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VOLUME II

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APPENDIX I: CLIMATIC STATISTICS

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from it should be acknowledged.

TABLE A

Station	Grid Reference	Ht.(ft.)	Av."	Rain Days
Stanhope	NY(35)997376	860	33.1	-
Burnhope (Grass Meres)	NY(35)825372	1850	59.7	-
Burnhope (Lodgegill Mine)	NY(35)802375	1950	65.8	-
Burnhope Reservoir	NY(35)850391	1160	54.7	228
Wellheads Hush	NY(35)826404	1690	56.9	-
Laneheads (1960-61)		1450	54.2	220
Wolsingham	NZ(45)091333	600	31.8	200
Allenheads	NY(35)860453	1350	49.3	230
Nenthead	NY(35)778438	1450	45.5	229
Moorhouse (Dufton)	NY(35)758328	1850	81.2	258

TABLE B

Monthly Means of Temperature °F
Laneheads School 1960/1961

	Maximum	Minimum	Mean
August	70.0	45.1	53.0
September	56.5	39.4	48.0
October	49.9	40.9	45.4
November	43.5	34.4	38.9
December	40.3	30.3	35.3
January	36.6	30.0	32.8
February	42.8	34.0	38.4
March	47.2	37.2	42.2
April	47.6	37.5	42.5
May	54.0	40.6	47.3
June	57.6	44.6	51.1
July	56.0	47.0	51.5

TABLE C

Month	Soil Temperatures Grass			
	Minimum	2"	4"	8"
August	41.2	53.8	53.6	53.1
September	33.1	49.3	51.2	52.1
October	36.1	46.1	45.9	-
November	29.8	39.2	40.1	-
December	26.4	35.3	36.2	-
January	27.6	34.1	33.8	-
February	34.2	36.8	37.0	-
March	32.8	39.7	40.2	41.1
April	33.9	42.4	43.2	44.0
May	35.2	48.8	48.6	49.4
June	38.7	51.2	50.8	50.9
July	41.5	53.4	51.3	53.4

APPENDIX II: SOIL HORIZON DESIGNATIONS

Systems of horizon designation are apt to be national attributes, varying from one country to another and evolving as soil methodology changes (KUBIENA 1953; SEVENTH APPROXIMATION 1960; GLENTWORTH and MUIR 1963; BRIDGES 1966).

The system used in this thesis to denote the sequence of organic and mineral horizons is that defined by the National Soil Survey Committee of Canada (1963; 1965). It does not claim overwhelming advantages of other currently used systems, but it does allow intricate subdivision of profiles and proves convenient for studies of soil genesis in a relatively small area. Not every horizon in this thesis has been subject to the rigorous chemical analysis which the Canadian system demands (e.g. oxalate extractable iron and aluminium), but some have, and the results have been extrapolated for similar horizons.

The outlines of the Canadian system, as presented by HOFFMAN (1965), are given below.

SOIL HORIZON DESIGNATIONS

Conventions Concerning the Use of Designations

1. The capital letters A and B may not be used singly in profile descriptions but must be accompanied by the lower case suffix (Ah, Bf, Bt, etc.) indicating the estimated modification from the parent material. The capital letter C may be used alone except when the material is affected by reducing conditions or has the properties of a fragipan.

2. Unless otherwise specified additional lower case suffixes indicate a secondary or subordinate feature or features in addition to those characteristic of the defined major horizon. The symbol Btg, for example, indicates that in addition to the dominance of illuvial clay in the B horizon there is also evidence of strong gleying.

3. All horizons except AB, A and B, AC, and B and A may be vertically subdivided by consecutive arabic numbers after the letter designations. The assigned arabic numeral has no meaning except that of vertical subdivision.

Organic Horizons

Organic horizons may be found at the surface of mineral soils, at any depth beneath the surface in buried soils

or overlying geologic deposits. They contain more than 30 per cent organic matter. Three horizons are recognized.

L - An organic layer characterized by the accumulation of organic matter in which the original structures are easily discernible

F - An organic layer characterized by the accumulation of partly decomposed organic matter. The original structures are discernible with difficulty. Fungi mycelia are often present.

H - An organic layer characterized by an accumulation of decomposed organic matter in which the original structures are undiscernible.

Note 1 - If it is not possible or advisable to subdivide the organic layer it may be referred to as L-H or other combinations.

Note 2 - It may be desirable to use lower case suffixes to differentiate kinds of organic material. However, none is suggested in this thesis.

Master Mineral Horizons and Layers

Mineral horizons are those that contain less organic matter than that specified for organic horizons.

A - A mineral horizon or horizons formed at or near the surface in the zone of removal of materials in solution and suspension and/or maximum in situ accumulation of organic matter. Included are:

- (1) organo-mineral horizons in which organic matter has accumulated as a result of biological activity (Ah);
- (2) horizons that have been eluviated of clay, iron, aluminum, and/or organic matter (Ae);
- (3) horizons having characteristics of 1 and 2 above but transitional to underlying B or C (AB or A and B);
- (4) horizons markedly disturbed by cultivation or pasture (Ap).

B - A mineral horizon or horizons characterized by one or more of the following:

- (1) an enrichment in silicate clay, iron, aluminum or humus, alone or in combination (Bt, Bf, Bfh, Bhf, and Bh);
- (2) An alteration by hydrolysis, reduction or oxidation to give a change in colour or structure from horizons above and/or below and does not meet the requirements of (1) above (Bm, Bg).

C - A mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (1) the process of gleying, and (2) the accumulation of calcium carbonates (Cca, Cg and C).

R - Underlying consolidated bedrock.

Lower Case Suffixes

b - Buried soil horizon.

c - A cemented (irreversible) pedogenic horizon. The ortstein of a Podzol, a layer cemented by manganese and a duripan are examples.

ca - A horizon with secondary carbonate enrichment where the concentration of lime exceeds that present in the unenriched parent material.

cc - Cemented (irreversible) pedogenic concretions.

e - A horizon characterized by removal of clay, iron, aluminium or organic matter alone or in combination. Higher in colour value by 1 or more units when dry than an underlying B horizon. It is used with A (Ae).

f - A horizon enriched with hydrated iron. It usually has a chroma of 3 or more. It is used with B alone (Bf), with B and h (Bfh and Bhf) and with B and g (Bfg), etc.

These horizons are differentiated on the basis of organic matter content into:

Bf less than 5% organic matter

Bfh from 5 to 10% organic matter

Bhf greater than 10% organic matter

g - A horizon characterized by grey colours and/or prominent mottling indicative of permanent or periodic intense reduction. Chromas of the matrix are generally 1 or less.

It is used with A and e (Aeg); with B alone (Bg); with B and f (Bfg); with B, h and f (Bfhg and Bhfg); with B and t (Btg); with C and k (Ckg); etc.

h - A horizon enriched with organic matter. It is used with A alone (Ah); or with A and e (Ahe); or with B and f (Bfh, Bhf).

k - Presence of carbonate as indicated by visible effervescence with dilute HCl. May be used with any master horizon or combination of master horizon and lower case suffix. Most often is used with B and m (Bmk) or C (Ck).

m - A horizon slightly altered by hydrolysis, oxidation and/or solution to give a change in colour and/or structure.

- p - A layer disturbed by man's activities, i.e. by cultivation and/or pasturing. It is to be used only with A.
- t - A horizon enriched with silicate clay. It is used with B alone (Bt) and with B and g (Btg), etc.
- x - A horizon of fragipan character. A fragipan is a loamy subsurface horizon of high bulk density. It is very low in organic matter, it is seemingly cemented when dry having a hard consistence. When moist it has a moderate to weak brittleness. It has few or many bleached fracture planes. It is overlain by a friable B horizon.

APPENDIX III: ANALYTICAL METHODS

III A. ORGANIC SOILS

Peat samples were dug out fresh in the field and taken to the laboratory in air-sealed polythene bags.

pH was measured by glass electrode on the field sample.

Water content was determined by noting the loss in weight after thorough drying at 100°C.

Ash content was determined on the oven-dry sample (100°C) by ashing at 400°C for 4 hours.

Nitrogen was determined on the oven-dry sample (100°C) by the modified Kjeldahl procedure (JACKSON 1958)

Water samples were collected in 250 ml. polythene containers and analysed as soon as possible.

pH was measured by glass electrode.

Ionic composition was determined after filtering through Whatman's No. 1.

Na⁺ and K⁺ by EEL Flame Photometer using propane fuel.

Ca⁺⁺ and Mg⁺⁺ by HILGER & WATTS Atomic Absorption Spectrophotometer using an acetylene/air mixture.

III B. MINERAL SOILS

All laboratory analyses were performed on the fine earth sample. The field sample was air-dried, reduced by mortar and pestle, and passed through a 2 mm. diameter sieve.

- (i) Mechanical Analysis was determined by a method used by MARSHALL (PIPER 1950), using a Bouyoucos hydrometer and pretreatment with hydrogen peroxide, hydrochloric acid, and sodium hexameta phosphate. Percentages of the mineral fractions are expressed as a percentage of the total recovered material.
- (ii) pH was determined on a saturated paste ($\frac{1}{2}$ 1:1) using a glass electrode.
- (iii) Loss on Ignition is percentage weight loss after heating for four hours at 400°C. (V.I. STEWART, personal communication).
- (iv) Exchangeable Cations of non-calcareous samples were extracted with 1N $\text{NH}_4 \text{OAc}$ and those of calcareous samples by a solution of BaCl_2 - triethanolamine of pH 8.1 (JACKSON 1958). Sodium and potassium were determined on the flame photometer using propane gas, and calcium and magnesium on the Atomic Absorption Spectrophotometer using an acetylene-air mixture. Exchangeable hydrogen has been determined by the change in the pH of the 1N $\text{NH}_4 \text{OAc}$ leaching solution. Calcareous samples were treated by a barium chloride-triethanolamine solution as given by JACKSON (1958).
- (v) Organic Carbon was determined by the 'wet oxidation' method of WALKLEY and BLACK (JACKSON 1958).
- (vi) Total Nitrogen was determined by Kjeldahl digestion

with copper sulphate and selenium as catalysts, followed by distillation in the Markham micro-Kjeldahl apparatus into boric acid.

(vii) Total Carbonates were determined by overnight treatment with N/1 HCl and subsequent titration with N/1 NaOH.

(viii) Iron Numerous methods have been suggested for the determination of iron in soils (ROBICHET 1957a, 1957b; Commonwealth Bureau of Soils 1965), the ultimate choice depending mainly on the particular iron fraction required.

The methods used in the present work include:

- a) Total iron: by the preparation of an acid extract by boiling with hot, concentrated hydrochloric acid for 24 hours (DERTEL 1944; PIPER 1950). Iron was then determined colorimetrically by the salicylate method of SCOTT (1941).
- b) Free Iron Oxides: by the MACKENZIE (1954) modification of DEB (1950) using sodium hydrosulphite.
- c) Total Ferric Iron: a rapid method outlined in CORNWALL (1958) using thioglycollic acid.
- d) "Active" Iron Oxides: using the principles of SCHWERTMANN (1964) and the methods of McKEAGUE and DAY (1966). The writer is indebted to Mr. J.L. Nowland (Soil Survey of Nova Scotia) for bringing this technique to his notice, the value of which has been recently emphasised by AVERY (1957).

(ix) Trace elements: the determination of manganese, lead, copper and zinc by a Hilger-Watts Atomic Absorption Spectrophotometer (WALSH 1955; DAVID 1958; ALLAN 1959; WILLIS 1962; FISHMAN and DOWNS 1966) on the acid extract. Instrument settings used were as follows:

	Mn	Pb.	Cu.	ZN.
Line	2795A ^o	2170A ^o	3248A ^o	2139A ^o
Lamp Current	20mA	7mA	10mA	10mA
Slit	0.1mm	0.2mm	0.1mm	0.3mm
Flame	neutral	lean	neutral	neutral
Burner	mid	mid	mid	mid

(x) Clay Analyses: clay separations performed in the manner used at the Macaulay Institute for Soil Research, Aberdeen. (MACKENZIE 1955).

D.T.A. analysis was carried out in a Bolton D.I.T.A. Furnace with a heating rate of 10^oC per minute, using calcined kaolinite as an inert reference substance.

X-ray analysis was performed on Mg-saturated, Mg-saturated glycerol-solvated, and on K-saturated mounted samples. The analysis was kindly supervised by Mrs. M. Kay, Department of Geology, University of Durham, on a Philips 1010 Generator and Diffractometer.

(xi) Thin sections: prepared for fabric studies using Araldite Resin MY 750 as outlined by CATT and ROBINSON (1961).

APPENDIX IV: PROFILE DESCRIPTIONS AND
ANALYTICAL DATA

Profile 1

Blanket Peat:- thick phase. G.R. NY(35)803421

Knoutberry Hill

<u>Height</u>	2150 ft.	<u>Vegetation</u>	Mixed wet Heath
<u>Slope</u>	4°	<u>Calluna-Eriophorum-Vaccinium</u>	
<u>Aspect</u>	East	with wet pools of <u>Sphagnum-Carex.</u>	
<u>Weather</u>	Cloudy, with strong wind		
<u>Surface</u>	Extensive hummock - pool complex on peat mounds. Erosion intense - category 5.		
<u>Land-use</u>	Unenclosed; sheep grazing. Face of peat mound excavated.		
<u>Depth</u>			
0-4"	2.5YR 2/0 Black damp peat with abundant roots. Fibrous. Occasional mineral grains detectable. Merges into		
4-12"	7.5YR 3/2 Dark brown wet peat. Remains of <u>Eriophorum-Calluna-Sphagnum</u> visible. Roots common. No mineral material. Clear change into		
12-20"	7.5YR 6/4 Light brown wet peat. Dominantly unhumified <u>Sphagnum</u> with occasional <u>Calluna</u> and <u>Eriophorum</u> . No live roots. Gradual change to		

- 20-80" 5YR 6/4 Light reddish brown wet peat. Mixed Eriophorum-Sphagnum peat, more humified than above. No roots visible. Resting sharply on
- 80-90" 2.5Y 6/0 Grey sandy loam. Wet and slightly plastic. No mottles. No roots. Sharp junction with
- 90"+ 5Y 4/1 Dark grey bleached and leached Upper Carboniferous sandstone.

