THE DANISH SCIENTIFIC EXPEDITION TO PATAGONIA AND TIERRA DEL FUEGO 1978-1979

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THE DANISH SCIENTIFIC EXPEDITION TO PATAGONIA AND TIERRA DEL FUEGO 1978-1979

HENRIK BREUNING MADSEN, EBBE SCHMIDT NIELSEN AND SØREN ØDUM

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The paper surveys geographical, botanical and zoological projects dealt with during six months of travelling and fieldwork in the Argentinean and Chilean Andes and adjacent lowlands: Soil development in relation to climate. General entomological and botanical studies and collecting work. Entomological collecting especially within certain families of Lepidoptera. Studies on snowbed vegetation an alpine lifeforms. Collecting of seed of Araucaria *for provenance trials and of* Nothofagus *seedlings for forestry experiments on the Faroe Isles. Collecting of* Hordeum, Plantago *and* Solanum *for taxonomic studies and experiments.*

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Fig. 1: Bertel Chr. Skou at the final planning in the committee at the Zoological Museum, Univ. of Copenhagen, in Sept. 1978.

Fig. 1: Dir. Bertel Chr. Skou ved det afsluttende planlægningsmøde i ekspeditionskomiteen, september 1978.

INTRODUCTION

During a dendrological collecting expedition from Hørsholm Arboretum to Argentina in 1975 the idea of a broader scientific expedition to Patagonia and Tierra del Fuego arose. After return to Denmark possibilities and qualified projects were considered with colleagues at university institutes. An outline of a possible expedition was then discussed with director Bertel Chr. Skou, Christiani & Nielsen, Buenos Aires, whom the arboretum people met in 1975, and with the Danish ambassador to Argentina at that time, Mrs. Nonny Wright, and they both supported the idea.

Dir. Bertel Skou most generously offered to cover all costs in the field of an expedition in Argentina. On this fundamental basis detailed planning of projects could be started, and a committee was formed with the purpose of supporting the planning and applying foundations and firms for cover of travelling expenses, etc. The commitee was joined by Dir. Bertel Chr. Skou, Dir. Jan Bonde Nielsen, Dir. A. W. Nielsen, Prof. T. W. Böcher, Prof. N. Kingo Jacobsen, Prof. Bent Muus, Dr. Arne Schiøtz, Dr. Bent Søegaard, and Dendrol. S. Ødum (secretary).

His Royal Highness, Prince Henrik, accepted kindly to be the protector of the expedition.

Bertel Chr. Skou carried out important planning work in Argentina, informed authorities and effected useful contacts. With a Ford pick-up from Christiani & Nielsen and a Unimog from Mercedes-Benz, Buenos Aires, placed at free disposal for the expedition, transportation problems were solved. Thanks to substantial support from Danish sources, travels to and from South America were secured,

LIST OF PARTICIPANTS in the expedition with approximate periods of field work

Geography

Henrik B. Madsen, Geographical Institute, Univ. of Copenhagen 1. 11. 1978 - 15. 1. 1979

Peter Frederiksen, Geographical Institute, Univ. of Copenhagen 1. 11. 1978 - 15. 4. 1979

Entomology

Ebbe Schmidt Nielsen, Zoological Museum, Univ. of Copenhagen 1. 11. 1978 - 15. 4. 1979

Søren Langemark, Zoological Museum, Univ. of Copenhagen 1. 11. 1978 - 15. 1. 1979

Bent W. Rasmussen, Zoological Museum, Univ. of Copenhagen 1. 11. 1978 - 30. 1. 1979

Ole Martin, Zoological Museum, Univ. of Copenhagen 15. 1. 1979 - 15. 4. 1979

Ernst Traugott-Olsen, c/o Zoological Museum, Univ. of Copenhagen 1. 11. 1978 - 15. 1. 1979

Botany

Niels Jacobsen, Institute of Systematic Botany, Univ. of Copenhagen 15. 12. 1978 - 1. 2. 1979

Fig. 2: The expedition members at the departure from S. C. de Bariloche, Jan. 6. From left Schmidt Nielsen, Lægaard, Rasmussen, Frederiksen, the daughter of the owner of hosteria Las Cartas, Traugott-Olsen, Madsen, Langemark, Baum and Jacobsen.

Fig. 2: Ekspeditionsdeltagerne ved afrejsen fra S.C. de Bariloche d. 6. 1. 1979. Fra venstre: Schmidt Nielsen, Lægaard, Rasmussen, Frederiksen, datteren fra hosteria las Cartas, Traugott-Olsen, Madsen, Langemark, Baum og Jacobsen.

Ronald von Bothmer, Institute of Systematic Botany, Univ. of Copenhagen 1. 2. 1979 - 1. 4. 1979

Bernard R. Baum, Biosystematic Research, Institute, Ottawa, Canada 1. 1. 1979 - 1. 3. 1979

Knud Rahn, Botanical Garden, Univ. of Copenhagen 15. 1. 1979 - 1. 4. 1979

J. P. Hjerting, Botanical Garden, Univ. of Copenhagen 1. 2. 1979 - 14. 4. 1979

Simon Lægaard, Botanical Institute, Univ. of Århus 15. 12. 1979 - 1. 3. 1979

Søren Ødum, Arboretum, Royal Vet. and Agric, Univ. 15. 2. 1979 - 16. 4. 1979

Trondur Leivsson, Plantation Comm., Torshavn, Faroe Isles 1. 4. 1979 - 16. 4. 1979

ITINERARY

Most fieldwork was carried out in the patagonian andine area. However, the routes travelled by the expedition, map Fig. 4, covered a broad variety of geographical and ecological conditions, see maps Fig. 5-7.

Fig. 3: The expedition members at the departure from Tecka, Febr. 17. From left Ødum, Rahn, Bothmer, Frederiksen, Hjerting, Schmidt Nielsen, Martin and Baum.

Fig. 3: Ekspeditionsdeltagerne ved afrejsen fra Tecka d. 17. 2. 1979. Fra venstre: Ødum, Rahn, Bothmer, Frederiksen, Hjerting, Schmidt Nielsen, Martin og Baum.

23.10.78 The first group arrived at Buenos Aires.

5.11.78 Both cars arrived at Colonia Suiza, W of San Carlos de Bariloche, Prov. Rio Negro, where headquarters were put up at Hosteria »Las Cartas«. Until 5.1.79 all field work took place in the Bariloche area, in Puerto Blest at the W end of Lago Nahuel Huapi, at Cerro Lopez, Cerro Otto, Cerro Tronador, and many excursion lasting from few days to a week were made to adjacent areas, e.g. to San Martin de los Andes, Pucará, and Hua-Hum at Lago Lacar, Lago Tromen, El Bolson, Lago Puelo, along river Limay to Piedra del Aguila, Arroyito, and Neuquen, and to Igr. Jacobacci and Villa La Angostura.

15.12.78 Jacobsen travelled in Prov. Buenos Aires until 2.1.79 collecting *Hordeum* and joined the expedition in Bariloche 3.1.79.

6.1.79 Both cars left Bariloche going south to respectively Tierra del Fuego and Lago Argentino.

15.1.79 Both cars met in Rio Gallegos for exchange of participants.

16.1.79 Both cars left for Tierra del Fuego. Headquarters were put up at Kaiken, at the E end of Lago Fagnano, in which area work took place until 26.1., with excursions to Rio Grande, Auricosta, Paso Garibaldi, Rio Ewan, Ea.Cullen, Ea. Haberton and Ushuaia.

25.1.79 One car left Kaiken and crossed around in Prov. Magellanes, Chile, and Prov. Santa Cruz, Argentina, passing through Punta Arenas, Rio Gallegos, Rio Coig, Piedra Buena, Rio Chico, Ea. La Julia, El Calafate, Tres Lagos, Laguna Grande, Gobernador Gregores, Puerto San Julián, El Salado, Puerto Deseado, Caleta Olivia, Pico Truncado, Perito Moreno, Rio Fénix Grande, Paso Rio Mayo, Coihaique, and to Sarmiento.

26.1.79 The other car moved the headquarters from Kaiken to Parque Nacional Tierra del Fuego.

5.2.79 From Parque Nacional Tierra del Fuego to Rio Grande, from where Lægaard flew to S.C. de Bariloche, where he worked until 1.3. The car left Tierra del Fuego via Porvenir-Punta Arenas, and came via Rio Gallegos, Tres Cerros, Rio Deseado, Caleta Olivia and Comodoro Rivadavia to Sarmiento 14.2. to meet the other car.

15.2.79 Repacking of cars, collecting near Sarmiento.

16.2.79 To Tecka, where the two cars separated. One went north and arrived at Tucuman 4.3. via Esquel, Bariloche, Pilcaniyeu, Lago Mascardi, Junin de los Andes Zapala, Barrancas, Malargüe, Los Molles, Consulta, Mendoza, Chacras de Coria, José de Jachál, Famatina, and Tafi del Valle. The other car with botanists and entomologists went to Corcovado and Parque Nacional Los Alerces, Esquel, Lago Puelo, Lago Steffen and to the first headquarters at Colonia Suiza, working for one week in the Bariloche area.

5.3.79 The car in Tucuman left for a collecting tour in the NW-most provinces being back in Tucuman 13.3. This trip went via Jujuy, Volcan, Cafayate, Amaicha del Valle, Santa Maria, Andalgala, Alamito, Yunka Suma, Catamarca, and El Rodeo.

The other car left Bariloche 7.3. and arrived at Alumine 13.3. via Villa La Augostura, Puyehue, San Martin de los Andes, Laguna Verde, Lago Tromen and Bajada de Rahue.

13.3.79 After a period in the Tucuman area a tour was made to Mendoza and Santiago de Chile and somewhat towards the north in Chile, and again back to Mendoza where the two cars met 31.3. This trip went via Catamarca, La Rioja, Chepes, Mendoza, Villavicencio, Uspallata, Las Cuevas, Santiago de Chile, Puente del Alto, Vina del Mar, Quinteros, Zapallar, Los Vilos, La Serena, Banos del Toro, Los Andes, Rio Colorado, Las Cuevas to Mendoza.

The other car was during this period mainly crossing around collecting seed passing through Lago Ruca Choroi, Lago Alumine, Lonquimay, Angol, Los Alpes, Cordillera Nahuelbuta, Canete, Contulmo, Termas de Manzanar, Las Lajas, Copahue, Chos Malal, Barrancas, Laguna del Maule, Talca, Santiago de Chile, Farellones, Curimon, Punta del Inca, Uspallata, Villavicencio to Mendoza.

31.3.79 The two cars went to Tucuman via Chepes, La Rioja and Catamarca.

3.4.79 One car left for the NW-most Argentina and the border of Bolivia via Jujuy, Humahuaca, La Quiaca, Sta. Victoria and returned to Jujuy to meet the other car, which during this period had been operating around Rosario de la Frontera.

8.4.79 Leivsson and Ødum went by air from Jujuy to Tierra del Fuego in order to collect seedlings of *Nothofagus*. The two cars went to Lib. Grl. San Martin, and then to Rosario de la Frontera, which were the headquarters until 12.4. During this period one excursion was undertaken to Parque Nacional El Rey.

12.4.79 The two cars left Rosario de la Frontera to Tucuman, from where they returned to Buenos Aires via Santiago del Estero, Ceres and San Nicolas. Arrival at Buenos Aires 15.4.

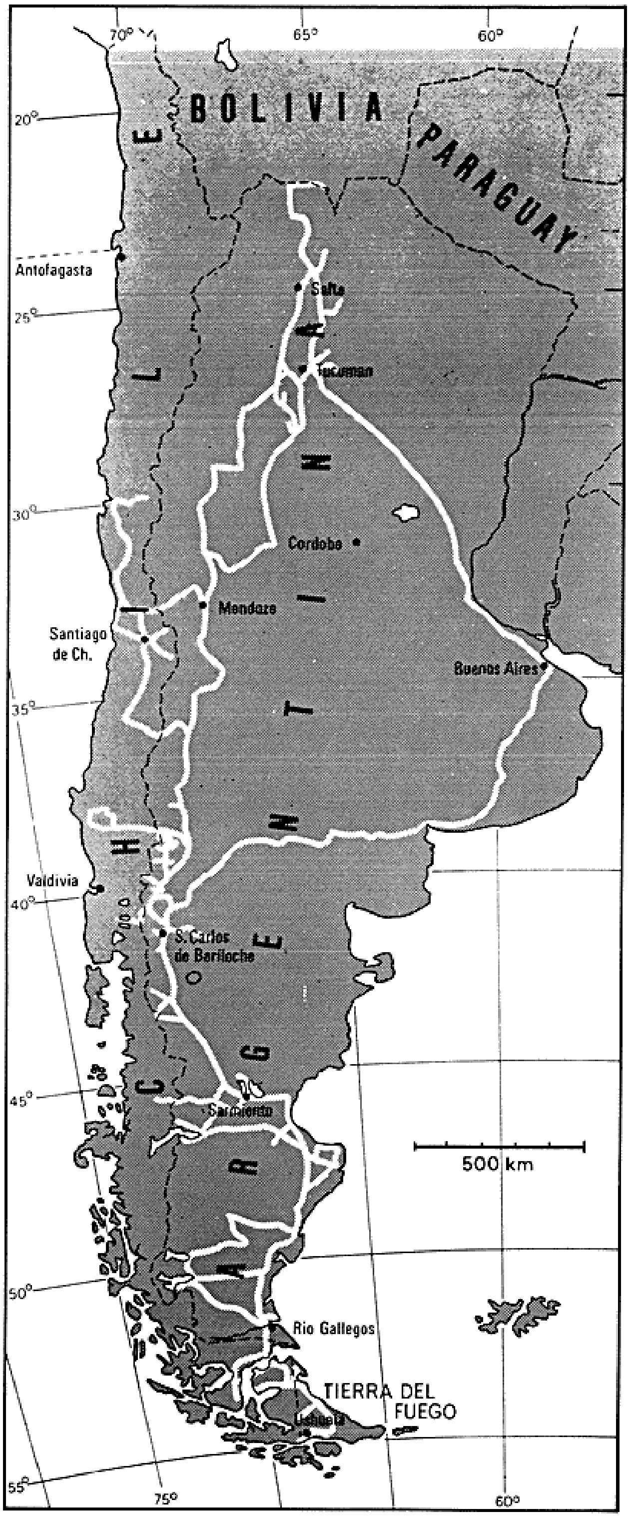


Fig. 4: The route of expedition which started at Buenos Aires Oct. 23 1978 reaching S.C. de Bariloche Nov. 5 1978, Tierra del Fuego Jan. 9 1979, Tucuman 4-3 1979, and back to Buenos Aires Apr. 15 1979.

Fig. 4: Ekspeditionsruten.

