in till
Mound in fluvioglacial deposits
Kettlehole
Boundary of thesis area
Two numbering systems are used and both read from left to right across the maps. The first refers to meltwater channels and the second to exposures.

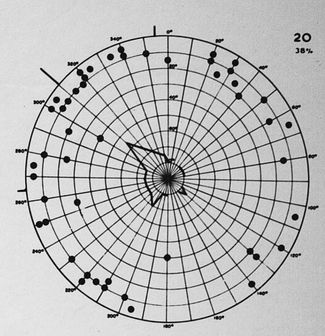
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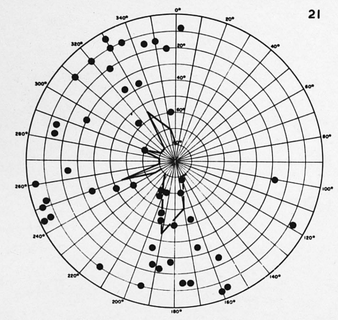


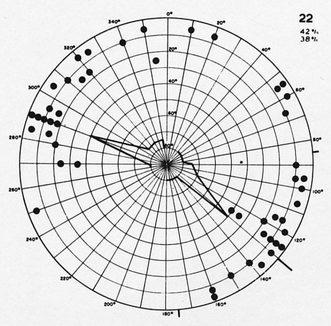


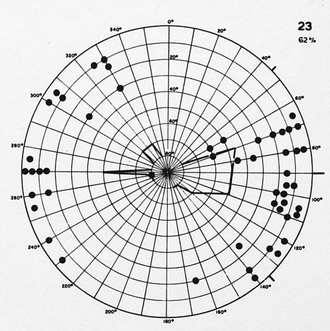


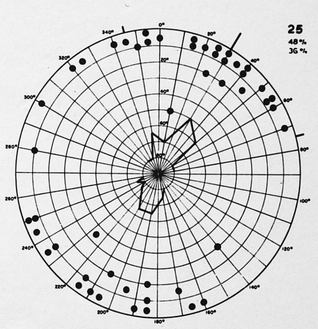


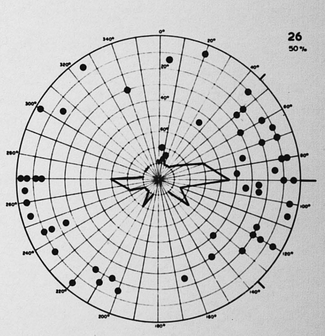


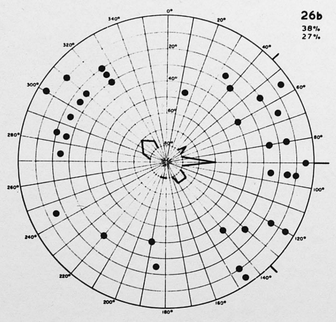


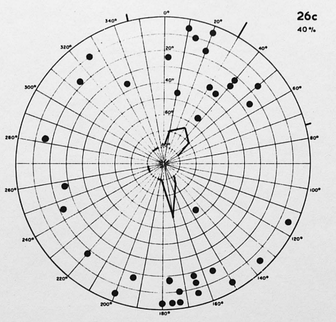


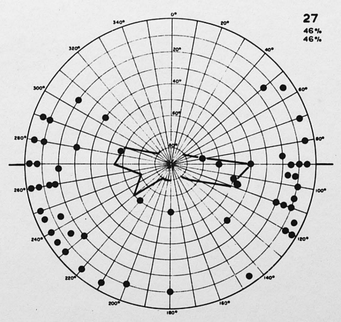


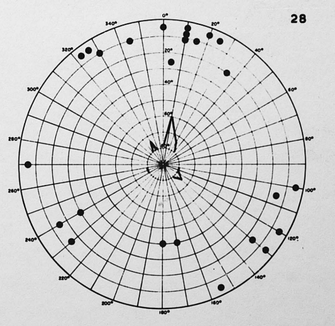


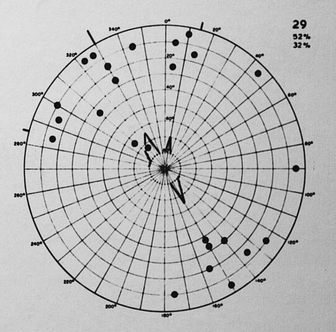


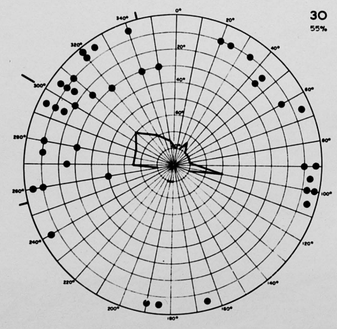


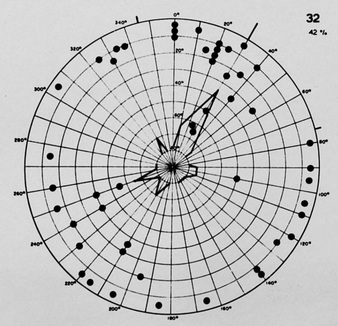












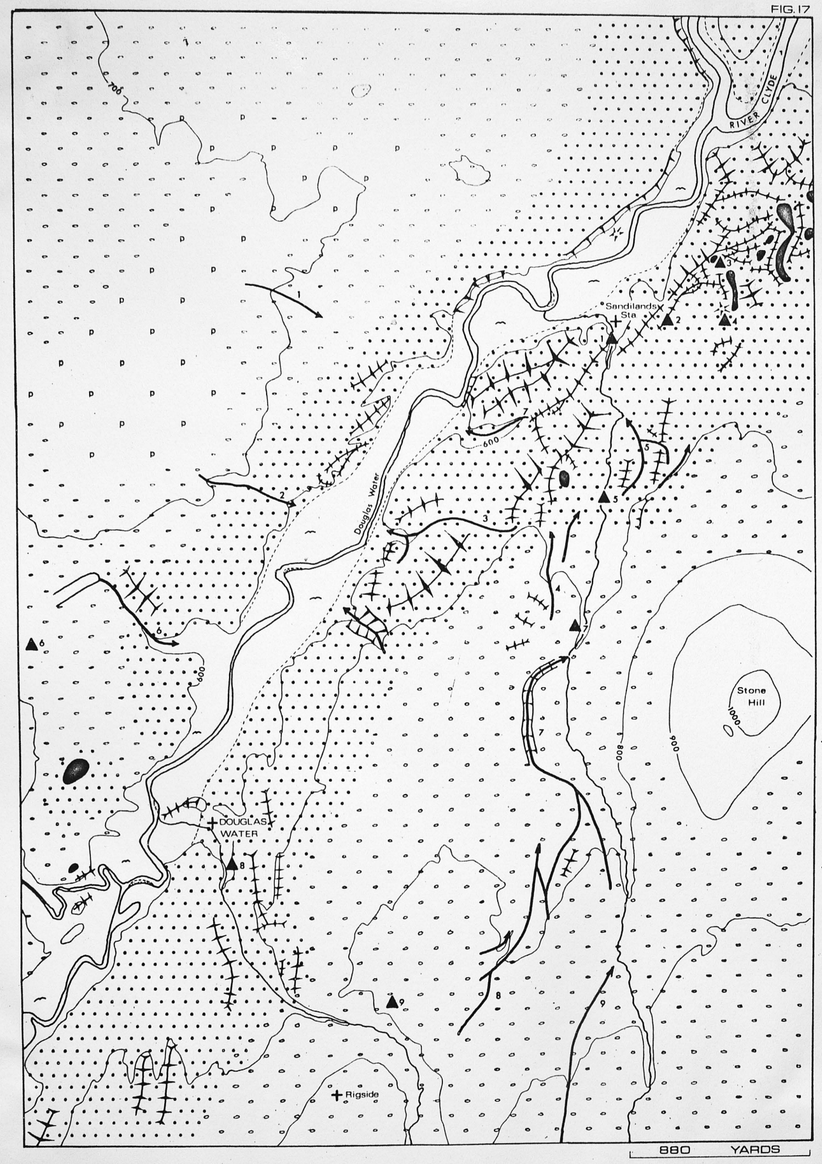
Till Fabric Diagrams

FIG. 16 TILL ROCK TYPE ANALYSIS

Area	Till No.	Percentage Content of Rocks Derived from:			
		"Highland"	"Carboniferous"	"Old Red Sandstone"	"Southern Upland"
I	1	-	68	26	6
	2	6	66	18	6
	3	-	56	22	14
	4	-	56	24	20
	5	-	44	40	16
	6	-	10	76	14
II	7	-	94	-	4
	8	-	96	-	2
	9	-	94	-	6
	10	-	82	14	4
	11	-	92	4	2
	12	2	88	8	2
	13	4	82	4	10
	14	-	58	24	14
III	15	2	76	4	18
	16	2	96	2	-
	17	-	24	4	72
	18	-	96	-	-
	19	-	100	-	-
	20	-	96	2	2
	21	-	100	-	-
	22	-	78	4	16
	23	2	92	-	2
	24	-	88	6	6
	25	6	84	8	-
	26	-	100	-	-
	27	-	100	-	-
	28	-	96	4	-
	29	2	90	4	4
	30	2	98	-	-
	31	4	88	2	2
	32	2	84	4	4
	33	2	92	2	4

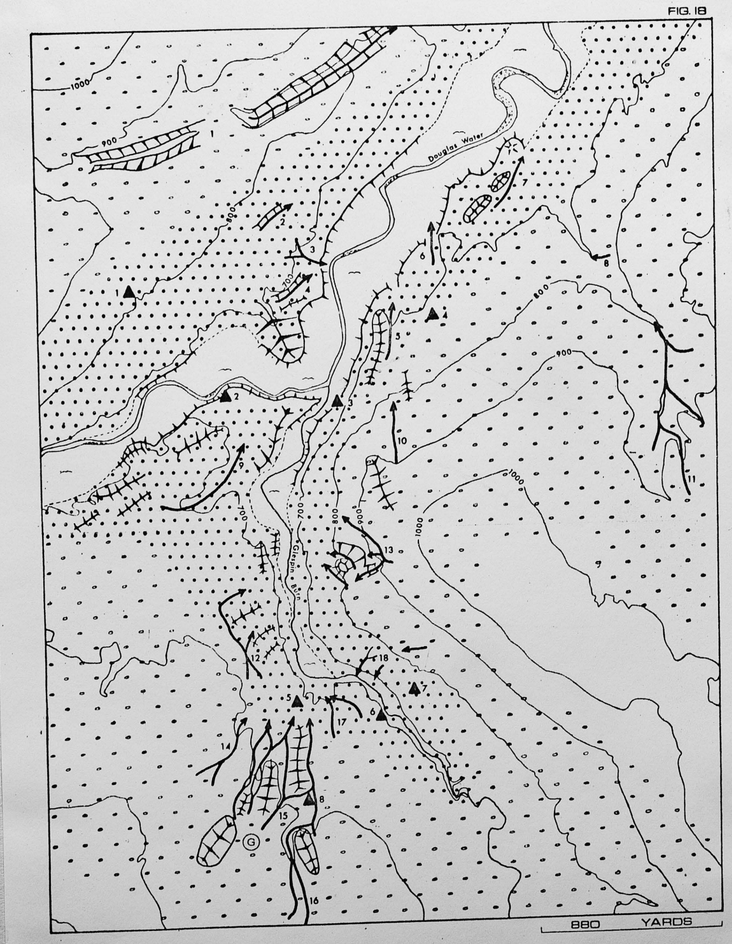
Deficit Percentage composed of unidentified rocks.

FIG. 17



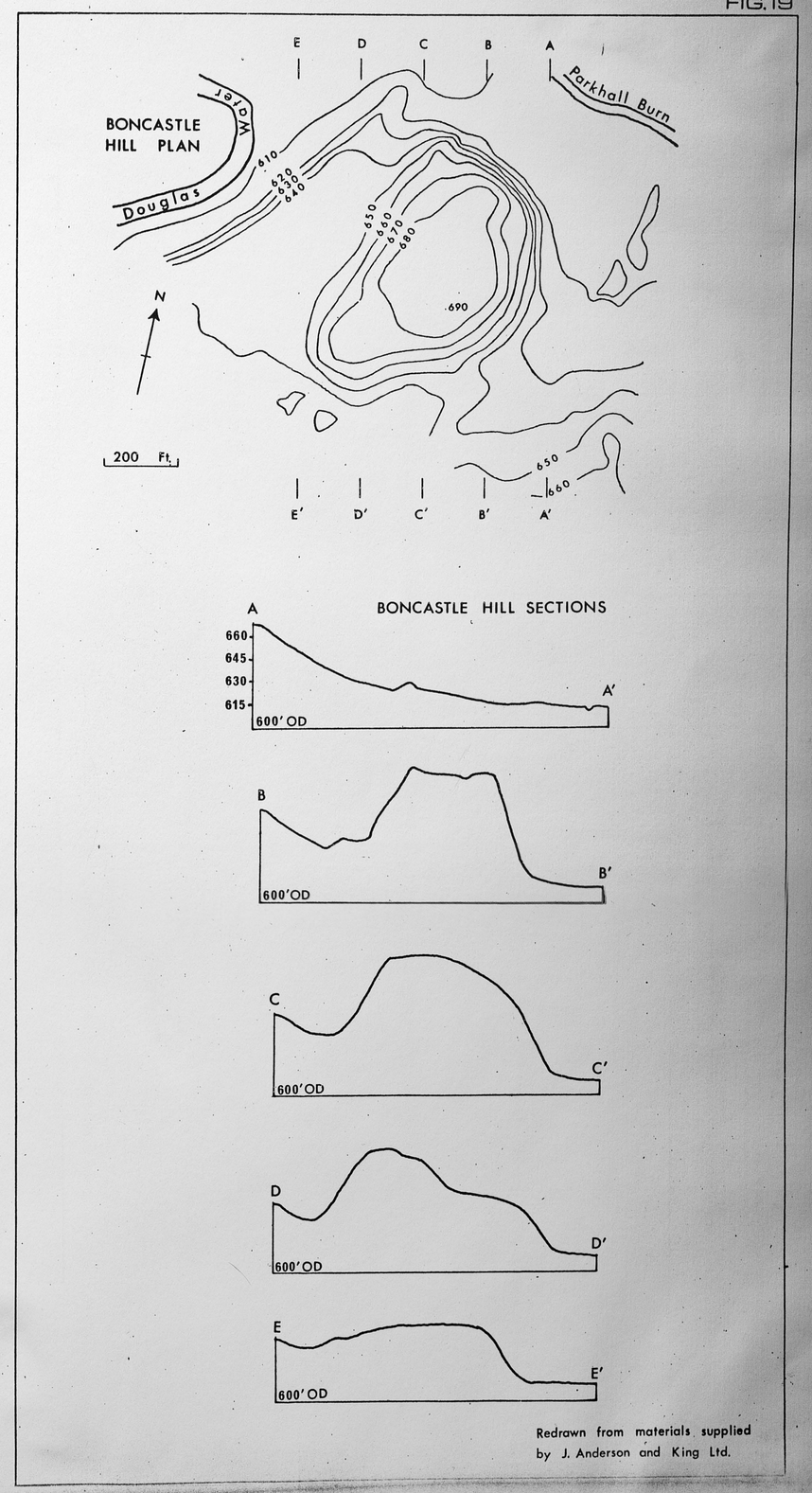
Lower Douglas Valley District

FIG. 18



Upper Douglas Valley District

FIG. 19



Redrawn from materials supplied by J. Anderson and King Ltd.

FIG. 20 GRAVEL ROCK TYPE ANALYSIS

Area	Gravel No.	Percentage of Rocks Derived from:			
		"Highland"	"Carboniferous"	"Old Red Sandstone"	"Southern Upland"
I	1	-	2	8	90
	2	-	36	34	30
	3	-	42	38	20
	4	-	24	28	48
	5	-	42	40	18
	6	-	56	22	22
	7	-	50	30	18
	8	2	46	40	12
	9	-	42	36	22
II	10	-	22	72	2
	11	4	26	47	20
	12	7	22	39	31
	13	1	29	42	15
	14	4	20	68	8
	15	3	26	59	7
	16	6	16	63	15
	17	-	10	52	28
	18	4	20	52	22
	19	-	19	50	31
	20	-	-	8	86
	21	-	-	20	76
	22	-	2	12	86
	23	-	12	68	20
	24	6	54	20	20
	25	12	60	18	10
	26	4	78	12	6
	27	10	64	24	2
	28	19	64	14	2
	29	2	88	8	2
III	30	6	94	-	-
	31	4	96	-	-
	32	-	96	4	-
	33	-	60	18	22
	34	2	42	2	54
	35	2	84	14	-
	36	-	98	2	-
	37	2	34	30	34
	38	2	44	42	2
	39	-	50	36	4
	40	6	68	8	14
	41	8	86	6	-
	42	8	84	4	-
	43	-	42	40	18
	44	4	36	42	18

Deficit Percentage composed of unidentified rocks.

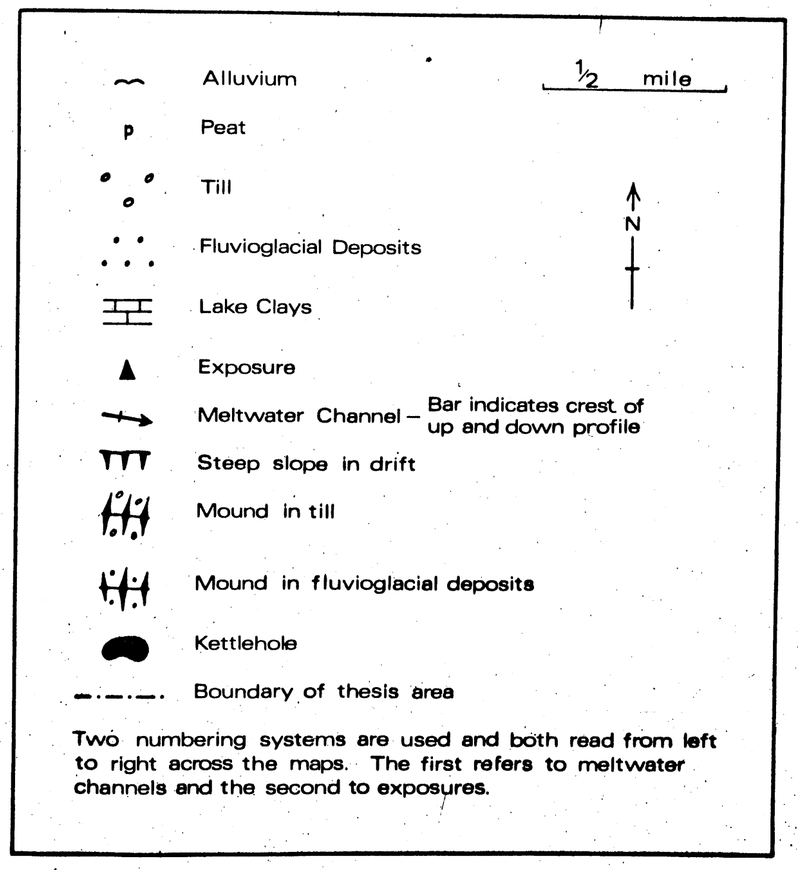
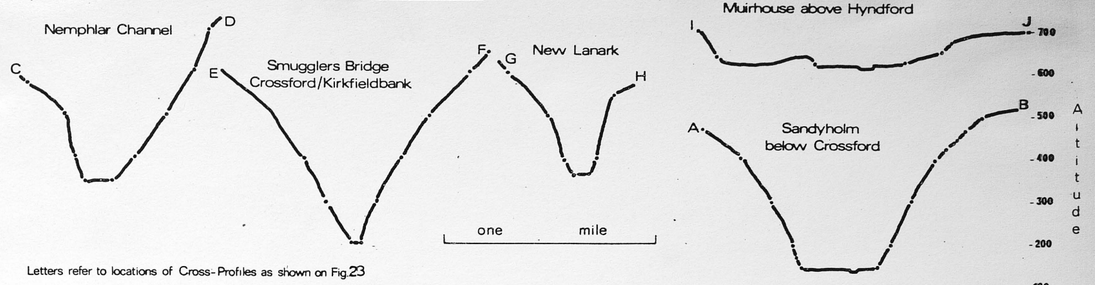

Alluvium
½ mile
p
Peat
Till
N
Fluvioglacial Deposits
Lake Clays
Exposure
Meltwater Channel – Bar indicates crest of up and down profile
Steep slope in drift
Mound in till
Mound in fluvioglacial deposits
Kettlehole
Boundary of thesis area
Two numbering systems are used and both read from left to right across the maps. The first refers to meltwater channels and the second to exposures.