ANALYTICAL DATA

Sample No.	Depth ins.	pH	H ₂ O	Ash	N
			% dry weight		
001	0-4	3.5	760	4.6	1.23
002	4-12	3.6	765	3.1	1.42
003	12-20	3.4	790	4.0	1.47
004	20-80	3.5	841	3.0	1.50

Profile 2

Blanket Peat:- thin phase. G.R. NY(35)865433

Wolfleugh Common

<u>Height</u>	1970 ft.	<u>Vegetation</u>	<u>Eriophorum</u> Bog
<u>Slope</u>	3°		
<u>Aspect</u>	North East		
<u>Weather</u>	Showery		
<u>Surface</u>	Regular.	<u>Eriophorum</u> tussocks with occasional <u>Sphagnum</u> pools.	
<u>Land Use</u>	Sheep grazing; open ditch drainage by 18" ditches at intervals of 60 yds.		
<u>Depth</u>			
0-6"	5YR 3/2 Dark reddish brown wet fibrous peat. Abundant live roots. No mineral material detectable. Gradual change to		
6-24"	7.5YR 3/2 Dark brown wet <u>Eriophorum</u> - <u>Sphagnum</u> peat. Roots common. No mineral material. Sharp change to		
24-45"	2.5YR 6/4 Light reddish brown wet <u>Sphagnum</u> peat. Highly humified. Resting sharply on		
45-56"+	10YR 4/1 Dark grey gleyed slope deposit. Saturated. Clay loam. Occasional bleached sandstone fragments.		

ANALYTICAL DATA

Sample No.	Depth ins.	pH	H ₂ O	Ash	N
			% dry weight		
005	0-6	4.1	856	3.9	1.01
006	6-24	3.8	870	2.4	1.66
007	24-45	3.9	940	2.1	1.73

Profile 3

Basin Peat. G.R. NY(35)820411

Wellhope Burn

Height 1525' Vegetation. Mixed wet Bog.
Juncus, Eriophorum, Polytrichum,
Sphagnum.

Slope 0°

Weather Sunny

Surface Disturbed by preparatory draining and ditching
for tree planting.

Land-use Sheep now excluded by Forestry Commission fencing.

Depth

0-22" 10YR 4/3 Dark brown fibrous Eriophorum-Sphagnum
peat. Saturated. Abundant live roots in
upper twelve inches. Only occasional lower
down. Clear change into

22-38" 10YR 4/4 Dark yellowish brown pseudo-fibrous
peat. Rich in remains of Eriophorum and Carex.
Saturated. Mineral material abundant. Merges
into

38-45" 5Y 5/3 Olive silty clay with Potamogeton
remains and 10YR 4/3 Brown organic bands.
Merges into

45-54"+ 10YR 5/1 Grey sandy clay.

ANALYTICAL DATA

Sample No.	Depth ins.	pH	H ₂ O	Ash	N
			% dry weight		
008	0-22	4.4	1308	4.3	1.42
009	22-38	4.6	1160	20.1	1.31
010	38-45	5.1	124	63.2	1.48

Profile 4

Basin Peat. G.R. NY(35)812387

Langtae Moss, Burnhope Burn

Height 1560' Vegetation Eriophorum bog,
with subdominant Sphagnum,
Juncus, and Carex.

Slope 0°

Weather Cloudy. Recent rain

Surface Cotton grass hummocks the only micro relief.

Land-use Within excluded zone of Burnhope Reservoir.

Depth

0-14" 7.5YR 3/2 Dark brown wet Eriophorum-Sphagnum
peat. Fibrous, with abundant roots. Occasional
mineral grains detectable. Merges into

14-41" 7.5YR 3/1 Very dark brown pseudo-fibrous peat.
Saturated. Phragmites remains visible. Mineral
material incorporated. No roots. Merges into

41-51" 5YR 2/1 Black organo-mineral layer. Humose
loam texture. Saturated. No mottles.

51-59"+ 2.5Y 5/4 light olive-brown massive clay loam.
Prominent 10YR 5/6 yellowish brown mottles,
irregularly distributed and in tubular form.
Occasional small bleached sandstone fragments.

ANALYTICAL DATA

Sample No.	Depth ins.	pH	H ₂ O	Ash	N
			% dry weight		
011	0-14	4.0	1264	4.9	1.03
012	14-41	4.7	958	15.1	1.54
013	41-51	4.9	108	69.4	1.00

Profile 5

Peaty flush. G.R.NY(35)873358

Chapel Fell

Height 1800' Vegetation Carex, Sphagnum
Juncus within Eriophorum-
Calluna-Vaccinium moorland

Slope 8°

Aspect North-west

Weather Heavy showers

Surface Gullied with Eriophorum hummocks. Water
flowing through.

Land-use Unenclosed; sheep grazing.

Samples from eastern edge of flush zone.

Depth

0-9" 10YR 2/1 Black saturated amorphous peat.
Probably redistributed. Few roots. Occasional
incorporated Sphagnum and Carex remains. Merges
into

9-22" 7.5YR 4/2 Dark brown fibrous Sphagnum peat.
Occasional roots. No mineral material.
Saturated. Clear change into

22-28" 10YR 2/1 Black humose loam. Mixture of peat
and mineral particles. No roots. No stones.
Saturated. Clear change into

28-36"+

10YR 6/2 Light brownish grey saturated loam.

Abundant 10YR 6/8 Brownish yellow mottles.

Massive. No roots.

ANALYTICAL DATA

Sample No.	Depth ins	pH	H ₂ O	Ash	N
			% dry weight		
014	0-9	4.8	1104	4.0	1.21
015	9-22	4.7	860	3.6	1.06
016	22-28	5.3	184	43.6	1.41

Profile 6

Peaty flush. G.R. NY(35)873358

Chapel Fell

Height 1800' Vegetation No vegetation
at sampling site.

Surroundings as for Profile 5.

Slope 8°

Aspect North-west

Weather Heavy showers

Surface Gullied with Eriophorum hummocks. Water
flowing through.

Land-use Unenclosed; sheep grazing.

Samples taken 3 yards to south of profile 5.

Depth

0-6" 10YR 2/1 Black saturated amorphous peat. No
roots. No observable plant remains. Sticky
surface. Merges into

6-24" 7.5YR 3/2 Dark brown Sphagnum peat. Fibrous
with occasional Eriophorum remains.

24-38"+ 10YR 6/2 Light brownish grey saturated loam.
Few mottles. Massive. No roots.

ANALYTICAL DATA

Sample No.	Depth ins.	pH	H ₂ O	Ash	N
			% dry weight		
017	0-6	4.6	938	3.6	0.94
018	6-24	4.7	1050	4.2	0.76

Profile 7

Lime flush G.R. NY(35) 832434

Killhope Moor

Height 1750' Vegetation Philonotis,
Molinia, and Carex spp.
locally within Eriophorum-
Calluna moorland.

Slope 7°

Aspect South

Weather Cloudy but dry.

Surface Even on edge of blanket peat

Land-use Unenclosed; sheep grazing

Depth

0-10" 10YR 3/1 Very dark grey saturated peat.
Numerous grass and rush remains, with dense
network of roots. Very incoherent. No mineral
material. Gradual change into

10-22" 10YR 2/1 Black saturated pseudo-fibrous peat.
Remains of grasses, rushes, reeds discernible.
No live roots. Occasional limestone and
sandstone pebbles. Merges into

22-24" 5YR 3/1 Very dark grey humose loam. Wet.
Transitional to

24-33"+

5Y 4/2 Olive grey clay loam slope deposit with occasional 10YR 5/6 mottles. No obvious pattern in mottling. Old root channels and occasional stone pebbles picked out. Saturated. Massive, but only weakly coherent.

ANALYTICAL DATA

Sample No	Depth ins.	pH	H ₂ O	Ash	N
			% Dry weight		
019	0-10	6.9	83.4	4.6	1.46
020	10-20	6.7	61.0	6.2	1.80
021	22-24	6.5	10.8	63.9	1.20

Profile 8

Lime flush G.R. NY(35)833402

Moss Moor

Height 1750' Vegetation: Philonotis,
Juncus, Carex spp locally
within Wet Grass Heath

Slope 5°

Aspect North East

Weather Cool and damp

Surface Dissected by rills

Land-use Unenclosed; sheep grazing

Depth

0-6" 7.5YR 2/0 Black saturated fibrous peat.
Dense mass of roots and plant remains. Firm.
No mineral material. Many live roots. Clear
change to

6-20" 7.5YR 3/2 Dark brown pseudo-fibrous peat.
Saturated. Occasional fine root penetrates.
Firm consistency. Merges into

20-23" 10YR 3/2 Very dark greyish brown humose loam.
Wet. Occasional small pebbles. No live roots.
Massive. Wavy lower boundary to

23-30"+

2.5Y 5/6 Light olive brown loam. Frequent
7.5YR 5/8 Strong brown mottles around included
limestone and sandstone fragments. Massive
and indurated. Wet. Old root channels but
no live roots.

ANALYTICAL DATA

Sample No.	Depth ins.	pH	H ₂ O	Ash	N
			% dry weight		
022	0-6	6.4	830	5.4	1.82
023	6-20	6.6	764	3.8	1.48
024	20-23	6.2	96	70.4	1.00

Profile 9

Iron flush G.R. NY(35)847427

Puddingthorn Moor

Height 1700' Vegetation Sparse Juncus
and Carex in pool complex.

Slope 16°

Aspect South-East

Weather Light rain

Surface Pool complex on edge of blanket peat.

Land-use Unenclosed; sheep grazing

Profile examined on edge of pool complex

Depth

- 0-4" 2.5YR 4/6 Red colloidal iron deposit forming coating on vegetation and remains. Silky to touch; non sticky. No sulphide odour. Wet. Merges into
- 4-7" 7.5YR 4/4 Dark brown amorphous peat with frequent streaks of 2.5YR 4/6 Red iron colloids. Saturated. Occasional live roots. Merges into
- 7-24" 10YR 3/3 Dark brown fibrous peat. Saturated. Remains of Sphagnum and Eriophorum visible. No mineral material nor obvious iron enrichment.
- 24-46" 10YR 5/6 Yellowish brown fibrous peat. Saturated. Sphagnum-Eriophorum blanket peat.

ANALYTICAL DATA

Sample No.	Depth	pH	H ₂ O	Ash	N	Fe ₂ O ₃ %
			% dry weight			CORNWALL
025	0-4	3.4	684	13.4	0.93	12.4
026	4-7	3.8	836	4.9	1.04	2.7
027	7-24	3.6	982	3.2	1.21	-
028	24-46	4.0	920	3.4	1.01	-

Profile 10

Iron flush GR. NY(35) 813439

Killhope Moor

Height 1975' Vegetation Intermittent

Carex and Juncus

Slope 6°

Aspect South-East

Weather Dry; bright sun

Surface Hagg Complex

Land-use Unenclosed; sheep grazing

Depth

0-3" 5YR 5/6 Yellowish red colloidal iron oxides.
Saturated, and smooth to the touch. Structureless
and incoherent. Forms cover over

3-7" 5YR 2/2 Dark reddish brown amorphous peat.
Saturated. Structureless. No mineral material.
No roots. Clear change to

7-36" 7.5YR 4/2 Dark brown fibrous peat. Saturated.
Firm. Remains of Eriophorum-Sphagnum. Clear
change to

36-43" 7.5YR 4/2 Dark brown fibrous peat. As above
but fibrous Calluna remains dominant.

ANALYTICAL DATA

Sample No.	Depth ins.	pH	H ₂ O	Ash	N	Fe ₂ O ₃ %
			% dry weight			CORNWALL
029	0-3	4.2	120	56.4	0.4	39.4
030	3-7	3.5	860	5.9	1.04	-
031	7-36	3.6	790	5.4	1.23	-
032	36-43	3.4	840	6.1	0.98	-

Profile 11

Sub-peat Gley G.R. NY(35)875355

Chapel Fell

Height 1975' Vegetation Eriophorum-Calluna

moorland

Slope 3°

Aspect North-West

Land-use Unenclosed; sheep grazing

Depth

49-0" Wet blanket peat

0-3" 10YR 3/3 Dark brown organo/mineral horizon
with common 10YR 2/2 Very dark brown vertical
organic streaks. Wet humose loam. Occasional
small sandstone pebbles with bleached edges
and internal areas of iron accumulation.

Merges into

3-12" 5Y 6/8 Olive yellow clay loam. Wet. Massive.
Frequent 7.5YR 6/8 Reddish yellow mottles and
stainings along old root channels. Sandstone
fragments, bleached and incoherent, with mottling
on stone-soil interface. Few dead roots.

Merges into

12-18"

5Y 4/1 Dark grey clay loam. Stone free.

Massive. Saturated. Rare ochreous mottles.

No roots. Clear change into

18"+

10YR 5/1 Grey clay loam solifluction deposit.

Damp and indurated. Frequent sandstone

fragments.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
033	0-3	12.9	30.4	28.5	28.2	3.6	43.2
034	3-12	27.2	18.8	28.1	25.9	3.9	19.1
035	12-18	24.9	22.3	22.4	30.4	4.1	6.1
036	18-22	23.0	24.1	19.7	33.2	4.8	1.9

Sample No.	Exchangeable Cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
033	0.34	0.24	0.21	0.68	47.14	48.61	3.03	28.2	1.32	21.4
034	0.47	0.26	0.04	0.19	12.46	13.42	7.15	10.3	1.08	9.5
035	0.63	0.62	0.21	0.30	15.45	17.21	10.23	3.2	0.64	5.0
036	1.21	0.69	0.10	0.22	12.11	14.33	15.49	0.8	0.24	3.3

Profile 12

Sub-peat Gley G.R. NY(35)809441

Killhope Moor

Height 2050' Vegetation Eriophorum-Vaccinium-
Calluna moorland, recently
planted with pine seedlings.