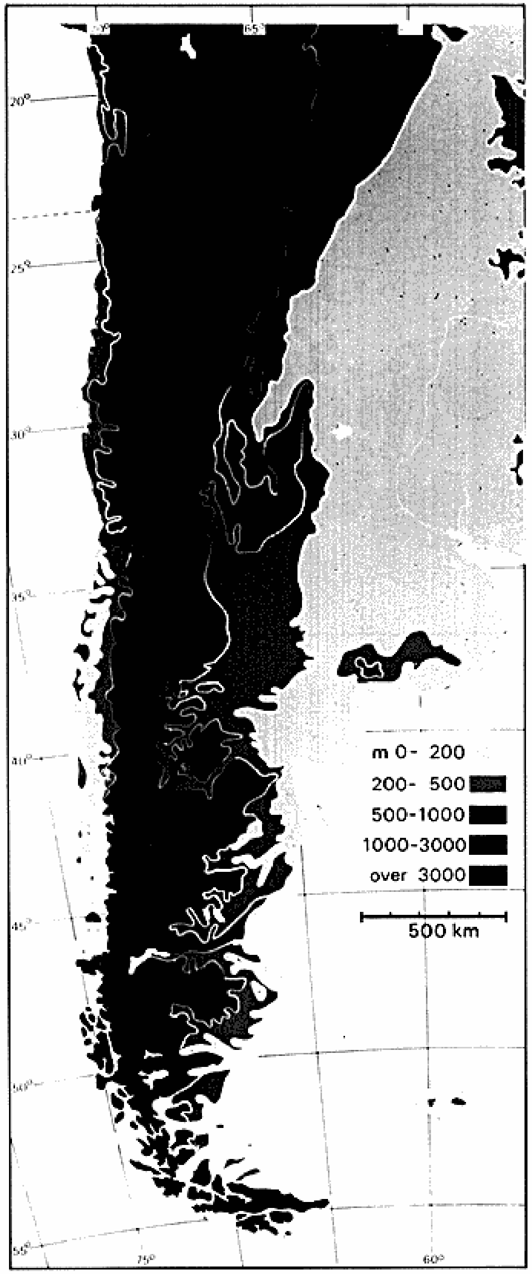


Fig. 5

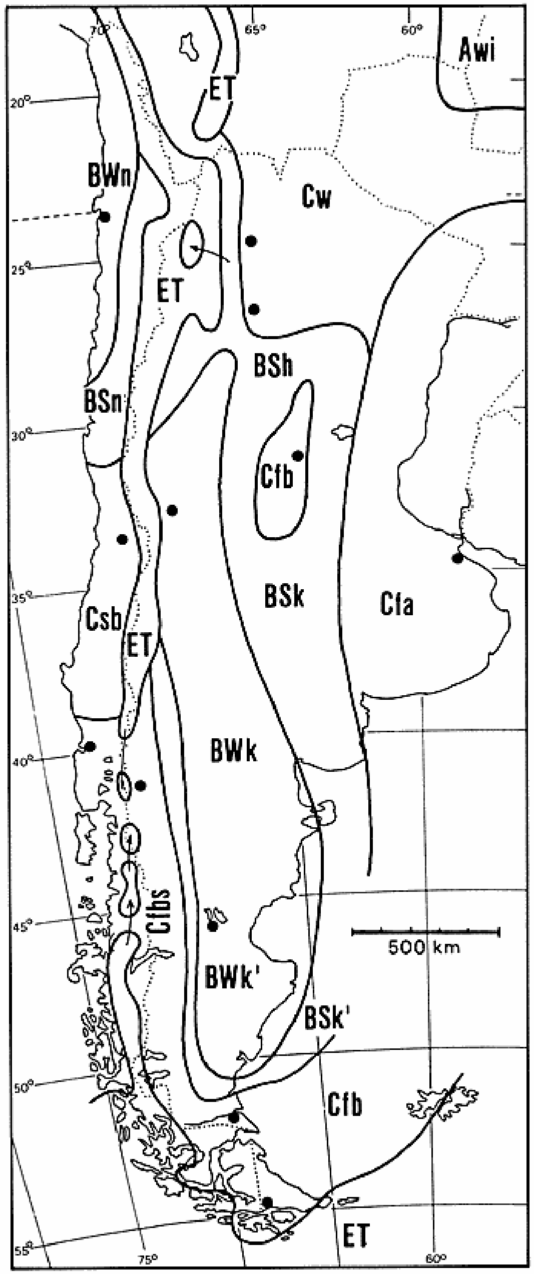


Fig. 6

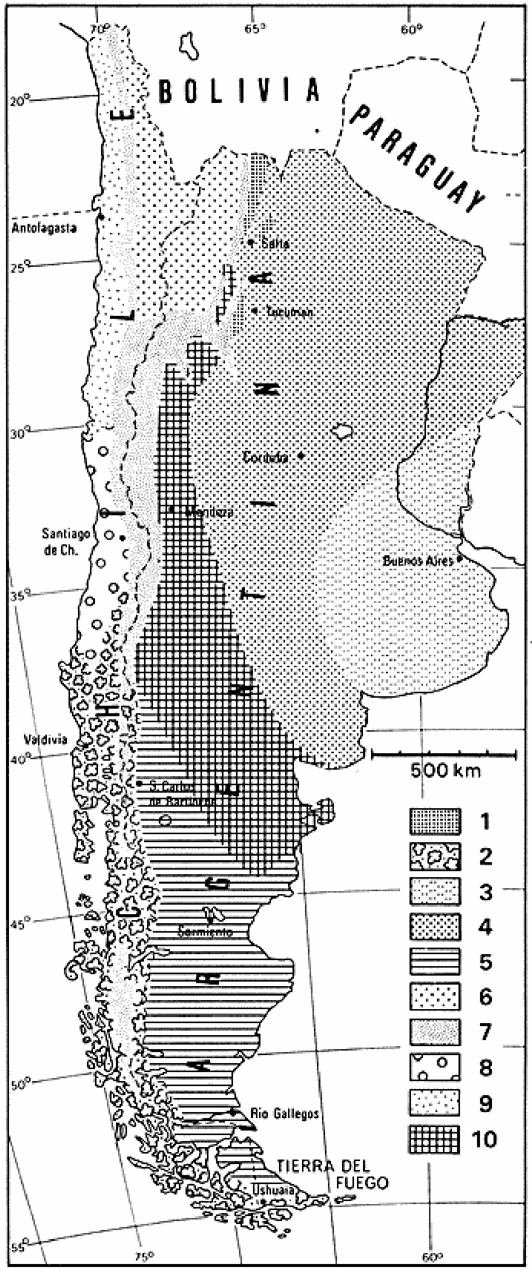


Fig. 7

Soil Geography

HENRIK BREUNING MADSEN & PETER FREDERIKSEN

The purpose of the geographic project was to investigate the relationship between soil development and climate in places where the climatic gradient is strongly evident due to the presence of a mountain chain.

The location of the southernmost Andes in an area with westerly winds and cyclones offers good possibilities for comparisons with Scandinavian soils; this is especially due for the eastern mountainsides where Quaternary glaciations have left moraine systems and outwash plains. Also this southernmost part of the Andes reaches high altitudes and functions as a barrier sheltering effectively against rains; soils developed in till in a dry environment can specifically be investigated here.

The investigations have been concentrated on three main localities: Bariloche, Tierra del Fuego, and Tucuman. The first is dominated by volcanic ashes, the second by glacial and glacio-fluviatile deposits, and the third by loess.

BARILOCHE

The investigation area is situated at the southern side of lake Nahuel Huapi at 41° S lat. Geologically the area is influenced by the eastern part of the Cordilleras which have up to 3000 m high peaks and deep glacial-eroded valleys, some of them embedding lakes. Nahuel Huapi has been formed in such a valley, delimited to the east by lateral moraines. After the last glaciation period there has been volcanic activity in the area and in several places thick layers of volcanic ashes are found. The age of these layers has been investigated by Salmi (1941), Auer (1950), and Laya (1977).

Climatologically, westerly winds dominate with migrating cyclones which are losing most of their humidity over the Andes as orographic precipitation. There is thus across the Andes chain a strong precipitation gradient; e.g. at Puerto Blest 3-4000 mm, in contrast to Maquinchao 400 km E of the chain which only receives 173 mm. As the cyclones in summer normally pass south of 40°S lat., the precipitation has a marked winter maximum which is most evident east of the chain where summer-months with nearly no precipitation often occur.

Fig. 5: Topographical map of Argentina and Chile.

Fig. 5: Topografisk kort over Argentina og Chile.

Fig. 6: The climate of the southern part of S. America according to Köppen. (1936).

Fig. 6: Klimakort over den sydlige del af Sydamerika, Köppen 1936.

Fig. 7: The vegetation zones in Argentina and Chile.
1: Subtropical forest. 2: Southern forest. 3: Pampas. 4: Xerophytic woodland and scrub. 5: Patagonien scrub. 6: Puna. 7: High andean vegetation and ice. 8: Chilean xerophytic scrub (medit. type) 9: Semidesert and desert. 10: Monte og prepuna.

Fig. 7: Vegetationszoner i Argentina og Chile.
1) Subtropisk skov. 2) Tempereret skov. 3) Pampas. 4) Chaco. 5) Patagonisk steppe. 6) Puna. 7) Højandin vegetation. 8) Maki (medit. type). 9) Halvørken og ørken. 10) Monte og præpuna.

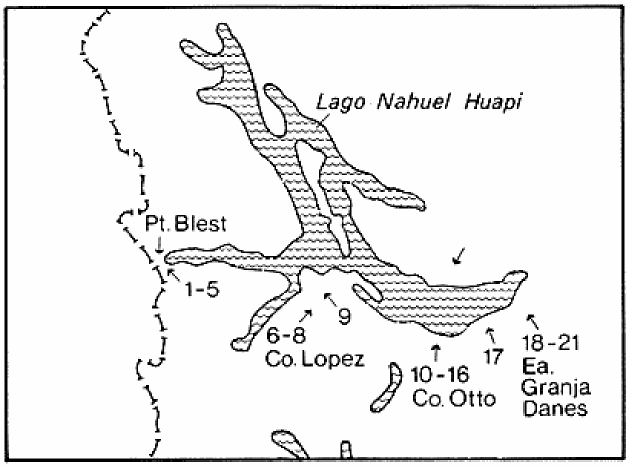


Fig. 8. Location of the investigated profiles around Lake Nahuel Huapi.
Fig. 8: Den geografiske placering af de undersøgte profiler omkring Nahuel Huapi søen.

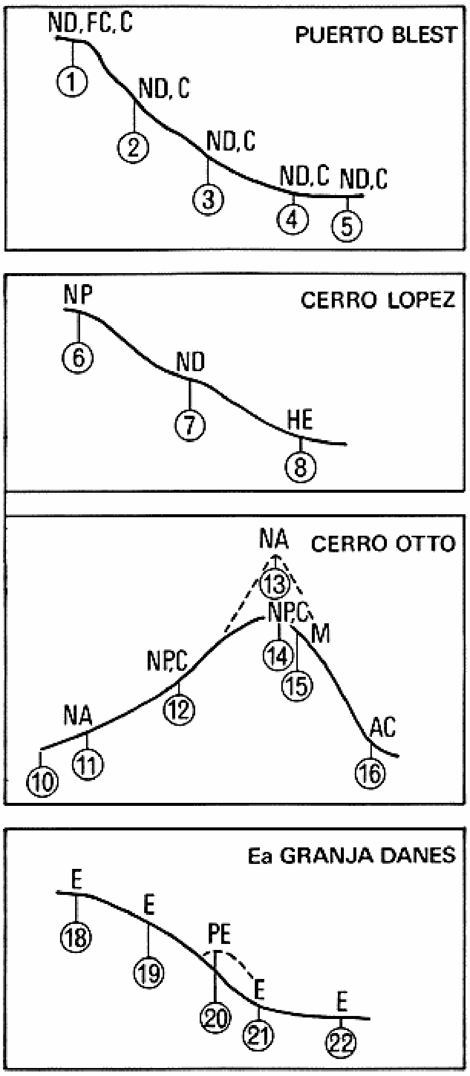
Temperatures at the lake surface vary from 3 to 15°C for warmest and coldest month with risk of night frost every month, especially in the eastern part, due to strong outgoing radiation.

The very high precipitation gradient, the extremely dry summers, and the low soil water capacity is reflected in marked vegetation zones from the Andes and eastward. At the western part of the lake, rain forest with *Nothofagus dombeyi, Fitzroya cupressoides, Chusquea culeou* is dominating, and *Nothofagus pumilio* is occupying the more elevated places. Around Cerro Lopez the forest is more open with *Nothofagus dombeyi* (800-1000m alt.) and *Nothofagus pumilio* (1000m-treeline 1600m alt.) whereas, at Cerro Otto, *Austrocedrus chilensis* and *Nothofagus pumilio* are the dominating trees. East of Bariloche, grass steppe dominates.

DESCRIPTION OF THE PROJECT

The purpose of the studies at lake Nahuel Huapi was to elucidate how climate and parent material influence the pedological development when sheltered by a mountain chain. It was decided that most of the profiles were to be dug in volcanic ashes, which dominate the area. Moreover it was aimed at to investigate a toposequence in each of the main vegetation zones. Fig. 8 shows the geographical location of the toposequences and the single profiles, and in Fig. 9 the toposequences have been drawn.

A total of 25 profiles were investigated, ranging from soils developed in volcanic ashes, over glaciofluvial sand, to aeolian sand, moraines, and talus creep. Two of the investigated profiles were taken outside the shown area as they were studied at a salt-pan near Ing. Jacobacci about 200 km east of lake Nahuel Huapi. From the profiles, samples were taken in rings for determining water retention and other samples for chemical determinations.



1. (A)C, volcanic ash, A:815 m
2. A(B)C, volcanic ash, A:795 m
3. A(B)C, volcanic ash, A:780 m
4. A(B)C, volcanic ash, A:765 m
5. A(B)CIICg volcanic ash, A:760 m

Precipitation: 3000-4000 mm/year.

6. A(B)CIICR, volcanic ash upon moraine, A:1370 m
7. A(B)CIIC, volcanic ash upon moraine, A:990 m
8. AhGoIIAhIIGoIIIAh, fluvial sand, A:820 m

Precipitation: about 1500 mm/year.

10. AIIBIIC, volcanic ash upon moraine, A:915 m
11. A(B)C, volcanic ash, A:950 m
12. A(B)C, volcanic ash, A:1010 m
13. A(B)CR, volcanic ash, A:1310 m
14. A(B)C, volcanic ash, A:1085 m
15. ACR, talus, A:1081 m
16. AIIC, colluvium, A:940 m

Precipitation: about 1100 mm/year.

18. (A)R, talus
19. (A)(B)C, volcanic ash mixed with talus
20. (A)(B)C, volcanic ash
21. (A)(B)C, volcanic ash mixed with talus
22. (A)(B)C, volcanic ash and lake deposits

Precipitation: about 800 mm/year, A about 800 m

Fig. 9: Toposequences investigated around Lake Nahuel Huapi. M: maki. ND: *Nothofagus dombeyi.* C: *Chusquea culeou.* NP: *Nothofagus pumilio.* NA: *Nothofagus antarctica.* AC: *Austrocedrus chilensis.* HE: pasture. E: *Stipa.* PE: Pines (planted).

Fig. 9: De undersøgte toposekvenser ved Nahuel Huapi søen. M: maki. ND: Nothofagus dombeyi. *C:* Chusquea culeou. *NP:* Nothofagus pumilio. *NA:* Nothofagus antarctica. *AC:* Austrocedrus chilensis. *HE: pasture. E:* Stipa. *PE: fyr (plantet).*

The preliminary results indicate that the pedological development in the volcanic soils is very weak, and more than a structural B-horizon was not observed. In forest areas, the humus type was mould with a marked trend towards weaker developed A-horizons the drier the climatic conditions; thus, east of Bariloche, in the grass-steppe, the A-horizon was only little significant, or, not developed at all.

Under a 16-year old pine plantation at Ea. Granja Danes, no humus layer was found, neither was a beginning podzolization observed. Degree of leaching decreased eastward due to decreasing precipitation; at Puerto Blest, in the uppermost horizons, pH-values of 4 were common, increasing to about 6 at 1-m depth. At Ea Granja Danes, pH was 6 for the whole profile, and a bit farther eastward, the first salt crusts were observed as also soils with petrocalcic horizons.

The weather conditions along the lake were studied at 6 climatological stations which recorded precipitation, evaporation, and maximum and minimum temperatures. Moreover, measurements of radiation and energy balances were made in the four vegetation zones.

TIERRA DEL FUEGO

Tierra del Fuego, the southernmost archipelago of South America, is divided from the continent by the glacially eroded Magellan Strait. The main island, by the Beagle Channel separated from the southernmost islands which terminate in Cape Horn, is geologically in its northern part a continuation of southern Patagonia's glacial and glaciofluvial deposits, whereas the southern part is a continuation of the Cordilleras. Geomorphologically, Tierra del Fuego is in its southern parts characterized by glacial erosion (valleys, fiords, sounds), and north of the Cordilleras by sandy and gravelly moraines and outwash plains from the Pleistocene glaciation and subsequent deglaciation.

Climatically, weather is dominated by extratropical cyclones with unstable polar airmasses. The major part passes through the Drake Strait, whereas the rest, upon passing the Cordilleras, generally dissolve and give orographic precipitation, mainly on the southwestern mountain slopes; this results in a marked precipitation gradient from SW towards NE and a more continental climate towards the NE. According to Köppen (1936), Rio Grande thus has a Cfc-climate and Ushuaia an ET-climate. Vegetation distribution is reflecting the climate. On the southern part of the main island *Nothofagus pumilio* is mixed with *Nothofagus betuloides*, northwards grading into pure *Nothofagus pumilio*. At Lago Fagnano it is replaced by *Nothofagus antarctica*, which at Rio Grande disappears and is replaced by Patagonian steppe with *Stipa*.

From Tierra del Fuego and the northern coast of the Magellan Strait soil samples have been taken from a total of 36 profiles developed on Quaternary sediments, hereof 16 glacial, 4 glaciofluvial, 5 glaciolacustrine, 3 marine, 2 fluvial, 4 colluvial, 1 aeolian, and 1 marsh profile. The location of the profiles and their horizon sequence, parent material, vegetation, annual precipitation, gradient and drainage condition appear from Fig. 10 and Table 1.

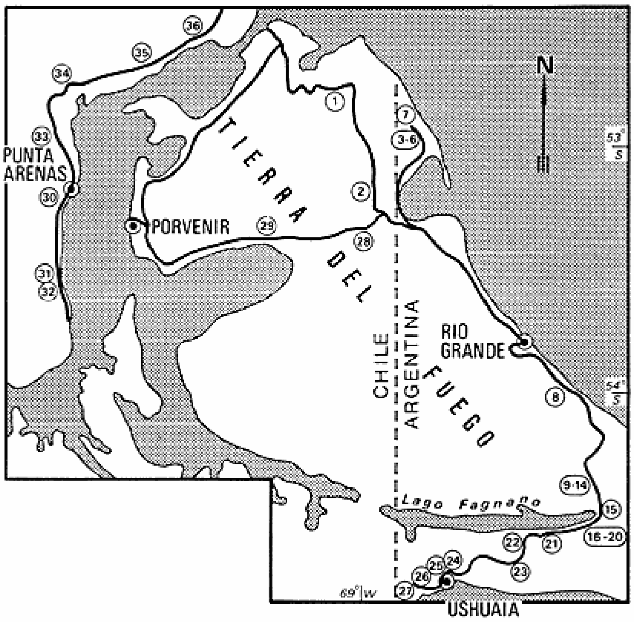


Fig. 10: Location of soil profiles in Tierra del Fuego and southern Patagonia.
Fig. 10: Den geografiske placering af de undersøgte profiler på Ildlandet og det sydlige Patagonien.

