Phytocoenologia	25 (3)	399 – 434	Berlin–Stuttgart, September 25, 1995

Plant communities of the Bol'šoj Čivyrkuj River Valley, Barguzinskij Range, East Siberia

by Milan CHYTRÝ, Brno, Oleg A. ANENCHONOV, Ulan-Ude, and Jiří DANIHELKA, Mikulov

with 1 figure and 5 tables

Abstract. The vegetation of the Bol'šoj Čivyrkuj River Valley in the Barguzinskij Range, East Siberia, is described and classified into 39 plant communities, using the Braun-Blanquet approach. These include 7 tundra communities, 2 talus, 6 meadow and tall-forb, 3 sand-dune, 2 rock, 1 spring, 1 mud, 9 fen and mire, 1 shrub, 6 forest and 1 krummholz communities. Five of them are formally described as new associations: Geranio albiflori-Pedicularietum uncinatae, Aconito rubicundi-Salicetum krylovii, Aquilegio glandulosae-Geranietum albiflori, Calamagrostio langsdorffii-Salicetum roridae, and Pleurozio schreberi-Pinetum pumilae. These communities are documented by 173 relevés, their ecology is briefly described and the syntaxonomy discussed.

Introduction

A syntaxonomical study of vegetation of Zabajkal'skij Nature National Park, using the Braun-Blanquet approach, was launched in 1991, when the first Czech biological expedition, organized by the International Center for Research and Conservation of Siberia, Praha, worked on the Svjatoj Nos Peninsula on eastern coast of Lake Baikal.

Phytosociological research of that area in 1991-1992 was partly summarized in two papers focusing on classification and description of plant communities and syntaxonomy (CHYTRÝ & PEŠOUT 1992, CHYTRÝ et al. 1993). To investigate the other parts of the National Park, research began in the river valleys in the southern part of the Barguzinskij Range. In 1992, the vegetation of the Bol'šaja Čeremšana River Valley was studied (DANIHELKA & CHYTRÝ, ms.) and in 1993, that of the Bol'šoj Čivyrkuj River Valley. The results of the latter study are summarized in the present paper, introducing descriptions of plant communities of the area.

Study area

The Bol'šoj Čivyrkuj River drains the western slopes of the Barguzinskij Range into Lake Baikal (Fig. 1). Its estuary is situated in the northern part of Čivyrkujskij Bay (approximately 53°49' N, 109°12' E). The river forms an

0340-269X/95/0025-0399 $ 9.00
© 1995 Gebrüder Borntraeger, D-14129 Berlin · D-70176 Stuttgart

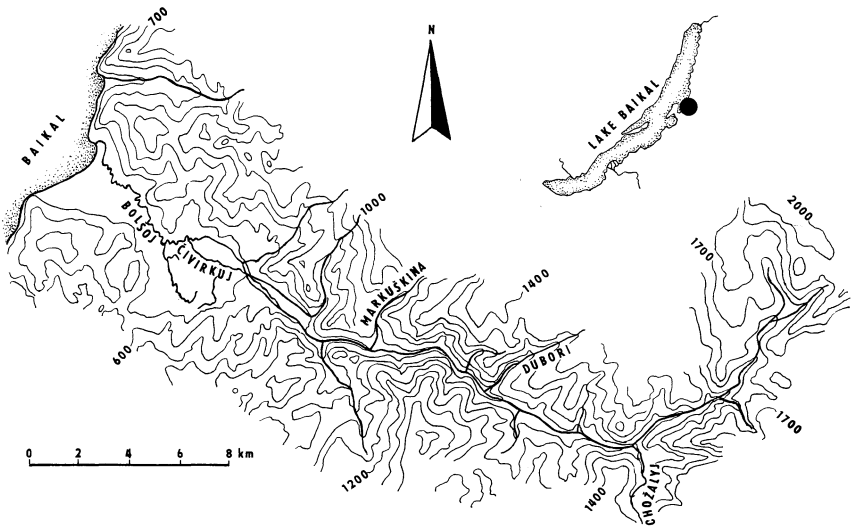

Fig. 1. Map of the Bol'šoj Čivyrkuj River Valley.

approximately 28 km long valley, running approximately in an E–W direction, from about 1800–1900 m in the spring area to 455.9 m a.s.l. in the estuary.

Small creeks forming the river drain comparatively flat mountain ranges into a glacial cirque with flat bottom at about 1500–1900 m a.s.l. Downstream, the valley becomes V-shaped, narrow and deep. At about 8 km from the mouth the current velocity decreases as the river almost approaches the altitude of Lake Baikal, forming a broad floodplain with numerous meanders.

The whole area is formed of nutrient-poor rocks of the crystalline complex: various types of granites, syenites, pegmatites, aplites and granite-porphyrites are present. In the lower part of the valley, this bedrock is overlaid by the Quarternary deposits: alluvial, lacustrine and eolian sands, gravels, loams, clays and sapropel peats (Davydov et al. 1980).

Floods on the river occur in June and early July, with the lowest water level in December-January. During the floods, the water level is 1–2 m higher than the average level.

The climate of the Lake Baikal area is generally continental, although the huge masses of water in the lake influence the coastal region in the manner of a sea (Moložnikov 1976). Summer temperatures are 4–6 °C lower than elsewhere in the area, whereas winter temperatures are 5–8 °C higher (Moložnikov 1976). On the Baikal shore, mean August temperatures vary approximately between 12 and 13 °C, mean February temperatures between –18 and –23.5 °C (Imetchenov & Matvejčuk 1990). During the vegetation period, temperatures of the middle altitudes of the mountains on Baikal coasts are generally higher than on the summits and in foothills along the shore. Western slopes of mountains above the eastern Baikal coast are the most humid habitats in the area (Tjulina 1967, 1976). Mean annual rainfall varies

between 350 and 400 mm on the Baikal coast and may be three times as high on the summits (MOLOŽNIKOV 1976). Snow lies from late October till early May on the shore and from late September till June on the summits (MOLOŽNIKOV 1976).

The vegetation of the area possesses an altitudinal pattern typical of the north-eastern Baikal shore (see TJULINA 1967, 1976). On sand dunes on the cool Baikal shore, patches of dwarf cedar pine (*Pinus pumila*) are developed as a descending subalpine belt vegetation. These krummholz stands and contact patches of floristically similar *Pinus sibirica* woodlands are accompanied by vegetation of open sand dunes. On the broad floodplain of the river behind the coastal sand bar, vast wetlands occur with sedge fens, mires and scattered pools. Wetlands are bounded by peaty forests. The slopes of the valley are covered with taiga forest, in which *Larix sibirica* and *Pinus sylvestris* predominate on gentle slopes, pure *Pinus sylvestris* on steeper south-facing slopes and *Abies sibirica* on steeper north-facing slopes. *Abies sibirica* floodplain forests and tall-forb communities occur along the river in the V-shaped part of the valley.

The alpine timberline lies approximately at 1000–1200 m a.s.l. (there are differences between slopes of various aspects and between the summits of ranges and bottoms of valleys) and above it the subalpine belt begins, formed of *Pinus pumila* krummholz, with islands of open tali. In the higher part of this belt, in the cirque, stands of shrubby birches *Betula divaricata* and *B. nana* ssp. *exilis* are developed besides the krummholz, forming a complex with subalpine meadows, tall-forb communities, short grasslands and mires. Scattered solitary *Larix sibirica* trees are also present there. The alpine belt that begins in about 1600–1700 m a.s.l., is represented by short grasslands and vegetation of *Dryas* tundra, talus slopes and snowbed patches. Details on the flora of the territory are summarized in DANIHELKA et al. (ms.).