Slope 7°

Aspect South-East

Surface Gully dissection of peat

Weather Cloudy and damp

Land-use Experimental forestry enclosure

Depth

62-0" Saturated Blanket peat

0-4" 10YR 2/2 Very dark brown humose loam with
faint ochreous mottling along old root channels.
Sub angular blocky structure. Firm consistency.
No live roots. Clear boundary to

4-10" 10YR 5/2 Grey brown sandy clay loam. Many
distinct 7.5YR 5/6 Strong brown mottles.
Frequent medium and large sub angular sandstone
fragments. Medium angular blocky structure.
Occasional fine dead roots. Merges into

10-22" 10YR 5/1 Grey clay loam. Many distinct fine and medium 10YR 5/6 Yellowish brown mottles. Occasional medium weathering sub angular sandstone fragments. Weakly developed medium prismatic structure. Plastic and sticky. No roots. Merges into

22-28"+ 5Y 5/1 Grey clay loam with many 5 YR 5/8 Yellowish red mottles and ochreous stainings along old root channels. Occasional medium and large sub angular and tabular weathering sandstone fragments. Well developed coarse prismatic structure. Plastic and sticky. Rare dead fine roots.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
037	0-4	21.0	24.3	35.3	19.4	4.5	32.3
038	4.10	16.0	29.1	25.4	29.5	5.1	3.4
039	10-22	17.1	25.3	29.2	28.4	4.8	2.1
040	22-28	16.1	29.2	33.4	21.3	5.2	1.3

Sample No.	Exchangeable Cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
037	0.35	0.14	0.32	0.62	52.41	53.84	2.56	15.4	0.98	15.7
038	0.87	0.20	0.06	0.03	27.23	28.39	4.09	2.3	0.74	3.1
039	1.46	0.31	0.20	0.04	11.40	13.41	14.99	1.4	0.04	35.0
040	3.42	0.21	0.18	0.06	9.80	13.67	28.32	1.1	0.02	55.0

Profile 13

Sub-peat Gley with pan G.R. NY(35)884356

Chapel Fell

Height 1925' Vegetation Wet grass heath
on blanket bog

Slope 10°

Aspect North

Weather Drizzle

Surface Gullied

Land-use Unenclosed; sheep grazing

Depth

34-0" Blanket peat

0-4" 10YR 5/2 Greyish brown loam with many shale
and sandstone fragments. Occasional 10YR 6/8
Brownish yellow mottles. Coarse and distinct.
In upper part 10YR 3/4 Dark yellowish brown
humic stainings. Massive structure.
Sticky and plastic. Many dead roots. Irregular
clear boundary to

4-4 $\frac{1}{4}$ " Thin iron pan with root mat above. Cemented
and hard.

4 $\frac{1}{4}$ -18" 10YR 5/8 Yellowish brown loam with many
shale fragments. Medium blocky structure.
Slightly sticky and moist. No roots. Merges
into

18-28"+ 10YR 5/6 Yellowish brown slope deposit.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
041	0-4	37.2	12.4	36.6	13.7	4.5	11.4
042	4 $\frac{1}{4}$ -18	25.2	14.3	43.0	17.5	4.6	3.2
043	18-28	24.6	15.7	42.3	19.0	5.1	1.9

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
041	2.13	0.44	0.36	0.13	29.35	32.41	9.44	6.8	0.61	11.1
042	2.37	0.25	0.18	0.20	28.00	31.00	9.67	2.1	0.32	6.6
043	3.16	0.62	0.29	0.32	19.90	24.29	18.08	1.3	0.16	8.1

Profile 14

Sub-peat Gley with pan G.R. NY(35)814443

Killhope Moor

<u>Height</u>	2125'	<u>Vegetation</u>	<u>Eriophorum-</u> <u>Vaccinium-Calluna</u> moorland
<u>Slope</u>	16°		
<u>Aspect</u>	South		
<u>Weather</u>	Dry and warm		
<u>Surface</u>	Gullied peat		
<u>Land-use</u>	Unenclosed; sheep grazing		
<u>Depth</u>			
23-0"	Wet blanket peat		
0-12"	5YR 3/3 Dark reddish brown wet loam. Frequent 5Y 5/2 Olive grey mottles. Many sub angular sandstone fragments. Coarse prismatic structure, picked out by humus staining. Sticky. A few roots penetrate. Resting on irregular.		
12-12½"	Thin iron pan. Concretionary and incoherent.		
12½-28"+	5GY 5/1 Bluish grey wet clay loam slope deposit. Many small angular and sub angular sandstone fragments. Massive and compact. Plastic and sticky. Occasional dead root with fine iron oxide staining.		

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
045	0-12	40.0	19.2	25.4	15.4	4.8	1.6
046	12½-28	24.9	24.1	33.6	17.4	5.0	0.3

Sample No.	Exchangeable cations m.e./100g.						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
045	0.29	0.31	0.27	0.05	11.42	12.34	7.46	2.2	0.13	16.9
046	0.19	0.23	0.34	0.07	8.40	9.23	9.00	0.5	0.05	10.0

Profile 15

Sub-peat Podzol G.R. NY(35)870349

Chapel Fell

Height 2075' Vegetation Eriophorum-
Calluna moorland.

Slope 4°

Aspect North-West

Weather Dry; snow lying

Surface Incipient gullies

Land-use Unenclosed; sheep grazing

Depth

28-0" Wet Blanket peat

0-4" 7.5YR 3/2 Dark brown humose sandy loam.
Damp. Occasional small angular sandstone
fragments. Weak crumb structure. Many fine
and medium roots. No mottling. Clear
change to

4-7" 10YR 3/3 Dark brown sandy loam. Friable
and loose. Weak crumb structure. Occasional
roots. Damp. No mottling. Transitional
horizon. Merges into

7-14 7.5YR 4/4 Brown sandy loam. Compact and
massive. Breaking down into medium crumbs
and clods. Many angular and sub angular

weathering sandstone fragments. No roots.

No mottling. Merges into shattered and bleached

Carboniferous sandstone below.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
047	0-4	41.7	33.6	12.4	12.3	4.8	11.9
048	4-7	41.1	32.9	12.8	13.2	5.0	7.8
049	7-14	41.3	24.5	14.3	19.9	5.1	3.6

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Totals				
047	0.93	0.82	0.35	0.21	12.64	14.95	15.45	5.9	0.32	18.4
048	0.41	0.21	0.26	0.24	9.47	10.59	10.58	4.1	0.19	21.6
049	0.04	0.12	0.12	0.09	6.81	7.18	5.16	1.0	0.08	12.5

Profile 16

Sub-peat Podzol G.R. NY(35)820448

Killhope Law

Height 2150' Vegetation Eriophorum-
Vaccinium-Calluna moorland

Slope 2°

Aspect South

Weather Windy and dry

Surface Severe gully erosion

Land-use Unenclosed; sheep grazing

Depth

33-0" Wet blanket peat

0-6" 10YR 2/2 Very dark brown sandy loam with prominent 10YR 5/1 Grey speckles. Damp. Massive, breaking down to weak sub angular blocky structure. Occasional small angular sandstone fragments up to 2" diameter. Occasional roots. No mottling. Clear change to

6-10" 7.5YR 6/8 Reddish yellow loam. Compact and massive. Breaks down with difficulty to medium sub angular blocky structures. Strong with angular and sub angular sandstone fragments. No observable mottling. Clear change to

10-22" 10YR 6/4 Light brownish yellow sandy loam.
Slightly indurated. Strong. Angular
fragments of Carboniferous sandstone up
to 3" diameter. Moist. No roots. No
mottling. Merges into

22"+ 10YR 7/2 Light grey loamy sand matrix within
shattering sub angular sandstone fragments.
Moist. No mottling. Merges into solid
bedrock sandstone below.

Sample No.	Depth ins.	Mechanical Analysis%				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
050	0-6	41.4	45.9	8.6	4.1	4.2	4.9
051	6-10	42.7	42.4	9.6	5.3	4.6	0.8
052	10-22	36.0	47.3	12.3	4.4	5.0	0.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
050	0.10	0.21	0.05	0.01	12.40	12.77	2.90	1.6	0.07	22.9
051	-	0.19	0.03	0.02	6.72	6.96	3.45	-	-	-
052	-	0.13	0.02	0.02	4.31	4.48	3.80	-	-	-

Profile 17

Sub-peat Podzol with pan G.R. NY(35)832443

Westend Moor

Height 2030' Vegetation: Eriophorum-Calluna
moorland

Slope 5°

Aspect South

Weather Light drizzle

Surface Occasional gullies

Land-use Unenclosed; sheep grazing

Depth

33-0" Surface blanket bog

0-6" 5YR 5/2 Reddish grey sandy clay loam with
5YR 3/2 Dark reddish brown patches. Moist.
Massive, with medium prismatic structure.
Many old root channels. Many small sandstone
fragments. Sharp change to

6-6 1/4" 2.5YR 5/8 Red iron pan. Passes through
included stones. Resting sharply on

6 1/4-9" 7.5YR 5/6 Strong brown sandy clay loam.
Massive. Breaking down to variable blocky.
Many included Carboniferous sandstone
fragments. Merging boundary to

9-18"

10YR 4/2 Dark grey brown sandy loam slope
deposit. Massive. Abundant sandstone
fragments. Moist. Merging into shattered
sandstone.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
053	0-6	23.2	17.3	39.4	20.1	3.5	5.8
054	6 $\frac{1}{4}$ -9	35.9	15.1	24.7	24.3	3.7	2.4
055	9-18	46.5	22.5	16.9	14.1	4.0	0.9

Sample No.	Exchangeable cations m.e./100g						%Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
053	0.32	0.41	0.03	0.04	20.72	21.52	3.72	2.4	0.23	10.4
054	0.09	0.31	0.05	0.02	19.95	20.42	2.30	2.1	0.06	35.0
055	0.10	0.28	0.02	0.01	9.20	9.61	4.27	0.7	0.04	17.5

Profile 18

Sub-peat Podzol with pan G.R. NY(35)845428

Puddingthorn Moor

Height 1850' Vegetation Mixed wet
heath (Calluna-Eriophorum-
Juncus-Deschampsia-Polytrichum)
on blanket peat.

Slope 11°

Aspect South-East

Present weather Showery

Land-use Once enclosed; now rough moorland for sheep

Surface Occasional gullies

Depth

36-0" Fibrous Eriophorum-Calluna blanket peat

0-11" 10YR 4/2 Dark grey brown loam with numerous
bleached sand grains and sandstone fragments.
Massive and slightly sticky. Friable.
Occasional roots. Humus stains towards the
base. Moist. Sharp boundary to

11-14" 5Y 4/1 Olive grey silty loam. Saturated.
Massive. Sticky. Occasional manganese
flecks. Sharp irregular boundary to

14-14 $\frac{1}{4}$ " Thin iron pan.

14 $\frac{1}{4}$ -29" 5YR 4/8 Yellowish red loam containing abundant

angular and platy shale fragments. Increasing
in frequency with depth. Many pores.
Friable, slightly sticky. Merges into
Weathering shattered shale.

29"+

Sample No.	Depth ins.	Mechanical Analysis%				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
056	0-11	19.6	27.3	33.4	19.7	4.6	7.3
057	11-14	10.7	21.0	46.2	22.1	4.9	3.4
058	14 $\frac{1}{4}$ -29	20.1	21.6	38.4	19.9	5.3	3.5

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
056	1.32	0.51	0.09	0.02	15.61	17.55	11.05	4.3	0.05	86.0
057	0.08	0.60	0.01	0.04	9.34	10.07	7.25	2.0	0.04	50.0
058	1.42	0.50	0.01	0.03	7.23	9.19	21.33	1.7	0.01	170.0

Profile 19

Non calcareous ground water gley G.R. NY(35)981433

Stanhope Burn

Height 1025' Vegetation Juncus patches
within improved pasture.

Slope 3°

Aspect South-East

Weather Dry and sunny

Land-use Improved pasture for hay

Depth

0-10" 10YR 4/3 Brown sandy clay loam. Damp. Weak
crumb structure. Many medium and fine roots.
Occasional earthworm. Occasional sub angular
sandstone pebble. Merges into

10-28" 5Y 5/1 Grey clay. Saturated. 10YR 5/4
Yellowish brown mottling around fine sand
patches. Massive structure with faint
prismatic tendency. Followed by old root
runs and 5B 6/1 Bluish grey colouration.
Occasional sub angular sandstone pebbles.
Merges into

28-36"+ 5BG 5/1 Greenish grey clay with rare 10YR 5/3
Brown mottles. Saturated. Massive with
occasional vertical fissures and old root
channels. Stones rare.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
059	0-10	35.0	16.4	16.5	32.1	6.0	7.5
060	10-28	13.3	19.2	31.0	36.5	6.3	5.5
061	28-36	21.3	10.3	39.1	29.3	6.7	4.3

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
059	9.21	0.41	0.13	0.13	6.31	16.19	61.03	3.1	0.49	6.3
060	12.34	2.10	0.19	0.32	3.02	17.97	83.19	0.8	0.06	13.3
061	16.21	3.42	0.23	0.31	3.21	23.38	86.27	0.3	0.03	10.0

Profile 20

Non-calcareous Ground Water Gley G.R. NY(35)941433

Rookhope Burn

<u>Height</u>	1000'	<u>Vegetation</u>	Pasture species for hay
<u>Slope</u>	0°		
<u>Aspect</u>	-		
<u>Weather</u>	Recent heavy rain		
<u>Land-use</u>	Improved pasture for hay		
<u>Depth</u>			
0-12"	10YR 2/2 Very dark brown humose loam. Wet. Sub angular blocky structure. Occasional rounded and sub angular shale and sandstone fragments. High organic matter content. Earthworm tracks. Merges into		
12-25"	2.5Y 5/2 Grey brown sandy clay loam. Wet. 10YR 5/6 Yellow brown diffuse mottling. Firm. Ferruginous staining around old root channels, occasional sandstone fragments, and occasional vertical fissures. Weak prismatic structure. Merges into		
25-32"+	5YR 6/2 Light olive grey clay loam. Saturated. Massive. Compact and sticky. No roots. Stones rare.		