No.	Horizon sequence	Geogenesis and parent material	Vegetation	Annual precipitation (mm/year)	Gradient (°)	Drainage condition	Soil-retention samples
1	A1 A2 A3 B(t) C	pre-quaternary	*Stipa*	300	6-12	well	
2	(A) C IIC	salt-marsh, sandy	*Lepidophyllum*	370	0	somewh. exc.	
3	A1 A2 B(t) C	till, sandy	*Stipa*	350	0-2	well	x
4	Boring (in saltlake)	lagoon, sandy	no vegetation	350	0	imperfect	
5	Boring (in saltlake)	lagoon, sandy	no vegetation	350	0	imperfect	
6	A1 B Bg Cg	colluvium, sandy	green grass	350	<2	imperfect	x
7	A C IIC	glaciofluvial, sandy/gravelly	*Stipa*	350	?	somewh. exc.	
8	(A) C II(A) IIC	aeolian, sand	*Elymus*	300	2	somewh. exc.	
9	Ah Go Gr	fluvial, sand	green grass	400	0-2	imperfect	x
10	A C IIC	glaciofluvial, sand/gravel	*Stipa*	400	½	excessive	x
11	A1 B(t) C	till, sandy	*Noth. antarctica*	400	0-2	well	x
12	A Bg Cg	till or coll., sandy	*Noth. antarctica*	400	2-6	mod. well	x
13	(A) C	fluvial, sand	*Stipa*	400	0	somewh. exc.	
14	A IIC IIIC IVC	glaciofluvial, sand/gravel	*Stipa*	400	0	excessive	
15	A21 A22 B2t C	till, clay	*Noth. pumilio*	450	6-12	mod. well	
16	A1 A21 A22x B2tx B3tx C	glaciolacustrine, clay	*Noth. pumilio*	450	18	mod. well	x
17	A1 A2 B2tg B3tg Cg	glaciolacustrine, clay	green grass	450	11	imperfect	x
18	A1 Cg	glaciolacustrine, clay	green grass	450	6	poor	x
19	A1 A2 B2tg(ox) B3tg(red) Cg C	glaciolacustrine, clay	*Noth. pumilio*	450	6	mod. well	x
20	(A1) A2 B2t B3t C	glaciolacustrine, clay	*Noth. pumilio*	450	0	mod. well	
21	A1 A2 B(s) IIC	till or coll., sand	*Noth. pumilio*	475	31	well	
22	A1 A2 Bs(placic) C IIC	colluvium, sand/gravel	*Noth. pumilio*	600	27	mod. well	
23	A1 A2 B(s) C	colluvium, sand/gravel	*Noth. pumilio*	550	20	somwh. exc.	
24	A1 A2 Bs IIC IIIC	till, sandy	*Noth. pumilio*	550	4	well	x
25	A1 A2 B(s) C IIC	till, sandy	grass shrubs	550	16	well	
26	A1 B Bs C	colluvium, sandy	*Noth. pumilio*	550	20	mod. well	
27	A1 A2 Bs C	marine, gravel	*Noth. pumilio*	550	2	somewh. exc.	
28	A1 A2 B(t) C	till, sandy	*Stipa*	350	0-2	well	
29	A C	till, sandy	*Stipa*	330	0-2	somewh. exc.	
30	A1 A2 B(t) C	till, sandy	*Noth. pumilio*	450	0-2	somewh. exc.	
31	A1 A2 B(t) C	till, sandy	thornbushes	500	0-2	somewh. exc.	
32	A1 A2 B(s) C	till, sandy	*Noth. betuloides*	500	6	somewh. exc.	
33	A1 A2 B2t B3t C	till, sandy/clayey	*Stipa*	400	0-2	well	
34	A1 A2 B(t) C	till, sandy	*Stipa*	350	0-2	somewh. exc.	
35	A1 C IIC	glaciofluvial, gravel	*Stipa*	250	0	excessive	
36	A1 A2 B(t) C	till, sandy	*Stipa*	275	0-2	well	

Table 1. Soil profiles from Tierra del Fuego and southern Patagonia. Textural classes are rough, field-determined approximates.

Tabel 1. Foreløbig beskrivelse af profilerne fra Ildlandet og det sydlige Patagonien. Teksturen er bestemt i felten.

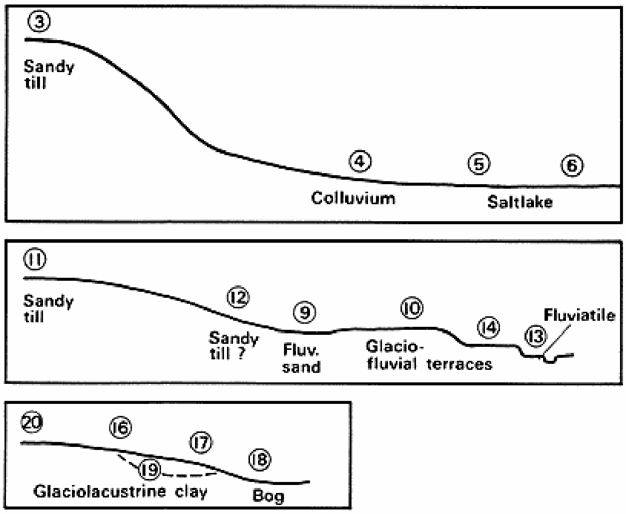


Fig. 11: Investigated toposequences in Tierra del Fuego.
Fig. 11: Undersøgte toposekvenser på Ildlandet.

Emphasis is laid upon: 1) toposequence studies (profiles 3-6, 9-14, and 16-20, (see also Fig. 11) under different climatic conditions, 2) an investigation of the podzolization process (profiles 21-27), 3) an investigation of clay mineralogy and degree of clay illuviation in sandy and clayey deposits with regard to a comparison with Scandinavian conditions, and, generally speaking, a comparison between the pedological development on the Quaternary sediments of the northern and southern hemisphere with special regard to glacial and glaciofluvial deposits.

The field methods were as follows: Profile description have been made according to FAO's Guidelines for Soil Profile Descriptions, and soil samples have been taken for chemical and physical investigations, including soil water retention samples (rings) from the toposequence profiles.

TUCUMAN

According to Zuccardi & Fadda (1972) the Tucuman province in the northwestern part of Argentina can be divided into two physiogeographical regions: 1) *the western mountainous region* consisting of a: Sierra Pampeanas (precambric crystalline basement and tertiary sediments), b: the subandine Sierras (anticlinals of mesozoic and teriary layers) and c: basins and intermountainous valleys (pleistocene slime and loess), 2) *the eastern plain region* which can be divided into d: the pedemountainous and the depressed plains (alluvial and colluvial sediments) and e: the chacopampeana plain (loess enriched by volcanic glasses). Soil studies have been undertaken in the c, d, and e subregions (Fig. 12).

The province lies in the subtropics and is influenced by anticyclonic activity with humid, unstable tropical air masses during the summer period. Running in a NNE-SSW direction through the province, the Andes chain functions as a barrier in many ways and thereby causes the great climatic

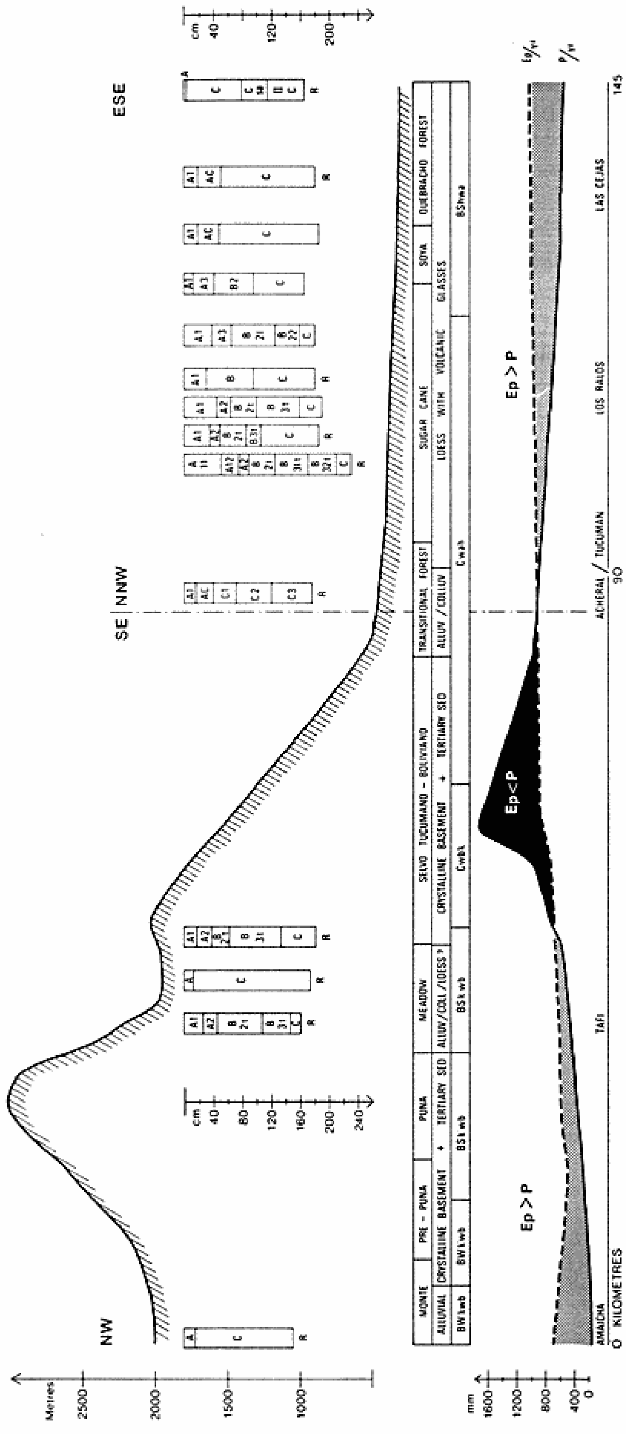


Fig. 12: Location of soil profiles in Prov. Tucuman. For each profile location, altitude, yearly precipitation, yearly potential evapotranspiration, climate zone according to Köppen (1936), parent material and vegetation are shown. Sources: Bruchmann (1971, 1978), Zuccardi & Fadda (1972). R = Samples for soil water retention have been taken.
Fig. 12: Den geografiske placering af de undersøgte profiler i Prov. Tucuman. For hvert profil kan aflæses: Højde over havniveau, årlig nedbør, årlig potentiel evapotranspiration, klimazone efter Köppens inddeling, udgangsmateriale og vegetation.

differences recorded in this province. On the plains the climatic gradient runs perpendicular to the eastern mountain slope, that is, from the chain and eastward, precipitation declines whereas annual mean temperature and potential evaporation increase. Consequently, the easternmost part of the plain has a high water deficit. Water surplus is found in the westernmost part of the plain and the eastern mountain slope, where most of the water contained in the air masses precipitates; this is also seen in the vegetation type with subtropical rain forest. West of the slope, both precipitation, potential evaporation, and annual mean temperature are significantly lower due to the shelter effect of the chain and the higher elevation (see Fig. 12).

Thus, when going E-W through the province one passes the following climatic zones: Bs, Cwah, Cwbk, Bs, and Bw climates (Bruchmann 1978) i.e. from arid steppe climate over hot temperated, damp climates, to arid steppe climate and finally, a desert climate - a zonation which is clearly reflected in vegetation as shown in Fig. 12. Soil samples have been taken from a total of 16 profiles whose location appear also from Fig. 12. All profiles were taken in Quaternary sediments, hereof 13 in loess, 2 in colluvium of loess and 1 in alluvial material.

The sites of the profiles were selected in order to obtain a climatic sequence; most clearly expressed on the Chaco-pampean plain with a clear relationship between precipitation, potential evaporation, and degree of clay illuviation: Fig. 12 illustrates this with a C_{sa}-horizon in the east (Bs-climate), and a B2t-horizon in the western part of the plain (Cwah-climate). Moreover, samples were taken in intermountainous valley soils (Bs and Bw climates) and on the pedemountainous plain.

The working methods were the same as applied in Tierra del Fuego and at Bariloche as regards profile descriptions and sampling, including retention samples from 10 profiles.

The samples are now being analyzed at the Geographical Institute, University of Copenhagen.

Entomology

EBBE SCHMIDT NIELSEN

Participance in the Danish Scientific Expedition to Patagonia and Tierra del Fuego fulfilled one of the primary wishes from the Department of Entomology, Zoological Museum, University of Copenhagen. As the museum devotes its research essentially to systematics and zoogeography, the possibility of extensive collecting activities in southern South America was beforehand regarded as particularly desirable, as the fauna here is likely to emphasize groups of interest for a substantiate understanding of zoogeography based on the plate tectonic theory. Moreover, from Argentina and Chile are known a number of representatives of higher insect taxa which within their respective higher groups seemingly are essentially primitive, or seem to hold a key-position for an understanding of the phylogeny of the higher group to which they are currently assigned. Examples are the Peloriidae among the Hemiptera, the Notiothaumidae and Nannochoristidae among the Mecoptera and Heterobathmiinae, Neopseustidae, Hepialoidea, Nepticuloidea and Incurvarioidea among the Lepidoptera. The main purpose of the entomological activities was therefore to collect such groups and to collect Lepidoptera, especially Microlepidoptera, and moreover to undertake a general collection of insects.

Collecting sites

The main collecting sites (localities) visited during the expedition are numbered. Label information for the collected specimens includes the locality number, the italicized text in the following locality list and *Mision Cientifica Danesa.* In the list is indicated, the altitude, latitude - longitude reference, and so is the Universal Transversal Mercator (U.T.M.)-reference (grid zone and 10 km grid square). Following the lists of localities, a short characteristics of the vegetation types are given, and the relevant locality numbers are listed.

List of sampling localities

1. *Argentina*, Prov. *Buenos Aires*, parks in central *Buenos Aires.* 34° 33' S, 58° 25' W; 21 H UB 72.
2. *Argentina*, Prov. *Buenos Aires, Tigre, Paranâ de los Palmas.* 34° 20' S, 58° 30' W; 21 H UC 69.
3. *Argentina*, Prov. *Buenos Aires*, W of *La Plata, Pereyra.* 34° 50' S, 58° 05' W; 21 H VB 05.
4. *Argentina*, Prov. *Buenos Aires*, W of *Oriente, Zubiaurre.* 38° 50' S, 60° 45' W; 20 H PB 90.
5. *Argentina*, Prov. *Buenos Aires, Rio Quequen* E of *Oriente.* 38° 44' S, 60° 35' W; 20 H QC 18.
6. *Argentina*, Prov. *Neuquen*, surroundings of *Neuquen.* 38° 58' S, 68° 05' W; 19 H ES 71.
7. *Argentina*, Prov. *Rio Negro*, 20 km W of *S. C. de Bariloche, Colonia Suiza.* 800 m; 41° 05' S, 71° 32' W; 19G BQ 85.
8. *Argentina*, Prov. *Rio Negro*, W end of *Lago Nahuel Huapi, Puerto Blest.* 770 m; 41° 02' S, 71° 41' W; 19 G BQ 74.
9. *Argentina*, Prov. *Neuquen*, SW end of *Lago Lacar, Pucarâ.* 750 m; 40° 09' S, 71° 38' W; 19 G BR 74.
10. *Argentina*, Prov. *Neuquen*, S of *Lago Meliquina, Caleufú.* 800 m; 40° 23' S, 71° 15' W; 19 G CR07.
11. *Argentina*, Prov. *Rio Negro*, 15 km NE of *S. C. de Bariloche, Nirihuau.* 760 m; 41° 04' S, 71° 09 W; 19 G CQ 18.
12. *Argentina*, Prov. *Neuquen*, at *Rio Limay* 50 km W of Neuquen, *Arroyito.* 39° 05' S, 68° 37' W; 19 H ES 32.