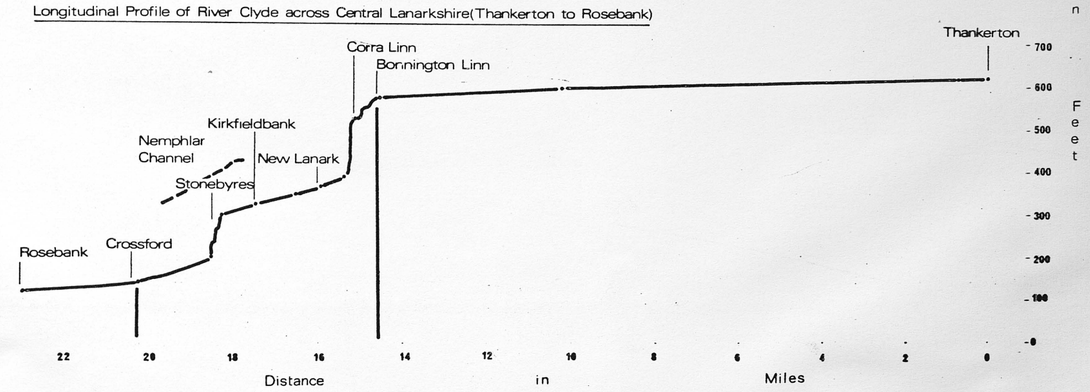
FIG.21

THE VARIOUS PROFILES OF THE CLYDE VALLEY

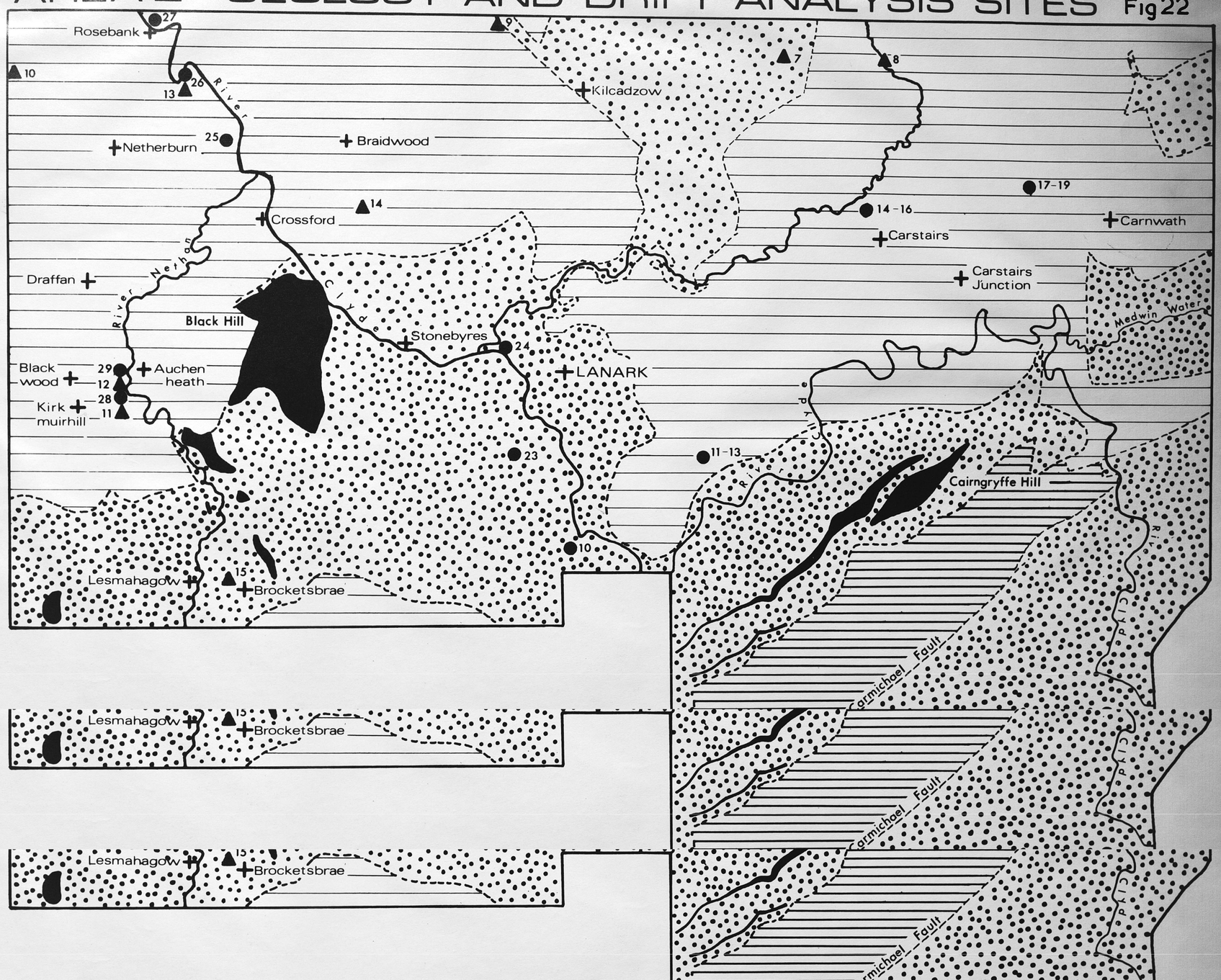


Letters refer to locations of Cross-Profiles as shown on Fig.23

Longitudinal Profile of River Clyde across Central Lanarkshire(Thankerton to Rosebank)



AREA 2 GEOLOGY AND DRIFT ANALYSIS SITES Fig 22



Area II Fig 23

A
B
C
D
E
F
G
H
I
J

Kilcadzow
Braidwood
Crossford
Nemphlar Channel
River Clyde
Cartland Muir
Draffan
Auchenheath
Blackwood
Kirkmuirhill
Nethan
River
Black Hill
Dillar Hill
Darnfillan Hill
Kirkfield Bank
LANARK
Cleghorn
Water
Mouse
Carstairs
Carnwath Burn
Carnwath
Medwin Water
Pettinain
Cairngryffe Hill
Bonnington
Corra Linn
Clyde
Hyndfordbridge
River
Bonnington Linn
Brocketsbrae
LESMAHAGOW
Carmichael Hill
Sandilands Station
Douglas Water
Shields
Drumalbin Burn
Quothquan Law
Thankerton
River Clyde
Broken Cross Muir
Stone Hill
Black Hill
Douglas Water
Ponteigh Burn
Carmichael Burn
Longmoor Hill
Tinto End
Tinto
Poniel Water
Garf Water
River Clyde
Douglas Water
Douglas

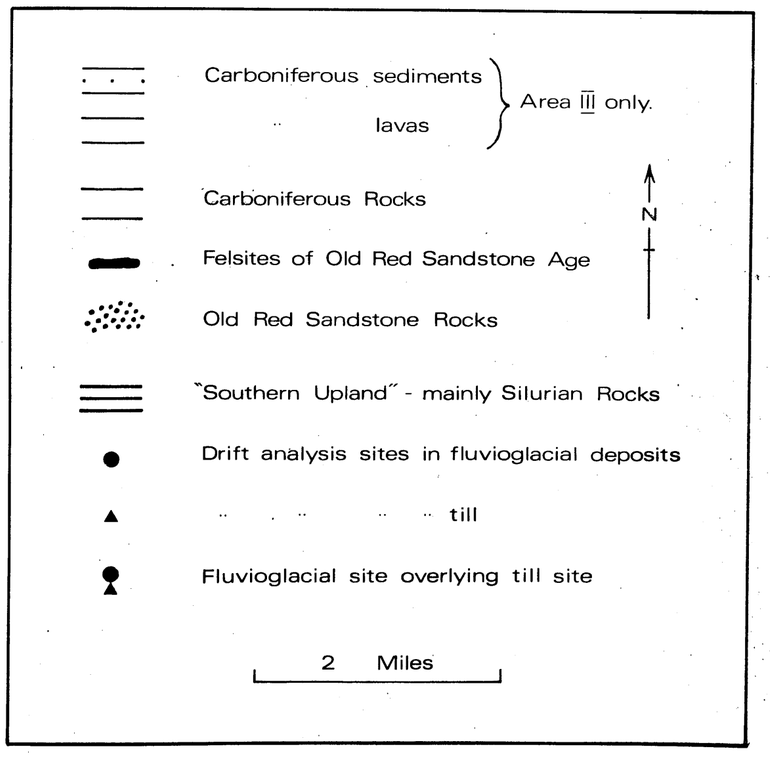

Carboniferous sediments
lavas
Area III only.
Carboniferous Rocks
Felsites of Old Red Sandstone Age
Old Red Sandstone Rocks
N
"Southern Upland" - mainly Silurian Rocks
Drift analysis sites in fluvioglacial deposits
till
Fluvioglacial site overlying till site
2 Miles

Fig 24

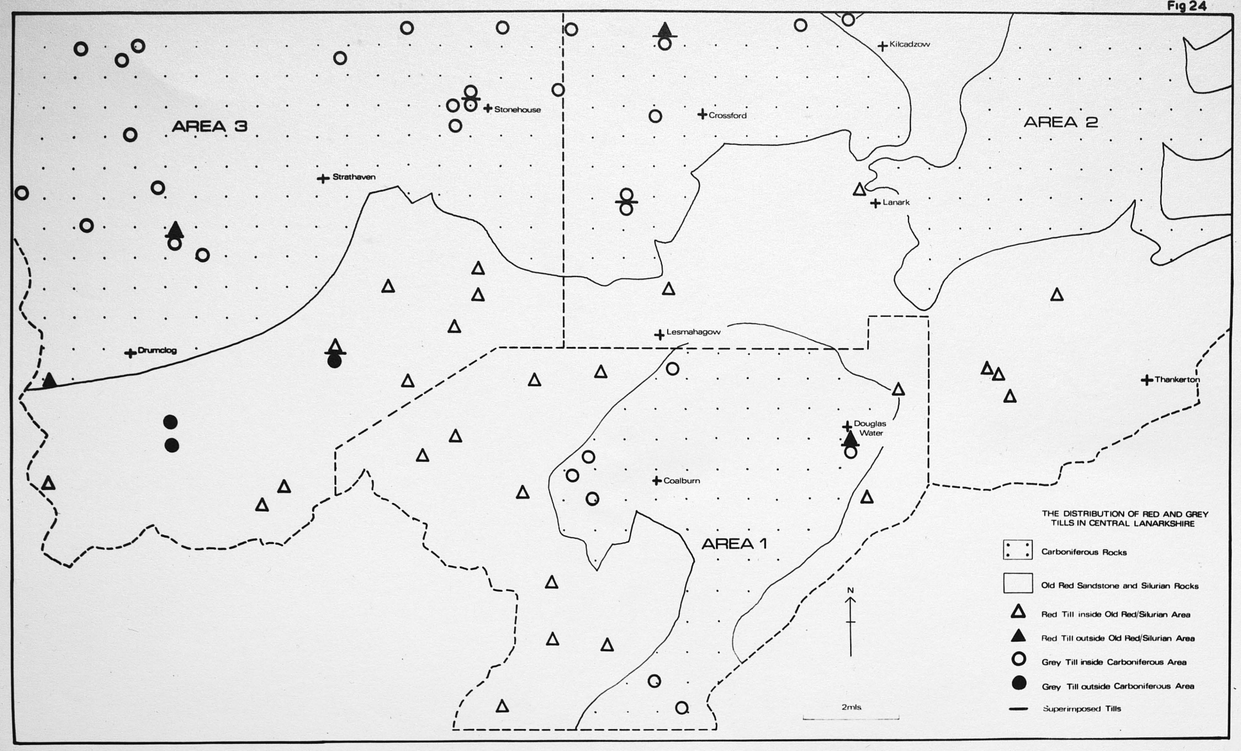
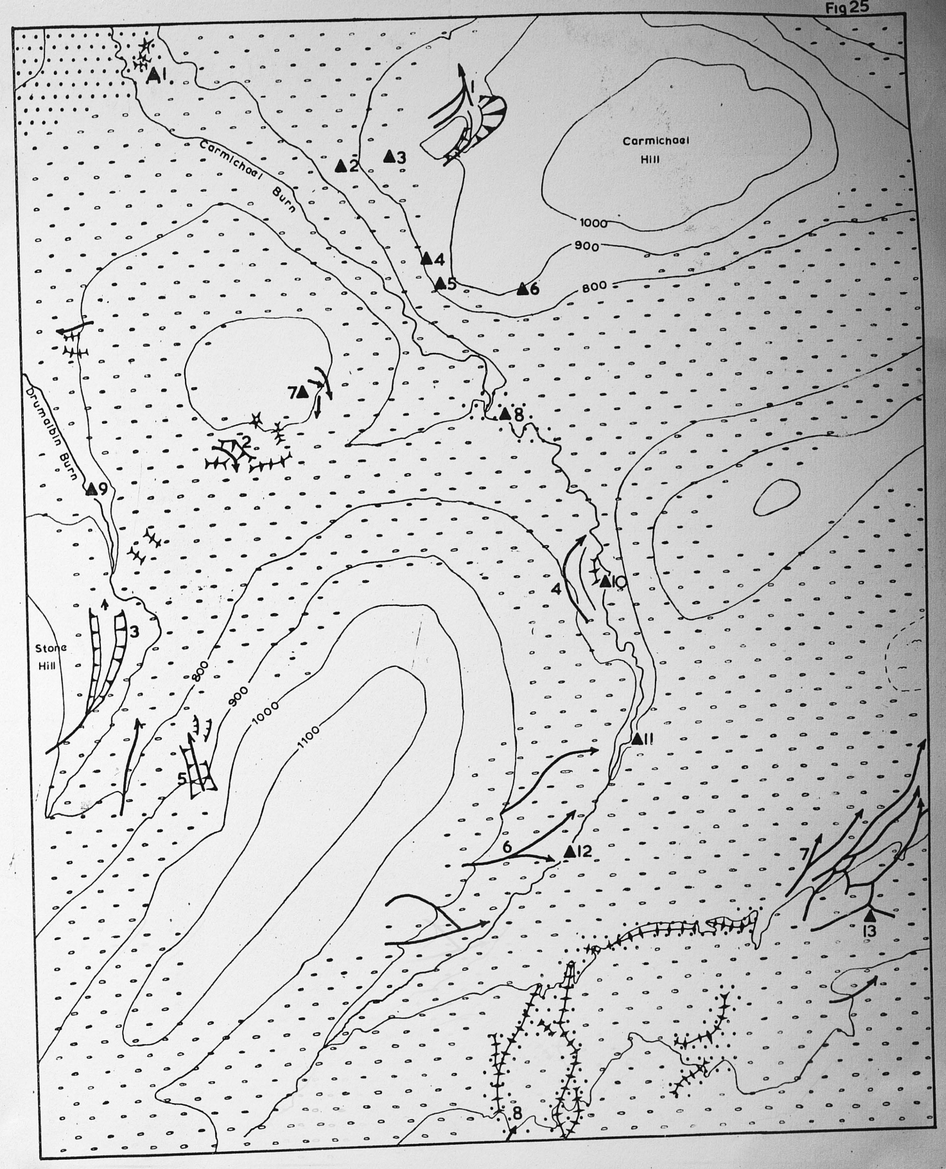


Fig 25



Carmichael District

Fig 26



Bonnington / Lanark District

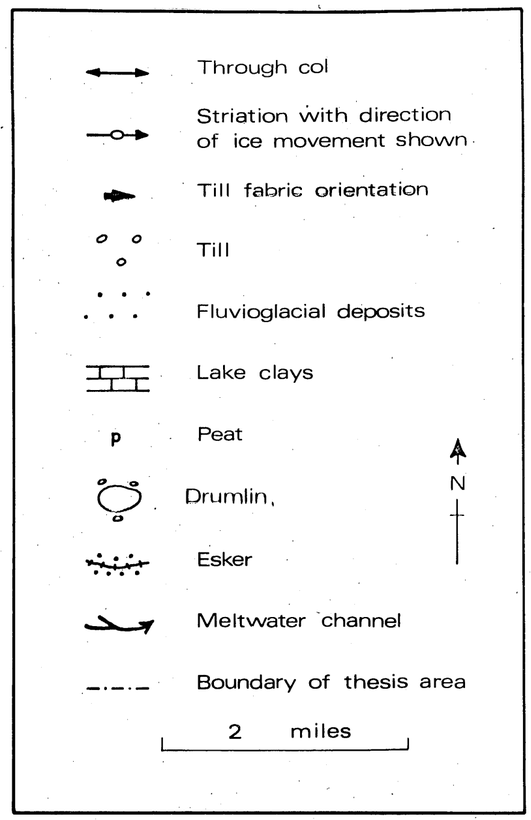

Through col
Striation with direction of ice movement shown
Till fabric orientation
Till
Fluvioglacial deposits
Lake clays
p
Peat
Drumlin
Esker
Meltwater channel
Boundary of thesis area
N
2 miles

FIG 27

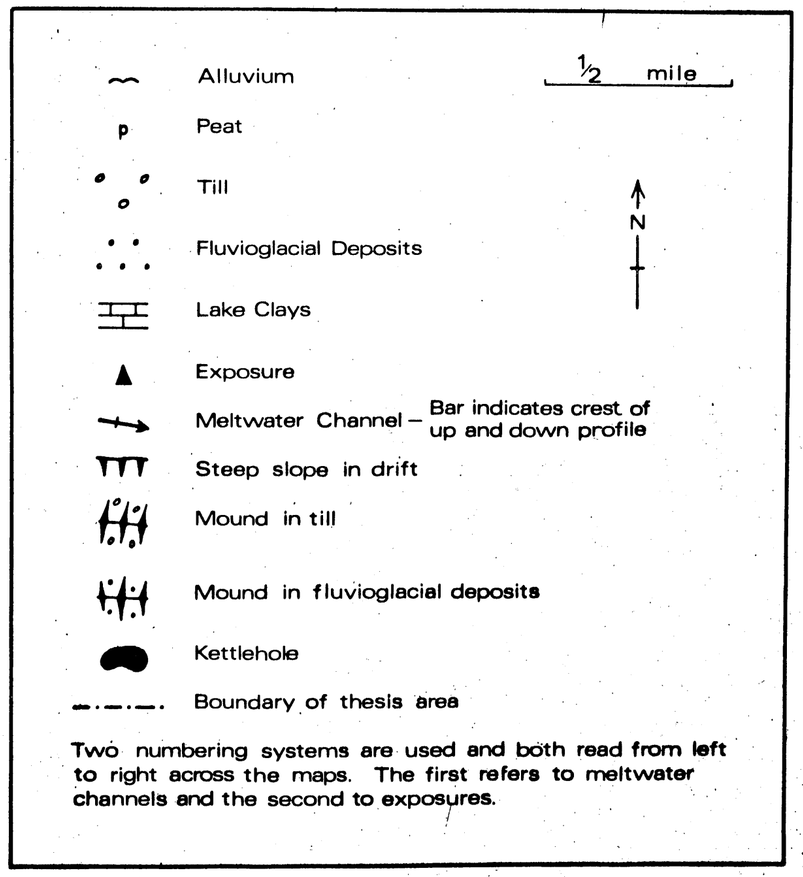
Shodshill Moss
Blacklaw Moss
Ryeflat Moss
Cranley Moss
Blackgate Moss
Woodend Moss
Carnwath Moss
Clydesdale Forest
Red Loch
White Loch
West End Wood
Cowford
Mouse Water
East End
Carstairs
Carstairs Station
Carnwath
Cleghorn Station
Carstairs Junction
700
880 YARDS

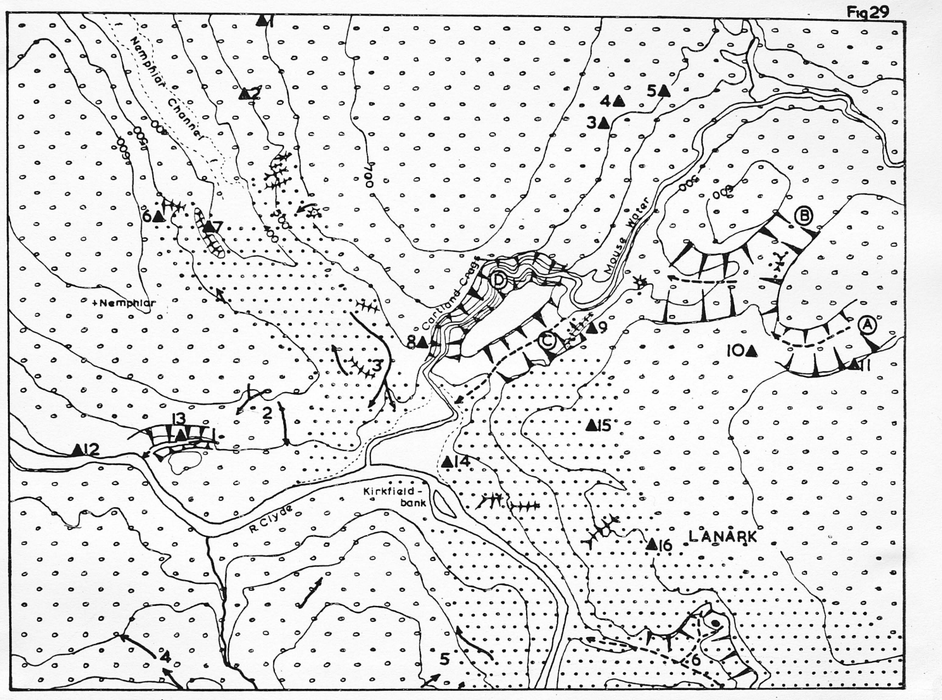
Carstairs District

Fig 28

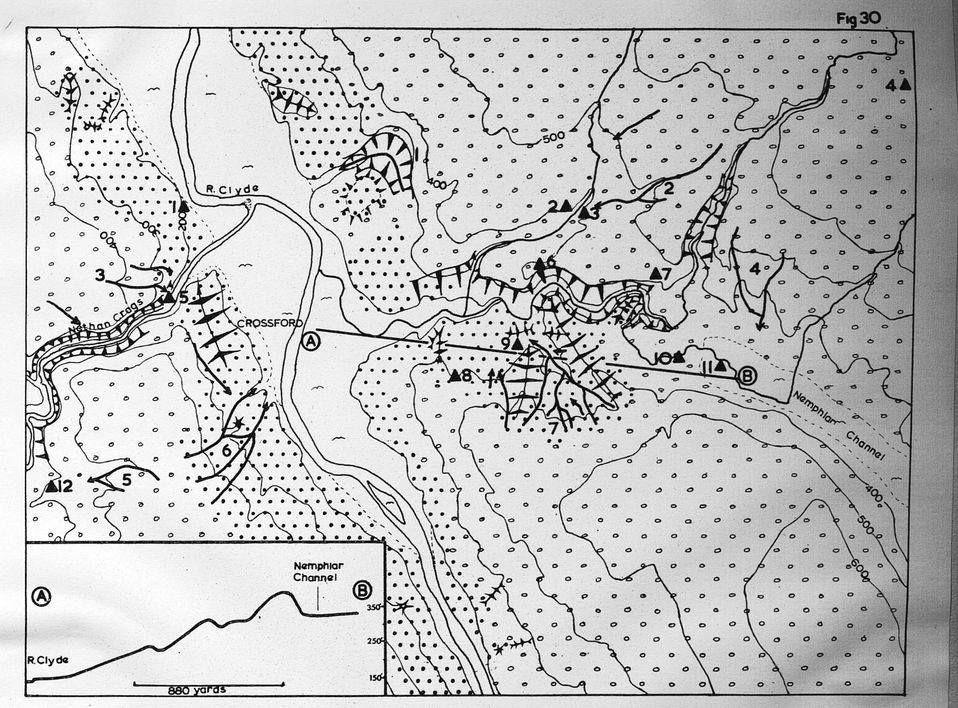
Conder Water
Draffan
R. Nethan
Southfield
Blackwood
Kirkmuirhill
Auchenheath
600

Blackwood / Auchenheath District


Alluvium
½ mile
p
Peat
Till
N
Fluvioglacial Deposits
Lake Clays
Exposure
Meltwater Channel – Bar indicates crest of up and down profile
Steep slope in drift
Mound in till
Mound in fluvioglacial deposits
Kettlehole
Boundary of thesis area
Two numbering systems are used and both read from left to right across the maps. The first refers to meltwater channels and the second to exposures.



South End of Nemphlar Channel



North End of Nemphlar Channel.