Methods

Preliminary phytosociological investigations were carried out by O.A.A. in August 1991. The bulk of the relevés and ecological observations presented in this paper was collected by M.C., O.A.A. and J.D. in July 1993. During the latter expedition, the vascular plant flora was simultaneously investigated (DANIHELKA et al., ms.). The methodological approach to vegetation description is based on that of the Zürich-Montpellier school (BRAUN-BLANQUET 1964, WESTHOFF & VAN DER MAAREL 1978). Emphasis is laid on the natural terrestrial vegetation. Synanthropic vegetation types (which are rare in the area, confined only to the vicinity of the settlement in the mouth of the Bol'šoj Čivyrkuj River), and aquatic plant communities are not treated in this paper. Relevés were made using the 7-degree Braun-Blanquet scale (–, +, 1, 2, 3, 4, 5). Crustaceous lichens and epiphytic cryptogams on the bark of trees were not recorded in relevés.

A total of 173 relevés was included in the final synthesis, after 4 relevés of non-stabilized successional stages (in particular, post-fire vegetation) had

been excluded. Relevés were joined with other relevés by O.A. Anenchonov, M. Chytrý, J. Danihelka and P. Pešout, collected at north-eastern Baikal area (mainly the Svjatoj Nos Peninsula and the Bol'šaja Čeremšana River Valley) and divided into preliminary groups according to physiognomic criteria (e. g., tundras, wetlands and mires, forests, etc.). Within these groups, divisive polythetic classification was applied using the program TWINSPAN (HILL 1979). TWINSPAN groups were used as the basis for the classification into particular communities accepted in this paper; ecological interpretation was decisive for the choice of hierarchical level at which a particular community was recognized. All the communities distinguished were compared with the communities described in the phytosociological literature. If a community proved to be identical with an association already described in the sense of the Code (BARKMAN et al. 1986), the valid name was accepted. The communities that have also been encountered in other territories of north-eastern Baikal region in analogous environments and species composition of which appears to be stable, are described as new associations, provided there are no unsolved problems of their syntaxonomic relationships to the communities described from other areas. Otherwise, communities are labelled with names of one or two typical species and with the word "community" that means here a vegetation unit corresponding to the association. Unless there were serious reasons to change the name of a "community", the same names were used for analogous vegetation types as in CHYTRÝ & PEŠOUT (1992) and CHYTRÝ et al. (1993).

Nomenclature of vascular plants follows "Flora Sibiri" for species from families that have been treated in the volumes published so far (KRASNOBOROV 1988; KRASNOBOROV & MALYŠEV 1992; MALYŠEV & PEŠKOVA 1987, 1990, 1993; PEŠKOVA & MALYŠEV 1990; POLOŽIJ & MALYŠEV 1988), the others are according to MALYŠEV & PEŠKOVA (1979). Names of lichens are used according to SANTESSON (1984) and that of bryophytes follow BARDUNOV (1992).

A list of the localities of relevés may be obtained on request from the senior author.

Results: Plant community survey

Tundra communities

Alectorio ochroleucae-Patrinietum sibiricae Chytrý, Pešout et Anenchonov 1993 (Tab. 1, rel. 1–11)

This is an alpine tundra community of the extremely windblown ridge habitats on the summits of mountain ranges. The soil developed on the siliceous bedrock is a very shallow ranker. In winter, the bulk of the snow cover is probably often blown away. Creeping chamaephytes, low hemicryptophytes, fruticose lichens and mosses are the dominant life forms in this community. This community was studied on the summits of the mountain range on the left side of the Bol'šoj Čivyrkuj River Valley 3–8 km NE of the confluence with the Chožalyj Creek. The association was described from the

summit area of the Svjatoj Nos Peninsula (CHYTRÝ et al. 1993). Very closely related communities were described by ŽITLUCHINA & ONIŠČENKO (1987) from the West Sayan Mts., as the associations Dryadetum oxyodontae ŽITLUCHINA et ONIŠČENKO 1987 ms., and Oxytropidetum alpinae Žitluchina et Oniščenko 1987 ms. *Dryas* tundras were described by HILBIG (1990a,b) from the alpine and subalpine belts of Mongolian mountains. However, there are some differences in the floristic composition of communities from Mongolia and the Barguzinskij Range or West Sayan Mts. Alectorio ochroleucae-Patrinietum sibiricae belongs to the alliance *Dryadion oxyodontae* Žitluchina et Oniščenko 1987 ex Chytrý, Pešout et Anenchonov 1993.

Salix turczaninowii-Sibbaldia procumbens community (Tab. 1, rel. 12–17)

This species-poor snowbed community is formed by prostrate herbs, grasses, creeping chamaephytes, mosses and lichens. It occurs in leeward sites in the alpine tundra where snow lies about 9 months. Soil, although developed in concave landforms, is usually a shallow ranker. In the study area, the community was encountered on slopes on the right side of the Bol'šoj Čivyrkuj River Valley 7.5–8.5 km of the confluence with the Chožalyj Creek. This community has also been reported from the summit of the Barguzinskij Range in the spring area of the Bol'šaja Čeremšana River (DANIHELKA & CHYTRÝ, ms.) and analogous vegetation is also reported by TJULINA (1976) from the Šumilicha River Valley. This community belongs to the order Salicetalia herbaceae Br.-Bl. in Br.-Bl. in Jenny 1926, nevertheless, its species composition differs from communities described in Europe (GJAEREVOLL 1956, DIERSSEN 1984) and the Arctic (HADAČ 1971, 1985, 1989; DANIELS 1994; ELVEBAKK 1994; KOROLEVA 1994; MATVEYEVA 1994; RAZZHIVIN 1994).

Rhododendro aurei-Betuletum exilis Chytrý, Pešout et Anenchonov 1993 (Tab. 1, rel. 18)

This is a *Betula nana* ssp. *exilis* dominated community of the alpine tundra developed as a result of paludification processes in poorly drained habitats, usually in shallow depressions on permafrost. A moss layer formed of hygrophilous mosses including *Sphagnum* sp. div., is a typical physiognomic feature of the communities of this association. The only occurrence of this association in the Bol'šoj Čivyrkuj Valley was ascertained on the bottom of the cirque in the upper part of the valley. This association is known from the summit area of the Svjatoj Nos Mountain Range (CHYTRÝ et al. 1993). From the mountain ranges in the northern Baikal area, similar stands were described by MOLOŽNIKOV (1986: 40–42, 68, see also for further references). Similar vegetation was described from the alpine tundra of the West Sayan Mts. (ŽITLUCHINA & ONIŠČENKO 1987, ŽITLUCHINA 1989). This association belongs to the alliance Empetro-Betulion rotundifoliae Žitluchina et Oniščenko ex Chytrý, Pešout et Anenchonov 1993.

Tab. 1. 1–11 Alectorio ochroleucae-Patrinietum sibiricae, 12–17 *Salix turczaninowii-Sibbaldia procumbens* comm., 18 Rhododendro aurei-Betuletum exilis, 19–23 Cladino stellaris-Betuletum exilis, 24–25 *Pleurozium schreberi-Betula divaricata* comm., 26–27 *Bergenia crassifolia-Juniperus sibirica* comm., 28–40 Anemonastro sibiricae-Festucetum ovinae, 41–43 *Artemisia lagocephala-Dryopteris fragrans* comm., 44–46 *Dryopteris fragrans-Rubus sachalinensis* comm.

