AUSTRALIAN NATIONAL ANTARCTIC RESEARCH EXPEDITIONS

ANARE RESEARCH NOTES 74

An atlas of the lakes of the Larsemann Hills,
Princess Elizabeth Land, Antarctica

David Gillieson, James Burgess, Andrew Spate and Anne Cochrane

ANTARCTIC DIVISION
DEPARTMENT OF THE ARTS, SPORT,
THE ENVIRONMENT, TOURISM AND TERRITORIES

ANARE RESEARCH NOTES (ISSN 0729-6533)

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Antarctic Division
Channel Highway
Kingston
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Published May 1990
ISBN: 0 642 15390 7

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AN ATLAS OF THE LAKES OF THE LARSEMANN HILLS, PRINCESS ELIZABETH LAND, ANTARCTICA

by

David Gillieson, James Burgess, Andrew Spate and Anne Cochrane

Department of Geography and Oceanography
University College
University of New South Wales
Australian Defence Force Academy
Canberra, ACT, Australia

ABSTRACT

The Larsemann Hills are a series of granite and gneiss peninsulas extending into Prydz Bay, between the Amery Ice Shelf and the Sørsdal Glacier. They are dissected by steep-sided valleys produced by at least two glacial stages in the Holocene. Meltwater streams are well developed while moraines are largely absent. There are over 150 freshwater lakes in the hills, ranging from small ponds less than 1 m deep to glacial lakes up to 10 ha and 38 m deep.

The lakes are young, with the oldest basins being about 9000 years old. Variations in the characteristics of the lakes reflect deglaciation history, proximity to the continental ice margin and exposure to the ocean. The main source of the water is snow melt, augmented by sea spray into the more exposed lakes. The waters are well mixed by katabatic winds. Most lakes thaw for up to 2 months in summer, but some are permanently frozen.

The waters have mainly low conductivity and exceptionally low turbidity, and have near-neutral pH values. The ionic order is $Na^+ > Mg^{2+} > Ca^{2+} > K^+$. This reflects a strong marine influence, with calcium dominating in a very few catchments.

1. INTRODUCTION

The existence of freshwater lakes on the Antarctic continent is surprising given that mean annual temperatures are always below zero degrees Celsius. The lakes exist because of high radiation receipt in the summer months and the influx of snow meltwater into rock basins eroded by prior glacial action. A second surprising fact is the complexity of the freshwater ecology, given that this is probably the most inhospitable climate on earth. This has received increasing attention, especially in the face of global climatic change which may be exacerbated towards the poles. The complete documentation of Antarctic freshwater ecosystems has been carried out by Kaup *et al.* 1988 for the Schirmacher and Untersee oases of Queen Maud Land, and by Heywood, Priddle, Hawes and Ellis-Evans for the subantarctic South Orkney Islands (Priddle and Heywood 1980, Priddle *et al.* 1986). A first step in any analysis is to account for the range of possible environments, and to characterise the lake basins in terms of their physiography and physical limnology. In this report the authors provide the first detailed account of a large number of freshwater lakes in the continental oasis of the Larsemann Hills, Princess Elizabeth Land.

The Larsemann Hills are ice free and form an area of approximately 200 km^2 at 69°24'S, 76°20'E on the Ingrid Christensen Coast of Princess Elizabeth Land, Antarctica. The area lies midway between the Vestfold Hills (Davis station) to the north-east and the Amery Ice Shelf to the west-south-west (Figure 1). The hills are therefore centrally located on the southern coast of Prydz Bay. A major feature of the Larsemann Hills is the more than 150 freshwater lakes that vary from small ponds up to substantial lakes, such as Lake Progress with an area of 10.5 ha.

The area was discovered in 1935 when Captain Klarius Mikkelsen in the *Thorshavn* led an expedition for Lars Christensen, a Norwegian whaling magnate, to Ingrid Christensen Land. That expedition mapped about one third of the Antarctic coastline and was the first expedition to employ aerial photography to aid the mapping program (Christensen 1937). Many of the placenames in the Larsemann Hills relate to Norwegian expeditions, which although privately funded had the support of their government. Despite this early interest in the area and a subsequent Australian National Antarctic Research Expedition (ANARE) led by Dr Phillip G. Law in March 1954, few scientists visited the area until the recent establishment of the Australian summer base, Law, and the Russian and Chinese winter stations, Progress Station and Zhong Shan. Law was commenced in 1986 when an Apple hut was unloaded from MV *Nella Dan*. A subsequent visit was made during the 1986 winter. The first Australian scientific expedition visited the area during the 1986-87 austral summer. Progress Station was occupied at the time. Building of Zhong Shan commenced in January 1989.

In the last 20 years an increasing number of scientists have reported characteristics of Antarctic lakes. The lakes have attracted considerable attention despite occupying only small, isolated areas on a cold desert continent. Only 2% of the continent is ice free, and although the continent holds more than 90% of the world's fresh water, very little of it is liquid. Apart from the lakes found on the more maritime Antarctic Peninsula and subantarctic islands, most Antarctic lakes are found in areas that are ice free and have been described as 'oasis' areas. These areas are usually found near the edge of the ice sheet and include the Vestfold Hills, Bunger Hills, Molodezhnaya, South Victoria Land and Schirmacher Ponds (Figure 2). Shumskiy (1957) defines an Antarctic oasis as a 'substantial ice free area separated from the ice sheet by a distinct ablation zone, and which is kept free from snow by ablation due to low albedo and positive radiation balance'.

Walton (1984) defines oasis areas slightly differently in that they are climatically similar because the bare rock has a lower albedo than snow and ice, and that net radiation is positive for longer

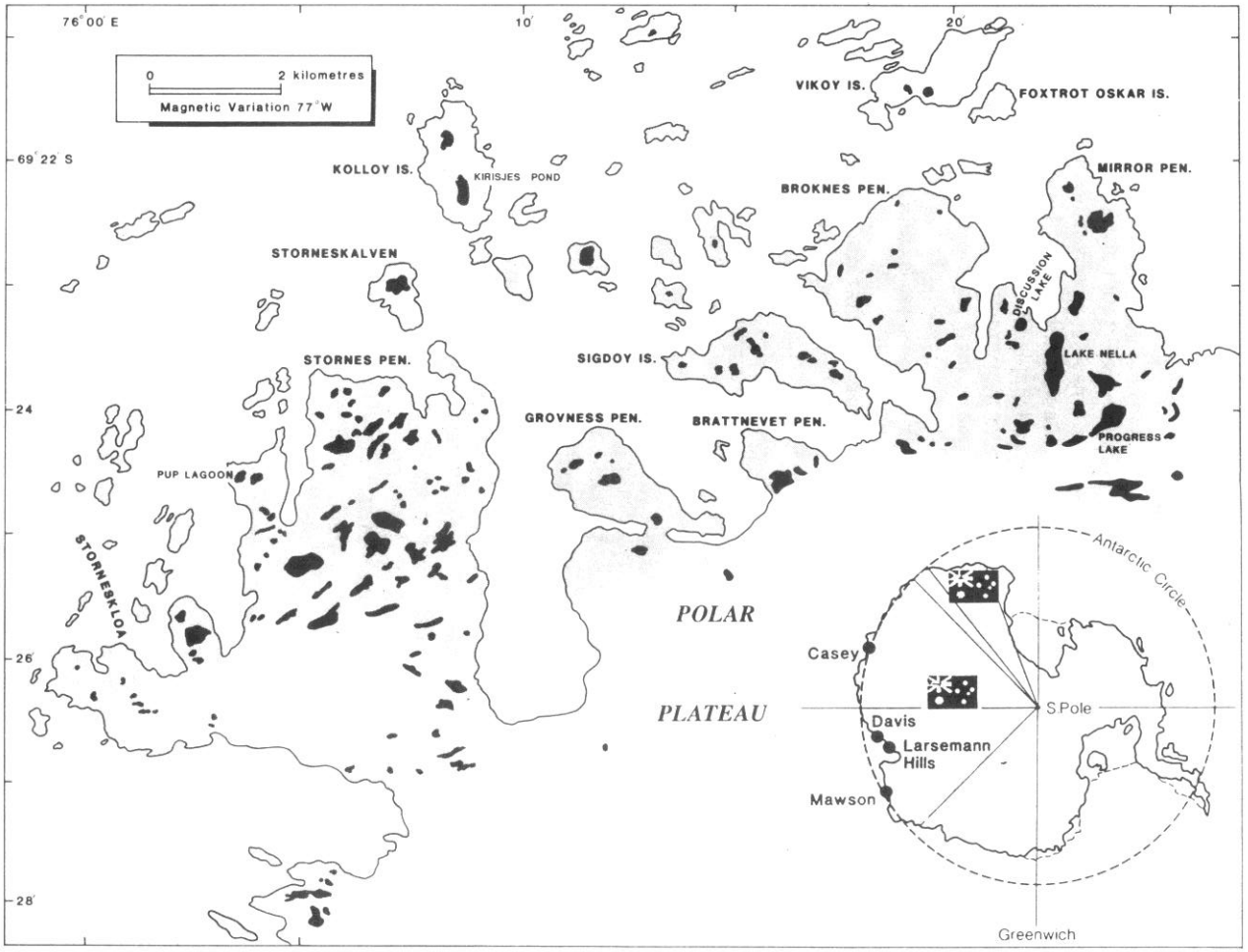


Figure 1. Location and morphology of the Larsemann Hills, east Antarctica. Black shapes are lakes; ice-free rock is shaded. Drawn from an uncontrolled aerial photograph mosaic.

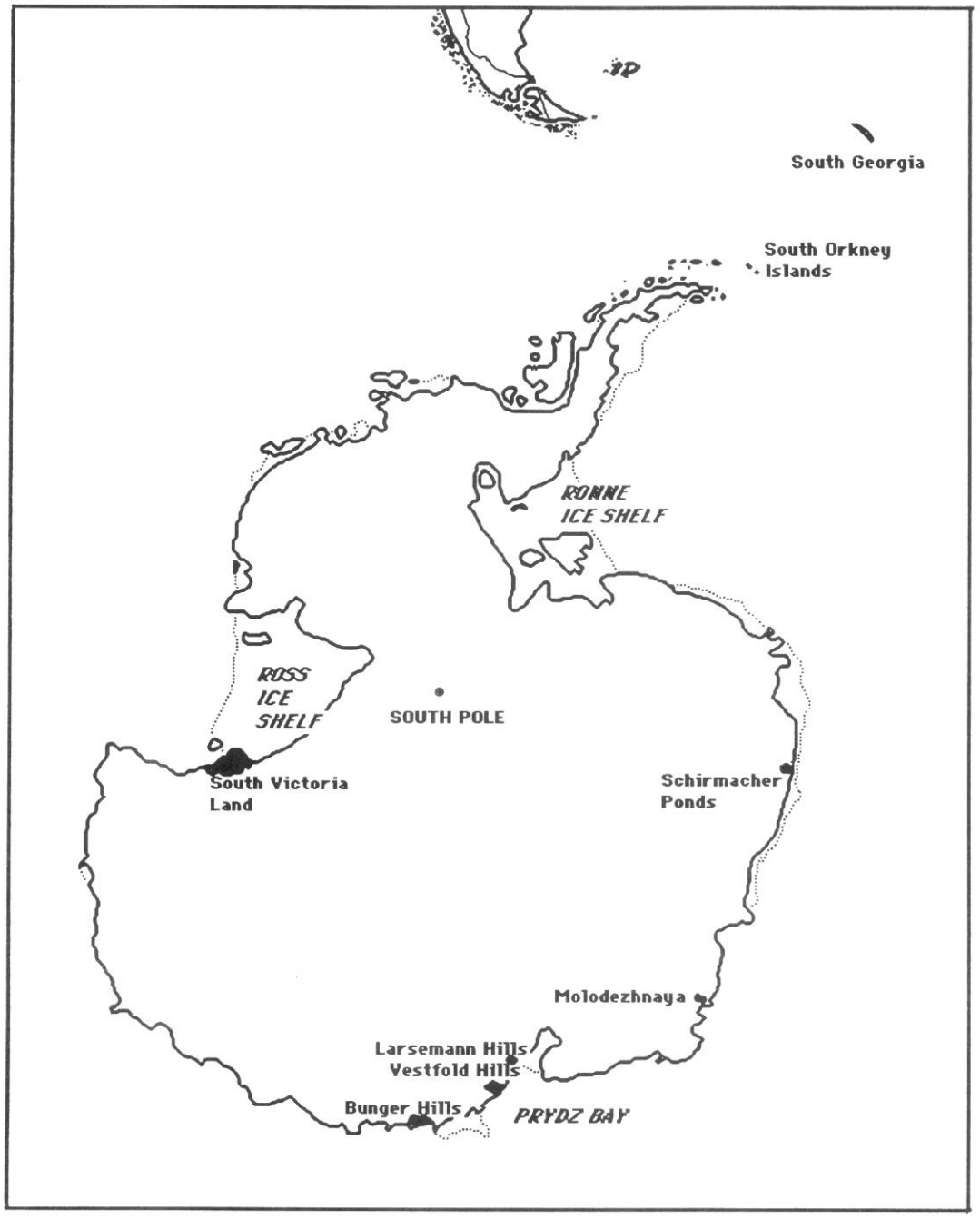


Figure 2. Location of Antarctic oases mentioned in the text.

periods than in non-oasis areas. In addition to climatic similarities, it is contended by Pickard (1986) that oasis areas are characterised by till cover, that at least one boundary is the ice sheet and that another is an active outlet glacier. Clearly just as there is debate on the origin of Antarctic oases (Pickard 1986) the precise definition of an Antarctic oasis is unclear. Common to all the areas, however, is the existence of lakes that are ice free or partially ice free during summer. The considerable literature describing these lakes has been summarised in a series of articles by workers like Heywood (1972, 1977, 1984), Burton (1981), Wright and Burton (1981) and Priddle (1985). A number of workers have suggested that most freshwater Antarctic lakes follow an evolutionary sequence as glaciation occurs (Priddle and Heywood 1980). Priddle (1985) suggests that the first stage of the sequence is when small ponds form in ice eroded basins which are replaced by 'proglacial' lakes that form next to the ice-sheet and are frequently dammed by ice. The third stage represents those lakes that occur in rock basins or in catchments dammed by moraine. Depending on environmental circumstances it is possible that such lakes evolve further with increasing salinity. Data presented by Priddle (1985) from Kriss *et al.* (1968), Kaup (1975), Heywood *et al.* (1980), Ellis-Evans (1981), and Light *et al.* (1981) indicate that as lakes proceed through the ice-melt evolutionary cycle, pH conductivity and nutrients increase. Associated with those changes are increases in biological activity. Some of the Larsemann Hills lakes are proglacial basins that have only recently begun the evolutionary cycle suggested by Priddle (1985).

2. REGIONAL GEOLOGY AND GEOMORPHOLOGY

The broad regional geology of the Prydz Bay coastline has been described by Sheraton and Collerson (1983) and Collerson and Sheraton (1986), and the Larsemann Hills in detail by Stuwe *et al.* (1989). Prydz Bay is essentially underlain by a band of Proterozoic rock (≈ 1200 million years old) that outcrops between the Vestfold Hills and Landing Bluff. At the Vestfold Hills the Proterozoic formations give way to older Archean formations (≈ 2500 million years) that have been intruded by swarms of dykes dated at ≈ 1200-1400 million years. Stuwe *et al.* (1989) have estimated (by inference) that the Larsemann Hills are of Proterozoic age. The basement rocks have been subjected to a complex metamorphic history with a number of deformation episodes (Harley 1987, Stuwe *et al.* 1989). Stuwe *et al.* (1989) suggests that the dominant rock types of the area are metapelitic cordierite and gneisses rich in Fe-Ti oxides. Unlike the Vestfold Hills the area does not have mafic dykes or charnockites

Physiographically the Larsemann Hills are a series of rocky peninsulas and islets in Prydz Bay, between the Amery Ice Shelf and the Sørsdal Glacier. They are dissected by steep-sided valleys which are structurally controlled and reflect at least two glacial stages involving episodes of valley glaciation after retreat of the icecap. More than 150 freshwater lakes are scattered through the hills; broadly they can be classified as supraglacial ponds, large open rock basins and colluvium dammed ponds. Meltwater streams are well developed and second order drainage networks exist. Large, sorted stone circles are common in outwash fans. Morainic deposits are virtually absent, though erratic blocks are scattered thinly throughout the hills.

Stornes Peninsula, at the western end of the hills, is deeply dissected with a relative relief of about 140 m. Relatively unweathered rockslabs surround the lake basins. Surficial deposits are thin and of restricted extent: they include snowpatch gravels, sandy deltas and talus. Ice movement has been from southwest to northeast, along structural trends. Glacial striations are uncommon though fine scratches can be seen on rocks near Allison Dome. Numerous deep

closed rock basins occur; Lake Oskar, for example, is 18 m deep. Organic sediment accumulation in the basins is thin, suggesting recent deglaciation.

Broknes Peninsula and Mirror Peninsula (on which Law is located) are also deeply dissected below a planation surface at approximately 60 m above sea level. Bare rock surfaces have a thickly weathered crust and surficial gravel and sand deposits are extensive. Many outcrops are deeply pitted with complex weathering hollows (tafoni) and slope instability is widespread. Extensive snowpack gravel and sand fans provide mineral sediments to the lakes. Many of the lakes are surrounded by evidence of higher shorelines indicating that water levels are lower by 2 m or so than in the past. The largest lakes, Progress and Nella, are 38 and 18 m deep respectively.

A complex pattern of ice movement is suggested, with a phase of ice plateau erosion creating a planation surface. Subsequently valley glaciation dissected the surface forming the Progress and Nella basins. A later phase of valley glaciation re-excavated these basins which have been separated by isostatic readjustment of about 10 m. Organic sediment accumulation in the lakes is thick, suggesting that Broknes may have emerged from the plateau ice earlier than Stornes.

The offshore islands appear to be roches moutonnees isolated by the present sea level. There are numerous small nivation cirques, in common with the two major peninsulas; many of these contain small ponds. A surficial mantle of boulders is present on the eastern islands but its lithology is similar to the underlying bedrock and it is unlikely to be morainic debris.

Perhaps the most obvious geomorphic process operating on the landscape is aeolian and salt weathering. Pickard (1986) noted such processes in the Vestfold Hills and like that area the Larsemann Hills has many surface features that reflect those processes. The lakes of the hills receive considerable wind blown sediment that accumulates on the winter snow and ice cover, and is released to the water column with the summer thaw.

3. CLIMATE

The climate of the Larsemann Hills (Jacques and Nairn 1987) resembles that of nearby Davis (68°35'S, 78°00'E) (Streten 1986). During December, January and February the daily air temperature can exceed 10°C and frequently exceeds 4°C, with the mean monthly temperature a little above 0°C. Mean monthly winter temperatures are between -15°C to -18°C (Streten 1986). Precipitation occurs as snow and is unlikely to exceed 250 mm water equivalent. A major feature of the climate of the Larsemann Hills is the existence of persistent, strong katabatic winds that blow most summer mornings, from approximately 0100-1200 hours local time. The area is on the edge of an airflow confluence zone centred on the Lambert Glacier (Parish and Bromwich 1987). Observations of wind speed and direction by Jacques and Nairn (1987) for January and February 1987 indicate a predominance of ENE to NE directions and a much lower spread of directions than at Davis. They attribute this to the area's close proximity to the adjacent ice sheet and the consequent consistent morning katabatic wind.

4. METHODS

The initial observations of the Larsemann Hills lakes were undertaken at two levels early in 1987. Firstly, a sample of 74 lakes was selected to include a wide range of sizes and depths, degree of ice cover and distance from the ice edge. A rapid survey technique was developed using a helicopter. Each lake was photographed, located and its altitude recorded using an aneroid barometer. Depth profiles were recorded using an echo sounder with a transducer mounted on a float deployed from the helicopter; depth readings were taken every 20 m on two orthogonal transects across each lake. Surface water temperature was measured using a thermistor mounted on the float and a surface water sample obtained in a polyethylene bottle. A grab sample of the bottom sediment was obtained at the same time. In a field laboratory water samples were analysed for pH, Eh and conductivity . Turbidity, total dissolved salts and major cations were analysed in the laboratory after the expedition (Table 1). Characterisation of the benthic sediments depended on sample size: in some cases there was insufficient mineral sediment for textural analysis. Subsamples of the organic fraction of bottom sediment were given to Dr R. Pidgeon, Dept. of Zoology, University of New England, for extraction of microfauna.

Secondly, nine lakes were selected for detailed study. The lakes and their catchments were surveyed, and detailed bathymetric profiles measured. Depth specific measurements of temperature, pH, conductivity and dissolved oxygen content were made on several occasions. Water samples for analysis were taken at depths of 0.3 m, 1.0 m, 3.0 m, 5.0 m, 10.0 m, 15.0 m etc. These samples were analysed in the same way as the helicopter survey samples.

Table 1. Water chemistry for Larsemann Hills lakes.

Area	n	Conductivity mS/cm	pH	Na^+ ppm	Mg^{2+} ppm	Ca^{2+} ppm	K^+ ppm
Larsemann Hills Total	71	mean 556 s.d. 705	6.86 0.56	86.7 111.8	10.7 12.4	10.8 16.2	3.2 4.2
Broknes Peninsula	20	mean 585 s.d. 815	6.83 0.47	100.4 150.1	10.0 12.7	10.3 14.4	3.4 4.7
Stornes Peninsula	29	mean 288 s.d. 412	6.59 0.52	45.6 62.6	6.7 8.2	4.9 10.3	2.0 3.2

Note: Additional 22 lakes on intermediate peninsulas and islands included in total.

5. ATLAS OF THE LARSEMANN HILLS LAKES

Locations of individual lakes are given in Figures 3 and 4. Geological nomenclature follows Stuwe *et al.* (1989). Topographic data are based on field observations or are derived from colour aerial photography at 1:25 000 scale. Lake names are informal names given by expedition members; some may be ratified by the Antarctic Names and Polar Medal Committee.

For each lake physiographic, depth and water chemistry data are given. For most lakes data on benthic sediment type are also given. For the lakes which were cored, details of stratigraphy and chronology are given. A photograph of each lake is provided to aid identification by future researchers.

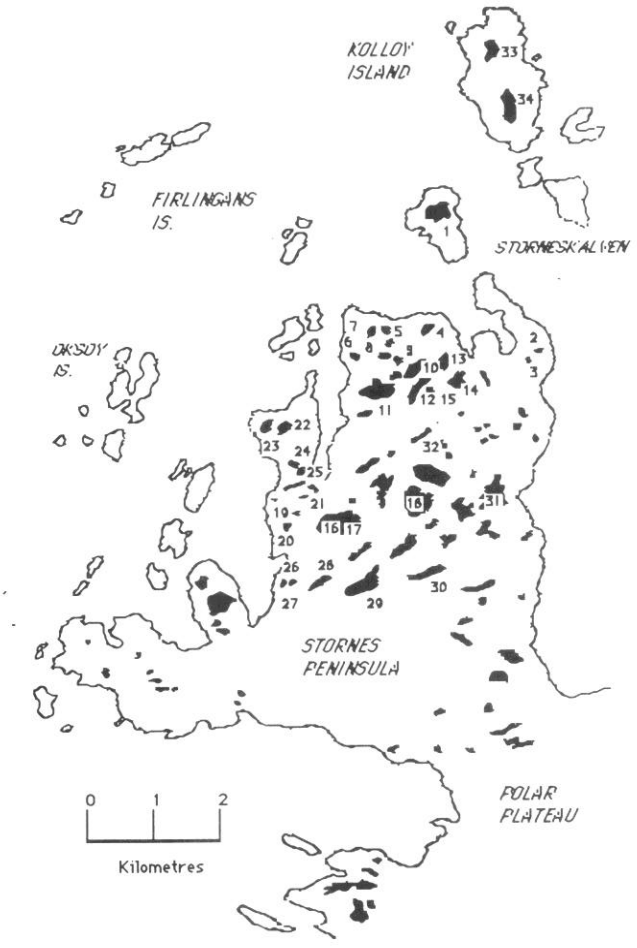


Figure 3. Location of lakes on Stornes Peninsula. Numbers refer to LH identifiers as used in the atlas.

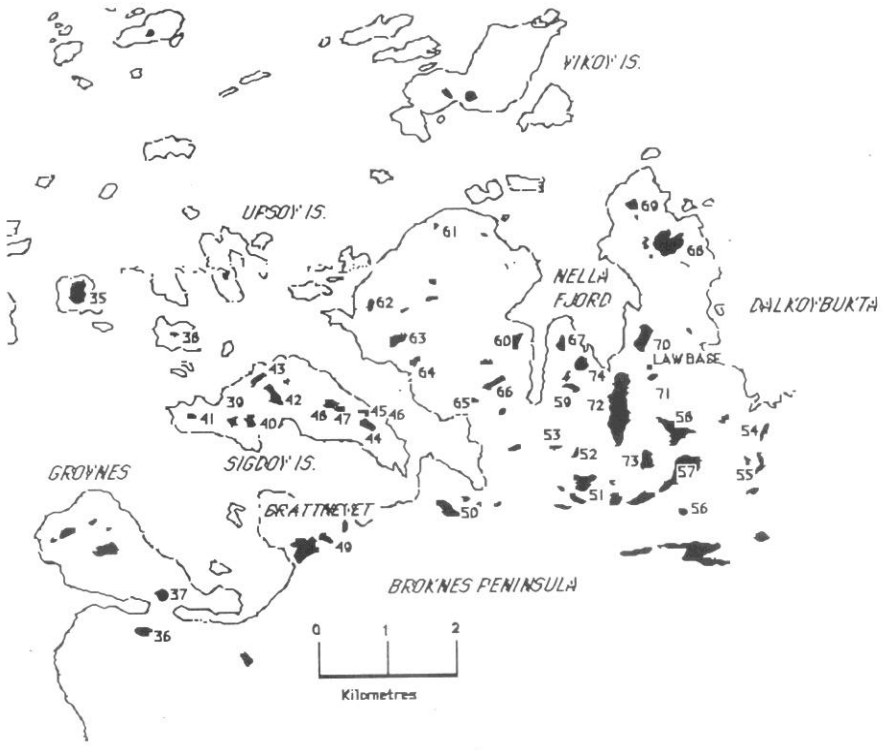


Figure 4. Location of lakes on Broknes Peninsula. Numbers refer to LH identifiers as used in the atlas.

LAKE NUMBER: LH1 **LAKE NAME:** None

LOCATION: Storneskalven **LATITUDE:** 76^0 17' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 100 **LAKE AREA (ha):** 2.5
CATCHMENT AREA (ha): 13.5

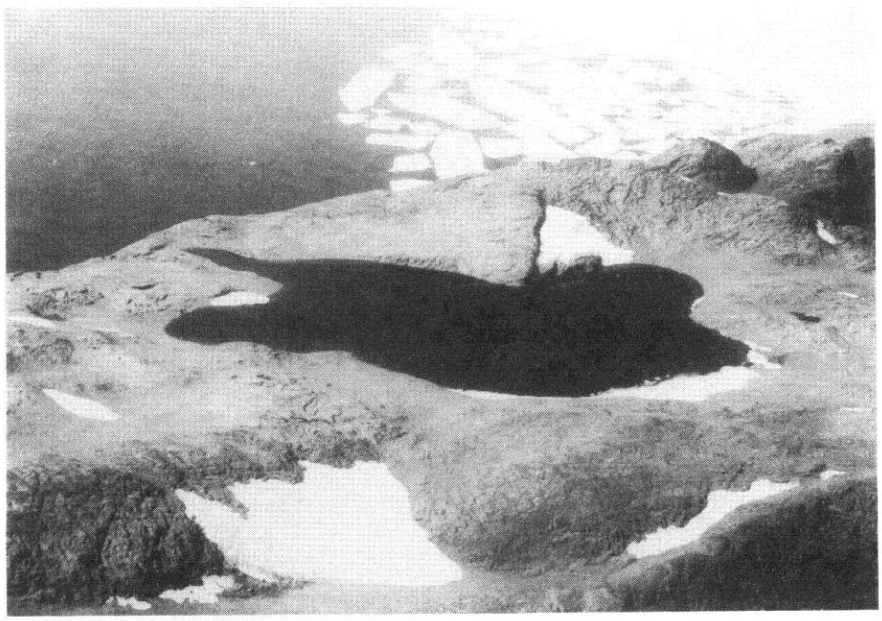
MAXIMUM DEPTH (m): 7.6 **DIMENSIONS (m):** 240 x 90

DISTANCE FROM POLAR PLATEAU (m): 6710

DESCRIPTION: Rock catchment

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



PROFILES:

No profile recorded.

WATER CHEMISTRY:

TEMPERATURE: 5.6^0 C **pH:** 7.7

CONDUCTIVITY: 290 mS cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	2.7	5.4	36.8	7.4

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.37$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH2 **LAKE NAME:** None

LOCATION: Long Peninsula **LATITUDE:** 76^0 09' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 55 **LAKE AREA (ha):** 0.5
CATCHMENT AREA (ha): 1.0

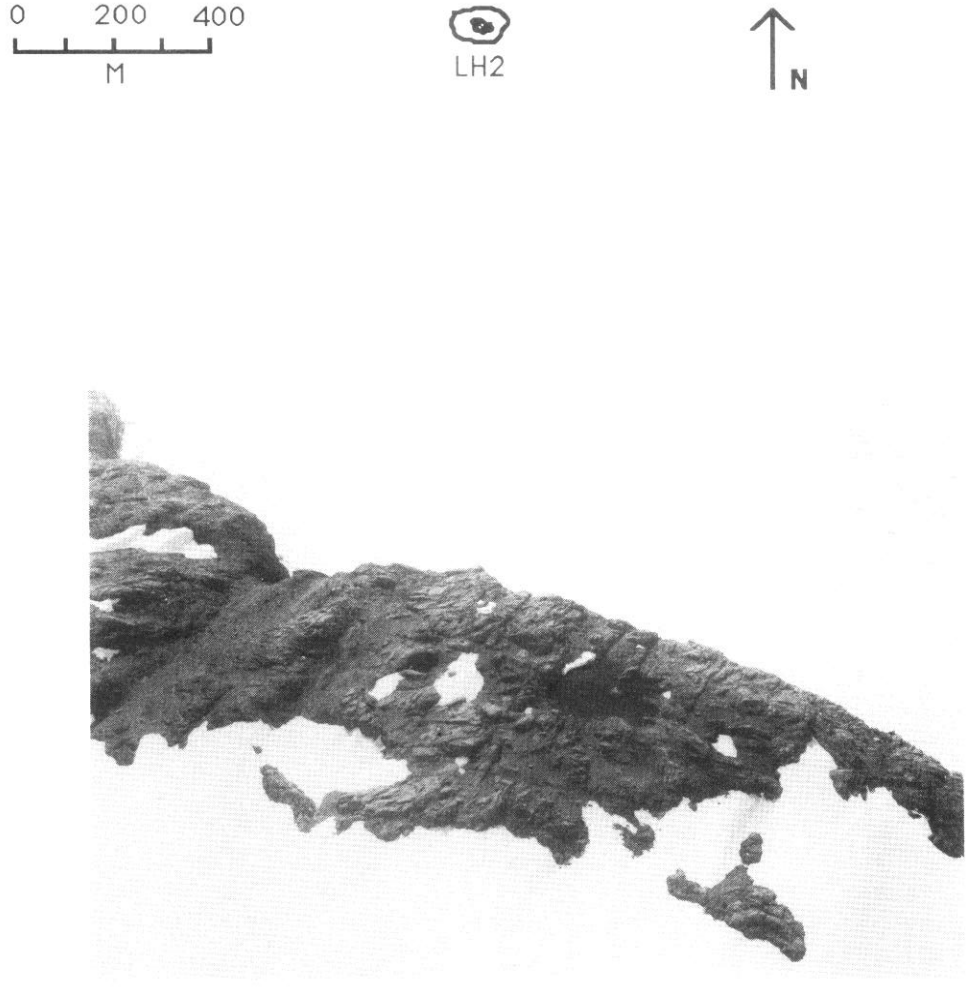
MAXIMUM DEPTH (m): 1.1 **DIMENSIONS (m):** 75 X 30

DISTANCE FROM POLAR PLATEAU (m): 3736

DESCRIPTION: Rock catchment; small rock basin; stony bottom; some algae

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 8.0^0 C **pH:** 7.2

CONDUCTIVITY: 219 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	NaK	
(ppm)	2.5	5.4	34.4	1.6

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.62$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH3

LAKE NAME: None

LOCATION: Long Peninsula

LATITUDE: 76^0 09' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 55

LAKE AREA (ha) : 0.5
CATCHMENT AREA (ha): 1.0

MAXIMUM DEPTH (m): 1.5

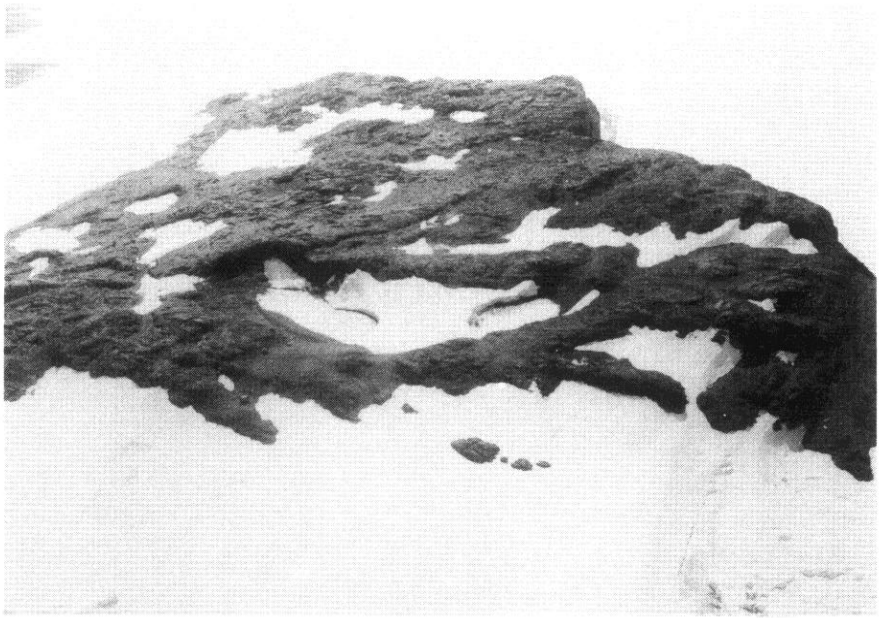
DIMENSIONS (m): 60 X 15

DISTANCE FROM POLAR PLATEAU (m): 3660

DESCRIPTION: Rock and gravel catchment; small tarn with snowbridge across it; stony bottom.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 2.8^0 C **pH:** 6.92

CONDUCTIVITY: 78 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	2.3	5.0	32.6	1.5

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.70$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH4

LAKE NAME: None

LOCATION: N.E. Stornes

LATITUDE: 76^0 07' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 10

LAKE AREA (ha): 3.5
CATCHMENT AREA (ha): 3.1

MAXIMUM DEPTH (m): 3.4

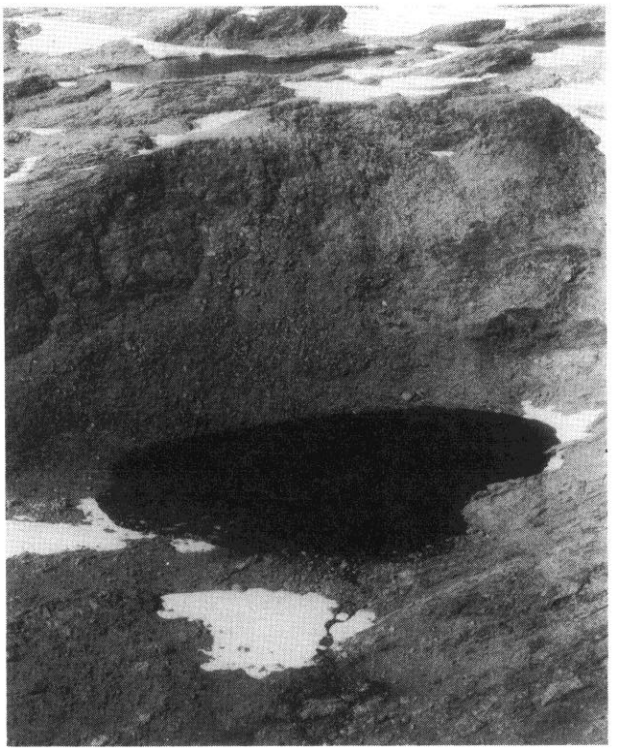
DIMENSIONS (m): 120 x 105

DISTANCE FROM POLAR PLATEAU (m): 4575

DESCRIPTION: Rock and gravel catchment; definite cirque basin with well foliated rocks; within 20m of sea; gravelly bottom.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