Bonnington Tunnel Excavations 31

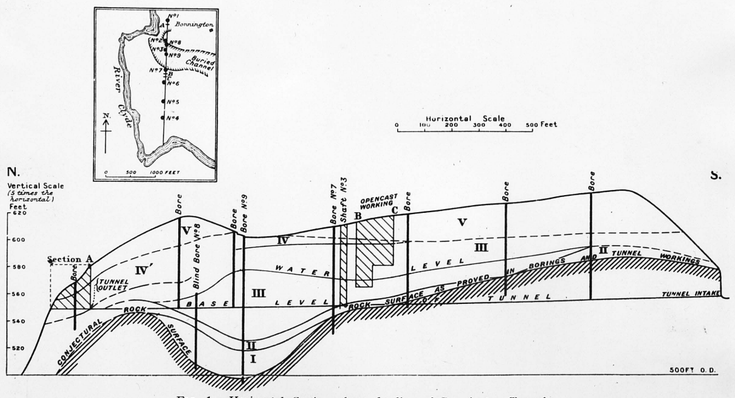
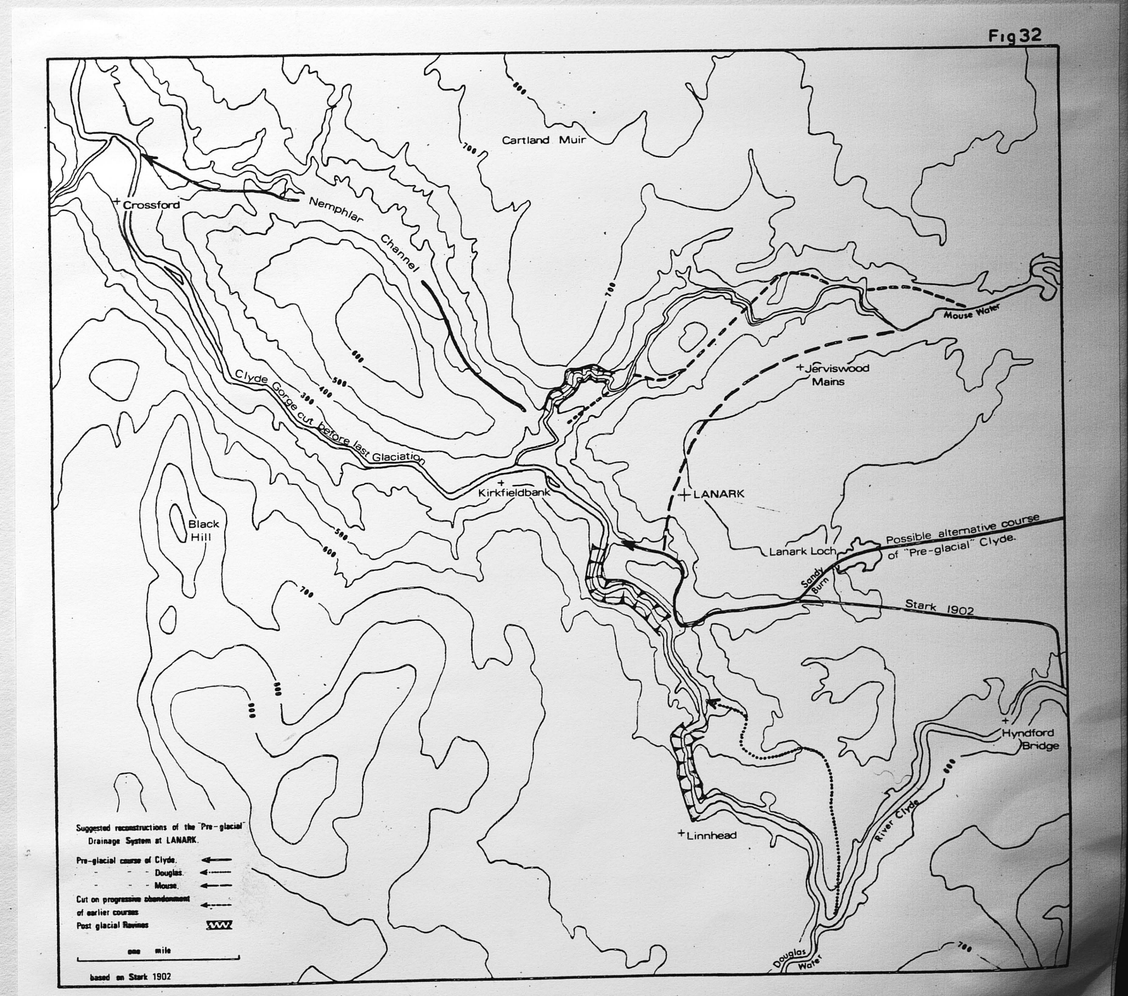


FIG. 1.—*Horizontal Section along the line of Bonnington Tunnel.*

(Geol. Survey Mem).



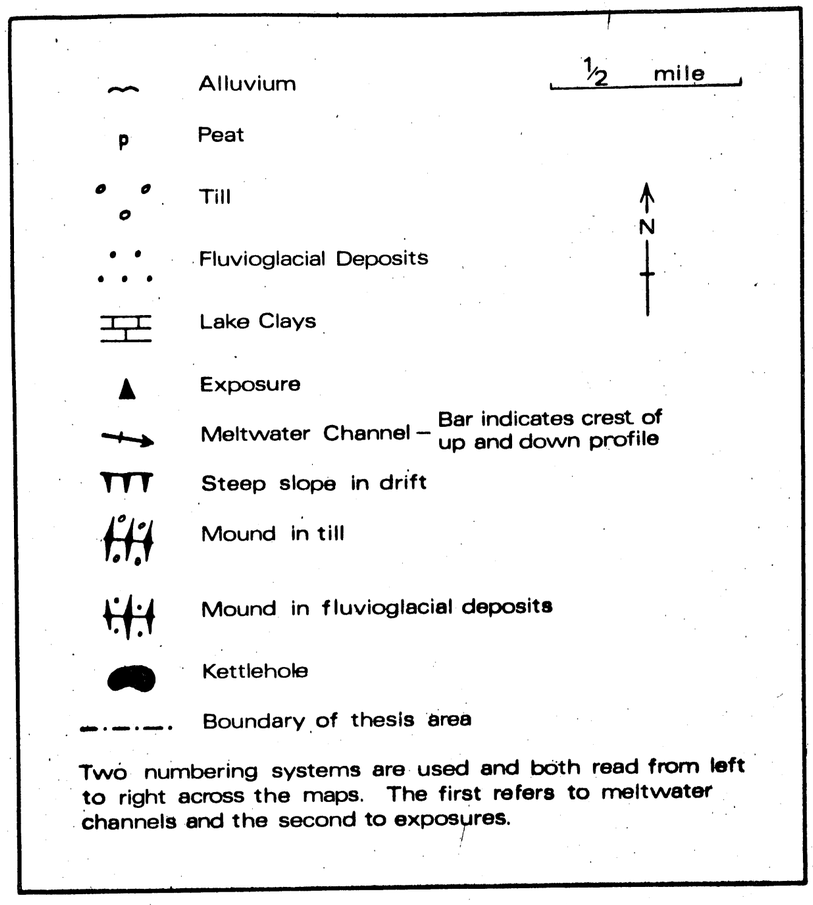
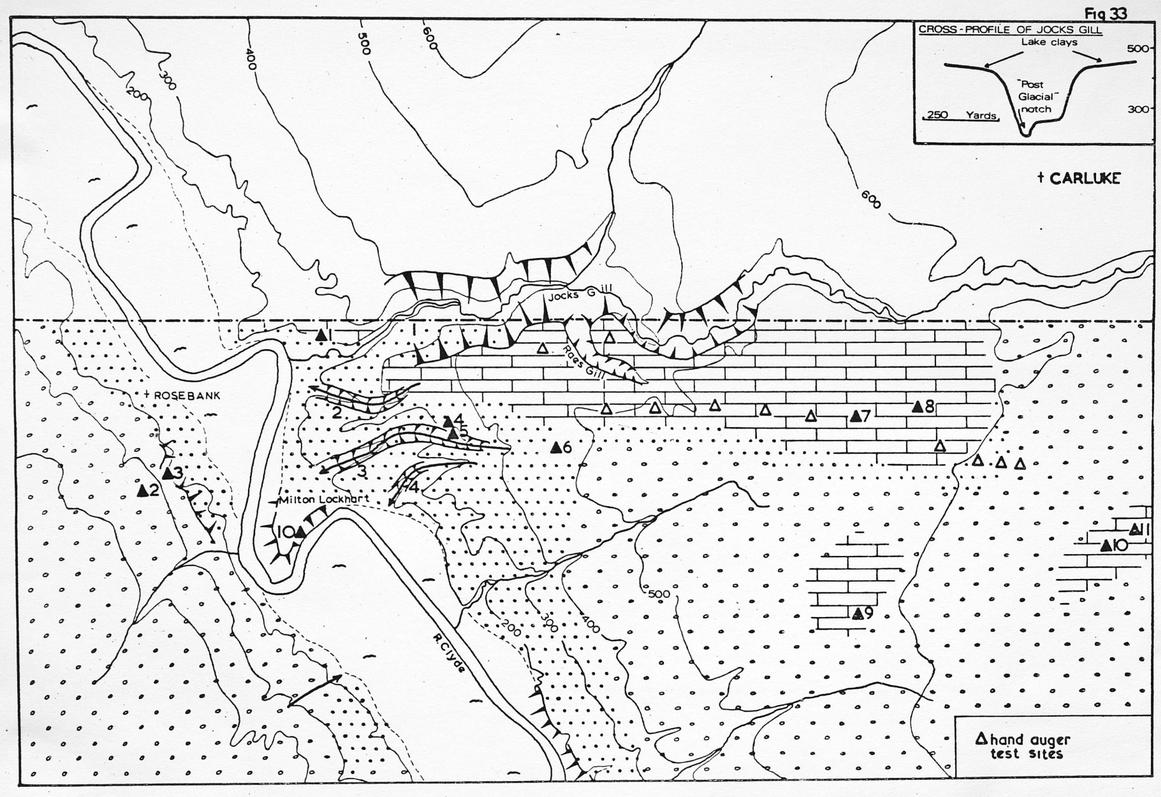

½ mile
N
Alluvium
p
Peat
Till
Fluvioglacial Deposits
Lake Clays
Exposure
Meltwater Channel – Bar indicates crest of up and down profile
Steep slope in drift
Mound in till
Mound in fluvioglacial deposits
Kettlehole
Boundary of thesis area
Two numbering systems are used and both read from left to right across the maps. The first refers to meltwater channels and the second to exposures.

Fig 33



Jocks Gill District

Fig 34 Ice Contact Position and Landforms near Bonnington

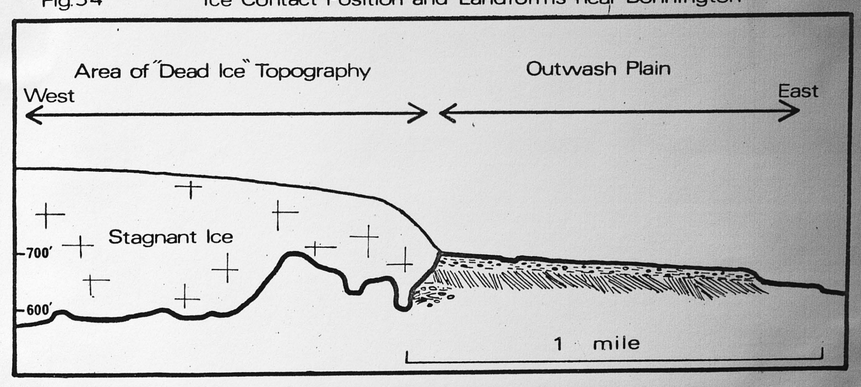
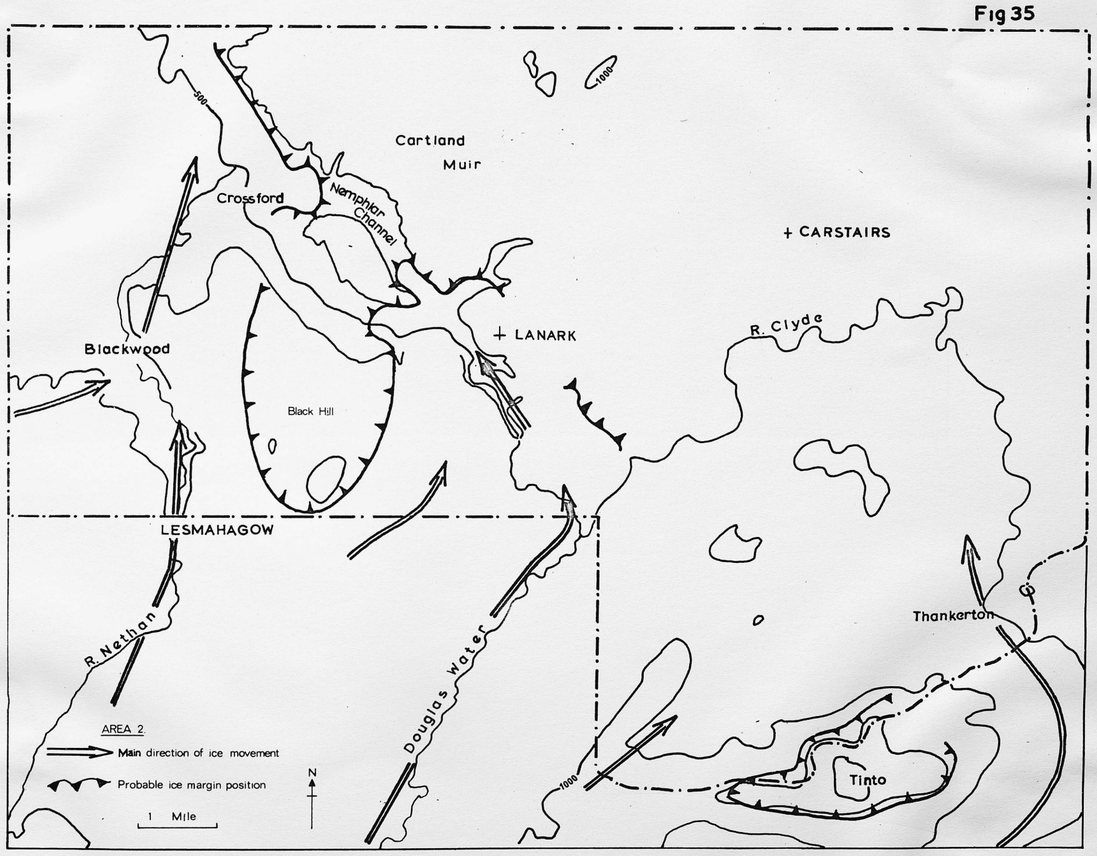
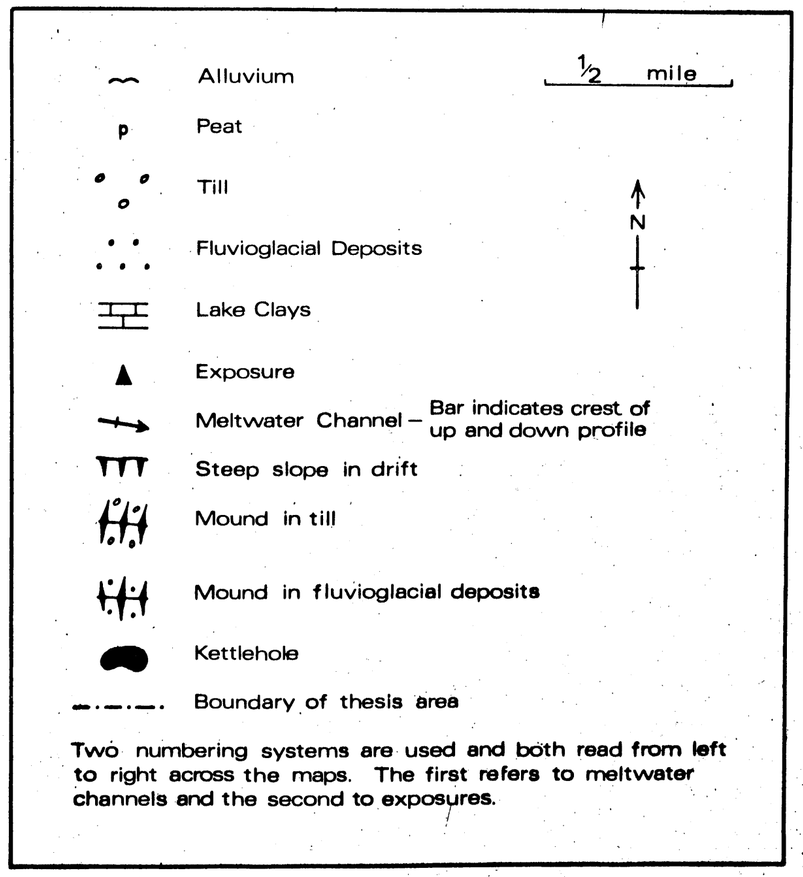


Fig 35



Ice Movements and Ice Limits in Area 11


Alluvium
½ mile
p
Peat
Till
N
Fluvioglacial Deposits
Lake Clays
Exposure
Meltwater Channel – Bar indicates crest of up and down profile
Steep slope in drift
Mound in till
Mound in fluvioglacial deposits
Kettlehole
Boundary of thesis area
Two numbering systems are used and both read from left to right across the maps. The first refers to meltwater channels and the second to exposures.


Cladance Moss
Powmillon Burn
Chapelton
Glassford
Stonehouse
Ardoch Rig
Ell Rig
STRATHAVEN
Cander Water
Yards Hill
Sandford
Browncastle
Galder Water
Queyholm
Avon Water
Deadwaters
Boghead
Caldermill
Lochar Water
Hairshaw Hill
Gainerhill
Kypes Rig
Kype Water
Loudoun Hill
Kepple Moss
Glengavel Water
Halls Burn
Feeshie Moss
Berry Moss
Cairnsaigh Hill
Avon Water
Waterhead
Mill Rig
Dungavel Hill
Auchengilloch Hill
Powbrone Burn
Woollenk Burn
Anderside Hill
Bankend Rig
Black Loch Moss

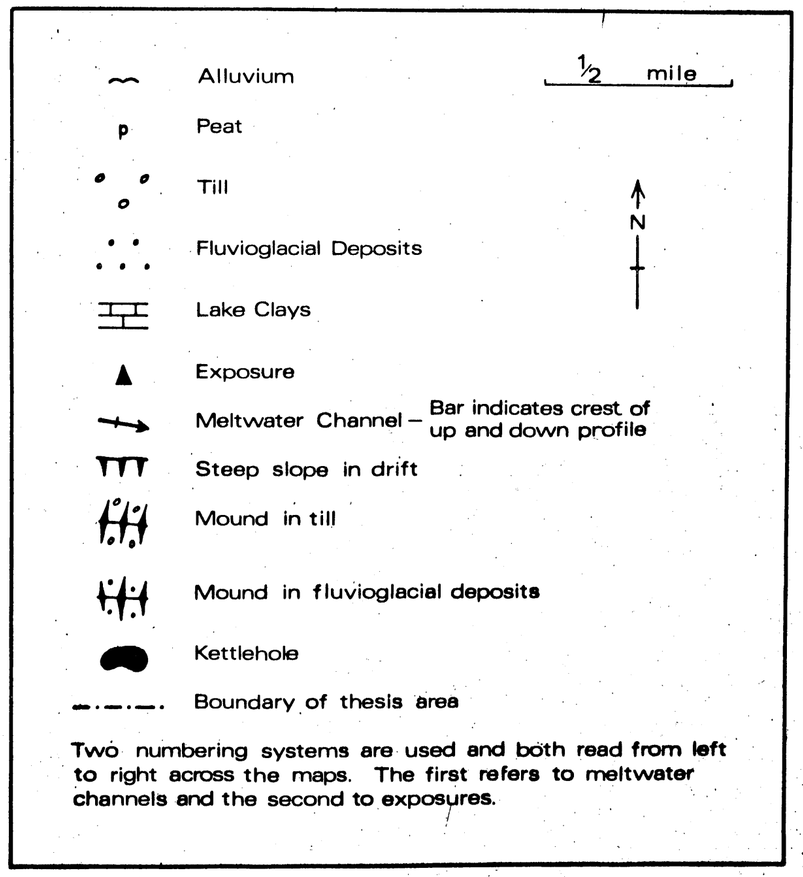
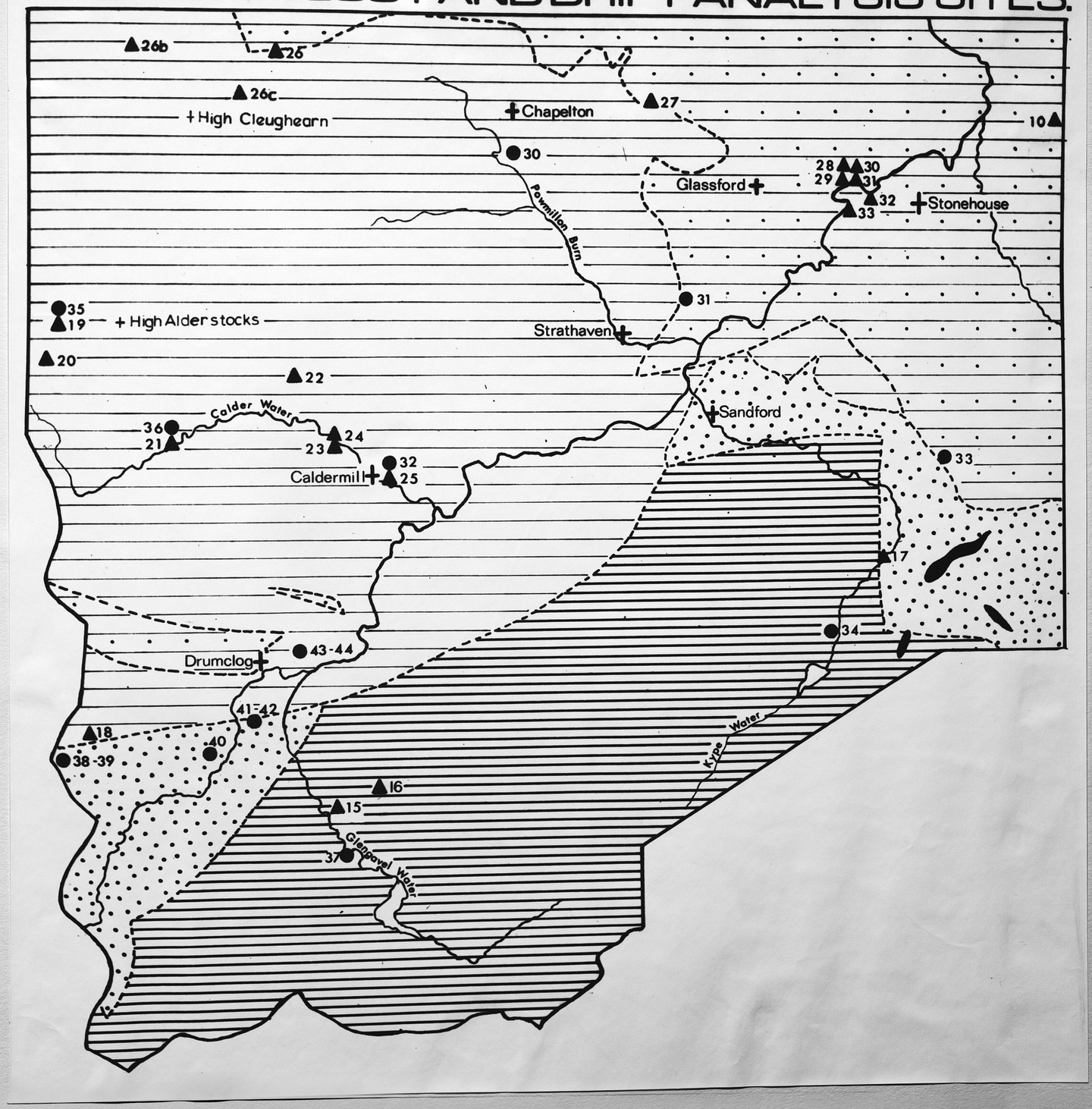

Alluvium
½ mile
p
Peat
Till
N
Fluvioglacial Deposits
Lake Clays
Exposure
Meltwater Channel – Bar indicates crest of up and down profile
Steep slope in drift
Mound in till
Mound in fluvioglacial deposits
Kettlehole
Boundary of thesis area
Two numbering systems are used and both read from left to right across the maps. The first refers to meltwater channels and the second to exposures.