Relevé nr.	11	111111	1	12222	22	22	2233333333334	444	444
	12345678901	234567	8	90123	45	67	8901234567890	123	456
E_2 - shrub layer									
Betula divaricata	. . . . .	. . . . .	.	. . . . .	44	. .	. . . . .	. . .	. . .
Juniperus sibirica	. . . . .	. . . . .	.	. . . . .	.1	45	. . .1 . . .1	. . .	. . .
Rubus sachalinensis	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	112
Ribes fragrans	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	2+.
Sambucus sibirica	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	2-.
Lonicera cf. *pallasii*	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	2.2
Betula nana ssp. *exilis*	. . . . .	. . . . .		3 45454	. .	. .	. . . . .	. . .	. . .
Salix krylovii	. . . . .	. . . . .	.	1.+. .	. .	. .	. . . . . - . . .	. . .	. . .
Pinus pumila	. . . . .	. . . . .	.	. . . . .	.+	.+	1	. . .	. . .
E_1 - field layer									
Salix sphenophylla	22322222+.1	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Dryas incisa	. .2+1321+.+	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Minuartia arctica	. .+.1+++1.+	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Bistorta vivipara	11+2.+. . . .1	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Vaccinium uliginosum	+++.1.++. . .	. . . . .	.	. . . . .	.+	. .	. . . . .	. . .	. . .
Pedicularis oederi	++.+++. . . .+	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Gentiana algida	++.+.+.+. .2	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Coeloglossum viride	+.++++. . . .+	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Artemisia furcata	. .1.++.1+.-	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Silene chamarensis	. .+.++.++.+	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Hierochloë alpina	++.+.+.+. . .	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Kobresia myusoroides	. .++.+1. . .+	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Carex ledebouriana	. .+1.+.+1. .	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Oxytropis alpicola	. .22. . .21.+	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	. . .
Poa attenuata	. .22.+.1. . .	. . . . .	.	. . . . .	. .	. .	. . . . .	. .+	. . .
Luzula camtschadalorum	. . . . .	2++.1+	.	. . . . .	. .	. .	. . . . . +	. . .	. . .
Sibbaldia procumbens	. . . . .	+23-.+	.	. . . . .	. .	. .	. . . . . + ... 1	. . .	. . .
Anthoxanthum alpinum	. . . . .	. . .+. .	.	1. . . .	. .	+.	++122122. .11+	. . .	. . .
Campanula rotundifolia	. . . . .	. . . . .	.	. . . . .	. .	+.	++.++1+1.+++.	. . .	. . .
Aquilegia glandulosa	. . . . .	. . . . .	.	. . . . .	. .	-.	+-+. .1+2.2. .+	. . .	. . .
Dianthus superbus	. . . . .	. . . . .	.	. . . . .	. .	. .	+.++++++.	. . .	. . .
Festuca altaica	. . . . .	. . . . .	.	. . . . .	. .	. .	.2. . . . .1+2. .+	. . .	. . .
Dracocephalum altaiense	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . .+++. .++. .	. . .	. . .
Artemisia lagocephala	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . . .	21-	. . .
Sorbaria pallasii	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . . .	+++	. . .
Ledum palustre	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . . .	+.1	. . .
Calamagrostis langsdorffii	. . . . .	. . . . .	.	+. . . .	.1	. .	. . . . .	. . .	211
Rubus sachalinensis juv.	. . . . .	. . . . .	.	. . . . .	. .	. .	. . . . .	. . .	1+1
Bupleurum triradiatum	. . . . .++-+. .	. . . . .	.	. . . . .	. .	. .	.+++.111+++. .	. . .	. . .
Carex podocarpa	. . . . .	.+++21	.	. . . . .	. .	. .	.+. .+.++++. .+	. . .	. . .
Carex pallida	. . . . .	. . . . .	.	22221	2.	+.	.+.+1. . .2. . . .	. . .	. . .
Vaccinium myrtillus	. . . . .	. . . . .	.	.+. .1	11	2.	221. .+1.	. . .	. . .
Rhodococcum vitis-idaea	. . . . . +	. . . . .	.	. .++1	11	+1	+. . .++. .++.+.	. .+	. . .
Festuca ovina	. . . .+.	2-.222	.	1111+	12	21	2232232+2222+	. . .	. . .
Solidago dahurica	. . . . .	. .-+.-	.	+. .++	. .	+-	++1.2+111+1++	. . .	. . .

Tab. 1. (cont.)

Relevé nr.	11 111111 1 12222 22 22 2233333333334 444 444 12345678901 234567 8 90123 45 67 8901234567890 123 456
Anemonastrum sibiricum	++22-+-++.2 ...+.. . ..1.. +. -1 ++2..+111111+ ... ...
Aconogonon ocreatum	...++.+1.+1 +.-+.. . ... +.+....+-..++ ... ...
Bergenia crassifolia	....+.. . ..... 12 12 +...2.+..2.1+ +1. ...
Schulzia crinita	.-+2.+.+..+ .....+ . ..+.. .. ..++...+ ... ...
Luzula sibirica	+.+.+..+... ...+.. . ...++...+ ... ...
Selaginella rupestris	..-..+.-+.+ ....1. ... ..+
Poa sibirica	.....2 ..... . +.... .. -. ...+.+++..... ... ...
Rhododendron aureum	....+ 1 ..+.. 2. .. ....1.....23 ... ...
Pinus pumila juv.	....+..... -..+.. . ... -. .....1- ... ...
Viola altaica	....+ . +.... .. ..+...+.+.+ ... ...
Veratrum lobelianum	.... +.... .. .- .....1..+-+ ... ...
Gentiana grandiflora	.... -. ..-..+-.+.1.. ... ...
Minuartia verna	.....1. .... ++.....+... ... ...
Trollius kytmanovii	.... - 1.... .. ..++.... ... ...
Dryopteris fragrans	.... .1. +++
Carex bigelowii ssp. *ensifolia*	22..... ..... 4 ....
Crepis chrysantha	..+1.....+ ....
Luzula confusa	...+-1..... ....
Rosa acicularis	...+...-..- ....
Patrinia sibirica	.....+++ ....
Chamaenerion angustifolium	.....+ ....+ .. ...+..... ... ...
Saxifraga bronchialis	.....+ .... 1.+ ...
Carex aterrima	..... +..... . ... +.+..... ... ...
Salix turczaninowii	....++ . ...1 ... ...
Geranium albiflorum	.... - 1.... .. ..3..... ... ...
Rubus arcticus	.... 1...+ .. ..+..... ... ...
Pyrola minor	....-..+ .. ..-..... ... ...
Antennaria dioica	....+ .. ...1..+..... ... ...
Bistorta major	....+ .. ...-.....1.. ... ...
Empetrum subholarcticum	.... .2 .. ..1. ..2 ...
Ranunculus propinquus	....-+1..... ... ...
Ribes fragrans juv.	.... 2.+ ..2
Gentiana tenella	...+.....+ ....
Saxifraga algisii	.....1-. ....
Calamagrostis lapponica	.....1 ....+ ...
Calamagrostis korotkyi	.....1 ....+
Woodsia ilvensis	.....+ ....+
Diphasiastrum alpinum	...2.. . ...1. ... ...
Campanula glomerata	.... + ...+..... ... ...
Doronicum altaicum	.... 1..+. .. ..
Trisetum altaicum	.... +. .. ..2.... ... ...
Carex pediformis s.l.	....+ .....+. ... ...
Salix rectijulis	....-.....3 ... ...
Silene repens	....+..... ... ..-
Acetosa pratensis	....-+..... ... ...
E_0 - ground layer	
Alectoria ochroleuca	+++.2211.+. ....
Polytrichum commune	.... 32312 1. .. ....2...2.... ... ...
Rhytidium rugosum	232++2.2..2 .... ++. ...
Umbilicaria mammulosa	....112.2.+ .... .22 +..

