

Oreti - Von Kettleholes:

Botanical Report

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INTRODUCTION

Kettleholes are surface depressions formed in moraines at the time of glacial recession. They may hold water, either permanently or seasonally; either way their water, levels usually fluctuate markedly, providing a specialist habitat for turf and sward plants that are tolerant of living both under water and out of it. A very large flora of native wetland plants is associated with this habitat, species which may be found otherwise on the margins of larger lakes (Johnson, 1972, 1980a) or in seasonally wet hollows on other landforms.

Aggregations of kettleholes with well-developed zones of turf vegetation are best developed on the terminal and lateral moraines associated with major Quaternary advances of large valley glaciers in inland eastern South Island. They are most common in inland Canterbury (e.g. Johnson & Molloy 1988), with a few in Marlborough (Johnson 1984), and only scattered occurrences in Otago/Southland. Thus the McKenzie country is well-endowed with kettleholes associated with the moraines of the Tekapo, Pukaki, and Ohau basins (Johnson 1978, 1980b, 1986, 1990, 1991 b), and a few in the Ahuriri Valley (Johnson 1983, 1991 a). Progressing further south, there appears to be a gap in their occurrence, with none so far as I can ascertain, in the Hawea or Wanaka basins, but the southernmost aggregation is found west of Lake Wakatipu, in the once-glaciated valleys of the Von and Oreti Rivers.

These eastern South Island moraine kettlehole systems all lie within montane upland landscapes of short tussock grassland. Those kettlehole systems that occur south of the Oreti-Von examples, on the moraines of eastern Fiordland, are at a lower altitude, and in somewhat heavier rainfall areas, and have developed a very different vegetation, with more permanent ponding or with peat accumulations, associated with bog and swamp vegetation, and surrounded by scrub or forest.

This account is based on a half-day reconnaissance visit to the upper Oreti valley on 27 February 1991. The information is summarised here at this time partly in the context of broader studies on water-margin wetlands, partly to bring the botanical features of this system to the attention of the Department of Conservation, and partly to assist with forthcoming assessment of wetlands in valley systems immediately to the north.

THE STUDY AREA

A poorly defined watershed separates the broad valley head of the Oreti River, which drains south, from the Von River, draining north into Lake Wakatipu. Some 50,000 years ago, valley glaciers linked the Wakatipu basin, Mararoa and Oreti Valleys, but it was the glacial advance of some 35,000 years ago which pushed into the Von as far as the south Von area (Turnbull & Forsyth 1988), leaving a dump of terminal

moraine on what is now the Von-Oreti watershed. This moraine is mapped as loose sandy till with rounded boulders and large erratics, part of the South Von Formation, by Turnbull (1980).

This patch of moraine, some 2 km across, and at 700 m altitude, has a general cover of hard tussock (*Festuca novae-zelandiae*) grassland, and holds a scattering of watery hollows of various dimensions. Vegetation and flora was noted on a selection of these, the five sites shown on Fig 1.

VEGETATION PATTERNS

SITE A This is much the largest kettle lake in the area, some 600m long, a permanent body of water with no surface outlet (Fig 3A). It probably reaches its highest level in spring. Most of the shore is relatively steep-sided, as shown in profile (Fig 2A). Although *Potamogeton cheesemani* was seen washed up on shore, no aquatic vegetation was visible at the time of study, suggesting the level may drop some distance further. Shore zone 2, extending 0.8m vertically upslope, is mostly stones and bare soil with only scattered colonist plants, e.g. sorrel and Californian thistle, and is probably regularly inundated.

An upper perimeter of turf (zone 3 in Fig 2A) and 0.6m in vertical extent, has a complete plant cover, of mainly native species, typical of sites that are flooded infrequently and for short periods, perhaps not every year. Plant composition is shown in Table 1. Highest water level is marked by the distinct line forming the lower limit of hard tussock grassland.

SITE B This is a shallow arm in the south-east corner of the kettle lake, c. 150m long x 30m wide, not inundated at the time of study (Fig 3B). Turf communities across the base show a distinct zonation (Fig 213 and Table 2). Zone 1 at the lowest level had a tight cover of *Leptinella maniototo* (a plant that is in frequent use in bowling greens) and of *Crassula sinclairii*, both species able to persist for long periods in an aquatic environment. 20% of the ground was still damp bare silt, with *Limosella* and *Claytonia* among the expected colonists after dewatering of this type of habitat.