FIG. 37

AREA 3. GEOLOGY AND DRIFT ANALYSIS SITES.



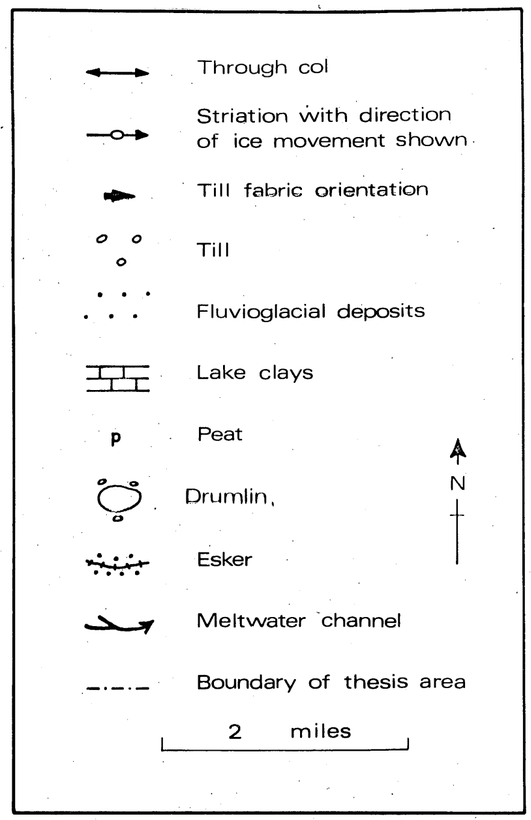
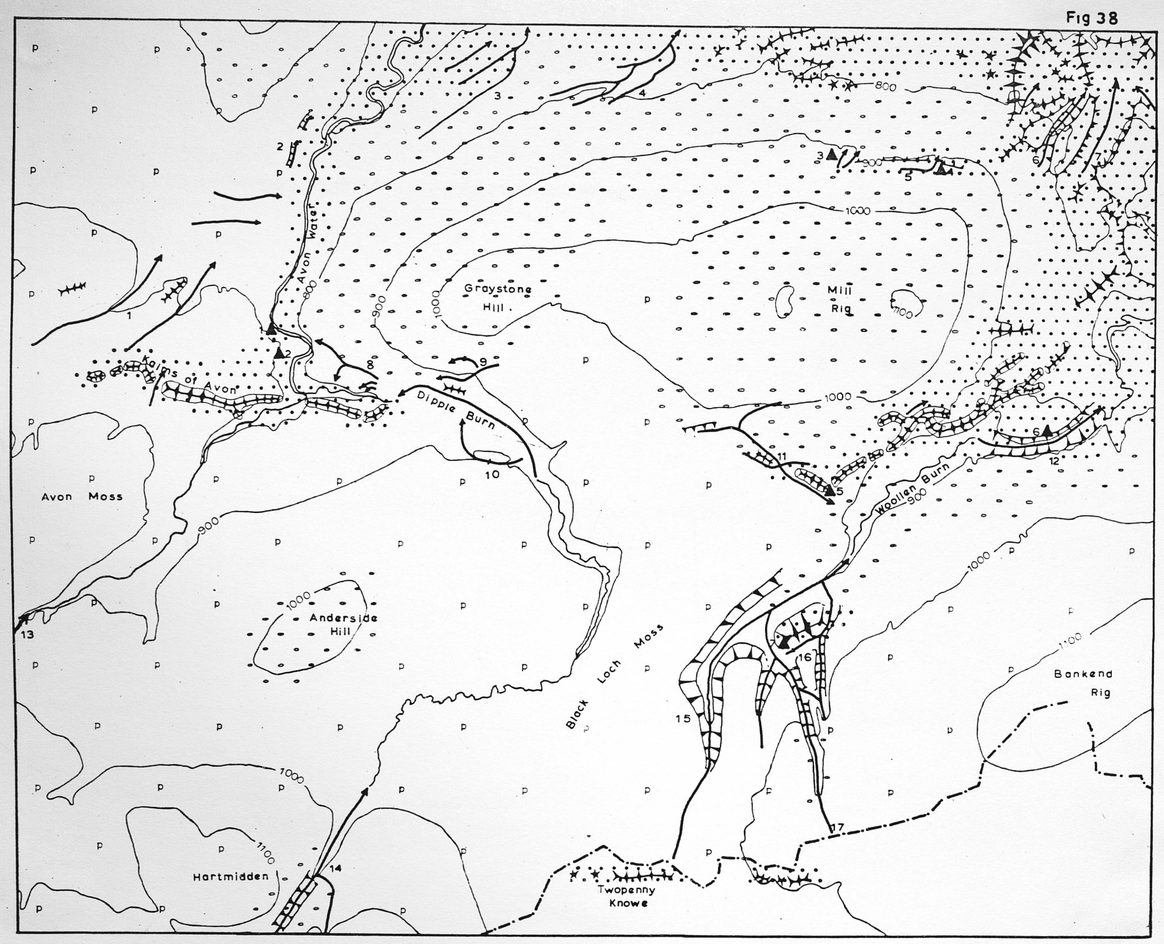
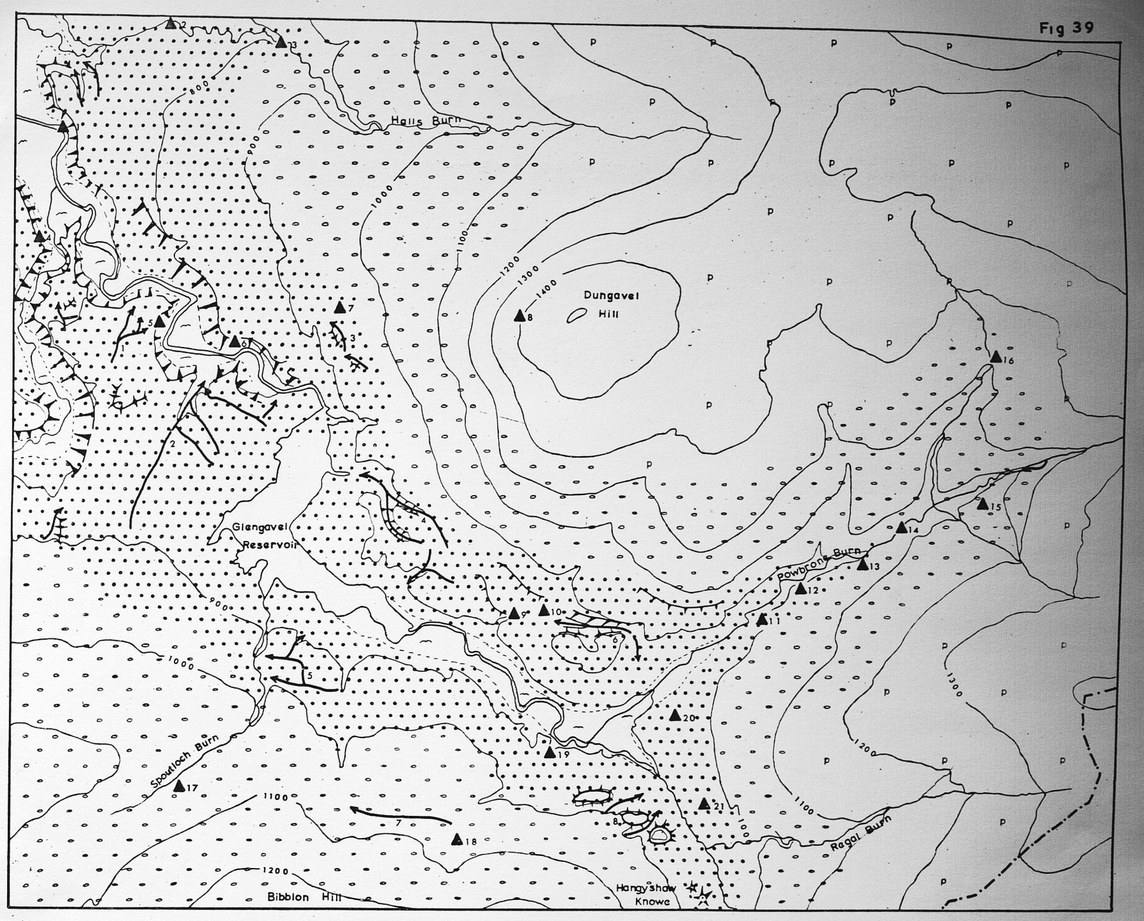

Through col
Striation with direction of ice movement shown
Till fabric orientation
Till
Fluvioglacial deposits
Lake clays
p
Peat
Drumlin
Esker
Meltwater channel
Boundary of thesis area
N
2 miles

Fig 38



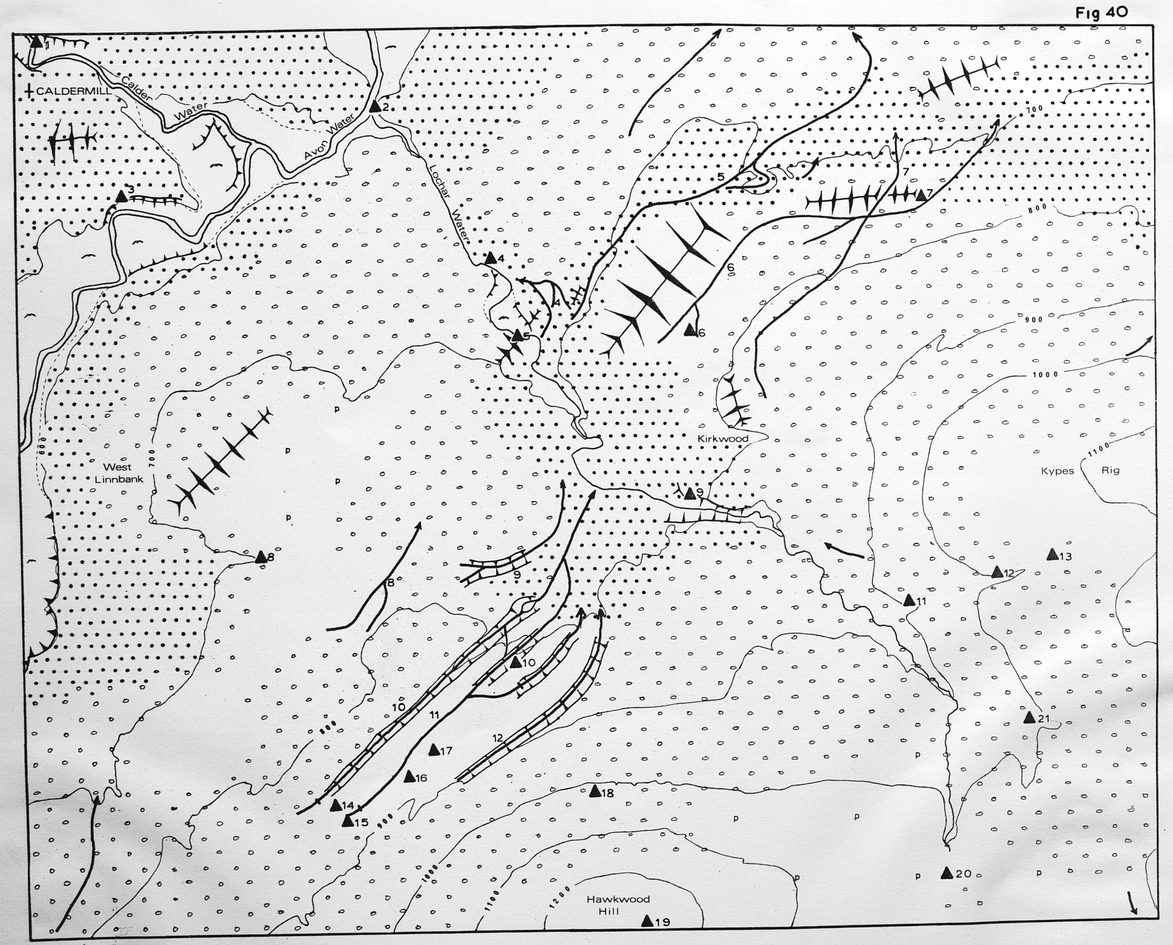
Woollen Burn / Kames of Avon District

Fig 39



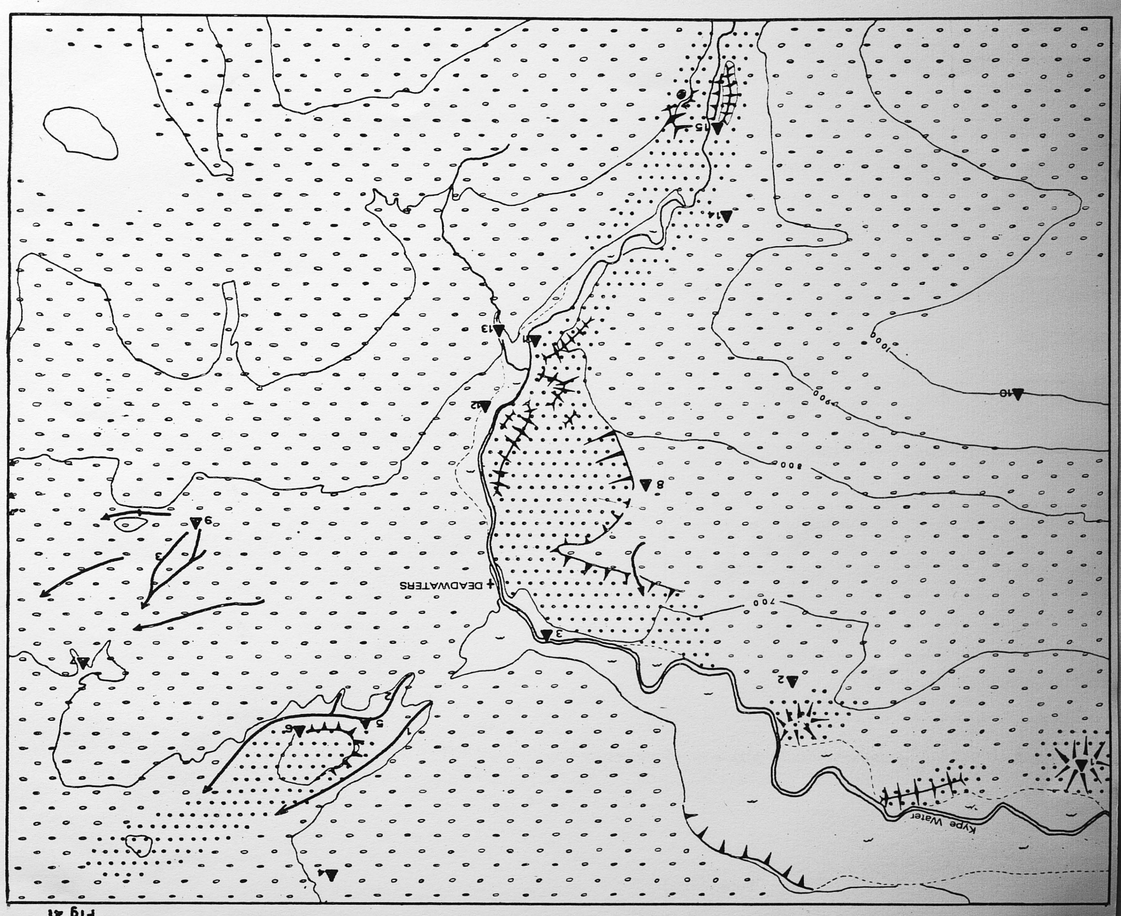
Upper Glengavel District

Fig 40



Lochar District

Fig 41



Deadwaters District

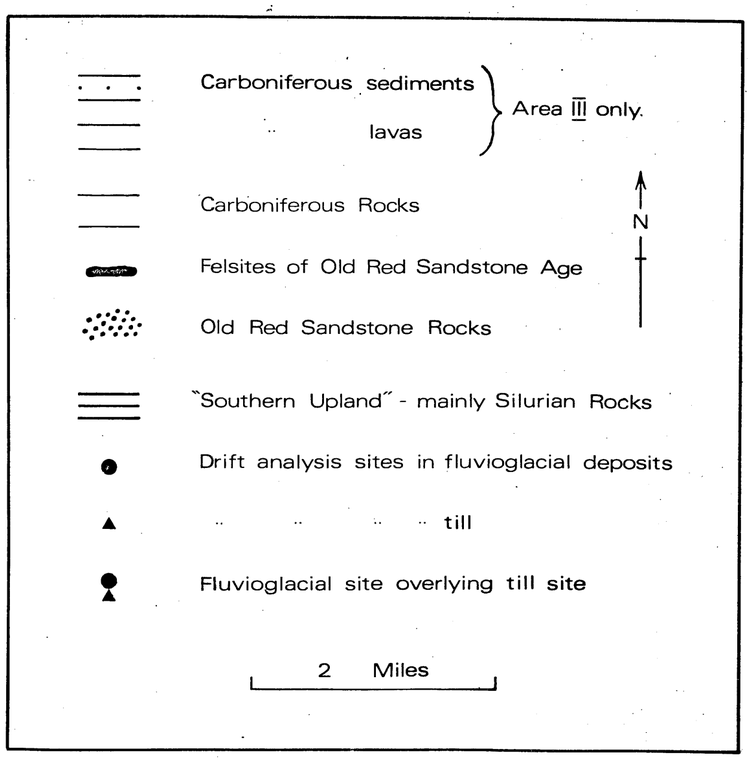
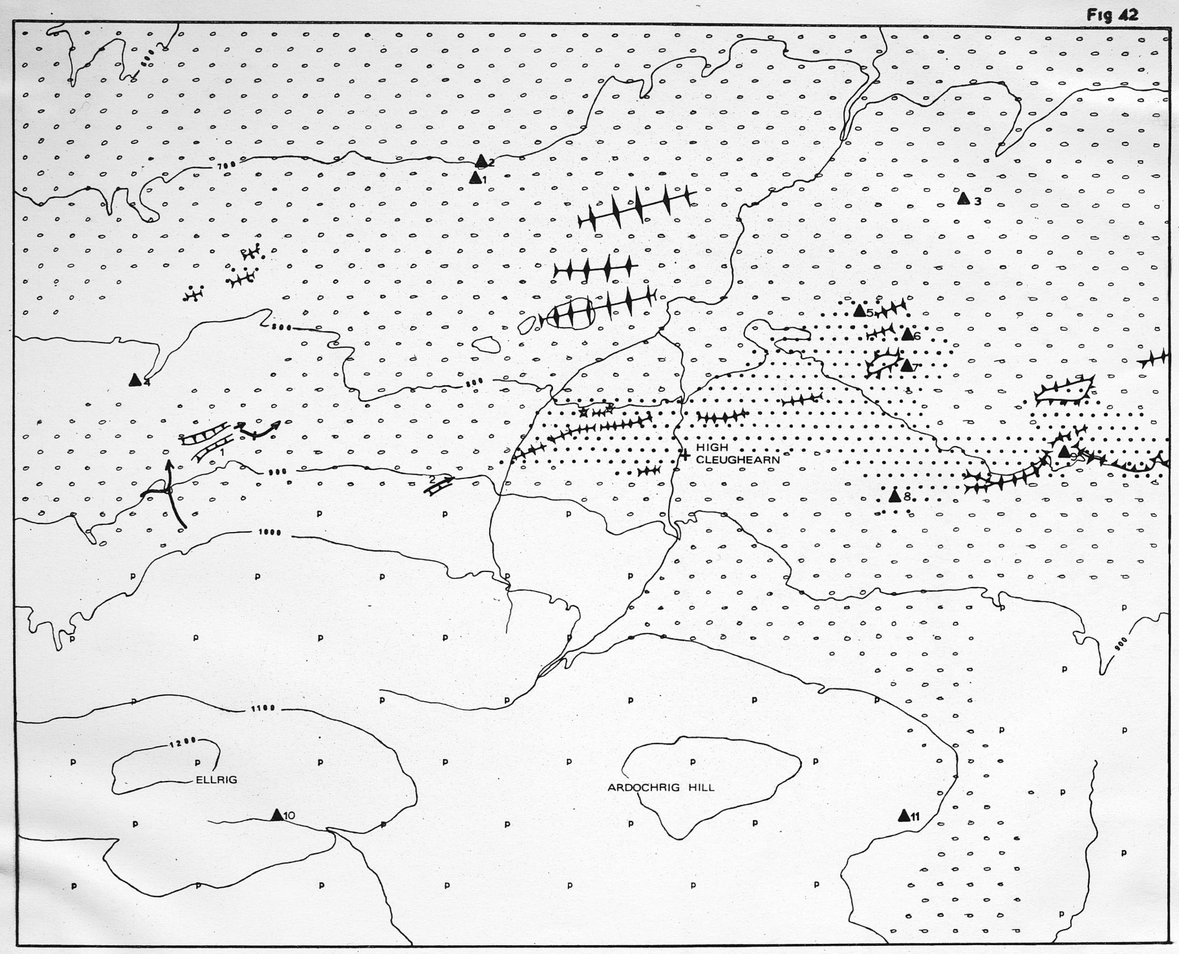
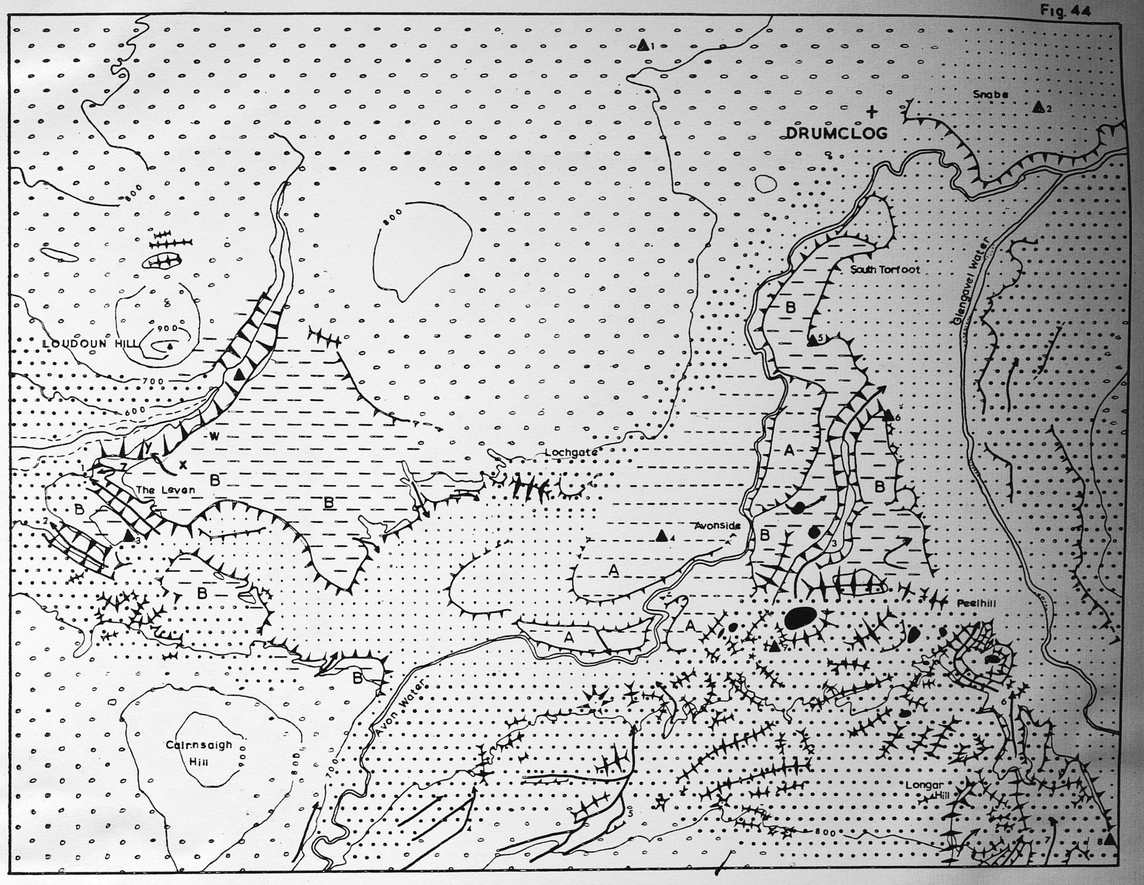