Tab. 1. (cont.)

Relevé nr.	11	111111	1	12222	22	22	2233333333334	444	444
	12345678901	234567	8	90123	45	67	8901234567890	123	456
Pleurozium schreberi	.....	.....	-	24344	41	3.	...21...1....	...	.+1
Polytrichum piliferum	....2.12...	321222	.	...+.	+.	+.	1+1.1+.1.+.12	...	.+1
Cetraria islandica	+++....+...	24	.	+.121	1.	.2	2..+122.322..	..1	...
Cladina arbuscula	.+.....	.....	.	.....	.2	1.	2121.12..3...	122	+++
Stereocaulon alpinum	..2.2.1....	2..+1.	.	..+..	..	2.	222.....232.2	...	...
Cladonia pyxidata	.....	+..+.1	.	.....	+.	..	.++.+..+++..+	+..	+.+
Cetraria nivalis	+...22+21..	1..2..	.	.....	..	2.	.23.....1	..2	...
Cladina rangiferina	.....+1..	.....	.	.....	+2	..	...2121...22.	.++	.+.
Stereocaulon sp.	.....2.2+..	1	.	...+.	..	..	....+12.....	.2.	1..
Polytrichum juniperinum	.....	.....	-	.....	11	..	..+2.2.2..1.2	...	.+.
Cladina stellaris	.....	.....	.	.+...	1.	+.	..+.....1+.	2.2	.+.
Cladonia gracilis	+++.....	.....	.	+....	..	.+	.....	.1+	...
Abietinella abietina	..+..+.+...	.....	.	.....	..	..	.....	1+.	2+.
Polytrichum strictum	1++.....	.....	2	.....	..	..	.....	...	...
Drepanocladus uncinatus	.....	.....	.	2.+..	..	..	....3.....+	...	...
Dicranum scoparium	.....	.....	.	.....	1.	+.	.....	+1.	...
Dicranum sendtneri	..+.....	.....	.	.....	..	..	.....1...+...	...	...
Cladonia uncialis	....+.....	.....	.	.....	..	..	.1.....	..+	...
Parmelia taractica	.....+	.....	.	.....	..	..	.....	.+.	1..
Stereocaulon paschale	.....	.....	.	.....	..	.2	.....3.	...	..+
Dicranum elongatum	43.....	.....	.	.....	..	..	.....	...	...
Peltigera aphthosa	..+.....	.....	.	.....	..	..	...+.....	...	...
Dicranum spurium	...+.....	.....	.	.....	..	..	...1.....	...	...
Tortula ruralis	2	.....	.	.....	..	..	.....	+..	...
Mniobryum wahlenbergii	.....	.+....	.	+....	..	..	.....	...	...
Cladonia anomaea	.....	..2...	.	.....	..	..	.....	...	..+
Aulacomnium palustre	.....	.....	2	1....	..	..	.....	...	...
Ceratodon purpureus	.....	.....	.	.....	..	..	..+.....	...	.+.
Cladina portentosa	.....	.....	.	.....	..	..	.....	...	++.

In one relevé only:

E_2: *Abies sibirica* 25:1, *Betula pendula* 31:+;

E_1: *Salix glauca* 1:+, *Pedicularis amoena* 3:+, *Myosotis suaevolens* 4:+, *Senecio turczaninowii* 4:+, *Stellaria peduncularis* 4:+, *Borodinia baicalensis* 10:+, *Androsace septentrionalis* 10:-, *Carex* sp. 11:2, *Allium splendens* 11:1, *Astragalus trigonocarpus* 11:+, *Potentilla nivea* 11:+, *Saxifraga flagellaris* ssp. *setigera* 11:-, *Juniperus sibirica* juv. 24:+, *Astragalus saralensis* 25:1, *Pedicularis labradorica* 25:+, *Scorzonera radiata* 25:+, *Hieracium* sp. 25:-, *Sanguisorba officinalis* 31:2, *Betula pendula* juv. 31:+, *Carex ericetorum* 31:+, *Equisetum hyemale* 31:+, *Equisetum variegatum* 31:+, *Euphrasia* sp. 31:+, *Melica nutans* 31:+, *Salix divaricata* juv. 31:+, *Thalictrum minus* 31:+, *Abies sibirica* juv. 31:-, *Botrychium lunaria* 31:-, *Botrychium multifidum* 31:-, *Senecio asiaticus* 32:-, *Pedicularis uncinata* 34:+, *Dracocephalum nutans* 35:+, *Veronica densiflora* 35:+, *Betula divaricata* juv. 38:+, *Scorzonera austriaca* 38:+, *Viola repens* 38:+, *Angelica saxatilis* 43:+, *Diplazium sibiricum* 44:2, *Poa palustris* 45:1, *Carex rostrata* 45:+, *Gymnocarpium dryopteris* 45:+, *Atragene sibirica* 45:-, *Aster serpentimontanus* 43:+, *Elymus mutabilis* 43:+, *Equisetum pratense* 43:+, *Poa* sp. 43:+, *Sambucus sibirica* juv. 43:+, *Aquilegia sibirica* 43:-, *Spiraea media* juv. 43:-, *Viola* sp. 43:-;

E_0: *Cetraria cucullata* 3:+, *Thuidium delicatulum* 4:+, *Bryum capillare* s.l. 4:+, *Cornicularia aculeata* 7:+, *Parmelia centrifuga* 10:+, *Pseudephebe minuscula* 10:+, *Cetraria* sp. 11:+, *Tomenthypnu nitens* 18:2, *Sphagnum recurvum* 18:2, *Sphagnum russowii* 18:2, *Peltigera malacea* 19:+, *Cladonia* sp. 25:1, *Brachythecium mildeanum* 25:1, *Brachythecium reflexum* 25:+, *Dicranum* sp. 27:1, *Sphagnum girgensohnii* 32:+, *Cladonia fimbriata* 34:+, *Barbilophozia kunzeana* 36:+, *Cetraria delisei* 39:1, *Dicranum fuscescens* 39:+, *Peltigera praetextata* 41:+, *Hedwigia ciliata* 44:2, *Ptilium crista-castrensis* 44:+, *Hypnum cupressiforme* 45:1, *Cladonia chlorophaea* 45:+, *Cladonia cornuta* 45:+, *Cladonia phyllophora* 45:+.