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
062	0-12	26.0	26.3	32.5	15.2	5.2	15.4
063	12-25	32.1	26.4	18.3	23.2	5.5	4.1
064	25-32	25.1	24.3	25.7	24.9	6.1	3.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
062	5.41	0.98	0.32	0.89	10.42	18.02	42.18	6.3	1.03	6.1
063	6.32	0.96	0.41	0.06	5.32	13.07	59.30	1.2	0.42	2.9
064	4.75	3.21	0.23	0.08	3.10	11.37	72.74	0.9	0.05	18.0

Profile 21

Peaty Gley G.R. NY(35)905434

Redburn Common

Height 1450' Vegetation Wet Grass Heath.
Eriophorum, Juncus, Nardus

Slope 7°

Aspect South-West

Weather Recent heavy rain

Land-use Unenclosed moorland; sheep grazing

Depth

0-8" 10YR 3/3 Dark brown surface peat with penetrating grass roots. Wet, compact but friable. Occasional earthworm. No stone fragments. Merging lower boundary to

8-11" 10YR 5/2 Greyish brown clay loam. Wet. Massive, breaking down to medium blocky on handling. Organic staining from overlying peat in upper section. No faunal activity observed. Many fine and medium roots. Several small (< 1/2" diameter) sandstone gravel fragments. Compact and slightly plastic. Distinct lower boundary to

11-16" 7.5YR 4/4 Dark grey sandy clay loam. Damp.
Massive and indurated, breaking down to variable
blocky. Stony, with angular sandstone flags
less than 9" diameter. Several large and
medium roots penetrate; channels etched out
by 10YR 6/6 Brownish yellow iron oxides.
Blotchy horizon. Sandy patches around sand-
stones in clayey groundmass. Merging lower
boundary to

16-28"+ 5Y 4/2 Olive grey sandy clay. Saturated.
As above but more complete anaerobism shown
in more even bluish hue. Very strong with
bleached and angular sandstone flags up to
18" diameter. Generally horizontal
i.e. not parallel to slope.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
065	0-8	-	-	-	-	5.2	92.4
066	8-11	18.8	21.6	32.4	27.2	5.6	12.1
067	11-16	23.4	32.1	16.2	28.3	5.8	3.1
068	16-28	23.9	29.8	12.4	33.9	6.1	1.0

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
065	-	-	-	-	-	-	-	73.4	1.23	59.7
066	2.06	1.26	0.12	0.22	10.03	13.69	26.73	3.4	0.42	8.1
067	5.87	4.64	0.01	0.31	9.40	20.23	53.53	2.1	0.05	42.0
068	10.00	6.30	0.02	0.36	8.35	25.03	66.64	2.8	0.04	70.0

Profile 22

Peaty gley G.R. NY(35)916353

Black Hill

Height 1575' Vegetation Grass heath;
Nardus-Calluna

Slope 9°

Aspect East

Weather Heavy showers

Land-use Unenclosed; sheep grazing

Depth

0-5" 7.5YR 2/0 Black amorphous peat. Wet. Massive
breaking down to weak crumb on handling.

Many roots penetrate. No faunal activity.

Dusting of bleached quartz grains. Merges into

5-14" 5Y 4/2 Olive grey sandy clay loam. Mottled
with 7.5YR 5/6 Strong brown distinct mottles
and blotches of ferric oxides. Massive,
plastic. Sand fraction derived from numerous
(≤ 10 " diameter) angular sandstone flags.

Incoherent to touch, rotting. Roots penetrate.

Merges into

14-29"+ 5B 4/1 Dark bluish grey sandy clay. 7.5YR 5/6
Strong brown mottles. White bleached sandstone
fragments. More indurated, mottled, and stonier
than above. Mottles mainly along root runs and
around weathering stone fragments. Stones angular

sandstone fragments, up to 18" diameter.

Large roots penetrate.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
069	0-5	-	-	-	-	5.1	84.3
070	5-14	20.9	29.3	25.6	24.2	5.4	9.2
071	14-29	20.8	28.6	19.2	31.4	5.6	2.6

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
069	-	-	-	-	-	-		72.1	1.26	57.2
070	3.02	1.01	0.51	2.61	12.42	19.57	36.53	7.6	0.61	12.5
071	2.09	0.06	0.06	0.10	8.31	10.62	21.75	1.2	0.05	24.0

Profile 23

Calcareous Gley G.R. NY(35)926388

Heights Quarry

Height 1200' Vegetation Improved pasture

Slope 5°

Aspect South

Weather Sunny and dry

Land-use Improved pasture for hay

Depth

0-7" 10YR 3/2 Very dark greyish brown clay loam.
Many roots. Medium angular blocky structure.
Moist. Worms. Occasional sandstone fragment.
Clear change to

7-25" 7.5YR 4/2 Brown clay loam with included
5YR 4/2 Brown clay loam with included 5YR 8/1
White carbonate aggregates. Groundmass massive
to weakly prismatic. Damp with occasional
stones. Effervesces weakly. Lime concretions
effervesce violently. Large, up to 5 inches
diameter. Faint diffuse ochreous mottling in
groundmass. Roots common. Clear change to

25-37"+ 10YR 4/1 Dark grey clay with irregular sandy inclusions. Wet. Large prismatic structure. Few roots. Effervesces faintly. Plastic and compact. Occasional sandstone fragment.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
072	0-7	18.1	20.3	32.4	29.2	6.1	9.4
073	7-25	14.1	17.4	40.2	28.3	7.4	6.9
074	25-37+	10.0	10.3	44.3	35.4	6.9	6.2

Sample No.	Exchangeable cations m.e./100g					
	Ca	Mg	Na	K	H	Total
072	19.01	1.31	0.32	0.51	2.19	23.34
073	39.21	3.16	0.53	0.50	-	43.40
074	28.31	6.13	0.21	0.32	-	34.97

Sample No.	% Base Saturation	% Carbon	% Nitrogen	C/N ratio	CaCO ₃ %
072	90.62	4.3	1.20	3.6	0.5
073	100.0	1.9	0.98	1.9	9.5
074	100.0	1.6	0.52	3.0	5.0

Profile 24

Calcareous Gley G.R. NY(35)946368

Snowhope Close

Height 1350' Vegetation Agrostis-fescue
grassland

Slope 9°

Aspect North

Weather Cloudy but dry

Land-use Improved pasture for sheep

Depth

0-8" 10YR 2/1 Black humose loam. Moist. No stones.
abundant roots. Massive, breaking down to
irregular crumb and blocky structure. Clear
change to

8-10" 10YR 3/4 Dark yellowish brown amorphous peaty
layer. Sharp boundary to

10-22" 10YR 5/2 Greyish brown saturated loam. Massive
breaking into variable clods. No stones.
Effervesces strongly. Occasional 10YR 8/2 White
segregation. Particularly along old root
channels. Live, Fine roots occasional.
Merges into

22-33"± 10YR 6/4 Light yellowish brown loam with 7.5YR
6/8 Reddish yellow mottling along old root
channels. Massive. Compact. Wet. Weak
effervescence. Becoming more indurated with
depth.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
075	0-8	-	-	-	-	6.4	23.4
076	8-10	-	-	-	-	6.6	38.9
077	10-22	33.9	40.4	9.8	15.9	7.1	1.3
078	22-33	25.7	36.5	23.1	14.7	6.9	2.4

Sample No.	Exchangeable cations m.e./100g					
	Ca	Mg	Na	K	H	Total
075	-	-	-	-	-	-
076	-	-	-	-	-	-
077	6.91	0.56	0.03	0.12	-	7.62
078	4.62	0.63	0.09	0.75	-	6.09

Sample No.	% Base Saturation	% Carbon	% Nitrogen	C/N ratio	CaCO ₃ %
075	-	10.3	0.96	10.7	-
076	-	18.9	1.07	17.7	-
077	100.0	0.3	0.04	7.5	8.0
078	100.0	3.1	0.06	51.7	2.5

Profile 25

Non-calcareous Surface Water Gley G.R. NY(35)922419

Lintzgarth Common

<u>Height</u>	1475'	<u>Vegetation</u>	Wet grass heath
<u>Slope</u>	10°		
<u>Aspect</u>	North		
<u>Weather</u>	Sunny and dry		
<u>Land-use</u>	Once enclosed, now relapsed grass heath		
<u>Depth</u>			
0-4"	10YR 3/2 Very dark greyish brown loam. Wet. Medium crumb structure within network of many roots. Friable, with much included organic matter. Many pores and earthworm tracks. Many vertical fissures. Few small stones. Clear change to		
4-8"	10YR 4/1 Dark grey loam. Wet. Many 2.5YR 5/4 Reddish brown district mottles. Occasional small pebbles. Medium angular blocky structure. Many dead and live roots, medium and fine. Rusty mottling along old root channels. Merges into		
8-15"	2.5Y 6/2 Light brownish grey sandy clay. Wet. With frequent 2.5YR 5/8 Red mottles. Medium angular blocky structure. Few roots. Little organic matter. Merges into		

15-25" 2.5Y 5/2 Greyish brown clay/sandy clay.
Wet. Many 7.5YR 5/8 Strong brown ochreous
mottles. Prismatic structure. Many large
sub angular stones. Compact and plastic.
Occasional dead roots. Clear change to
25-32"+ 7.5YR 4/4 Brown sandy loam with many small
grit and pebble fragments. Indurated, with
2.5Y 5/0 Grey gleying along vertical
fissures. Coarsely prismatic structure.
Frequent shale and sandstone pebbles
embedded in the matrix.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
079	0-4	40.2	29.1	6.2	24.5	5.2	12.3
080	4-8	32.5	36.4	7.2	23.9	5.6	5.8
081	8-15	35.1	27.7	9.5	27.7	5.9	5.3
082	15-25	50.4	20.0	7.9	21.7	6.0	3.6
083	25-32	53.4	27.4	7.1	12.1	6.5	3.1

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
079	3.80	0.72	0.80	0.80	23.12	29.24	20.93	5.1	1.01	5.0
080	3.33	0.36	0.31	0.89	19.62	24.51	19.95	1.3	0.07	18.6
081	3.08	0.27	0.65	0.17	14.91	19.08	21.86	0.5	0.06	8.3
082	3.70	0.27	0.79	0.23	9.32	14.31	34.87	0.3	0.02	15.0
083	3.08	0.27	0.71	0.19	8.32	12.57	33.81	0.2	0.02	10.0

Profile 26

Non-calcareous Surface Water Gley G.R. NY(35)888340

Swinhope Moor

<u>Height</u>	1775'	<u>Vegetation</u>	Wet grass heath
<u>Slope</u>	11°		
<u>Aspect</u>	North		
<u>Weather</u>	Showery		
<u>Land-use</u>	Unenclosed moorland; sheep grazing		
<u>Depth</u>			
0-7"	5Y 3/1 Very dark grey clay loam with ochreous mottles along dead root channels. Structure sub angular and angular blocky. Compact. Many fine and medium roots. Occasional large tabular and sub angular weathering sandstone fragments. Occasional earthworms. Clear boundary to		
7-14"	5Y 5/1 Grey sandy clay loam. Many distinct medium 10YR 6/3 Brownish yellow mottles, particularly around weathering sandstone fragments. Angular blocky structure. Plastic and slightly sticky. Occasional fine roots. Merges into		
14-27"	2.5Y 5/0 Grey sandy clay loam with many 7.5YR 6/8 Reddish yellow mottles. Structure coarsely prismatic. Many medium and large sub angular weathering sandstone fragments. Plastic and sticky. Merges into		

27-32"+

10YR 5/3 Brown sandy clay loam slope deposit.

Weathering sandstone fragments common. No

roots. Compact and indurated.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
084	0-7	17.3	30.7	27.0	25.0	5.6	11.3
085	7-14	15.0	30.4	23.8	30.8	5.4	13.4
086	14-27	16.9	26.9	24.9	31.3	5.2	2.1
087	27-32+	14.0	28.3	28.3	29.4	5.1	4.1

Sample No	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
084	9.41	1.36	0.62	0.40	10.33	22.12	53.30	9.8	0.93	10.5
085	8.23	1.04	0.88	0.39	11.42	21.96	48.00	2.0	0.54	3.7
086	3.12	0.89	1.47	0.22	11.24	16.94	33.65	1.8	0.32	5.6
087	4.04	1.07	1.05	0.24	12.11	18.51	34.58	3.7	0.16	23.1

Profile 27

Peaty Gleyed Podzol G.R. NY(35)887450

Rookhope Head

Height 1700' Vegetation Eriophorum

moorland

Slope 9°

Aspect South-West

Weather Heavy showers

Land-use Unenclosed moorland; sheep grazing

Depth

0-11" 10YR 2/1 Black wet amorphous peat. Friable.
No stones, no fauna. Many roots. Clear change to

11-17" 10YR 6/3 Grey silty clay loam with 7.5YR 5/7
Strong brown staining. Massive, firm. Angular
and sub angular sandstone fragments. Sticky,
humic staining at top. Fine roots common.
Sharp, wavy lower boundary to

15-15 $\frac{1}{4}$ " 5YR 2/2 Dark reddish brown thin iron pan. Clear
change to

15 $\frac{1}{4}$ -20" 10YR 4/2 Dark grey brown loam with fine angular
shale and sandstone fragments. Weak platy
structure. Dense. Occasional fine roots.
Clear change to

20-31"+ 2.5Y 4/4 Olive brown loam with many sub angular
and angular shale fragments. Massive, becoming more
indurated with depth. Diffuse iron staining along old
root channels and around stones.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
088	0-11	-	-	-	-	4.1	56.3
089	11-17	8.3	35.4	30.4	25.9	4.0	9.7
090	15 $\frac{1}{4}$ -20	23.2	19.8	32.8	24.2	4.6	7.4
091	20-31	31.4	13.4	33.1	22.1	4.9	4.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
088	-	-	-	-	-	-	-	35.4	2.2	16.1
089	0.92	0.37	0.51	1.21	16.72	19.73	15.26	3.2	0.61	5.2
090	0.31	0.09	0.03	0.87	15.42	16.72	7.78	1.7	0.03	56.7
091	0.04	0.02	0.04	1.05	17.89	19.04	6.04	0.4	0.05	8.0