Carboniferous sediments
lavas
Area III only.
Carboniferous Rocks
Felsites of Old Red Sandstone Age
Old Red Sandstone Rocks
N
"Southern Upland" - mainly Silurian Rocks
Drift analysis sites in fluvioglacial deposits
till
Fluvioglacial site overlying till site
2 Miles

Fig 42



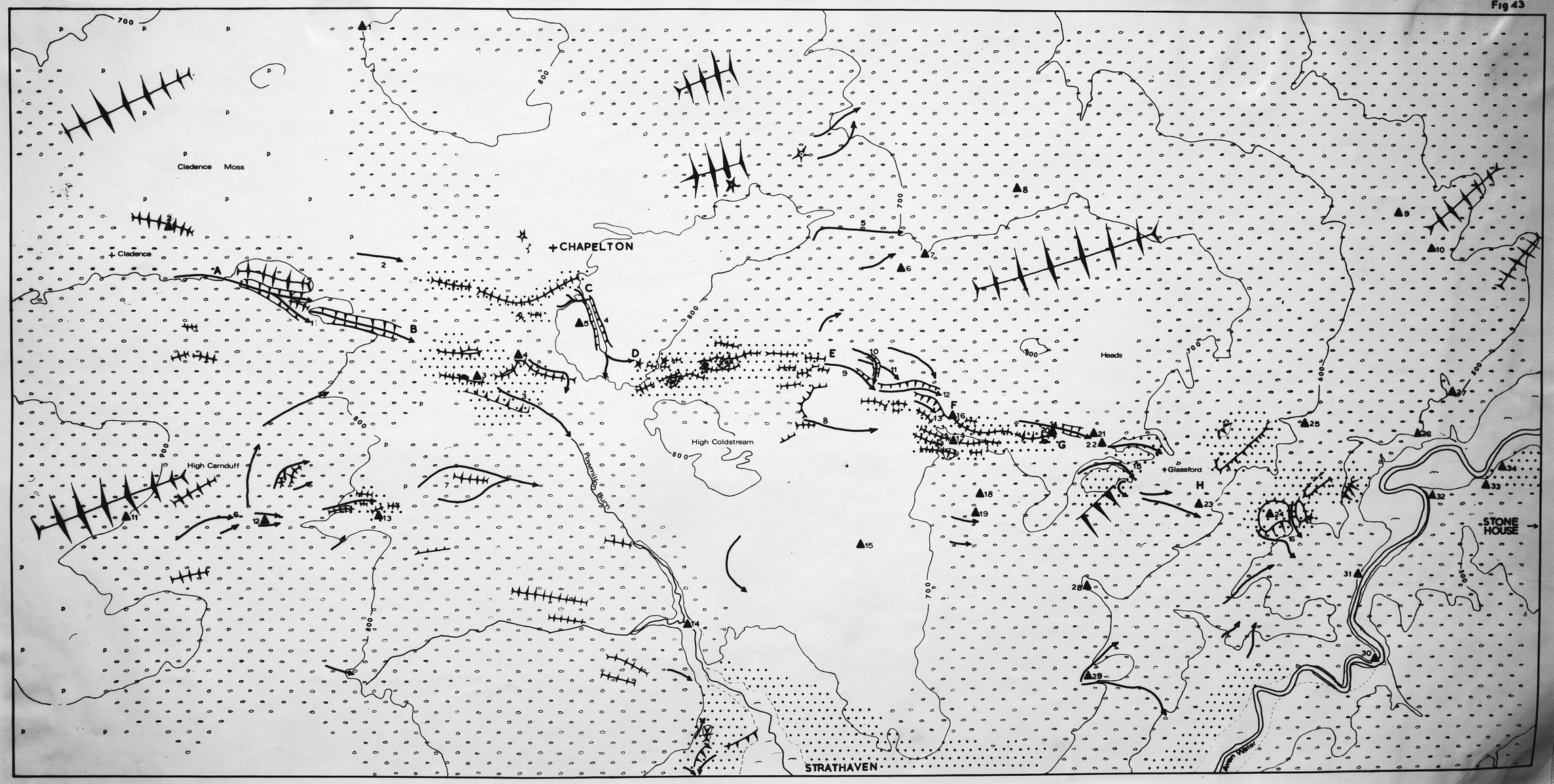
High Cleugheam District

Fig. 44



Upper Avondale District.

Fig 43



Chapelton / Stonehouse District

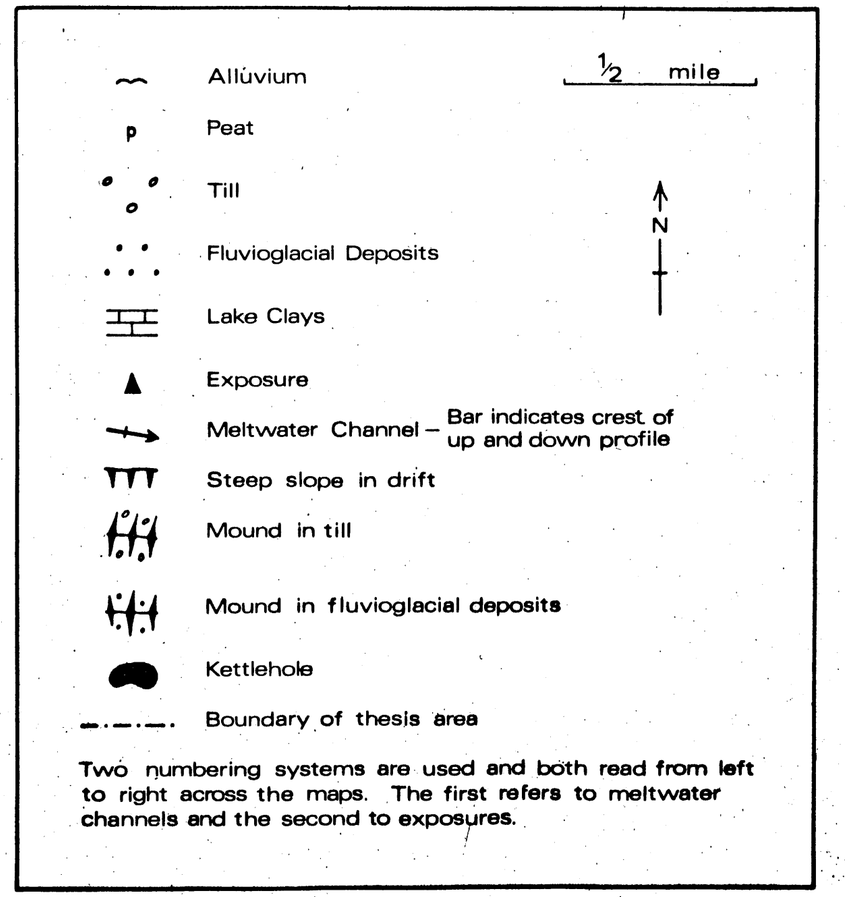
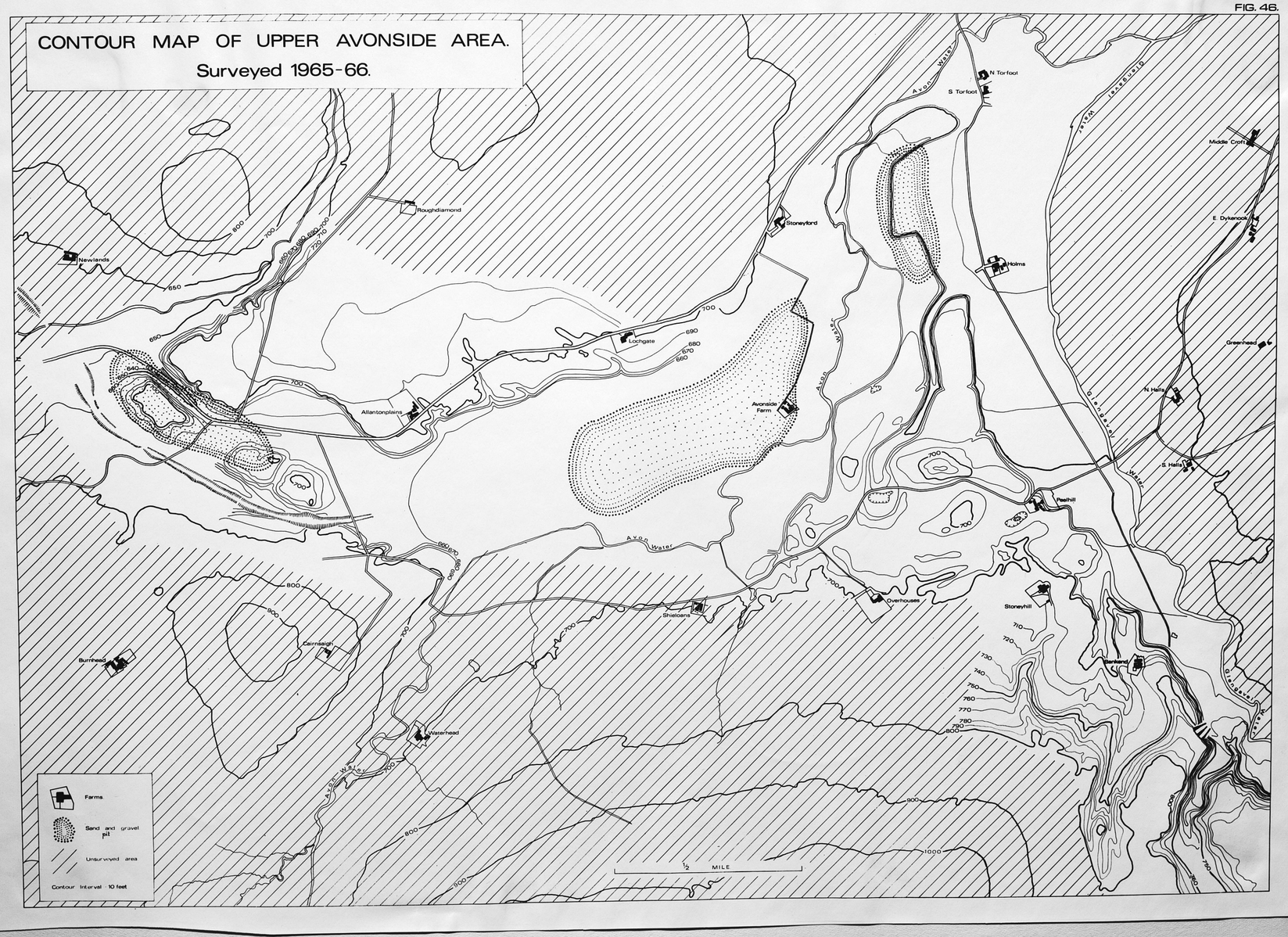
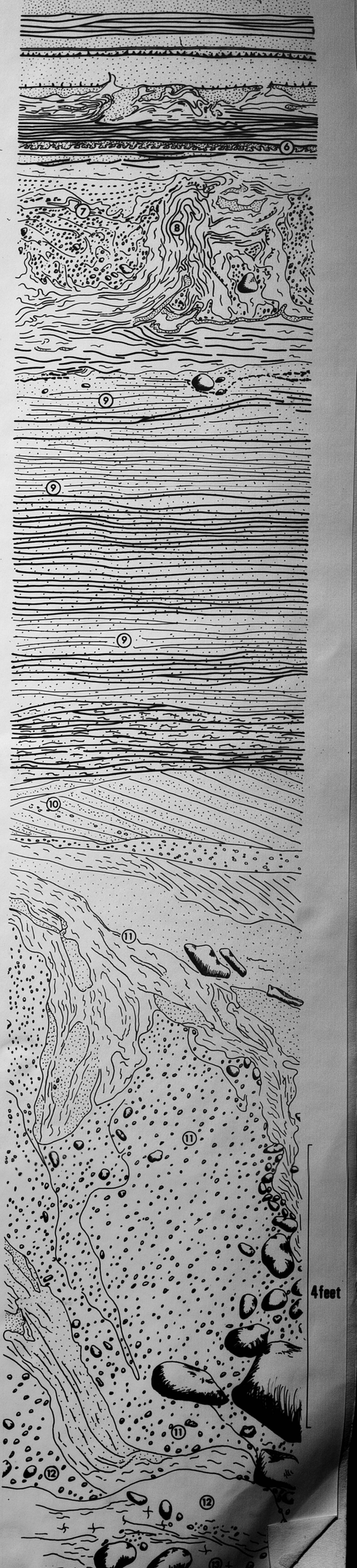

Allúvium
½ mile
p
Peat
Till
N
Fluvioglacial Deposits
Lake Clays
Exposure
Meltwater Channel – Bar indicates crest of up and down profile
Steep slope in drift
Mound in till
Mound in fluvioglacial deposits
Kettlehole
Boundary of thesis area
Two numbering systems are used and both read from left to right across the maps. The first refers to meltwater channels and the second to exposures.

FIG. 46.

CONTOUR MAP OF UPPER AVONSIDE AREA.
Surveyed 1965-66.





Stonehouse Exposure

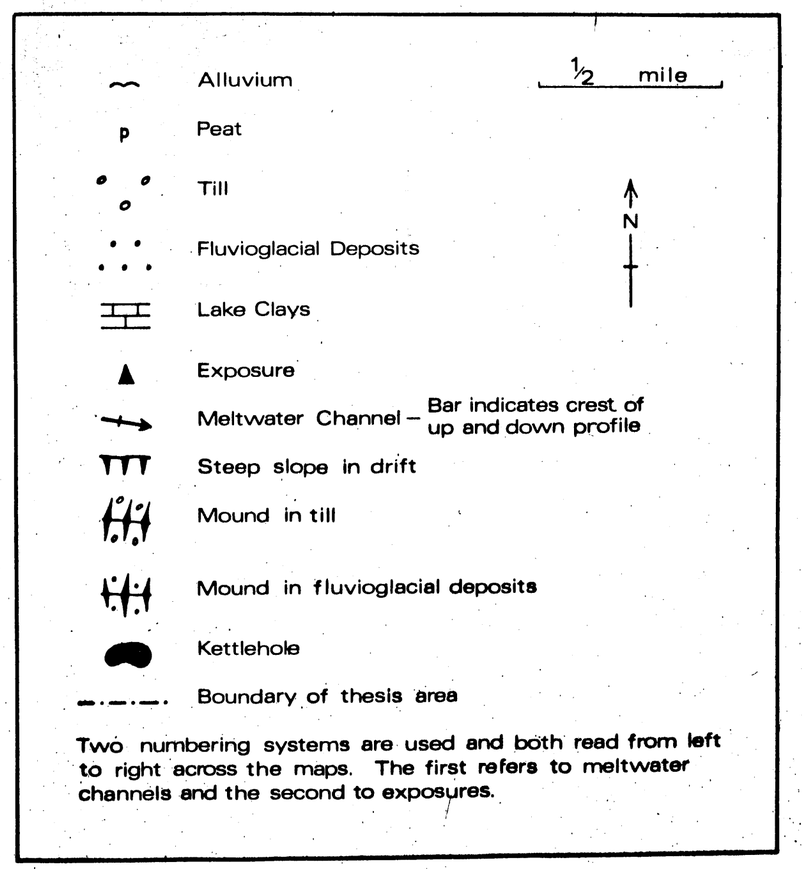
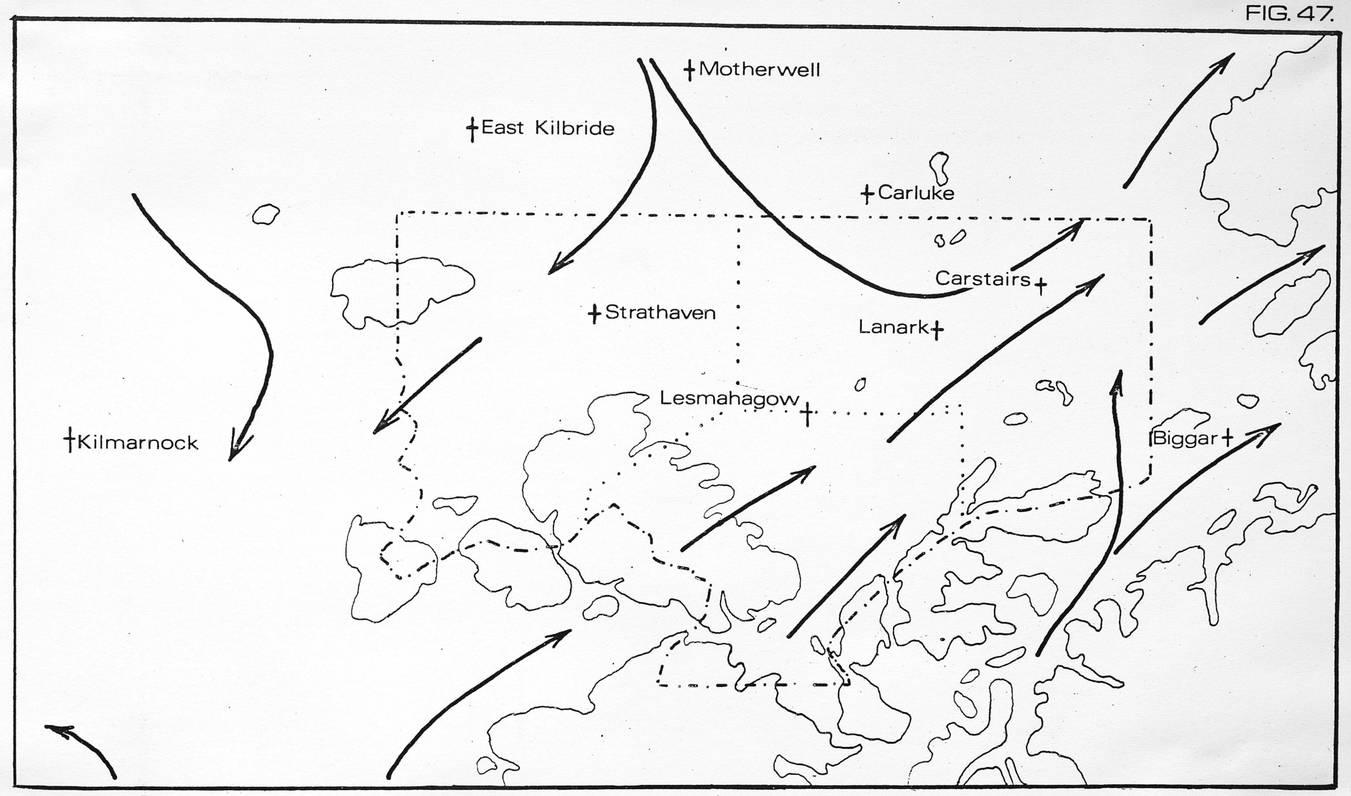

Alluvium
½ mile
p
Peat
Till
N
Fluvioglacial Deposits
Lake Clays
Exposure
Meltwater Channel – Bar indicates crest of up and down profile
Steep slope in drift
Mound in till
Mound in fluvioglacial deposits
Kettlehole
Boundary of thesis area
Two numbering systems are used and both read from left to right across the maps. The first refers to meltwater channels and the second to exposures.

FIG. 47.



Main Directions of Ice Movement during "Pre Perth Readvance" Glaciation Periods. Based on Geikie 1894 and field survey.

FIG. 48.