Tab. 1. (Headings)

Relevé nr.	Area (m^2)	Aspect	Slope (°)	Alti-tude	Cover E_2 (%)	Cover E_1 (%)	Cover E_0 (%)	Date
1	25	NNW	3	1,730	0	30	95	27.7.1993
2	15	NNW	5	1,730	0	25	95	27.7.1993
3	25	W	5	1,750	0	70	50	27.7.1993
4	25	W	5	1,750	0	95	2	27.7.1993
5	25	NW	10	1,730	0	50	70	27.7.1993
6	25	NW	5	1,730	0	60	60	27.7.1993
7	25	NW	5	1,730	0	30	40	27.7.1993
8	25	NW	5	1,730	0	70	40	27.7.1993
9	25	E	10	1,730	0	20	20	27.7.1993
10	100	NE	5	1,600	0	5	3	21.8.1991
11	25	SE	20	1,730	0	80	30	27.7.1993
12	16	ESE	25	1,650	0	20	60	26.7.1993
13	6	E	5	1,650	0	15	20	26.7.1993
14	8	-	0	1,650	0	35	20	26.7.1993
15	16	E	20	1,650	0	35	35	26.7.1993
16	25	NE	30	1,680	0	40	40	26.7.1993
17	25	NE	10	1,680	0	40	90	26.7.1993
18	25	-	0	1,610	50	70	100	26.7.1993
19	25	-	0	1,600	70	50	70	25.7.1993
20	25	SW	5	1,550	80	30	80	25.7.1993
21	25	E	5	1,690	70	40	90	26.7.1993
22	25	W	10	1,690	80	40	90	26.7.1993
23	25	SW	3	1,640	70	15	90	25.7.1993
24	100	-	0	1,590	70	30	80	25.7.1993
25	400	-	0	1,040	50	55	40	20.8.1991
26	25	SE	30	1,620	60	30	70	25.7.1993
27	25	-	0	1,700	85	20	40	21.8.1991
28	25	SW	40	1,620	5	30	50	25.7.1993
29	25	SE	30	1,630	0	30	40	25.7.1993
30	25	SE	20	1,600	0	50	60	26.7.1993
31	25	-	0	930	5	60	60	23.7.1993
32	25	S	5	1,500	0	90	70	25.7.1993
33	25	SE	2	1,590	0	70	60	25.7.1993
34	25	SE	5	1,580	0	80	60	25.7.1993
35	25	SE	30	1,650	3	90	10	26.7.1993
36	25	E	5	1,690	0	80	70	26.7.1993
37	25	SW	20	1,680	0	50	90	26.7.1993
38	100	SW	5	1,400	0	30	70	20.8.1991
39	100	SE	20	1,700	0	25	70	21.8.1991
40	12	E	20	1,650	0	70	50	26.7.1993
41	16	W	20	1,700	0	20	30	27.7.1993
42	16	NW	20	1,730	0	15	70	27.7.1993
43	25	N	30	1,730	0	40	85	27.7.1993
44	64	WSW	40	780	40	30	60	23.7.1993
45	25	SW	35	700	5	10	5	23.7.1993
46	100	-	0	820	20	15	15	20.8.1991

Cladino stellaris-Betuletum exilis Chytrý, Pešout et Anenchonov 1993 (Tab. 1, rel. 19–23)

This association is represented by nearly closed *Betula nana* ssp. *exilis* stands on the comparatively well drained habitats of the alpine tundra. Stands of dwarf birches are usually confined to permafrosts. Patches of this vegetation form a mosaic with the alpine grasslands of the Anemonastro sibiricae-Festucetum ovinae (see below) and the *Pinus pumila* and *Betula divaricata* stands. It occurs in the upper part of the valley 6.5–9 km NE of the confluence of the Bol'šoj Čivyrkuj River Valley with the Chožalyj Creek. This community was described from the summits of the Svjatoj Nos Mountain range (Chytrý et al. 1993) and it is probably widely distributed in the mountains of the Baikal area (see Mološnikov 1986: 67, who also reports these stands from the upper part of the Bol'šoj Čivyrkuj Valley). Similar communities, with *Betula nana* ssp. *exilis*, *B. n.* ssp. *rotundifolia* or *B. n.* ssp. *nana*, were described from the West Sayan Mts. (Žitluchina & Oniščenko 1987, Žitluchina 1989), Mongolian mountains (Mirkin et al. 1983, Hilbig 1990b), Norway (Nordhagen 1943), the Kola Peninsula (Koroleva 1994) and northern Alaska (Walker et al. 1994). This association is classified to the alliance Empetro-Betulion rotundifoliae Žitluchina et Oniščenko ex Chytrý, Pešout et Anenchonov 1993.

Pleurozium schreberi-Betula divaricata community (Tab. 1, rel. 24–25)

This community is dominated by the shrubby birch *Betula divaricata*, occurring in leeward locations of the subalpine belt. Its composition is, except the dominant species, very similar to the above described *Betula nana* ssp. *exilis* stands. Compared with them, *Betula divaricata* stands are developed at sites somewhat less exposed to the wind where the winter snow cover is probably thicker, thus enabling the development of higher scrub. Through its species composition, *Pinus pumila* stands are also very closely related to this community and both these communities often form a mosaic with one another. Our observations suggest that *Betula divaricata* stands prefer comparatively humid sites, e. g., flat bottoms of valleys and cirques, while *Pinus pumila* is rather confined to slightly drier habitats, e. g., slopes and tali. *Betula divaricata* also tends to spread to *Pinus pumila* habitats after fires (Mološnikov 1986). Its stands are common in the upper part of the Bol'šoj Čivyrkuj River Valley from the confluence with the Chošalyj Creek upstream. They are also widely distributed throughout the Bajkalskij and Barguzinskij Ranges (Mološnikov 1986). A number of detailed descriptions of these stands presents Tjulina (1976) from the Šumilicha River Valley. Siberian syntaxonomical literature does not mention *Betula divaricata* communities (see Korotkov et al. 1991) and their classification to higher syntaxa is under question.

Bergenia crassifolia-Juniperus sibirica community (Tab 1, rel. 26–27)

This is a community of the subalpine to alpine belt, formed of *Juniperus sibirica* stands. This species forms a comparatively low and dense scrub which often occurs in contact with *Pinus pumila* stands. Species composition of the field and ground layers is poor in species, analogous to those of Pleurozio schreberi-Pinetum pumilae and *Pleurozium schreberi-Betula divaricata* community. It is a rare community in the Bol'šoj Čivyrkuj Valley, being confined to the slopes and summits of the mountain ranges in its upper part, and MOLOŽNIKOV (1986) reports no *Juniperus sibirica* dominated communities for the Baikal area, nor does the Siberian syntaxonomic literature (see KOROTKOV et al. 1991).

Anemonastro sibiricae-Festucetum ovinae Chytrý, Pešout et Anenchonov 1993 (Tab. 1, rel. 28–40)

These alpine short grasslands are widely distributed in the subalpine and alpine belts of the Bol'šoj Čivyrkuj River Valley. Usually, they form a mosaic with the Cladino stellaris-Betuletum exilis and with subalpine meadows in wet sites. This community is probably widely distributed throughout the Barguzinskij Range, as it is evident from the data by TJULINA (1976) and MOLOŽNIKOV (1986, there also further references). Relevés of the vegetation belonging to this association were reported by CHYTRÝ et al. (1993) from the Svjatoj Nos Peninsula and by DANIHELKA & CHYTRÝ (ms.) from the upper part of the Bol'šaja Čeremšana River. This association belongs to the alliance Anemonastro sibiricae-Festucion ovinae Chytrý, Pešout et Anenchonov 1993.

Talus communities

Artemisia lagocephala-Dryopteris fragrans community (Tab. 1, rel. 41–43)

This is a community of siliceous talus slopes and block fields in the alpine belt. The shrub layer is usually absent because of harsh climatic conditions. Only a few species occur in the field layer; bryophytes and lichens are frequent. It was only found on the block field on the left side of the Bol'šoj Čivyrkuj River Valley 7.5 km NE of its confluence with the Chožalyj Creek. Similar communities have not yet been studied in Siberia, except in the Bol'šaja Čeremšana Valley (DANIHELKA & CHYTRÝ, ms.). Syntaxonomical relations to higher syntaxa are not clear.