Profile 28

Peaty Gleyed Podzol G.R. NY(35)817405

Malakoff Edge

Height 1800' Vegetation Eriophorum-Calluna
moorland

Slope 11°

Aspect North

Weather Sunny and dry

Land-use Unenclosed moorland; sheep grazing

Depth

0-8" 7.5YR 2/1 Very dark brown wet fibrous peat.
Remains of Eriophorum and Calluna. Frequent roots

8-10" 10YR 2/0 Black amorphous peat. Wet. Frequent
roots. Soft, spongy. Sharp change to

10-14" 10YR 4/2 Dark grey brown loam with common
bleached sub angular sandstone fragments.
Structureless and slightly sticky. Obvious
humus staining at top. Roots common. Sharp
wavy boundary to

14-14 $\frac{1}{4}$ " 5YR 2/2 Dark reddish brown iron pan. Sharp
change to

14 $\frac{1}{4}$ -23" 5YR 4/8 Yellowish red loam with abundant angular
sandstone fragments. Friable, breaking down to
irregular blocky structures. Occasional roots.
Merges into

23-28"+ Rubble horizon of weathering sandstone fragments
with some loamy infill.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
092	0-8	-	-	-	-	4.1	73.1
093	8-10	-	-	-	-	4.2	68.2
094	10-14	27.3	22.8	23.8	26.1	4.5	6.3
095	14 $\frac{1}{4}$ -23	45.6	17.9	24.1	12.4	4.5	4.2
096	23-28	48.9	16.2	24.8	10.1	4.6	1.4

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
092	-	-	-	-	-	-	-	49.6	1.92	25.8
093	-	-	-	-	-	-	-	40.3	1.81	22.3
094	0.71	0.32	0.09	0.21	18.41	19.74	6.74	3.1	0.26	11.9
095	0.42	0.21	0.13	0.35	18.03	19.14	5.80	2.6	0.13	20.0
096	0.63	0.31	0.09	0.12	19.86	21.01	5.48	0.9	0.05	18.0

Profile 29

Iron Podzol G.R. NY(35)902438

Redburn Common

Height 1600' Vegetation Mixed Grass Heath
Agrostis, Festuca, Deschampsia,
Nardus, Juncus squarrosus,
with moss. Old Calluna clumps

Slope 12°

Aspect South-West

Weather Sunny and dry

Land-use Unenclosed heath for sheep grazing

Depth

0-3" Dense most of grass roots. Mainly live, but some
dead, as ~~mat~~ showing no signs of humification.

Dry, firm fibrous layer, with an occasional
included rabbit coprolith. Fine dusting of
mineral material seen under the hand lens.

Merges into

3-5" 10YR 3/6 Very dark grey layer of humified organic
material. Firm consistency, breaking down to
medium and strong blocky and crumb structures.

Fine powdering of quartz grains. Occasional
included stones up to 1" diameter; mainly
angular coarse sandstone fragments. Dry. Many
fine and medium penetrating roots. Merging
lower boundary to

- 5-14" 10YR 5/1 Grey loamy sand with faint humic staining from above. Massive, but breaking down to weak blocky structure. Roots common. Several large (c10" diameter) included angular bleached sandstone boulders. Sharp and irregular change to
- 14-16" 2.5YR 4/6 Red zone of ferric oxide accumulation. Frequent iron concretions within main zone of deposition. Many roots, forming dense mat in places. Occasional sandstone fragments with ferric cutans.
- 16-23" 7.5YR 5/6 Strong brown sandy loam with occasional 5YR 5/8 Yellowish red mottles. Angular sandstones up to 4" diameter, increasing in frequency with depth. Massive, breaking down to variable weak aggregations.
- 23-32"+ 2.5Y 4/4 Olive brown colluvial layer. Stony with loam matrix. Damp. Occasional fine roots. Indurated and compact.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
097	0-3	-	-	-	-	4.4	93.2
098	3-5	-	-	-	-	3.8	42.1
099	5-14	50.5	37.1	5.5	3.8	4.0	6.2
100	14-16	40.1	40.0	10.4	9.5	4.9	7.9
101	16-23	55.1	24.6	11.9	8.4	5.1	3.4
102	23-32	55.8	25.1	11.1	8.0	5.2	2.6

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
097	-	-	-	-	-	-	-	50.9	0.98	52.1
098	-	-	-	-	-	-	-	24.6	0.49	50.2
099	0.30	0.23	0.04	0.11	8.04	8.74	8.01	3.6	0.10	36.0
100	0.15	0.02	0.02	0.02	4.39	4.60	4.57	4.3	0.09	47.8
101	0.15	0.02	0.01	0.02	3.27	3.47	5.77	3.1	0.05	62.0
102	0.15	0.01	0.02	0.02	4.58	4.78	4.19	1.6	0.03	53.3

sandstones (c6" diameter), all bleached.

Merges into

18-23" 7.5YR 4/4 Dark brown loam. Variable blocky structure. Friable, dry, well drained. Many included gravel fragments up to 1" diameter, coated with iron oxides. Many fine roots penetrate. Loam matrix around shale and sandstone fragments. Stones increase in frequency with depth.

23-29" 2.5Y 3/2 Very dark greyish brown colluvial material. Loam, with high stone content. Shattered shale fragments with occasional sandstone. Friable and non indurated. Occasional fine roots. Merges into

29-35"+ As above but more indurated and cemented.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
103	0-3	-	-	-	-	3.9	91.7
104	3-8	-	-	-	-	3.7	82.4
105	8-13	-	-	-	-	3.9	39.6
106	13-18	31.8	27.4	13.4	27.3	4.4	5.6
107	18-23	33.6	23.6	15.7	27.1	4.8	3.7
108	23-29	33.3	25.3	12.4	29.0	4.9	3.4
109	29-35	31.2	25.2	14.3	29.3	4.8	3.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
103	-	-	-	-	-	-	-	63.7	1.47	43.3
104	-	-	-	-	-	-	-	60.1	1.6	37.6
105	-	-	-	-	-	-	-	24.9	0.64	38.9
106	0.36	0.24	0.13	0.0	12.57	13.30	5.49	3.1	0.09	34.4
107	0.42	0.60	0.15	0.10	19.32	20.59	6.17	1.9	0.04	47.5
108	0.31	1.23	0.15	0.15	17.20	19.04	9.67	1.8	0.03	60.0
109	0.60	1.48	0.20	0.15	12.41	14.84	16.38	1.8	0.05	36.0

- 10-13" 10YR 2/2 Very dark brown humic loam. Dense, compact and cemented pan-like layer. Breaks down moderately on handling to give angular blocky structures. Many included humic-stained sandstones. Occasional medium roots.
Clear change to
- 13-20" 5YR 5/8 Yellowish red sandy loam. Compound structure, massive with weak platiness. Occasional root. High stone content; mainly tabular sandstone, stained with iron oxides. Merges into
- 20-26" As above but more indurated with fewer stones. Weak platy structure. Clear change to
- 26-37" 7.5YR 6/4 Light brown sandy loam. Weathered sandstone material with many included stones. No roots. Occasional iron segregations. Stones angular and tabular, increasing in frequency to the parent rock at 37". Horizontally bedded tabular, fine grained carboniferous sandstone.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
110	0-2	-	-	-	-	3.5	94.0
111	2-5	-	-	-	-	3.7	56.5
112	5-7	57.5	29.0	7.1	2.4	3.8	8.0
113	7-10	51.5	27.5	11.1	7.1	4.1	5.7
114	10-13	46.1	26.0	11.0	3.4	4.4	18.9
115	13-20	48.4	24.0	13.1	11.3	4.8	6.4
116	20-26	47.2	30.2	11.2	11.4	4.9	2.6
117	26-37	49.2	24.0	11.8	11.6	4.9	3.0

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
110	-	-	-	-	-	-	-	56.7	0.85	66.5
111	-	-	-	-	-	-	-	34.6	0.60	60.9
112	0.61	0.55	0.10	0.34	36.41	38.01	4.21	4.7	0.14	33.8
113	0.15	0.14	0.05	0.09	30.75	31.18	1.38	3.1	0.08	38.4
114	0.16	0.37	0.12	0.20	50.14	50.99	1.67	12.3	0.54	22.8
115	0.15	0.05	0.05	0.05	6.32	6.62	4.54	4.3	0.05	86.0
116	0.45	0.05	0.03	0.03	7.10	7.66	7.32	1.4	0.02	70.0
117	0.46	0.04	0.03	0.03	1.55	2.11	26.54	0.9	0.02	45.0

Profile 32

Humus-iron Podzol G.R. NY(35)965355

Bollihope Carrs

Height 1600' Vegetation Calluna- Dry mixed
Grass Heath

Slope 6°

Aspect East

Weather Cloudy but dry

Land-use Unenclosed heathland for sheep grazing

Depth

0-2" Mat of grass roots and Calluna remains. Dry.
Fibrous. Porous. Resting sharply on

2-4" 10YR 2/1 Black amorphous organic material. Damp.
Many roots. Massive, but breaking down to weak,
irregular crumb. Clear change to

4-9" 10YR 5/3 Brown loam. Small angular blocky
structure. Moist and friable. Occasional gravel
fragment. Many fine and medium roots. Clear
change to

9-13" 7.5YR 4/4 Brown humic loam. Many roots. Angular
and sub-angular blocky units. Many stained sand-
stone fragments (< 2" diameter). Friable and
damp. Merges into

13-17" 7.5YR 5/6 Strong brown loam. Well developed
angular and sub-angular blocky structures. Porous,
with many fine and medium roots. Friable.
Many small stones. Merges into

17-25" . 10YR 5/8 Yellowish brown loam. Fine angular blocky structure, with many fine roots. Many small stones. Becoming paler and more indurated with depth. Friable. Merges into

25-31"+ . 10YR 6/8 Brownish yellow sandy clay loam slope deposit. Many roots. Many small sub-angular sandstone and platy shale fragments. Porous and damp.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
118	0-2	-	-	-	-	3.6	72.1
119	2-4	-	-	-	-	3.8	65.7
120	4-9	15.6	37.4	29.7	17.3	4.0	6.4
121	9-13	12.4	24.8	33.4	29.4	4.2	16.3
122	13-17	14.7	37.9	25.3	22.1	4.2	6.7
123	17-25	15.9	42.3	21.4	20.4	4.4	2.9
124	25-31	14.2	39.8	22.8	23.2	4.7	2.1

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
118	-	-	-	-	-	-	-	53.2	0.82	64.9
119	-	-	-	-	-	-	-	49.1	0.61	80.5
120	0.88	0.12	0.10	0.05	14.17	15.32	7.51	3.8	0.42	9.0
121	1.43	0.86	0.58	0.13	33.50	36.50	8.22	12.4	0.57	21.8
122	1.03	0.57	0.50	0.10	27.22	29.42	7.48	6.1	0.32	19.1
123	1.01	0.32	0.31	0.10	28.08	29.82	5.84	2.0	0.20	10.0
124	0.82	0.30	0.52	0.10	20.67	22.41	7.77	1.8	0.15	12.0

Profile 33

Podzol with gleying G.R. NY(35) 960432

Stanhope Common

<u>Height</u>	1450'	<u>Vegetation</u>	<u>Calluna</u> heath with sub-dominant grass species
<u>Slope</u>	7°		
<u>Aspect</u>	East		
<u>Weather</u>	Sunny and dry		
<u>Land-use</u>	Unenclosed moorland for sheep grazing		
<u>Depth</u>			
0-4"	10YR 3/3 Dark brown root mat. Becoming darker with depth and more amorphous. Abundant roots. Resting sharply on		
4-8"	10YR 5/3 Brown loam. Variable colours, with dark humic staining from above, and 10YR 5/2 Greyish brown mottles. Weak angular blocky structure. Many fine roots and small sandstone fragments. Merges into		
8-11"	10YR 4/3 Dark brown loam with angular blocky structure. Occasional roots and many small sandstone fragments. Friable and firm. Merges into		
11-20"	10YR 5/6 Yellowish brown loam. Damp and compact. Few roots. Many sandstone fragments. Slightly cemented. Breaks down under pressure to give angular blocky structures. Few roots.		