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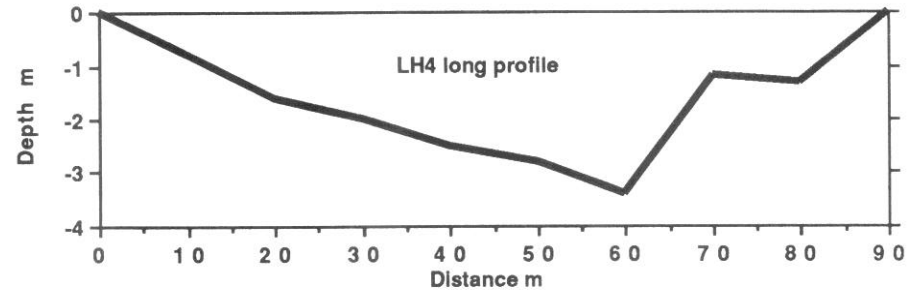
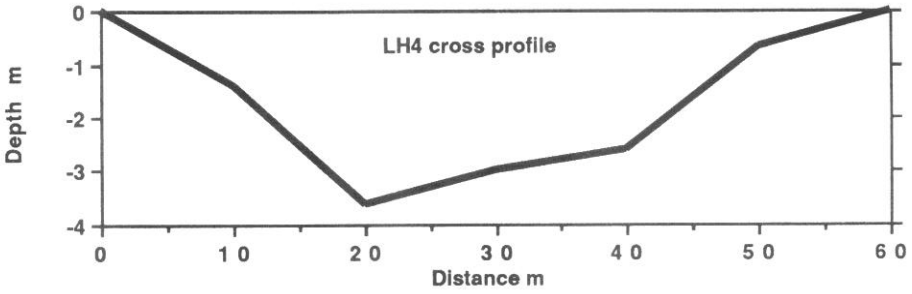




WATER CHEMISTRY:

TEMPERATURE: 7.2^0 C **pH:** 7.1

CONDUCTIVITY: 718 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	2.5	5.5	36.2	1.4

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.85$ $\frac{NCa}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH5

LAKE NAME: None

LOCATION: N.E. Stornes

LATITUDE: 76^0 06' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 5

LAKE AREA (ha): 6.0
CATCHMENT AREA (ha): 25.1

MAXIMUM DEPTH (m): 3.0

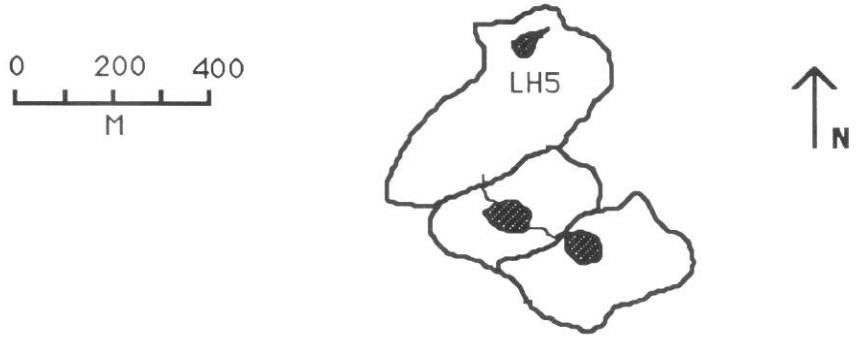
DIMENSIONS (m): 75 X 30

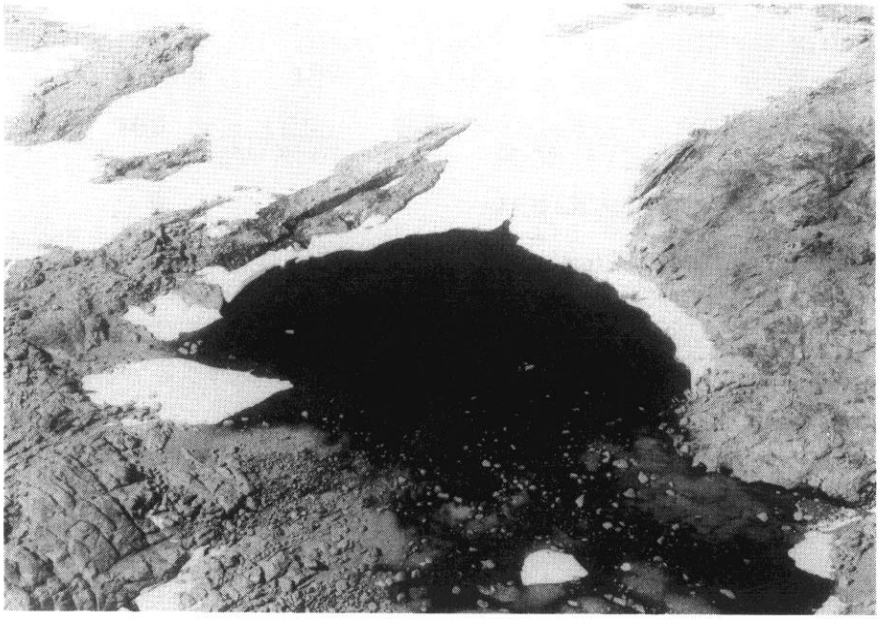
DISTANCE FROM POLAR PLATEAU (m): 5063

DESCRIPTION: Gravel catchment; within 10m of sea; pebble/boulder bottom.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:





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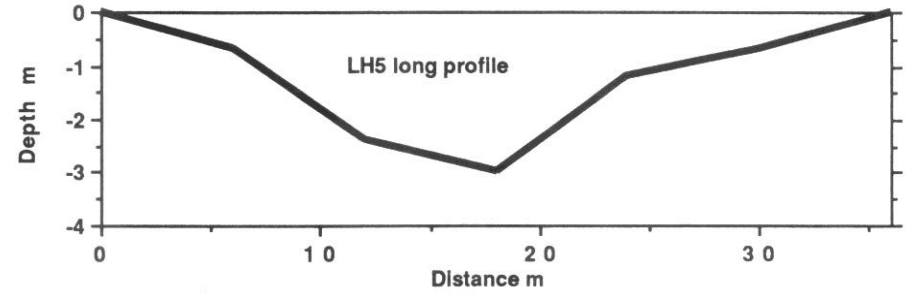
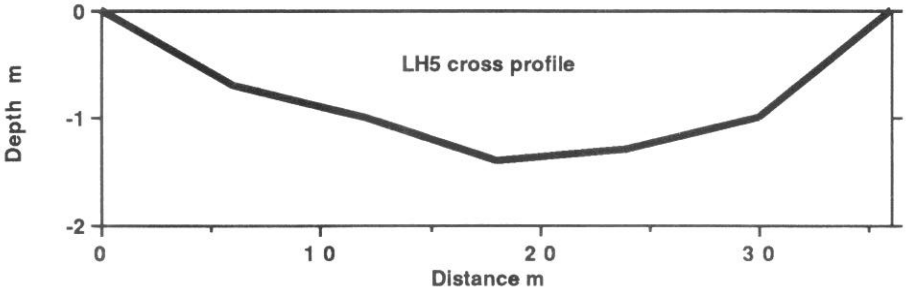




WATER CHEMISTRY:

TEMPERATURE: 5.2^0 C **pH:** 6.66

CONDUCTIVITY: 140 µmho cm^{-1} **Eh:** 191 mv

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.1	3.3	20.6	0.9

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.89$ $\frac{Ca}{Na+K+Mg} = 0.04$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH6

LAKE NAME: None

LOCATION: N. Stornes

LATITUDE: 76^0 05' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 5

LAKE AREA (ha): 4.5
CATCHMENT AREA (ha): 7.9

MAXIMUM DEPTH (m): 4.7

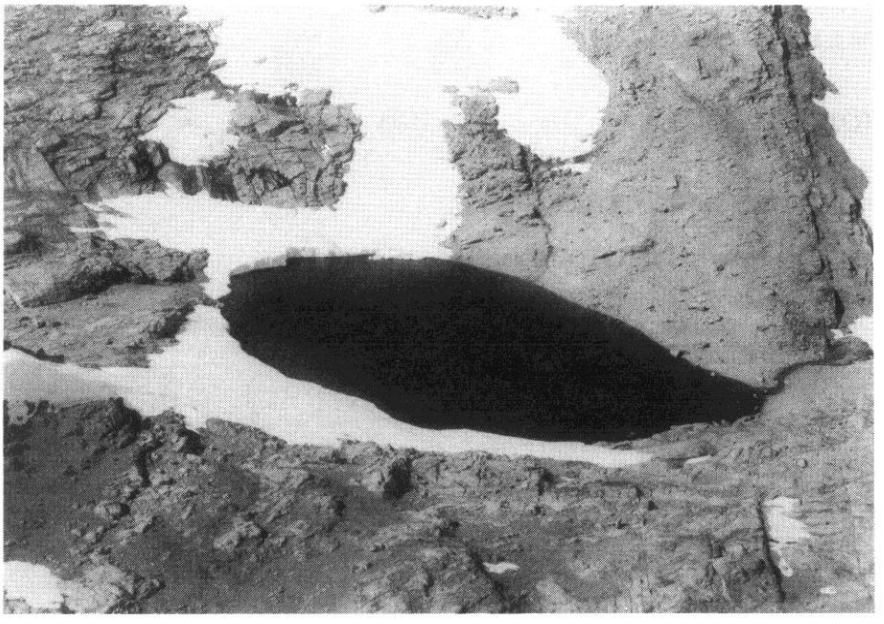
DIMENSIONS (m): 105 x 45

DISTANCE FROM POLAR PLATEAU (m): 4972

DESCRIPTION: Rock catchment; small rock basin with steep slabby slopes and a deep snowdrift on one side gravelly bottom.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



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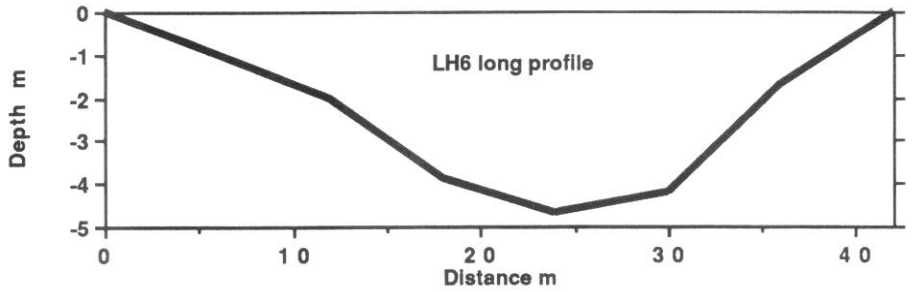
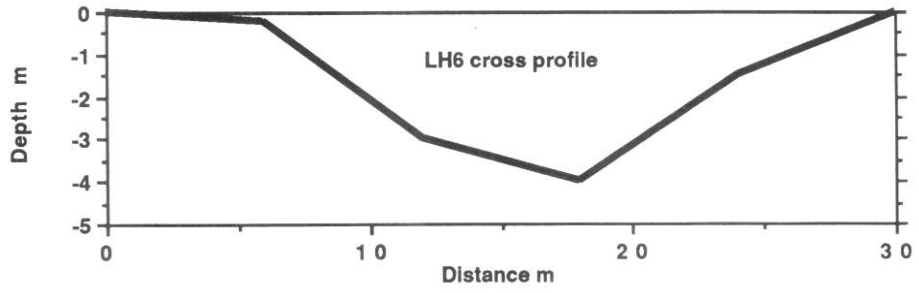




WATER CHEMISTRY:

TEMPERATURE: 7.1^0 C **pH:** 6.51

CONDUCTIVITY: 151 µmho cm^{-1} **Eh:** 195 mv

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.2	3.5	21.7	0.8

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.95$ $\frac{Na}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH7

LAKE NAME: None

LOCATION: N.E. Stornes

LATITUDE: 76^0 05' E
LONGITUDE: 69^0 09' S

ALTITUDE (m): 5

LAKE AREA (ha): 2.5
CATCHMENT AREA (ha): 10.7

MAXIMUM DEPTH (m): 4.8

DIMENSIONS (m): 165 x 60

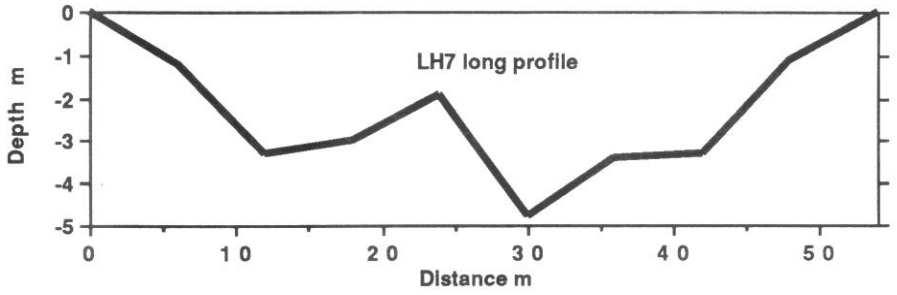
DISTANCE FROM POLAR PLATEAU (m): 5017

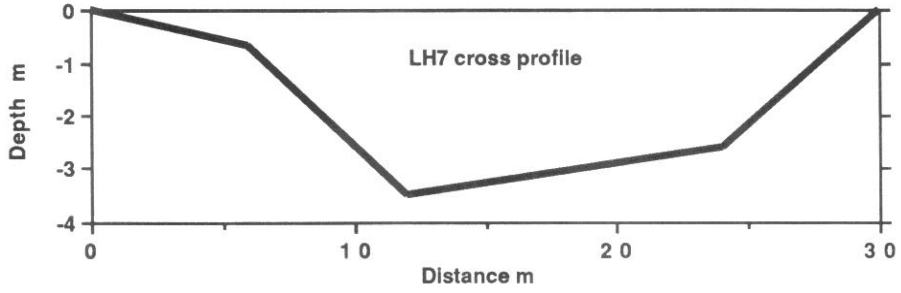
DESCRIPTION: Boulders and gravel catchment; small lagoon between LH5 and LH6; partially ice covered; skua nest site; large boulders on bottom of lagoon; not much sediment.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 3.3^0 C **pH:** 6.5

CONDUCTIVITY: 354 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	3.1	7.2	52.7	2.0

MAJOR ANIONS:	Cl
(ppm)	188.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.28$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH8

LAKE NAME: None

LOCATION: N. Stornes

LATITUDE: 76^0 06' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 25

LAKE AREA (ha): 2.5
CATCHMENT AREA (ha): 12.9

MAXIMUM DEPTH (m): 4.5

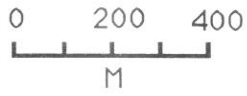
DIMENSIONS (m): 105 x 60

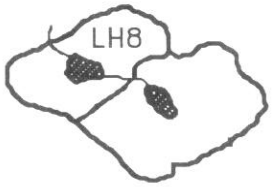
DISTANCE FROM POLAR PLATEAU (m): 4423

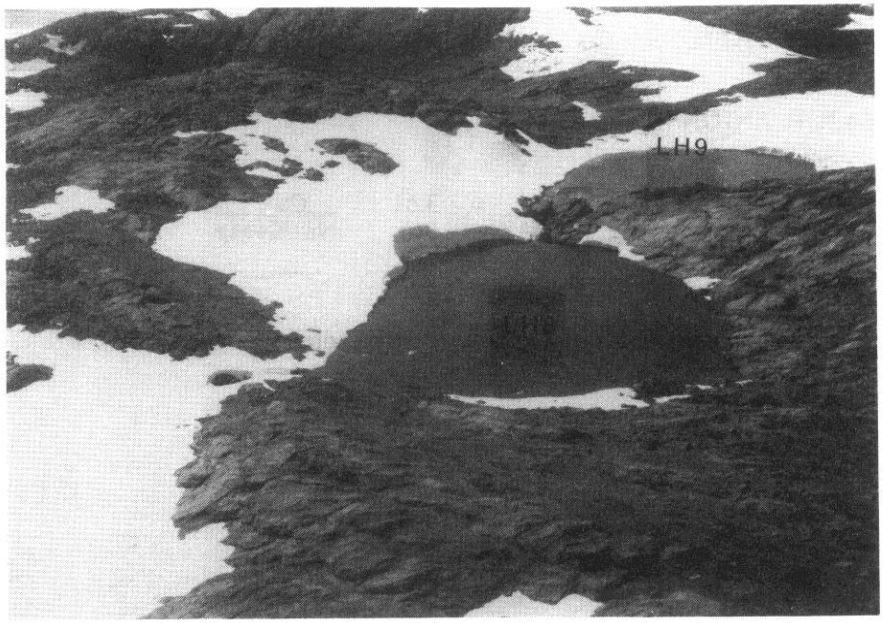
DESCRIPTION: Gravel catchment; tarn with sloping rock backwall; boulder bottom; little algal growth.

GEOLOGY: Grey Gneiss

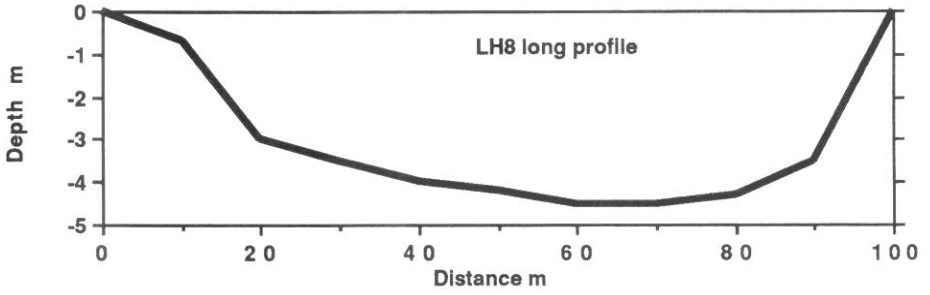
LAKE AND CATCHMENT:

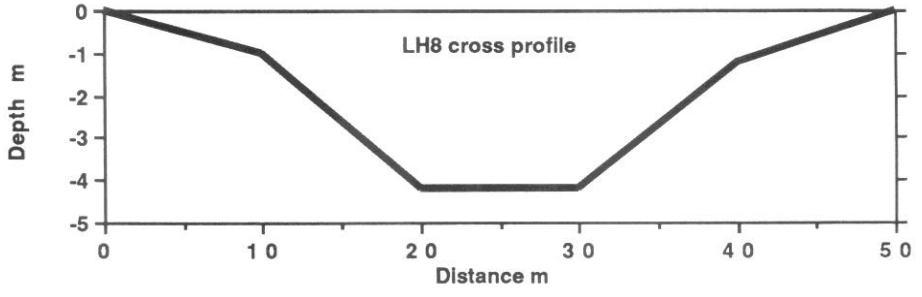






PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 4.0^0 C **pH:** 6.44

CONDUCTIVITY: 110 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.7	4.0	24.2	1.0

MAJOR ANIONS:	Cl			
(ppm)	36.2			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.61$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH9

LAKE NAME: None

LOCATION: N. Stornes

LATITUDE: 76^0 06' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 30

LAKE AREA (ha): 2.5
CATCHMENT AREA (ha): 7.2

MAXIMUM DEPTH (m): 3.8

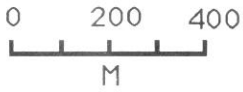
DIMENSIONS (m): 90 x 45

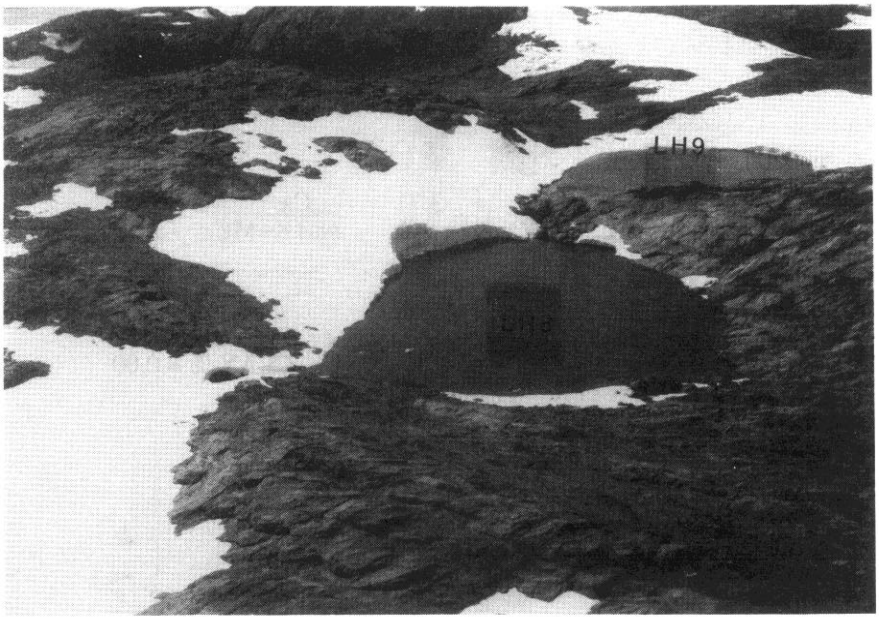
DISTANCE FROM POLAR PLATEAU (m): 4392

DESCRIPTION: Gravel catchment; sediment banks on both sides of pond; granular gravel mostly; bottom pebbles and boulders.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:





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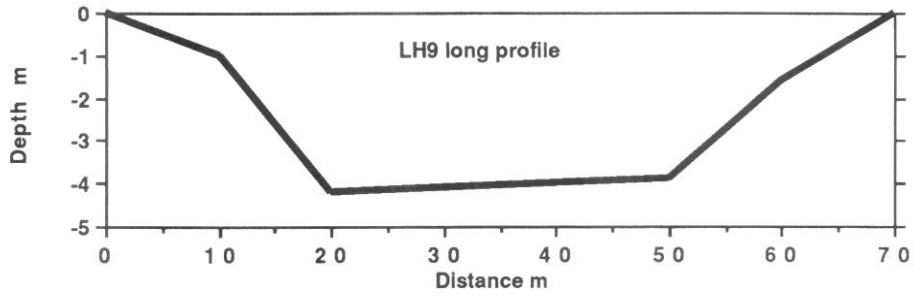
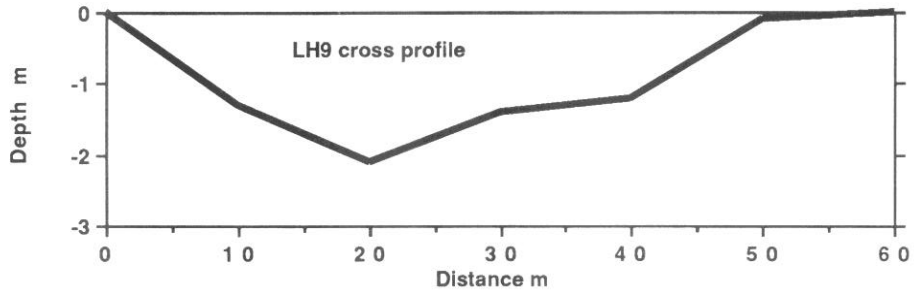




WATER CHEMISTRY:

TEMPERATURE: 4.4^0 C **pH:** 6.05

CONDUCTIVITY: 37 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.3	3.5	20.8	0.8

MAJOR ANIONS:	Cl			
(ppm)	17.6			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.71$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.30 SAND % = 99.69 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.57 Phi coarse sand
Sorting = 0.77 moderately sorted
Skewness = 0.88 near symmetrical
Kurtosis = 0.98 mesokurtic

LAKE NUMBER: LH10 **LAKE NAME:** Lake Heidi

LOCATION: N. Stornes **LATITUDE:** 76^0 06' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 60 **LAKE AREA (ha):** 7.5
CATCHMENT AREA (ha): 12.1

MAXIMUM DEPTH (m): 5.0 **DIMENSIONS (m):** 305 x 76

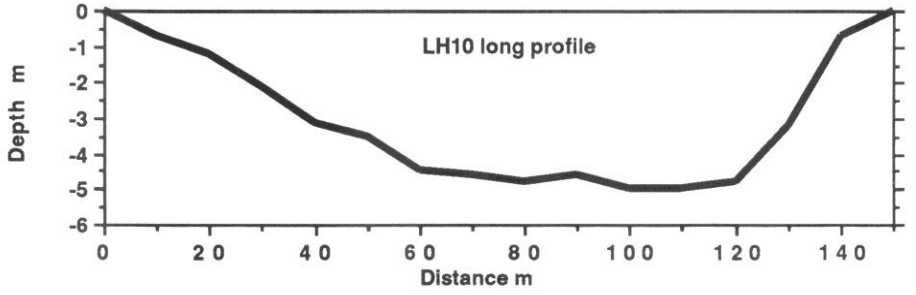
DISTANCE FROM POLAR PLATEAU (m): 4255

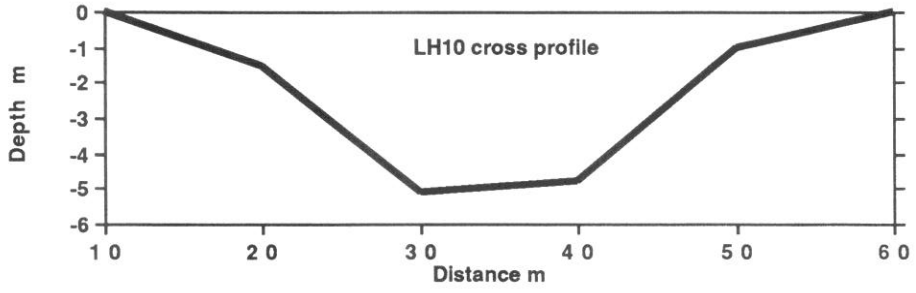
DESCRIPTION: Gravel and rock catchment; long tarn next to frozen lake; divided by sand bar; boulder bottom.

GEOLOGY: Opx Gneiss, Layered Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 8.3^0 C **pH:** 6.23

CONDUCTIVITY: 161 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	2.0	4.9	31.4	1.2

MAJOR ANIONS:	Cl
(ppm)	47.9

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.88$ $\frac{Ca}{Na+K+Mg} = 0.05$

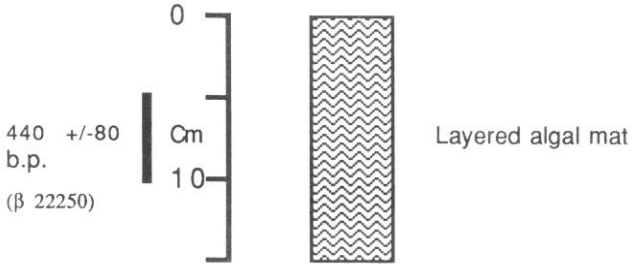
LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 1.47 SAND % = 98.52 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.43 Phi coarse sand
Sorting = 0.88 moderately sorted
Skewness = 0.21 fines skewed
Kurtosis = 0.94 mesokurtic

RADIOCARBON AGES:

Beta No.	Sample Code	Depth cm	14C Age y.b.p.	Delta 13C $^{0}/_{00}$
22249	L101	5-10	440 +/- 80	-10.7

SEDIMENT STRATIGRAPHY:



LAKE NUMBER: LH11 **LAKE NAME:** Lake Ferris

LOCATION: N. Stornes **LATITUDE:** 76^0 06' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 50 **LAKE AREA (ha):** 10.5
CATCHMENT AREA (ha): 51.1

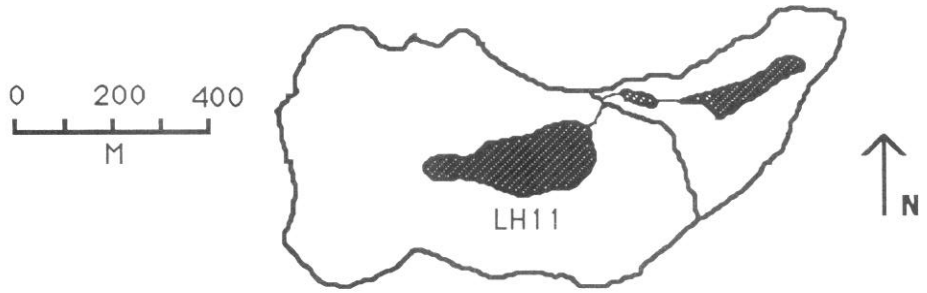
MAXIMUM DEPTH (m): unknown **DIMENSIONS (m):** 375 x 165

DISTANCE FROM POLAR PLATEAU (m): 4270

DESCRIPTION: Snow and gravel catchment; large and frozen to some depth except for melt pools on margins.

GEOLOGY: Opx Gneiss, Layered Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 0.3^0 C **pH:** 5.96

CONDUCTIVITY: 69 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	--	--	--	--

MAJOR ANIONS:	Cl
(ppm)	23.4

IONIC RATIOS: $\frac{Na}{Ca+Mg+K}$ = -- $\frac{Ca}{Na+K+Mg}$ = --

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.02 SAND % = 99.97 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.63 Phi coarse sand
Sorting = 0.67 moderately well sorted
Skewness = 0.24 fine skewed
Kurtosis = 0.98 mesokurtic

LAKE NUMBER: LH12

LAKE NAME: Long Lake

LOCATION: N. Stornes

LATITUDE: 76^0 07' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 80

LAKE AREA (ha): 5
CATCHMENT AREA (ha): 8.7

MAXIMUM DEPTH (m): 11

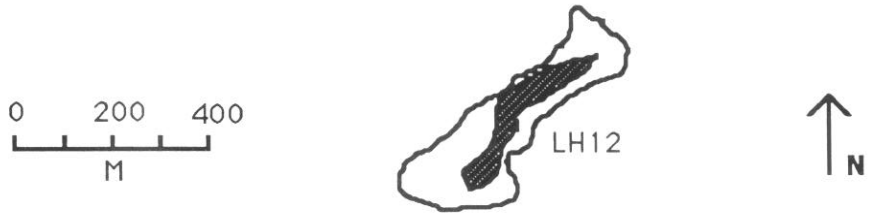
DIMENSIONS (m): 390 x 75

DISTANCE FROM POLAR PLATEAU (m): 3965

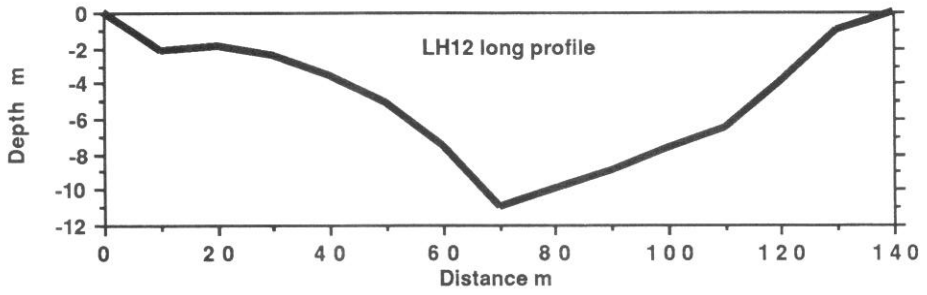
DESCRIPTION: Rock slab catchment; rock cut basin with wedge shape profile; deeper on south side of basin below rock wall; some ice cover but thin; lens of sediment visible on depth trace - clean contact.

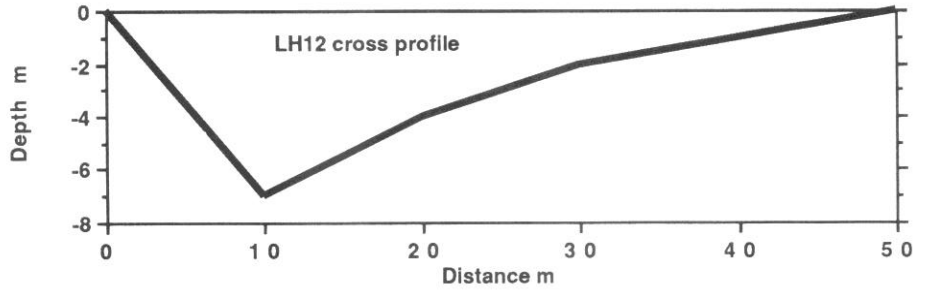
GEOLOGY: Blue Gneiss, Um

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 3.5^0 C **pH:** 6.41

CONDUCTIVITY: 118 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	--	--	--	--

MAJOR ANIONS:	Cl
(ppm)	36.7

IONIC RATIOS: $\frac{Na}{Ca+Mg+K}$ = -- $\frac{Ca}{Na+K+Mg}$ = --

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample, bottom rocky

LAKE NUMBER: LH13 **LAKE NAME:** None

LOCATION: N. E. Stornes **LATITUDE:** 76^0 07' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 75 **LAKE AREA (ha):** 5
CATCHMENT AREA (ha): 4.7

MAXIMUM DEPTH (m): 4.8 **DIMENSIONS (m):** 270 x 75

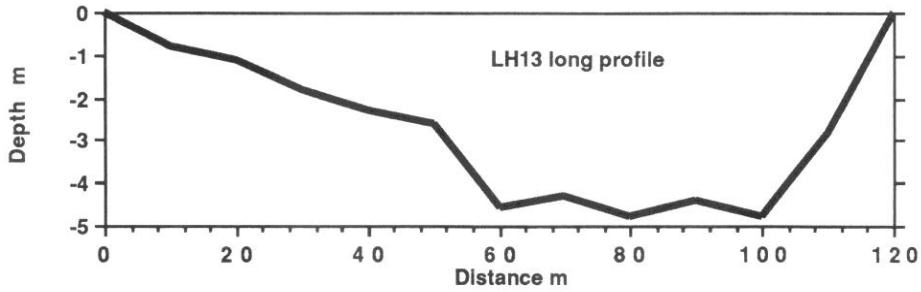
DISTANCE FROM POLAR PLATEAU (m): 4270

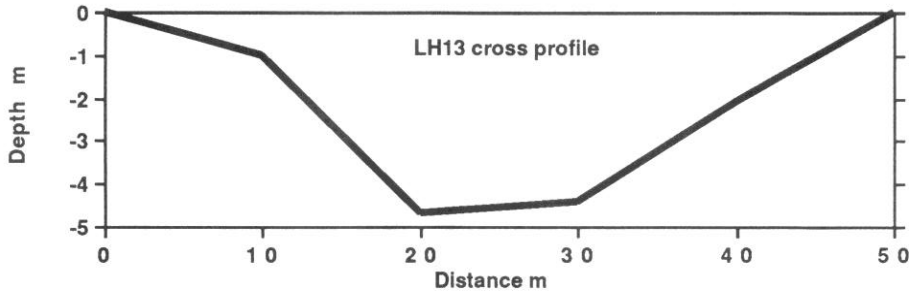
DESCRIPTION: Rock catchment; downstream from LH12; surrounded by scree.

GEOLOGY: Opx Gneiss, Blue Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 6.0^0 C **pH:** 7.13

CONDUCTIVITY: 479 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	5.4	9.7	72.9	3.0

MAJOR ANIONS:	Cl
(ppm)	252.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.03$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH14

LAKE NAME: None

LOCATION: N. E. Stornes

LATITUDE: 76^0 07' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 60

LAKE AREA (ha): 5.5
CATCHMENT AREA (ha): 7.1

MAXIMUM DEPTH (m): 4.7

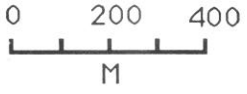
DIMENSIONS (m): 165 x 90

DISTANCE FROM POLAR PLATEAU (m): 3874

DESCRIPTION: Rock catchment; south of LH13; no outlet stream.