Dryopteris fragrans-Rubus sachalinensis community (Tab. 1, rel. 44–46)

This community is an altitudinal vicariant of the preceding one, occurring on the siliceous talus slopes of the forest belt. A more favourable climate than in the alpine belt makes possible the development of a shrub layer, formed of shrubs resistant to the disturbance caused by the occasional movement of

boulders. In the study area, it was recorded on the block fields near the confluence of the Bol'šoj Čivyrkuj River with the Dubori Creek. Similar communities were studied in the Svjatoj Nos Peninsula (CHYTRÝ ined., ANENCHONOV ined.). From various areas in Mongolia, similar shrub vegetation of block fields is known as the association Spiraeo mediae-Ribetum altissimi Hilbig 1990 (HILBIG & KNAPP 1983, HILBIG 1990a,b) which is, contrary to the *Dryopteris fragrans-Rubus sachalinensis* community, richer in tall forbs. HILBIG (1990b) reports a similar vegetation type of open tali in Mongolia as *Saxifraga spinulosa*-Blockflur. Syntaxonomically, the relation of these communities to each other and to higher syntaxa have not yet been defined.

Meadow and tall-forb communities

Cacalio hastatae-Calamagrostietum langsdorffii Mirkin in Mirkin et al. 1992 (Tab. 2, rel. 1–6)

This is a meadow community, occurring on well-drained but permanently moist floodplain habitats. It is spatially connected with shrub and tree stands. In the area under study, it was only found at two sites in the lower part of the river course with wide valley bottom, approximately 3–4.5 km SE of the river mouth. This association is reported from the Middle Lena Valley in the Olekminskij district, Yakutia (MIRKIN et al. 1992) and from the Bol'šaja Čeremšana River Valley (DANIHELKA & CHYTRÝ, ms.). It belongs to the alliance Calamagrostion langsdorffii Achtjamov, Mirkin et Urazmetov 1985.

Rubo-Cardaminetum macrophyllae Guinochet 1982 (Tab. 2, rel. 7)

Communities belonging to this association inhabit shaded banks of creeks in narrow valleys, at sites which are permanently wet. Here and there, small shallow pools may also be present. In the study area, this community was only encountered on the banks of the Markuškina Creek near its confluence with the Bol'šoj Čivyrkuj River. It was described from the south-western Baikal area (GUINOCHET 1982); no other data have been published. It belongs to the alliance Trollio-Crepidion sibiricae Guinochet ex Chytrý, Pešout et Anenchonov 1993.

Geranio albiflori-Pedicularietum uncinatae ass. nova (Tab. 2., rel. 8–14, nomenclatural type: Tab. 2, rel. 11)

This is a tall-forb community forming comparatively narrow strips along the fast running mountain rivers with stony banks in the forest belt and the lower part of the subalpine belt. The soil is sandy, occurring in spaces between stones and boulders. This vegetation is flooded in spring when disturbance caused by high current velocity occurs, while in summer, the well-drained soil tends to dry out. This community occurs along the Bol'šoj Čivyrkuj River

Tab. 2. 1–6 Cacalio hastatae-Calamagrostietum langsdorffii, 7 Rubo-Cardaminetum macrophyllae, 8–14: Geranio albiflori-Pedicularietum uncinatae, 15–17 Aconito rubicundi-Salicetum krylovii, 18–22 Aquilegio glandulosae-Geranietum albiflori.

Relevé nr.	11111 111 11222 123456 7 8901234 567 89012
E_2 - shrub layer	
Spiraea salicifolia	.221.. . ...
Salix krylovii	.... 555 .+...
E_1 - field layer	
Veronica longifolia	+11112 . .+.+... ... .
Carex schmidtii	2245.2 . ...
Filipendula palmata	+1++2. . ...
Galium boreale	+.++++ . .1..... ... .
Alopecurus pratensis	1...23 . ...
Lactuca sibirica	.+++.. . ...
Moehringia lateriflora	.+..++ . ...
Chrysosplenium alternifolium	..... 2 ..++... ... .
Caltha palustris	..... 2 ...+... ... .+...
Angelica decurrens	..... . +123++. 2
Anthoxanthum alpinum	....++. ... +12++
Aquilegia glandulosa	..... . -...+.. +.. 2+2.2
Bupleurum triradiatum	....+.. ... -.11+
Schulzia crinita	.... ++1..
Dracocephalum altaiense	....+++
Chamaenerion angustifolium	...+.. + .-11+11 ... .
Cardamine macrophylla	..... 4 ++11... ... .
Aconitum rubicundum	+..... . .-+12+2 114 .....
Calamagrostis langsdorffii	332231 + 1222++2 .+. .....
Cirsium helenioides	1.+.22 + -+1+2+2 .+. .....
Geranium albiflorum	+.1..+ + ...+312 241 31122
Acetosa pratensis	+.++.2 . ..-++1. 1.. +21++
Veratrum lobelianum	..++.+ . .+..211 .1+ 1.2++
Trollius kytmanovii	..+..2 . .-.+++. 312 111.1
Poa sibirica	1...++ . ..+.... 11. .+.++
Pedicularis uncinata	....+11+. 1+. .++.+
Pleurospermum uralense	+.++21 . ....+.2 ..+ .....
Saxifraga punctata	....+1+.+. +.. .1+.+
Solidago dahurica	....+1+. 21. +..2+
Anthriscus aemula	2...2. . ..++..1 ++. .....
Myosotis scorpioides var. *nemorosa*	+..... + .++1... ... .1..-
Doronicum altaicum	....++.. -.+ 222..
Lamium album	....+. . ..-+-.1 .-. .....
Carex pallida	....+..... ..1 +.11+
Trisetum altaicum	....++.. ... +111.
Ranunculus propinquus	..++.. . ..-.... ... .+..-
Tanacetum vulgare	....+. . +.21... 1
Thalictrum minus	+....+ . .+....2 ... .
Rubus arcticus	.+++.. . ...+..
Senecio nemorensis	.1.... . ..12..1 ... .
Equisetum pratense	...+.. . .1.+... .+. .....
Poa cf. *palustris*	1...1+ . -1..1.. ... .
Aconitum baicalense	.++..- . ...1... ... .

Tab. 2. (cont.)