Merges into

20-31"+ 10YR 7/6 Yellow soliflucted weathered material
from Carboniferous sandstone. Compact and
indurated. Loam texture with many small
sandstone fragments. No roots. No mottles.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
125	0-4	-	-	-	-	3.5	73.2
126	4-8	25.4	36.7	19.4	18.5	3.6	5.4
127	8-11	28.3	38.9	21.9	10.9	4.1	3.2
128	11-20	24.2	24.9	18.2	32.7	4.4	4.8
129	20-31+	30.3	29.8	17.6	22.3	4.5	3.6

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
125	-	-	-	-	-	-	-	46.3	0.76	60.9
126	0.81	0.29	0.13	0.21	10.87	12.31	11.70	3.9	0.31	12.6
127	0.36	0.13	0.10	0.20	13.13	13.92	5.68	2.7	0.29	9.3
128	0.51	0.22	0.19	0.13	22.45	23.60	4.87	3.5	0.25	14.0
129	0.43	0.20	0.13	0.30	16.67	17.73	5.98	2.4	0.15	16.0

Profile 34

Podzol with gleying G.R. NY(35)984337

Bollihope Common

Height 1250' Vegetation Eriophorum-Calluna
association

Slope 9°

Aspect North-West

Weather Cloudy but dry

Land-use Unenclosed

Depth

0-3" 10YR 3/2 Very dark greyish brown fibrous organic layer. Roots and stocks abundant. No stones. Moist. Clear change to

3-4" 10YR 2/1 Black amorphous organic material. Well decomposed remains. Moist. Clear change to

4-9" Blotchy sandy loam with 7.5YR 6/2 Pinkish grey and 7.5YR 5/4 Brown blotches. Abundant roots. Moist. Massive structure, breaking down to coarse sub-angular blocky. Occasional stone. Merges into

9-23" 7.5YR 5/6 Strong brown sandy clay loam. Damp, Friable, with blocky structure. Many fine roots. Few stones clear change to

23-39"+ 10YR 5/8 Yellowish brown sandy loam. Indurated with platy structures. Few roots. Many platy sandstone fragments. Firmly embedded into groundmass.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
130	0-3	-	-	-	-	3.5	74.2
131	3-4	-	-	-	-	3.5	79.8
132	4-9	20.4	27.4	35.3	16.9	3.7	6.8
133	9-23	29.5	25.3	25.4	19.8	4.3	6.9
134	23-39	27.4	26.1	30.2	16.3	4.5	4.1

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
130	-	-	-	-	-	-	-	54.2	0.93	58.3
131	-	-	-	-	-	-	-	53.1	0.98	54.2
132	0.61	0.20	0.15	0.07	14.51	15.54	6.63	5.2	0.28	18.6
133	0.83	0.31	0.19	0.10	16.60	18.03	7.93	5.3	0.34	15.6
134	0.53	0.24	0.10	0.10	13.32	14.29	6.79	3.2	0.19	16.8

Profile 35

Sol Brun Acide G.R. NY(35)984399

Stanhope Burn

Height 875' Vegetation Improved
grassland species

Slope 13°

Aspect South-East

Weather Dry and sunny

Land-use Improved pasture for hay

Depth

0-2" 7.5YR 3/2 Dark brown sandy loam. Loose, friable. Weak crumb structure. Bleached quartz grains in evidence. Occasional fragments of sandstone. Many fine roots. Merges into

2-8" 7.5YR 4/2 Brown sandy loam. Loose, friable, and structureless with many stone fragments. Many roots. Merges into

8-15" 7.5YR 5/4 Brown loam. Weak angular blocky structure. Dry, with occasional fragments of limestone. No free carbonates. Several roots. Merges into

15-28" 7.5YR 6/2 Pinkish grey loam with many included sandstone and limestone fragments. Compact with angular blocky structure. Few roots. Colluvial horizon.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
135	0-2	18.2	35.8	33.0	13.0	5.2	9.2
136	2-8	26.4	35.6	21.3	16.7	5.3	3.1
137	8-15	28.1	34.8	18.1	19.0	5.5	2.5
138	15-28	29.9	32.8	19.2	18.1	5.3	1.8

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
135	2.91	1.43	0.57	0.61	9.32	14.84	37.20	6.1	0.74	8.2
136	1.32	0.71	0.63	0.60	5.32	8.58	38.00	1.9	0.48	4.0
137	2.19	0.84	0.76	0.42	4.39	8.60	48.96	1.6	0.25	6.4
138	1.83	0.42	0.36	0.41	5.32	8.34	36.22	0.8	0.15	5.3

Profile 36

Sol Brun Acide G.R. NY(35)952418

High Brandon Walls

Height 1500' Vegetation Calluna - grass Heath

Slope 11°

Aspect South-West

Weather Sunny and dry

Land-use Enclosed but unimproved heath

Depth

0-6" 5YR 3/2 Dark reddish brown sandy loam. Moist.
Friable. Medium sub-angular blocky structure.
Organo-mineral horizon with many fine roots.
Merges into

6-12" 5YR 3/3 Dark reddish brown sandy loam. Moist.
Friable. Many fine penetrating roots. Medium
blocky structure. No stones. Merges into

12-19" 7.5YR 5/6 Strong brown sandy loam. Friable but
massive. Many small (< 2" diameter) sandstone
fragments. Few roots. Merges into

19-31" As above, but more indurated and compact and
with higher frequency of sandstone fragments.
Colluvial slope deposit. Dry.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
139	0-6	47.6	32.1	10.2	10.1	6.5	7.3
140	6-12	40.8	35.4	13.22	10.6	6.1	4.2
141	12-19	47.1	33.7	7.0	12.2	5.8	1.7
142	19-31	46.3	31.9	8.7	13.1	5.6	0.8

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
139	7.32	0.91	0.35	0.14	6.42	15.14	57.6	4.3	0.56	7.7
140	3.24	0.92	0.36	0.10	10.32	14.94	30.93	2.1	0.32	6.6
141	3.51	0.46	0.31	0.20	8.32	12.80	35.00	1.3	0.17	7.6
142	3.19	0.26	0.25	0.15	12.32	16.17	23.81	0.5	0.05	10.0

Profile 37

Sol Brun Acide with gleying G.R. NY(35)977375

Newlandside

Height 1050' Vegetation Improved grassland
species

Slope 8°

Aspect North

Weather Cloudy with light drizzle

Land-use Improved pasture for hay

Depth

0-3" 7.5YR 3/2 Dark brown clay loam. Well developed medium and fine crumb structure. Dry and soft. Occasional sandstone fragment. Many fine roots and pores. Intimate organic matter. Merges into

3-9" 7.5YR 3/2 Dark brown sandy clay loam. Moist. Well developed sub-angular blocky structure. Many fine roots and pores. Stones frequent. Merges into

9-13" 7.5YR 4/6 Strong brown sandy clay with many large stones and boulders. Sub-angular blocky structure, becoming more compact and indurated with depth. Merges into

13-24" 2.5YR 5/3 Light olive grey brown sandy clay with abundant 7.5YR 5/8 Strong brown mottles. Fewer stones than above. No roots. Firm and indurated

Breaks down with difficulty to give variable angular blocks. Moist.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
143	0-3	12.4	30.1	24.6	32.9	5.1	8.3
144	3-9	10.3	39.3	15.7	34.7	5.2	2.1
145	9-13	8.1	27.3	16.3	39.3	5.1	3.3
146	13-24	19.2	30.4	14.2	36.2	5.5	1.4

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
143	10.31	2.16	0.93	0.71	15.42	29.53	47.79	6.2	0.56	11.1
144	3.61	0.93	1.62	0.25	14.03	20.44	31.37	2.2	0.27	8.1
145	6.23	1.15	0.24	0.36	5.30	13.28	60.10	2.1	0.20	10.5
146	3.21	1.26	0.13	0.35	4.89	9.84	50.31	0.9	0.05	18.0

Profile 38

Sol Brun Acide with gleying G.R. NY(35)889391

Carr Brow Moor

Height 1450' Vegetation Improved grass
species, plus Nardus and
Juncus

Slope 8°

Aspect South

Weather Sunny and dry

Land-use Improved, but relapsing, pasture for hay

Depth

0-9" 7.5YR 4/2 Dark brown loam. Moist and friable.
Medium blocky structure. Occasional small
sandstone fragments. Many roots and pores.
Clear change to

9-18" 7.5YR 5/6 Strong brown loam with weak 2.5YR 5/2
Reddish grey mottling. Moist and friable.
Sub-angular blocky structures. Occasional
large sandstones present. Fine roots penetrate.
Merges into

18-25" As above, but more indurated and higher stone
content. Merges into

25-37"

10YR 4/1 Dark grey loam with many large 7.5YR
6/6 Reddish yellow mottles. Many included
small sandstone fragments. No roots. Compact
and Massive. Becoming more and more indurated
with depth.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
147	0-9	16.1	38.7	24.0	21.2	5.6	6.4
148	9-18	15.3	39.1	22.2	23.4	5.9	3.2
149	18-25	22.1	43.4	15.3	19.2	6.1	1.0
150	25-37	22.9	42.8	13.0	21.3	5.9	0.8

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
147	3.90	0.56	0.21	0.10	5.73	10.50	45.43	3.9	0.32	12.2
148	2.31	0.72	0.10	0.05	6.19	9.37	33.94	2.5	0.21	11.9
149	2.04	0.89	0.10	.07	4.39	7.49	41.39	0.7	0.06	11.7
150	2.02	0.82	0.06	0.05	4.29	7.24	40.75	0.3	0.05	6.0

Profile 39

Podzolised sol brun acide G.R. NY(35)968419

Stanhope Common

Height 1650' Vegetation Calluna-Grass Heath

Slope 14°

Aspect South-West

Present Weather
Dry

Land-use Unenclosed; sheep grazing

Depth

0-2" Dense mat of dominantly grass roots, mainly live but some dead. No signs of humification. Dry and fibrous. Merges into

2-5" 10YR 2/2 Very dark brown organo-mineral horizon. Firm and massive, but with abundant roots. Fine sandstone gravel up to ½" diameter. Humic sandy loam texture. Clear change to

5-12" 5YR 5/4 Reddish brown loam. Massive and compacted but not indurated. Normal cementation by ferric oxides breaking down to fine weak crumb structure on handling. Under lens, coarse quartz fragments coated with sesquioxidic ground mass. Slightly damp. Many fine and medium roots. Common, less than 3" diameter, shale and sandstone fragments.

Abrupt boundary to

12-19" . 10YR 4/1 Dark grey dense, hard and massive slope deposit of shale fragments, approximately 1" diameter. Rotted with liberal 5YR 5/4 Reddish brown iron staining from above, particularly along the pore channels and on shale faces. Angular sandstone foreigners, up to 4" diameter included. Merges into

19-29"+ 10YR 4/1 Dark grey compacted shale colluvium consisting of damp shale fragments. Several large, up to 17" diameter, sandstone flags.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
151	0-2	-	-	-	-	4.1	63.4
152	2-5	-	-	-	-	4.2	31.3
153	5-12	33.0	23.2	28.5	15.3	4.3	4.6
154	12-19	33.8	24.5	32.3	19.4	4.7	5.3
155	19-29	21.3	21.3	34.6	22.8	4.9	3.1

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
151	-	-	-	-	-	-	-	32.1	1.03	31.2
152	-	-	-	-	-	-	-	21.7	0.62	35.0
153	1.32	0.26	0.05	0.12	13.61	15.32	11.61	3.2	0.13	24.6
154	0.31	0.26	0.13	0.10	9.62	10.42	7.68	3.4	0.04	85.0
155	0.41	0.20	0.10	0.15	10.03	10.89	7.90	2.6	0.04	65.0

Profile 40

Podzolised Sol Brun Acide G.R. NY(35)893435

Wolfeleugh Common

Height 1625' Vegetation Erophorum -
Calluna heath

Slope 10°

Aspect North-East

Weather Dry and sunny

Land-use Walled but unimproved; sheep grazing

Depth

0-3" 10YR 3/2 Very dark greyish brown humic sandy loam. Compact, firm and dry with many fine and medium roots. Weak medium crumb structure. No stones. Clear change to

3-9" 10YR 4/3 Brown sandy loam. Medium sub-angular blocky structure. Several small sandstone fragments. Friable. Many fine penetrating roots

9-15" 10YR 5/4 Yellowish brown sandy loam with many small sandstone fragments. Dry. Friable. Medium sub-angular blocky structure. Many roots penetrate. Merges into

15-21" 7.5YR 6/6 Reddish yellow sandy loam. Many small and medium sandstone fragments. Friable. Angular blocky structure. Occasional fine roots. Merges into

21-31"+ 10YR 6/3 Pale brown sandy loam slope deposit.

Many sandstone gravels and pebbles. Dry.

Compact. No roots.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
156	0-3	17.2	36.8	32.4	13.6	4.3	21.3
157	3-9	31.3	27.7	25.3	15.7	4.5	3.2
158	9-15	32.1	26.9	29.0	12.0	4.8	2.1
159	15-21	32.8	26.2	26.3	14.7	4.9	1.3
160	21-31	35.6	23.4	29.4	11.6	4.8	1.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
156	2.31	0.72	0.90	0.80	19.69	24.42	19.37	19.8	0.93	21.3
157	2.10	0.63	0.72	0.63	14.45	18.53	22.02	3.4	0.08	42.5
158	0.96	0.65	0.38	0.57	13.42	15.88	15.50	2.3	0.07	32.9
159	0.61	0.43	0.42	0.56	11.98	14.00	14.43	1.9	0.05	38.0
160	0.83	0.62	0.57	0.40	9.32	11.74	20.62	2.1	0.06	35.0

Profile 41

High Pennine Brown Earth G.R. NY(35)828445

Middlehope Moor

Height 2050' Vegetation Grass Heath
Nardus-Eriophorum

Slope 2°

Aspect South-East

Weather Dry, sunny, snow lying

Land-use Unenclosed moorland

Depth

- 0-5" 7.5YR 4/2 Dark brown humic sandy loam.
Fine and medium sub-angular blocky structure.
Moist. Many small sandstone fragments.
Fine and medium roots. Friable consistency.
Merges into
- 5-8" 7.5YR 3/2 Very dark brown sandy loam. Massive,
moist, with many included sandstone fragments.
Breaks down into structureless mass. Slightly
sticky. Rare fine roots. No mottling.
Merges into
- 8-20"+ 7.5YR 5/6 Strong brown loam. Massive and
compact, with many included sandstones.
Moist, and sticky. No roots. Incoherent
slope deposit.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
161	0-5	21.4	32.5	33.3	13.7	5.2	8.9
162	5-8	19.6	35.7	28.6	16.1	5.5	3.7
163	8-20+	15.4	28.4	26.4	29.8	5.3	4.4

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
161	3.12	0.42	0.20	0.15	14.31	18.20	21.38	5.3	0.73	7.3
162	1.93	1.02	0.36	0.14	12.32	15.77	21.88	3.2	0.35	9.1
163	2.13	3.42	1.31	0.12	10.26	17.24	40.49	3.6	0.09	40.0