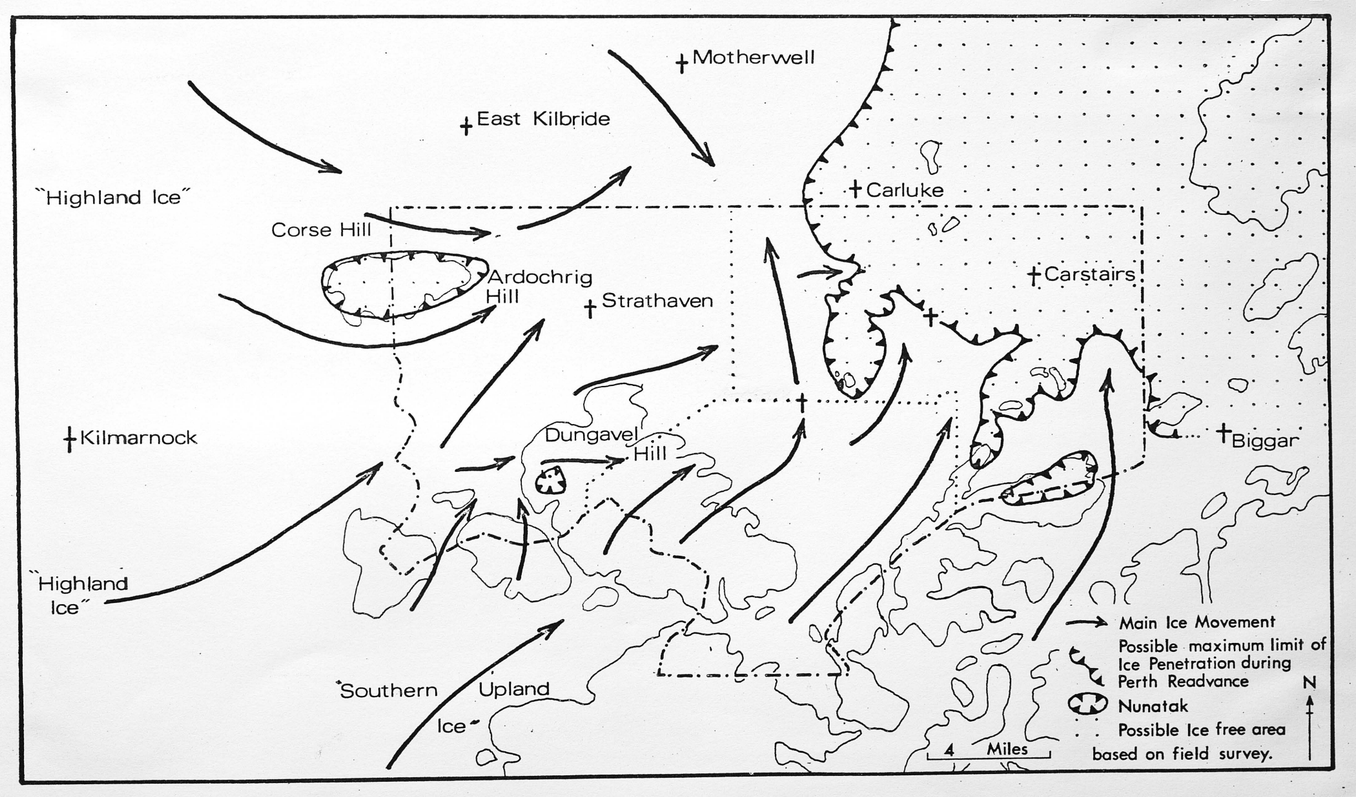
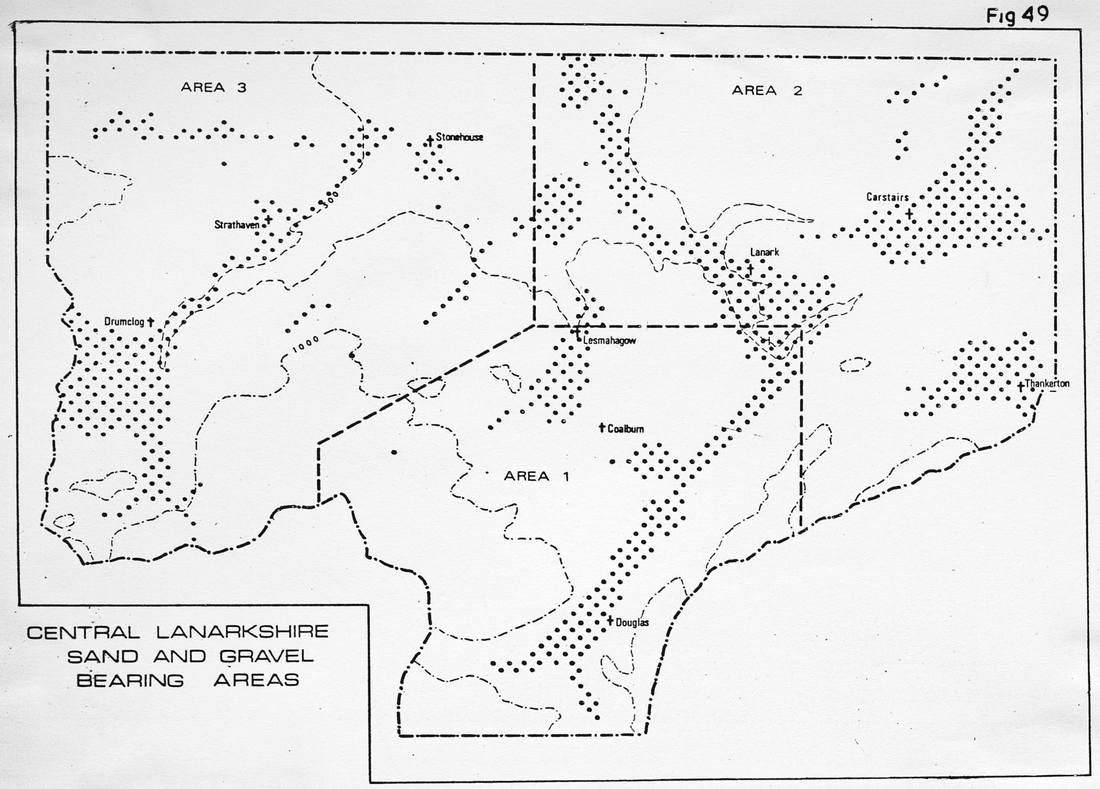
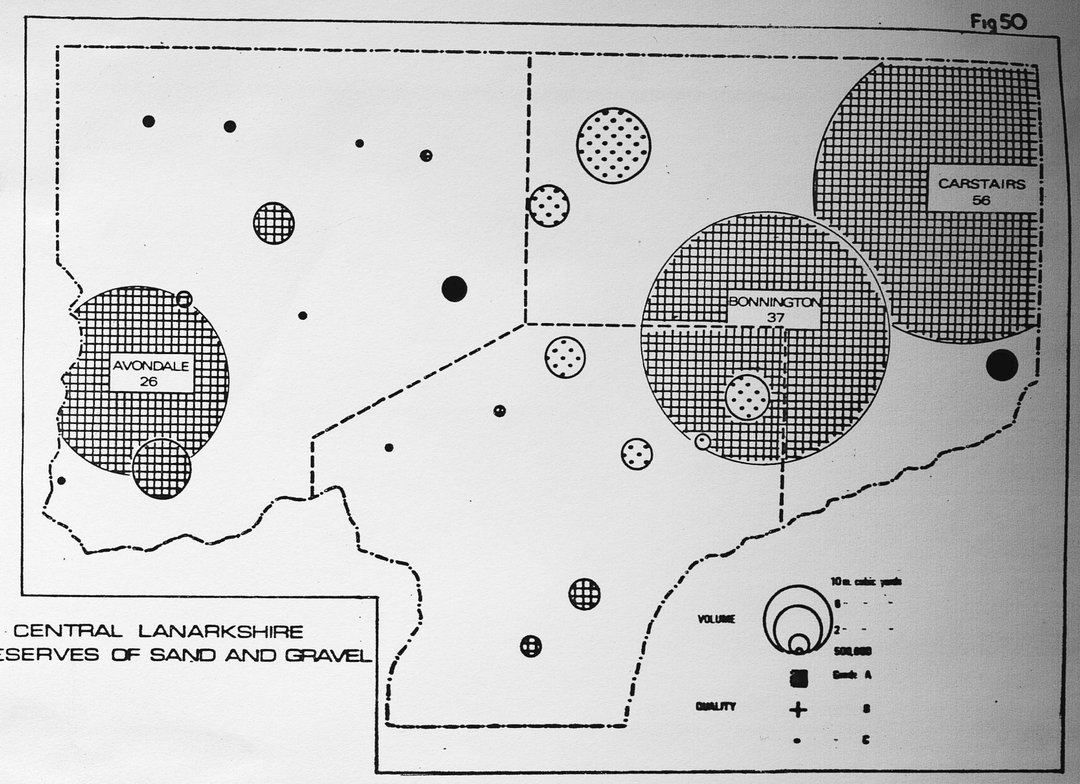


Fig 49



CENTRAL LANARKSHIRE
SAND AND GRAVEL
BEARING AREAS

Fig 50



CENTRAL LANARKSHIRE
RESERVES OF SAND AND GRAVEL

Fig 51

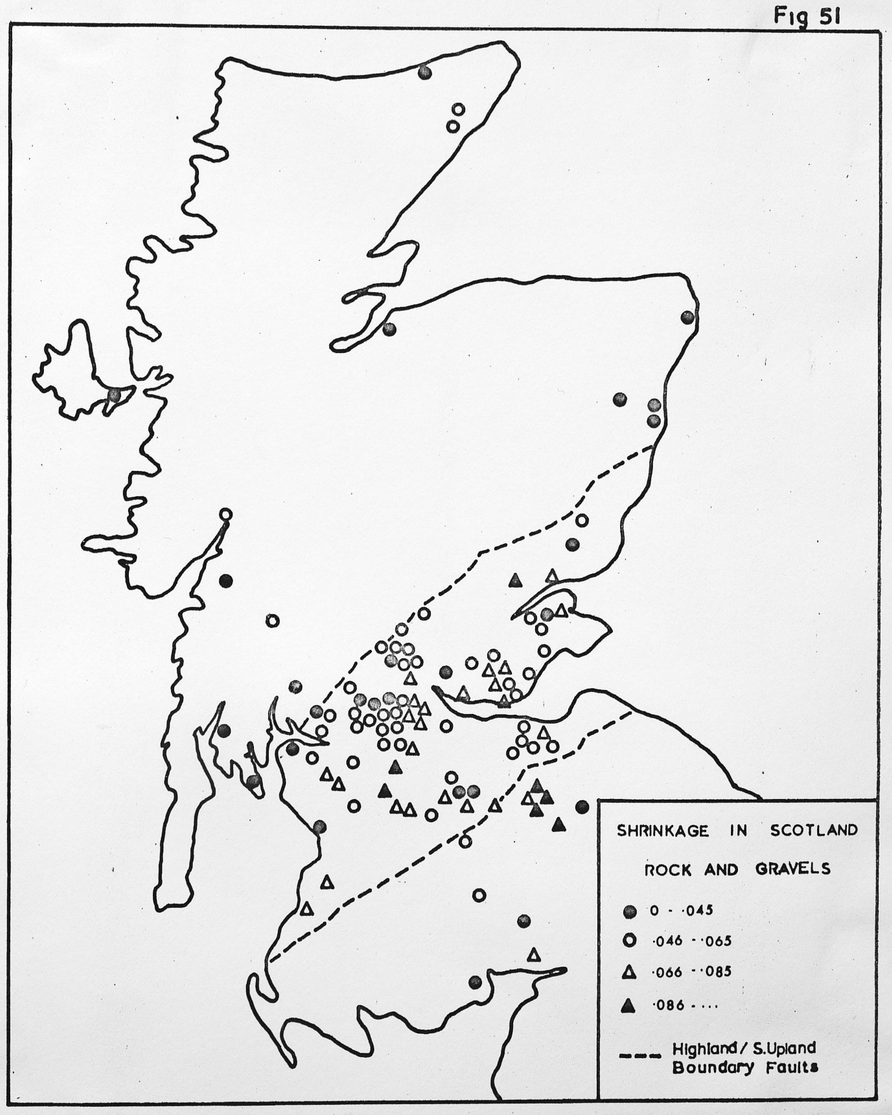
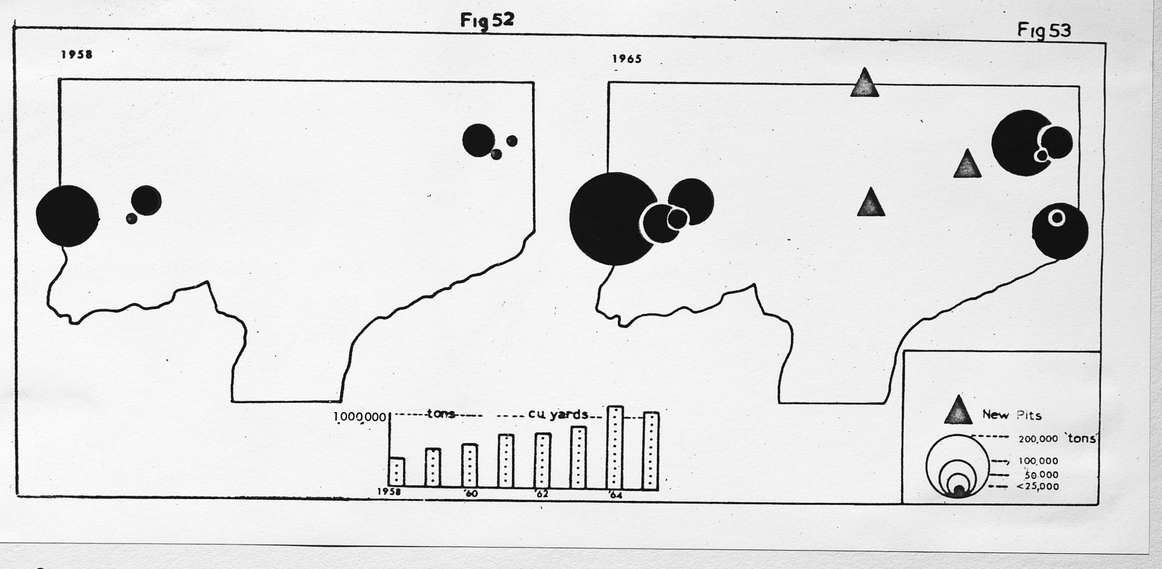


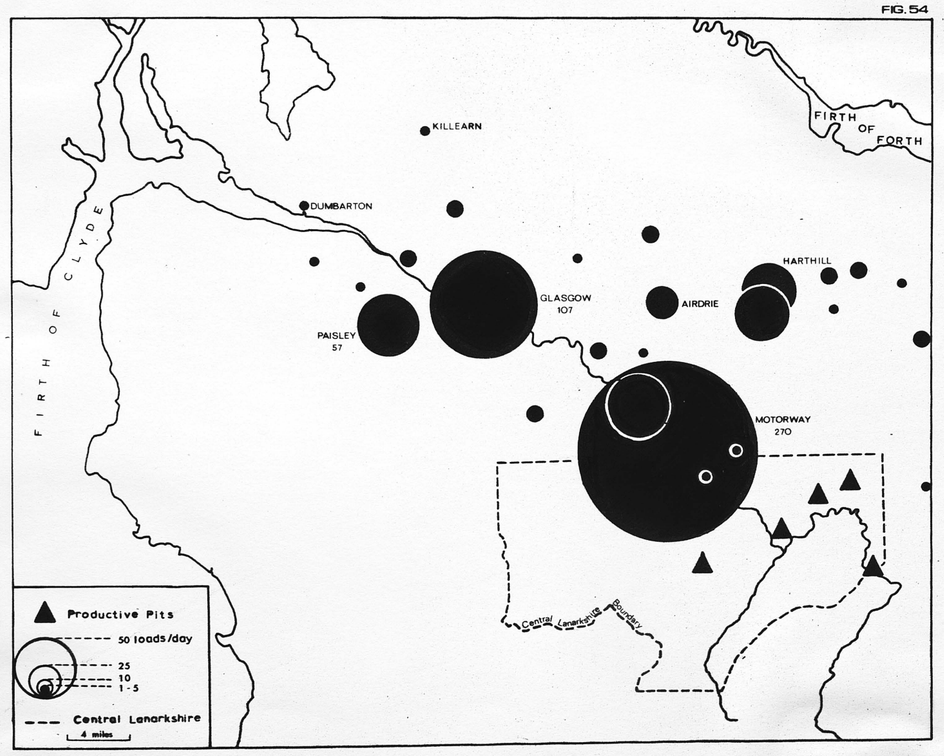
Fig 52

Fig 53



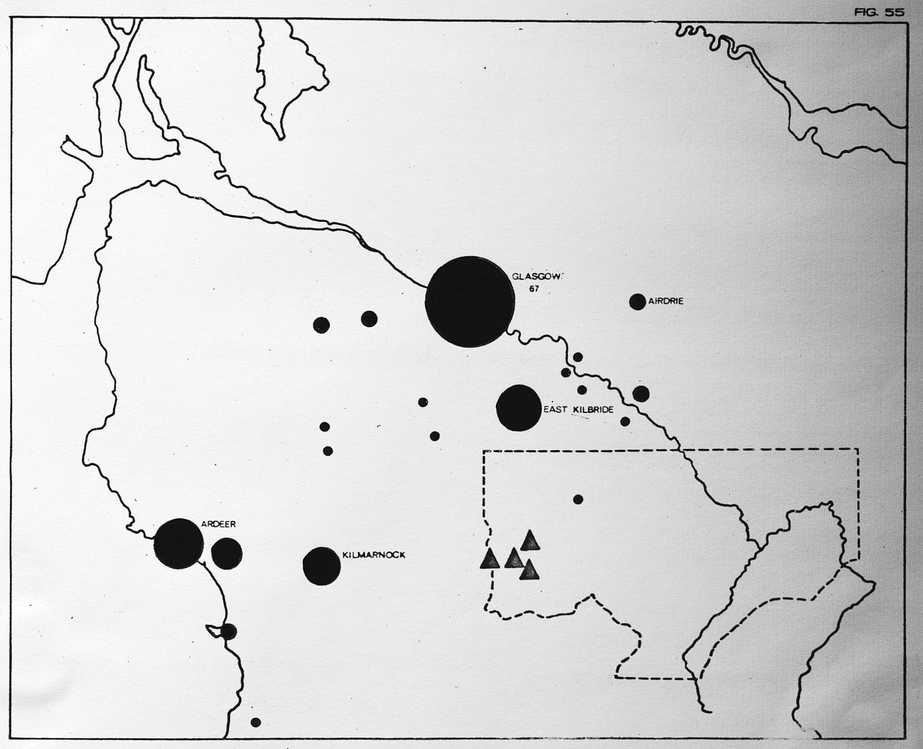
Sand and Gravel Production 1958-1965

FIG. 54



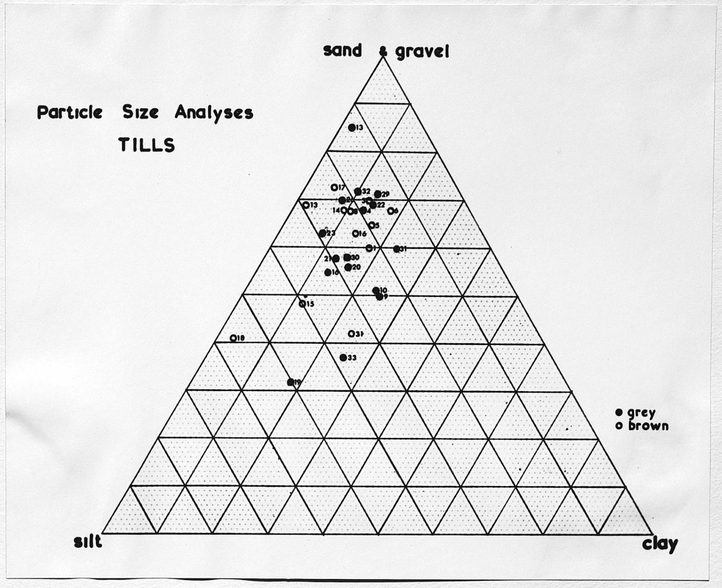
Market Area of Eastern Sand and Gravel Pits.

FIG. 55



Market Area of Western Sand and Gravel Pits.

IA



Form No. K4

RE. Z8497

PARTICLE SIZE DISTRIBUTION

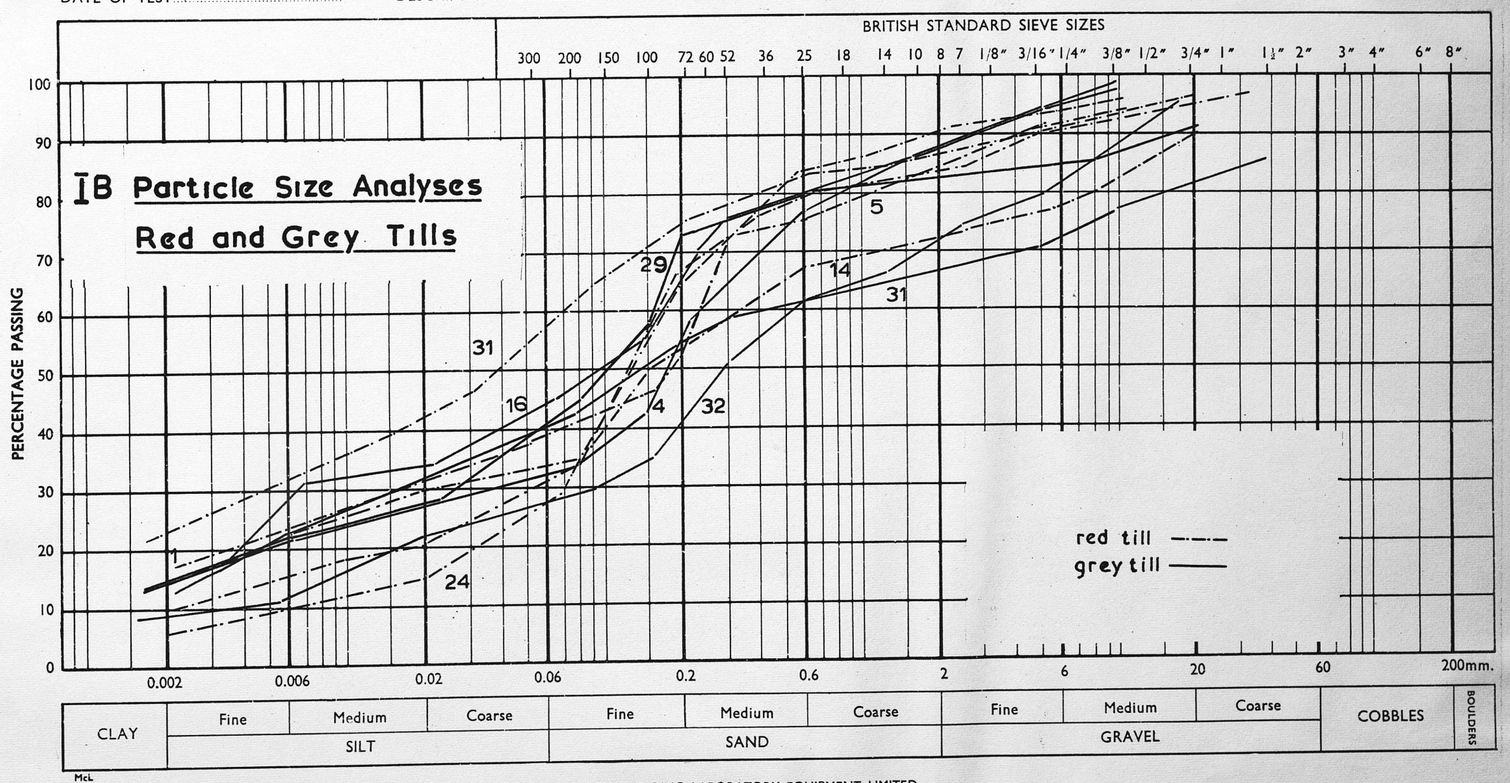
LOCATION No..... BORE HOLE No..... SAMPLE No.....

DATE OF TEST..... DESCRIPTION.....

PRETREATMENT DETAILS.....