Relevé nr.	123456	7	8901234	567	89012
Urtica dioica	.....	+	−+.+...	...	.....
Festuca ovina	.....	.	.1−....	...	..12.
Campanula rotundifolia	.....	.	.+..+..	...	...++
Carex juncella	.....	.	.+...3.	...	.2..+
Carex podocarpa	.....	.	....+..	...	+..++
Polemonium racemosum	.+....	.	.++....	...	.....
Chamaenerion latifolium	.....	.	−.+....	...	2
Luzula sibirica	.....	.	.−−....	...	..+..
Dianthus superbus	.....	.	.+..+..	...	...1.
Milium effusum	.....	.	..++..1	...	.....
Dichodon cerastoides	.....	.	..++...	...	.+...
Epilobium anagallidifolium	.....	.	..++...	...	.+...
Saussurea parviflora	.....	.	...+...	1.1	.....
Vicia cracca	+....−	.	.....	...	.....
Aegopodium alpestre	+.....	.	.+.....	...	.....
Poa palustris	1.....	.	....1..	...	.....
Poa pratensis	+.....	.	.....	...	.+...
Lathyrus pilosus	.++...	.	.....	...	.....
Carex rhynchophysa	.3.+..	.	.....	...	.....
Anemonidium dichotomum	..++..	.	.....	...	.....
Crepis sibirica	11	.	.....	...	.....
Equisetum hyemale	.....+	.	+.....	...	.....
Agrostis clavata	.....	+	+.....	...	.....
Ribes nigrum juv.	.....	+	+.....	...	.....
Rosa acicularis	.....	.	−+.....	...	.....
Salix rorida juv.	.....	.	+.−....	...	.....
Epilobium palustre	.....	+	.....+.	...	.....
Viola repens	.....	.	.+...+.	...	.....
Oxyria digyna	.....	.	..+....	...	1
Astragalus saralensis	.....	.	...+...	...	2
Senecio asiaticus	.....	.	.....	1+.	.....
Sibbaldia procumbens	.....	.	.....	...	+..+.
Aconogonon ocreatum	.....	.	.....	...	−...+
Salix rectijulis	.....	.	.....	...	.2..+
Gentiana grandiflora	.....	.	.....	...	..+−.
E_0 - ground layer					
Drepanocladus aduncus	.....	.	....1..	22.	2....
Conocephalum conicum	.....	2	..11...	...	.....
Polytrichum piliferum	.....	.	.2+....	...	+....
Bryum pseudotriquetrum	.....	.	..+2.2.	...	.....
Aulacomnium palustre	.....	1	..1....	...	.....
Plagiomnium medium	.....	2	.....1.	...	.....
Pleurozium schreberi	.....	.	5.....	...	..2..
Marchantia polymorpha	.....	.	.+...+.	...	.....
Polytrichum juniperinum	.....	.	.+.....	...	..1..
Hygrohypnum duriusculum	.....	.	..+1...	...	.....
Drepanocladus pseudostramineus	.....	.	..11...	...	.....
Dicranum sendtneri	.....	.	.....	..1	...1.
Cetraria islandica	.....	.	.....	...	+..2.
Stereocaulon sp.	.....	.	.....	...	..+2.

Tab. 2. (cont.)

In one relevé only:

E_2: *Lonicera* cf. *pallasii* 9:1, *Ribes nigrum* 9:+, *Betula nana* ssp. *exilis* 19:1;

E_1: *Elymus mutabilis* 1:+, *Hierochloë odorata* 1:+, *Poa remota* 1:+, *Ranunculus repens* 1:+, *Lathyrus pratensis* 3:+, *Paris quadrifolia* 3:+, *Equisetum fluviatile* 4:+, *Spiraea salicifolia* juv. 5:1, *Pedicularis resupinata* 5:+, *Stellaria filicaulis* 5:+, *Galium uliginosum* 6:+, *Vicia nervata* 6:+, *Carex loliacea* 7:+, *Equisetum sylvaticum* 7:+, *Rubus sachalinensis* juv. 7:+, *Athyrium filix-femina* 7:-, *Elymus transbaicalensis* 8:-, *Poa* sp. 8:-, *Elymus caninus* 8:+, *Populus suaveolens* juv. 8:+, *Erigeron politus* 9:+, *Euphrasia* sp. 9:+, *Hieracium ganeschinii* 9:+, *Hieracium umbellatum* 9:+, *Allium splendens* 9:-, *Myosotis krylovii* 15:+, *Veronica densiflora* 15:+, *Rhodococcum vitis-idaea* 17:+, *Viola uniflora* 17:+, *Carex bigelowii* ssp. *ensifolia* 18:+, *Comarum palustre* 19:+, *Carex bipartita* 20:+, *Viola altaica* 20:-, *Aquilegia sibirica* 21:1, *Anemonastrum sibiricum* 21:+, *Bergenia crassifolia* 21:+, *Carex aterrima* 22:+;

E_0: *Calliergon stramineum* 7:3, *Fontinalis antipyretica* 7:2, *Cladonia gracilis* 7:+, *Dicranum polysetum* 8:1, *Ptilium crista-castrensis* 8:+, *Mnium stellare* 9:1, *Brachythecium rivulare* 9:2, *Barbilophozia attenuata* 9:+, *Barbilophozia hatcheri* 9:+, *Schistidium alpicola* 9:+, *Peltigera rufescens* 9:+, *Dicranella* sp. 9:+, *Cladonia fimbriata* 9:+, *Umbilicaria mammulosa* 9:+, *Mniobryum wahlenbergii* 9:+, *Cladonia coniocraea* 9:-, *Drepanocladus exannulatus* 10:1, *Rhizomnium* sp. 13:+, *Brachythecium reflexum* 17:+, *Lophozia wenzelii* 19:2, *Pellia epiphylla* 19:1, *Polytrichum commune* 20:2, *Cladina stellaris* 20:+.

Tab. 2. (Headings)

Relevé nr.	Area (m^2)	Aspect	Slope (°)	Altitude	Cover E_2 (%)	Cover E_1 (%)	Cover E_0 (%)	Date
1	25	-	0	460	0	100	0	19.7.1993
2	150	-	0	460	15	90	0	19.7.1993
3	25	-	0	460	10	100	0	20.7.1993
4	25	-	0	460	5	100	0	20.7.1993
5	25	-	0	460	0	100	0	19.7.1993
6	25	-	0	460	0	100	0	19.7.1993
7	18	-	0	680	0	90	90	22.7.1993
8	400	-	0	490	0	10	0	20.7.1993
9	30	-	0	840	5	60	30	23.7.1993
10	50	NW	10	1,100	5	60	10	24.7.1993
11	50	NE	5	1,100	0	80	30	24.7.1993
12	25	SE	20	1,570	0	100	5	25.7.1993
13	25	-	0	1,570	0	80	10	25.7.1993
14	25	-	0	1,200	0	100	0	20.8.1991
15	25	WSW	5	1,570	80	100	10	25.7.1993
16	25	WSW	5	1,570	90	90	15	25.7.1993
17	25	SW	10	1,680	80	90	5	26.7.1993
18	25	NE	10	1,680	0	90	10	26.7.1993
19	8	NW	60	1,600	5	90	40	25.7.1993
20	25	W	5	1,500	0	90	50	25.7.1993
21	25	SE	2	1,570	0	80	20	25.7.1993
22	25	-	0	1,570	0	80	0	25.7.1993

and its tributaries from about 6 km SE of its mouth upstream to the subalpine belt. It was firstly reported from the Svjatoj Nos Peninsula (*Geranium albiflorum-Pedicularis uncinata* community in CHYTRÝ et al. 1993) and it was

also found in the Bol'šaja Čeremšana River Valley (DANIHELKA & CHYTRÝ, ms.). A similar community is the Aconito-Angelicetum decurrentis Hilbig 1990 from the mountains of northern Mongolia (HILBIG 1990a,b). These communities belong to the alliance Trollio-Crepidion sibiricae Guinochet ex Chytrý, Pešout et Anenchonov 1993.

Aconito rubicundi-Salicetum krylovii ass. nova (Tab. 2, rel. 15–17, nomenclatural type: Tab. 2, rel. 16)

This association comprises subalpine tall-forb communities dominated by shrubby willows, confined to wet habitats along creeks. Within the subalpine belt, these habitats are the richest in resources. Separate field and shrub layers may hardly be distinguished. This association was studied in the Bol'šoj Čivyrkuj River Valley 7–8.5 km NE of its confluence with the Chošalyj Creek. It has been reported from the Bol'šaja Čremšana River Valley (DANIHELKA & CHYTRÝ, ms.) and the stands described by TJULINA (1976) from the Šumilicha River Valley are also identical. ŽITLUCHINA & ONIŠČENKO (1987) and ŽITLUCHINA (1989) report similar communities from the West Sayan Mts. This group of communities belongs to the order Trollio-Crepidetalia sibiricae Guinochet ex Chytrý, Pešout et Anenchonov 1993.