In zone 2, *L. maniototo* again contributed 60% cover, as circular patches that had reached 5-15cm diameter during the current growing season. Small mosses provided 20% of the cover and the native pin-cushion grass *Agrostis muscosa* 10%, as cushions 5-8 cm across, again probably representing a season of growth since water level had dropped. Zone 3 had a greater diversity, with 9 native turf species, and an increasing proportion of naturalised pasture plants.

The pasture grasses browntop and sweet vernal become dominant in zone 4, as a narrow fringe which abruptly borders the hard tussock grassland of the drier hill slope.

SITE C This is an example of a small kettlehole that is permanently wet, with a surface seepage outlet governing uppermost water level, and having scarcely any fluctuation. A central pool is surrounded by sphagnum and cushion bog overlying peat (Fig 3C). Plant zonation is shown in Fig 2C, and Table 3. The main features are the complete aquatic cover of milfoil and pondweed with emergent sedges of *Eleocharis acuta*; scattered rushes of *Juncus effusus* on the pool margin; a gradation from *Sphagnum falcatulum* on the wet margin to *S. cristatum* cushions on slightly raised ground of zone 3; then the narrow zone with comb sedge (*Oreobolus*) at 70% cover, against the hard tussock of the hill slope.

SITE D This is a very slight and shallow kettlehole, c.10m across, to the east of the kettle lake, representing a type of depression which probably holds a shallow extent of water, regularly but for only a few days at a time. It is dominated by *Polytrichum* mosses, apparently three species, for they grow as coalescing patches 1-3m across, in strikingly different colours: bright green, red-brown, and olive. The reddish one is turned a brilliant red along dribbling lines of what were surmised to be hare or rabbit urine. Few other plant species were present: *Juncus effusus*, *Rumex acetosella*, *Agrostis muscosa*, and *Ranunculus foliosus*.

SITE E To the south-west of the kettle lake, a series of moist depressions are linked by narrow seepages, and contain a further range of wetland communities, including the following:

- (a) Swampy depression, 100 x 20m, with puddly ground having *Eleocharis acuta* 40% cover, *Carex sinclairii* 20%, *Juncus articulatus* 10%, *Drepanocladus fluitans* 10%, *Carex diandra*, *Holcus lanatus*, *Stellaria alsine*, *Ranunculus glabrifolius*, and *Epilobium chionanthum*.
- (b) Small swamp pools with *Potamogeton cheesemanii* 50%, *Myriophyllum pedunculatum* 40%, and *M. triphyllum* 10% cover.
- (c) Pool margins fringed with tussocks of *Carex secta*.
- (d) Moist stream edges with *Hydrocotyle sulcata*, *Ranunculus cheesemanii*, *Leptinella squalida*, *Juncus articulatus*, *Mimulus moschatus*, and *Myosotis laxa* subsp. *caespitosa*.

DISCUSSION

From this brief study it is clear that these kettleholes represent the same sort of systems found further north in the South Island. They exhibit the typical variation in size, range of fluctuation and wetness regimes, and consequently of vegetation types of kettlehole landforms, and are our southernmost such examples. The flora of native wetland turf and aquatic species is reasonably well represented; further study would add considerably to the flora recorded so far. The area has adjacent

swamp and seepage communities adding to those of the kettleholes proper. Some naturalised plant species are present, but none that could be considered a threat or a problem in the wetland turf vegetation.

The geological map (Turnbull 1980) shows a complexity of Quaternary moraine and outwash surfaces in the Oreti, Von, and Mararoa catchments, and the topographic maps indicate widespread ponds, kettleholes, swamps, flushes, and river meanders in these montane valleys. The glacial valley landforms and habitats are a major feature of the Livingstone Ecological District and are in need of assessment for representative biological conservation purposes.

This report merely touches one corner of a botanically fascinating system. My conclusions at this point are that the Department of Conservation should bring the conservation values of this area to the attention of their staff in Otago and Southland Conservancies, and ensure that these values are not compromised pending PNA or similar surveys towards identifying areas that require protection.