13. *Argentina*, Prov. *Chubut*, S of *El Bolson*, *Lago Puelo*.
220 m; 42° 11' S, 71° 36' W; 19 G BP 87.
14. *Argentina*, Prov. *Rio Negro*, 70 km S of *S. C. de Bariloche*, *Pampa del Toro*.
1000 m; 41° 32' S, 71° 29' W; 19 G BP 90.
15. *Argentina*, Prov. *Neuquen*, between Neuquen and S.C. de Bariloche at Rio Limay, *Piedra del Aguila*.
40° 03' S, 70° 04' W; 19 G DR 03.
16. *Argentina*, Prov. *Rio Negro*, SW of *S.C. de Bariloche*, *Camino del Tronador*.
800 m; 41° 13' S, 71° 50' W; 19 G BQ 66.
17. *Argentina*, Prov. *Rio Negro*, SW of *Villa Mascardi*, *Cascada Los Alerces*.
800 m; 41° 23' S, 71° 45' W; 19 G BQ 78.
18. *Argentina*, Prov. *Neuquen*, SE of *Lago Tromen*, *Rodeo Grande*.
900 m; 39° 42' S, 71° 11' W; 19 H LB 19.
19. *Argentina*, Prov. *Rio Negro*, *S. C. de Bariloche*, *Cerro Otto*.
1200 m; 41° 10' S, 71° 20' W; 19 G CQ 05.
20. *Argentina*, Prov. *Rio Negro*, 20 km W of *S.C. de Bariloche*, *Cerro Lopez*.
1400 m; 41° 06' S, 71° 35' W; 19 G BQ 85.
21. *Argentina*, Prov. *Chubut*, 15 km S of *Leleque*, *Colonia Lepá*.
700 m; 42° 29' S, 71° 04' W; 19 G CN 30.
22. *Argentina*, Prov. *Chubut*, *Tecka*.
750 m; 43° 24' S, 70° 51' W; 19 G CM 50.
23. *Argentina*, Prov. *Chubut*, 80 km S of *Tecka*, *Gobernador Costa*.
600 m; 43° 58' S, 70° 48' W; 19 G CM 56.
24. *Argentina*, Prov. *Santa Cruz*, S shore of *Lago Buenos Aires*, *Los Chenques*.
46° 31' S, 71° 17' W; 19 G CJ 25.
25. *Argentina*, Prov. *Santa Cruz*, 60 km W of *Fitz Roy*, *Pico Truncado*.
46° 50' S, 67° 57' W; 19 G EJ 88.
26. *Argentina*, Prov. *Santa Cruz*, 10 km S of *Fitz Roy*, *Rio Deseado*.
46° 36' S, 66° 45' W; 19 G FJ 76.
27. *Argentina*, Prov. *Santa Cruz*, *San Julián*.
49° 18' S, 67° 45' W; 19 F EF 96.
28. *Argentina*, Prov. *Santa Cruz*, *Lago Argentino*, *Península Magallanes*.
250 m; 50° 29' S, 73° 02' W; 18 F XK 39.
29. *Argentina*, Prov. *Santa Cruz*, S shore of *Lago Argentino*, 10 km W of *El Calafate*.
250 m; 50° 18' S, 72° 30' W; 18 F XK 77.
30. *Argentina*, Prov. *Santa Cruz*, 130 km NW *of Rio Gallegos*, *La Esperanza*.
51° 02' S, 50° 50' W; 19 F CD 75.
31. *Argentina*, Prov. *Santa Cruz*, surroundings of *Rio Gallegos*.
51° 37' S, 69° 30' W; 19 F DC 61.
32. *Chile*, Prov. *Magallanes*, *Tierra del Fuego*, 10 km W of *Cullen*.
40 m; 53° 07' S, 69° 05' W, 19 F DB 98.
33. *Argentina*, *Tierra del Fuego*, E end of *Lago Fagnano*, *Kaiken*.
100 m; 54° 20' S, 67° 18' W; 19 F FV 12.
34. *Argentina*, *Tierra del Fuego*, Parque Nacional Tierra del Fuego W of *Ushuaia*, *Lapataia*.
20 m; 54° 51' S, 68° 27' W; 19 F EV 37.
35. *Argentina*, *Tierra del Fuego*, NE of Ushuaia, *Paso Garibaldi*.
450 m; 54° 43' S, 67° 48' W; 19 F EV 76.
36. *Argentina*, *Tierra del Fuego*, Atlantic coast S of *Estancia Viamonte*, *Auricosta*.
2 m; 54° 03' S, 67° 19' W; 19 F FA 19.
37. *Argentina*, *Tierra del Fuego*, NE of Lago Fagnano, *Rio Ewan (south)*.
10 m; 54° 15' S, 67° 15' W; 19 F FV 11.
38. *Argentina*, *Tierra del Fuego*, E of *Lago Hantu*, *Ea. La Nueva*.
40 m; 54° 28' S, 67° 16' W; 19 F FV 13.
39. *Argentina*, *Tierra del Fuego*, at the Beagle Channal W of Ushuaia, *Estancia Haberton*.
54° 25' S, 67° 25' W; 19 F FV 03.
40. *Chile*, Prov. Magallanes, *Tierra del Fuego*, E shore of *Bahía Inútil*, *Onaisin*.
5 m; 53° 20' S, 69° 25' W; 19 F DA 70.
41. *Chile*, Prov. *Magallanes*, 30 km SW of *Punta Arenas*, *Puerto del Hambre*.
50 m; 53° 33' S, 71° 00' W; 19 F CA 63.
42. *Chile*, Prov. *Magallanes*, 150 km NE of *Punta Arenas*, *San Gregorio*.
5 m; 52° 32' S, 70° 02' W; 19 F DB 22.
43. *Argentina*, Prov. *Santa Cruz*, 130 km S of *Fitz Roy*, *Tres Cerros*.
48° 07' S, 67° 56' W; 19 F EG 72.
44. *Argentina*, Prov. *Santa Cruz*, 30 km S of *Caleta Olivia*.
40 m; 46° 35' S, 67° 35' W, 19 G FJ 05.
45. *Argentina*, Prov. *Santa Cruz*, 15 km S of *Comodoro Rivadavia*.
60 m; 46° 02', 67° 31' W; 19 G FK 19.
46. *Argentina*, Prov. *Chubut*, surroundings of *Sarmiento*.
600 m; 45° 25' S, 69° 37' W; 19 G DK 52.
47. *Argentina*, Prov. *Chubut*, 80 km W of *Tecka*, *Corcovado*.
750 m; 43° 27' S, 71° 25' W; 19 G CM 01.
48. *Argentina*, Prov. *Chubut*, W of *Esquel*, SE shore of *Lago Futalaufquen*.
600 m; 42° 46' S, 71° 43' W; 19 G BN 73.
49. *Argentina*, Prov. *Chubut*, W of *Esquel*, *Lago Menéndez*, *El Sagrario Puerto*.
550 m; 42° 37' S, 71° 53' W; 19 G BN 62.
50. *Argentina*, Prov. *Chubut*, *NE of Esquel*, *La Hoya*.
800-1350 m; 42° 47' S, 71° 15' W; 19 G CN 13.
51. *Argentina*, Prov. *Chubut*, surroundings of *Esquel*.
550 m; 42° 56' S, 71° 17' W; 19 G CN 15.
52. *Argentina*, Prov. *Rio Negro*, 75 km S of *S. C. de Bariloche*, *Lago Steffen*.
550 m; 41° 32' S, 71° 30' W; 19 G BP 90.
53. *Chile*, Prov. *Osorno*, *Parque Nacional Puyehue*, *Anticura*.
300 m; 40° 37' S, 72° 10' W; 19 G GR 39.
54. *Argentina*, Prov. *Neuquen*, NW of Lago Nahuel Huapi, *Paso Puyehue*.
1300 m; 40° 39' S, 71° 58' W; 19 G BQ 40.
55. *Argentina*, Prov. *Neuquen*, 50 km W of *Junin de los Andes*, *Laguna Verde*.
1000 m; 39° 51' S, 71° 32' W; 19 H BR 81.
56. *Argentina*, Prov. *Neuquen*, *SE of Aluminê*, *Bajada de Rahue*.
1500 m; 39° 24' S, 73° 12' W; 19 H FS 56.
57. *Argentina*, Prov. *Neuquen*, surroundings of *Aluminê*.
1200 m; 39° 14' S, 70° 56' W; 19 H CS 34.
58. *Argentina*, Prov. *Neuquen*, 30 km W of *Aluminê*, *Lago Rucachoroi*.
1250 m; 39° 15' S, 71° 11' W; 19 H CS 14.

59. *Argentina*, Prov. *Neuquen*, N of *Aluminé*, SE of *Lago Aluminé*. 1100 m; 38° 55' S, 71° 11' W; 19 H GS 10.
60. *Chile*, Prov. *Malleco*, 10 km W of *Angol*, *Los Alpes*. 650 m; 37° 35' S, 73° 00' W; 18 H XD 76.
61. *Chile*, Prov. *Arauco*, between Angol and Lebu, *ridge of Cord. Nahuelbuta*. 1250 m; 37° 42' S, 73° 09' W; 18 H XD 37.
62. *Chile*, Prov. *Malleco*, E of *Curacautin*, *Termas de Manzanar*. 700 m; 38° 28' S, 71° 44' W; 19 H BT 66.
63. *Argentina*, Prov. *Neuquen*, 100 km N of *Chos Malal*, *Barrancas*. 850 m; 36° 48' S, 69° 53' W; 19 H DV 47.
64. *Argentina*, Prov. *Mendoza*, 100 km S of *Malrgüe*, *Las Charas*. 1500 m; 36° 08' S, 69° 50' W; 19 H DA 29.
65. *Chile*, Prov. *Talca*, 20 km E of *Laguna del Maule*, *La Mina*. 1000 m; 35° 50' S, 70° 47' W; 19 H CA 36.
66. *Chile*, Prov. *Santiago*, 50 km E of *Santiago*, *Farellones*. 2650 m; 33° 18' S, 70° 18' W; 19 H CD 78.
67. Chile, Prov. *Aconcagua*, *W of Los Andes*, *Curimon*. 700 m; 32° 47' S, 70° 43 W; 19 H CD 32.
68. *Chile*, Prov. *Aconcagua*, *Paso de Bermejo*. 3200 m; 32° 49' S, 70° 05' W; 19 H CD 93.
69. *Argentina*, Prov. *Mendoza*, 100 km NW of *Mendoza*, *Puente del Inca*. 2750 m; 32° 49' S, 69° 56' W; 19 H DD 13.
70. *Argentina*, Prov. *Mendoza*, N of Mendoza, *25 km N of Villavicencio*. 1850 m; 32° 26' S, 68° 58' W; 19 H EE 08.
71. *Argentina*, Prov. *La Rioja*, NE of La Rioja, *25 km NE of Cebollar*. 29° 06' S, 66° 35' W; 19 J GH 32.
72. *Argentina*, Prov. *Salta*, 5 km E of *Rosario de la Frontera*, *Los Banos*. 25° 51' S, 64° 54' W; 19 J CM 06.
73. *Argentina*, Prov. *Salta*, 50 km E of *Grl. Gümes*, *Parque Nacional El Rey*. 24° 40' S, 64° 31' W; 19 J CN 42.

Based on vegetation, altitude and climate, the main stations can be grouped as follows (compare also Fig. 7):
Parks in central Buenos Aires: 1.
Rural areas in the Pampa: 4, 5.
Rural areas in wine district: 67.
Transition between bush steppe and Patagonian steppe: 6, 12, 15.
Patagonian steppe: 11, 21-31, 42-46, 51, 57, 59, 63.
Patagonian steppe with scattered small stands of *Nothofagus antarctica* and *Berberis:* 10, 18.
Fuegian grass steppe: 32, 36, 37, 40.
Fuegian moor: 35, 38.
Meadow in temperate steppe area: 64.
Mountain areas above the timber line: 50, 54, 66, 68, 69.
Araucaria forest: 56, 58.
Forest dominated by *Nothofagus dombeyi* with little or no *Chusquea*, relatively dry: 7, 13, 17, 48, 52.
Forest dominated by *Nothofagus antarctica* and *N. pumilio*, with little or no *Chusquea:* 14, 16, 19, 20.

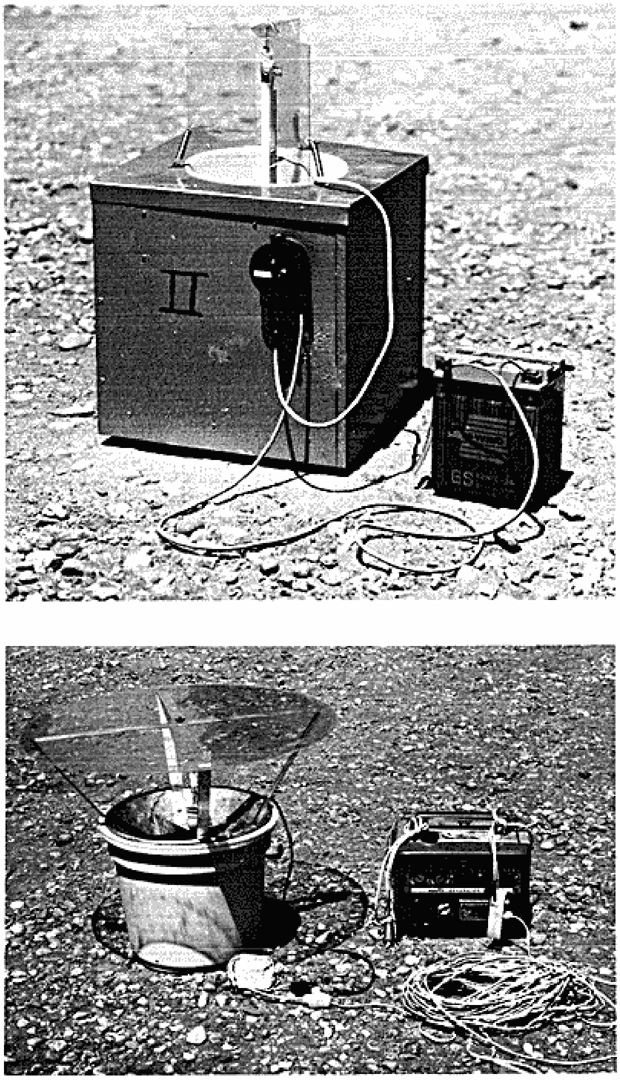


fig 13: The light traps used: a. A portable Heath trap with MC battery. b. A modified Robinson trap with Honda E-300 generator. Notice the Plexiglass coverplate.
Fig. 13: De anvendte lysfælder: a. En sammenklappelig Heath-fælde med MC batteri. b. En modificeret Robinson-fælde med en Honda E-300 generator. Bemærk dækpladen af plexiglas.

Forest dominated by *Nothofagus betuloides*, *N. pumilio* and *N. antarctica*, often with *Berberis*, without *Chusquea:* 28, 33, 34, 39, 41.
Forest dominated by *Nothofagus obliqua*, with little or no *Chusquea*, relatively dry: 60, 61, 62, 65.
Very humid forest dominated by *Nothofagus dombeyi* and *Chusquea culeou:* 8, 49.
Very humid forest dominated by *Eucryphia cordifolia* and *Chusquea montana:* 53.
Humid forest dominated by *Nothofagus obliqua* and *Chusquea culeou:* 9, 55.
Subtropical bush steppe (monte): 70, 71.
Subtropical forest: 72, 73.

METHOD

Night-flying insects were collected by light traps and by using a »moth sheet and egg tray« arrangement. The traps used were three portable Heath traps (professional model), each provided with a 6 watt 5' Actinic 5 (BL) lamp, with power supplied from 12 V MC batteries (Fig. 13a), car batteries or from a Honda E-300 generator. To avoid rainwater in the catch, the traps were often placed below an umbrella that was fastened to a 1.5 m bar. Three modified Robinson traps were also used (Fig. 13b). Each consisted of an aluminium funnel placed over a plastic container; the diameter of the 29 cm high funnel was 38 cm at the top and 4 cm in the lower end. The lamp was held by four metal baffles in the center. Rainwater in the catch was avoided by placing a 72 cm diameter Plexiglas plate 25 cm above the funnel. This plate was easily moved and mounted on a metal cross held in position by four wing nuts. The lamp used was mainly Osram HQA 80 watt, but other types were used to a lesser extent. The power was supplied by Honda E-300 generators. In both types of traps the containers were filled with egg trays, and the anaesthetic used was 1.1.2.2.-tetrachlorethane placed in a number of plastic bottles provided with an alcohol lamp wick in the top. The light traps were used at all localities where more intensive night collecting was undertaken, i.e., they were not used at localities 1-3, 5, 10, 16, 17, 19, 20-25, 27, 30-32, 40, 42, 45, 46, 50, 54, 56, 59, 61, 64, 66, 68, 70 and 71.

Two Malaise traps were also used at more permanent stations. The Malaise traps used were the quadratic type with opening to all four sides. The traps were used at localities 7, 8, 28, 33 and 34.

Day flying and crepuscular insects were collected by normal sweeping, and especially Microlepidoptera and Neuroptera were collected by knocking branches of trees an bushes and netting the disturbed specimens. Other insects hiding in the leaf cover on branches were collected by using white upside-down umbrellas as beating trays. Sieving was used in the search for smaller Coleoptera and Hemiptera.

Aquatic insects were sampled only at more permanent stations, and only by the use of a simple dip net. The localities where aquatic samples were taken are 7, 32, 33, 37, 38, 51 and 72. All aquatic samples were preserved in 70% alcohol.

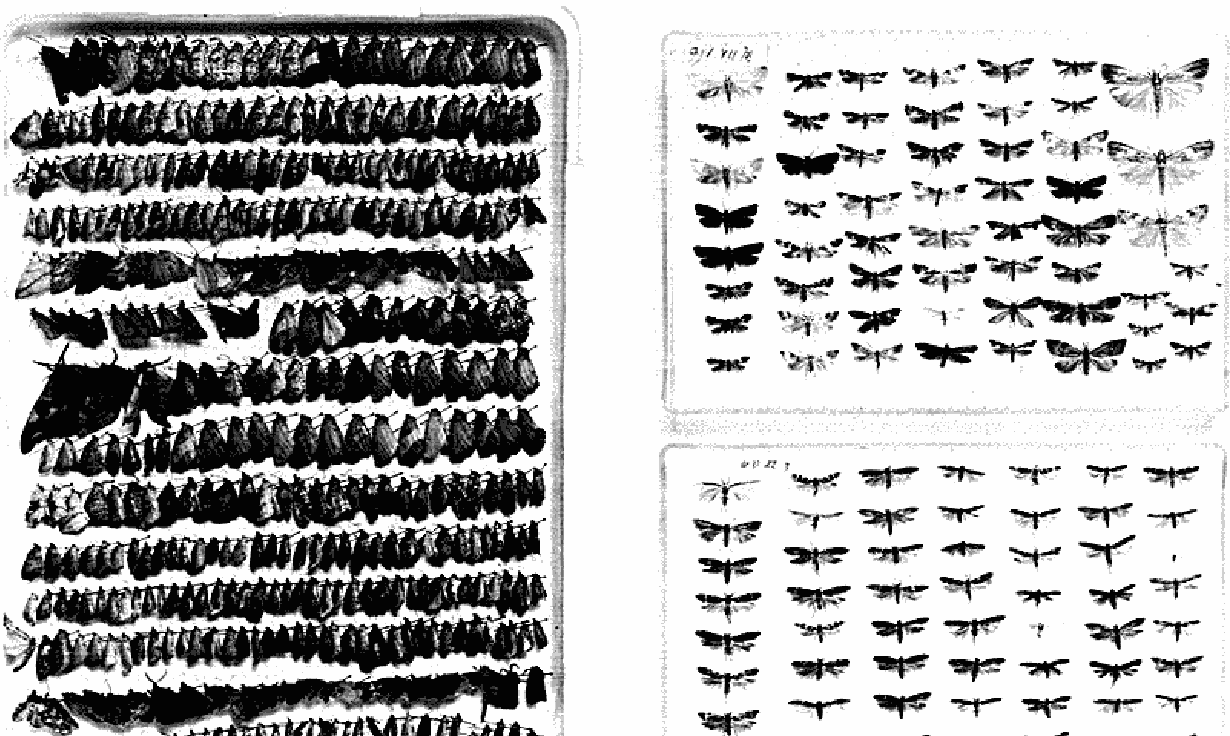


Fig 14: Lepidoptera as they were arranged in the field. a. Macrolepidoptera arranged in foam box. b. Microlepidoptera set in plastic boxes with Plastizote.