GEOLOGY: Layered Gneiss, Blue Gneiss

LAKE AND CATCHMENT:



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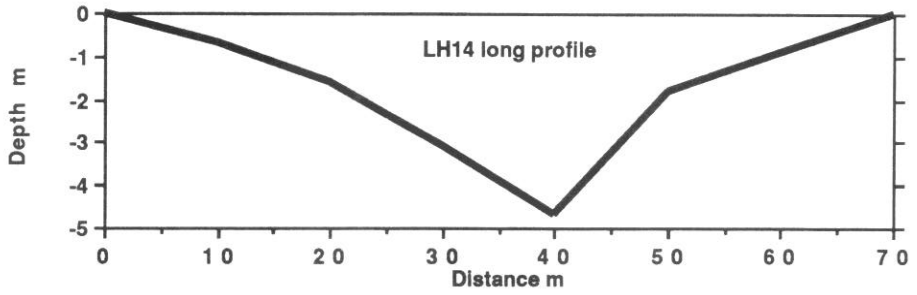
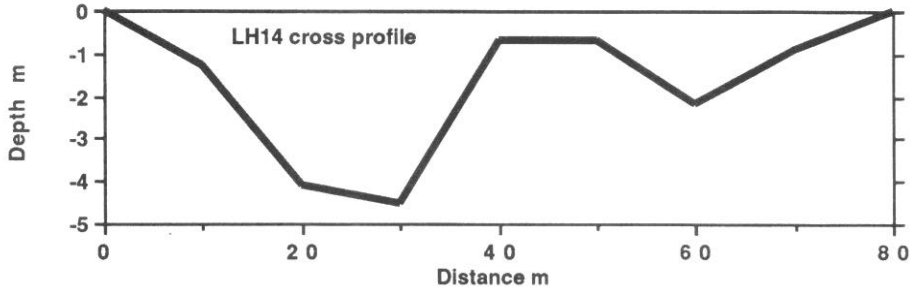




WATER CHEMISTRY:

TEMPERATURE: 9.4^0 C **pH:** 7.2

CONDUCTIVITY: 495 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca --	Mg --	Na --	K --
MAJOR ANIONS: (ppm)	Cl 256.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K}$ = -- $\frac{Ca}{Na+K+Mg}$ = --

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH15 **LAKE NAME:** None

LOCATION: N. E. Stornes **LATITUDE:** 76^0 07' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 75 **LAKE AREA (ha):** 4.5
CATCHMENT AREA (ha): 7.2

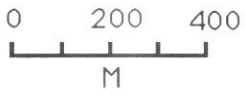
MAXIMUM DEPTH (m): 1.0 **DIMENSIONS (m):** 150 x 55

DISTANCE FROM POLAR PLATEAU (m): 3813

DESCRIPTION: Gravel catchment; south of LH12, slightly higher; ice cover and shallow with boulders on bottom.

GEOLOGY: Um, Blue Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 3.8^0 C **pH:** 6.76

CONDUCTIVITY: 108 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca	Mg	Na	K
	--	--	--	--

MAJOR ANIONS: (ppm)	Cl
	33.4

IONIC RATIOS: $\frac{Na}{Ca+Mg+K}$ = -- $\frac{Ca}{Na+K+Mg}$ = --

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH16 **LAKE NAME:** None

LOCATION: N. E. Stornes **LATITUDE:** 76^0 05' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 75 **LAKE AREA (ha):** 12.0
CATCHMENT AREA (ha): 43.0

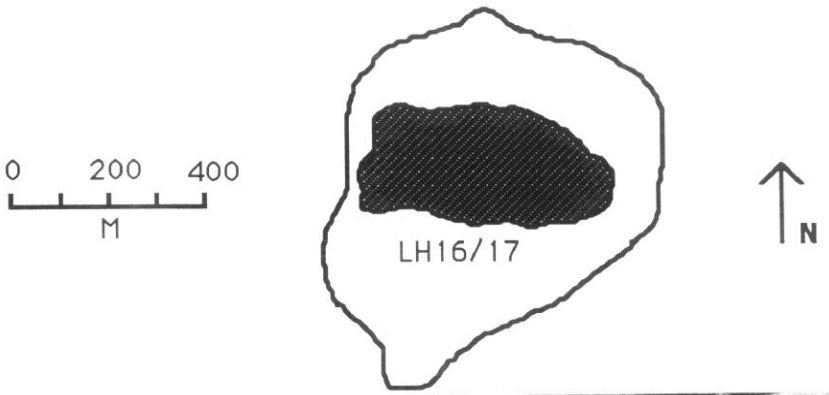
MAXIMUM DEPTH (m): 2.0 **DIMENSIONS (m):** 570 x 270

DISTANCE FROM POLAR PLATEAU (m): 3736

DESCRIPTION: Rock catchment; ice covered lake near deep gorge feeding fjord; bridge of thicker ice extends to middle of lake; large algal mats on bottom.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 3.7^0 C **pH:** 6.16

CONDUCTIVITY: 145 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.0	3.5	19.9	0.8

MAJOR ANIONS:	Cl			
(ppm)	43.4			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.75$ $\frac{Ca}{Na+K+Mg} = 0.04$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.00 SAND % = 100.00 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.68 Phi coarse sand
Sorting = 0.79 moderately sorted
Skewness = 0.11 fine skewed
Kurtosis = 0.94 mesokurtic

LAKE NUMBER: LH17

LAKE NAME: None

LOCATION: W. Stornes

LATITUDE: 76^0 05' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 50

LAKE AREA (ha): 12.0
CATCHMENT AREA (ha): 43.0

MAXIMUM DEPTH (m): 5.2

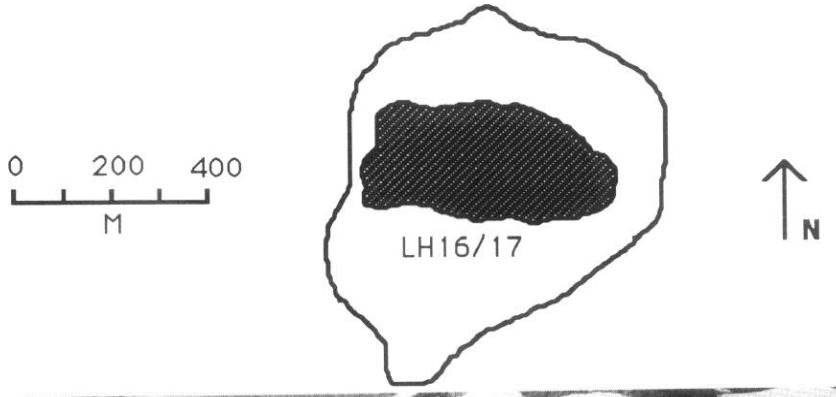
DIMENSIONS (m): 570 x 270

DISTANCE FROM POLAR PLATEAU (m): 3736

DESCRIPTION: Rock catchment; ice covered lake near deep gorge feeding fjord; bridge of thicker ice extends to middle of lake; large algal mats on bottom.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 0.5^0 C **pH:** 6.03

CONDUCTIVITY: 109 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.7	2.6	13.6	0.6

MAJOR ANIONS:	Cl
(ppm)	30.8

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.49$ $\frac{Ca}{Na+K+Mg} = 0.04$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH18

LAKE NAME: Lake Oskar

LOCATION: Central Stornes

LATITUDE: 76^0 07' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 85

LAKE AREA (ha): 9.0
CATCHMENT AREA (ha): 20.7

MAXIMUM DEPTH (m): 11.0

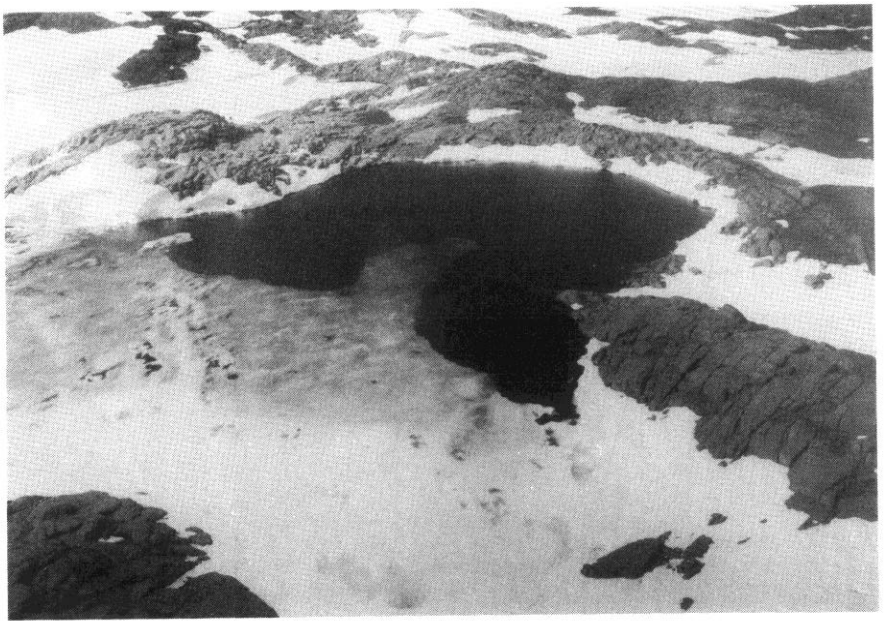
DIMENSIONS (m): 330 x 240

DISTANCE FROM POLAR PLATEAU (m): 3294

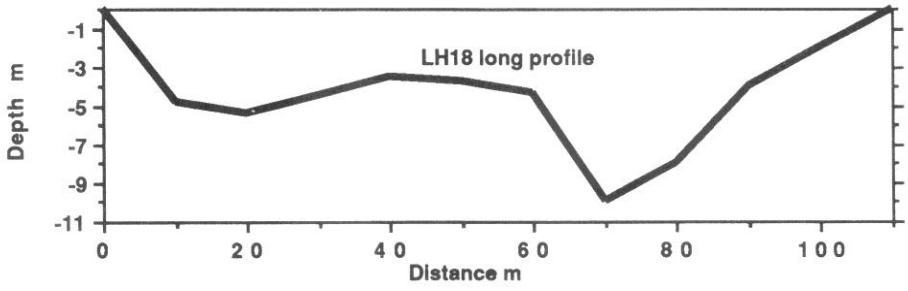
DESCRIPTION: Rock catchment; large lake, deep with some ice cover; rock cut basin.

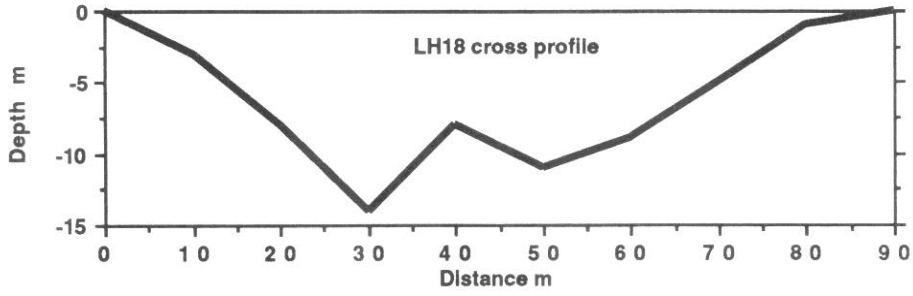
GEOLOGY: Grey Gneiss, Opx

LAKE CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 4.3^0 C **pH:** 6.98

CONDUCTIVITY: 401 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 6.3	Mg 7.0	Na 57.1	K 2.2
MAJOR ANIONS: (ppm)	Cl 214.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.68$ $\frac{Ca}{Na+K+Mg} = 0.10$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.33 SAND % = 99.66 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.56 Phi coarse sand
Sorting = 0.84 moderately sorted
Skewness = 0.23 fine skewed
Kurtosis = 0.99 mesokurtic

LAKE NUMBER: LH19

LAKE NAME: None

LOCATION: W. Stornes

LATITUDE: 76^{0} 04' E
LONGITUDE: 69^{0} 25' S

ALTITUDE (m): 90

LAKE AREA (ha): 0.5
CATCHMENT AREA (ha): 2.3

MAXIMUM DEPTH (m): 4.0

DIMENSIONS (m): 56 x 40

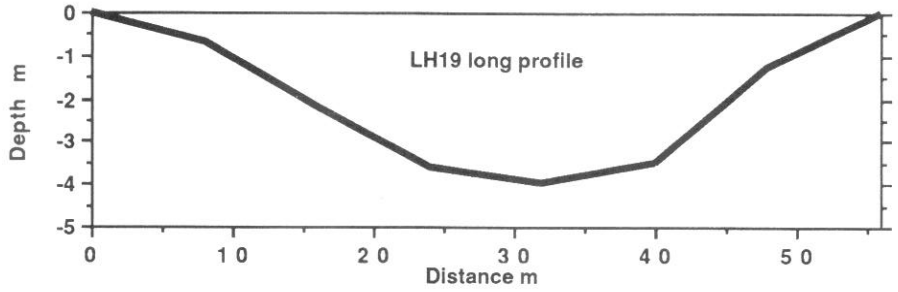
DISTANCE FROM POLAR PLATEAU (m): 4423

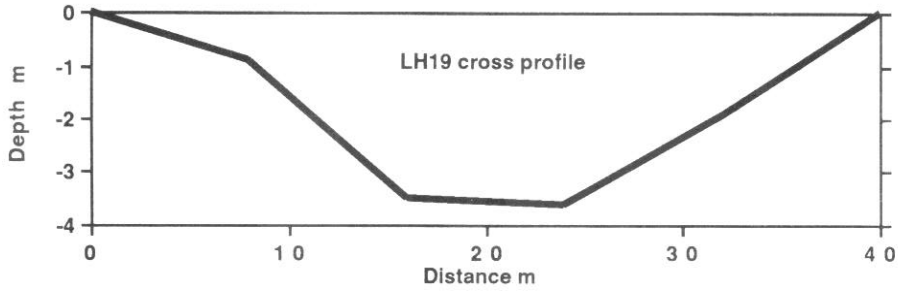
DESCRIPTION: Rock catchment; on top of ridge; two small tarns - obviously deep.

GEOLOGY: Opx Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 6.8^0 C **pH:** 6.92

CONDUCTIVITY: 411 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	4.1	8.4	61.0	2.6

MAJOR ANIONS:	Cl			
(ppm)	240.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.04$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH20 **LAKE NAME:** None

LOCATION: W. Stornes **LATITUDE:** 76^0 04' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 80 **LAKE AREA (ha):** 0.5
CATCHMENT AREA (ha): 6.4

MAXIMUM DEPTH (m): 3.4 **DIMENSIONS (m):** 50 x 25

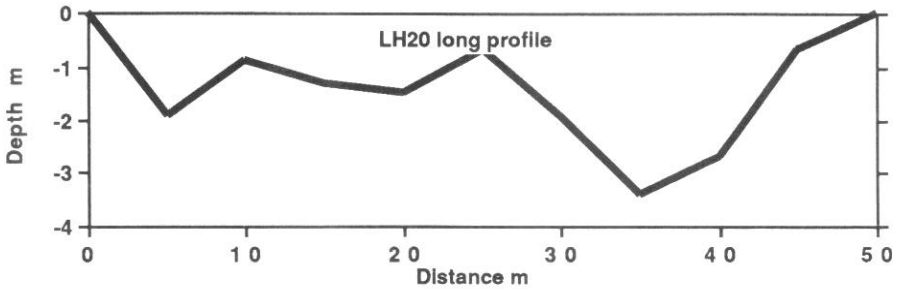
DISTANCE FROM POLAR PLATEAU (m): 4423

DESCRIPTION: Rock catchment; fed by outlet over low saddle from LH19; boulder bottom.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:

PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 1.9^0 C **pH:** 5.25

CONDUCTIVITY: 14 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.9	1.5	5.2	0.3

MAJOR ANIONS:	Cl
(ppm)	18.9

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 1.93$ $\frac{Ca}{Na+K+Mg} = 0.13$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): no sample

LAKE NUMBER: LH21 **LAKE NAME:** None

LOCATION: W. Stornes **LATITUDE:** 76^0 04' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 50 **LAKE AREA (ha):** 1.0
CATCHMENT AREA (ha): 8.65

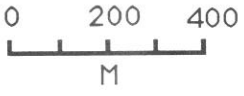
MAXIMUM DEPTH (m): 2.1 **DIMENSIONS (m):** 105 x 30

DISTANCE FROM POLAR PLATEAU (m): 4346

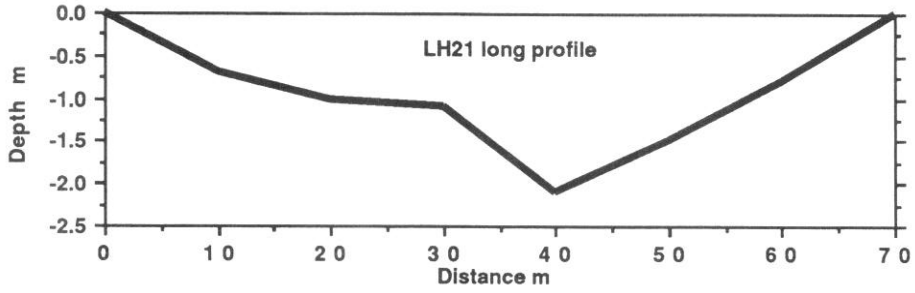
DESCRIPTION: Rock and gravel catchment; long profile; boulder bottom.

GEOLOGY: Opx Gneiss

LAKE AND CATCHMENT:



PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 8.0^0 C **pH:** 7.37

CONDUCTIVITY: 1600 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	34.6	30.7	236.7	12.4

MAJOR ANIONS:	Cl			
(ppm)	462.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.05$ $\frac{Ca}{Na+K+Mg} = 0.12$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH22

LAKE NAME: None

LOCATION: W. Stornes

LATITUDE: 76^0 04' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 20

LAKE AREA (ha): 1.0
CATCHMENT AREA (ha): 15.0

MAXIMUM DEPTH (m): 2.2

DIMENSIONS (m): 105 x 90

DISTANCE FROM POLAR PLATEAU (m): 5459

DESCRIPTION: Rock catchment; ice covered lake near to coast; few cracks around edge; scree and gravel bottom; little flora.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:

WATER CHEMISTRY:

TEMPERATURE: 0.7^0 C **pH:** 6.44

CONDUCTIVITY: 145 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.4	3.6	20.2	0.8

MAJOR ANIONS:	Cl			
(ppm)	41.3			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.48$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.00 SAND % = 99.99 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.81 Phi coarse sand
Sorting = 0.82 moderately sorted
Skewness = -0.02 near symmetrical
Kurtosis = 0.88 platykurtic

LAKE NUMBER: LH23 **LAKE NAME:** Pup Lagoon

LOCATION: W. Stornes **LATITUDE:** 76^0 03' E
LONGITUDE: 69^0 25'S

ALTITUDE (m): 5 **LAKE AREA (ha):** 1.0
CATCHMENT AREA (ha): 7.84

MAXIMUM DEPTH (m): 4.6 **DIMENSIONS (m):** 105 x 90

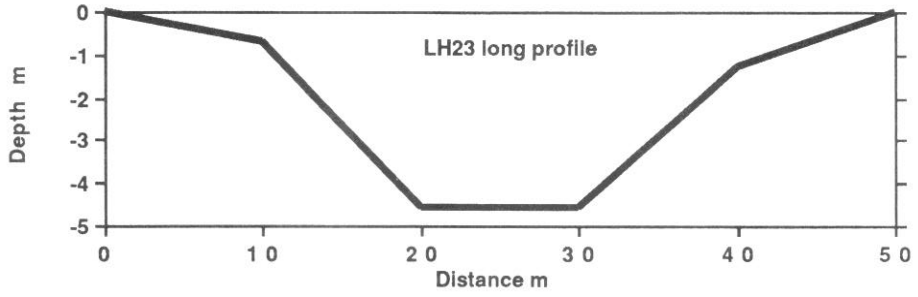
DISTANCE FROM POLAR PLATEAU (m): 5643

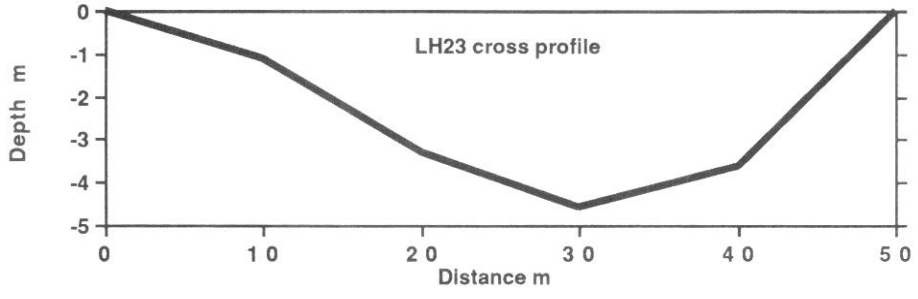
DESCRIPTION: Gravel catchment; very close to sea;

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 8.0^0 C **pH:** 7.14

CONDUCTIVITY: 399 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	5.2	8.8	66.5	2.6

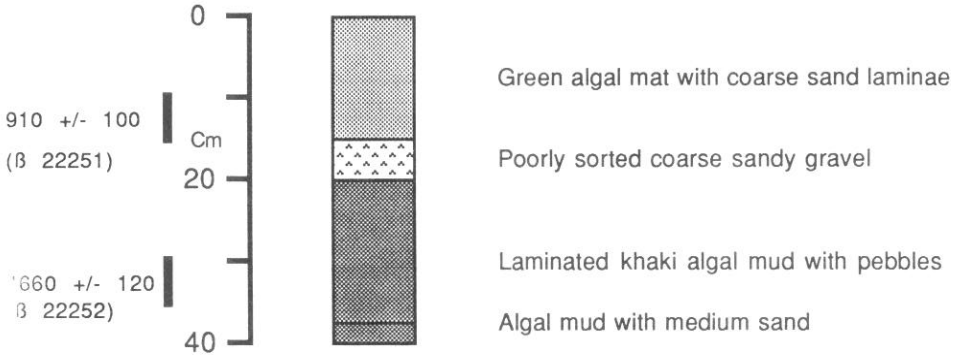
MAJOR ANIONS:	Cl			
(ppm)	210.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.01$ $\frac{Ca}{Na+K+Mg} = 0.07$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 1.40 SAND % = 98.59 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.35 Phi coarse sand
Sorting = 0.81 moderately sorted
Skewness = 0.19 fine skewed
Kurtosis = 0.92 mesokurtic

SEDIMENT STRATIGRAPHY:



RADIOCARBON AGES:

Beta No.	Sample Code	Depth cm	14C Age y.b.p.	Delta 13C $^{0}/_{00}$
22251	L232	10-14	910 +/- 100	-11.8
22252	L232	29-34	4660 +/- 120	-20.8

LAKE NUMBER: LH24

LAKE NAME: None

LOCATION: Central Stornes

LATITUDE: 76^0 04' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 50

LAKE AREA (ha): 1.5
CATCHMENT AREA (ha): 2.9

MAXIMUM DEPTH (m): 4.8

DIMENSIONS (m): 150 x 60

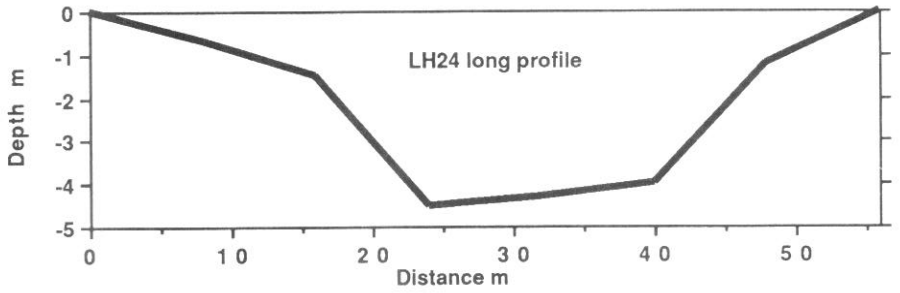
DISTANCE FROM POLAR PLATEAU (m): 4819

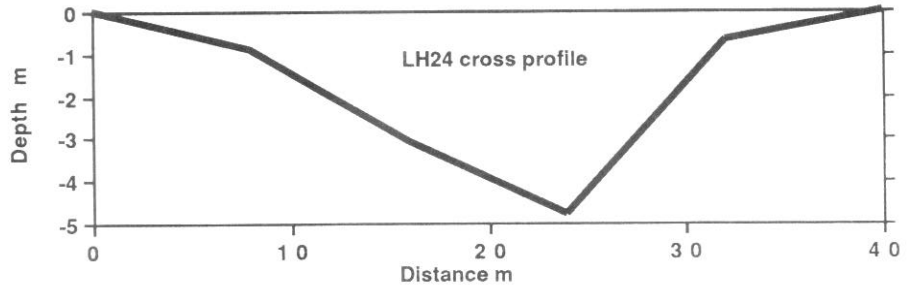
DESCRIPTION: Rock catchment; long tarn next to frozen lake; boulder bottom; outlets to frozen lake down steep stream; rock cut channel with veneer of sandy gravel.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 8.6^0 C **pH:** 7.97

CONDUCTIVITY: 1701 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	42.1	34.9	250.8	12.4

MAJOR ANIONS:	Cl
(ppm)	282.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.81$ $\frac{Ca}{Na+K+Mg} = 0.14$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH25

LAKE NAME: None

LOCATION: Central Stornes

LATITUDE: 76^0 04' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 50

LAKE AREA (ha): 0.5
CATCHMENT AREA (ha): 3.6

MAXIMUM DEPTH (m): 7.2

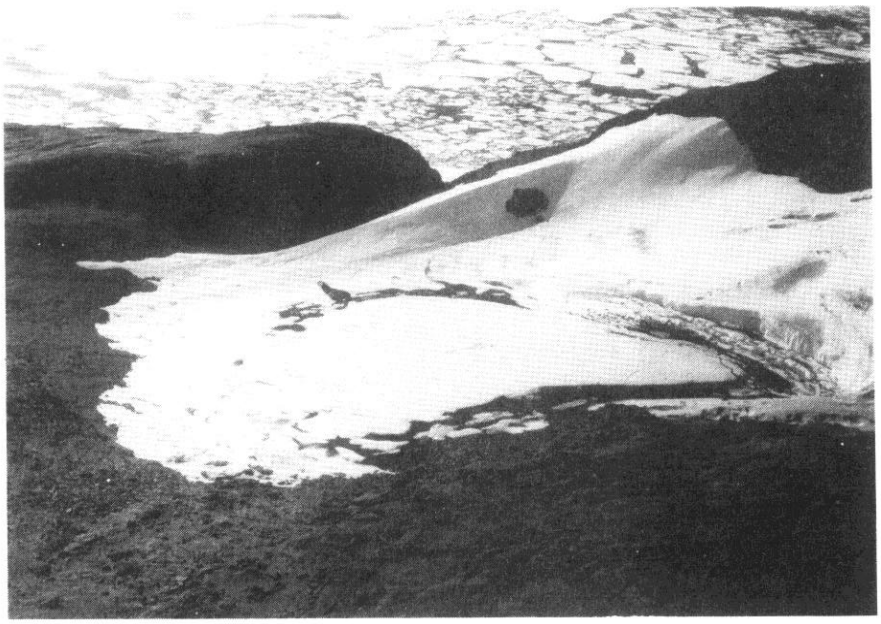
DIMENSIONS (m): 90 x 45

DISTANCE FROM POLAR PLATEAU (m): 4789

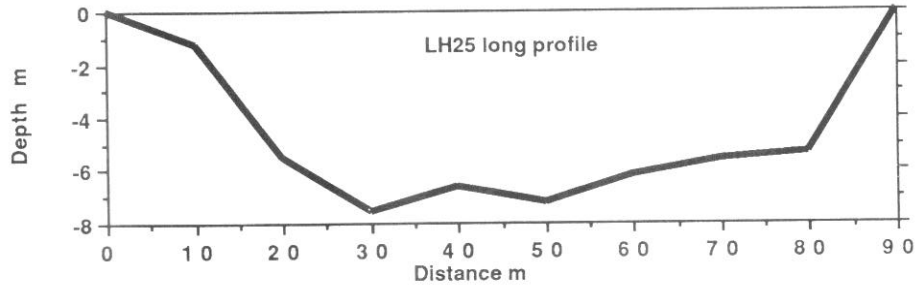
DESCRIPTION: Rock and ice catchment; frozen lake near LH24.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



PROFILE:



WATER CHEMISTRY:

TEMPERATURE: 0.7^0 C **pH:** 6.37

CONDUCTIVITY: 151 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.2	3.7	22.5	0.9

MAJOR ANIONS:	Cl
(ppm)	41.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.88$ $\frac{Ca}{Na+K+Mg} = 0.04$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.02 SAND % = 99.97 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.02 Phi medium sand
Sorting = 0.78 moderately sorted
Skewness = 0.10 fine skewed
Kurtosis = 1.11 mesokurtic

LAKE NUMBER: LH26 **LAKE NAME:** None

LOCATION: S.W. Stornes **LATITUDE:** 76^0 04' E
LONGITUDE: 69^0 26' S

ALTITUDE (m): 65 **LAKE AREA (ha):** 2.0
CATCHMENT AREA (ha): 4.9

MAXIMUM DEPTH (m): 4.8 **DIMENSIONS (m):** 135 x 50

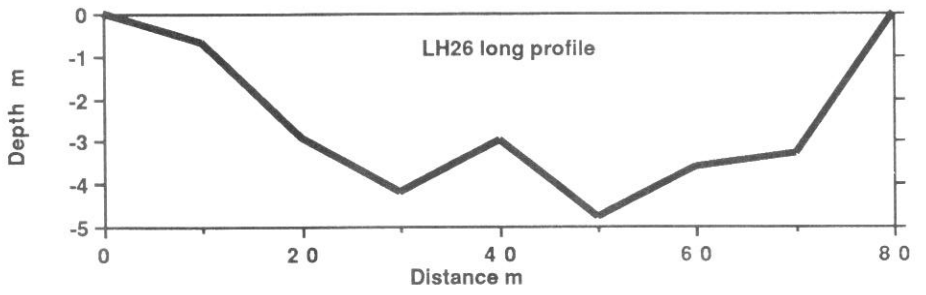
DISTANCE FROM POLAR PLATEAU (m): 3843

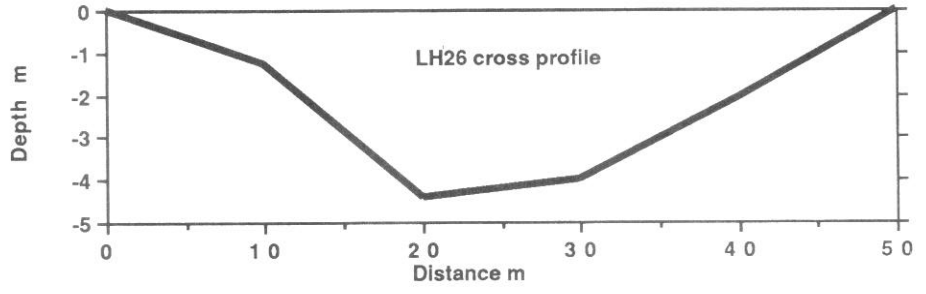
DESCRIPTION: Rock and ice catchment; two tarns near head of fjord and marginal to Stornes icecap; very young basins; boulder bottom.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 4.5^0 C **pH:** 6.55

CONDUCTIVITY: 98 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.0	2.9	13.8	0.6

MAJOR ANIONS:	Cl
(ppm)	25.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.07$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.00 SAND % = 100.00 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.17 Phi medium sand
Sorting = 0.72 moderately sorted
Skewness = 0.08 fine skewed
Kurtosis = 1.01 mesokurtic

LAKE NUMBER: LH27 **LAKE NAME:** None

LOCATION: S.W. Stornes **LATITUDE:** 76^0 04' E
LONGITUDE: 69^0 26' S

ALTITUDE (m): 65 **LAKE AREA (ha):** 0.5
CATCHMENT AREA (ha): 7.6

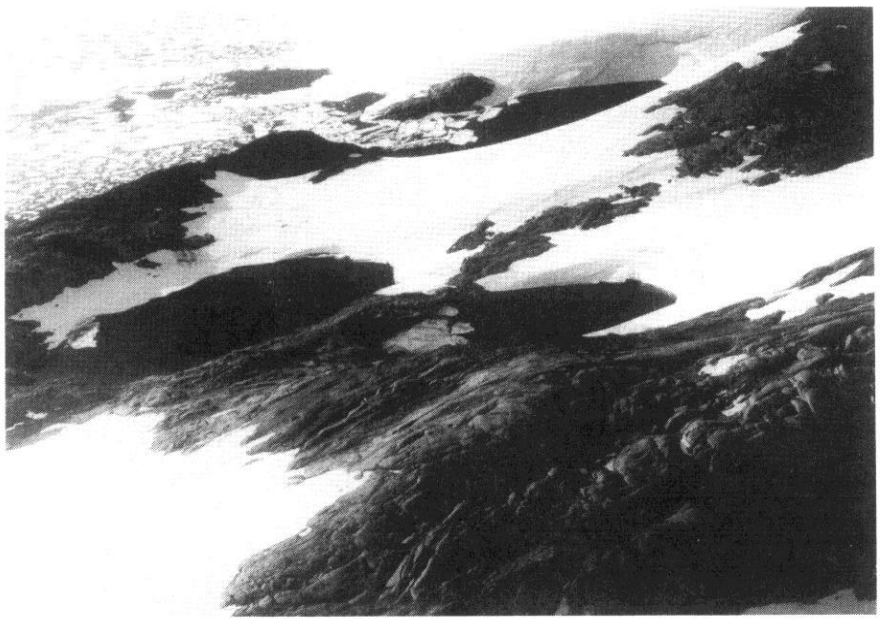
MAXIMUM DEPTH (m): 6.3 **DIMENSIONS (m):** 90 x 50

DISTANCE FROM POLAR PLATEAU (m): 3813

DESCRIPTION: Rock and ice catchment; small rock basin next to LH26.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



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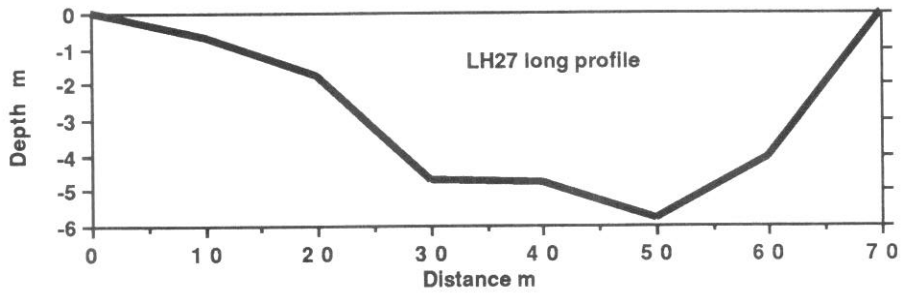
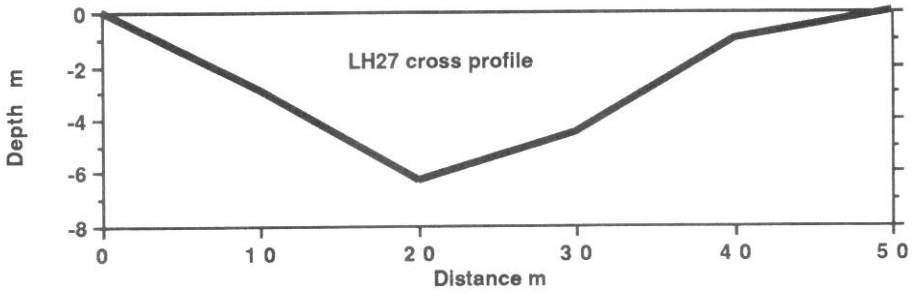




WATER CHEMISTRY:

TEMPERATURE: 3.4^0 C **pH:** 6.27

CONDUCTIVITY: 101 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.9	2.7	13.0	0.6

MAJOR ANIONS:	Cl
(ppm)	26.6

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.10$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH28

LAKE NAME: Malachite Lake

LOCATION: S.W. Stornes

LATITUDE: 76^0 04' E
LONGITUDE: 69^0 26' S

ALTITUDE (m): 85

LAKE AREA (ha): 4.0
CATCHMENT AREA (ha): 10.6

MAXIMUM DEPTH (m): Unknown

DIMENSIONS (m): 165 x 40

DISTANCE FROM POLAR PLATEAU (m): 3447

DESCRIPTION: Rock catchment; frozen lake next to ice edge.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:

WATER CHEMISTRY:

TEMPERATURE: 0.3^0 C **pH:** 6.64

CONDUCTIVITY: 70 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.6	2.1	9.3	0.4

MAJOR ANIONS:	Cl
(ppm)	22.2

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.00$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH29

LAKE NAME: Jokullvatn Jill

LOCATION: S.W. Stornes

LATITUDE: 76^0 04' E
LONGITUDE: 69^0 26' S

ALTITUDE (m): 80

LAKE AREA (ha): 7.0
CATCHMENT AREA (ha): 21.2

MAXIMUM DEPTH (m): 3.5

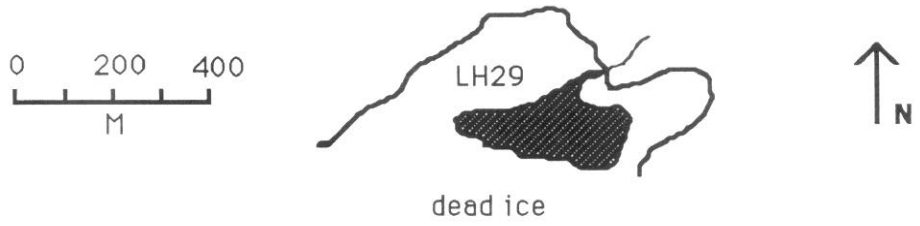
DIMENSIONS (m): 390 x 150

DISTANCE FROM POLAR PLATEAU (m): 2776

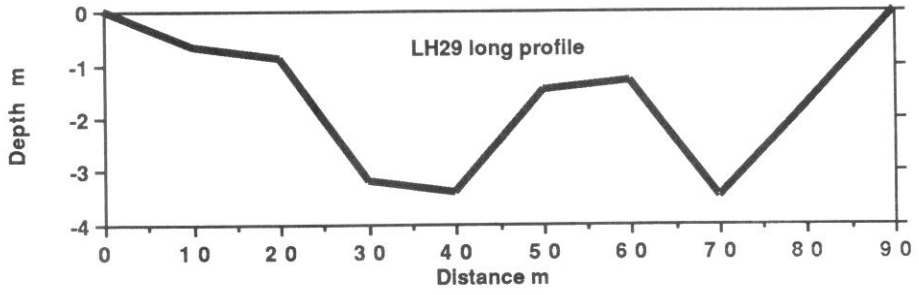
DESCRIPTION: Rock and ice catchment; near ice edge; green algae on rocks.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 1.8^0 C **pH:** 6.33

CONDUCTIVITY: 79 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 1.0	Mg 2.7	Na 12.8	K 0.6
MAJOR ANIONS: (ppm)	Cl 24.7			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.98$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH30

LAKE NAME: Blundell Lake

LOCATION: S.E. Stornes

LATITUDE: 76^0 07' E
LONGITUDE: 69^0 26' S

ALTITUDE (m): 95

LAKE AREA (ha): 7.0
CATCHMENT AREA (ha): 10.4

MAXIMUM DEPTH (m): 5.7

DIMENSIONS (m): 195 x 50

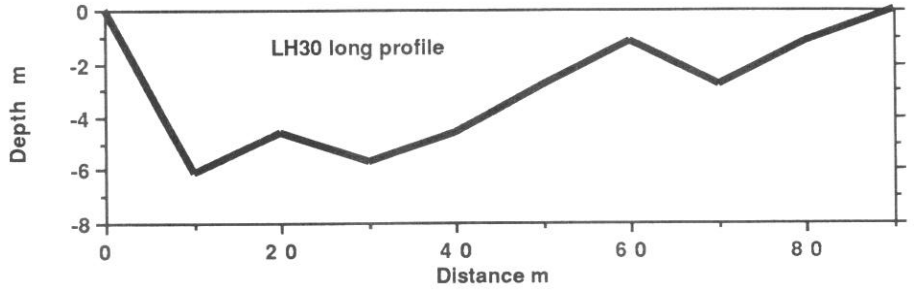
DISTANCE FROM POLAR PLATEAU (m): 2532

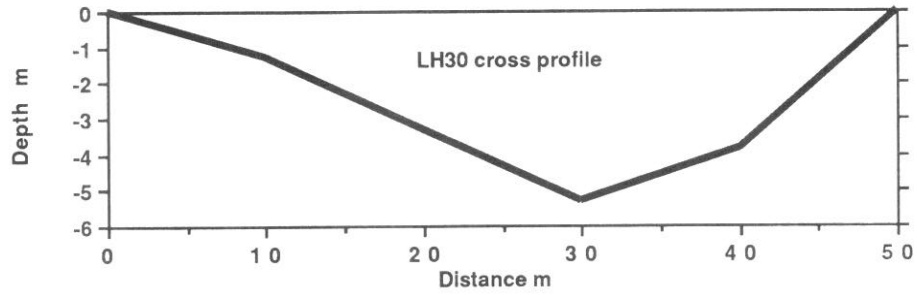
DESCRIPTION: Rock and gravel catchment.