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Table 1 Upper Oreti, site A, the big pond: Percent cover of principal plant species in marginal zones.

zone:	1	2	3	4
stones, gravel	100	70		
bare soil		20		
<i>Anthoxanthum odoratum</i>			25	5
<i>Muehlenbeckia axillaris</i>			15	
<i>Cyathodes fraseri</i>			10	5
<i>Coprosma petriei</i>			10	
<i>Rumex acetosella</i>			5	
<i>Pernettya macrostigma</i>			5	
<i>Pratia angulata</i>			5	
<i>Sagina procumbens</i>			5	
<i>Gnaphalium traversii</i>			5	
<i>Geranium sessiliflorum</i>			5	
<i>Colobanthus apetalus</i>			2	
<i>Linum catharticum</i>			2	
<i>Hydrocotyle microphylla</i>			2	
<i>Ranunculus foliosus</i>			2	2
<i>Festuca novae-zelandiae</i>				30
<i>Rhacomitrium lanuginosum</i>				20
<i>Raoulia subsericea</i>				20
<i>Hypnum cupressiforme</i>				5
<i>Pimelea oreophila</i>				5
<i>Hieracium pilosella</i>				2
<i>Festuca rubra</i>				2

Table 2 Upper Oreti, site B, turfy arm of the big pond: percent cover of principal plant species in marginal zones.

zone:	1	2	3	4	5
<i>Leptinella maniototo</i>	60	60			
<i>Crassula sinclairii</i>	10				
mosses	8	25			
bare ground	20		15		
<i>Limosella lineata</i>	2				
<i>Agrostis muscosa</i>		10	15		
<i>Viola cunninghamii</i>		2	+	+	
<i>Epilobium alsinoides</i>		+	15		
<i>Potentilla anserinoides</i>			10		
<i>Acaena caesiiglauca</i>			10		
<i>Gnaphalium traversii</i>			10		
<i>Gnaphalium ruahinicum</i>			10	10	
<i>Cirsium arvense</i>			5		
<i>Rumex acetosella</i>			5	10	
<i>Agrostis capillaris</i>			5	20	
<i>Anthoxanthum odoratum</i>				50	10
<i>Rhacomitrium lanuginosum</i>				10	30
<i>Festuca novae-zelandiae</i>					50
<i>Raoulia subsericea</i>					10

Table 3 Upper Oreti, site C, boggy kettlehole: percent cover of principal plant species in marginal zones.

zone	1	2	3	4	5
<i>Myriophyllum pedunculatum</i>	80				
<i>Potamogeton cheesemanii</i>	10				
<i>Eleocharis acuta</i>	10				
<i>Juncus effusus</i>		10			
<i>Carex echinata</i>		40	10		
<i>Sphagnum falcatulum</i>		50			
<i>Sphagnum cristatum</i>			50	5	
<i>Oreobolus pectinatus</i>			10	70	
<i>Breutelia pendula</i>			10		
<i>Drosera arcturi</i>			5		
<i>Gonocarpus micranthus</i>			5	20	
<i>Agrostis capillaris</i>			2	2	15
<i>Plantago uniflora</i>			2		
<i>Celmisia graminifolia</i>			2	2	5
<i>Lachnagrostis Iyallii</i>			2		
<i>Carex coriacea</i>			2		
<i>Festuca novae-zelandiae</i>					50
<i>Anthoxanthum odoratum</i>					10
<i>Ranunculus foliosus</i>					5
<i>Muehlenbeckia axillaris</i>					5
<i>Coprosma perpusilla</i>					5
<i>Pimelea oreophila</i>					5

LIST OF PLANTS RECORDED FROM ORETI-VON KETTLEHOLE MARGINS, 27.2.91

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ABBREVIATIONS

* = naturalised, not native

ABUNDANCE:

a = abundant

f = frequent

o = occasional

r = rare

MAIN HABITATS:

A = aquatic

T = turf within flooding zone

B = boggy kettles

S = seepages and streamsides

G = grassland

MONOCOTYLEDONS

* <i>Agrostis capillaris</i>	f	GT
<i>A. muscosa</i>	f	T
* <i>Anthoxanthum odoratum</i>	f	GT
<i>Carex coriacea</i>	o	SB
<i>Carex diandra</i>	o	B
<i>C. echinata</i>	f	B
<i>C. petriei</i>	r	T
<i>C. ?resectans</i>	r	T
<i>C. secta</i>	r	S
<i>C. sinclairii</i>	o	BS
<i>Deschampsia novae-zelandiae</i>	r	T
<i>Eleocharis acuta</i>	f	AT
<i>Festuca novae-zelandiae</i>	f	G
* <i>F. rubra</i>	r	G
* <i>Holcus lanatus</i>	o	SG
* <i>Juncus articulatus</i>	o	S
* <i>J. effusus</i>	o	B
<i>Lachnagrostis lyallii</i>	o	TB

Luzula rufa	o	G
Oreobolus pectinatus	o	B
Poa lindsayi	o	T
Potamogeton cheesemanii	f	A
Rytidosperma gracile	o	BT

DICOTYLEDONS

Acaena caesiiglauca	o	G
A. fissistipula	r	G
Celmisia glandulosa	r	BS
C. graminifolia	o	B
* Cerastium fontanum	r	GT
* Cirsium arvense	o	TG
* C. vulgare	r	G
Colobanthus apetalus	r	GS
Coprosma perpusilla	o	TG
C. petriei	o	TG
Crassula sinclairii	f	TA
Cyathodes colensoi	r	G
C. fraseri	o	GT
Drosera arcturi	o	B
Epilobium alsinoides	f	ST
E. angustum	r	T
E. chionanthum	r	BS
Euphrasia zelandica	r	GT
Galium perpusillum	r	T
Geranium sessiliflorum	o	GT
Gnaphalium limosum	r	ST
G. ruahenicum	o	T
G. traversii	o	T
Gonocarpus micranthus	o	BT
* Hieracium pilosella	o	G
Hydrocotyle hydrophila	r	T
H. microphylla	o	S
H. "montana"	o	T
H. sulcata	o	S
Lagenifera cuneata	r	TG
Leptinella maniototo	a	TA
L. squalida	o	B
Limosella lineata	o	T
* Linum catharticum	f	SG
* Mimulus moschatus	o	S
Muehlenbeckia axillaris	f	GT

* <i>Myosotis laxa</i>		
subsp. <i>caespitosa</i>	r	S
<i>Myriophyllum pedunculatum</i>	f	TAB
<i>M. triphyllum</i>	o	SA
<i>Neopaxia</i> sp.	r	T
<i>Oreomyrrhis colensoi</i>	r	SG
<i>Pernettya macrostigma</i>	o	G
<i>Pimelea oreophila</i>	o	GT
<i>Plantago triandra</i>	r	T
<i>P. uniflora</i>	o	S
<i>Potentilla anserinoides</i>	o	T
<i>Pratia angulata</i>	o	TS
* <i>Prunella vulgaris</i>	r	T
<i>Pseudognaphalium luteo-album</i>	r	TG
<i>Ranunculus cheesemanii</i>	r	S
<i>R. multiscapus</i>	o	GT
<i>R. glabrifolius</i>	o	S
<i>Raoulia subsericea</i>	o	G
* <i>Rumex acetosella</i>	o	GT
* <i>Sagina apetala</i>	o	TS
* <i>Stellaria alsine</i>	o	S
* <i>Trifolium dubium</i>	r	TG
<i>Viola cunninghamii</i>	r	TGS

MOSSES

<i>Breutelia pendula</i>	o	B
<i>Drepanocladus fluitans</i>	o	SA
<i>Hypnum cupressiforme</i>	f	G
<i>Polytrichum</i> sp.	f	BT
<i>Rhacomitrium lanuginosum</i>	o	G
<i>Sphagnum cristatum</i>	o	B
<i>S. falcatulum</i>	o	B