Fig. 14: Sommerfugle (Lepidoptera) præpareret i felten. a. Macrolepidoptera sat op i en skumplastæske. b. Mikrolepidoptera præpareret i plastæsker på plastizoteunderlag.

	Pinned	Alco-hol	Total
Scorpiones		15	15
Pseudoscorpiones		55	55
Araneae		520	520
Opiliones		35	35
Acarina		150	150
Diplopoda		140	140
Symphyla		25	25
Chilopoda		55	55
Thysanura		15	15
Ephemeroptera		160	160
Odonata	220	80	300
Plecoptera	10	180	190
Dermaptera		40	40
Orthoptera	410	20	430
Dictyoptera	30	70	100
Psocoptera	30	30	60
Hemiptera	510	630	1140
Coleoptera	3240	640	3880
Neuroptera	120	510	630
Hymenoptera	1640	570	2210
Trichoptera	200	1750	1950
Lepidoptera	24500	100	24600
Mecoptera	10	40	50
Diptera	5280	1250	6530
Various other groups		420	420
Total	36200	7500	43700

Table 2. The approximate number of specimens in the orders collected by the entomological section of the expedition.

Tabel 2. Oversigt over antallet af eksemplarer af de forskellige insektordner indsamlet af den entomologiske sektion på ekspeditionen.

Berlese funnels or other similar extracting apparatuses were not used, thus the few collembolans, acarids and symphylans collected were taken by chance during sieving or when searching fallen trunks and mosses. It should be mentioned that there are, however, several hundred Berlese samples from Argentina and Chile preserved in the Zoological Museum, Copenhagen, collected by Dr. M. Hammer in 1954-58. The oribatid mites from these samples were studied by Dr. Hammer whereas the remaining in these samples has so far not been examined.

All the material brought back was prepared in the field, by conservation in 70% alcohol, by papering (only butterflies and Odonata) or by pinning (see Table 2). All Microlepidoptera and pinned non-Lepidoptera were set in 12x8 cm clear plastic boxes with a layer of Plastizote, the Microlepidoptera in 2 cm deep boxes and the non-Lepidoptera in 5 cm deep boxes. All Macrolepidoptera were pinned and, unset, arranged in 36x26 cm plastic foam boxes (Fig. 14a). All Microlepidoptera were set in the boxes (Fig. 14b) immediately after being collected.

Representatives of particularly interesting groups were fixed in Bouin's fluid and larvae collected were preserved in Pampel's fluid.

To avoid fungi and pests in the collected material, before use all boxes were sprayed with pyrethrin and painted with a solution of thymol dissolved in alcohol. All boxes were further sprayed with pyrethrin when the contained insects were dry, before the boxes were taped.

RESULTS

A list of the material collected is given in Table 2. As will be seen, Lepidoptera, which were the main collecting objects during the expedition, account for more than half of the material collected. The Lepidoptera are almost all moths, as butterflies were only collected to a small extent and comprise but a few hundred specimens. The heading »various groups« includes freshwater snails, crustaceans, flatworms and annelids, Solifugae, Collembola, Embioptera and Stepsiptera. On addition to the material listed in the table, special samples were made for Enchytraeidae.

Alpine Lifeforms and Snowbed Vegetation

SIMON LÆGAARD

During the expedition the following projects were undertaken.

1. Analysis of snowbed vegetation in alpine areas.
2. Investigation in life forms and adaption of higher plants in the alpine flora.
3. General collecting of herbarium speciments etc.

SNOWBED VEGETATION

In all arctic and alpine areas with a regular snowfall in winter there will be a vegetation zonation that is heavily dependant on snowcover in wintertime.

The snowcover influences the plantlife in two ways, a favourable and an unfavourable. The favourable effect will usually be many-sided. A primary effect is that the plants are covered and protected against hard frost and danger of desiccation. The soil will usually be only faintly and superficially frozen, if it is frozen at all, as there will most often be some snowcover before the first strong frost. The snow will further collect windborne dust of mineral origin or plant material. When the snow melts in spring this material will at least partly be trapped in the vegetation and will act as a fertilizer. Further a snowcover melting in springtime will act as a waterreserve and secure the surrounding plants an adequate amount of water during this time of the year, which in many arctic and alpine areas has a very low precipitation.

The unfavourable effect of the snowcover on the vegetation is generally that the summer growth period is shortened, often so much that the plants hardly or not at all will be able to produce ripe seed. Also the production of vegetative propagules and of winter buds will be hampered.

The unevenness of the snowcover in a certain area will depend on the regularity of snowfall, the prevailing wind and the topography, but in all areas there will be some, often small, spots always covered by heavy snowdrifts. Around these spots there will be zones with decreasing security for a cover, and additionally there will be large areas which are usually uncovered or only get a thin and irregular cover.

A number of plant species will always be adapted for a certain niche within this system according to their dependence on the protection and on other favourable effects of the snowcover and to their tolerance to a shorter growth period in summertime. Of course there will be other parameters effecting the distribution of plants, as e.g. soil mineral conditions, competition between species, etc. but generally it is very easy to recognize a clear zonation of plant species and thus of vegetation types around such late snowbeds.

The snowbed vegetation was studied in the region above the timber-line on Cerro Lopez at Bariloche and at three sites on Tierra del Fuego: on Cerro Huehuepen at the eastern part of Lago Fagnano, in the mountain range west of Paso Garibaldi and on Cordon del Toro at Alakush, west of Ushuaia. Only snowbed vegetation on rather dry ground was studied. Snowbeds in bogs and springs are very common but they were left out to confine the project. They are rather complex as the character of the water also heavily influences the plantlife.

On each site the zones for analysis were visually delimited, and 5 or 10 sample plots were then randomly distributed within each zone. Each plot was 1 m² and the vegetation was analyzed by estimating the percentage of the total cover of each species.

With each vegetation analysis was further taken a soil sample for an analysis of the edaphic conditions.

LIFEFORM AND ADAPTION

A lifeform system is a system within which plants are referred to a number of categories characterized by a single or very few vegetative characters. During the last century a number of such lifeform systems have been proposed. Prominent among these is Raunkiærs lifeform system, which is mainly based on the position of winter-buds in relation to the soil surface.

There has been many discussions about which of these lifeform systems is the most »correct«, that is, the one that most truthful expresses the adaptation of plants to one or more decisive environmental factors. However, only rarely has a combination of several lifeforms system been used to decribe morphological adaptation in a flora.

For such a combined investigation characters from as many alpine species as possible were recorded within the following lifeform systems:

1. Tree. Shrub. Dwarf-shrub. Subshrub. Perennial herb. Hapaxantic herb.
2. For perennial plants: Vertical, unbranched rhizome. Dense tussock. Loosely tufted. Short stolons. Long stolons. Short rhizomes. Long rhizomes. Budding roots. Special vegetative diaspores.
3. For hapaxantic herbs: Few years old. Biannual. Winterannual. Summerannual.
4. Raunkiærs lifeforms: Phanerophyte. Chamaephyte. Hemicryptophyte. Geophyte. Helophyte. Hydrophyte. Therophyte.
5. Vegetative reserve: Taproot. Root tubers. Hypocotyle corm. Rhizome tubers. Scale-leaves on rhizome. Bulb. Other types.
6. Shoot structure: Monopodial. Sympodial after flowering. Sympodial.

Further notes were taken in cases where special morphological adaptation was observed, e.g. cushion plants, parasitic or semiparasitic plants, plants with root nodules etc.

The records will now be verified and supplemented from herbarium material, and it will then be worked over to see how the relationship is between morphologically characterized lifeforms and external conditions. Preliminary studies in a few similar records from a mountain flora of Norway have shown that there are at least some undisputable relationships.

COLLECTIONS

During the whole expedition were collected herbarium specimens. These will mainly be used for identification and as documentation for reports of other studies, especially the vegetation analysis of snowbeds. Some will also be used for further studies of lifeform systems.

A total of 1350 specimens were collected. Many of these are unicates, while others were collected with one or more duplicates, which will be sent to herbarias in Argentina and other centers for studies in the Patagonian flora. Most collections are from the mountain areas in which snowbed vegetation was studied. Another station in which many collections were made is Cerro Buenos Aires at Lago Argentino. A full list of stations has been issued and copies will be sent on request.

210 specimens were brought home as transplants to be grown in the botanical garden and experimental fields. About 70 seed-samples were collected in the field, but others have been extracted from the herbarium specimens. Most of these have germinated and the plants will be grown with the transplants.

From 155 specimens root-tips or flower-buds were fixed for chromosome studies.

From 70 specimens material was collected for anatomical studies, 20 of these are wood-samples.

For the more special collections of transplants, plants grown from seed, chromosome-fixations and material for anatomical studies lists will be worked out when most of the species have been identified. Copies will be sent on request.

Arboretum projects, especially with Araucaria and Nothofagus

SØREN ØDUM

BACKGROUND AND GENERAL COLLECTING

Due to the generally endemic status and conspicuously deviating appearance of the ligneous flora of the temperate southern hemisphere, the botanical and horticultural interest in growing trees and shrubs from this part of the world has increased in W-Europe. This is not least the case in Great Britain where botanical and horticultural traditions in combination with an oceanic climate have led to introduction and favoured survival and growth of a substantial number of species from New Zealand, Tasmania, SW-Australia, and southernmost South America.

The more or less extreme oceanic conditions prevailing within the regions occupied by southern hemisphere temperate forests are reflected i an abrupt decline in number of species surviving and thriving when moving from the West towards the East of the British Isles and further on to Holland and Scandinavia. Towards the W and S of the Brit. Isles aboreta and gardens include big specimens of e.g. evergreen, broadleaved trees belonging to the genus *Nothofagus* and the families *Myrtaceae, Lauraceae, Proteaceae,* and *Eucryphiaceae,* the latter a main element of the Valdivian rain forest. In Denmark, SW-Sweden, and along the Norwegian westcoast, however, only a very limited selection of trees and shrubs of southern hemisphere origin are found in botanical collections, nurseries and gardens, e.g. species and hybrids of *Hebe, Fuchsia,* and *Pernettya,* and trees such as *Araucaria araucana* and deciduous species of *Nothofagus* from S. America.

Among the exotic trees and shrubs cultivated in Europe, only a limited number of introductions are of well known origin, and variation in e.g. hardiness and vigor among various geographical races (origins, provenances) of certain species is generally little known, except from tree species of economic importance in forestry. Probably many ot the southern hemisphere trees and shrubs in cultivation so far have been propagated from single or few collections from low altitudes, coastal sites, etc., and in S. America mostly from Chile.

When a close Nordic arboretum cooperation was established in 1972, it was therefore decided to send out collecting expeditions to various parts of the world with the purpose of collecting species of interest, where possible, on several sites within their natural range (Nordic Arboretum Commitee 1977). Expeditions carried out in 1975, conducted by the Norwegian Arboretum at Milde, Bergen, to New Zealand-Tasmania (Søndergaard et al. 1977), and by the Danish Arboretum in Hørsholm to S. America (Ødum et al. 1977), resulted in the introduction of a comprehensive material for experiments and studies. In South America it was considered to collect especially close to tree line and within the transition zone between forest and Patagonian steppe, as ecotypes adapted to colder and drier climatic conditions might have developed here.

On the succeeding expedition dealt with in the present paper, dendrological studies and collecting work included new localities and added seed, plants, and herbarium material of a number of species and origins to the introductions from 1975, first and foremost from the transition zone between forest and steppe in Argentina, but also from Chile, e.g. the rain forest at Puyehue, the coastal Cordillera Nahuelbuta, and the northernmost outposts of temperate forest at Rio Maule.

The collections include species of doubtful taxonomic position like *Griselinia ruscifolia (Cornaceae?)* for chemical analysis, species rare in cultivation like *Polylepis australis* and *Kageneckia oblonga* (both *Rosaceae), Ovidia andina (Thymelaeaceae)* and *Juglans australis (Juglandaceae),* and species of horticultural interest like firebush *Embothrium coccineum, Guevina avellana,* and *Lomatia hirsuta* (all *Proteaceae*), *Pilgerodendron uviferum, Fitzroya cupressoides,* and *Austrocedrus chilensis* (all *Cupressaceae) Fabiana imbricata (Solanaceae), Maytenus disticha* and *M. boaria (Celastraceae),* the deciduous *Nothofagus antarctica, N. obligua, N. procera,* and the evergreen *N. betuloides* and *N. dombeyi (Fagaceae),* just to mention some examples. To avoid total loss of less hardy species and origins, seed and plants have been sent to arboreta and botanical gardens in other countries.

With background in experiences from field work during the 1975-expedition and with the material introduced at that occasion, two main projects were planned and accomplished on this expedition.

SEED COLLECTING OF ARAUCARIA ARAUCANA FOR PROVENANCE TRIALS

The genus *Araucaria* belonging to the strange and geologically old gymnosperm family *Araucariaceae* is represented in the Australia-New Guinea region with c. 20 species and in S. America with two species, *A. augustifolia* in S. Brazil and adjacent northern Argentina, and *A. araucana* in Argentina and Chile as indicated on the map, Fig. 15. The only species hardy in NW-Europe is *A. araucana* which was first introduced to England from Chile in 1795. This and succeeding introductions, mainly or only from Chile, have resulted in numerous trees in British gardens and tree collections. In Scandinavia big specimens can be seen in Bergen, while in Denmark only small specimens are represented, as all bigger trees were killed during the severe winters 1940 to 1942. Even in less severe winters araucarias may be injured or killed by frost or dessicating easterly winds and sun in the spring.

Within its natural range *Araucaria araucana* is covering a broad span of edaphic and climatic conditions, from poor volcanic ashes and boulders bordering the dry steppe in Prov. Neuquen (Fig. 16) to luxuriant rain forest on the western slopes of Cordillera Nahuelbuta (Fig. 17).

Collecting of various origins for comparative studies has probably never been carried out. Therefore, from March 11 to March 21 *Araucaria*-seed was collected from 14 localities in Prov. Neuquen and adjacent Chile (map Fig. 15) in quantities big enough for provenance trials, especially studies of variation in hardiness and development.

On long term scale the influence of cutting and seed predation, especially by the numerous goat flocks, is obviously reducing the *Araucaria* area, and seed from some isolated

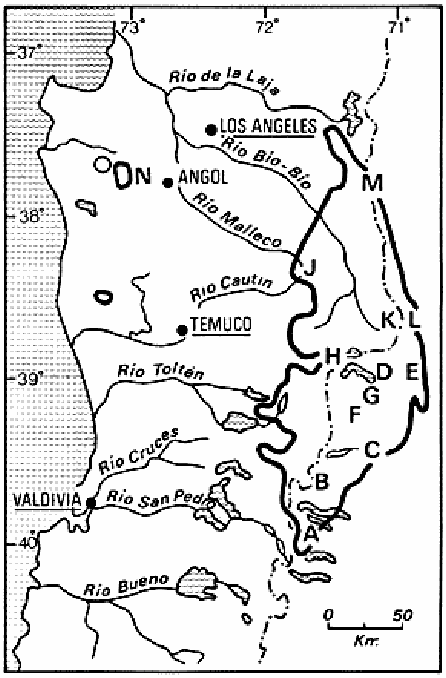


Fig. 15: The approximate range of *Araucaria araucana* with the collecting localities A to O indicated. Figure redrawn after Montaldo (1974).
Fig. 15: *Områder med forekomst af* Araucaria araucana. *Frøindsamlingslokaliteterne A - O er vist.*

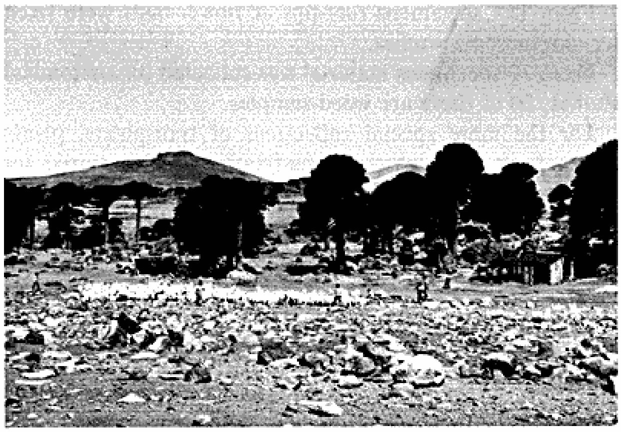


Fig. 16: Part of the easternmost stands of *Araucaria*, »Primeros Pinos«, (Loc. E). Obs. the goats feeding on the *Araucaria* seeds.
Fig. 16: Del af den østlige forekomst af Araucaria *(lok. E). Obs. flokke af geder, der spiser de store frø og på langt sigt er en alvorlig trussel mod skovens fortsatte eksistens.*

populations with extremely sparse regeneration might additionally serve as a future gene-resource.

Due to the rapid decline in viability of the seed, the samples were taken to Santiago, from where they March 27 were sent by air to Denmark to be kept in cold store. During the first half of May 100 to 120 seeds of each origin were distributed to the following institutions and sown: Hørsholm Arboretum, Denmark. Plantation Committee, Faroe Isles. Bot. Garden, Göteborg, Sweden. Milde Arboretum, Bergen, Norway. Forestry Commission, Scotland, U.K. Bot. Garden, Wageningen, Holland. Academy of Forestry, China. Washington Arboretum, Seattle, USA. Bot. Garden, Vancouver, B. C., Canada.