GEOLOGY: Grey Gneiss, Layered Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 3.2^0 C **pH:** 6.48

CONDUCTIVITY: 140 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.3	3.5	19.7	0.7

MAJOR ANIONS:	Cl	
(ppm)	46.5	

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.58$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH31

LAKE NAME: Forefinger Lake

LOCATION: S.E. Stornes

LATITUDE: 76^0 08' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 80

LAKE AREA (ha): 5.0
CATCHMENT AREA (ha): 17.9

MAXIMUM DEPTH (m): 6-7

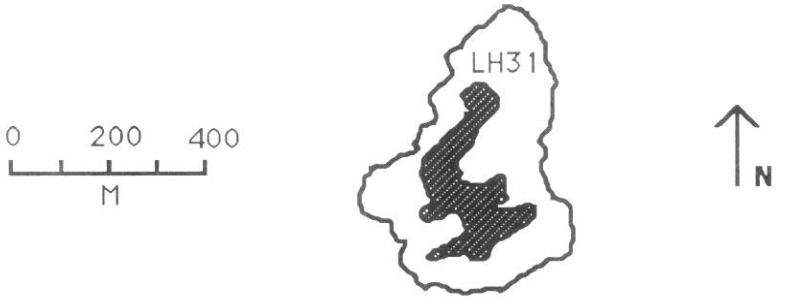
DIMENSIONS (m): 300 x 60

DISTANCE FROM POLAR PLATEAU (m): 2593

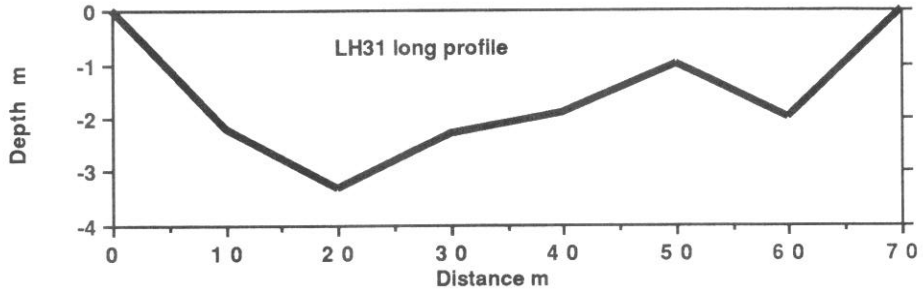
DESCRIPTION: Rock and gravel catchment; extensive complex lake with many shallow arms.

GEOLOGY: Grey Gneiss, Opx Gneiss

LAKE AND CATCHMENT:



PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 1.1^0 C **pH:** 6.72

CONDUCTIVITY: 113 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.0	3.1	15.7	0.6

MAJOR ANIONS:	Cl
(ppm)	38.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.34$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.00 SAND % = 99.99 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.38 Phi medium sand
Sorting = 0.89 moderately sorted
Skewness = 0.02 near symmetrical
Kurtosis = 1.03 mesokurtic

LAKE NUMBER: LH32

LAKE NAME: None

LOCATION: E. Stornes

LATITUDE: 76^0 07' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 75

LAKE AREA (ha): 3.0
CATCHMENT AREA (ha): 15.1

MAXIMUM DEPTH (m): 2.2

DIMENSIONS (m): 240 x 60

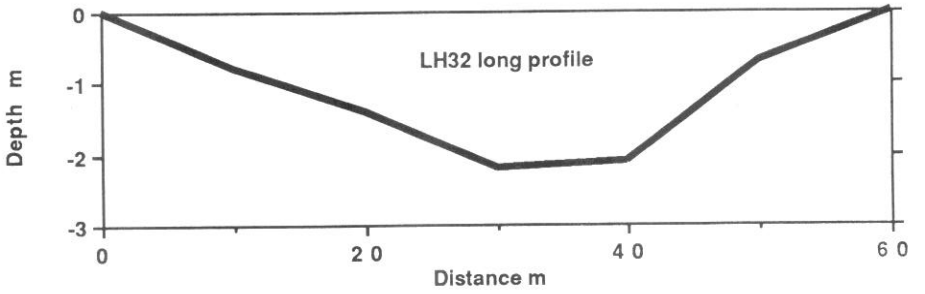
DISTANCE FROM POLAR PLATEAU (m): 3965

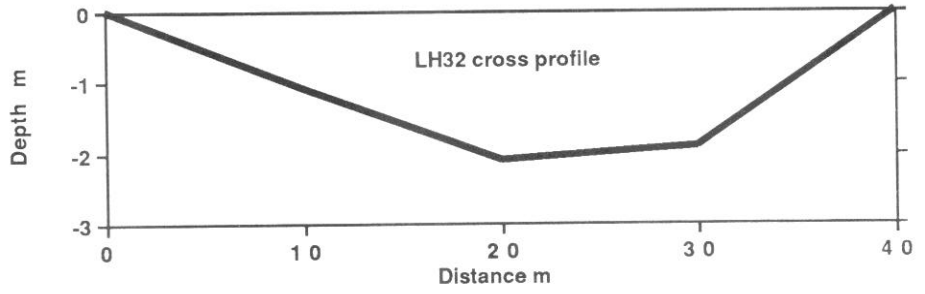
DESCRIPTION: Gravel and rock catchment; bilobed lake.

GEOLOGY: Opx Gneiss, Layered Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 7.9^0 C **pH:** 6.61

CONDUCTIVITY: 145 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.9	3.5	21.1	0.8

MAJOR ANIONS:	Cl
(ppm)	43.5

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.06$ $\frac{Ca}{Na+K+Mg} = 0.04$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH33

LAKE NAME: None

LOCATION: Kolloy Island

LATITUDE: 76^0 08' E
LONGITUDE: 69^0 22' S

ALTITUDE (m): 30

LAKE AREA (ha): 4.0
CATCHMENT AREA (ha): 18.4

MAXIMUM DEPTH (m): 3.0

DIMENSIONS (m): 195 x 60

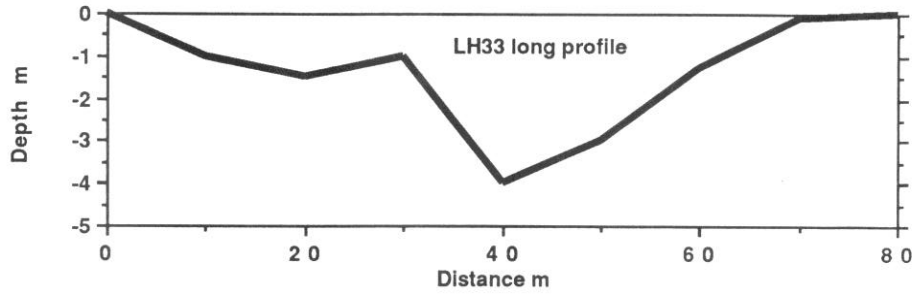
DISTANCE FROM POLAR PLATEAU (m): 7671

DESCRIPTION: Gravel catchment; north end of island.

GEOLOGY: Opx Gneiss

LAKE AND CATCHMENT:

PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 3.7^0 C **pH:** 6.57

CONDUCTIVITY: 197 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.5	3.0	14.7	0.5

MAJOR ANIONS:	Cl
(ppm)	59.3

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.67$ $\frac{Ca}{Na+K+Mg} = 0.03$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH34

LAKE NAME: Kirisjes Pond

LOCATION: Kolloy Island

LATITUDE: 76^0 09' E
LONGITUDE: 69^0 22' S

ALTITUDE (m): 5

LAKE AREA (ha): 12.0
CATCHMENT AREA (ha): 16.5

MAXIMUM DEPTH (m): 9.0

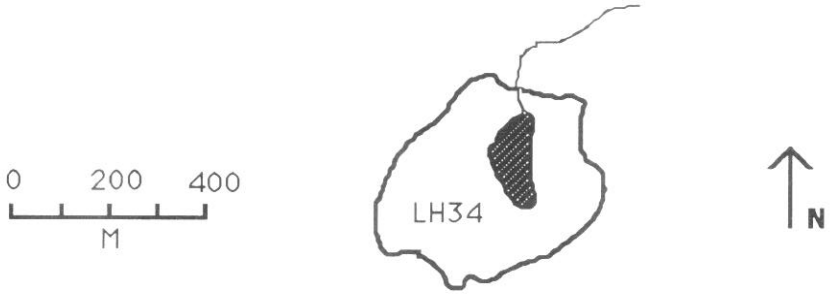
DIMENSIONS (m): 210 x 90

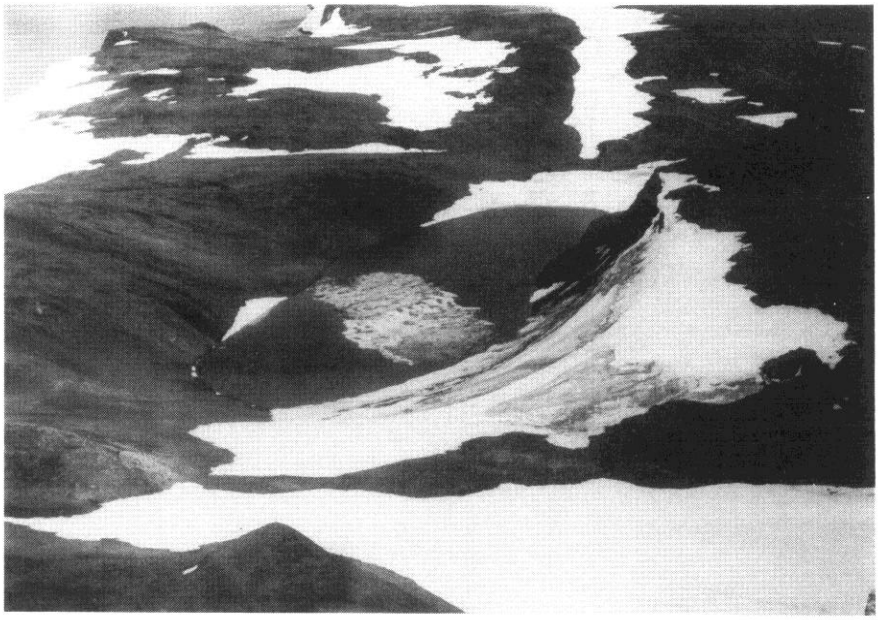
DISTANCE FROM POLAR PLATEAU (m): 6756

DESCRIPTION: Gravel catchment with cliff on E side and outflow stream to coast; deep sediment accumulation.

GEOLOGY: Opx Gneiss

LAKE AND CATCHMENT:





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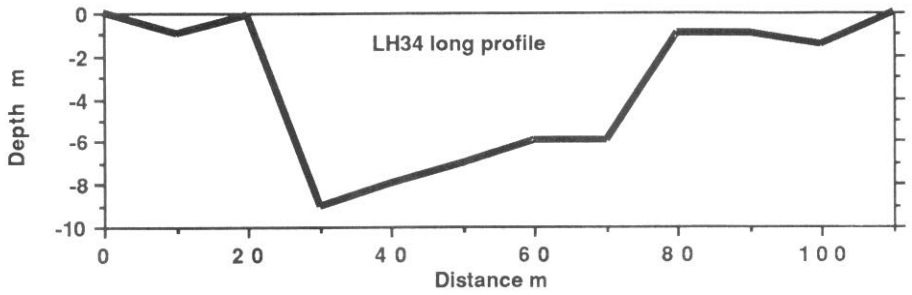
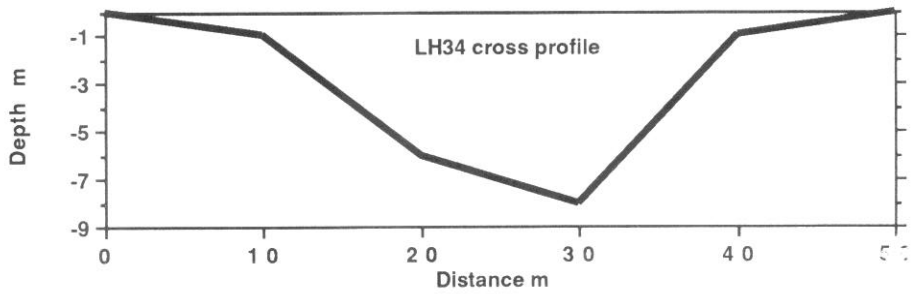




WATER CHEMISTRY:

TEMPERATURE: 2.6^0 C **pH:** 6.74

CONDUCTIVITY: 261 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 0.5	Mg 3.0	Na 13.1	K 0.5

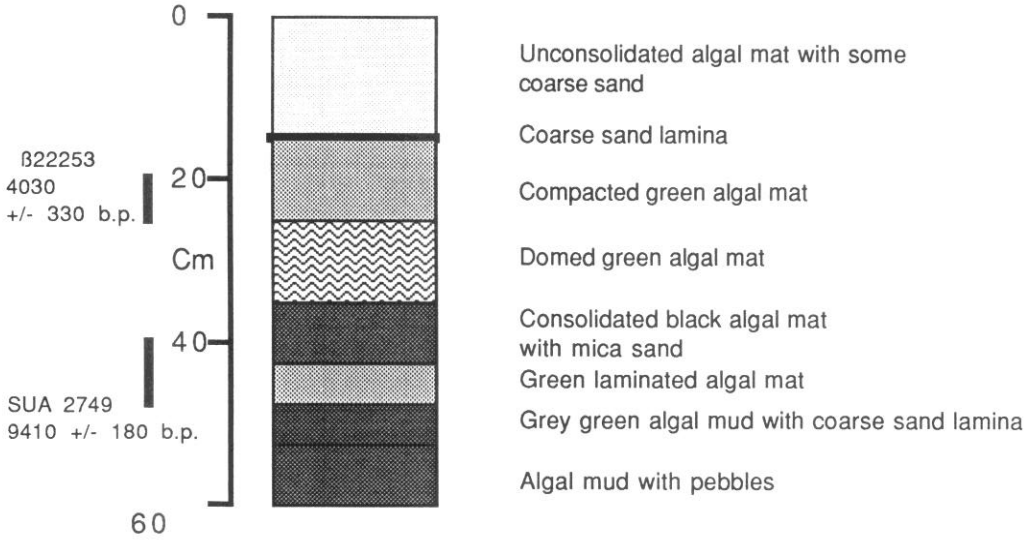
MAJOR ANIONS: (ppm)	Cl 75.7

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.27$ $\frac{Ca}{Na+K+Mg} = 0.03$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.17 SAND % = 99.82 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.52 Phi coarse sand
Sorting = 0.80 moderately sorted
Skewness = 0.39 strongly fine skewed
Kurtosis = 1.29 leptokurtic

SEDIMENT STRATIGRAPHY:



RADIOCARBON AGES:

SUA No.	Sample Code	Depth cm	14C Age y.b.p.	Delta 13C $^{0}/_{00}$
2749	L344	41-46	9410 +/- 180	-15.2

Beta No.	Sample Code	Depth cm	14C Age y.b.p.	Delta 13C $^{0}/_{00}$
22253	L344	20-25	4030 +/- 330	-19.6

LAKE NUMBER: LH35 **LAKE NAME:** Crater Lake

LOCATION: Eliza Kate Island **LATITUDE:** 76^0 11' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 30 **LAKE AREA (ha):** 3.2
CATCHMENT AREA (ha): 9.3

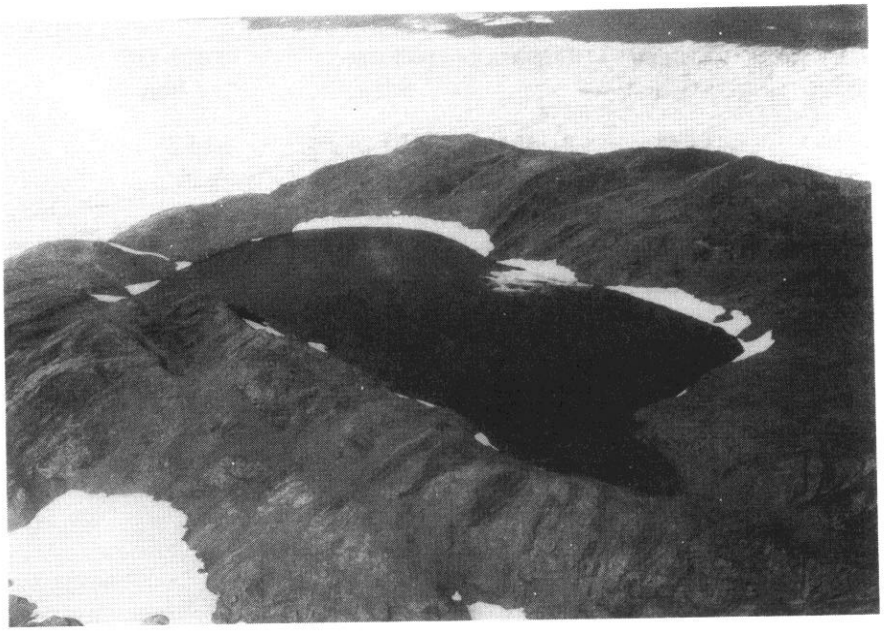
MAXIMUM DEPTH (m): 12.0 **DIMENSIONS (m):** 285 x 90

DISTANCE FROM POLAR PLATEAU (m): 4880

DESCRIPTION: Rock catchment; good coring prospect.

GEOLOGY: Um, Opx Gneiss

LAKE AND CATCHMENT:



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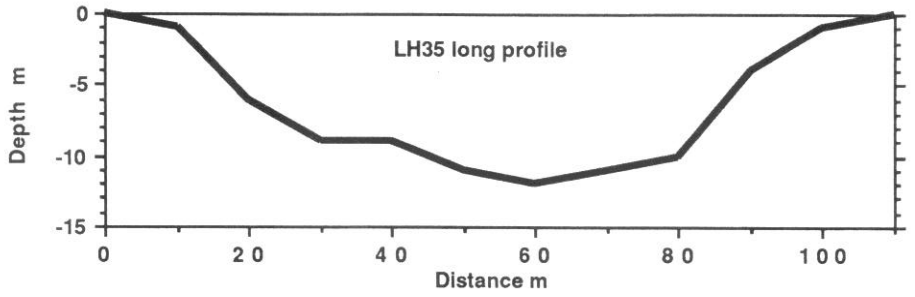
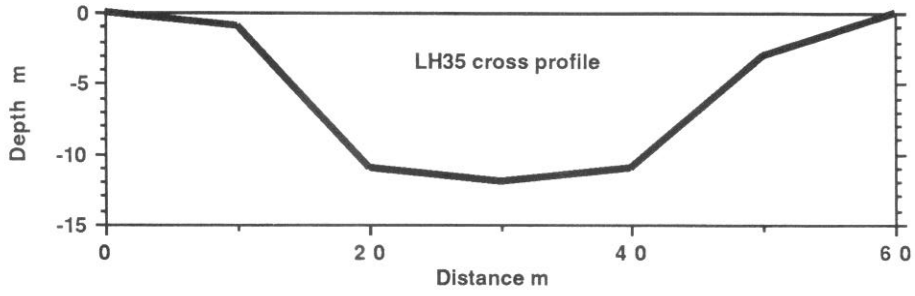




WATER CHEMISTRY:

TEMPERATURE: 4.8^0 C **pH:** 7.49

CONDUCTIVITY: 2340 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 30.1	Mg 46.5	Na 363.0	K 13.3
MAJOR ANIONS: (ppm)	Cl 704.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.04$ $\frac{Ca}{Na+K+Mg} = 0.07$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH36

LAKE NAME: None

LOCATION: Groness

LATITUDE: 76^{0} 13' E
LONGITUDE: 69^{0} 25' S

ALTITUDE (m): 60

LAKE AREA (ha): 5.5
CATCHMENT AREA (ha): 17.6

MAXIMUM DEPTH (m): 15.0

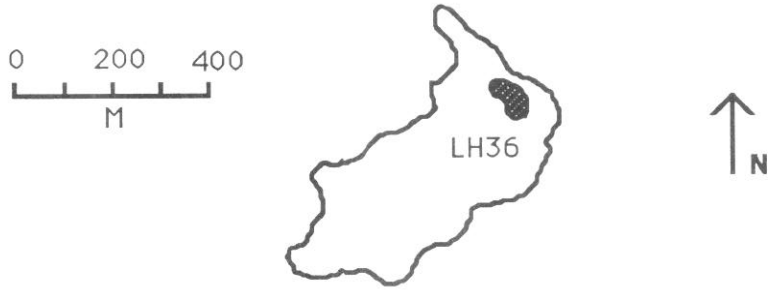
DIMENSIONS (m): 120 x 60

DISTANCE FROM POLAR PLATEAU (m): 534

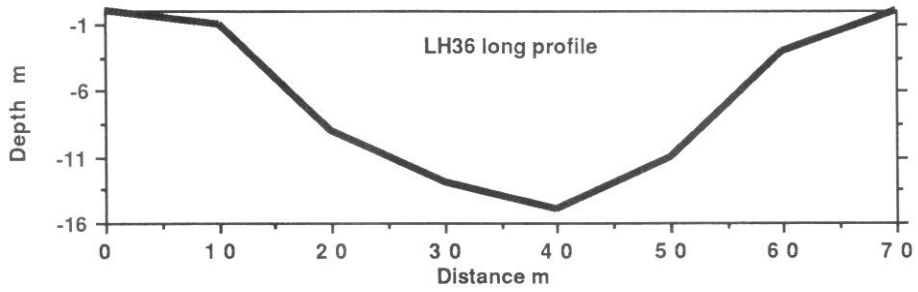
DESCRIPTION: Gravel catchment; salty.

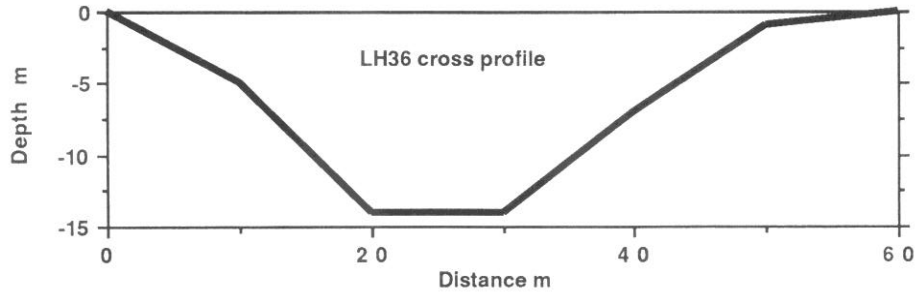
GEOLOGY: Opx Gneiss

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 1.1^0 C **pH:** 7.75

CONDUCTIVITY: 1962 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 29.3	Mg 21.1	Na 157.6	K 6.2
MAJOR ANIONS: (ppm)	Cl 534.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.78$ $\frac{Ca}{Na+K+Mg} = 0.16$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH37

LAKE NAME: Murkwater

LOCATION: Grovness

LATITUDE: 76^0 13' E
LONGITUDE: 69^0 25' S

ALTITUDE (m): 5.0

LAKE AREA (ha): 5.0
CATCHMENT AREA (ha): 19.7

MAXIMUM DEPTH (m): 1.1

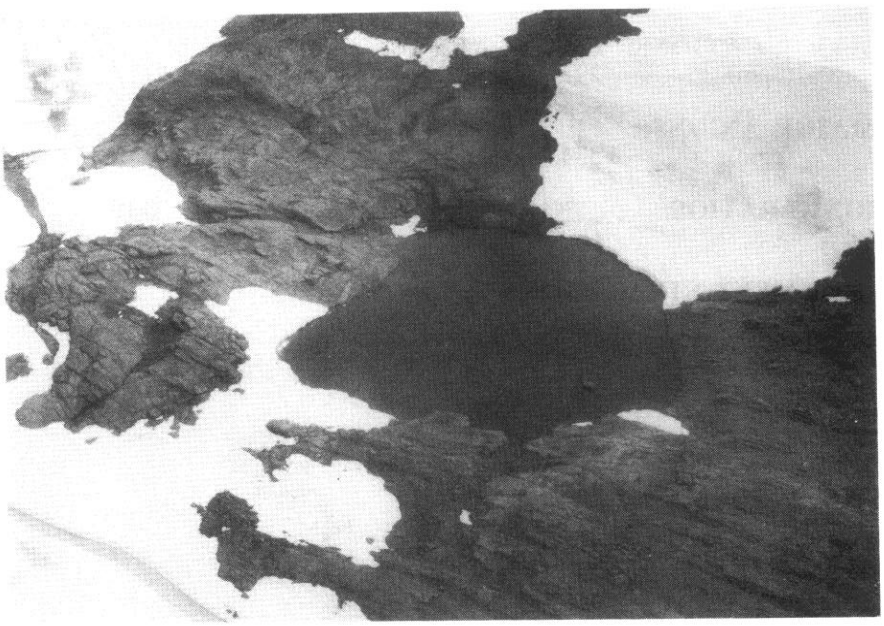
DIMENSIONS (m): 240 x 165

DISTANCE FROM POLAR PLATEAU (m): 1617

DESCRIPTION: Rock and gravel catchment; small discoloured lake; virtually continuously murky; katabatic may be stirring it up; fair sediment supply.

GEOLOGY: Opx Gneiss

LAKE AND CATCHMENT:



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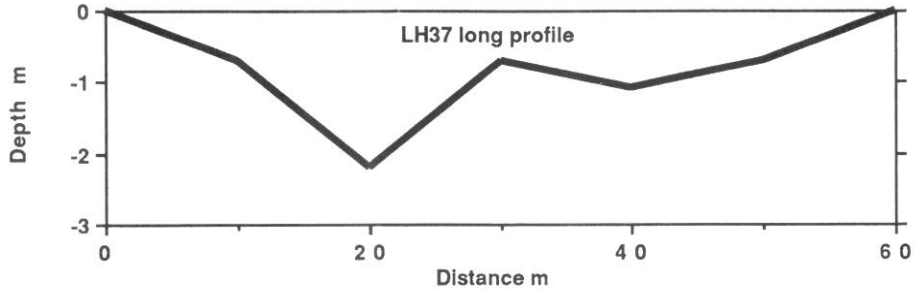
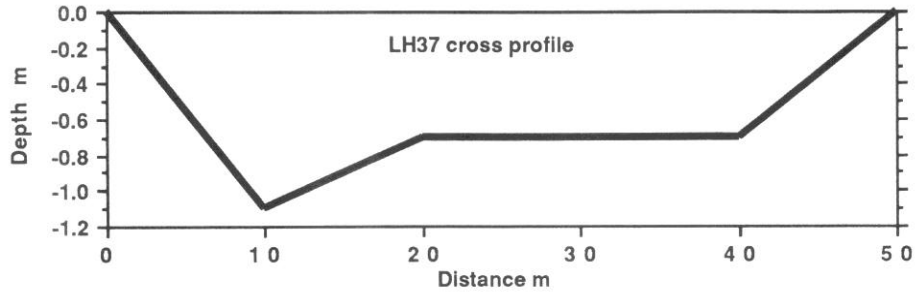




WATER CHEMISTRY:

TEMPERATURE: 5.1^{0} C **pH:** 7.32

CONDUCTIVITY: 296 µmho cm^{-1} **Eh:** 174 mv

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	11.3	5.5	34.7	1.4

MAJOR ANIONS:	Cl			
(ppm)	68.3			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 1.91$ $\frac{Ca}{Na+K+Mg} = 0.27$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH38

LAKE NAME: None

LOCATION: Near Breadloaf Is.

LATITUDE: 76^0 13' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 25

LAKE AREA (ha): 0.5
CATCHMENT AREA (ha): 2.2

MAXIMUM DEPTH (m): 1.5

DIMENSIONS (m): 90 x 45

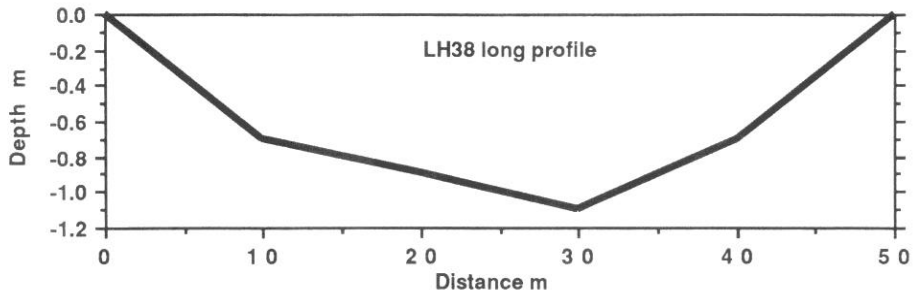
DISTANCE FROM POLAR PLATEAU (m): 3706

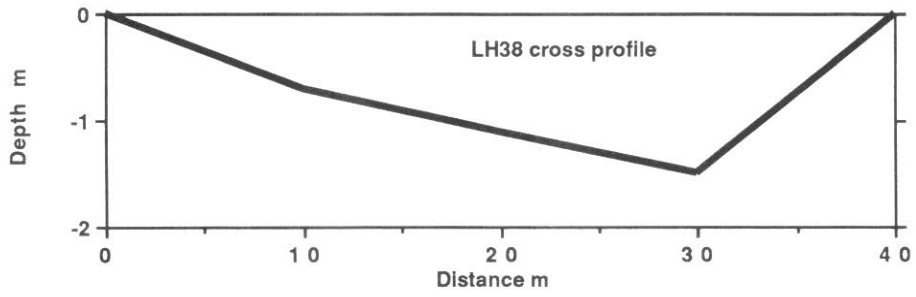
DESCRIPTION: Rock catchment.

GEOLOGY: Layered Gneiss, Blue Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 5.5^0 C **pH:** 7.38

CONDUCTIVITY: 1113 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	13.5	19.5	172.4	7.5
MAJOR ANIONS:	Cl			
(ppm)	414.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.26$ $\frac{Ca}{Na+K+Mg} = 0.07$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH39

LAKE NAME: None

LOCATION: Sigdoy Is.

LATITUDE: 76^0 15' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 40

LAKE AREA (ha): 0.5
CATCHMENT AREA (ha): 9.1

MAXIMUM DEPTH (m): 3.7

DIMENSIONS (m): 90 x 75

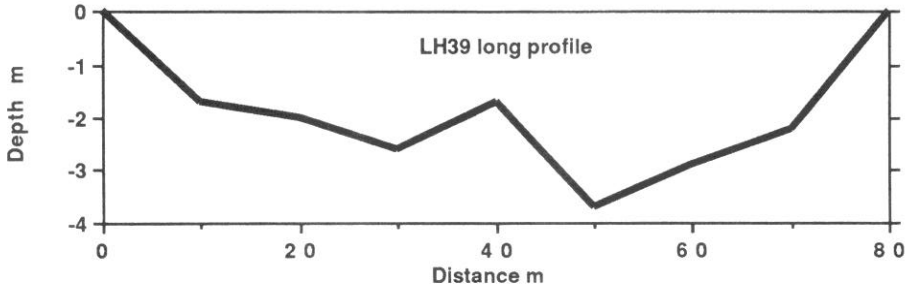
DISTANCE FROM POLAR PLATEAU (m): 2547

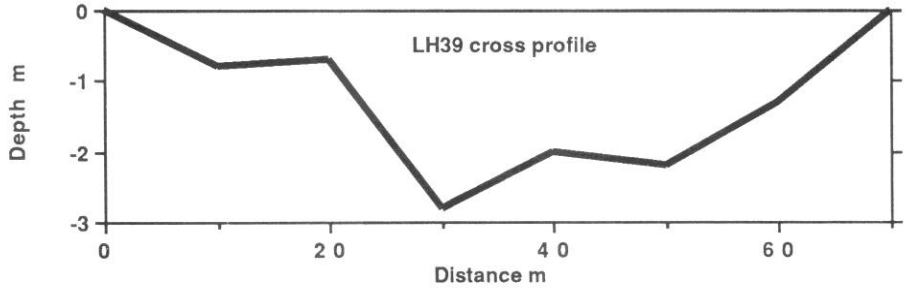
DESCRIPTION: Rock catchment; shallow rocky lake.