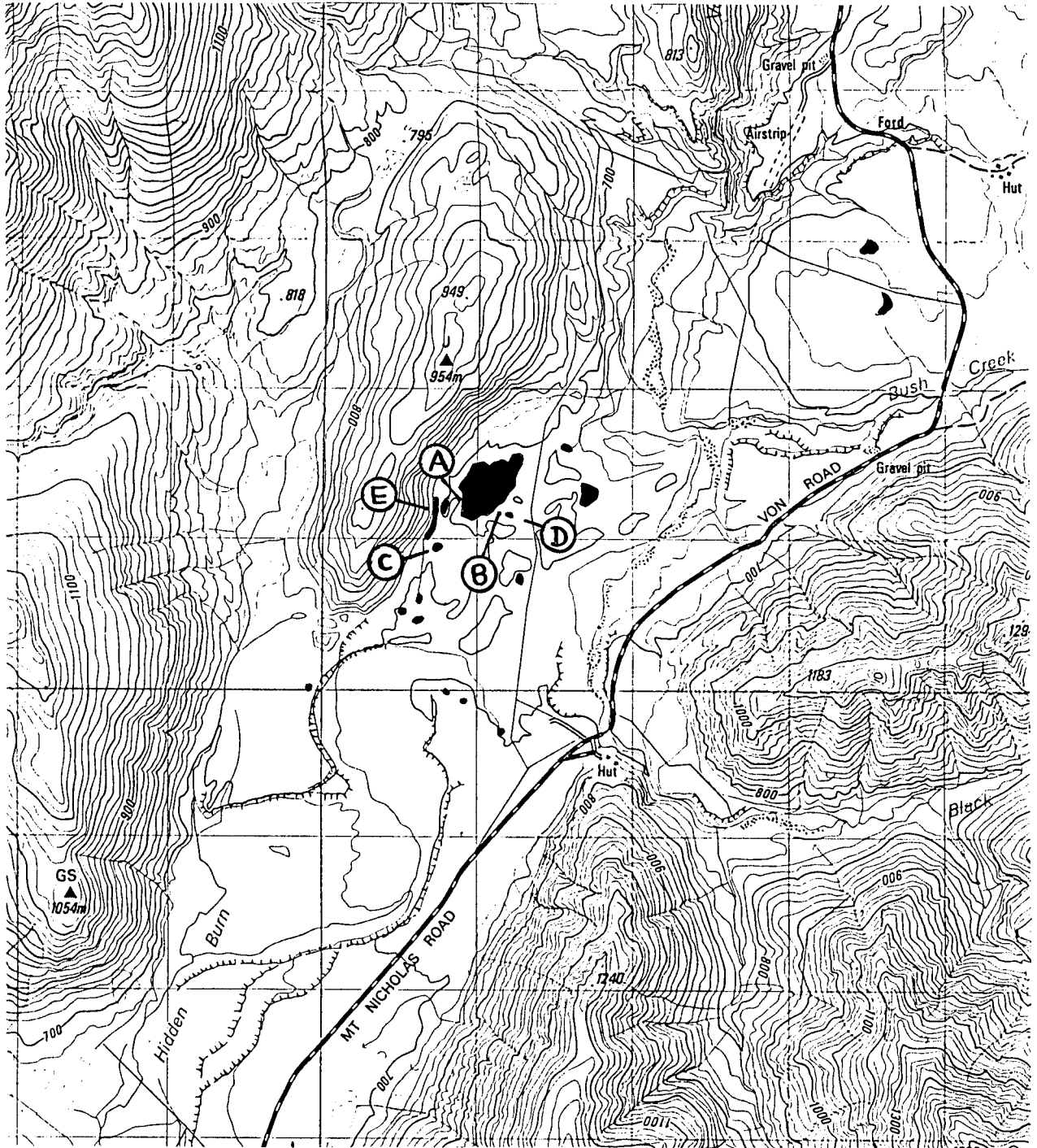


Fig 1. Map, enlarged from NZMS 260 -E42, showing kettlehole study sites on the Oreti River - Von River Divide.