LOSS ON PRETREATMENT..... %

IB Particle Size Analyses
Red and Grey Tills



McL

ENGINEERING LABORATORY EQUIPMENT LIMITED

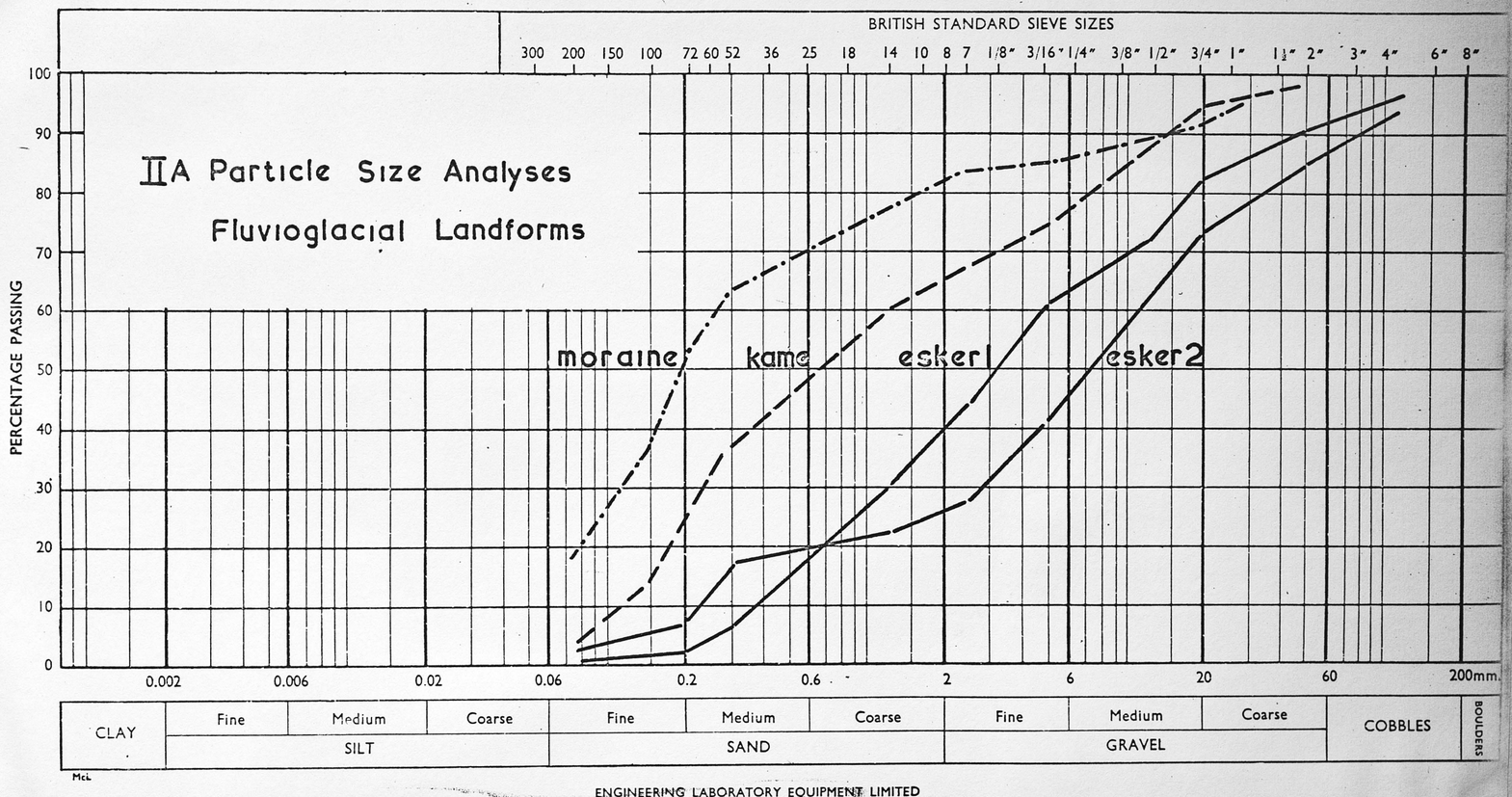
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RE. Z8497

PARTICLE SIZE DISTRIBUTION

LOCATION No. ..... BORE HOLE No. ..... SAMPLE No. ..... PRETREATMENT DETAILS .....

DATE OF TEST ..... DESCRIPTION ..... LOSS ON PRETREATMENT ..... %



Mcl

ENGINEERING LABORATORY EQUIPMENT LIMITED

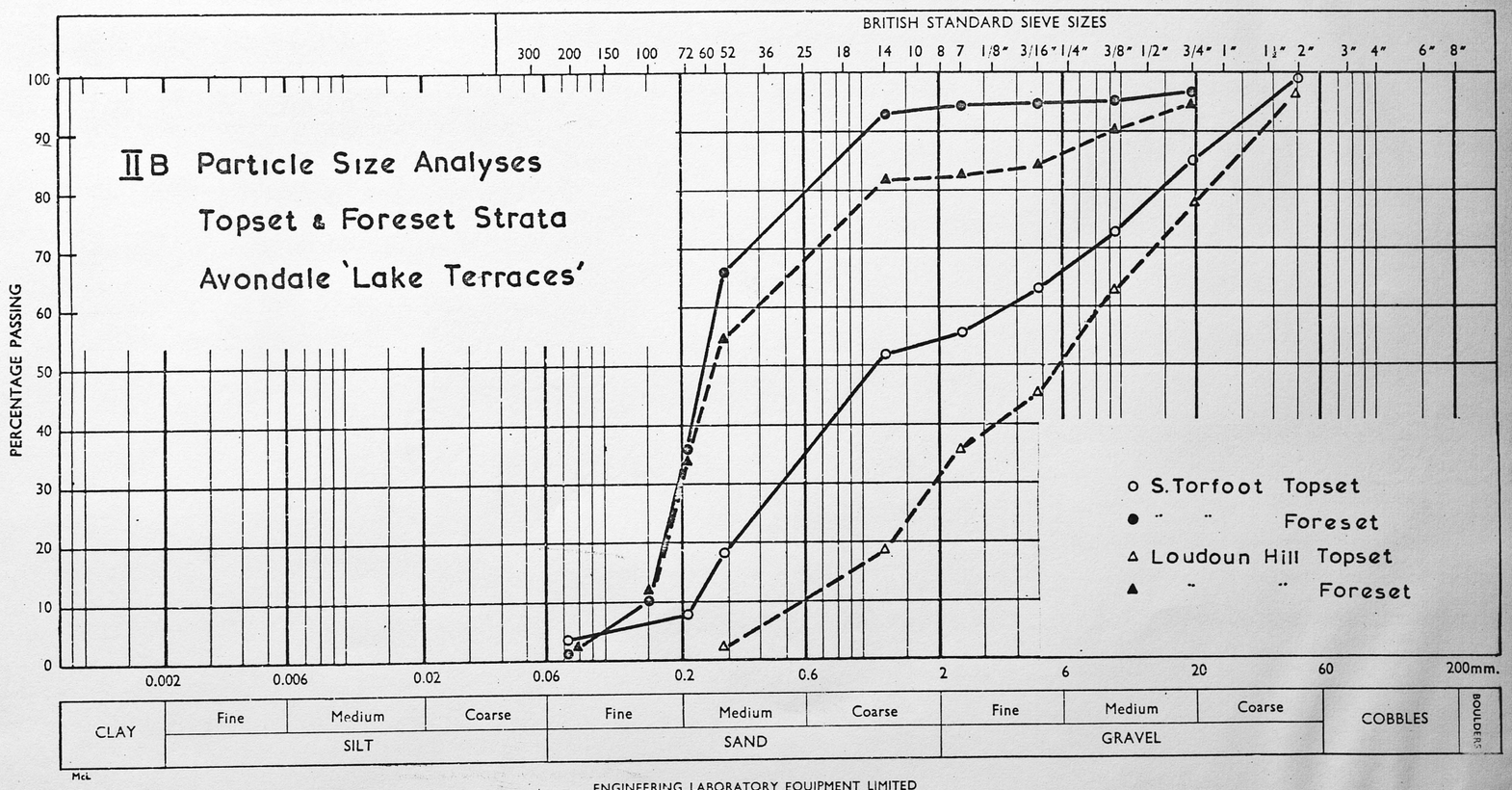
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PARTICLE SIZE DISTRIBUTION

LOCATION No. ..... BORE HOLE No. ..... SAMPLE No. ..... PRETREATMENT DETAILS .....

DATE OF TEST ..... DESCRIPTION ..... LOSS ON PRETREATMENT ..... %



Mcl

ENGINEERING LABORATORY EQUIPMENT LIMITED

RE. Z8497

Form No. K4

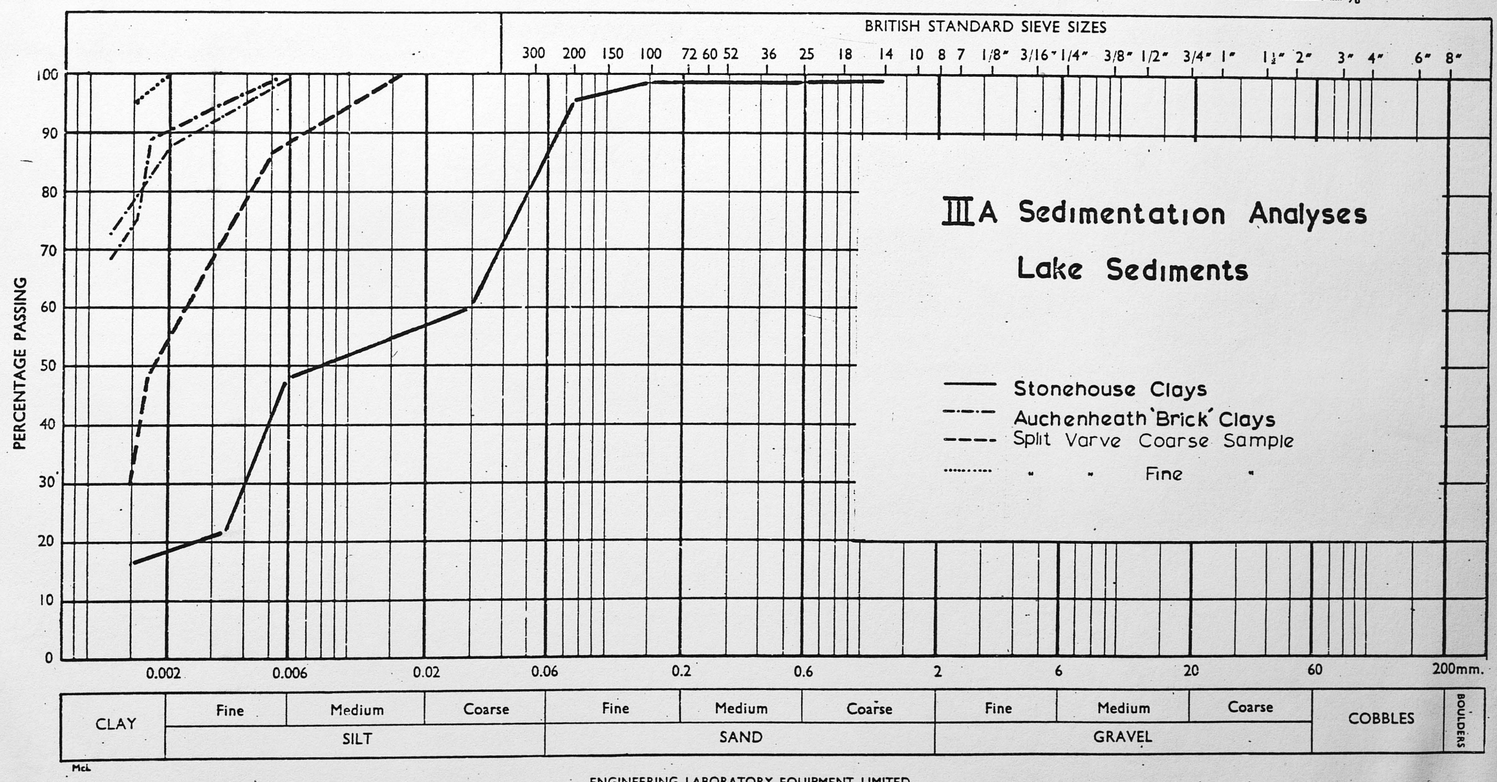
PARTICLE SIZE DISTRIBUTION

LOCATION No. ..... BORE HOLE No. ..... SAMPLE No. .....

DATE OF TEST ..... DESCRIPTION .....

PRETREATMENT DETAILS .....

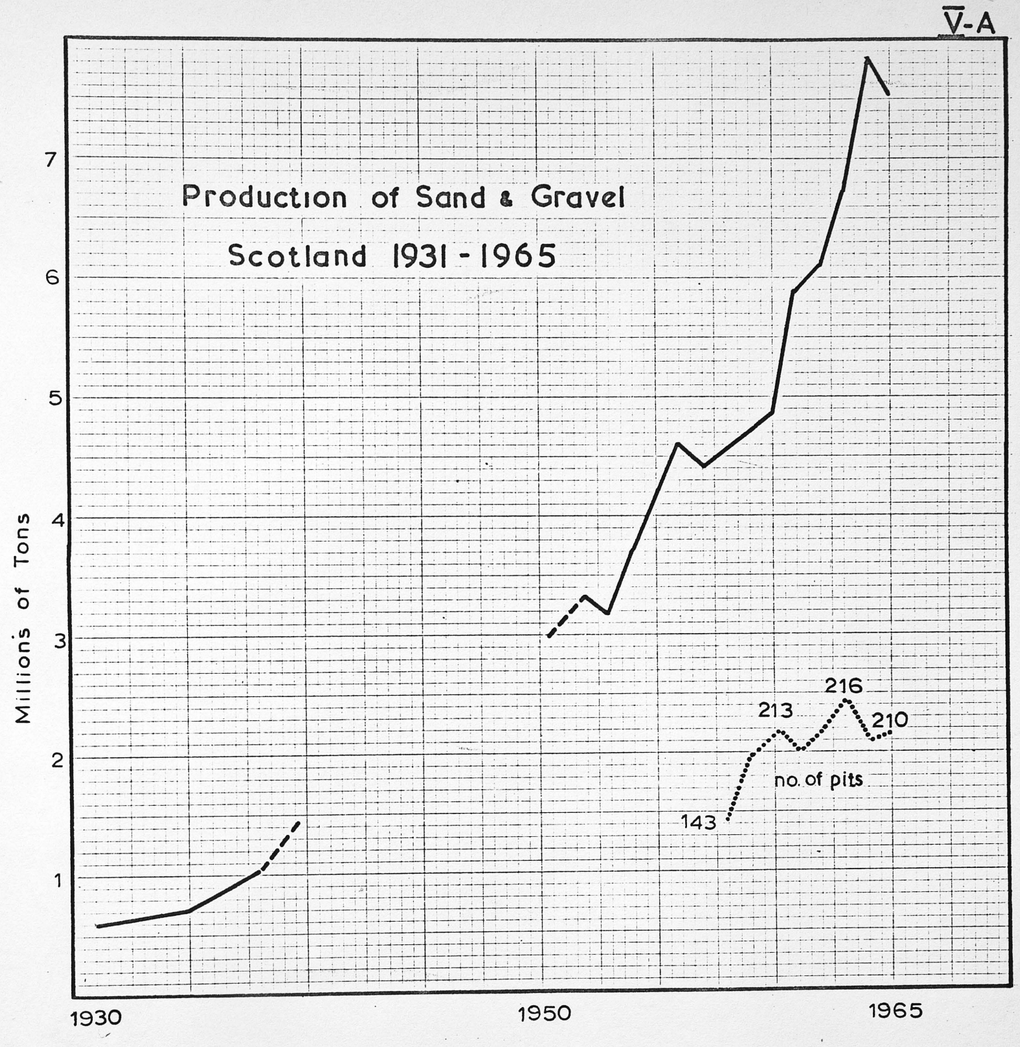
LOSS ON PRETREATMENT ..... %



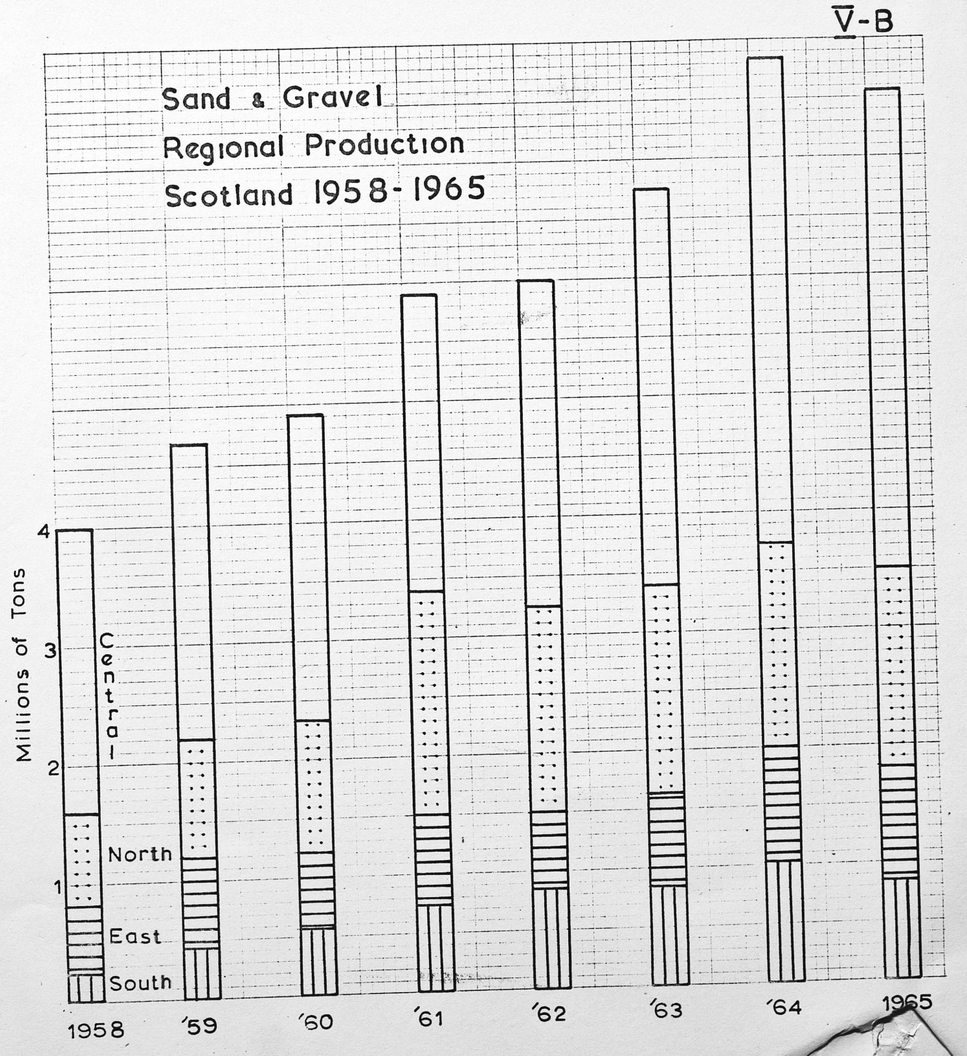
Mcl.

ENGINEERING LABORATORY EQUIPMENT LIMITED

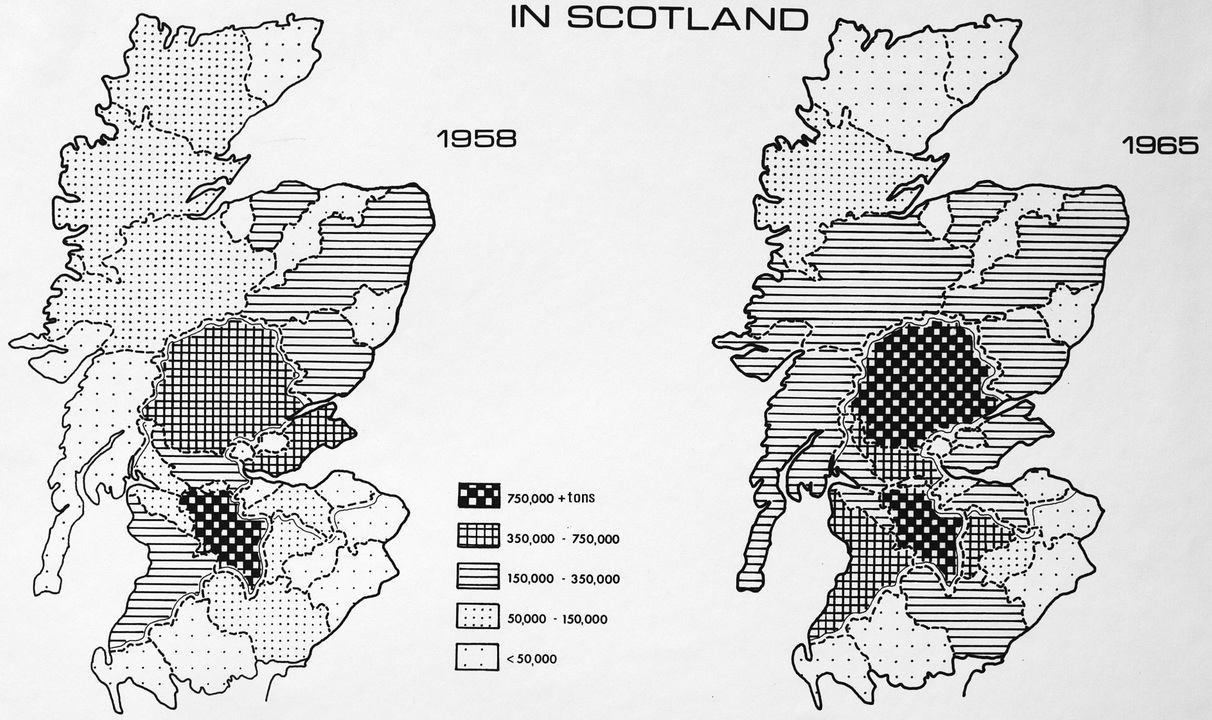
V-A


Production of Sand & Gravel
Scotland 1931 - 1965
Millions of Tons
7
6
5
4
3
2
1
1930
1950
1965
216
213
210
143
no. of pits

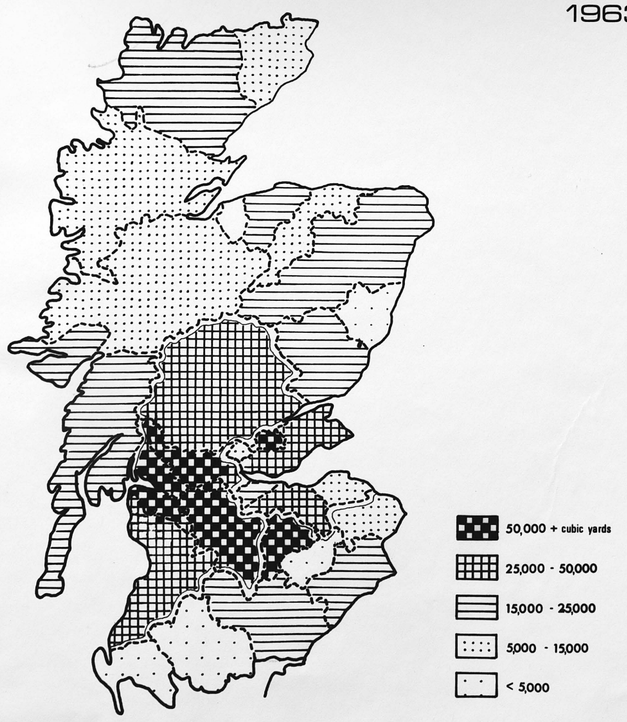
V-B


Sand & Gravel
Regional Production
Scotland 1958 - 1965
Millions of Tons
4
3
2
1
Central
North
East
South
1958
'59
'60
'61
'62
'63
'64
1965