GEOLOGY: Grey Gneiss

LAKE CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 7.3^0 C **pH:** 7.91

CONDUCTIVITY: 1180 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	50.2	26	188.5	8.0

MAJOR ANIONS:	Cl			
(ppm)	448.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.24$ $\frac{Ca}{Na+K+Mg} = 0.23$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH40 **LAKE NAME:** None

LOCATION: Sigdoy Is. **LATITUDE:** 76^0 15' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 45 **LAKE AREA (ha):** 0.5
CATCHMENT AREA (ha): 5.0

MAXIMUM DEPTH (m): 3.6 **DIMENSIONS (m):** 135 x 75

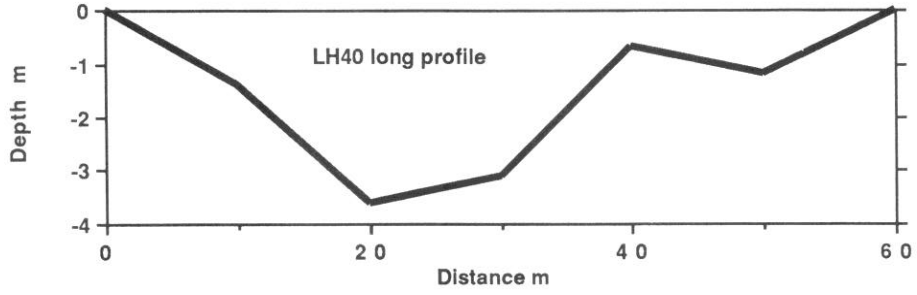
DISTANCE FROM POLAR PLATEAU (m): 2440

DESCRIPTION: Rock catchment; small rocky lake about 5m above LH39.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:

PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 3.1^0 C **pH:** 6.63

CONDUCTIVITY: 80 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.5	2.5	10.5	0.5

MAJOR ANIONS:	Cl
(ppm)	23.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.33$ $\frac{Ca}{Na+K+Mg} = 0.11$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.06 SAND % = 99.93 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.17 Phi medium sand
Sorting = 1.03 poorly sorted
Skewness = 0.04 near symmetrical
Kurtosis = 0.97 mesokurtic

LAKE NUMBER: LH41

LAKE NAME: None

LOCATION: Sigdoy Is.

LATITUDE: 76^0 14' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 25

LAKE AREA (ha): 0.5
CATCHMENT AREA (ha): 7.9

MAXIMUM DEPTH (m): 4.0

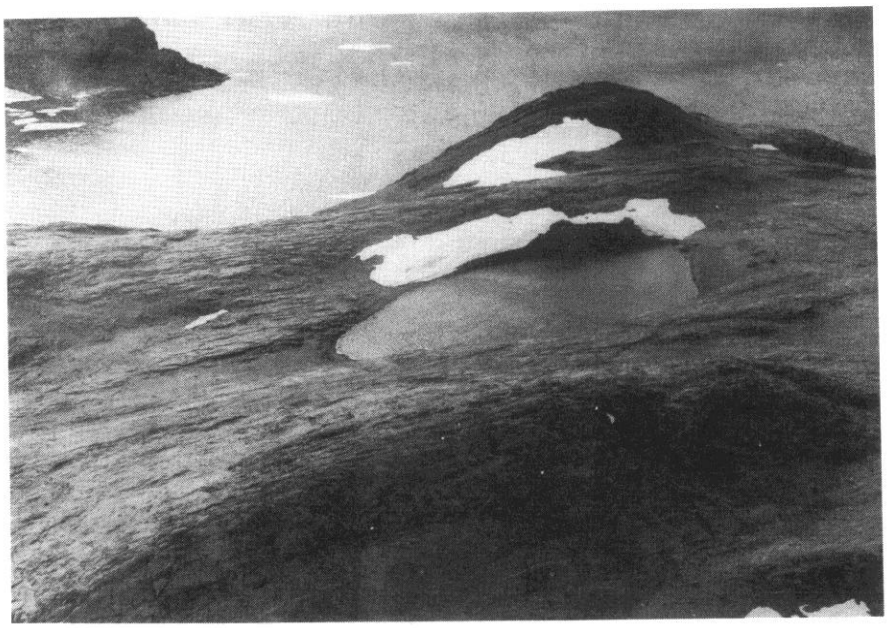
DIMENSIONS (m): 60 x 60

DISTANCE FROM POLAR PLATEAU (m): 3050

DESCRIPTION: Rock and ice catchment; 60% ice covered - probably over deepest part.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



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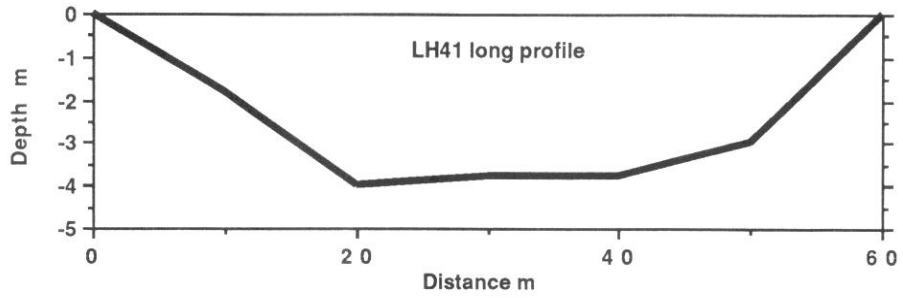


WATER CHEMISTRY:

TEMPERATURE: 1.7^0 C **pH:** 7.19

CONDUCTIVITY: 176 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	2.3	3.1	15.5	0.7

MAJOR ANIONS:	Cl
(ppm)	50.5

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.54$ $\frac{Ca}{Na+K+Mg} = 0.12$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH42 **LAKE NAME:** None

LOCATION: Sigdoy Is. **LATITUDE:** 76^0 15' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 25 **LAKE AREA (ha):** 4.0
CATCHMENT AREA (ha): 13.5

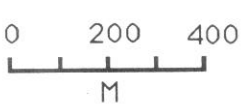
MAXIMUM DEPTH (m): 11.0 **DIMENSIONS (m):** 345 x 135

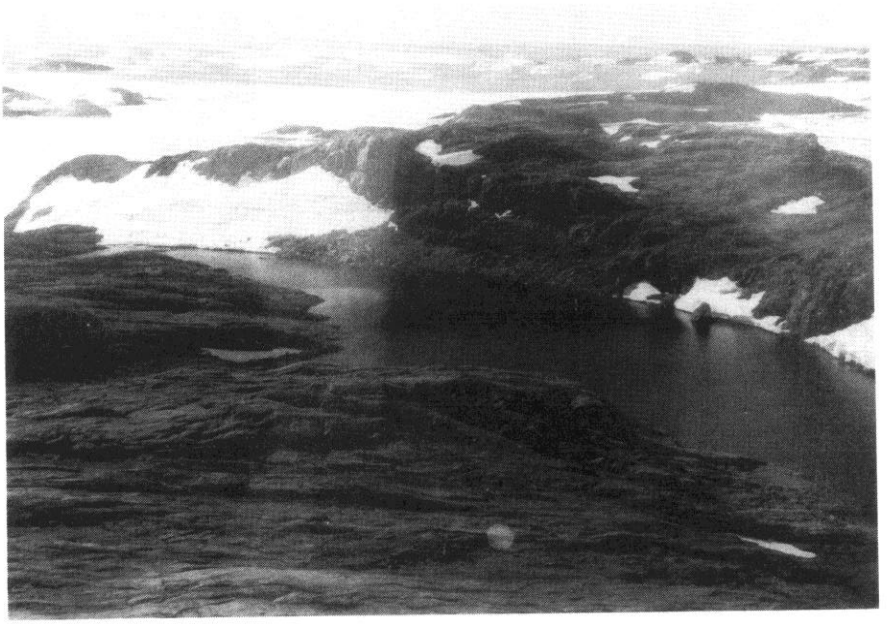
DISTANCE FROM POLAR PLATEAU (m): 2486

DESCRIPTION: Rock catchment (two types); large rocky lake; not much run off.

GEOLOGY: Um, Opx Gneiss

LAKE AND CATCHMENT:





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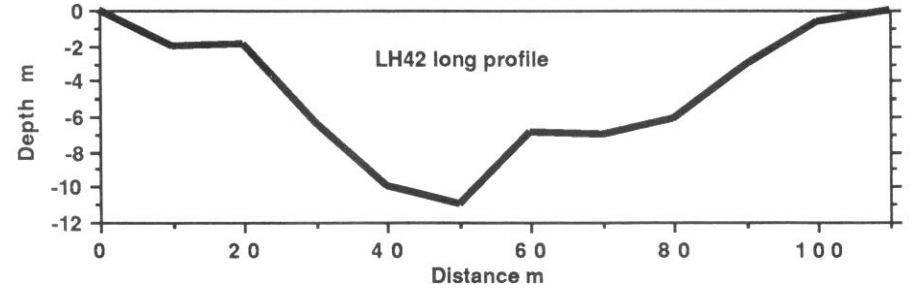
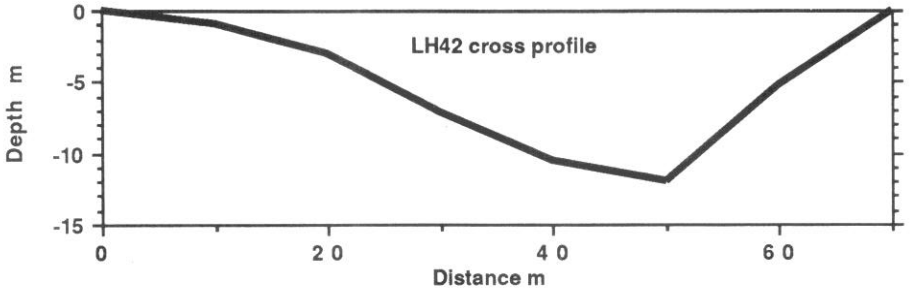




WATER CHEMISTRY:

TEMPERATURE: 5.4^0 C **pH:** 8.16

CONDUCTIVITY: 1920 μmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 57.9	Mg 42.7	Na 270.2	K 11.6
MAJOR ANIONS: (ppm)	Cl 498.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.41$ $\frac{Ca}{Na+K+Mg} = 0.18$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH43 **LAKE NAME:** None

LOCATION: Sigdoy Is. **LATITUDE:** 76^0 15' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 10 **LAKE AREA (ha):** 2.5
CATCHMENT AREA (ha): 9.9

MAXIMUM DEPTH (m): 6.5 **DIMENSIONS (m):** 135 x 60

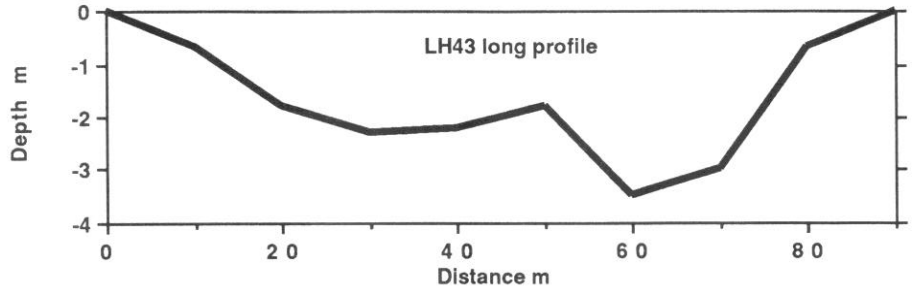
DISTANCE FROM POLAR PLATEAU (m): 2745

DESCRIPTION: Rock catchment; steep and rocky lake below LH42; several outflows possible during flood conditions.

GEOLOGY: Um, Opx Gneiss

LAKE AND CATCHMENT:

PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 6.5^0 C **pH:** 7.33

CONDUCTIVITY: 146 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	2.4	3.6	19.2	

MAJOR ANIONS:	Cl			
(ppm)	38.4			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.74$ $\frac{Ca}{Na+K+Mg} = 0.10$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH44 **LAKE NAME:** None

LOCATION: Sigdoy Is. **LATITUDE:** 76^0 17' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 45 **LAKE AREA (ha):** 3.0
CATCHMENT AREA (ha): 9.6

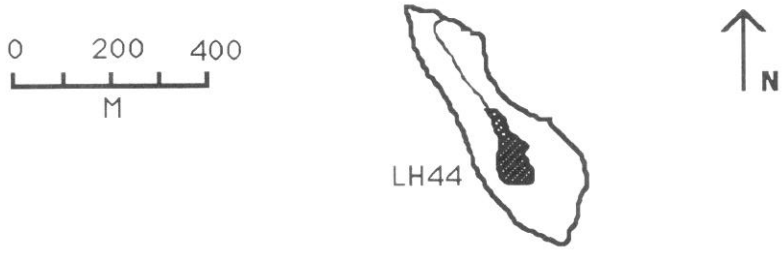
MAXIMUM DEPTH (m): 7.7 **DIMENSIONS (m):** 210 x 60

DISTANCE FROM POLAR PLATEAU (m): 1098

DESCRIPTION: Rock catchment; rocky lake; not much sediment source.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



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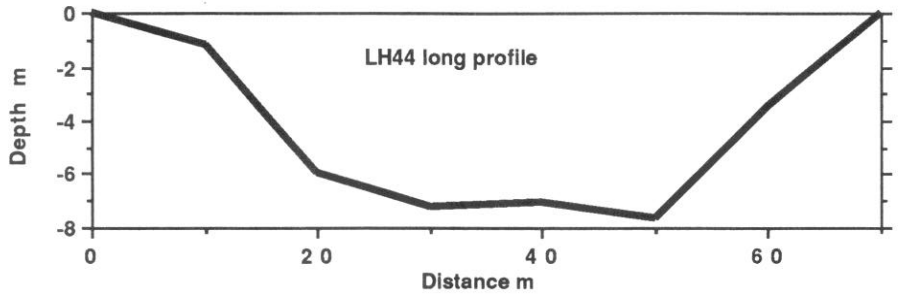
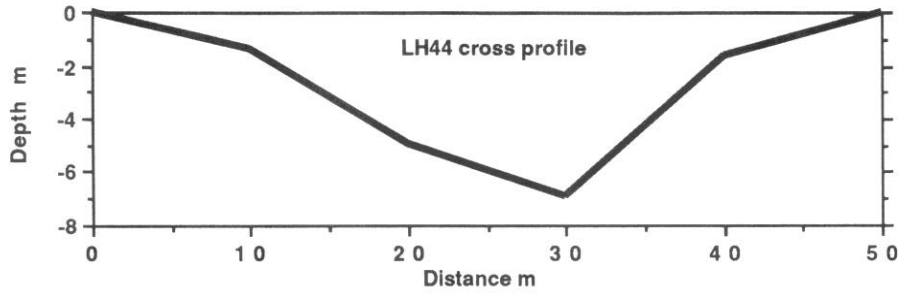




WATER CHEMISTRY:

TEMPERATURE: 6.5^0 C **pH:** 7.99

CONDUCTIVITY: 2820 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 73.4	Mg 48.4	Na 442.8	K 14.9
MAJOR ANIONS: (ppm)	Cl 826.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.24$ $\frac{Ca}{Na+K+Mg} = 0.15$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 1.45 SAND % = 98.54 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.35 Phi coarse sand
Sorting = 0.87 moderately sorted
Skewness = 0.37 strongly fine skewed
Kurtosis = 1.23 leptokurtic

LAKE NUMBER: LH45 **LAKE NAME:** None

LOCATION: Sigdoy Is. **LATITUDE:** 76^0 17' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 45 **LAKE AREA (ha):** 0.5
CATCHMENT AREA (ha): 0.9

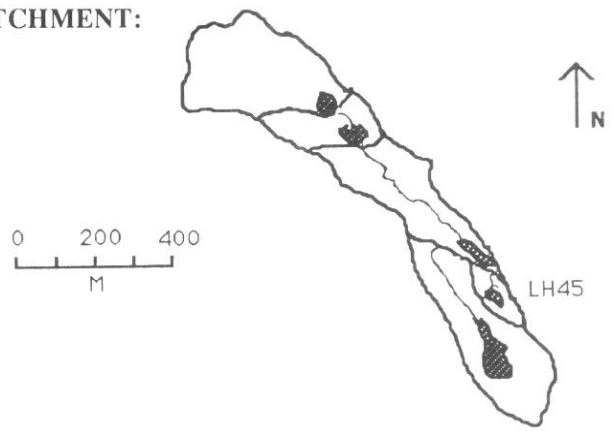
MAXIMUM DEPTH (m): 3.2 **DIMENSIONS (m):** 45 x25

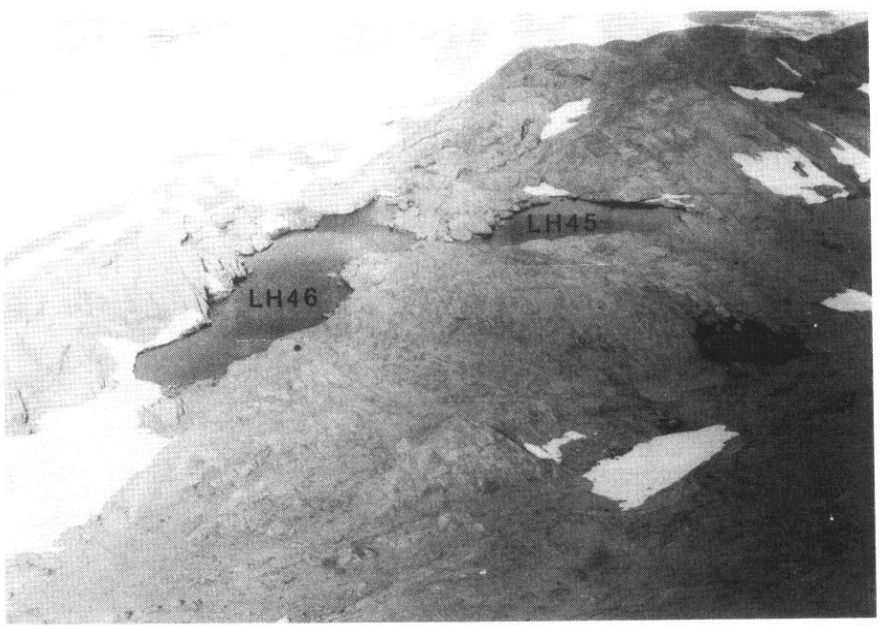
DISTANCE FROM POLAR PLATEAU (m): 1266

DESCRIPTION: Rock catchment; just joined to LH46.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:





WATER CHEMISTRY:

TEMPERATURE: 6.4^0 C **pH:** 7.51

CONDUCTIVITY: 705 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	18.0	14.9	123.4	4.2

MAJOR ANIONS:	Cl			
(ppm)	346.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.33$ $\frac{Ca}{Na+K+Mg} = 0.13$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH46

LAKE NAME: None

LOCATION: Sigdoy Is.

LATITUDE: 76^0 17' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 45

LAKE AREA (ha): 1.0
CATCHMENT AREA (ha): 30.5

MAXIMUM DEPTH (m): 1.3

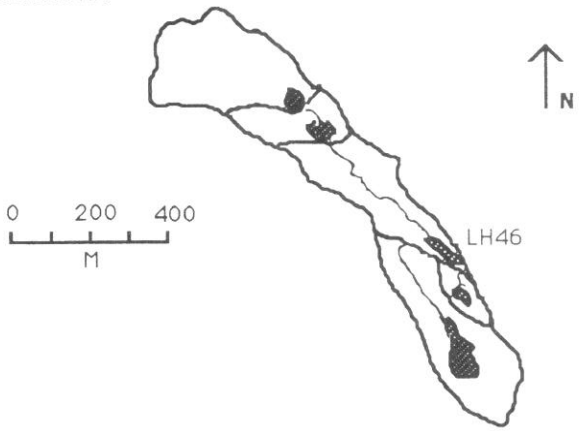
DIMENSIONS (m): 120 x 15

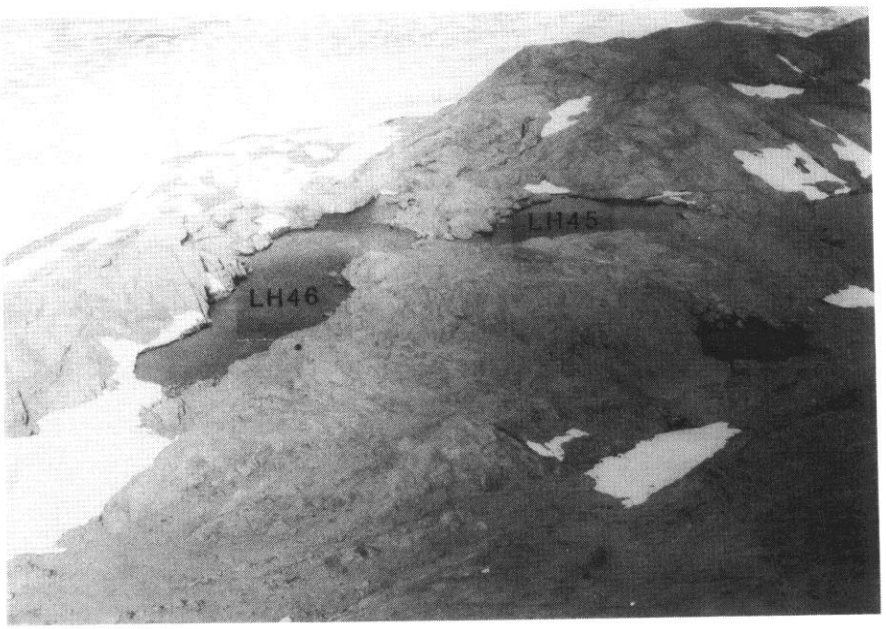
DISTANCE FROM POLAR PLATEAU (m): 1342

DESCRIPTION: Rock catchment; just joined to LH45.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:





WATER CHEMISTRY:

TEMPERATURE: 5.8^0 C **pH:** 7.59

CONDUCTIVITY: 579 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	10.9	10.9	84.3	3.1

MAJOR ANIONS:	Cl			
(ppm)	288.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.39$ $\frac{Ca}{Na+K+Mg} = 0.11$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.23 SAND % = 99.76 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.16 Phi medium sand
Sorting = 0.91 moderately sorted
Skewness = 0.02 near symmetrical
Kurtosis = 1.08 mesokurtic

LAKE NUMBER: LH47 **LAKE NAME:** None

LOCATION: Sigdoy Is. **LATITUDE:** 76^0 17' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 60 **LAKE AREA (ha):** 2.5
CATCHMENT AREA (ha): 12.6

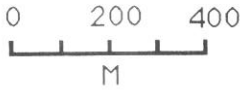
MAXIMUM DEPTH (m): 1.1 **DIMENSIONS (m):** 75 x 25

DISTANCE FROM POLAR PLATEAU (m): 1678

DESCRIPTION: Rock catchment; small high, shallow basin - not much catchment.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 6.7^0 C **pH:** 7.1

CONDUCTIVITY: 433 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	7.4	8.2	62.0	2.0

MAJOR ANIONS:	Cl
(ppm)	238.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.52$ $\frac{Ca}{Na+K+Mg} = 0.10$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH48

LAKE NAME: None

LOCATION: Sigdoy Is.

LATITUDE: 76^0 17' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 60

LAKE AREA (ha): 4.0
CATCHMENT AREA (ha): 9.6

MAXIMUM DEPTH (m): 2.1

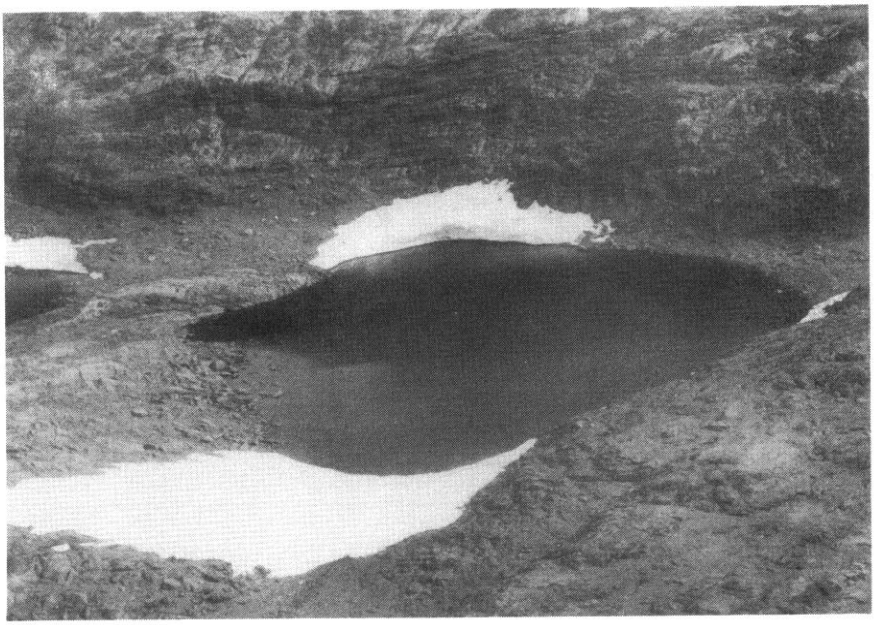
DIMENSIONS (m): 75 x 60

DISTANCE FROM POLAR PLATEAU (m): 1845

DESCRIPTION: Rock catchment; small high shallow basin - not much catchment.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 6.8^0 C **pH:** 7.58

CONDUCTIVITY: 1509 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	CaMg	Na	K	
(ppm)	34.6	28.9	225.3	7.4
MAJOR ANIONS:	Cl			
(ppm)	476.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.18$ $\frac{Ca}{Na+K+Mg} = 0.13$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH49 **LAKE NAME:** None

LOCATION: Brottnevet **LATITUDE:** 76^0 16' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 30 **LAKE AREA (ha):** 2.0
CATCHMENT AREA (ha): 24.3

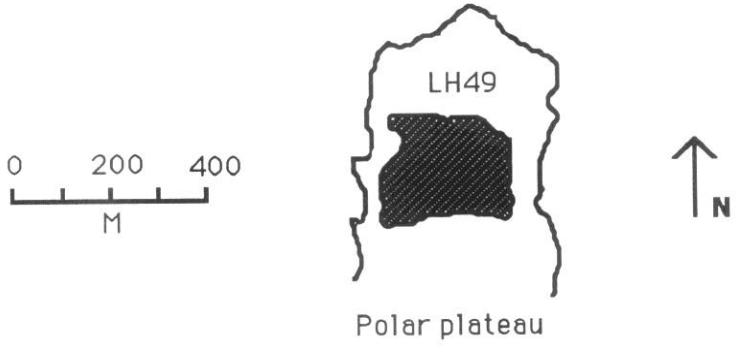
MAXIMUM DEPTH (m): 3.5 **DIMENSIONS (m):** 300 x 240

DISTANCE FROM POLAR PLATEAU (m): 0

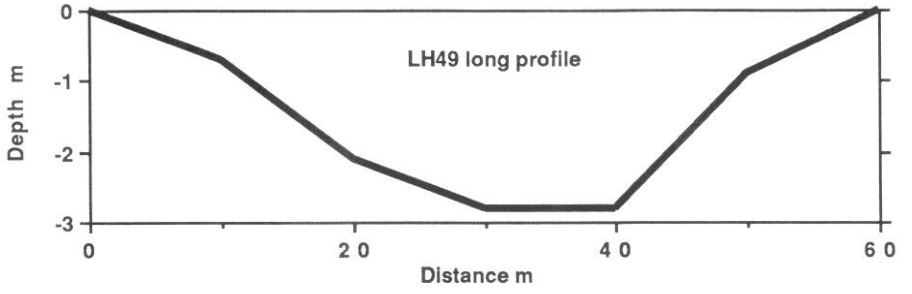
DESCRIPTION: Rock catchment; rocky shored lake; not much sediment source.

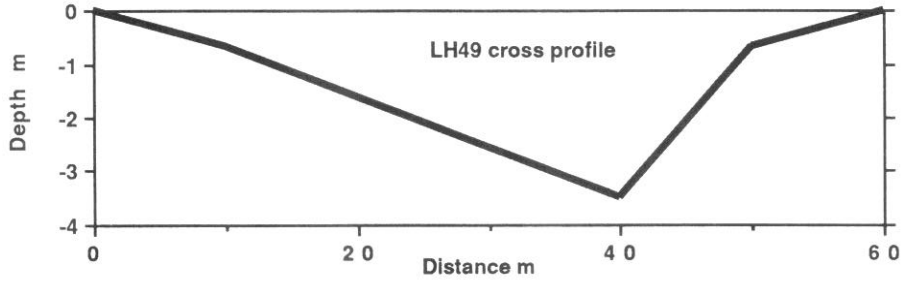
GEOLOGY: Um, Grey Gneiss

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 6.6^0 C **pH:** 6.63

CONDUCTIVITY: 893 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 26.6	Mg 23	Na 114.2	K 4.3
MAJOR ANIONS: (ppm)	Cl 340.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.12$ $\frac{Ca}{Na+K+Mg} = 0.19$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH50

LAKE NAME: None

LOCATION: S.W. Broknes

LATITUDE: 76^0 19' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 60

LAKE AREA (ha): 3.0
CATCHMENT AREA (ha): 13.0

MAXIMUM DEPTH (m): 1.6

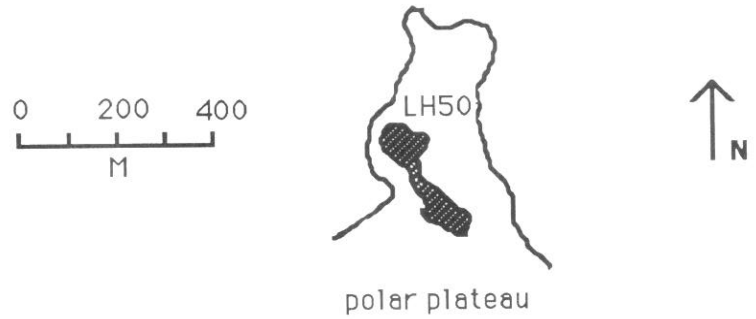
DIMENSIONS (m): 120 x 75

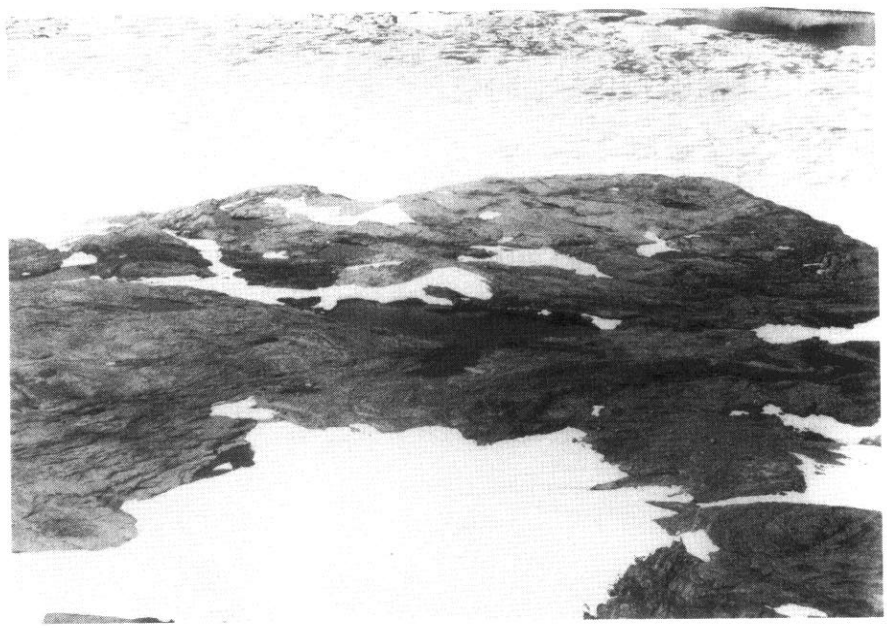
DISTANCE FROM POLAR PLATEAU (m): 0

DESCRIPTION: Gravel and ice catchment; small lake just below ice cap; appears to have much sediment.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:





WATER CHEMISTRY:

TEMPERATURE: 1.9^0 C **pH:** 6.47

CONDUCTIVITY: 33 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.0	1.5	4.3	0.3

MAJOR ANIONS:	Cl			
(ppm)	14.7			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.39$ $\frac{Ca}{Na+K+Mg} = 0.00$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.02 SAND % = 99.97 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.07 Phi medium sand
Sorting = 0.90 moderately sorted
Skewness = 0.20 fine skewed
Kurtosis = 1.12 leptokurtic

LAKE NUMBER: LH51 **LAKE NAME:** Mertz Lake

LOCATION: S. Broknes **LATITUDE:** 76^0 21' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 85 **LAKE AREA (ha):** 2.5
CATCHMENT AREA (ha): 17.3

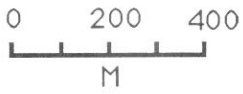
MAXIMUM DEPTH (m): 7.6 **DIMENSIONS (m):** 210 x 150

DISTANCE FROM POLAR PLATEAU (m): 610

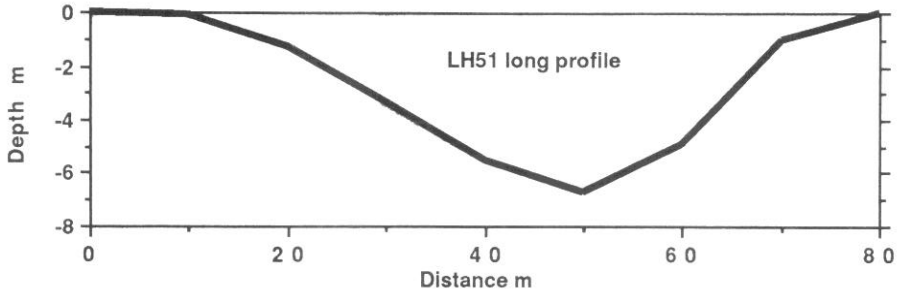
DESCRIPTION: Gravel catchment; high level basin with fair catchment; reasonable sediment.