Collecting Localities

The following survey describes briefly the collecting localities indicated on the map (Fig. 15). The suggested name of origin (provenance) is printed with capital letters.

Sample A

Coll.no.4703. March 11. Argentina prov. Neuquén, dep. Huiliches. Near crossing of Arroyo de Los Pinos and road south of LAGO CURRHUÉ. 39° 52' S, 71° 27' W, 1100 m. N-facing slope. Small stand with some 100 trees mixed with *Nothofagus antarctica. Chusquea culeou, Berberis buxifolia, Maytenus disticha, Schinus patagonica, Embothrium coccineum, Ribes magellanicum, Pernettya mucronata, Mutisia decurrens, M. retusa, Diostea juncea.*

Sample B

Coll.no.4712. March 12. Argentina, prov. Neuquén, dep. Huiliches, S of LAGO TROMEN, 4 km E of gendarmeria. Parq. Nac. Lanin. 39° 35' S, 71° 26' W, 1000 m. Volcanic deposits (boulders, ashes). Rather big stands with only scattered *Nothofagus antarctica, Berberis buxifolia, Mulinum spinosum, Pernettya poeppigii.*

Sample C

Coll.no.4715. March 13. Argentina, prov. Neuquén, dep. Catán Lil.

At road between Rahué and Zapala, just E of pass at BAJADA DE RAHUE. 39° 24' S, 70° 47' W, 1450 m. Volcanic deposits. Rather big stand obviously well isolated from other stands. Very low scrub of *Nothofagus antarctica.*

Sample D
Coll.no.4718. March 14. Argentina, prov. Neuquén, dep. Aluminé. 10 km E of Lago Aluminé at road to Zapala, above the W-slope, towards the plane of PAMPA LONCO LUAN. 38° 54' S, 71° 02' W, 1600 m. Volcanic ashes. Steppe-vegetation and stands of *Araucaria,* patches with low scrub of *Nothofagus antarctica.*

Sample E
Coll.no.4719. March 14. Argentina, prov. Neuquén, dep. Picunches. PRIMEROS PINOS, at road between Lago Aluminé and Zapala. 38° 52' S, 70° 36' W, 1700 m. Easternmost isolated stand, dry conditions, volcanic ashes and boulders. Very scarce regeneration.

Sample F
Coll.no.4721. March 15. Argentina, prov. Neuquén, dep. Aluminé. N-facing slopes towards LAGO RUCA CHOROI. 39° 14' S, 71° 11' W, 1250 m.

Mixed woods of *Araucaria* and *Nothofagus antarctica,* scattered low scrub of *Chusquea culeou.* The whole region around the lake with extensive *Araucaria* woods.

Sample G
Coll.no.4723. March 16. Argentina, prov. Neuquén, dep. Aluminé. RIO ALUMINÉ valley, 7 km S of Lago Aluminé. 39° 01' S, 71° 01' W, 1150 m. Volcanic deposits. Rather open stands of *Araucaria* mixed with *Nothofagus antarctica.* In between steppe-vegetation with *Mulinum spinosum.* Trees rather badly shaped in most of the valley. *Araucaria* common at higher altitudes around.

Sample H
Coll.no.4725. March 16. Chile, IX Region, prov. Malleco. NE of LAGO ICALMA, 20 km SW of Liucura. 38° 46' S, 71° 13' W, 1000 m. Volcanic ashes. *Araucaria* widely distrubuted in this region, mixed with *Nothofagus antarctica.* In between steppes with *Stipa.*

Sample J
Coll.no.4746. March 20. Chile, IX Region, prov. Malleco. Pass between Manzanar and LONQUIMAY, SE of Volcano Lonquimay. 38° 26' S, 71° 28' W, 1600 m. Extensive woods of *Araucaria* on volcanic ashes, mixed with *Nothofagus pumilio. Ribes cucullatum, Berberis montana, Chusquea culeou.* In between large slopes of ash with scattered cover of *Acaena.*

Sample K
Coll.no.4747. March 20. Chile, IX Region, prov. Malleco. 6 km W OF PASO PINO HACHADO. 38° 40' S, 70° 55' W, 1550 m. Scattered stands of *Araucaria* with low scrub of *Nothofagus antarctica* and *Chusquea culeou.* Volcanic ashes and boulders, basalt rocks. Paso Pino Hachado, 1864 m. Araucaria up to about 1600 m. *Nothofagus* and *Chusquea* up to about 1800 m.

Sample L
Coll.no.4749. March 20. Argentina, prov. Neuquén, dep. Picunches. 12 km E OF PASO PINO HACHADO. 38° 39' S, 70° 48' W, 1400 m. Widely distributed *Araucaria,* in stands or well spaced. In patches low scrub of *Nothofagus antarctica* and *Chusquea culeou.* In between sparse ground cover. Volcanic ashes and basalt rocks. *Araucaria* up to about 1700 m.

Fig. 17: *Araucarias* on the westernmost ridge of Cordillera Nahuelbuta, (Loc. N).
Fig. 17: Araucaria *på den vestlige kam af kystkæden, Cordillera Nahuelbuta (lok. N.).*

Sample M
Coll.no.4752. March 21. Argentina, prov. Neuquén, dep. Norquin. W of LAGO CAVIAHUE. 37° 52' S, 71° 03' W, 1600 m. Volcanic rocks and boulders. *Araucaria* in stands scattered around the lake. Sparse undergrowth on N-facing slopes. On S-slopes dense scrub of Nothofagus antarctica.

Sample N
Coll.no.4737. March 18. Chile, XIII Region, prov. Arauco. CORDILLERA NAHUELBUTA, THE RIDGE, between Los Alpes (W of Angol) and Canete. 37° 42' S, 73° 09' W, 1250 m. *Araucaria* mixed with *Nothofagus obliqua, N. antarctica. Desfontainea spinosa, Lomatia hirsuta, Pernettya mucronata, Chusquea culeou.* Patches with swamp-like vegetation. *Araucaria* with extremely thick bark. Vigourously regeneration from stumps. Cloud-zone with rich lichen-vegetation on trees.

Sample O
Coll.no.4740. March 18. Chile, VIII Region, prov. Arauco. CORDILLERA NAHUELBUTA, outer W-SLOPE, NE of Canete. 37° 40' S, 73° 11' W, 800 m. *Araucaria* mixed with »rainforest« of *Nothofagus procera, N. dombeyi, N. obliqua, Eucryphia cordifolia, Chusquea quila, Guevina avellana, Dasyphyllum diacanthoides, Fuchsia magellanica, Myrtaceae,* etc. Slender araucarias with tall stems. *Araucaria* down to about 650 m. Forest to a great extent destroyed by cutting and fires.

TRANSFER OF NOTHOFAGUS-PLANTS FROM TIERRA DEL FUEGO TO THE FAROE ISLES

No trees have immigrated naturally to the Faroe Isles in the North Atlantic Ocean, probably due to geographical barriers. Additionally sheep-grazing has during centuries prevented tree-growth. However, at low altitudes a potential forest climate is obviously present (Ødum 1979) as a broad

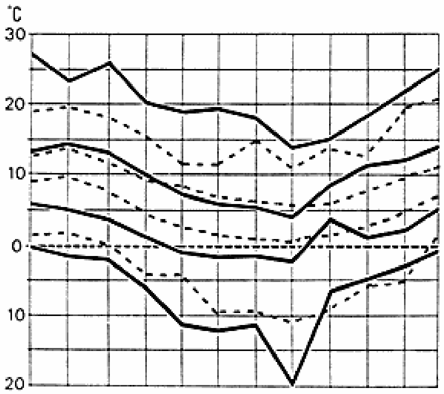


Fig. 18: Absolute and average max. and min. temperatures in Ushuaia, Tierra del Fuego (fat curves) and Torshavn, Faroe Isles (dotted curves) correlated according to season. After Dimitri 1972 and the Danish Meteorol. Inst., respectively.

Fig. 18: Absolutte og gennemsnitlige max. og min. temperaturer i Ushuaia (optrukne kurver) og Torshavn (stiplede kurver) korrelleret med hensyn til årstid.

selection of trees and shrubs have been successfully introduced into fenced gardens and some small plantations during this century. The climate of the Faroe Isles is not very different from that of southernmost Tierra del Fuego (Fig. 18) and probably other forest-clad extreme oceanic regions

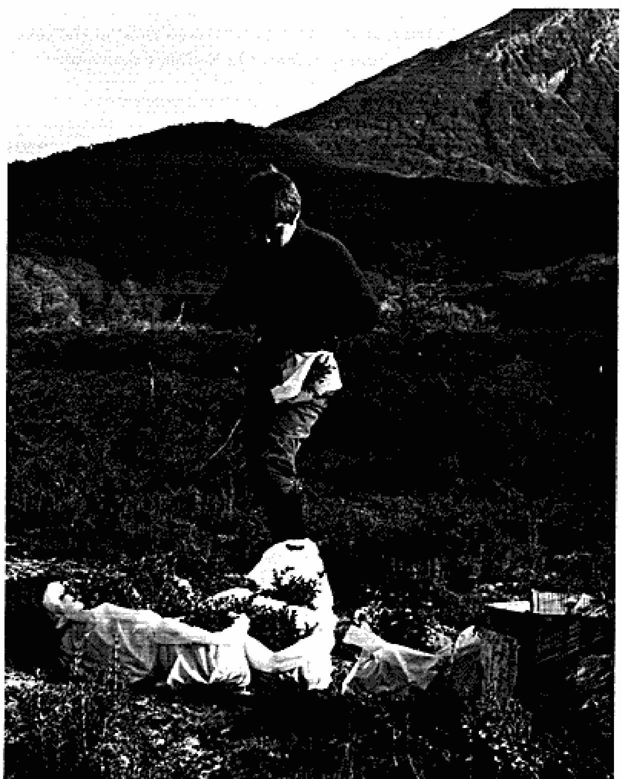


Fig. 19: Trondur Leivsson packing *Nothofagus*-seedlings at a bog in the woodlands west of Ushuaia, Tierra del Fuego.

Fig. 19: Pakning af Nothofagus *- småplanter i mose på Ildlandet.*

of the southern hemisphere. Hence it was found tempting to experiment with trees and shrubs from there.

During the Nordic Arboretum Expedition 1975 to S. America small scale experiments with transfer of seedlings of various trees and shrubs were carried out. The change of season did only influence the plants slightly. In 1976 a small southern hemisphere arboretum was initiated at Torshavn on the Faroes with material from S. America as well as from the New Zealand Expedition. Among the transferred tree species seedlings of *Nothofagus pumilio, N. antarctica,* and the evergreen *N. betuloides* collected on Tierra del Fuego appeared hardy and showed vigorous growth during the subsequent three years. The Faroese Plantation Comittee and the Faroese government therefore decided to support the idea of further introductions of *Nothofagus* in connection with this expedition.

At the end of the expedition Trondur Leivsson and the author went by air to Tierra del Fuego. From April 10 to 16 almost 7000 plants, 10 to 30 cm high, were collected from localities around Ushuaia and Lago Fagnano. They were bundled 25 or 50 together with sphagnum from local bogs around the roots and then lashed tightly in plastbags with the tops free, Fig. 19. Finally they were packed and transported in flour sacks. April 17 the sacks were taken by air to Buenos Aires and kept in cold store until return to Europe on April 21. Late April and early May 3500 *Nothofagus betuloides,* 2250 *N. pumilio* and 550 *N. antarctica* plus various shrubs were planted in Torshavn by Leivsson and forest manager Leivur Hansen. In August they were reported in good condition.

Wild Species of *Hordeum* (Barley) in Argentina and Chile

ROLAND VON BOTHMER & NIELS JACOBSEN

In later years, our interest in the wild relatives to cultivated plants has increased. This is mainly caused by the putative possibilities of transferring valuable genetical material from the wild to the cultivated species, but also of studying the evolution of cultivated plants from their wild ancestors. Since 1976, the Danish Natural Science Research Council has financed a project for studies of the genus *Hordeum* on a worldwide scale (Bothmer & Jacobsen 1979). The aim of the project has been, firstly, to work out a comprehensive taxonomic monograph of the genus and, secondly, to present data on phylogenetic relationships by means of crossing experiments and cytogenetic studies. The investigations will also be used to evaluate the possibilities of transferring genetic material to cultivated barley.

The main purposes of our participation in the Danish Expedition to Patagonia and Tierra del Fuego 1978/79 were: 1. to collect as much living material (seeds and plants) as possible for subsequent cultivation and crossing experiments; 2. to collect herbarium specimens for taxonomic studies; and 3. to make observations of the various species under natural conditions. Besides the fieldwork, several botanical institutes in Argentina and Chile were visited.

Dr. Bernard R. Baum, Agriculture Department of Canada, Ottawa, who also is working with the taxonomy of *Hordeum*, was invited to join the expedition for a two months period and the team had great benefit from this cooperation.

The general data on the route and the localities where collections of *Hordeum* were made will be found in the preceding diary. During the trip, c. 700 collections of *Hordeum* seeds were made, representing some 20 indigenous and 3 introduced, naturalized species.

Fig. 20: River valley with *Hordeum parodii* and *H. lechleri*, north of San Carlos de Bariloche. Prov. Neuquen.
Fig. 20: Floddal med Hordeum parodii *og* H. lechleri, *nord for San Carlos de Bariloche. Prov. Neuquen.*

THE GENUS HORDEUM IN SOUTH AMERICA

The genus *Hordeum* contains some 35 species distributed in the temperate zones of Europe, Asia, South Africa, and North and South America. About half of them are native to South America.

The interspecific relationships between the native South American species, totalling c. 20, will be the matter of further studies based on the material collected during the expedition. The delimitation of taxa here, is preliminary, but it is possible to classify them into four major groups.

The Hordeum comosum group

This group belongs to sect. *Critesion*, which has a wide distribution area: South and North America, and eastern Asia. It seems to be a distinct group within the genus. To the *H. comosum* group belongs *H. comosum*, *H. lechleri*, *H. halophilum* (incl. *H. pubiflorum*), and *H. procerum*. *H. jubatum* from North America is introduced and widely naturalized.

The Hordeum parodii group

There are morphological similarities between species in South and North America, Eurasia, and South Africa; and the *H. parodii* group probably belongs to this major complex with a wide geographical distribution (sect. *Stenostachys*). The *H. parodii* group is, taxonomically, rather complicated and the delimitation of taxa, still, is rather uncertain; several intermediate forms seem to occur. The group has its northern limit in the province of Mendoza and extends southwards to Tierra del Fuego. The following taxa are referred to the *H. parodii* group: *H. parodii*, *H. tetraploideum*, *H. santacrucense*, *H. patagonicum*, *H. setifolium*, *H. chilense* var. *magellanicum* (the latter is probably a distinct species), and *H. mustersii*.

The Hordeum stenostachys group

The species in this group (sect. *Anisolepis)* are exclusively South American and occur mainly in Argentina and Chile. One species. *H. muticum*, has a more northern distribution, from Northwest Argentina via Bolivia and Peru to Columbia. Some of the taxa are morphologically variable and need more detailed studies. The following taxa are referred to the *H. stenostachys* group: *H. muticum* (incl. *H. andicola)*, *H. stenostachys*, *H. compressum*, *H. chilense*.

The Hordeum pusillum group

Only three species belong here, viz. *H. pusillum*, *H. euclaston*, and *H. flexuosum* (= *H. bonariense*). The first one occurs in North America and is introduced to South America. The other two species are endemic to South America. *H. pusillum* and *H. euclaston* are annual, and *H. flexuosum* is perennial. The taxa are morphologically distinct and probably closely related.

DISTRIBUTION AND ECOLOGY

In South America, c. 20 species occur (cf. Nicora 1978) all of which are found in Argentina and Chile. A few species extend their northern distribution areas to the Andean regions, viz. *H. muticum*, *H. halophilum*, and *H. comosum*. A few others also occur in SE Brazil and Uruguay, viz. *H. stenostachys*, *H. compressum*, *H. flexuosum* and *H. euclaston*. The introduced taxa *H. marinum* s. l., *H. murinum* s. l., and *H. jubatum* are relatively widespread all over South America. Most species and groups show correlations with the phytogeographical regions as proposed by e.g. Cabrera (1953). The species also show preferences to certain habitats but, due to human activities, the original biotopes are disturbed in many cases. In the following, the various phytogeographical provinces will be dealt with in connection with species that occur there.

Fig. 21: Salt pan on the Patagonian Steppe with *Hordeum santacrucense*, and along the margins *H. lechleri* and *H. comosum*. Southeast of Cmte. Luis Piedra Buena. Prov. Santa Cruz.
Fig. 21: Saltpande på den patagoniske steppe med Hordeum santacrucense *og med* H. lechleri *og* H. comosum *langs kanten. Sydvest for Cmte. Luis Piedra Buena. Prov. Santa Cruz.*

As one positive result of the expedition, it was found that the species of *Hordeum* are much more common that expected. Often they are dominating species in the vegetation. It also seems that some species and also groups of species have distinct but often small distribution areas. The species are, generally, inhabitants of open grassland or among shrubs in the steppes, only rarely occurring in woodland areas.

The Pampas and Espinal Provinces
In the Pampas and Espinal provinces, three species, viz. *H. euclaston, H. flexuosum,* and *H. stenostachys,* are the most common ones. They often grow together, the first two most frequently occupying areas that are strongly influenced by the dry season, and in the plant communities with a high percentage of annual species.

H. flexuosum and *H. stenostachys* are often found together in grazed fields or roadsides with a permanent, perennial grass cover.

In the northern part, extending into the Chaco province, *H. compressum* is often found together with *H. stenostachys* in pastures and roadsides.

In scattered localities towards the west and south, into the Monte province, *H. procerum* and *H. parodii* can commonly be found in pastures, often near water. They extend their distribution areas farther to the Patagonian steppe.