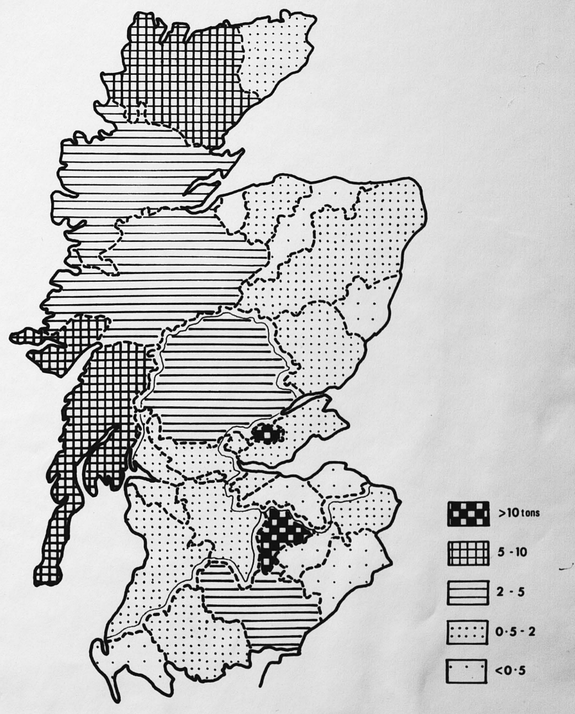
PRODUCTION OF SAND AND GRAVEL IN SCOTLAND



AVERAGE OUTPUT PER PIT 1963

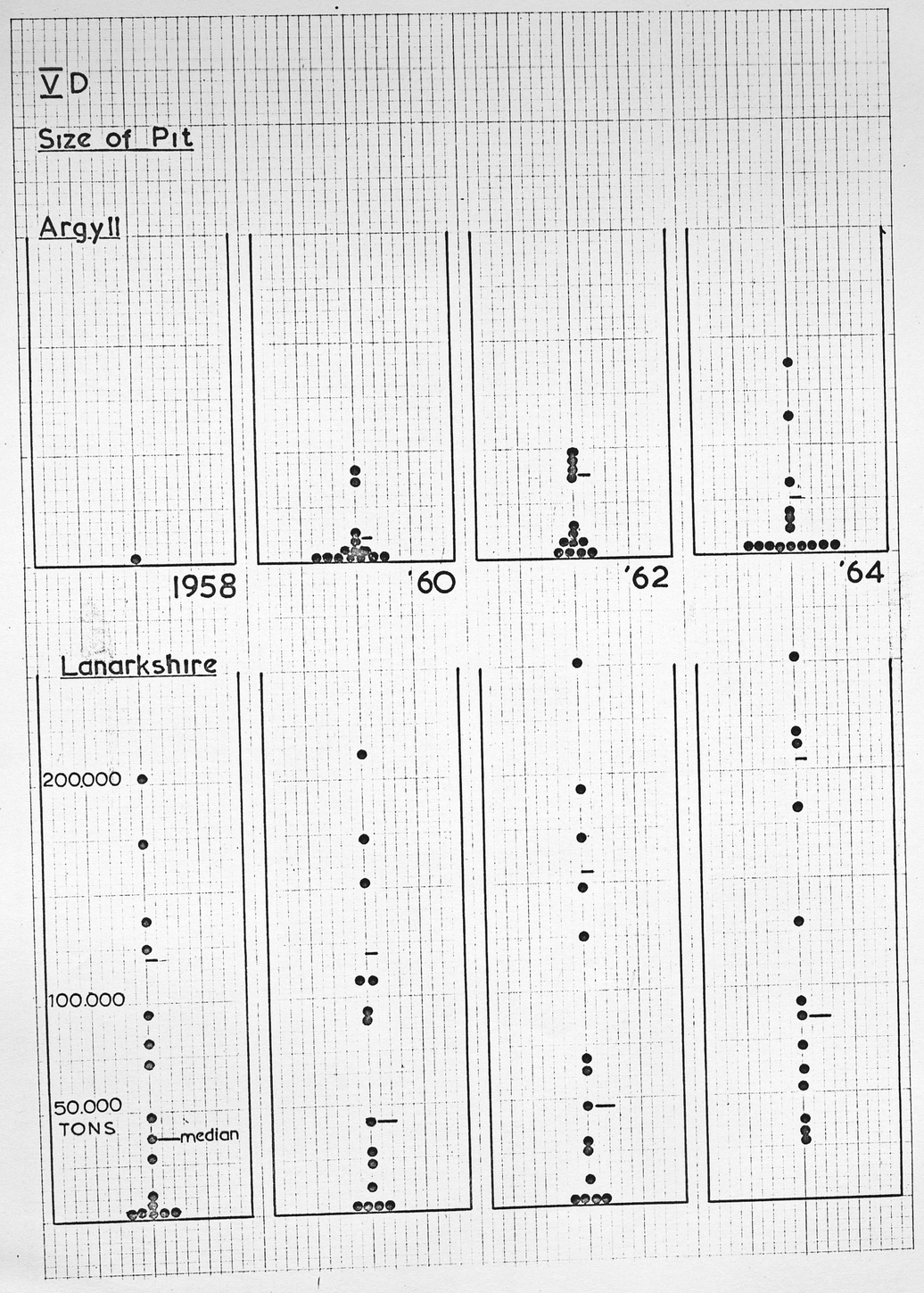


PRODUCTION OF SAND AND GRAVEL PER PERSON 1961



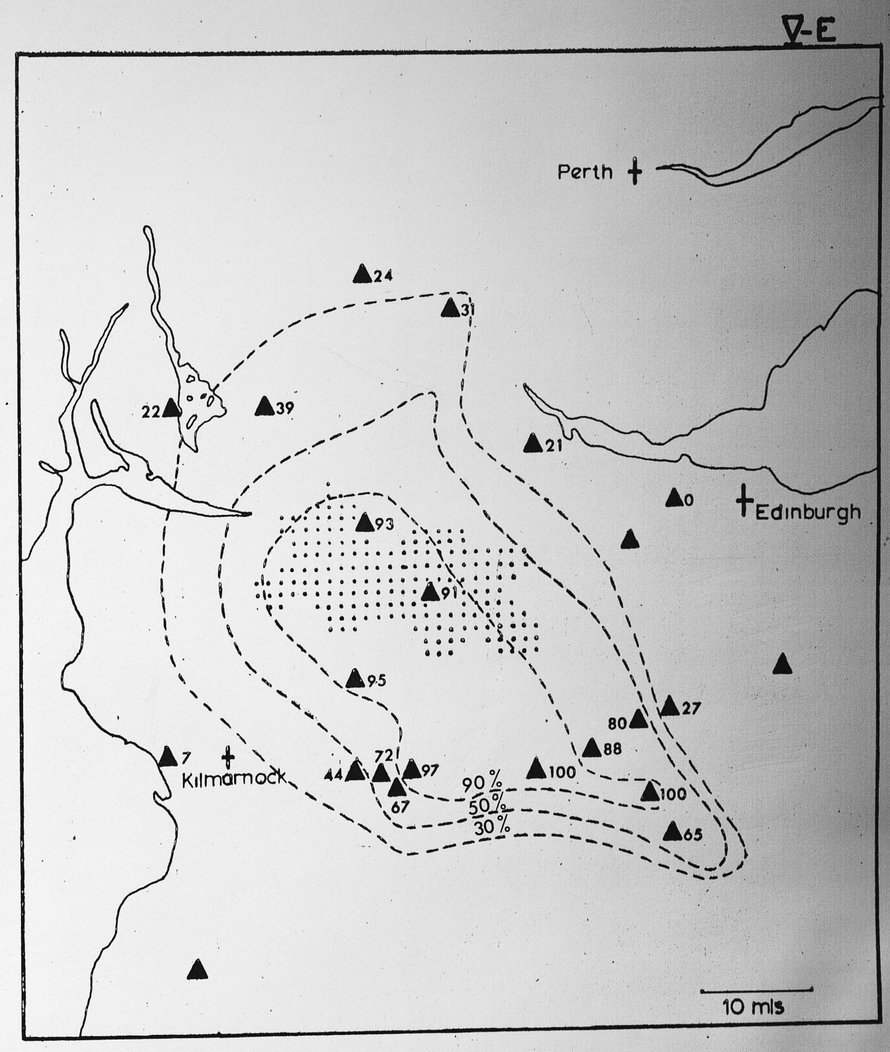
V D

Size of Pit



Source of Sand and Gravel used in the Glasgow Conurbation

V-E



1. Terrace at Loudoun Hill - Area III
2. Thick Peat Cover at Coalburn - Area I
3. Exposure in Nethan Valley - Area I
4. Slope Deposits in Nethan Headwaters - Area I
5. Stone Stripes - Tinto Hill - Area II
6. Stone Stripes - Tinto Hill - Area II
7. Meltwater Channel - Logan - Area I
8. Storm Gully - Logan - Area I

1



2



3



4



5



6



7



8



9. Meltwater Channel System - Auchengilloch Hill - Area I

10. Meltwater Channel System - Auchengilloch Hill - Area I

11. Meltwater Erosion - Poniel - Area I

12. Esker on Valley fill terraces - Douglas - Area I

13. Dead-Ice deposits - Sandilands looking East - Area I

14. Dead-Ice deposits - Sandilands looking West - Area I

15. Thankerton Basin looking south - Area II

16. Corra Linn - Area II

17. Air Photo. Valleys of Mouse and Clyde - Area II

9



10



11



12



13



14



15



16



17



18. Floodplain of Clyde near Crossford - Area II

19. Air Photo Clyde floodplain - Watermeetings - Area II

20. Working brick clays Carluke - Area II

21. Till Exposure-Hartiesford Bridge - Area II

22. Nemphlar Channel looking north - Area II

23.) North entrance to Nemphlar Channel - Area II
24.) (beyond drift barrier). Note soil
) creep on drift mounds. - Area II
25)

26. Nemphlar Channel, on south side of drift barrier looking south - Area II

27. Surface creep on Clydeside fluvioglacial deposits - Area II

18



19



20



21



23-25



22



26



27



28. Exposure Clydeside fluvioglacial deposits - Crossford - Area II

29. Working "brick clays" - Auchenheath - Area II

30. Laminated clays - Auchenheath - Area II

31. Laminated clays - Auchenheath - Area II

32. "Brick Clay" - Carluke - Area II

33. Tile Works - Auchenheath - Area II

34. Vegetation remains site - Carluke - Area II

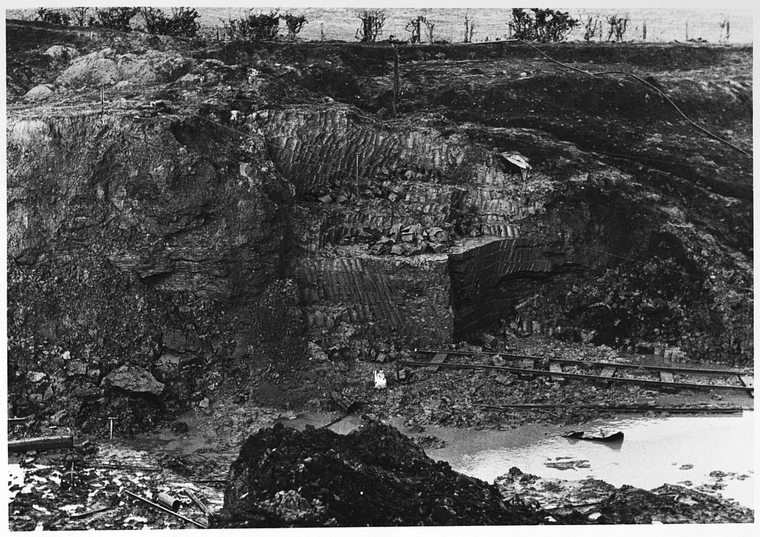
35. Clay Nodules from Auchenheath "Brick Clays" - Area II

36. Clay Nodules from Auchenheath "Brick Clays" - Area II

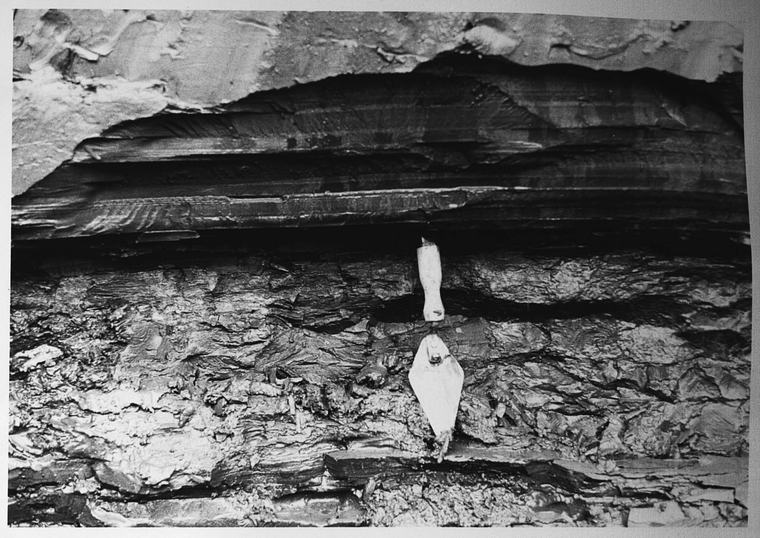
28



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30



31



32



33



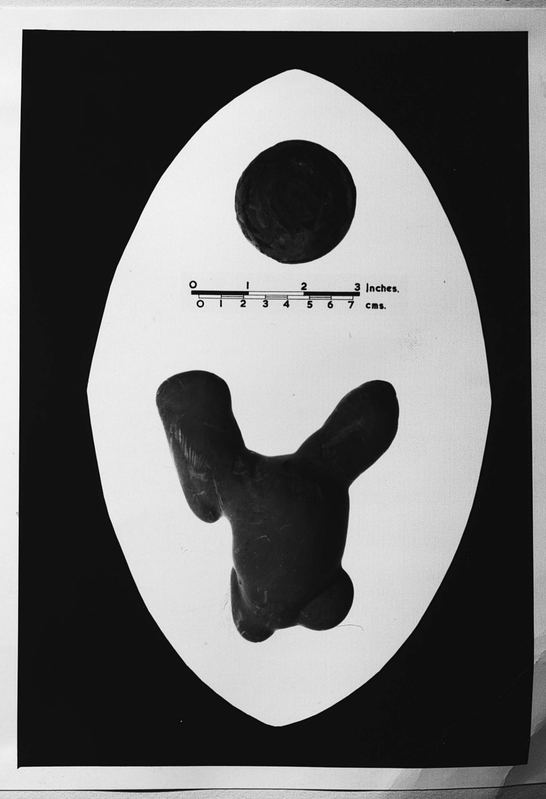
34



35



36



37. Clay Nodules from Auchenheath "Brick Clays" - Area II

38. Clay Nodules from Auchenheath "Brick Clays" - Area II

39. Meltwater Channel leading to Carstairs deposits - Area II

40. Kettle-hole - Bonnington - Area II

41. Meltwater Channel above Crossford - Area II

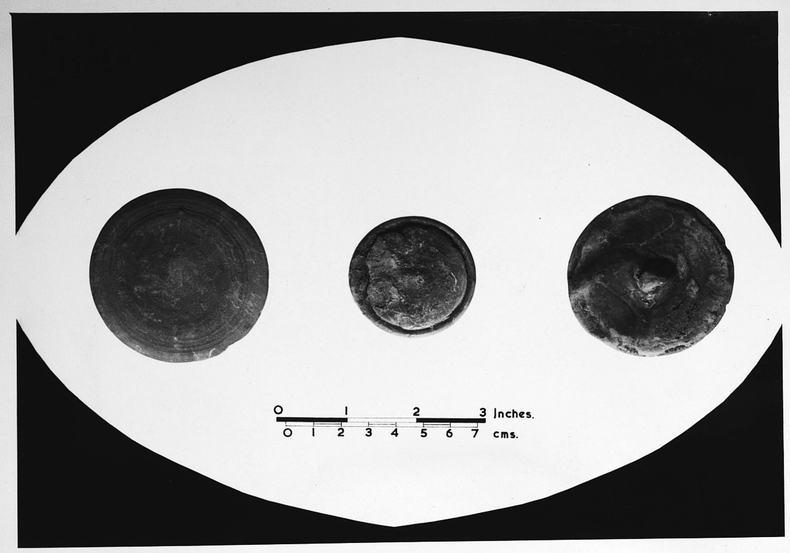
42. Meltwater Channel -Tillietudlem - Area II

43. Air Photo. Dead-Ice deposits at Bonnington - Area II

44. Westernmost of Carstairs fluvioglacial deposits - Area II

45. Carstairs Ridges - Area II

37



38



39



40



41



42



43



44



45



46. Air Photo. Carstairs Esker System - Area II

47. Air Photo. Carstairs Esker System - Area II

48. Carstairs Ridges from Moss to north - Area II

49. Sheaffyknowe to left - Carstairs Ridges in background - Area II

50. Clydeside fluvioglacial deposits - Crossford - Area II

51. Glengavel Valley - Area III

52. Exposure W. Browncastle - Area III

53. Meltwater Channel on western watershed boundary of AreaIII - Area III



46-47

48



49



50



51



52



53



54. Air Photo. Fluvioglacial Deposits in Woollen/Glengavel Valleys -Area III

55. Air Photo. Fluvioglacial Deposits in Woollen/Glengavel Valleys - AreaIII

56. Parallel Meltwater channels - Lochar Water - AreaIII

57.) Air Photo.Fluvioglacial Deposits in Upper Avondale - Area III
)

58.) Air Photo.Fluvioglacial Deposits in Upper Avondale - Area III

59. Esker - Chapelton - Area III

60. Esker system east of Chapelton - Area III

57

0048 F64 :58/RAF/3262: 15OCT'59:RAF OFFICIAL CROWN COPYRIGHT RESERVED



58

0052 F64 :58/RAF/3262: 15OCT'59:RAF OFFICIAL CROWN COPYRIGHT RESERVED



56



59



54-55

3293 R.106G/SCOT/UK157:20AUG46:RAF OFFICIAL CROWN COPYRIGHT RESERVED



3295 R.106G/SCOT/UK157:20AUG46:RAF OFFICIAL CROWN COPYRIGHT RESERVED



60



61.) Stonehouse Section - Area III

62.) Stonehouse Section - Area III

63.) Stonehouse Section - Area III

64. Kirk Hill - Strathaven - Area III

65. Esker overlying Valley fill terrace -Kype Valley looking south - Area III

66. Esker overlying Valley fill terrace -Kype Valley looking north - Area III

67. Kames of Avon - Area III

61



62



63



64



65



66



67



68. Fluvioglacial Deposits, - Woollen Valley - Area III

69.) Upper Avondale Terraces - Area III
)
70.) Upper Avondale Terraces - Area III
)
71.) Upper Avondale Terraces - Area III
)
)

72. Upper Avondale Terraces Sand and Gravel extraction - Area III

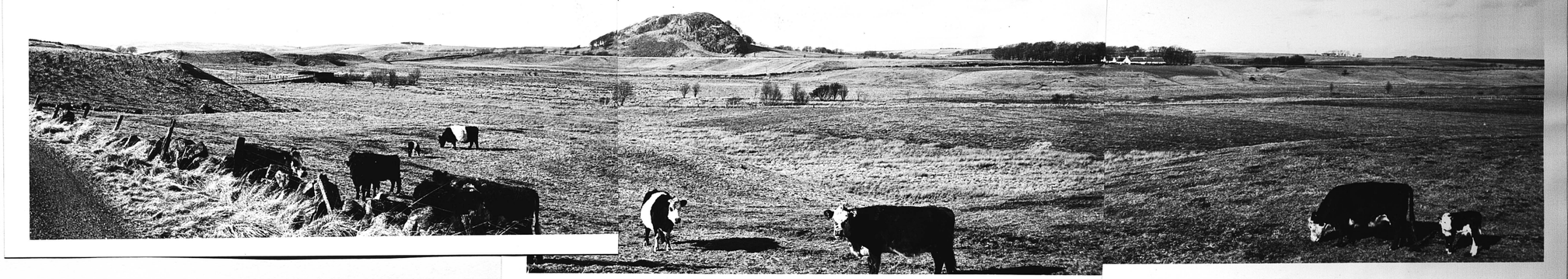
73. Upper Avondale Terraces Sand and Gravel extraction - Area III

74.) Upper Avondale Terraces Exposures - Area III
)
75.) Upper Avondale Terraces Exposures - Area III
)
76.) Upper Avondale Terraces Exposures - Area III
)
)

68



69-71



72



73



74



77. M 74 Hamilton By-Pass Construction - Area II

78. Sand and Gravel Workings. Land Restoration - Area II

79. Sand and Gravel Workings. Land Restoration - Area II

80. Sand and Gravel Workings. Land Restoration - Area II

81 Sand and Gravel Workings. Land Restoration - Area II

82. Tree screening of plant - Area II

75



76



77



78



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82



83. Gravel Extraction. First World War - Area II

84. Gravel Extraction. Second World War - Area II

85. Gravel Dredging; River Clyde at Thankerton - Area II

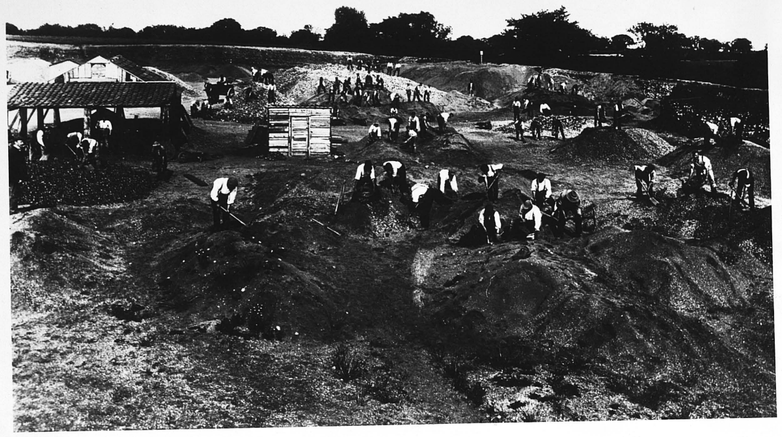
86. Wet Pit Dredging - Greater London Area - Area II

87. Wet Pit Dredging - Greater London Area - Area II

88. Sand and Gravel extraction -beaches N.E. England - Area II

89. Sand and Gravel extraction -River Gravels N.E. England - AreaII

83



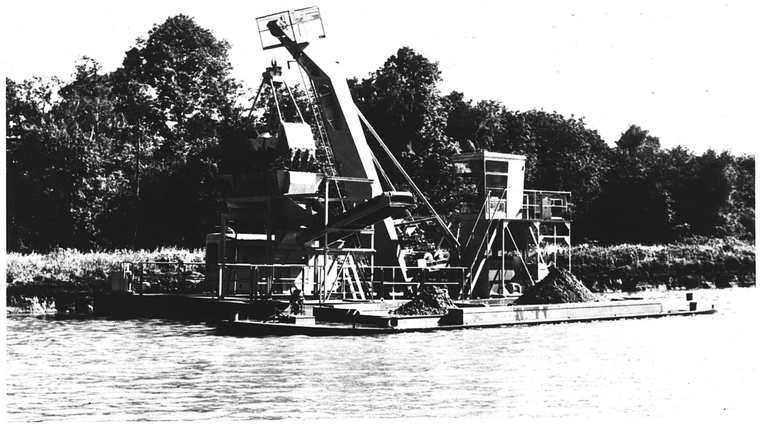
84



85



86



87



88



89