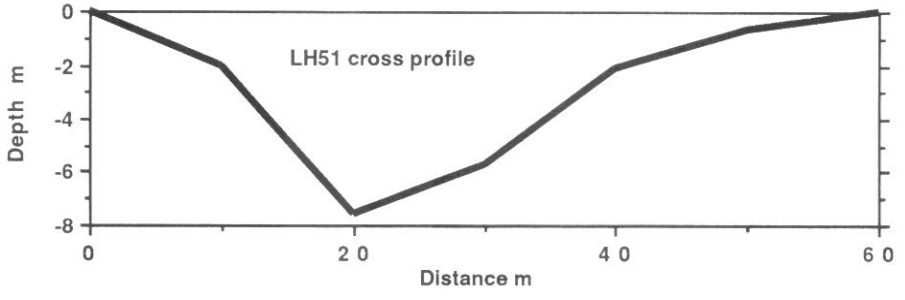
GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 7.2^0 C **pH:** 6.97

CONDUCTIVITY: 265 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	2.4	3.5	20.8	0.8

MAJOR ANIONS:	Cl			
(ppm)	80.5			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.85$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH52 **LAKE NAME:** None

LOCATION: Broknes **LATITUDE:** 76^0 21' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 80 **LAKE AREA (ha):** 1.0
CATCHMENT AREA (ha): 22.8

MAXIMUM DEPTH (m): 0.7 **DIMENSIONS (m):** 105 x 45

DISTANCE FROM POLAR PLATEAU (m): 1022

DESCRIPTION: Gravel catchment; too shallow to profile; fair sediment accumulation.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:

WATER CHEMISTRY:

TEMPERATURE: 8.0^0 C **pH:** 6.74

CONDUCTIVITY: 145 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.3	3.5	20.8	0.8

MAJOR ANIONS:	Cl			
(ppm)	41.9			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.71$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.20 SAND % = 99.79 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.90 Phi coarse sand
Sorting = 0.84 moderately sorted
Skewness = 0.01 near symmetrical
Kurtosis = 0.97 mesokurtic

LAKE NUMBER: LH53

LAKE NAME: Lovering Lake

LOCATION: Broknes

LATITUDE: 76^0 21' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 80

LAKE AREA (ha): 1.0
CATCHMENT AREA (ha): 16.3

MAXIMUM DEPTH (m): 2.6

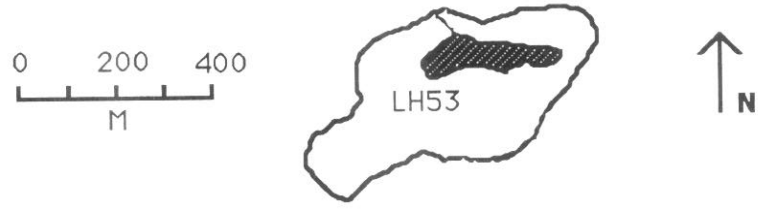
DIMENSIONS (m): 90 x 30

DISTANCE FROM POLAR PLATEAU (m): 1052

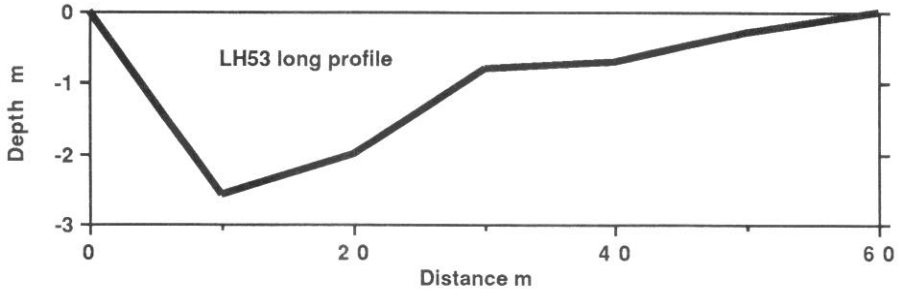
DESCRIPTION: Gravel catchment; partially ice covered; fair sediment fan in NW end.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:



PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 1.7^0 C **pH:** 6.28

CONDUCTIVITY: 56 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.4	2.7	15.0	0.7

MAJOR ANIONS:	Cl
(ppm)	20.4

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.95$ $\frac{Ca}{Na+K+Mg} = 0.02$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH54 **LAKE NAME:** None

LOCATION: Broknes **LATITUDE:** 76^0 25' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 90 **LAKE AREA (ha):** 0.5
CATCHMENT AREA (ha): 5.9

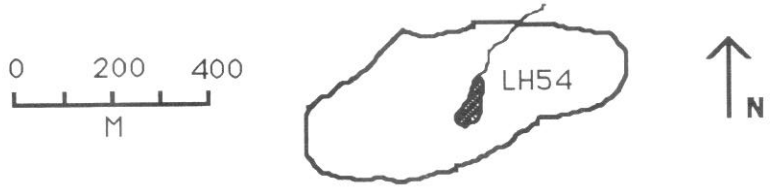
MAXIMUM DEPTH (m): 14.0 **DIMENSIONS (m):** 120 x 40

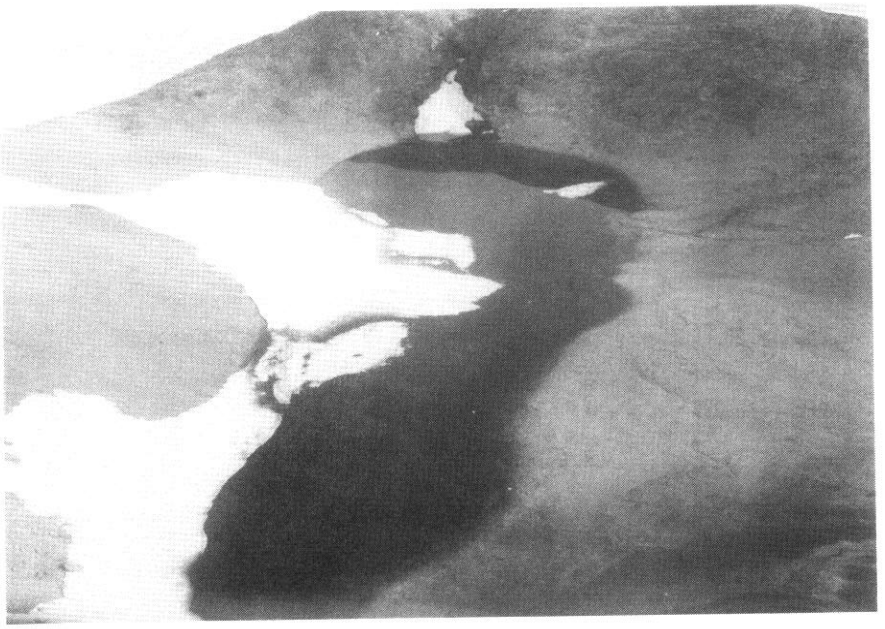
DISTANCE FROM POLAR PLATEAU (m): 153

DESCRIPTION: Ice and gravel catchment; high lake very near ice sheet; good sediment source; red algal mat.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:





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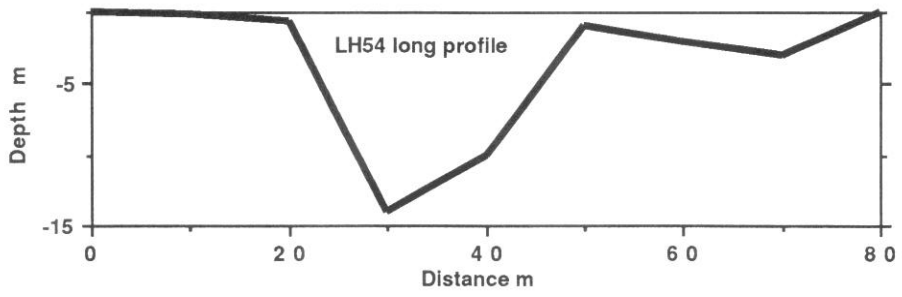


WATER CHEMISTRY:

TEMPERATURE: 3.1^0 C **pH:** 7.5

CONDUCTIVITY: 240 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	9.4	5.8	29.0	0.6

MAJOR ANIONS:	Cl
(ppm)	45.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 1.84$ $\frac{Ca}{Na+K+Mg} = 0.27$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.39 SAND % = 99.60 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.27 Phi coarse sand
Sorting = 0.71 moderately sorted
Skewness = 0.34 strongly fine skewed
Kurtosis = 1.17 leptokurtic

LAKE NUMBER: LH55

LAKE NAME: None

LOCATION: E. Broknes

LATITUDE: 76^0 25' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 55

LAKE AREA (ha): 2.0
CATCHMENT AREA (ha): 19.0

MAXIMUM DEPTH (m): 4.2

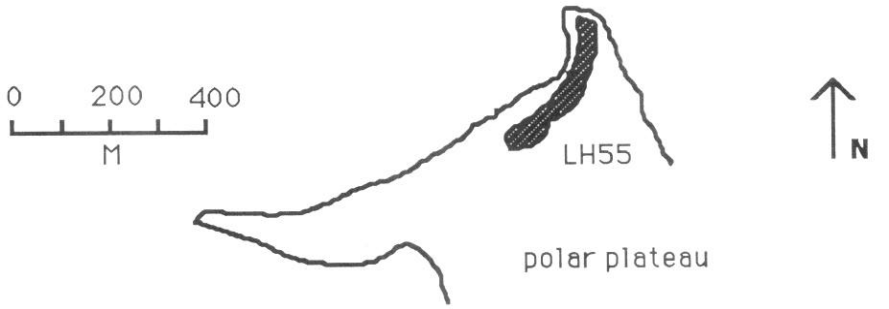
DIMENSIONS (m): 110 x 40

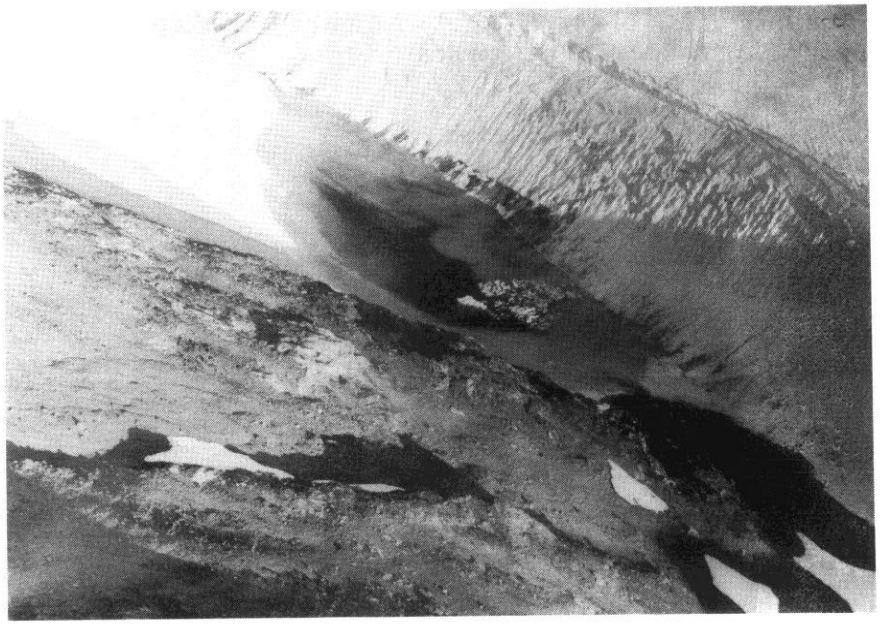
DISTANCE FROM POLAR PLATEAU (m): 0

DESCRIPTION: Rock and ice catchment; lake abuts ice sheet on one side, rock on other; part of long lead running alongthe ice/rock contact.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:





WATER CHEMISTRY:

TEMPERATURE: 1.1^0 C **pH:** 6.33

CONDUCTIVITY: 64 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.5	2.2	11.3	0.5

MAJOR ANIONS:	CL			
(ppm)	23.3			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.53$ $\frac{Na}{Na+K+Mg} = 0.04$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH56

LAKE NAME: None

LOCATION: E. Broknes

LATITUDE: 76^0 24' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 115

LAKE AREA (ha): 2.0
CATCHMENT AREA (ha): 14.2

MAXIMUM DEPTH (m): 1.4

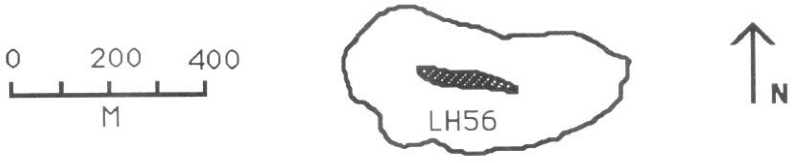
DIMENSIONS (m): 210 x 30

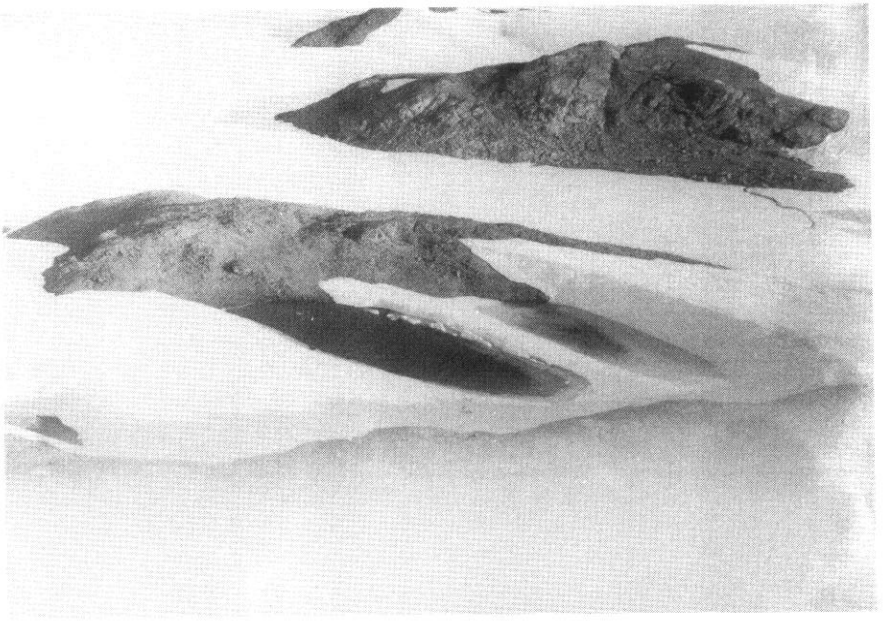
DISTANCE FROM POLAR PLATEAU (m): 656

DESCRIPTION: Ice and gravel catchment; two small lakes parallel and very high up; seems to be much sediment and relatively algal free.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:





WATER CHEMISTRY:

TEMPERATURE: 1.2^0 C **pH:** 6.07

CONDUCTIVITY: 37 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.0	1.5	4.5	0.3

MAJOR ANIONS:	Cl	
(ppm)	16.4	

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 2.50$ $\frac{Ca}{Na+K+Mg} = 0.00$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 3.13 SAND % = 96.86 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.14 Phi coarse sand
Sorting = 0.64 moderately well sorted
Skewness = 0.18 fine skewed
Kurtosis = 1.18 leptokurtic

LAKE NUMBER: LH57

LAKE NAME: Progress Lake

LOCATION: Broknes Peninsula

LATITUDE: 76^0 24' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 65

LAKE AREA (ha): 10.5
CATCHMENT AREA (ha): 39.1

MAXIMUM DEPTH (m): 34

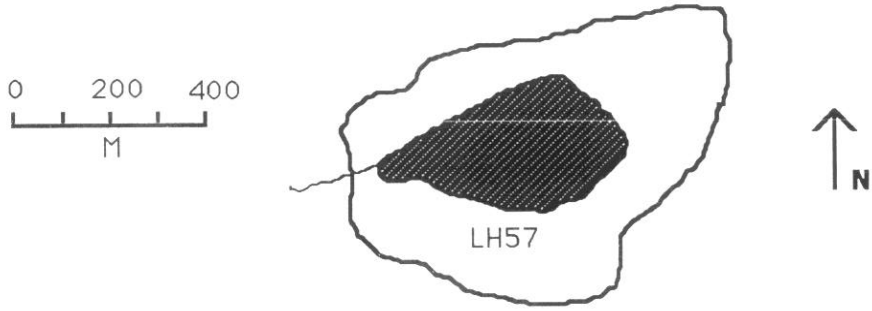
DIMENSIONS (m): 600 x 300

DISTANCE FROM POLAR PLATEAU (m): 885

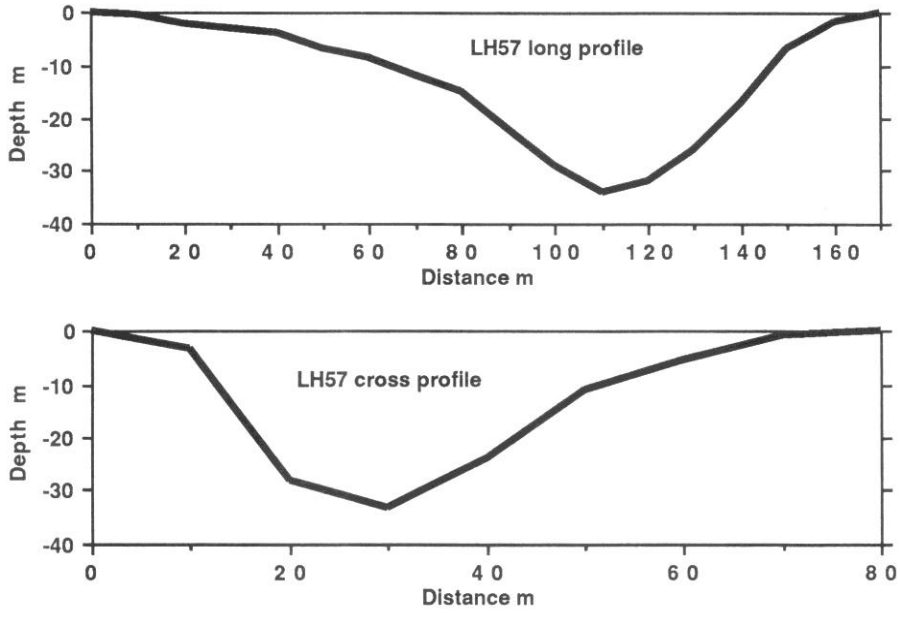
DESCRIPTION: Rock and gravel catchment.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:



PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 4.9^0 C **pH:** 6.68

CONDUCTIVITY: 321 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	3.8	6.8	64.4	1.8

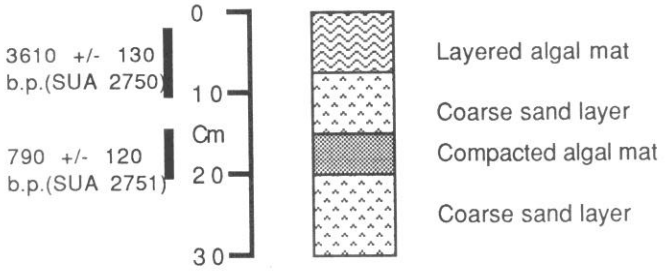
MAJOR ANIONS:	Cl			
(ppm)	103.3			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 5.19$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.13 SAND % = 99.86 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.40 Phi medium sand
Sorting = 0.80 moderately sorted
Skewness = -0.03 near symmetrical
Kurtosis = 1.12 leptokurtic

SEDIMENT STRATIGRAPHY:



RADIOCARBON AGES:

SUA No.	Sample Code	Depth cm	14C Age y.b.p.	Delta 13C $^{0}/_{00}$
2750	L572	2-10	3610 +/- 130	-13.4
2751	L575	13-18	790 +/- 120	-9.0

LAKE NUMBER: LH58 **LAKE NAME:** Lake Mir

LOCATION: Broknes Peninsula **LATITUDE:** 76^0 24' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 60 **LAKE AREA (ha):** 12.5
CATCHMENT AREA (ha): 82.0

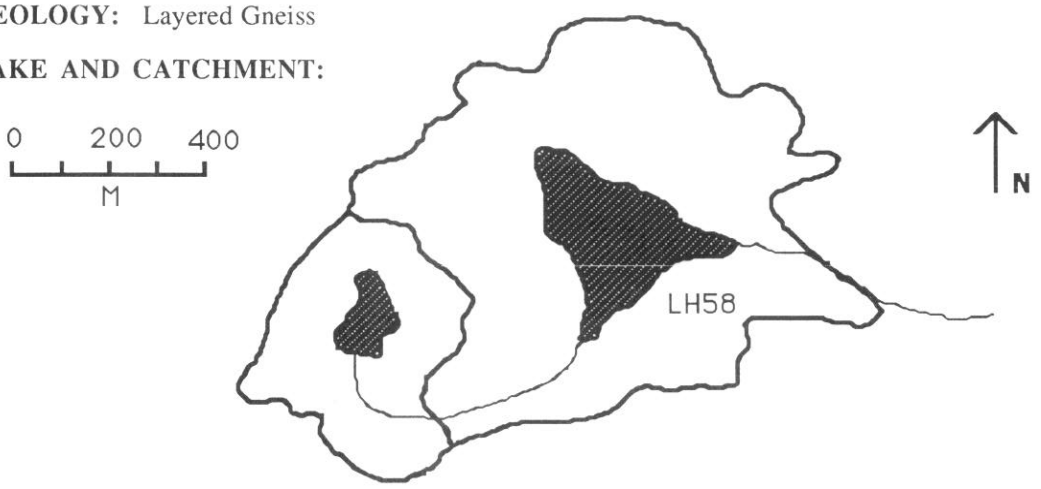
MAXIMUM DEPTH (m): 0.7 **DIMENSIONS (m):** 375 x 165

DISTANCE FROM POLAR PLATEAU (m): 1113

DESCRIPTION: Gravel and ice catchment; much sediment; very little algae; opposite Camp Progress.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 0.8^0 C **pH:** 6.4

CONDUCTIVITY: 130 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.5	2.9	18.3	0.8

MAJOR ANIONS:	Cl			
(ppm)	37.3			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.36$ $\frac{Ca}{Na+K+Mg} = 0.02$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.29 SAND % = 99.70 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.97 Phi coarse sand
Sorting = 0.75 moderately sorted
Skewness = 0.07 near symmetrical
Kurtosis = 1.21 leptokurtic

LAKE NUMBER: LH59

LAKE NAME: Moore Lake

LOCATION: Broknes Peninsula

LATITUDE: 76^0 21' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 20

LAKE AREA (ha): 1.5
CATCHMENT AREA (ha): 48.8

MAXIMUM DEPTH (m): 3.8

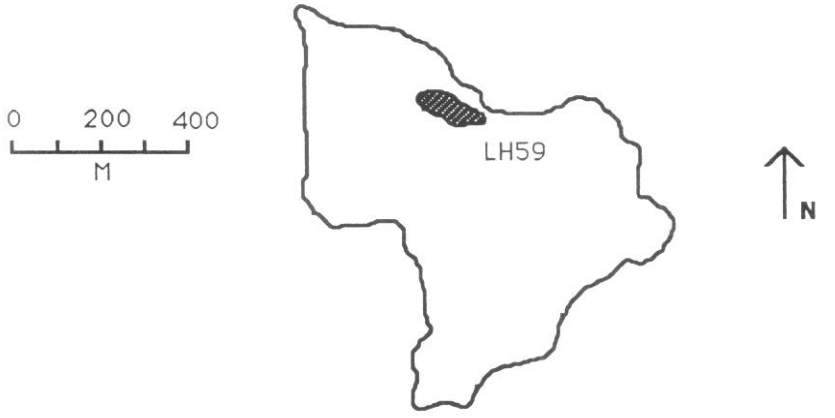
DIMENSIONS (m): 150 x 55

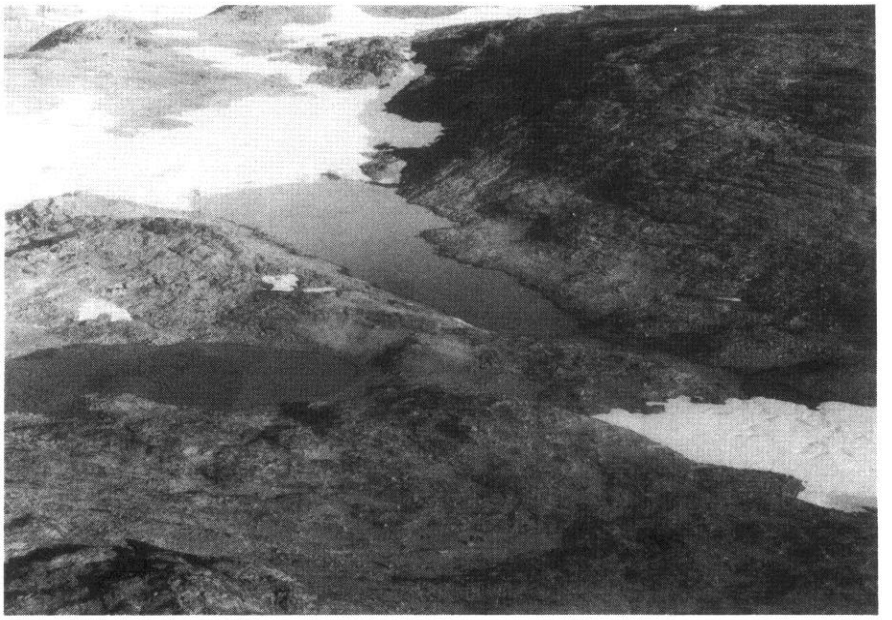
DISTANCE FROM POLAR PLATEAU (m): 1845

DESCRIPTION: Rock and ice catchment.

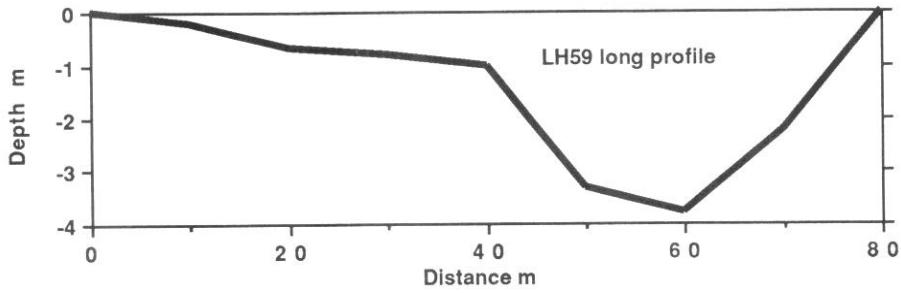
GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:





PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 5.6^0 C **pH:** 6.4

CONDUCTIVITY: -- **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	--	--	--	--

IONIC RATIOS: $\frac{Na}{Ca+Mg+K}$ = -- $\frac{Ca}{Na+K+Mg}$ = --

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.19 SAND % = 99.80 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.07 Phi medium sand
Sorting = 0.85 moderately sorted
Skewness = 0.19 fine skewed
Kurtosis = 1.04 mesokurtic

LAKE NUMBER: LH60 **LAKE NAME:** None

LOCATION: W. Broknes **LATITUDE:** 76^0 20' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 45 **LAKE AREA (ha):** 1.5
CATCHMENT AREA (ha): 23.9

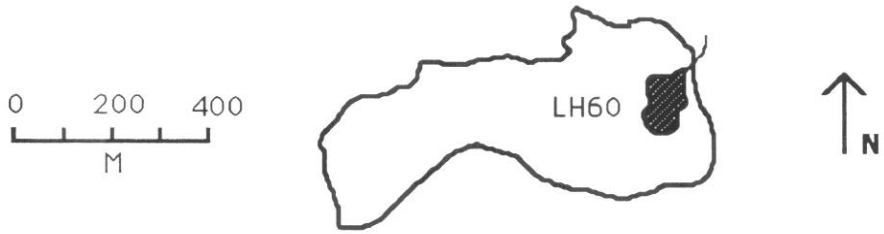
MAXIMUM DEPTH (m): 5.4 **DIMENSIONS (m):** 195 x 90

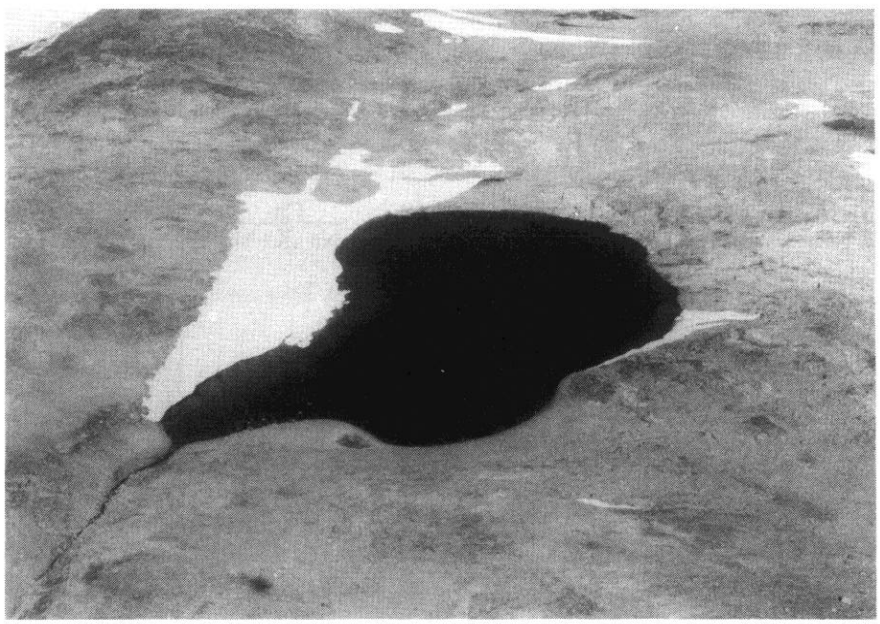
DISTANCE FROM POLAR PLATEAU (m): 3035

DESCRIPTION: Rock catchment; high level rocky shored lake; not much sediment supply.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:





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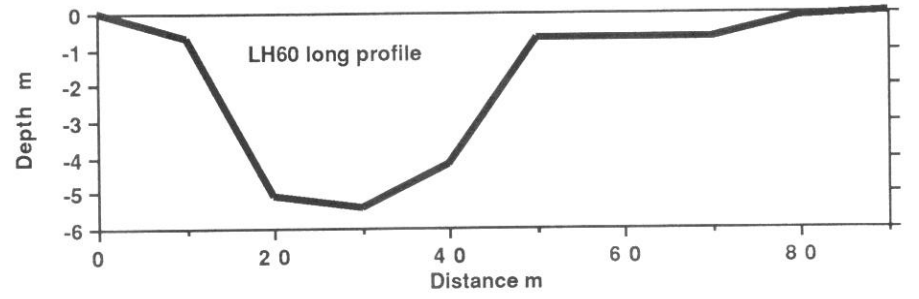
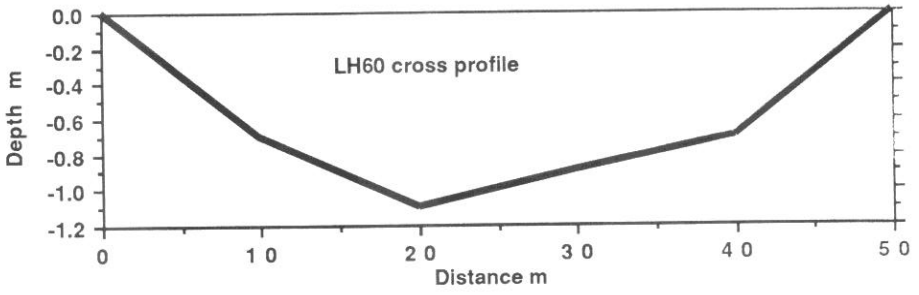




WATER CHEMISTRY:

TEMPERATURE: 5.3^0 C **pH:** 7.09

CONDUCTIVITY: 502 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 7.4	Mg 9.9	Na 71.2	K 2.5
MAJOR ANIONS: (ppm)	Cl 264.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.60$ $\frac{Ca}{Na+K+Mg} = 0.09$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH61

LAKE NAME: None

LOCATION: W. Broknes

LATITUDE: 76^0 19' E
LONGITUDE: 69^0 22' S

ALTITUDE (m): 50

LAKE AREA (ha): 0.5
CATCHMENT AREA (ha): 6.2

MAXIMUM DEPTH (m): 0.5

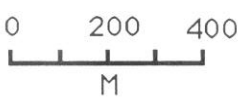
DIMENSIONS (m): 75 x 40

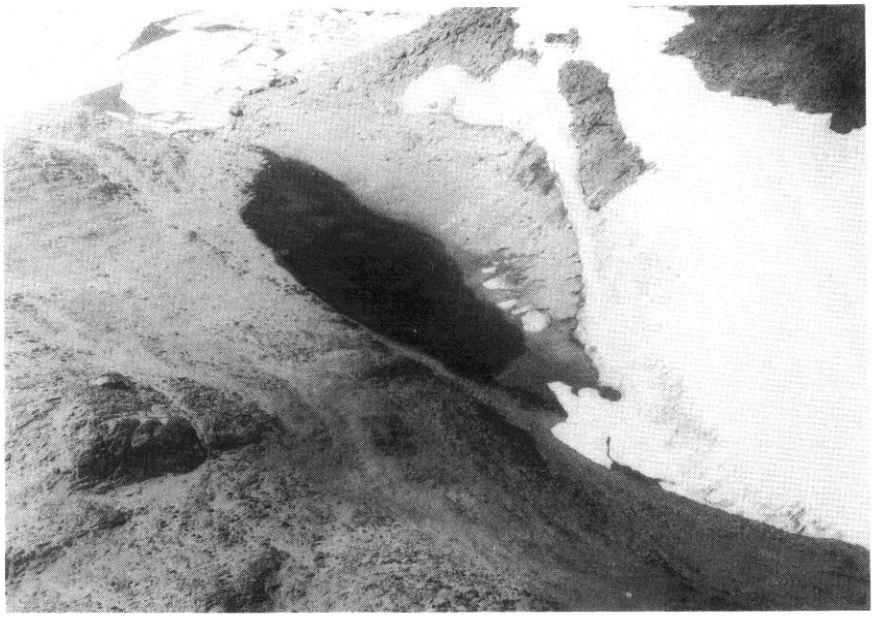
DISTANCE FROM POLAR PLATEAU (m): 3965

DESCRIPTION: Gravel catchment; very shallow; excellent sediment trap.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:





WATER CHEMISTRY:

TEMPERATURE: 8.6^0 C **pH:** 6.45

CONDUCTIVITY: 162 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.7	3.5	22.8	1.0

MAJOR ANIONS:	Cl			
(ppm)	46.2			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.38$ $\frac{Ca}{Na+K+Mg} = 0.03$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.25 SAND % = 99.74 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.69 Phi coarse sand
Sorting = 0.79 moderately sorted
Skewness = 0.26 fine skewed
Kurtosis = 1.16 leptokurtic

LAKE NUMBER: LH62 **LAKE NAME:** None

LOCATION: W. Broknes **LATITUDE:** 76^0 17' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 60 **LAKE AREA (ha):** 0.5
CATCHMENT AREA (ha): 18.8

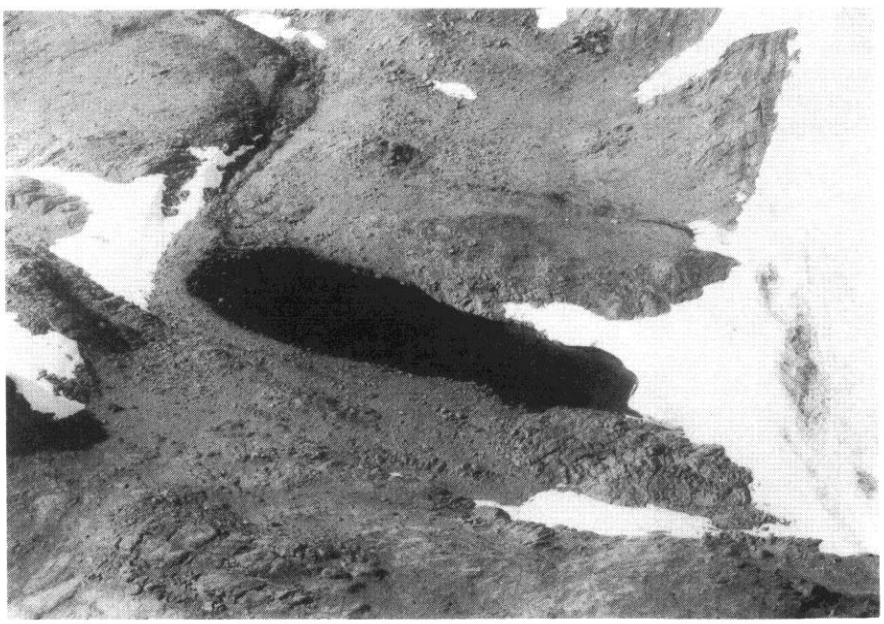
MAXIMUM DEPTH (m): 2.8 **DIMENSIONS (m):** 50 x 30

DISTANCE FROM POLAR PLATEAU (m): 3111

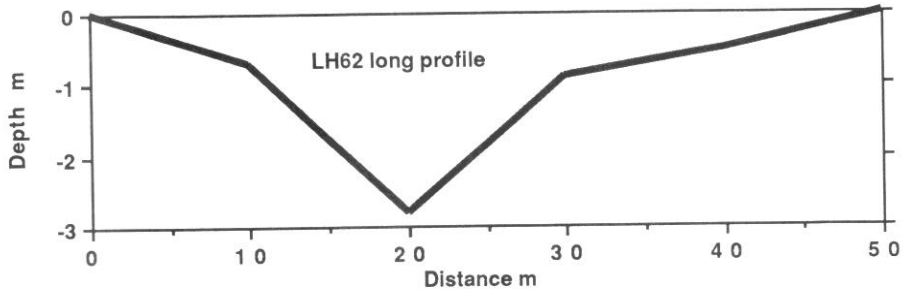
DESCRIPTION: Gravel catchment; small lake with some sediment on snow.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:



PROFILES:



WATER CHEMISTRY:

TEMPERATURE: 4.1^0 C **pH:** 6.25

CONDUCTIVITY: 140 mmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	1.0	3.1	18.8	0.8

MAJOR ANIONS:	Cl
(ppm)	41.4

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.84$ $\frac{Ca}{Na+K+Mg} = 0.04$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.04 SAND % = 99.95 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.14 Phi medium sand
Sorting = 0.80 moderately sorted
Skewness = 0.14 fine skewed
Kurtosis = 1.17 leptokurtic

LAKE NUMBER: LH63 **LAKE NAME:** None

LOCATION: W. Brokness **LATITUDE:** 76^0 18' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 60 **LAKE AREA (ha):** 1.0
CATCHMENT AREA (ha): 25.2

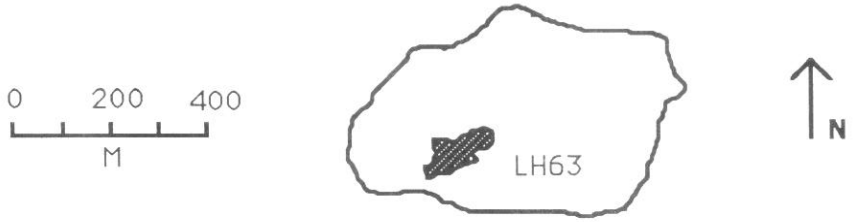
MAXIMUM DEPTH (m): 3.3 **DIMENSIONS (m):** 150 x 60

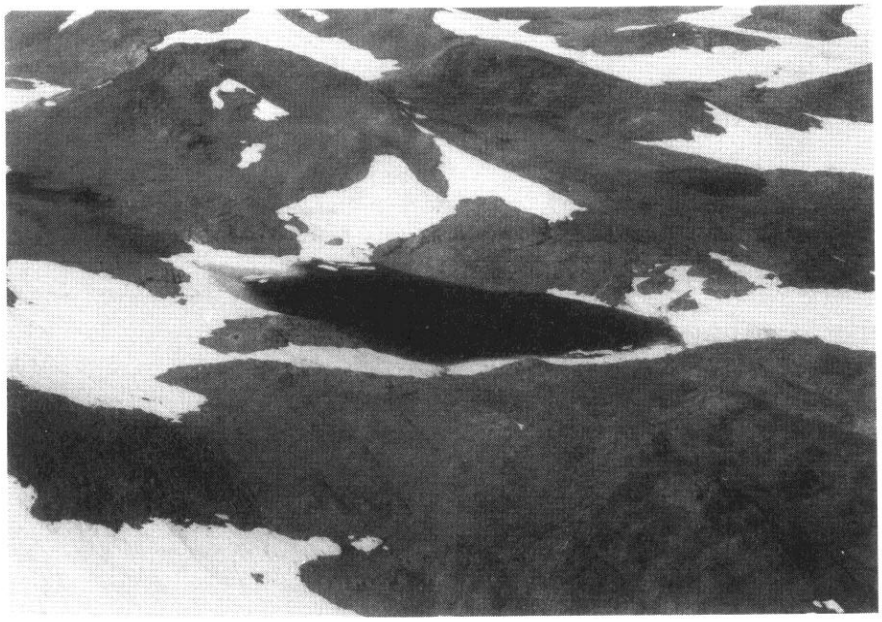
DISTANCE FROM POLAR PLATEAU (m): 2409

DESCRIPTION: Rock catchment; rocky bottom; very little sediment source

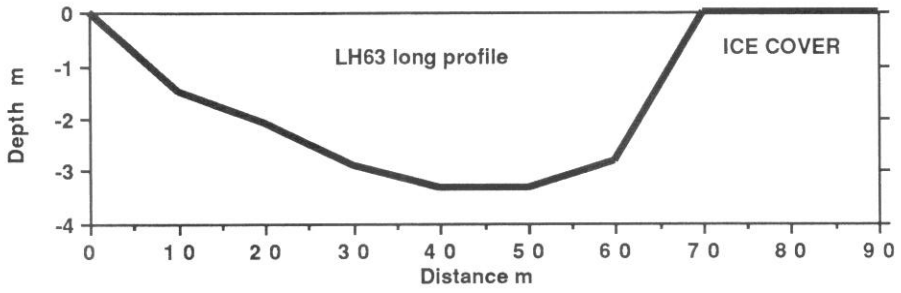
GEOLOGY: Layered Gneiss, Grey Gneiss

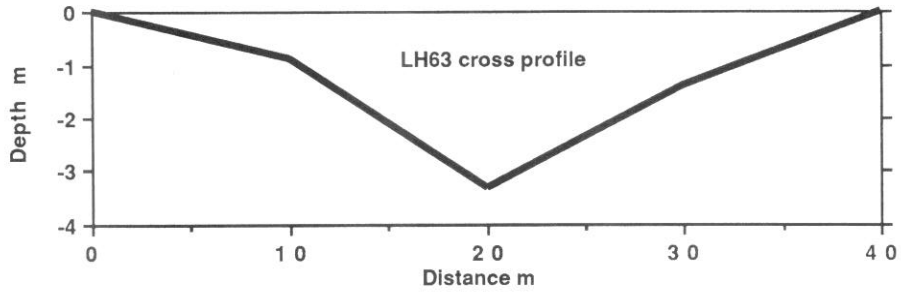
LAKE AND CATCHMENT:





PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 1.7^0 C **pH:** 6.84

CONDUCTIVITY: 180 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.4	2.0	9.7	0.5

MAJOR ANIONS:	Cl
(ppm)	53.6

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.34$ $\frac{Ca}{Na+K+Mg} = 0.03$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH64 **LAKE NAME:** None

LOCATION: W. Broknes **LATITUDE:** 76^0 18' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 55 **LAKE AREA (ha):** 0.5
CATCHMENT AREA (ha): 14.4

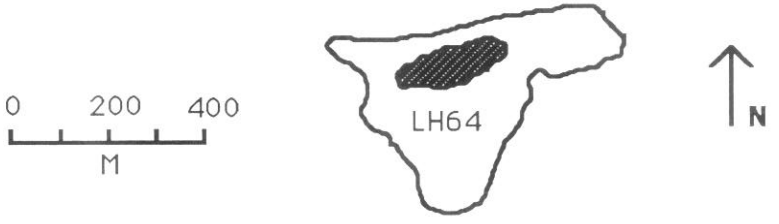
MAXIMUM DEPTH (m): 0.7 **DIMENSIONS (m):** 50 x 40

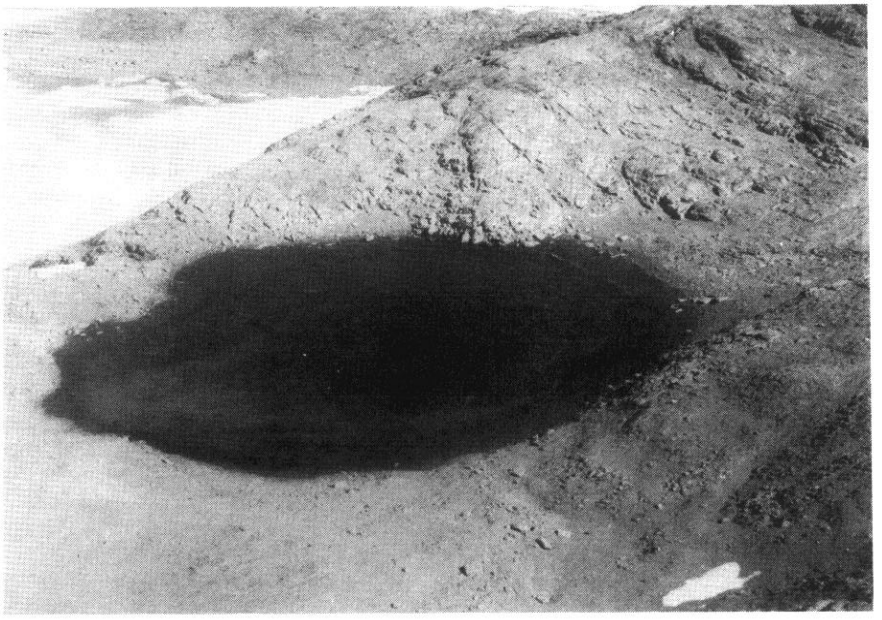
DISTANCE FROM POLAR PLATEAU (m): 2181

DESCRIPTION: Rock catchment; very small; no sediment supply.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:





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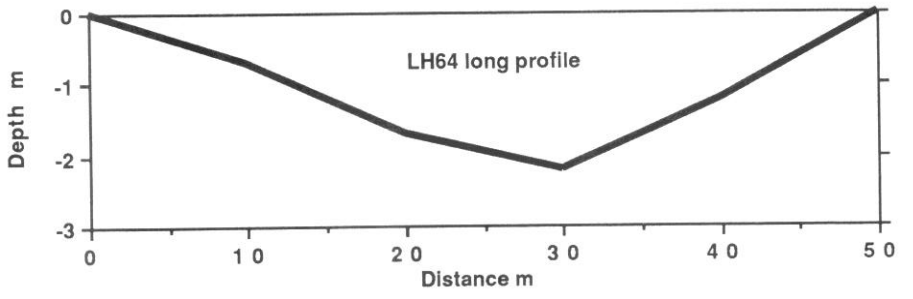
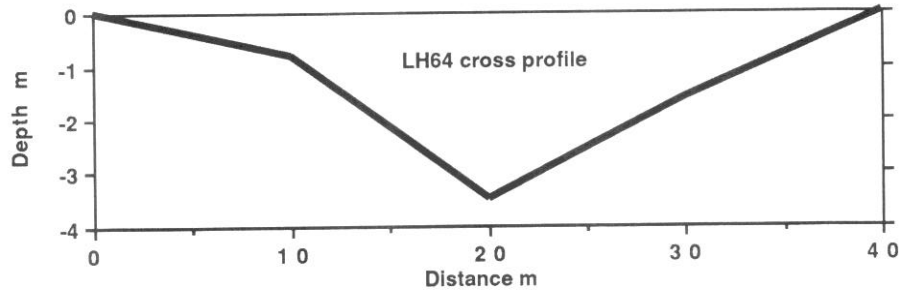




WATER CHEMISTRY:

TEMPERATURE: 6.4^0 C **pH:** 7.1

CONDUCTIVITY: 570 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 9.2	Mg 10.0	Na 79.0	K 3.1
MAJOR ANIONS: (ppm)	Cl 286.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.54$ $\frac{Ca}{Na+K+Mg} = 0.10$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH65

LAKE NAME: None

LOCATION: W. Broknes

LATITUDE: 76^0 19' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 20

LAKE AREA (ha): 1.0
CATCHMENT AREA (ha): 31.7

MAXIMUM DEPTH (m): 0.7

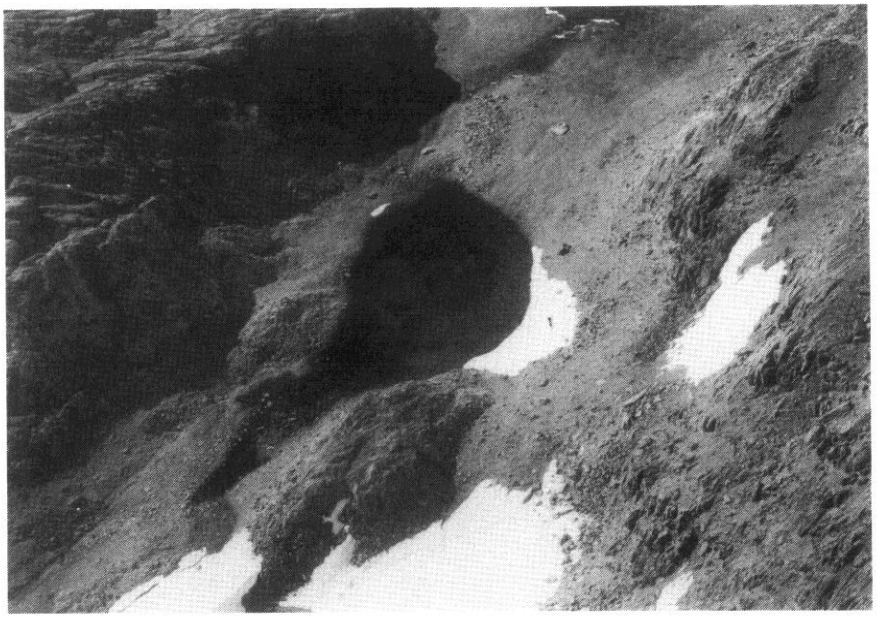
DIMENSIONS (m): 90 x 15

DISTANCE FROM POLAR PLATEAU (m): 1922

DESCRIPTION: Gravel catchment; small shallow lake on major lineament.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: 6.1^0 C **pH:** 7.52

CONDUCTIVITY: 1100 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	28.0	9.8	170.5	6.8

MAJOR ANIONS:	Cl			
(ppm)	426.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.82$ $\frac{Ca}{Na+K+Mg} = 0.15$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH66

LAKE NAME: None

LOCATION: W. Broknes

LATITUDE: 76^0 20' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 25

LAKE AREA (ha): 2.5
CATCHMENT AREA (ha): 26.3

MAXIMUM DEPTH (m): 2.3

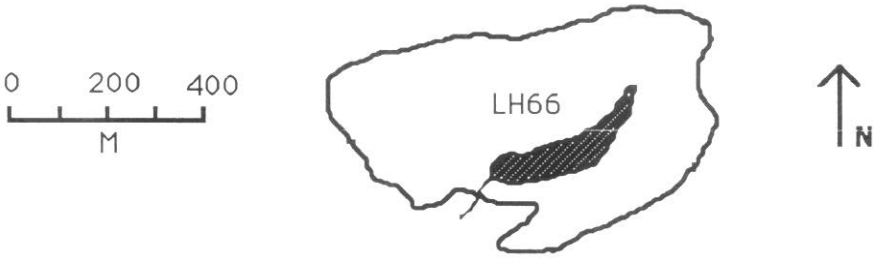
DIMENSIONS (m): 375 x 60

DISTANCE FROM POLAR PLATEAU (m): 2135

DESCRIPTION: Gravel catchment; long shallow lake in lineament valley.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:



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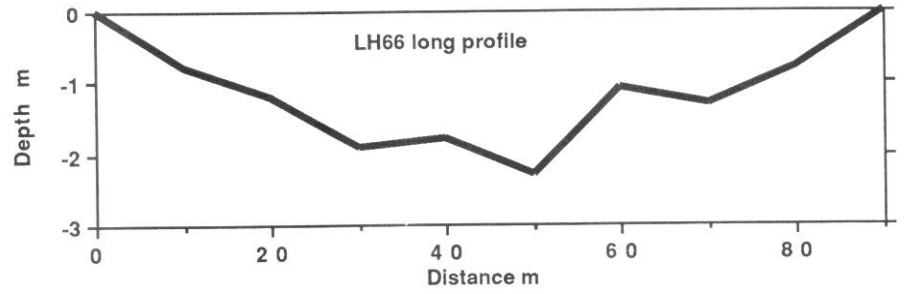
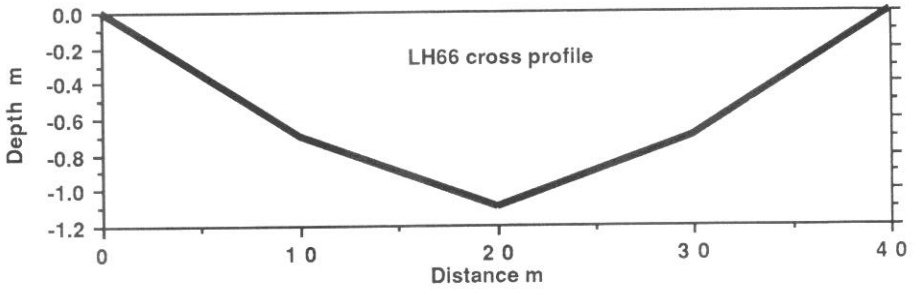




WATER CHEMISTRY:

TEMPERATURE: 6.0^0 C **pH:** 7.36

CONDUCTIVITY: 1492 µmho cm^{-1} **Eh:** --

	Ca	Mg	Na	K
MAJOR CATIONS: (ppm)	34.7	18.9	236.3	8.2

	Cl
MAJOR ANIONS: (ppm)	460.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.82$ $\frac{Ca}{Na+K+Mg} = 0.13$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.30 SAND % = 99.69 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.06 Phi medium sand
Sorting = 0.93 moderately sorted
Skewness = 0.02 near symmetrical
Kurtosis = 1.03 mesokurtic

LAKE NUMBER: LH67

LAKE NAME: None

LOCATION: Broknes Peninsula

LATITUDE: 76^0 21' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 45

LAKE AREA (ha): 4.5
CATCHMENT AREA (ha): 6.3

MAXIMUM DEPTH (m): 5.0

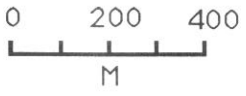
DIMENSIONS (m): 165 x 75

DISTANCE FROM POLAR PLATEAU (m): 2577

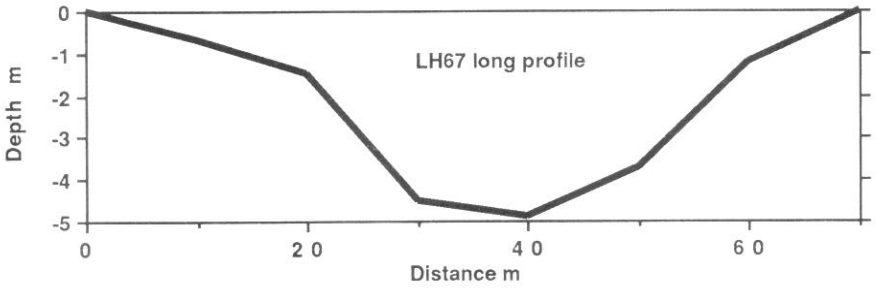
DESCRIPTION: Rock catchment; high lake on intermediate surface; not much sediment supply.

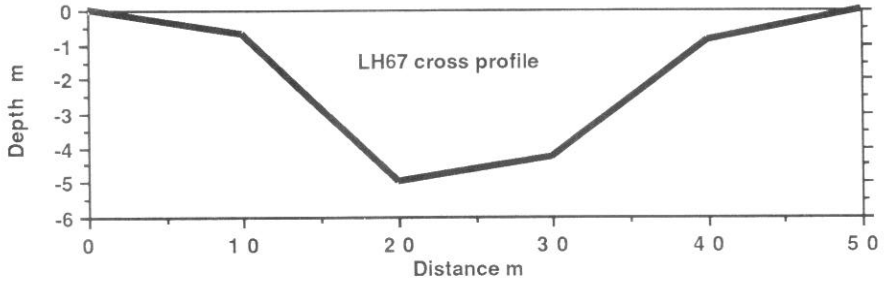
GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 6.9^{0} C **pH:** 7.5

CONDUCTIVITY: 933 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	18.8	21.1	147.7	4.5

MAJOR ANIONS:	Cl
(ppm)	382.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 3.33$ $\frac{Ca}{Na+K+Mg} = 0.11$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH68

LAKE NAME: Heart Lake

LOCATION: Mirror Peninsula

LATITUDE: 76^0 23' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 5.0

LAKE AREA (ha): 5.0
CATCHMENT AREA (ha): 57.8

MAXIMUM DEPTH (m): 4.5

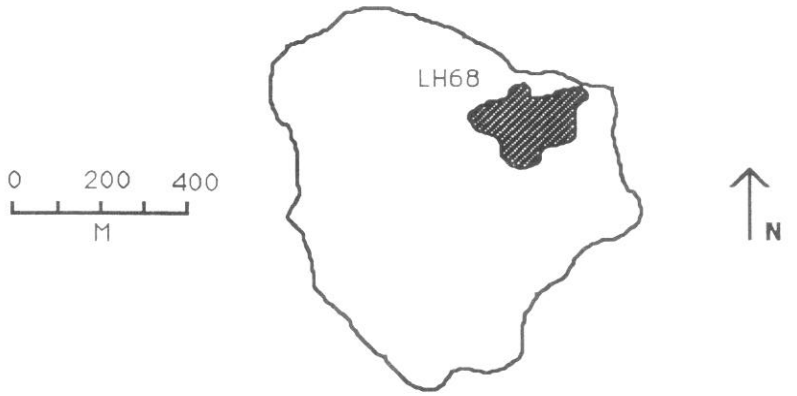
DIMENSIONS (m): 255 x 225

DISTANCE FROM POLAR PLATEAU (m): 2623

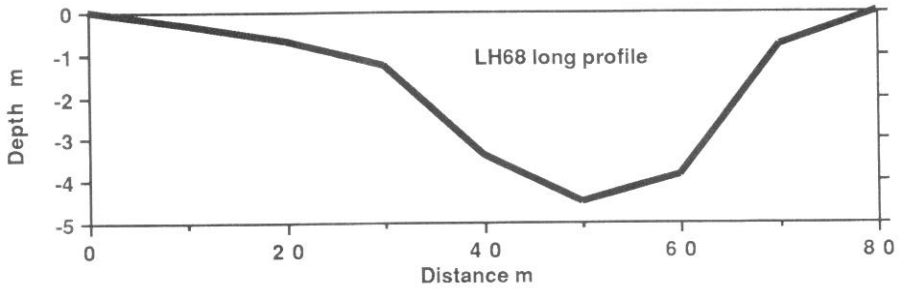
DESCRIPTION: Gravel catchment; shallow coastal lagoon.

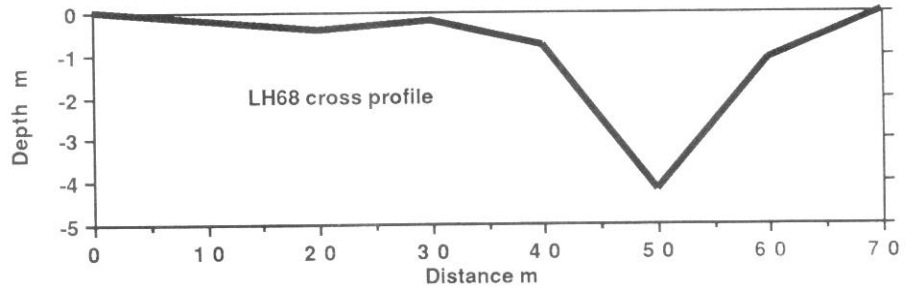
GEOLOGY: Foliated Gneiss

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 7.0^0 C **pH:** 6.66

CONDUCTIVITY: 987 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	7.4	12.3	127.1	- -

MAJOR ANIONS:	Cl
(ppm)	388.0

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 6.45$ $\frac{Ca}{Na+K+Mg} = 0.05$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH69

LAKE NAME: None

LOCATION: Mirror Peninsula

LATITUDE: 76^0 23' E
LONGITUDE: 69^0 22' S

ALTITUDE (m): 10

LAKE AREA (ha): 2.5
CATCHMENT AREA (ha): 27.3

MAXIMUM DEPTH (m): 3.8

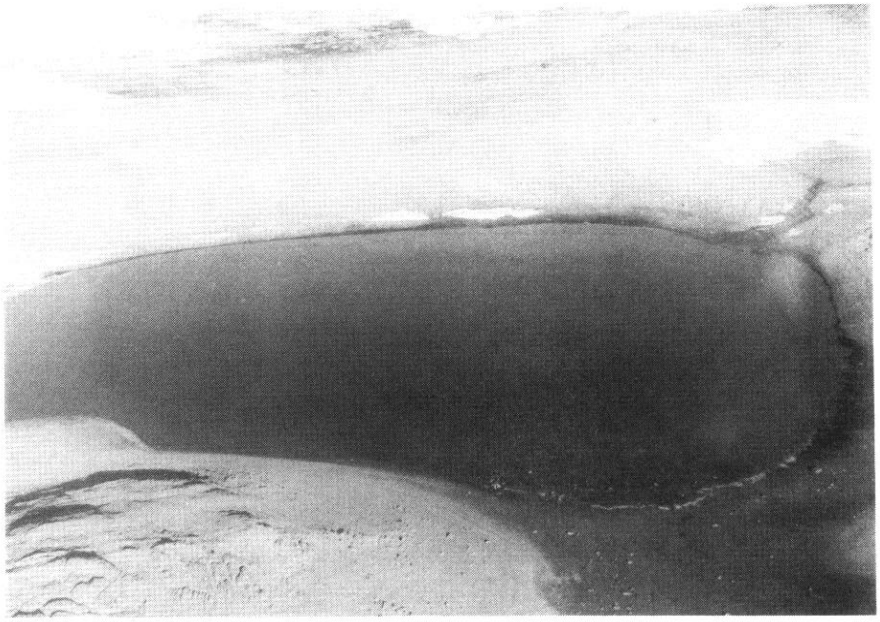
DIMENSIONS (m): 120 x 75

DISTANCE FROM POLAR PLATEAU (m): 3401

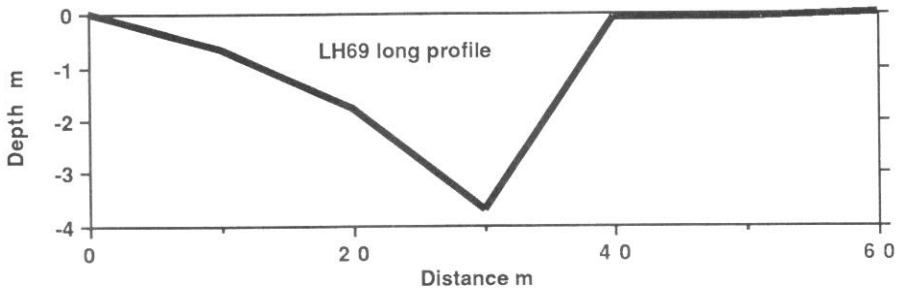
DESCRIPTION: Gravel catchment; coastal lake; fair amount of sediment

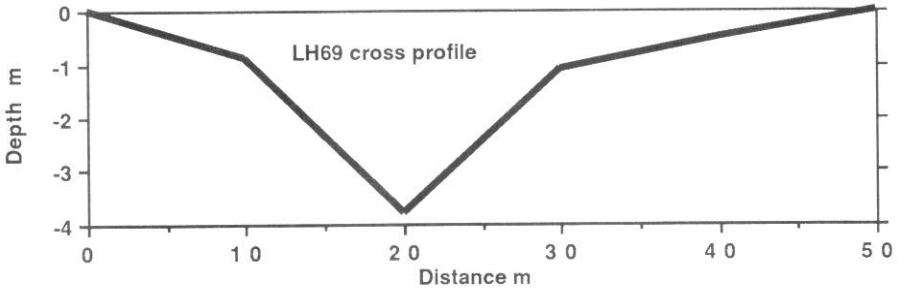
GEOLOGY: Blue Gneiss

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 6.3^{0} C **pH:** 6.57

CONDUCTIVITY: 958 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 10.4	Mg 11.3	Na 148.7	K 5.0
MAJOR ANIONS: (ppm)	Cl 382.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 5.57$ $\frac{Ca}{Na+K+Mg} = 0.06$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH70

LAKE NAME: Big Lake

LOCATION: Broknes Peninsula

LATITUDE: 76^0 23' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 30

LAKE AREA (ha): 5.5
CATCHMENT AREA (ha): 19.6

MAXIMUM DEPTH (m): 3.8

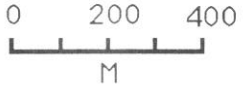
DIMENSIONS (m): 300 x 90

DISTANCE FROM POLAR PLATEAU (m): 2455

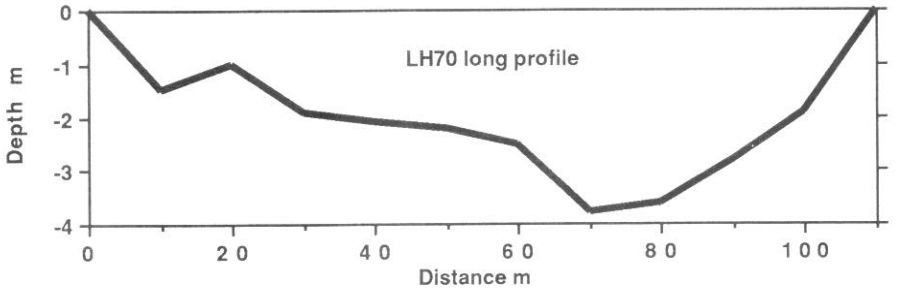
DESCRIPTION: Gravel catchment; fair sediment supply; largish catchment; only lake likely to be affected by Law Base.

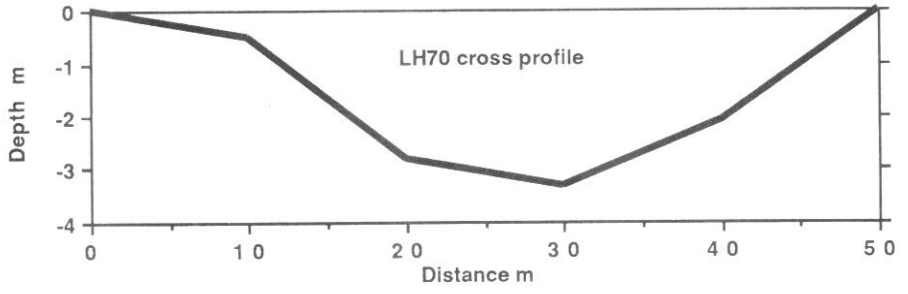
GEOLOGY: Blue Gneiss, Layered Gneiss

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 6.6^0 C **pH:** 7.32

CONDUCTIVITY: 1730 µmho cm^{-1} **Eh:** --

MAJOR CATIONS: (ppm)	Ca 31.4	Mg 31.3	Na 425.6	K 14.0
MAJOR ANIONS: (ppm)	Cl 502.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 5.55$ $\frac{Ca}{Na+K+Mg} = 0.07$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH71 **LAKE NAME:** Sarah Tarn

LOCATION: Broknes Peninsula **LATITUDE:** 76^0 23' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 75 **LAKE AREA (ha):** 1.0
CATCHMENT AREA (ha): 5.7

MAXIMUM DEPTH (m): 2.5 **DIMENSIONS (m):** 120 x 60

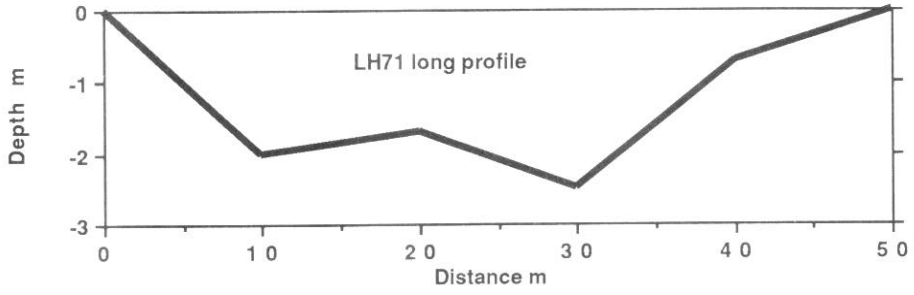
DISTANCE FROM POLAR PLATEAU (m): 1998

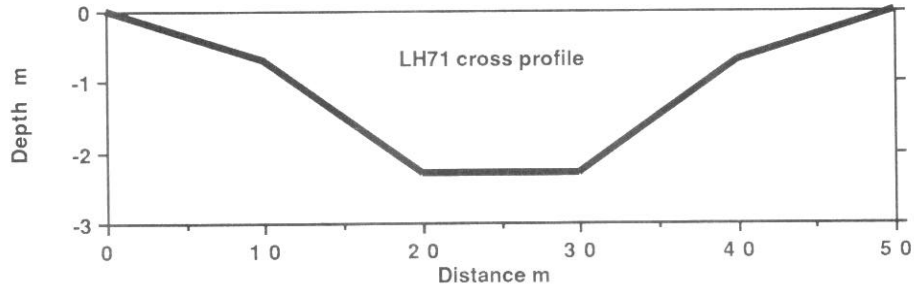
DESCRIPTION: Gravel catchment; fair amount of sediment although catchment not large.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:

PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 6.0^0 C **pH:** 7.32

CONDUCTIVITY: 3340 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	46.8	50.4	538.8	16.4

MAJOR ANIONS:	Cl			
(ppm)	1038.0			

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 4.74$ $\frac{NC}{Na+K+Mg} = 0.08$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.58 SAND % = 99.41 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 0.84 Phi coarse sand
Sorting = 0.92 moderately sorted
Skewness = 0.17 fine skewed
Kurtosis = 1.10 mesokurtic

LAKE NUMBER: LH72

LAKE NAME: Lake Nella

LOCATION: Broknes Peninsula

LATITUDE: 76^0 22' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 15

LAKE AREA (ha): 13.0
CATCHMENT AREA (ha): 259.0

MAXIMUM DEPTH (m): 8.2

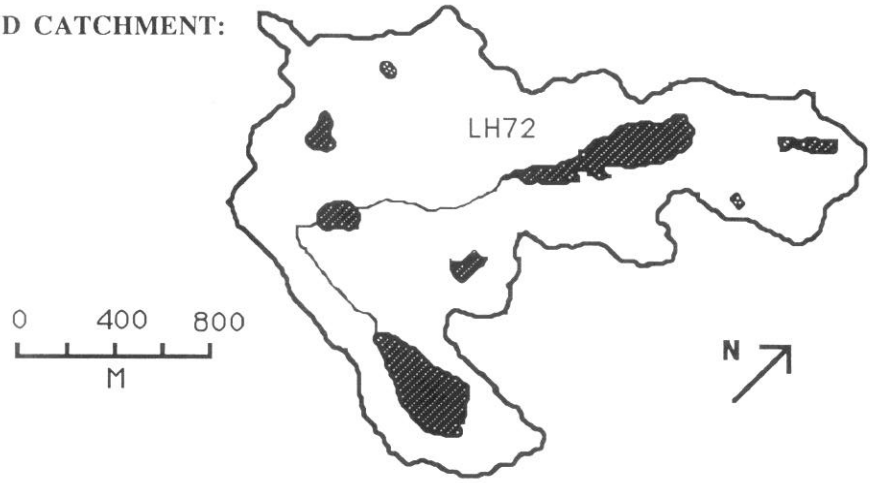
DIMENSIONS (m): 945 x 195

DISTANCE FROM POLAR PLATEAU (m): 1647

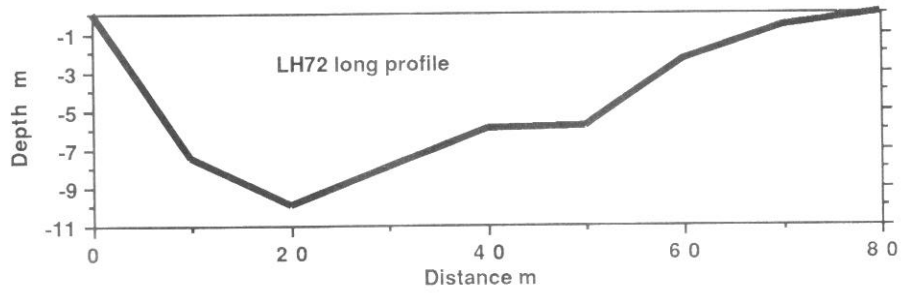
DESCRIPTION: Gravel, rock and ice catchment.