Introduced into the area are also *H. jubatum, H. murinum,* s. l., and *H. marinum* s. l., sometimes closely associated with human activities but in other cases rather well naturalized. The two latter species are, also, frequently met with in other regions of Argentina and Chile.

The Patagonian Province
In the foothills of the Andes, on the Argentinean side, the rainfall is higher than on the steppe areas towards the east. Lakes and rivers give additional humidity to these areas and some comparatively tall-growing species, *H. parodii* and *H. tetraploideum,* are found here. *H. chilense* is found in pastures and along lakeshores.

Grazing cattle can molest the soil in wet areas so that it is in a permanent state of unstability, facilitating the growth of species with weedy abilities. In some of the meadows and river valleys, *H. lechleri* and *H. halophilum* are rather common.

The above mentioned species are, usually, confined to river valleys and do not go higher up into the mountains. In the dry part of the Andean foothills, *H. comosum* is a typical component of the steppe. It is very common and always occurs on dry soil. It can also be found as a successful colonizer of roadsides etc.

In the numerous saltpans and riverbeds, some of which may be saline, on the steppe, several species occur. Along rivers, *H. parodii, H. halophilum,* and *H. lechleri* are very abundant and, actually, they often are the main components in the plant communities. They are common in both saline and non-saline habitats. In the open saltpans, *H. patagonicum, H. santacrucense, H. setifolium,* and *H. chilense* var. *magellanicum* can be dominating. The newly described *H. mustersii* was found near Rio Gallegos, in a *Lepidophyllum* association along a salt lake.

Fig. 22: *Hordeum lechleri* from Brazo Rico. West of Calafate. Prov. Santa Cruz.
Fig. 22: Hordeum lechleri *fra Brazo Rico. Vest for Calafate. Prov. Santa Cruz.*

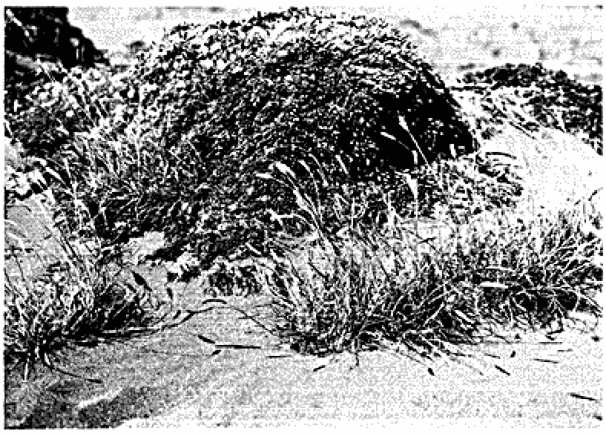


Fig. 23: *Hordeum chilense* var. *magellanicum* on the shore of the Strait of Magellan. Punta del Gado, Chile.
Fig. 23: Hordeum chilense *var.* magellanicum *på stranden ved Magellian Strædet. Punta del Gado, Chile.*

In the northern part of Patagonia, *H. euclaston* and *H. flexuosum* are also found in saline habitats, often in association with other annual species.

The Patagonian and Subarctic Provinces - Tierra del Fuego
On the large river plains of Tierra del Fuego, *H. lechleri, H. halophilum,* and a tetraploid form resembling *H. parodii* dominate the grasslands. These habitats, where the various species grow close together, facilitate hybridization, and hybrids occur frequently.

H. chilense var. *magellanicum* occurs along the sandy beaches of Tierra del Fuego and the Strait of Magellan where it occupies almost the same habitat as *Elymus arenarius* (introduced to South America). It can also be found in the inland saline habitats of the Santa Cruz province, where, however, it is not so well developed as on the beaches.

The Prepuna and Puna Provinces
H. muticum occurs in these regions. It grows at altitudes above c. 2000 m and has its southernmost known locality in northeastern Catamarca. It is common in Departemento Tafi in the province of Tucuman and in the province of Jujuy near the Bolivian border. In Tucuman, it grows mainly in wet Andine meadows or along streams with fresh water, often being a dominating grass. *H. halophilum* was often found together with *H. muticum,* the two either growing intermingled or the former growing in somewhat drier sites. Hybrids between the two are not uncommon.

The Central Chilean Province
Only three native *Hordeum* species are found in central Chile, viz. *H. halophilum, H. comosum,* and *H. chilense.* The first two occur at rather high altitudes in the Andes (above 2500 m). *H. comosum* grows, as in other areas, on dry soil in the mountain steppes, and *H. halophilum* in moist, often somewhat saline habitats.

H. chilense is a variable species and is met with in various habitats, but at lower altitudes. In the Chilean inland, it is common along small streams and in wet pastures. Between Valparaiso and La Serena, it was found to be common along the coast on alluvial soil and roadside gravel.

Plantago Investigation in Argentina and Chile

KNUD RAHN

Plantago sect. *Oliganthos* is a group of plants in which the delimitation of species is poorly understood, in spite of the availability of good and abundant dried material. Cultivation and chromosome counts in a few collections (Rahn 1957, 1976, Moore 1967) suggested that further material might contribute in solving the problems. This expedition offered an opportunity for making new collections.

The preliminary results (August 1979) are:

1. *Plantago* sect. *Oliganthos* is less common in South America than expected. The species are only found in some of the localities where the ecological conditions at least superficially seem appropriate. But when present the populations are often large.
2. 52 seed samples of this section where sown in May 1979 in a greenhouse at the experimental field of the Botanical Garden near Copenhagen. Chromosomes were counted in July. 5 samples of *Plantago pulvinata* and 9 of *Plantago tehuelcha* had 2n=24. Both species are often found growing together, apparently without hybridizing. The remainder of the material had 2n=48, 72 or 96 (in 18, 10 and 7 samples respectively) and forms several morphological groups, distinguishable at least when cultivated. Some of these groups may correspond to more than one chromosome number, and each number corresponds to more than one group.
3. When these morphological groups are found growing together in one area they occupy different polyploidy levels; but in another region, groups which apparently are identical with the preceding groups may occupy other levels.

Drastic climatic changes, like those during the different glacial periods, exterminate species in many localities, but open others for colonization by the same species. If the habitats differ somewhat in two isolated places colonized by the same population, then the evolution of the new populations will be slightly different. If the climate changes again, a third locality may offer conditions suitable for both populations. The locality may not yet have been reached by any of the populations (cp. 1. above), may have been reached by only one, or have been reached by both. If they are able to exchange genes, it is probable that only the population which arrived first will be recognizable. If the second colonizing population arrives a few years later, the genes brought by a few seeds or pollen grains will completely disappear in the multitude of genes of the already established population. If however the two populations are unable to exchange genes, e.g. if they have different chromosome number (3. above), the two populations are able to live side by side, especially if their ecological requirements are slightly different. This will prevent them from competing with each other everywhere, and the two populations would act like two species.

Plantago sect. *Oliganthos* is distributed in the mountains of New Guinea and East Australia, in Tasmania, New Zealand, Falkland Isl., Tierra del Fuego, Patagonia and at high altitudes in the Andes; a few collections are also known from the mountains of Guatemala and Mexico. Some of the species from New Guinea and South America are surprisingly similar. The section is a very distinct group, undoubtedly with a common origin.

The surface of the seeds, like that of all other species within the genus, turns into mucilage when moistened, and so facilitates long-distance dispersal e.g. by birds. In spite of this, the distribution pattern cannot be explained reasonably without accepting the presence of the section on the Antarctic continent in the past, and supposing a shorter distance than today between Australia and Antarctica, or the islands between these continents.

Our knowledge about the geography and climate of the southern continents during the Tertiary has increased rapidly in recent years.

In early Eocene (54 MY ago) Antarctica had its present position near the South Pole, but was united with Australia (incl. New Guinea and New Zealand) and South America. The Andes were not elevated, but the mountains in East Australia, Central Argentina and Eastern Brazil were higher then. A tropical climate with summer rainfall dominated 70-80% of the globe (Flohn 1978: 8). A climate suitable for *Plantago* sect. *Oliganthos* today, was then probably found in the Australian mountains and in Antarctica, but not in South America.

At about that time Australia was separated from Antarctica (Kennett 1978: 44) and subsequently moved 25° lat. North to its present position, i.e. about 50 km each MY. The cooling of the world climate during the Tertiary was compensated in Australia by its movement towards lower latitudes.

The Oligocene (38 MY BP) lowering of temperature caused a new temperate flora, dominated by *Nothofagus*, to develop near the Strait of Magellan (Mercer 1978: 75). The species came mainly from Antarctica.

About 26 MY ago the Antarctic glaciers reached the coast (Mercer 1978: 76), but pollen of *Nothofagus*, *Myrtaceae* etc. indicates that a rich flora still existed in Antarctica at Ross Bay (Coetzee 1978: 120), 14-10 MY ago the ice sheet of East Antarctica was build up, and plant life probably disappeared from that part of the continent. The ice started to accumulate in West Antarctica about 5 MY ago and was fully formed 3.8 MY ago (Mercer 1978: 86). Until then plant life probably persisted there.

The first glaciers in South America are known from about 3.5 MY ago; by then the Andes were also elevated in the southern part. Several cold and warm periods followed, and in some periods ice covered large areas of Patagonia. The climate in the lake region 40° S was, in the last interglacial period (128 000-75 000 Y ago), warmer than today. The last glaciation in South America ended 13 000 years ago.

If this information about palaeogeography and palaeoclimate is essentially correct the conclusion must be that *Plantago* sect. *Oliganthos* has existed in both Australia and Antarctica before these continents were far separated, e.g. more than 40 MY ago; the section reached South America after 38 MY BP and before 10 MY BP. Most genera with a comparable pattern of distribution must have had a similar history.

Collection made for the Botanical Garden, Copenhagen

JENS PETER HJERTING

During the whole expedition living plant material was collected for the Botanical Garden. The material was either in form of plants, tubers, bulbs, corms or as true seed. Totally 49 numbers of living plants and about 400 numbers of seeds were collected.

Special emphasis was laid on alpine plants expected to withstand the Danish climatical conditions, especially plants from high altitudes and from the southernmost Argentina and Chile. Among the more interesting genera can be mentioned: *Nassauvia, Oxalis, Sisyrinchium, Valerianella, Lupinus, Ourisia, Calceolaria, Tropaeolum, Astragalus, Primula* and several species within *Compositae, Malvaceae, Cruciferae* etc. A considerable number of *Calceolaria* were collected, partly in order to work taxonomically on the southern species and partly in order to find species that may grow and survive outdoors in Denmark. Another interesting group of plants is *Cactaceae.* Cacti were collected as far south as possible or from areas of extreme rough climate. It is expected that some of these cacti can survive in Denmark, especially when planted in well-drained soil. Of other collections should be mentioned *Chusquea culeou*, a bamboo with solid stems, which may be hardy in Denmark. *Begonia cucullata* was collected in Tucuman and is an interesting addition to our collection of that species, which is actually being hybridized with other *Begonia*-species. Seed from some of the tuberbearing wild species of *Solanum*, namely *S. chacoense, S. kurtzianum, S. sanctae-rosae, S. spegazzinii, S. vernei, S. infundibuliforme* was collected in the northwestern provinces. Unfortunately it was a very bad year for collecting wild potatoes, as many of the most important roads leading to interesting potato localities were interrupted by heavy rains. When we finally reached the Santa Victoria area in N. Salta, it was too late in the season, and only few potatoes were found. The road leading from La Quiaca to Santa Victoria is most interesting. Half of the 150 km road is above 4000-4500 m and display very good oportunities to collect alpine plants.

For the Institute of Plantanatomy and Cytology, Univ. of Copenhagen, species of *Chuquiraga, Adesmia, Mulinum, Baccharis, Umbelliferae* etc. were collected for current studies on stem assimilating plants. For the botanists working on arctic and alpine plants species of *Melandrium, Armeria, Epilobium, Draba, Ranunculus, Caltha* etc. were collected. Interesting in this connection is *Colobanthus quitoensis*, which is one of the two or three species of higher plants known from the Antarctica. This species, which is found up through the Andes to Ecuador, was now collected in Patagonia.

Acknowledgements

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Argentina, San Martin de los Andes: Instituto Patagonico de Ciencias Naturales.

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RESÚMEN

Expedicion Cientifica Danesa a Patagonia y Tierra del Fuego.

En el período de Octubre 1978 hasta Mayo 1979 se realizó una expedición científica hasta la parte más austral de Sudamérica, principalmente hasta la Patagonia y Tierra del Fuego. La realización de esta expedición se debe a la iniciativa del Sr. Bertel Chr. Skou, Buenos Aires, quien ofreció sufragar todos los gastos conectados con el trabajo de campo de la expedición. Los demás gastos fueron solventados por firmas privadas, bancos y fundaciones en Dinamarca.

La Patagonia y Tierra del Fuego tienen muchos rasgos climáticos en común con el Norte de Europa, siendo dominante el frente polar y los típicos vientos occidentalis en la región. A raíz de la cadena Andina los aires marítimos pierden la mayoría de su humedad como lluvia cuando suben en las sierras, y como consecuencia disminuye marcadamente la precipitación yendo hacia el este. Esto influye mucho sobre la flora y la fauna de la región. Por ejemplo, en las sierras se encuentra una selva siempre verde dominado por *Nothofagus dombeyi* y *N.betuloides*. Hacia arriba o hacia el este será reemplazada por *N. pumilio* o *N.antarctica*, las dos de follaje caedizo. Todavía más abajo y más hacia el este será reemplazada por vegetación de estepa.

La mayoría de las investigaciones de la expedición fueron realizadas en los Andes y en los territorios hacia el este. Comprendieron principalmente estudios de la evolución de los suelos; recolección de insectos, especialmente mariposas; estudios de la flora alpina y recolección de semilla, plantas vivas y material de herbario. En la última parte de la expedición se dirigieron hacia el Norte, y se hicieron estudios y recolecciones en la región subtropical alrededor de Salta y Tucumán. En continuación se da un resumen de los diversos proyectos.

Pedología
Henrik Breuning Madsen y Peter Frederiksen

Durante la expedición se sacaron muestras para estudios edafológicos detallados cerca de Bariloche, en Tierra del Fuego y alrededor de Tucumán. El propósito de las investigaciones fué investigar la influencia del clima sobre la evolución pedológica de diferentes sedimentos, en lugares donde una sierra da motivo a un gradiente climatico. Cerca de Bariloche se investigaron especialmente la evolución pedológica de ceniza volcánica y de »talus creep«, los dos sedimentos dominantes de la región. Se encontraron unicamente una ligera evolución pedológica en los suelos, y así un horizonte B estructural fué la evolución más fuerte en las capas de ceniza volcánica. El grueso y el contenido de humus en los horizontes A disminuyeron proporcionalmente con la precipitación, así que horizontes A apenas se han desarrollado en la región de estepas, de donde se en cambio describieron suelos salados. La localización de los perfiles se ven en figs. 8 y 9. En Tierra del Fuego se investigaron 37 perfiles, y su colocación geográfica se ven en figs. 10 y 11. Ciertos de los perfiles se han desarrolado bajo bosque, otros bajo vegetación de estepa, y por fin algunos sin vegetación. En esta región se investigó la evolución pedológica, particularmente sobre sedimentos glaciales o glaciofluviales, y se encontraron suelos con iluviación de arcilla acentuada, suelos con un ligera grado de podzolizacion y además, en las regiones secas, suelos con acumulación de sal. No se investigaron regiones turbosas, las que en ciertos lugares dominaban el paisaje.

Cerca de Tucumán se investigó especialmente la evolución pedológica en material de loess. En fig. 12 se ve la colocación de los perfiles en relación a geología, clima y vegetación. El clima se refleja claramente en el desarrollo del suelo, teniendo las regiones lluviosas iluviación de arcilla (horizontes Bt) mientras que perfiles con horizontes Csa se encuentran en las regiones más secas. De la mayoría de los precedentes perfiles se tomaron muestras para investigaciones químicas y físicas del suelo.

Entomología
Ebbe Schmidt Nielsen

Durante la expedición los cinco entomólogos colectaron insectos de 73 localidades principales en total. Se atribuyó la mayor importancia a colecciones de la región de los bosques subantárticas. El propósito principal de las actividades entomológicas fué el colectar representantes primitivos de varios órdenes de insectos como por ejemplo, Nannochoristidae, Peloriidae, Heterobathmiinae, Neopseustidae, Hepialoidea, Nepticuloidea e Incurvarioidea; además se realizaron recolecciones generales de insectos, especialmente de mariposas. Se da una lista de las localidades con las caracteristicas de su naturaleza, y el material colectado se presenta en cuadro II. El material de insectos volando de noche fué colectado por medio de 3 trampas de luz del tipo Heath (fig. 13a) y 3 del tipo Robinson modificado (fig. 13b). Además se utilizaron 2 trampas del tipo Malaise. El material colectado de Microlepidoptera se preparó inmediatamente después de la recolección en cajitas de plástico, mientras que el material de Macrolepidoptera se guardó sin preparación en cajas más grandes, también de plástico, para preparación más tarde. Algunos grupos de insectos, sin embargo, se conservaron en alcohol del 70%; material destinado a investigaciones anatómicas se fijaron en Bouin y larvas en Pampel y después fueron guardados en alcohol del 70%.

Formas de vida (lifeforms) en regiones alpinas y vegetación de 'lecho de nieve' (snowbed)
Simon Lægaard

Durante la expedición las investigaciones han comprendido los temas siguientes:

1. Análisis de vegetación de lecho de nieve (snowbed) en regiones alpinas. Estas investigaciones se realizaron en Tierra del Fuego y alrededor de Bariloche. En conexión con los análisis de vegetación se sacaron muestras de suelo, también para análisis.
2. Investigaciones de los tipos biológicos de las plantas vasculares y su adaptación a las condiciones alpinas.
3. Se herborizaron aprox. 1350 collecciones, se colectaron aprox. 210 plantas vivas y aprox. 70 muestras de semilla para cultivar. De 155 plantas se colectó material para investigaciones cromosómicas y de aprox. 70 plantas material para investigaciones anatómicas.