Profile 42

High Pennine Brown Earth G.R. NY(35)831358

Coldberry End

<u>Height</u>	2125'
<u>Slope</u>	4°
<u>Aspect</u>	East
<u>Weather</u>	Light Drizzle
<u>Land-use</u>	Unenclosed; sheep grazing
<u>Depth</u>	
0-2"	10YR 3/2 Very dark greyish brown amorphous humus. Damp and sticky. No stones. Fine and medium penetrating roots. Clear boundary to
2-7"	10YR 3/3 Dark brown clay loam. Damp and Massive. Sticky and plastic. Strong with embedded shale and sandstone fragments. Occasional roots. No mottles, but slight organic staining at top. Merges into
7-15"	10YR 5/6 Yellowish brown silty loam. Damp, with many stones. Massive and indurated. Few pores. Merges into
15-28"	10YR 5/6 Yellowish brown silty loam. Friable and softer than above. Many small gravel fragments. No roots. Sticky.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
164	0-2	-	-	-	-	4.3	55.4
165	2-7	26.6	15.9	28.2	29.3	4.3	6.9
166	7-15	21.2	18.3	32.1	28.4	4.5	4.2
167	15-28	22.2	17.9	34.6	25.3	4.7	4.1

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
164	-	-	-	-	-	-	-	37.4	0.93	40.2
165	2.13	0.62	0.19	0.31	15.73	18.98	17.13	4.8	0.42	11.4
166	1.32	0.31	0.10	0.20	13.21	15.14	12.75	3.2	0.09	35.6
167	0.49	0.29	0.15	0.20	12.39	13.52	8.36	3.1	0.05	62.0

Profile 43

Rendzina G.R. NY(35)851422 Greenfield

Height 1650' Vegetation Agrostis,
Festuca, nettles;
Sesleria common

Slope 5°

Aspect South-West

Weather Dry spell

Land-use Enclosed pasture

Depth

0-4" 10YR 4/2 Dark grey-brown loam. Fine and medium crumb structure, becoming more sub-angular blocky with depth. Damp, friable. Earth worms common, roots frequent. Passes abruptly to

4"+ Blue grey Great Limestone. Well jointed and eroded to give clints and grykes. Profile examined in the fracture between a block.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
168	0-4	15.4	26.4	26.9	31.3	6.8	27.4

Sample No.	Exchangeable Cations m.e./100g					
	Ca	Mg	Na	K	H	Total
168	10.31	2.92	0.32	0.41	8.32	22.28

Sample No.	% Base Saturation	% Carbon	% Nitrogen	C/N ratio	% CaCO ₃
168	62.7	19.2	1.31	14.7	2.5

Profile 44

Rendzina G.R. NY(35)924390

Heights

Height 1300' Vegetation Agrostis-Festuca
grassland with Sesleria
frequent.

Slope 3°

Aspect South

Weather Cloudy, but dry

Land-use Enclosed pasture

Depth

0-5" 10YR 3/1 Very dark grey loam. Strong crumb structure. Earthworms common. Many fine and medium roots. Dry. Friable.

Occasional bleached sand grains. Resting sharply on

5"+ Dark Grey Great Limestone. No signs of weathering except for shallow clint and gryke formations

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
169	0-5	20.1	21.6	25.4	32.9	6.5	17.4

Sample No.	Exchangeable cations m.e./100g					
	Ca	Mg	Na	K	H	Total
169	12.32	2.19	0.42	0.56	6.32	21.81

Sample No.	% Base Saturation	% Carbon	% Nitrogen	C/N ratio	% CaCO ₃
169	71.0	15.4	1.69	9.1	1.5

Profile 45

Brown calcareous G.R. NY(35) 851422

Greenfield

<u>Height</u>	1650'	<u>Vegetation</u> <u>Agrostis-Festuca</u> grassland
<u>Slope</u>	5°	
<u>Aspect</u>	South West	
<u>Weather</u>	Sunny and dry	
<u>Land Use</u>	Enclosed pasture	
<u>Depth</u>		
0-8"	5YR 2/1 Black humic loam. Well developed weak and medium crumb structure. Friable and dry. Earthworms common. Dense network of fine and medium grass roots. Occasional small (0.5" diameter) limestone fragments. Merging lower boundary to	
8-15"	10YR 4/2 Dark Greyish Brown clay loam. Massive breaking down to irregular blocks. Earthworms present. Slightly plastic to touch. Resting sharply on	
15-17"	Horizon of weathered limestone fragments. Rubble. Passes sharply into	
17"	Grey Great Limestone.	

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
170	0-8	20.7	25.6	25.3	28.4	6.4	19.2
171	8-15	16.1	21.2	27.8	34.9	6.8	7.4

Sample No.	Exchangeable Cations m.e./100g					
	Ca	Mg	Na	K	H	Total
170	12.31	6.23	1.32	0.68	6.42	26.96
171	7.41	2.93	0.42	0.31	2.19	13.26

Sample No.	% Base Saturation	% Carbon	% Nitrogen	C/N ratio	% CaCO ₃
170	76.19	12.4	1.08	11.5	2.5
171	83.49	4.9	0.73	6.7	1.5

Profile 46

Brown calcareous G.R. NY(35) 924390

Heights

<u>Height</u>	1300'	<u>Vegetation</u>	<u>Agrostis-Festuca</u> grassland
<u>Slope</u>	2°		
<u>Aspect</u>	South		
<u>Weather</u>	Dry and sunny		
<u>Land use</u>	Enclosed sheep grazing		
<u>Depth</u>			
0-5"	10YR 3/2 Very Dark Greyish Brown humic loam. Prolific network of fine and medium roots. Small and medium granular structure. Occasional limestone fragment (up to 1" diameter). Earthworms. Merges into		
5-9"	10YR 3/3 Dark Brown loam. Small sub angular blocky structure. Roots but fewer than above. Occasional fragments of sandstone, limestone and coal. Earthworms. Sharp boundary to		
9-16"	10YR 5/8 Yellowish brown clay loam with frequent 7.5 YR Strong Brown mottles. Very Damp. Strong medium to large sub-angular blocky structure. Firm consistency. Only occasional roots. Merges into		
16-18"	Layer of limestone fragments. Angular. Shattered.		
18" +	Grey Great Limestone.		

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
172	0-5	21.1	26.2	25.4	27.3	6.8	21.3
173	5-9	12.7	31.3	26.8	29.2	6.4	14.2
174	9-16	8.0	30.8	27.3	33.9	6.2	7.8

Sample No.	Exchangeable cations m.e./100g					
	Ca	Mg	Na	K	H	Total
172	15.91	3.72	0.42	0.56	4.57	25.18
173	6.21	2.49	1.32	0.30	3.26	13.58
174	4.31	1.39	0.62	0.41	3.91	10.64

Sample No.	% Base Saturation	% Carbon	% Nitrogen	C/N ratio	% CaCO ₃
172	81.85	16.2	1.32	12.3	2.5
173	75.99	8.3	0.98	8.5	1.5
174	63.25	3.1	0.53	5.8	0.5

Profile 47

Fine Alluvial Soil G.R. NY(35)935382 Brotherlee

<u>Height</u>	900'	<u>Vegetation</u>	Improved pasture
<u>Slope</u>	0°		
<u>Weather</u>	Dry and Sunny		
<u>Land-use</u>	Grazing		
<u>Depth</u>			
0-6"	10YR Dark grey silty clay loam. Stone free, friable, breaking down to sub-angular blocks. Many fine roots. Merging boundary to		
6-12"	10YR 4/2 Dark greyish brown silty clay. Faint 5YR 4/6 Yellowish red mottles. Friable, breaking down to medium sub-angular blocky structures. Occasional small rounded gravel fragments. Many fine roots. Iron oxide coatings on structure faces and along pore channels. Well defined lower boundary to		
12-18"	2.5Y 5/2 Greyish brown clay. Firm, with faint 10YR 6/8 Brownish yellow mottles. Roots common. Fine prismatic structure. Sharp boundary to		
18-32"	10Y5 5/1 Grey plastic clay. Abundant 10YR 6/8 Brownish yellow mottles. No stones. Well developed prismatic structure. Becomes more massive with depth.		

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
175	0-6	25.8	16.2	17.3	40.7	6.1	17.0
176	6-12	20.3	17.4	18.5	43.8	5.8	13.6
177	12-18	18.2	24.4	15.1	42.3	5.8	12.3
178	18-32	18.3	21.4	15.2	45.1	5.6	9.3

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
175	14.95	0.71	0.12	0.25	18.60	34.63	46.29	9.3	1.03	9.0
176	5.71	0.44	0.08	0.10	18.91	25.24	25.08	7.1	0.62	11.5
177	4.07	0.38	0.05	0.06	15.23	19.79	23.04	6.2	0.21	29.5
178	2.28	0.25	0.04	0.05	24.13	26.75	9.80	3.9	0.18	21.7

Profile 48

Fine Alluvial Soil G.R. NY(35)967386 White House

Height 725' Vegetation Improved grassland
species

Slope 0°

Weather Cloudy and dull

Land use Improved pasture

Depth

0-9" 10YR 5/2 Greyish brown silty clay loam. Free
of stones. Well developed crumb structure with
many fine penetrating roots. Merges into

9-19" 10YR 6/4 Light yellowish brown silty clay
loam. Compact, breaking down to sub-angular
blocky structures. Few roots. No stones.
Merges into

20-32"+ 10YR 5/1 Light grey silty clay loam. No
roots, no stones. Damp, with faint 10YR 4/3
Brown Mottles.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
179	0-9	28.0	12.4	31.3	28.3	5.9	11.1
180	9-19	29.8	15.1	26.4	28.7	5.9	6.3
181	19-32	26.8	17.2	25.2	30.8	6.2	5.5

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
179	12.31	1.31	0.96	0.52	6.31	21.41	70.53	8.1	0.93	8.7
180	7.23	0.81	0.84	1.03	5.32	15.23	65.07	5.3	0.21	25.2
181	4.19	1.36	0.72	1.02	2.16	9.45	77.15	2.9	0.32	9.1

Profile 49

Coarse Alluvial Soil : G.R. NY(35)854406

Burtree Ford

<u>Height</u>	11:50'
<u>Slope</u>	0°
<u>Weather</u>	Heavy rain
<u>Land use</u>	Improved pasture for stock
<u>Depth</u>	
0-5"	10YR 3/1 Very dark grey sandy loam. Single grain structure. Loose, stony with many sandstone pebbles and loose sand grains. Abundant fibrous roots. Merging lower boundary to
5-15"	10YR 5/1 Grey sandy loam. Single grain structure. Rounded pebbles. Occasional roots. Sharp lower boundary to
15-32"+	7.5YR 3/2 Dark brown compact sandy loam. Massive structure. Stony. Few roots. Many black flecks of manganese dioxide.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
182	0-5	50.2	23.3	12.9	13.6	5.8	7.4
183	5-15	54.1	21.2	14.4	10.3	5.2	2.3
184	15-32	48.8	22.4	14.2	14.6	5.6	5.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
182	8.30	4.43	0.16	0.28	1.54	14.71	89.54	4.9	0.41	12.0
183	9.02	3.16	0.12	0.22	2.31	14.83	84.43	1.9	0.15	12.7
184	1.12	0.59	0.11	0.09	2.21	4.12	46.36	2.3	0.15	15.3

Profile 50

Coarse Alluvial Soil G.R. NY(35)900382

Huntshield Ford

Height 950' Vegetation Meadow pasture

Slope 2°

Aspect South

Weather Light drizzle

Land use Meadow for hay

0-3" Surface organo-mineral horizon consisting of relatively dense root network set in 10YR 3/2 Very dark greyish brown loam mineral material. Friable, breaking down into small crumb units. Large earthworm population. Many small sub-angular stones. Dry. Merging lower boundary to

3-11" 10YR 3/3 Dark brown sandy loam. Loose and very stony. Few roots. Damp.

11-35" 10YR 5/2 Greyish brown sandy loam. Compact, with many included stone fragments. Rare roots. Damp. No signs of mottling or manganese deposition.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
185	0-3	28.3	34.2	24.6	12.9	6.6	32.1
186	3-11	43.0	35.9	12.7	8.4	5.9	4.3
187	11-35	39.7	38.2	13.6	8.5	5.8	2.9

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
185	8.10	1.36	0.32	0.41	1.50	11.69	87.17	21.4	1.90	11.3
186	3.16	0.43	0.21	0.12	0.93	4.85	80.83	3.6	0.41	8.8
187	2.94	0.56	0.20	0.26	1.03	4.99	79.36	2.1	0.18	11.7

Profile 51

Sandy Alluvial Soil G.R. NY(35) 863397 Wearhead

Height 1100' Vegetation Meadow grasses

Slope 0°

Weather Cloudy and damp

Land use Stock grazing

Depth

0-7" 10YR 4/2 Dark greyish brown sandy loam.

Friable, occasional stones. Medium sub-angular blocky structure. Occasional rounded limestone and sandstone pebbles. Roots common. Well defined lower boundary to

7-15" 10YR 4/4 Dark yellowish brown sandy loam.

Damp and firm. Medium blocky structure. Roots Common. Signs of earthworm activity. Merging lower boundary to

15-23" 10YR 4/4 Dark yellowish brown loamy. Stony

with occasional 7.5YR 6/6 Reddish yellow mottles, especially around occasional sandstone fragments. Earthworms present. Medium prismatic structure. Well defined lower boundary to

23-35" 7.5YR 4/4 Brown sandy clay loam. Frequent

10YR 6/4 Light yellowish brown mottles.

Firm and massive with occasional stones.

Roots occasional. Sharp lower boundary to

35"+

7.5YR 5/6 Strong brown sandy clay loam.

Many black manganiferous concretions and
weathering sandstone fragments.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
188	0-7	26.3	35.6	22.7	15.4	5.9	7.5
189	7-15	37.4	29.8	14.6	18.2	5.9	3.5
190	15-23	32.3	27.2	16.4	24.1	6.2	3.6
191	23-35	32.4	24.3	17.3	26.0	6.3	3.3
192	35"+	29.0	30.6	21.2	19.2	6.1	3.8

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
188	4.20	0.30	0.09	0.06	9.31	13.96	33.31	5.6	0.54	10.4
189	3.86	0.27	0.04	0.06	5.62	9.85	42.95	2.6	0.09	28.9
190	4.73	0.36	0.07	0.09	3.32	8.57	61.27	2.7	0.13	20.8
191	4.26	0.26	0.08	0.06	3.41	8.07	57.75	2.1	0.21	10.0
192	4.04	0.17	0.07	0.07	3.41	7.76	66.06	2.2	0.09	24.4

Profile 52

Sandy Alluvial Soil. G.R. NY(35) 944383

Ludwell

Height 750' Vegetation Dense hawthorn
thicket with rich grass
and herbaceous ground flora.