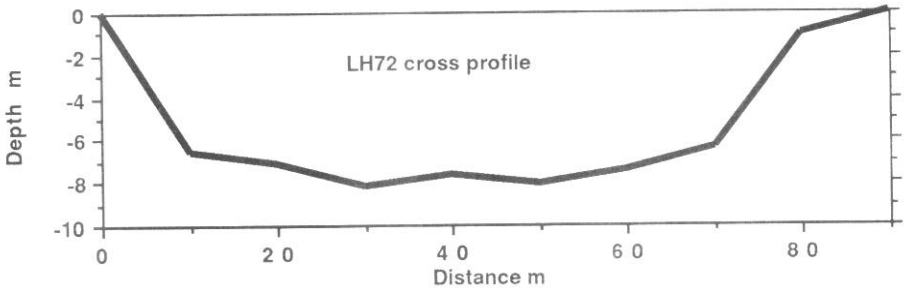
GEOLOGY: Layered Gneiss, Grey Gneiss

LAKE AND CATCHMENT:



PROFILES:





WATER CHEMISTRY:

TEMPERATURE: 3.7^{0} C **pH:** 6.86

CONDUCTIVITY: 139 µmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	0.9	2.2	19.7	0.8

MAJOR ANIONS:	Cl
(ppm)	39.4

IONIC RATIOS: $\frac{Na}{Ca+Mg+K} = 5.05$ $\frac{Ca}{Na+K+Mg} = 0.04$

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample):
GRAVEL % = 0.03 SAND % = 99.96 SILT % = 0.00 CLAY % = 0.00
STATISTICAL PARAMETERS (graphical):
Mean = 1.01 Phi medium sand
Sorting = 0.78 moderately sorted
Skewness = 0.00 near symmetrical
Kurtosis = 1.09 mesokurtic

SEDIMENT STRATIGRAPHY:

RADIOCARBON AGES:

SUA No.	Sample Code	Depth cm	14C Age y.b.p.	Delta 13C 0/00
2752	L724	0-8	2800 +/- 130	-13.8
2753	L7212	0-4	6650 +/- 450	-24.1
2754	L7212	20-26	1970 +/- 100	-24.1

LAKE NUMBER: LH73 **LAKE NAME:** None

LOCATION: Broknes Peninsula **LATITUDE:** 76^0 23' E
LONGITUDE: 69^0 24' S

ALTITUDE (m): 85 **LAKE AREA (ha):** 3.5
CATCHMENT AREA (ha): 18.2

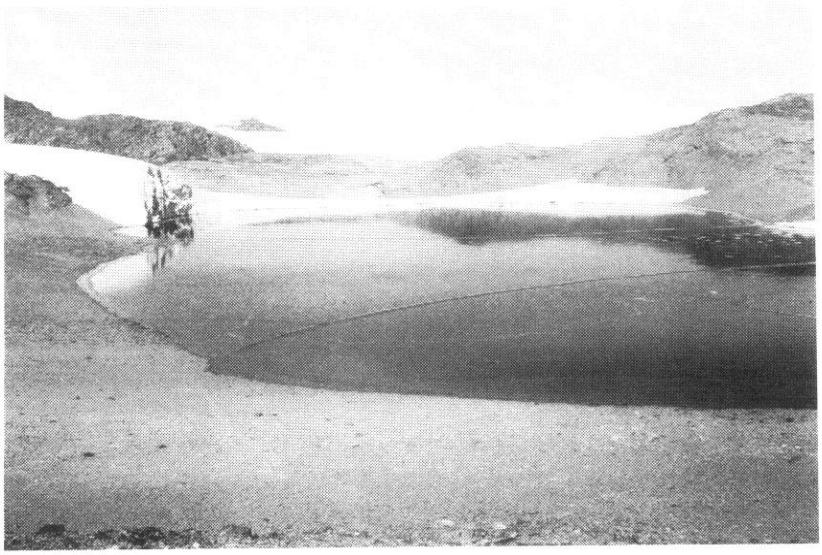
MAXIMUM DEPTH (m): 3-4 **DIMENSIONS (m):** 225 x 120

DISTANCE FROM POLAR PLATEAU (m): 793

DESCRIPTION: small tarn to SW of Lake Mir, at highest plateausurface; catchment is sandy with extensive fans extending from snowbanks; algal mats present - both cowpat type and white mat.

GEOLOGY: Layered Gneiss

LAKE AND CATCHMENT:



WATER CHEMISTRY:

TEMPERATURE: -- **pH:** 7.21

CONDUCTIVITY: 265 μmho cm^{-1} **Eh:** --

MAJOR CATIONS:	Ca	Mg	Na	K
(ppm)	--	--	--	--

IONIC RATIOS: $\frac{Na}{Ca+Mg+K}$ = -- $\frac{Ca}{Na+K+Mg}$ = --

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

LAKE NUMBER: LH74

LAKE NAME: Discussion Lake

LOCATION: Broknes Peninsula

LATITUDE: 76^0 22' E
LONGITUDE: 69^0 23' S

ALTITUDE (m): 5

LAKE AREA (ha): 2.0
CATCHMENT AREA (ha): 74.8

MAXIMUM DEPTH (m): 4.0

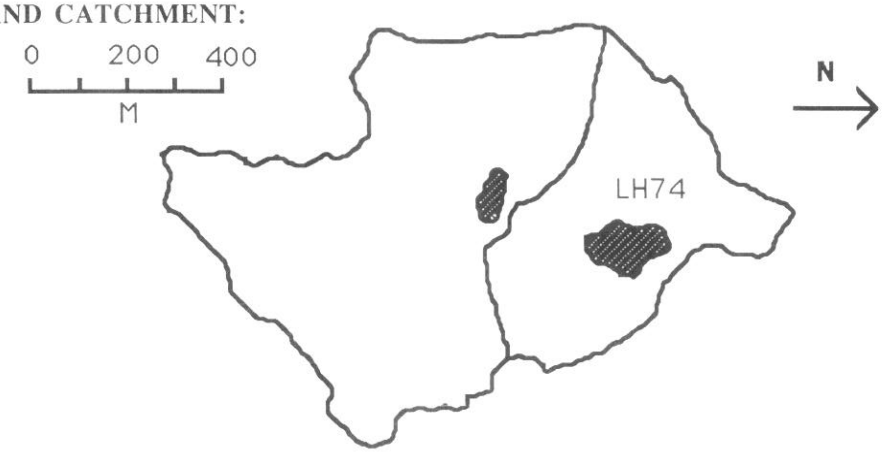
DIMENSIONS (m): 195 x 90

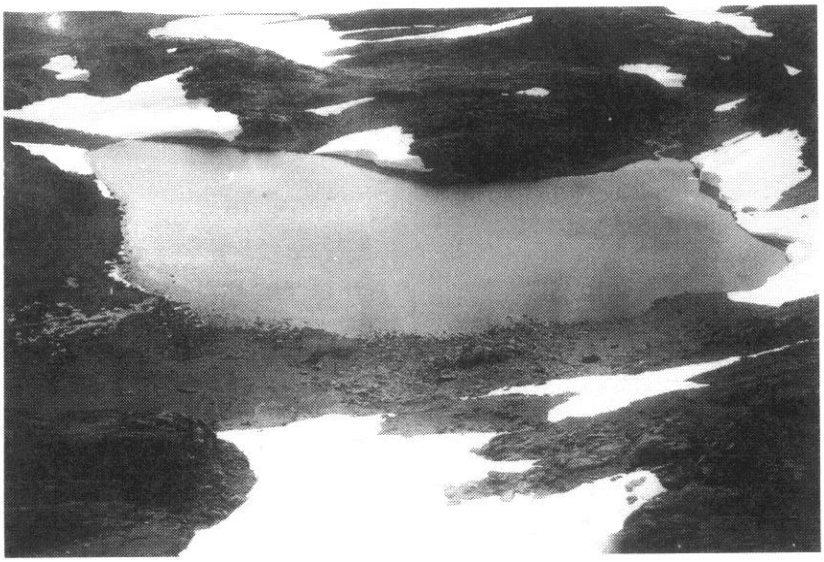
DISTANCE FROM POLAR PLATEAU (m): 2119

DESCRIPTION: Gravel catchment; a large lake with stream inflow and delta; extensive sandy fan on W side; steep rocky slopes on E.

GEOLOGY: Grey Gneiss

LAKE AND CATCHMENT:





WATER CHEMISTRY:

TEMPERATURE: 8.0^0 C **pH:** 6.6

CONDUCTIVITY: -- **Eh:** --

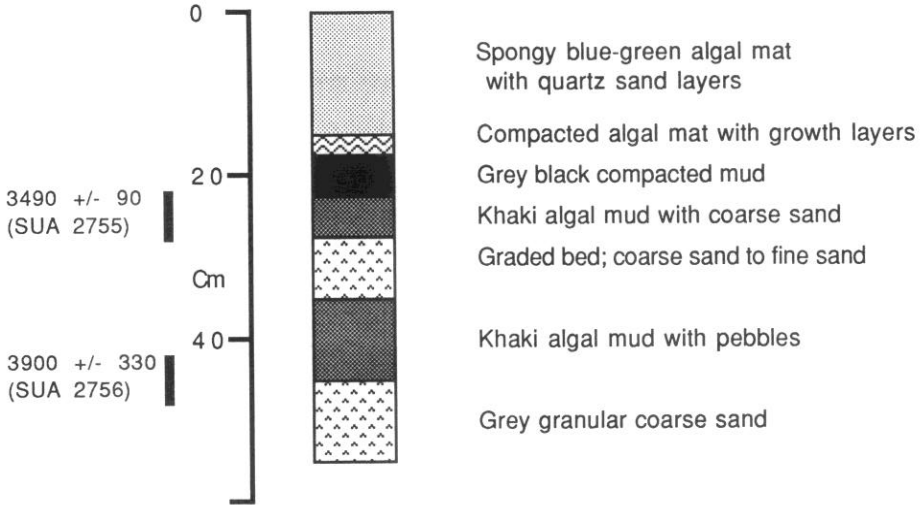
MAJOR CATIONS: (ppm)	Ca	Mg	Na	K
	--	--	--	--

IONIC RATIOS: $\frac{Na}{Ca+Mg+K}$ = -- $\frac{Ca}{Na+K+Mg}$ = --

LAKE SEDIMENT STRATIGRAPHY:

BOTTOM SEDIMENT (grab sample): No sample

SEDIMENT STRATIGRAPHY:



RADIOCARBON AGES:

SUA No.	Sample Code	Depth cm	14C Age y.b.p.	Delta 13C $^0/_{00}$
2755	L743	21.5-26.5	3490 +/- 90	-21.5
2756	L743	41.5-46.5	3900 +/- 330	-22.1

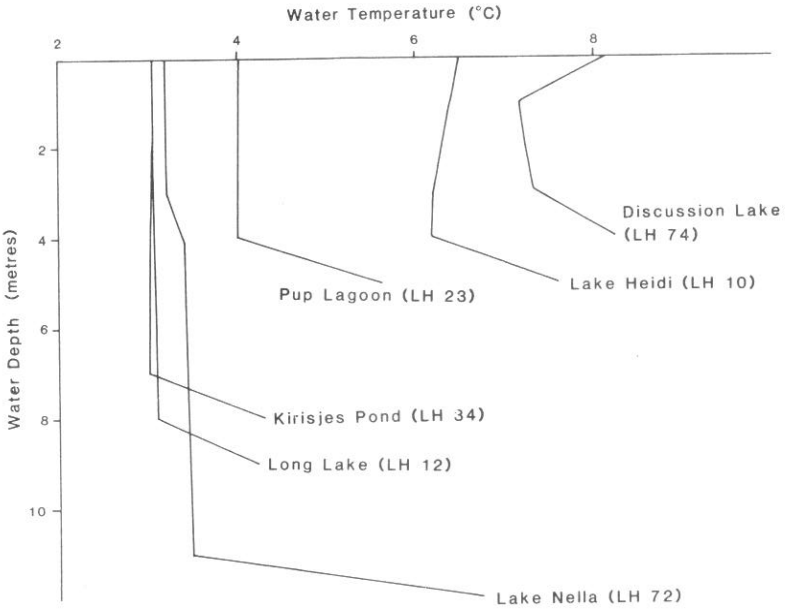


Figure 5. Water temperature profiles for selected lakes in the Larsemann Hills, January and February 1987.

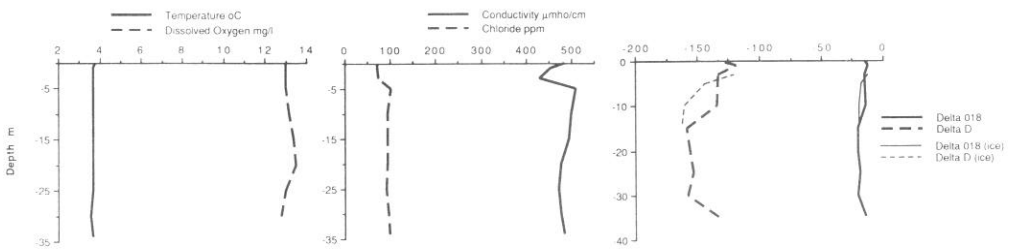


Figure 6. Variation of water properties with depth, Progress Lake, 12 February 1987.

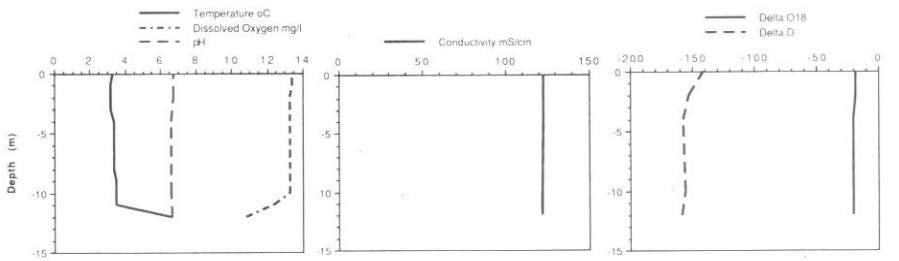


Figure 7. Variation of water properties with depth, Lake Nella, 10 February 1987.

6. GENERAL LAKE CHARACTERISTICS

The Larsemann Hills lakes are generally shallow ponds or ice-deepened basins that thaw (or partially thaw) between December and February, or in some cases, remain permanently frozen. Sedimentary accumulations in the lakes are thin (Gillieson *et al.* 1988) in comparison to the subantarctic lakes. Lake sediment stratification shows several phases of algal mat accretion, separated by sand laminae of various thickness and textures. In a number of lakes coarse gravel was the dominant sediment type.

The ice sheet of the late Wisconsin glaciation reached to at least the nearshore islands of Prydz Bay. In this area the ice attained a thickness of 1000-1500 m. Cyanobacterial and green algal mats have accumulated in all the lakes since ice retreat, with the thickest accumulations on the islands (about 60 cm over glacial debris or bedrock) and the thinnest in young lakes adjacent to the polar plateau (about 5 cm over bedrock). In all the lake sediment stratigraphies there are thick, coarse, sandy layers, the products of fluvioglacial sedimentation. In addition, thin, fine sandy laminae are the products of annual aeolian deposition on snow and ice covered lakes.

Basal radiocarbon ages on the algal mats provide a minimum age for the retreat of glacial ice from the lake basin. The nearshore islands such as Kolloy were free of glacial ice by about 9500 BP, while the present coastline at Pup Lagoon was exposed by 4500 BP. The large glacial troughs of Progress and Nella Lakes were probably free of ice by 3500-4000 BP (Gillieson *et al.* 1988). A relatively slow, steady rate of ice retreat is indicated, about 0.3 ma^{-1}. This is lower than estimates for the nearby Vestfold Hills, where rates of ice margin retreat vary between 2.2 and 3.0 ma^{-1} (Adamson and Pickard 1986). The lakes therefore provide a potential evolutionary sequence for freshwater ecosystems on the Antarctic mainland.

7. LAKE TEMPERATURE REGIMES

During the summer months most of the Larsemann Hills lakes thaw or partially thaw; temperatures increased rapidly with some of the very shallow lakes reaching temperatures of 7-8°C (Burgess *et al.* 1988). Generally the temperature through the water column reached a summer maximum of 4°C. The exceptional clarity of the waters (less than 20 NTU) aids the transmission of sunlight to depths of 35 m. Temperature varied from lake to lake depending on depth and location but within individual lakes temperature rarely changed by more than 0.2°C regardless of depth. The lakes are well mixed due to the very strong and persistent katabatic winds.

Near the beds of the lakes temperatures did change and a sharp increase occurred. The lake bottoms are characterised by extensive blue-green cyano-bacterial felts up to a metre thick, with lake margin growths of filamentous green algae and benthic mats of *Nostoc*. Associated with these algal felts were temperature increases usually of about 2°C but in one case of as much as 3-5°C (Figure 5). Such temperature increases in freshwater Antarctic lakes have been noted previously (Fogg and Horne 1970, Goldman *et al.* 1963, Grobbelaar 1975) but are not considered common. Normally heat increases are associated with salinity increases (Burton 1981, Heywood 1972, 1977) due to anoxic hypersaline pools on the lake bottoms. Fogg and Horne (1970) consider that the benthic mat may achieve higher temperatures than their surroundings as a result of absorption of radiant energy.

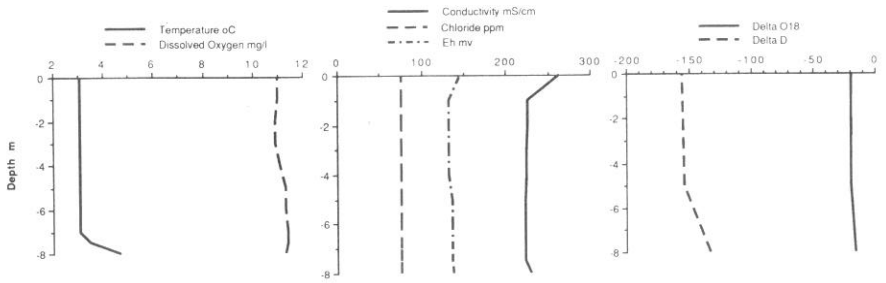


Figure 8. Variation of water properties with depth, Kirisjes Pond, 30 January 1987.

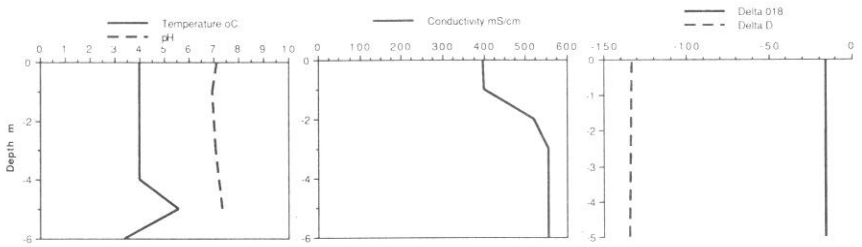


Figure 9. Variation of water properties with depth, Pup Lagoon, 6 February 1987.

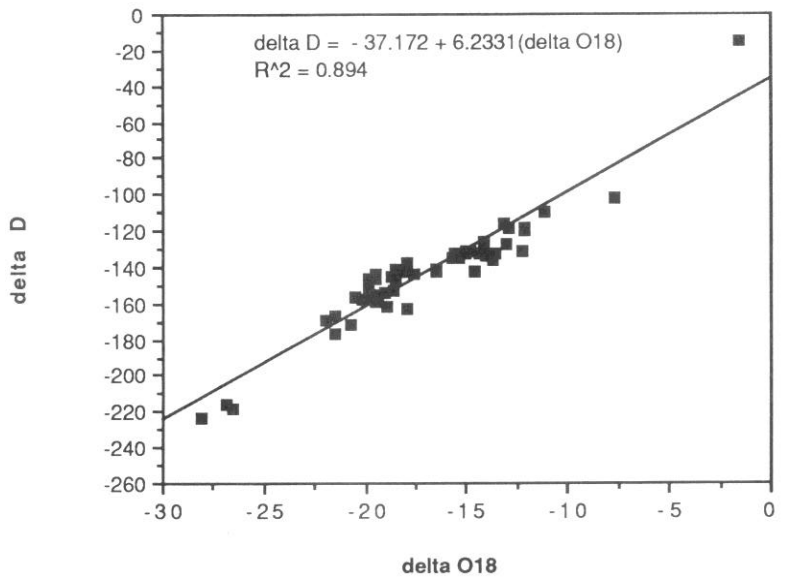


Figure 10. Correlation between $\delta^{18}O$ and δD for natural waters in the Larsemann Hills, January and February 1987.

8. WATER CHEMISTRY

Conductivity ranged from 14 mS in an unnamed lake (LH 20) close to the ice sheet on the western side of Stornes Peninsula, to 3340 mS in Sarah Tarn near Law on Broknes Peninsula (Table 1). Most of the lakes sampled had conductivities below 1000 mS. Generally speaking the lowest conductivity values were recorded near the continental ice edge, particularly on Stornes Peninsula. Highest conductivities were recorded in lakes close to the ocean, particularly offshore islands or in locations exposed to sea spray (e.g. Sarah Tarn).

pH ranged from close to 6.0 to in excess of 8.0. The values recorded are closely related to conductivity values due to the dominance of chloride in the waters. Most values were near neutral. The lowest pH values were again found near the continental ice edge while the highest were found near the ocean. Variations in water chemistry with depth have been recorded from a number of Antarctic lakes (Kaup *et al.* 1988, Heywood *et al.* 1980). In contrast there is little variation with depth in the well-mixed lakes of the Larsemann Hills. In Progress Lake (LH57), which was sampled to 35 m, there is little variation with depth; both conductivity and chloride concentration are lower in the surface waters (Figure 6) due to dilution from snow meltwater. In contrast, temperature is virtually uniform and dissolved oxygen is constant and saturated at around 13 mg/L. Values of the stable isotopes ^{18}O and Deuterium (D) are again fairly constant with depth and have values close to that of snow. There is some variation, however, in the profile under an ice cover which may relate to the mixing and fractionation of snow melt and older ice. The water profile of Lake Nella (Figure 7) shows that it is extremely well mixed, with a slight increase in temperature and a slight decrease in dissolved oxygen in the benthic algal mat. All other parameters are virtually constant with depth.

The shallow lake Kirisjes Pond, on Kolloy Island, shows little variation in water parameters with depth. It is exposed and is thus well mixed. The temperature profile (Figure 8) shows an increase in the uppermost part of the benthic mat, as noted previously, while dissolved oxygen is constant and saturated. All other parameters are virtually constant with depth.

Similarly, shallow Pup Lagoon (Figure 9) shows almost no variation with depth. Changes sometimes occur in the immediate vicinity of the algal mat where Eh values, which invariably were 0-400 mV in the main water body which is well oxygenated, fell to negative (reducing) values in the vicinity of -300 mV.

Variation of conductivity, pH and Eh over the hills, while being small, tended to indicate that the physiography and evolutionary history of a particular lake was important in determining its chemistry. A simple evolutionary model based on linear ice retreat does not explain the spatial variation in lake water chemistry (compare with Heywood 1981). Lakes close to the continental ice edge show a very slight marine influence. There also appears to be a west to east increase in both conductivity and pH. Also of interest is that the lakes with the highest pH and conductivity are located not just on the offshore islands but also on Mirror Peninsula. Rather ironically the lake closest to Sarah Tarn on Mirror Peninsula, recorded the highest conductivity of any lake in the Larsemann Hills.

The waters of the Larsemann Hills lakes recorded turbidity values generally below 20 NTU. Variations between lakes were small and there appears to be no significance in any variation that did occur. Similarly little variation in dissolved oxygen values between lakes occurred.

The concentration of Na^+, Ca^{2+}, Mg^{2+} and K^+ was measured for each of the 74 surveyed lakes. Na^+ was clearly the dominant ion in the Larsemann Hills lakes. Values of Na^+ varied from close

to 5.0 mg/L to approximately 540.0 mg/L. Most of the lake waters recorded values less than 50.0 mg/L. As with conductivity, variations in Na^+ concentration largely reflect proximity to the ice edge or to the ocean. Variations occur from peninsula to peninsula, with lower levels occurring on Stornes Peninsula.

The next most dominant metallic cation was usually Mg^{2+} with values ranging from less than 2.0 mg/L to as high as 50 mg/L in Sarah Tarn. Most values were less than 10.0 mg/L. In order of dominance Ca^{2+} usually exceeded K^+. Most waters recorded less than 3.0 mg/L of Ca^{2+} and less than 1.5 mg/L of K^+, however, values as high as 70.0 mg/L of Ca^{2+} and 16.0 mg/L of K^+ were recorded.

The chemical analyses show that unlike most freshwater lakes (Hutchinson 1975) Na^+ is the dominant ion. Bayly and Williams (1973) suggest that a normal freshwater ionic order is

$Ca^{2+} > Na^+ > Mg^{2+} > K^+$

and seawater is

$Na^+ > Mg^{2+} > Ca^{2+} > K^+$

In the Larsemann Hills the standard ionic order took the form of

$Na^+ > Mg^{2+} > Ca^{2+} > K^+$

Normally the concentration of Na^+ exceeds the sum of all other metallic cations.

Occasionally Ca^{2+} replaces Mg^{2+} as the second dominant cation particularly in the case of the lakes of Sigdoy Island and parts of Broknes Peninsula. Lakes 39, 44, 45 and 48 on Sigdoy Island all have larger concentrations of Ca^{2+} than Mg^{2+} as do lakes 54, 65 and 66 on Broknes Peninsula. An examination of the basement geology of those areas (Stuwe *et al.* 1989) reveals that in those areas the gneiss contains significant quantities of plagioclase which may well be weathered sufficiently rapidly to produce quantities of free calcium ions.

A detailed analysis of the chemistry of the lakes also indicates that there are lakes where the dominance of Na^+ over other ions is not as great. That phenomena is again attributed to the basement geology and the probability that these rocks are weathering more rapidly than gneisses and granites in the rest of the Larsemann Hills.

In five of the sample lakes K^+ values approached or exceeded Ca^{2+} concentrations. This was not considered particularly significant as in all cases the actual ionic concentrations were very low. The lakes were, however, associated with the same plagioclase rich gneisses that produced higher values of calcium.

Finally, some lakes returned Na^+ values that were five times or more the combined concentrations of the other cations. All five such lakes were located on Broknes Peninsula and geomorphological evidence suggested that lake levels had been subjected to recent lowering due to evaporation.

Samples for stable isotopes analysis were collected in glass McCartney bottles and stored without freezing at less than 4°C. These samples were analysed for the stable isotopes deuterium and oxygen -18; results are expressed as δD ‰ (D/H) and as $\delta^{18}O$ ‰ ($^{18}O/^{16}O$). Analysis was performed by Dr C. Barnes at the Division of Water Resources Research, Canberra.

Differences in the isotopic composition of water bodies reflect fractionation processes that occur in the hydrological cycle. The changes of state during condensation and evaporation allow slight fractionation to occur, changing the isotopic ratio of the water. Evaporation from an open water surface depletes the vapour of heavy isotopes relative to the unevaporated water. Temperature will also affect the fractionation: the lower the temperature, the greater the depletion in heavy isotopes. Thus polar and alpine precipitation is isotopically lighter than temperate or tropical water. Snow meltwater has an isotopic ratio heavier than ice or meltwater. Enrichment of lake waters in stable isotopes by evaporation is a common phenomenon, and may be used to gauge the extent of evaporation (Kaup and Vaikmae 1986).

For Kirisjes Pond, Lake Oskar and Progress Lake, depth profiles of $\delta^{18}O$ show no significant variation (less than 1‰) and the values suggest snow meltwater as the source. The lakes are well mixed. There is, however, some variation in δD that may be explained by a different fractionation rate in surface waters. The values of $\delta^{18}O$ range from -15‰ to -19‰ for the lake waters, while fresh snow has values in the range -17.9 to -19.6‰ and meltwater -16.5‰. These are comparable with values obtained by Kaup and Vaikmae (1986) for lakes of the Schirmacher oasis.

There is a good correlation between $\delta^{8}O$ and δD for the Larsemann Lake waters (r^2= 0.894, n=48) implying that the two isotopes come from the same source and no differential mixing of atmospheric and groundwater sources has occured (Figure 10). The regression is very similar to the global meteoric water line. A deviation towards enrichment from the meteoric line indicates evaporation has occurred.

The plot of $\delta^{18}O$ against δD for each peninsula therefore allows some inferences to be made about relative evaporation. For Stornes (Figure 11), deviation from the global meteoric water line is slight and is more pronounced for the large, exposed lakes like Kirisjes Pond and Lake Oskar. The small, snowpack fed lakes have isotopic compositions close to that of fresh snow. Pup Lagoon is clearly influenced by sea spray. For Broknes, the deviation is greater (Figure 12) and evaporation seems to be greatest in the coastal ponds, Discussion and Progress Lakes. In Progress Lake this enrichment is confined to the surface layers, suggesting that wind is the likely agent. Lake Nella plots closer to the meteoric water line, and this may reflect the greater addition of water from snowpacks and meltwater streams. Sarah Tarn is greatly depleted isotopically, and this may relate to a marine influence.

The two peninsulas are therefore distinctly different in their water chemistry and in their isotopic composition and behaviour. We infer that Broknes was exposed earlier by icecap retreat, and that Stornes has only recently emerged from under the ice. This view is borne out by the radiocarbon dates on basal algal mats.

9. DISCUSSION

While it is difficult to make direct comparisons between the Larsemann Hills lakes and other Antarctic freshwater lakes, some similarities exist. Firstly, the increases in temperature at lake bottoms previously reported by Fogg and Horne (1970), Goldman *et al.* (1963) and Grobbelaar (1975) were also found in the Larsemann Hills. Like those studies, increases in temperature are attributed to the ability of benthic blue-green algal mats to absorb radiant energy.

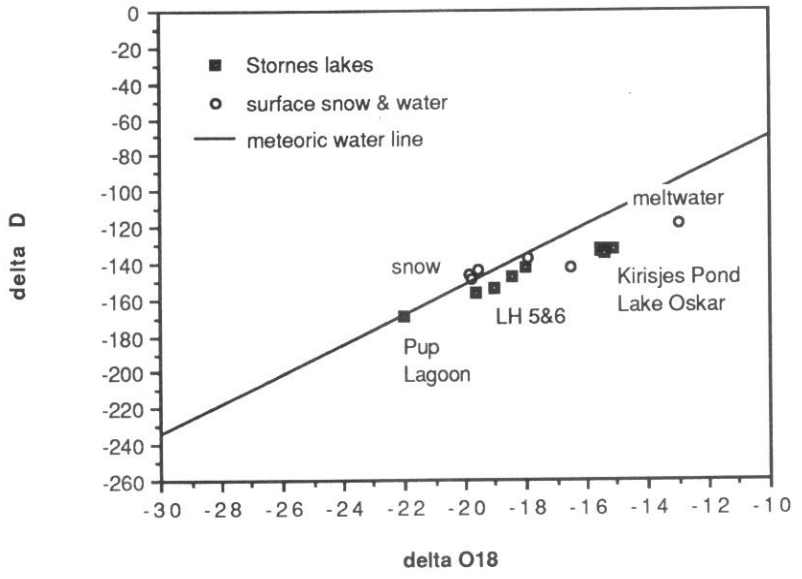


Figure 11. Plot of $\delta^{18}O$ against δD for lakes on Stornes Peninsula. Global meteoric water line is also plotted. Deviations below the meteoric water line indicate evaporation has affected samples.

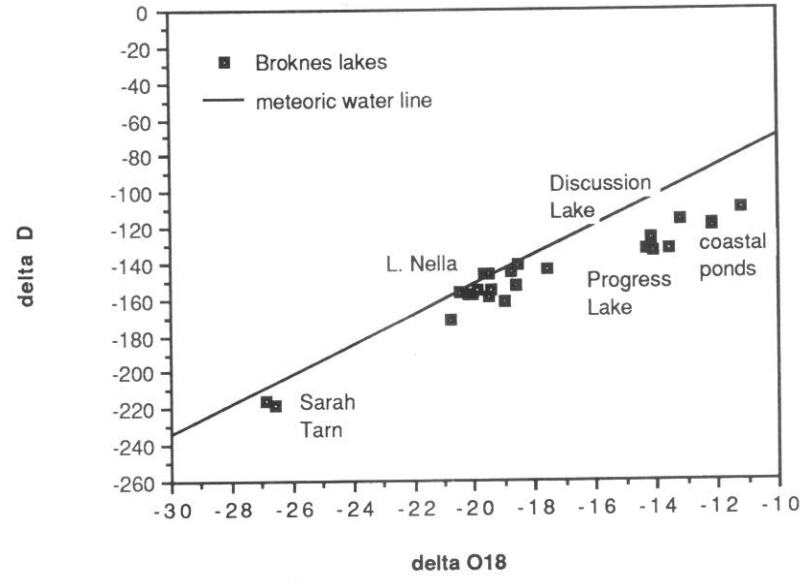


Figure 12. Plot of $\delta^{18}O$ against δD for lakes on Broknes Peninsula. Global meteoric water line is also plotted. Deviations below the meteoric water line indicate evaporation has affected samples.

Many studies have reported variation with depth in such parameters as conductivity and dissolved oxygen. In the Larsemann Hill lakes little variation was recorded and the only variations occurred in the algal felt and in the surface waters. This was considered to be the result of the substantial mixing of the lake waters resulting from the very strong and persistent katabatic winds. Unlike many Antarctic oases, almost all the Larsemann lakes melt for up to 2 months each year. Thus mixing is enhanced and there is also significant release of mineral sediment into the water column from the melted snowpacks and ice cover.

The ionic concentrations of the lake waters showed considerable variation from lake to lake in this study and comparison is difficult because of the paucity of comparable material. Yamagata *et al.* (1967) in inland South Victoria Land have reported balances of $Ca^{2+} > Na^{+} > Mg^{2+} > K^{+}$ while Bardin and Leflat (1965) report $Na^{+} > K^{+} > Ca^{2+} > Mg^{2+}$ for the Schirmacher Ponds. Perhaps the most comparable study is that of Yamagata *et al.* (1967b) on Ongul Island where they report a balance of $Na^{+} > Mg^{2+} > Ca^{2+} > K^{+}$ similar to the Larsemann Hills. There does appear to be a difference between the areas however, as Yamagata *et al.* (1967) report conductivities in Lake Orite, for example, of 5500 mS with Na^{+} (51.1 mg/L, Mg^{2+} (7.2 mg/L), Ca^{2+} (5.4 mg/L) and K^{+} (2.5 mg/L). In comparison lake 38 on an unnamed island in the Larsemann Hills with a conductivity of 1113 mS returned mg/L values of 172.4 Na^{+}, 19.2 mg^{2+}, 12.8 Ca^{2+} and 7.5 K^{+}.

Variations in conductivity, pH etc. that occurred from lake to lake are complex. The stable isotope analysis indicates that there are broad regional differences between Broknes and Stornes Peninsulas. There are also differences (particularly conductivity) within each of the peninsulas. It would appear that variations depend largely on the exposure of the lake to the ocean and especially exposure towards the NE (the predominant wind direction). Also important is the proximity of the lake to the continental ice plateau. Those closest have been deglaciated more recently and that is reflected in conductivity, pH and isotope ratios. Also of significance is the extent of meltwater streams. Lake Nella, for example, receives considerable meltwater and in February 1989 it was estimated that the outflow stream flowed at in excess of 1 m^3s^{-1}. Other lakes like Sarah Tarn only receive small quantities of snow melt and consequently there is little water replacement. Local topography is also important. Some lakes are less exposed to the katabatic winds than others and consequently lakes that are located similar distances from the ocean and continental ice edge can have significantly different lake chemistries.

It is, however, possible to suggest with some confidence that the Larsemann Hills lakes are comparatively young and their trophic stratus indicates ecologies characterised by low nutrient concentrations. Within the hills it would appear that the lakes on Stornes Peninsula have lower concentrations of dissolved salts than the lakes on the other peninsulas and offshore islands. Those variations are consistent with the suggestion that Storness Peninsula may have deglaciated later than the offshore islands or Broknes Peninsula. The existence of extensive algal mats does indicate a surprising degree of biological activity. This is reflected in a diverse diatom assemblage (Gillieson in press). Determination of the extent of that activity requires detailed examination of the algal mat.

ACKNOWLEDGMENTS

This research was funded by ARC Grant No. A38615869 to the senior authors. Funding was also provided by an ASAC grant and by the Rector, University College, University of New South Wales. Considerable assistance was also provided by staff of the Australian Antarctic Division, in particular Mr H.R. Burton and Dr P.G. Quilty. The authors are grateful for the help

given by Prof. G.V.H. Wilson, A/Prof. G. Jackson, Mr M. Kelson, Mr J. McLeod, Mr R. Robson, Ms R. Bartlett, Mr P. Ballard and Ms E. Hampson at the University College. Isotopic analyses were carried out by Dr C. Barnes, CSIRO Division of Water Resources Research. Members of the 1986-87 ANARE to the Larsemann Hills gave considerable field assistance, particularly Mr G. Johnson and Dr L. Fletcher.

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