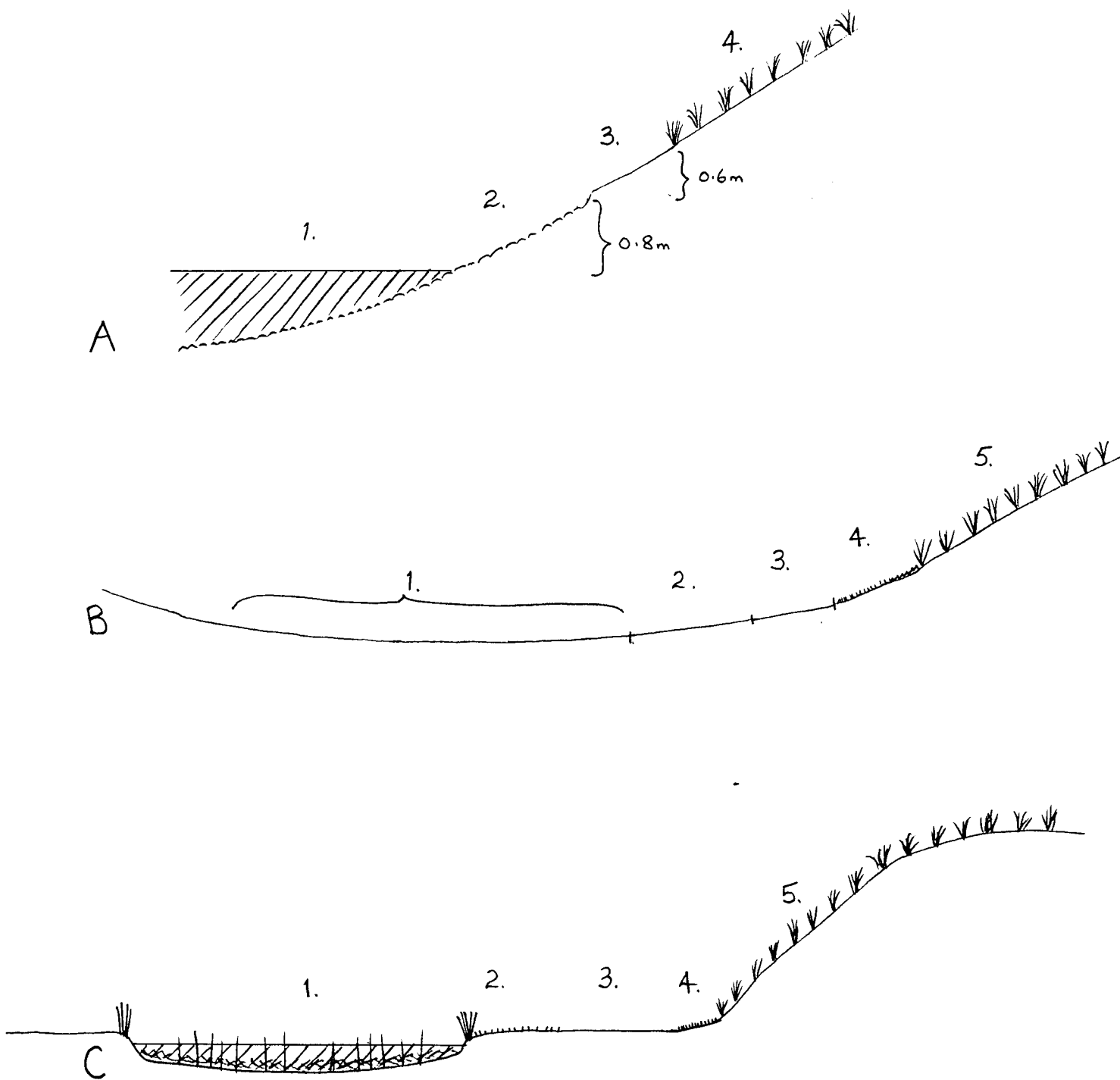


Fig 2. Profiles showing vegetation zones marginal to three kettlehole sites on the Oreti River - Von River divide.
 Site A: south shore of the largest kettle lake.
 Site B: a turfy embayment on the south-east of this lake.
 Site C: a boggy kettlehole.



A



B



C

Fig 3. Three kettleholes on the Oreti River - Von River divide. Site A is the largest kettle lake, a view north-east towards the Von Valley. Site B is a turfy embayment on the south-east of this lake. Site C is a boggy kettlehole.