Slope 0°

Weather Cold and Sunny

Land use Waste

Depth

0-7" 10YR 2/2 Very dark brown sandy loam. Friable
and stoneless. Fine angular blocky structure.
Abundant fibrous roots. Dry. Sharp boundary to

7-16" 5YR 4/4 Reddish brown sandy loam. Friable
with occasional small sandstone pebbles.
Medium sub-angular blocky structure. Infilled
earthworm channels. Abundant fibrous roots.
Sharp lower boundary to

16-36" 5YR 4/4 Reddish brown sandy clay loam.
Loose with very weak prismatic structure
tending to single-grain. Slightly stony
with fragments of sandstone. Few roots.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
193	0-7	35.1	25.6	21.1	18.2	6.0	16.8
194	7-16	31.8	26.2	22.3	19.7	5.7	5.1
195	16-36	36.2	27.3	12.4	24.1	5.9	5.9

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
193	3.84	0.84	0.25	0.40	2.30	7.19	68.02	12.3	1.03	11.9
194	1.75	0.28	0.08	0.12	1.97	4.20	53.10	4.1	0.51	8.0
195	1.62	0.72	0.12	0.08	1.84	4.38	57.99	3.8	0.41	9.3

Profile 53

Whin Ranker G.R. NY(30) 851409 Copt Hill

Height 1300' Vegetation Grasses and herbs
Slope 5°
Aspect South-west
Weather Bright and sunny
Land-use Waste land round disused quarry

Depth

0-3" 10YR 5/6 Yellowish brown loam. Damp organo-mineral horizon of friable consistency. Medium crumb structure. Abundant roots. Occasional small (1" diameter) Whin fragments. Angular and with brown weathering crust. Resting sharply on

3"+ Solid Whin Sill. Little fractured and cracked, but 7.5YR 5/4 Brown in colour due to surface weathering.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
196	0-3	21.7	32.4	20.3	25.6	6.4	17.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
196	9.31	1.20	0.98	1.36	2.06	14.91	86.19	10.3	1.09	9.4

Profile 54

Whin Ranker G.R. NY(30)982392 Greenfoot

<u>Height</u>	700'	<u>Vegetation</u>	Grasses and clovers
<u>Slope</u>	3°		
<u>Aspect</u>	West		
<u>Weather</u>	Cloudy and damp		
<u>Land-use</u>	Waste land in disused quarry		
<u>Depth</u>			
0-2"	7.5YR 4/4	Dark brown organo-mineral layer.	
		Humic loam texture. Porous and friable	
		Small and medium crumb structure with many	
		fine penetrating roots. Occasional bleached	
		sand grains. Rests sharply on	
2"+	Whin Sill.	Thin skin of weathered material	
		round grey-black unaltered rock.	

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
197	0-2	21.7	28.6	22.3	27.4	6.7	24.3

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
197	10.32	1.04	0.56	0.82	1.92	14.66	86.91	13.7	1.08	12.7

Profile 55

Sandstone Ranker G.R. NY(30) 869350 Chapelfell

Height 2050' Vegetation Thick mat of
mosses with occasional
J. squarrosus

Slope 4°

Aspect North

Weather Cloudy with slight drizzle

Land-use Unenclosed sheep grazing round disused quarry.

Depth

0-2" 10YR 2/2 Very dark brown organic material.
Wet and greasy. Significant content of
quartz grains. Massive. Rests sharply on

2-4" 10YR 4/4 Dark yellowish brown sandy loam.
Damp and incoherent. Single grain structure.
Many medium roots. Rests sharply on

4"+ Solid sandstone. Bleached immediately below
solum for depth of three inches. Then merges
into brown coloured rock.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
198	0-2	-	-	-	-	4.4	73.6
199	2-4	37.5	38.2	11.9	12.4	4.7	7.4

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
198	1.20	0.32	0.04	0.02	26.93	28.51	5.55	65.7	2.31	28.4
199	0.56	0.13	0.02	0.05	15.42	16.18	4.70	4.1	0.06	68.3

Profile 56

Sandstone Ranker G.R. NY(30) 982371 Shield Ash

Height 1250' Vegetation Mosses and occasional
Deschampsia flexuosa

Slope 0°

Weather Sunny and frosty

Land-use Unenclosed moorland for sheep; signs of
'hushing' for minerals.

Depth

0-3" 10YR 2/1 Black amorphous peaty organic
matter. Damp with abundant quartz grains.

Medium fibrous roots. Resting sharply on

3"+ White fine grained Carboniferous sandstone.
Massive and non fractured.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
200	0-3	-	-	-	-	4.8	83.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
200	0.83	0.40	0.05	0.05	18.23	19.56	6.80	74.6	1.19	62.7

Profile 57

Ironstone Ranker G.R. NY(30) 870368 West Grain

Height 1350' Vegetation Mosses and occasional
Nardus stricta

Slope 2°

Aspect North-East

Weather Dry and sunny

Land-use Sheep grazing

Depth

0-3" 7.5YR 4/2 Dark brown loam with high organic content. Dry and friable. Mixed structure of small sub-angular blocky and crumb units. Occasional fibrous roots. Bleached sand grains and included small gravel fragments of ironstone. Resting sharply on

3"+ Ironstone outcrop with thin brown weathering crust.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
201	0-3	25.7	36.7	16.4	21.2	5.7	29.3

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
201	2.06	0.32	1.02	0.41	16.23	20.04	19.02	21.4	1.31	16.3

Profile 58

Ironstone Ranker G.R. NY(30) 904394 Slit Mines

Height 1200' Vegetation Bare surface with
moss and occasional Deschampsia
flexuosa

Slope 2°

Aspect South-East

Weather Cloudy with slight drizzle

Land-use Waste land around disused mine

Depth

0-2" 10YR 5/4 Yellowish brown sandy clay loam.
Damp and Friable. Occasional large ironstone
fragment (up to 1" diameter). Weak sub-
angular blocky structure. Occasional roots.
Becomes slightly wetter towards the base.
Sharp boundary to
2"+ Ironstone outcrop. Thin brown weathering
crust but little fractured.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
202	0-2	25.5	36.9	9.4	28.2	5.9	16.3

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
202	0.93	0.46	0.52	1.06	12.49	15.46	19.22	14.3	0.82	17.4

Profile 59

Tip Ranker G.R. NY(30) 825430 Broad Meres

Height 1500' Vegetation Bare with
occasional lichen, moss,
and grass

Slope 0°

Weather Cloudy and damp

Land-use Disused tip heap near old crushing mill

Depth

0-6" 10YR 5/2 Greyish brown sandy loam. Damp
Structureless, breaking down to single grain.
Many small (less than 1" diameter) sandstone
and vein rock fragments. Loose and porous.
Abrupt change to

6-17" 10YR 2/1 Black fine sand. Loose and incoherent.
Single grain structure. Vein waste material
with no roots. Slightly damp. Abrupt lower
boundary to

17-28" Grey rubble horizon consisting of medium
(less than 6" diameter) stone fragments.
Angular material with little fine earth
fraction. Mainly charred rubble from mill
workings.

28-38" 10YR 5/1 Gray fine sand. Slightly compacted
but structureless, loose and friable.
Black speckles common. Occasional large
(over 6" diameter) stone fragment.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
203	0-6	67.4	22.9	8.4	1.3	5.2	2.1
204	6-17	31.7	46.8	19.4	2.1	4.3	4.2
205	17-28	-	-	-	-	-	-
206	28-38	26.4	59.2	10.5	3.9	4.9	1.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
203	-	-	-	-	-	-	-	1.2	0.0	-
204	-	-	-	-	-	-	-	1.7	0.32	5.3
205	-	-	-	-	-	-	-	-	-	-
206	-	-	-	-	-	-	-	0.5	0.0	-

Profile 60

Tip Ranker G.R. NY(30)929344 Blaeberry Burn

Vegetation Old C. vulgaris;

recently fired.

Depth

0-2"	10YR 2/1 Black humus layer. Charcoal and peaty humus mixture. Frequent bleached sand grains. Occasional large and medium fibrous roots. Merges into
2-13"	2.5Y 5/4 Light olive brown silty clay. Compact mineral layer. Damp. Platey structure. Occasional roots penetrate. Many small (less than 1" diameter) weathering shale fragments. Merges into
13-26"+	As above but no roots and more compacted. Massive structure. Abundant weathering shale fragments.

Sample No.	Depth ins.	Mechanical Analysis %				pH	% Loss on Ignition
		Coarse Sand	Fine Sand	Silt	Clay		
207	0-2	-	-	-	-	4.1	81.3
208	2-13	8.0	29.4	28.7	33.9	5.3	6.4
209	13-26	5.5	26.4	32.4	35.7	5.9	5.2

Sample No.	Exchangeable cations m.e./100g						% Base Saturation	% Carbon	% Nitrogen	C/N ratio
	Ca	Mg	Na	K	H	Total				
207	-	-	-	-	-	-	-	73.2	1.46	50.1
208	2.91	0.53	0.06	1.42	14.92	19.84	24.80	4.3	0.04	107.5
209	1.94	0.93	0.32	0.94	17.31	21.44	19.27	3.9	0.05	78.0

APPENDIX V HORIZON SEQUENCES

Horizon sequences are presented for the profiles described in Appendix IV. Master horizons are designated by letters and the underlying numerals give their depths in inches.

1.	L 4	F 8	F 8	F 60	C 10	R
2.	L 6	F 18	H 19	Cg 11+		
3.	F 22	F 16	H 7	Cg 9+		
4.	L 14	F 27	H 10	Cg 8+		
5.	H 9	F 13	H 6	Cg 8+		
6.	H 6	F 18	Cg 14+			
7.	L 10	F 12	H 2	Cg 9		
8.	L 6	F 14	Cg 3	Cg 7+		
9.	B _F 4	F 3	F 17	F 22		
10.	B _F 3	H 4	F 29	F 7		
11.	F 3	Bg 9	Cg 6	Cg		
12.	F 4	Bg 6	Cg 12	Cg 6+		
13.	Aeg 4	B _F 4	C 13 ³ / ₄	C 10		
14.	Ag 12	B _F 2	Cg 15 ¹ / ₂			
15.	A _e 4	B _F 3	B _F 7	R		

16.	A ₆ ^e	B ₄ ^F	B ₁₂ ^F	C				
17.	A ₆ ^e	B ₄ ^{Fc}	B ₂ ^F	Cg				
18.	Ae ₁₁	Ag ₃	B ₄ ^{Fc}	B ₁₄ ^F	C			
19.	A ₁₀ ^h	Bg ₁₈	Cg ₈₊					
20.	A ₁₂ ^h	Bg ₁₃	Cg ₇₊					
21.	F ₈	Bgh ₃	Cg ₃	Cg ₁₂₊				
22.	H ₅	B _{9g}	Cg ₁₅₊					
23.	A ₇ ^h	B ₁₈ ^{gca}	C ₁₂₊ ^{gca}					
24.	Ah ₈	H ₂ ^b	B ₁₂ ^{gca}	C ₁₁₊ ^{gca}				
25.	Ah ₄	Bg ₄	Bg ₇	Cg ₁₀	C ₇			
26.	Ah ₇	Bg ₇	Bg ₇	C ₅				
27.	F ₁₁	Aeg ₆	B ₄ ^{Fc}	B ₄ ^F	C ₁₁₊			
28.	F ₈	H ₂	Aeg ₄	B ₄ ^{Fc}	B ₈ ^F	C ₅₊		
29.	L-F ₃	H ₂	A ₉ ^e	B ₂ ^F	B ₇ ^{fg}	C ₉		
30.	L ₃	F ₅	H ₅	A ₅ ^e	B ₅ ^f	C ₆	C ₆₊	
31.	L _{2 2}	F ₃	A ₂ ^e	A ₃ ^e	B ₃ ^h	B ₇ ^f	B ₆ ^f	C ₁₁
32.	L ₂	F ₂	A ₅ ^e	B ₄ ^h	B ₄ ^f	B ₈ ^f	C ₆₊	

33.	L-F 4	A _{eg} 4	B _f 3	B _f 9	C 11+
34.	L-F 3	H 1	A _{eg} 5	B _f 14	C 16+
35.	A _h 2	A _m 6	B _m 7	C 13	
36.	A _{6h} 6 ^h	A _{6m} 6 ^m	B _m 7	C 12	
37.	A _h 3	A _m 6	B _m 4	B _g 11	C
38.	A _{9h} 9 ^h	B _g 9	B _g 7	C _g 12	
39.	L-F 2	A _h 3	B _f 7	C _f 7	C 10
40.	A _h 3	A _h 6	B _f 6	B _f 6	C 11+
41.	A _h 5	B _m 3	C 12+		
42.	H 2	A _h 5	B _m 8	C 13	
43.	A _{hca} 2	R			
44.	A _{hca} 5	R			
45.	A _{hca} 8	B _{ca} 7	C _{ca} 2	R	
46.	A _{hca} 5	A _{ca} 4	B _{ca} 7	C _{ca} 2	R
47.	A _h 6	C 6	C 6	C 14	
48.	A _h 9	C 10	C 12		
49.	A _h 5	C 10	C 17		

50.	Ah 5	C 10	C 17		
51.	A _h 7	B _m 8	C 8	C 12	C
52.	A _h 7 ^h	C 9	C 20		
53.	A _h 3	R			
54.	Ah 2	R			
55.	F-H 2	A _h 2	R		
56.	F-H 3	R			
57.	Ah 3	R			
58.	Ah 2	R			
59.	C 6	C 11	C 11	C 10	
60.	F-H 2	C 11	C 13+		

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