Colecciones de arboretum, especialmente de Araucaria y Nothofagus
Søren Ødum

Durante la expedición se colectaron semilla y material vivo de árboles y arbustos de un gran número de localidades para estudios y ensayos de cultivo. Además se ejecutaron dos tareas especiales:

1. Colección de proveniencia de *Araucaria araucana*. Durante el mes de marzo se colectaron aprox. 1000 semillas de cada una de

las 14 localidades, comprendido dentro de la zona de extensión natural de la especie, con el propósito de investigar la variación de cualidades, especialmente con respecto a resistencia al frío.

2. Recolección de plantas de *Nothofagus betuloides, N. pumilio* y *N. antártica* para ensayos forestales y de horticultura en las Islas Feroes en el Atlántico Norte. En estas islas, donde no existe bosque natural, el clima es parecido al clima de las Islas Malvinas y la costa sur de Tierra del Fuego. Un ensayo en 1975-76 con replantación de plantas desde el sur de Argentina hasta las Islas Feroes ha dado resultados prometedores, y por lo tanto en el mes de Abril de este año se han sacado 6500 plantas chicas de *Nothofagus*, las cuales fueron llevadas hasta las Islas Feroes para ensayo de plantación.

Especies silvestres de Hordeum (cebada) en Argentina y Chile
Roland von Bothmer y Niels Jacobsen

En Sudamérica se encuentran aprox. 20 especies de cebada silvestre. Todas las especies se encuentran en Argentina o Chile, pero unas pocas se extienden también al norte. Durante la expedición se colectaron aprox. 700 muestras de semilla de cebadas silvestres. Cuando fué posible se prepararon también material de herbario. El herbario principal se encuentra en Copenhaque (C) y en Ottawa (DAO), y duplicados en Århus (AAU), Buenos Aires (BAA) y Kew (K). Todas las especies sudamericanas están representadas. Los estudios del material colectado comprenden preferentemente investigaciones sistemáticas y citogenéticas con el propósito de aclarar el parentesco entre las especies. Además se tratará de cruzar todas las especies silvestres con cebada cultivada para conocer las posibilidades de transferir cualidades deseables de las especies silvestres.

Investigationes de Plantago en Argentina y Chile
Knud Rahn

El número de cromosomas de 49 muestras de *Plantago* sect. *Oliganthos* fué determinado. *Plantago tehuelcha* Speg. y *P. pulvinata* Speg. tienen ambos 2n=24. Las dos especies a veces en la naturaleza se encuentran una cerca de la otra. Las demás especies tienen 2n=48, 72 o 96 y forman diversos grupos morfológicos. Cuando dos o más de estos grupos se encuentran en la misma región, el número de cromosomas siempre es diferente, pero en una región diferente los mismos grupos tienen a veces otros números. *Plantago* sect. *Oliganthos* existió en Australia y Antártica hace 40 miliones de años y llego a America del Sur hace menos de 38 y más de 10 miliones de años. Gran parte de la flora templada en América del Sur llegó de Antártica durante esta época.

Colecciones para el Jardín Botánico, Copenhague
Jens Peter Hjerting

Para el Jardín Botánico de Copenhague se hicieron 49 colecciones de plantas vivas y aprox. 400 de semillas. Con preferencia se colectaron especies alpinas con la esperanza de que pueden crecer bajo las condiciones climáticas de Dinamarca. *Calceolaria* fué colectado para el doctor Ulf Molau, Suecia, para un tratamiento monográfico del género, y las *Cactaceas* para probarlas al aire libre en Dinamarca. Para el profesor T.W. Böcher se colectaron plantas áfilas, y para investigaciones bioquímicas fué colectado material de *Calyceraceae* y *Loasaceae.* En el noroeste de Argentina fué colectado semillas y tubérculos de especies silvestres de papas.

RESUME

Den Danske Naturvidenskabelige Ekspedition til Patagonien og Ildlandet 1978/79

I perioden fra oktober 1978 til maj 1979 blev der gennemført en dansk terrestrisk naturvidenskabelig ekspedition i det sydligste af Sydamerika, overvejende i det patagoniske område samt på Ildlandet. Realiseringen af denne ekspedition skyldes et initiativ fra dir. Bertel Chr. Skou, Buenos Aires, der tilbød at afholde samtlige udgifter forbundet med ekspeditionens feltarbejde. De øvrige udgifter blev afholdt af danske virksomheder, banker og fonds.

Patagonien og Ildlandet har klimatisk mange fælles træk med det nordlige Europa, idet polarfronten og udprægede vestenvinde dominerer i området. På grund af Andeskæden mister de maritime luftmasser hovedparten af deres fugtighed som stigningsregn over bjergkæden, og en markant nedbørsgradient opstår med aftagende nedbørsmængder mod øst. Dette har stor indflydelse på floraen og faunaen i området; i bjergene findes der således en stedsegrøn løvskov domineret af *Nothofagus dombeyi* og *N. betuloides*, der op mod skovgrænsen eller mod øst afløses af de løvfældende *Nothofagus pumilio* eller *N. antarctica*, der igen omkring kædens østlige fod går over i en steppevegetation. I Andeskæden og i de øst for liggende områder blev hovedparten af ekspeditionens forskningsmæssige opgaver udført. Disse omfattede især studier af jordbundsudviklingen i relation til klima og udgangsmateriale, indsamling af insekter med særligt henblik på sommerfugle, studier af alpin flora og snelejevegetation samt indsamling af frø, levende planter og herbariemateriale. På den sidste del af ekspeditionen kørtes mod nord, og der blev foretaget studier og indsamlinger i det subtropiske område omkring Tucuman og Salta. I det efterfølgende er de forskellige projekter sammenfattet.

Jordbundsgeografi
Henrik Breuning Madsen og Peter Frederiksen

På den danske naturvidenskabelige ekspedition til Patagonien og Ildlandet blev der udført prøveudtagning for detaljerede jordbundsstudier nær Bariloche, på Ildlandet og omkring Tucuman. Formålet med undersøgelserne var at undersøge klimaets indflydelse på forskellige aflejringers pedologiske udvikling, hvor en bjergkæde giver anledning til en klimatisk gradient.

Ved Bariloche blev den pedologiske udvikling især undersøgt på vulkansk aske og talus creep, der var de dominerende aflejringer i området. Der blev kun fundet en svag pedologisk udvikling i jordene, og således var en strukturel B horisont den stærkeste udvikling i de vulkanske askelag. A horisontens tykkelse og humusindhold faldt med aftagende nedbørsmængde, således at A horisonter knapt var udviklet i stepperegionen. Profilernes lokalisering ses af fig. 8 og 9.

På Tierra del Fuego blev 37 profiler undersøgt, og deres geografiske placering ses af fig. 10 og 11. Visse af profilerne var udviklet under skov, andre under steppevegetation og atter andre uden vegetation. Den pedologiske udvikling i dette område blev især undersøgt på glaciale og glacifluviale aflejringer, og der blev fundet jorde med udpræget lernedslemming, svagt podzolerede jorde samt i de tørre regioner jorde med saltakkumulation. Der blev ikke udført undersøgelser i de tørveprægede områder, der visse steder er dominerende i landskabet.

Ved Tucuman blev den pedologiske udvikling især undersøgt på løssmateriale. På fig. 12 ses profilernes placering i forhold til geologi, klima og vegetation. Klimaet afspejles tydeligt i jordbundsudviklingen, idet de nedbørsrige regioner har lernedslemninger (Bt-horisonter), medens salthorisonter optræder i de mere tørre regioner.

Fra hovedparten af de ovenstående profiler er der udtaget prøver til vandretention, medens der fra alle profiler er udtaget prøver til jordbundskemiske og -fysiske undersøgelser.

Entomologi
Ebbe Schmidt Nielsen

De fem deltagende entomologer indsamlede under hele ekspeditionen insekter på ialt 73 hovedlokaliteter, med hovedvægten lagt på indsamlinger i det tempererede andino-patagoniske skovområde. Formålet med de entomologiske aktiviteter var specielt at indsamle primitive repræsentanter for en række insektordner, så som Nannochoristidae, Peloriidae, Heterobathmiinae, Neopseustidae, Hepialoidea, Nepticuloidea og Incurvarioidea, samt desuden at foretage generelle indsamlinger af insekter, specielt sommerfugle. En liste over lokaliteterne og deres naturtyper er givet, og det indsamlede materiale opregnet i Tabel 2. Materialet af natflyvende insekter blev indsamlet med tre lysfælder af Heath typen (Fig. 13a) og tre af en modificeret Robinson type (Fig. 13b). Desuden blev der benyttet to Malaise fælder. Det indsamlede materiale af Microlepidoptera blev præpareret umiddelbart efter indsamlingen i flade plastæsker (Fig. 14b), mens Macrolepidoptera nålet blev opbevaret i større plastæsker (Fig. 14a) for senere præparation. En del grupper blev dog konserveret i 70% alkohol, materiale indsamlet med henblik på anatomiske undersøgelser blev fikseret i Bouin og larver konserveret i Pampel og derefter opbevaret i 70% alkohol.

Alpine livsformer og snelejevegetation
Simon Lægaard

Under ekspeditionen har undersøgelserne omfattet følgende emner:

1. Analyse af snelejevegetation i alpine områder. Disse undersøgelser har fundet sted ved Bariloche og på Tierra del Fuego. Sammen med vegetationsanalyserne er der indsamlet jordprøver til analyse.
2. Undersøgelse af de højere planters livsformer og tilpasning til de alpine forhold.
3. Der er foretaget indsamlinger og herunder samlet ca. 1350 herbarieeksemplarer, ca. 210 levende planter til dyrkning, ca. 70 frøprøver til dyrkning. Fra 155 planter blev samlet materiale til chromosom-cytologiske undersøgelser og fra ca. 70 planter materiale til planteanatomiske undersøgelser.

Arboretprojekter specielt med Araucaria og Nothofagus
Søren Ødum

På et stort antal lokaliteter blev der under ekspeditionen indsamlet frø og plantemateriale af træer og buske til studier og dyrkningsforsøg. Endvidere blev to specielle opgaver udført:

1. Proveniensindsamling af *Araucaria araucana.* I marts indsamledes portioner på ca. 1000 frø på hver af 14 lokaliteter i artens naturlige udbredelsesområder med henblik på dyrkning og undersøgelse af variation i egenskaber, specielt hårdførhed.
2. Indsamling af planter af *Nothofagus betuloides, N. pumilio* og *N. antarctica* til forsøg i skovbrug og havebrug på Færøerne i Nordatlanten. På Færøerne, hvor naturlig skov ikke forekommer, er klimaet af næsten samme type som på Islas Malvinas og sydkysten af Tierra del Fuego. Et forsøg i 1975-76 med flytning af planter fra det sydlige Argentina til Færøerne har givet lovende resultater, og i april blev der derfor i skoven omkring Ushuaia optaget 6.500 små *Nothofagus*-planter, som blev fløjet til Færøerne til plantningsforsøg.

Vilde arter af byg (Hordeum) i Argentina og Chile
Roland von Bothmer og Niels Jacobsen

I Sydamerika forekommer ca. 20 vildtlevende bygarter. Alle arter findes i Argentina og Chile, men nogle af dem har udbredelsesområder, der strækker sig længere mod nord. På ekspeditionen blev der indsamlet ca. 700 frøprøver af vilde bygarter. Pressede eksemplarer blev dog også medtaget i vid udstrækning, og de to hovedsæt findes i de botaniske museer i København og Ottawa (dubletsæt i Århus, Buenos Aires og Kew). Materiale fra samtlige sydamerikanske taxa er repræsenteret. Arbejdet med det indsamlede materiale omfatter fortrinsvis systematiske og cytogenetiske undersøgelser for at få rede på de slægtsmæssige forhold. Alle de vilde arter vil blive forsøgt krydset med den dyrkede byg, for at undersøge mulighederne for at overføre ønskede, arvelige egenskaber fra de vilde arter.

Undersøgelser af vejbred (Plantago) i Argentina og Chile
Knud Rahn

Kromosomerne hos 49 prøver af *Plantago* sect. *Oliganthos* blev talt. *Plantago tehuelcha* Speg. og *P. pulvinata* Speg., som kan vokse i nærheden af hinanden, har begge 2n=24. De øvrige har 2n=48, 72 eller 96 og danner flere morphologisk forskellige grupper. Når to eller flere af disse grupper er indsamlet fra samme område, har de forskellige kromosomtal, men samme grupper kan i et andet område have andre kromosomtal. *Plantago* sect. *Obliganthos* må have eksisteret i Australien og Antarctis for mere end 40 mill. år siden (Eocene) og kommet til Sydamerika for mindre end 38 og mere end 10 mill. år siden. En stor del af den tempererede flora i Sydamerika må være indvandret fra Antarctica i dette tidsrum.

Indsamlinger til Botanisk Have i København
Jens Peter Hjerting

For Botanisk Have i København blev der indsamlet 49 numre af levende planter og ca. 400 numre af frø. Der blev lagt særlig vægt på alpine arter, som måtte formodes at egne sig for danske klimatiske forhold. *Calceolaria* blev indsamlet med henblik på en monografisk behandling af slægten, og kaktus med henblik på dyrkning på friland i Danmark. Stængel-assimilanter blev indsamlet til Institut for Planteanatomi og Cytologi, og med henblik på biokemiske undersøgelser blev der samlet materiale af *Calyceraceae* og *Loasaceae.* I det nordvestlige Argentina fra Mendoza til Jujuy-Salta blev der indsamlet frø og knolde af vilde arter af kartoffel. En særlig interesse knytter sig til indsamlinger langs vejen fra La Quiaca til Santa Victoria, som på store strækninger løber i en højde på mellem 4000 og 4500 m over havet.

Fig. 24: Rio Maule valley towards the W just west of Lago Maule, E of Talca, Chile.
Fig. 24: Rio Maule dalen lige vest for Lago Maule, der ligger øst for Talca i Chile.

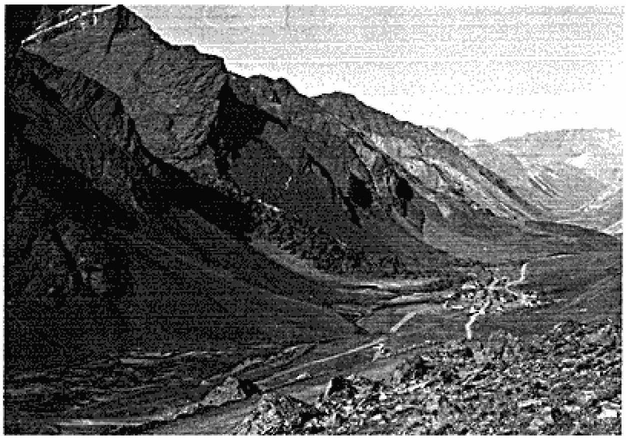

Fig. 25: The situation of the Argentinean frontier station, Las Cuevas, at the main road between Mendoza and Santiago, seen towards the NE.
Fig. 25: Den argentinske grænsestations beliggenhed ved hovedvejen mellem Mendoza og Santiago, set mod nordøst.

Fig. 26: Indian family (Araucans) collecting seed of Araucaria araucana for food. At Rio Aluminé S of Lago Aluminé.
Fig. 26: Indiansk familie, der indsamler frø fra Araucaria araucana til senere fortæring.

Fig. 27: Patagonian steppe with easternmost outpost of Nothofagus antarctica between Tecka and Corcovado, Prov. Chubut.
Fig. 27: Den patagoniske steppe med de østlige forekomster af Nothofagus antarctica mellem Tecka og Corcovado.

Fig. 28: Hordeum procerum and H. jubatum on a salt marsh SW of Bahia Blanca, Prov. Buenos Aires.
Fig. 28: Hordeum procerum og H. jubatum i et marskområde sydvest for Bahia Blanca, Prov Buenos Aires.

Fig. 29: Big trees of the evergreen Nothofagus betuloides NW of Paso Garibaldi, Tierra del Fuego.
Fig. 29: Store stedsegrønne Nothofagus betuloides nordvest for Paso Garibaldi, Tierra del Fuego.

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dition to our collection of that species, which is actually being hybridized with other *Begonia*-species. Seed from some of the tuberbearing wild species of *Solanum*, namely *S. chacoense, S. kurtzianum, S. sanctae-rosae, S. spegazzinii, S. vernei, S. infundibuliforme* was collected in the northwestern provinces. Unfortunately it was a very bad year for collecting wild potatoes, as many of the most important roads leading to interesting potato localities were interrupted by heavy rains. When we finally reached the Santa Victoria area in N. Salta, it was too late in the season, and only few potatoes were found. The road leading from La Quiaca to Santa Victoria is most interesting. Half of the 150 km road is above 4000-4500 m and display very good oportunities to collect alpine plants.

For the Institute of Plantanatomy and Cytology, Univ. of Copenhagen, species of *Chuquiraga, Adesmia, Mulinum, Baccharis, Umbelliferae* etc. were collected for current studies on stem assimilating plants. For the botanists working on arctic and alpine plants species of *Melandrium, Armeria, Epilobium, Draba, Ranunculus, Caltha* etc. were collected. Interesting in this connection is *Colobanthus quitoensis*, which is one of the two or three species of higher plants known from the Antarctica. This species, which is found up through the Andes to Ecuador, was now collected in Patagonia.

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