Aquilegio glandulosae-Geranietum albiflori ass. nova (Tab. 2, rel. 18–22, nomenclatural type: Tab. 2., rel. 18)

These subalpine meadows occur on well-drained gentle slopes near creeks, replacing the preceding community in vegetation zonation along the gradient of decreasing soil moisture. Tall forbs dominate here; still some species of the subalpine-alpine short grasslands (Anemonastro sibiricae-Festucetum ovinae) begin to play a certain role. The distribution of this community in the study area corresponds with that of the preceding community. Identical vegetation was studied in the Bol'šaja Čeremšana River Valley (DANIHELKA & CHYTRÝ, ms.) and it is also distributed at other sites in the Barguzinskij Range, as is evident from the descriptions in TJULINA (1976) and MOLOŽNIKOV (1986). Similar communities were described from the West Sayan Mts. (ŽITLUCHINA & ONIŠČENKO 1987, ŽITLUCHINA 1989). Aquilegio glandulosae-Geranietum albiflori belongs to the order Trollio-Crepidetalia sibiricae Guinochet ex Chytrý, Pešout et Anenchonov 1993.

Pteridium aquilinum-Bergenia crassifolia community

This forb community is rare in the Bol'šoj Čivyrkuj River Valley, found at one locality only. It represents a community of wet, stony soils in the forest belt, deforested for various reasons. This community was described on the Svjatoj Nos Peninsula (CHYTRÝ et al. 1993) where, unlike in the Bol'šoj Čivyrkuj River Valley, *Bergenia crassifolia* is a dominant species. It is probably identical with a stand described by TJULINA (1981) from the

Tab. 3. 1–4 Craniospermo-Leymetum secalini, 5 Stellario dichotomae-Rosetum acicularis, 6–11 *Phlojodicarpus baicalensis-Festuca ovina* comm., 12–13 *Thalictrum foetidum-Woodsia ilvensis* comm., 14–19 *Saxifraga bronchialis-Spiraea media* comm.

Relevé nr.	1234	5	678901	23	11 11 111111 456789
E_2 - shrub layer					
Spiraea media	....	.	.....	..	.23232
Rosa acicularis	....	3	.....	..	.+.++.
E_1 - field layer					
Craniospermum subvillosum	++++	-	.....	..	.....
Isatis oblongata	++.-	.	.....	..	.....
Phlojodicarpus baicalensis	....	.	++-1-1	..	.....
Patrinia sibirica	....	.	.+-1-+	..	.....
Artemisia cf. *pubescens*	....	.	.++...	..	.....
Equisetum hyemale	....	.	.22+..	..	.....
Thalictrum foetidum	....	.	.....	11	.....
Valeriana transjenisensis	....	.	.....	+2	.....
Draba nemorosa	....	.	.....	++	.....
Orostachys spinosa	....	.	.....	++	.....
Rhodiola rosea	....	.	.....	++	.....
Dendranthemum mongolicum	....	.	.....	-+	.....
Campanula rotundifolia	....	.	.....	..	-++..+
Silene repens	....	.	.....	..	.+++1.
Vicia nervata	....	.	.....	..	.++++.
Sedum maximum s.l.	....	.	.....	..	---...
Dracocephalum nutans	....	.	.....	..	..+1+.
Carex pediformis s.l.	....	.	.....	..	...212
Leymus secalinus	+.1.	2	.....	..	.....
Aconogonon ocreatum	1111	.	+++.+-	.+	.....
Festuca ovina	....	1	21-.+1	12	.....+
Allium splendens	....	+	+-+++-	++	.+++++
Saxifraga bronchialis	....	.	.....	11	1221..
Woodsia ilvensis	....	.	.....	21	1+++..
Selaginella rupestris	....	.	.....	1+	+.++.1
Poa cf. *urssulensis*	....	.	.....	+.	..++1+
Artemisia sericea	....	.	.....	.1	.+112.
Artemisia cf. *leucophylla*	....	+	.+..+.	..	+.+11.
Festuca rubra ssp. *baicalensis*	.+++	.	...11.	+.	.....
Scrophularia incisa	..-.	.	.++.+.	..	.....
Astragalus propinquus	....	+	.+.+.+	..	.....
Rubus sachalinensis juv.	....	1	.....	+.	.....+
Myosotis suaevolens	....	+	.....	..	...+1.
Calamagrostis korotkyi	....	.	.....	++	1
Calamagrostis langsdorffii	.-..	.	.....	..	.....+
Equisetum pratense	....	.	....1+	..	.....
Draba baicalensis	....	.	.....	+.	..-...
Sedum aizoon	....	.	.....	..	-..+..
Chamaenerion angustifolium	....	.	.....	..	.+...-
Calamagrostis epigeios	....	.	.....	..	...++.
E_0 - ground layer					
Physcia phaea	....	.	.....	31	.....
Caloplaca sp.	....	.	.....	21	.....
Parmelia omphalodes	....	.	.....	2+	.....
Phascum cuspidatum	....	.	.....	+1	.....
Abietinella abietina	....	.	.....	1.	.....+
Polytrichum juniperinum	....	.	.....	.+	1

Tab. 3. (cont.)

In one relevé only:

E_2: *Ribes fragrans* 19:1;

E_1: *Equisetum arvense* 4:+, *Achillea asiatica* 5:+, *Bromopsis sibirica* 5:+, *Elytrigia repens* 5:+, *Galium verum* 5:+, *Lactuca sibirica* 5:+, *Arctostaphylos uva-ursi* 11:1, *Bergenia crassifolia* 13:1, *Atragene sibirica* 13:+, *Salix rorida* juv. 15:-, *Campanula glomerata* 16:+, *Pulsatilla patens* s.l. 17:1, *Carex rostrata* 17:+, *Turritis glabra* 18:+, *Dryopteris fragrans* 19:2, *Aster korshinskyi* 19:1, *Galium boreale* 19:+;

E_0: *Evernia mesomorpha* 7:2, *Cladina rangiferina* 11:+, *Leucodon sciuroides* 12:2, *Ramalina pollinaria* 12:+, *Hedwigia ciliata* 12:+, *Collema* sp. 12:+, *Hypogymnia austerodes* 12:+, *Rhytidium rugosum* 13:2, *Cladonia pyxidata* 19:2, *Polytrichum piliferum* 19:1, *Ceratodon purpureus* 19:+, *Cladina stellaris* 19:+, *Ptilium crista-castrensis* 19:+.

Tab. 3. (Headings)

Relevé nr.	Area (m^2)	Aspect	Slope (°)	Altitude	Cover E_1 (%)	Cover E_0 (%)	Date
1	20	NNW	5	460	5	0	18.7.1993
2	15	-	0	460	5	0	18.7.1993
3	25	-	0	460	10	0	18.7.1993
4	25	NW	5	460	5	0	18.7.1993
5	25	-	0	460	70	0	18.7.1993
6	25	-	0	460	10	0	18.7.1993
7	25	WSW	5	460	15	1	18.7.1993
8	25	-	0	460	15	0	18.7.1993
9	25	-	0	460	15	0	18.7.1993
10	25	-	0	460	10	0	18.7.1993
11	25	-	0	460	15	1	18.7.1993
12	9	WNW	80	480	30	70	20.7.1993
13	9	NW	80	480	60	30	20.7.1993
14	9	SE	80	660	20	10	22.7.1993
15	25	SE	60	670	20	0	22.7.1993
16	12	SE	60	680	20	0	22.7.1993
17	25	SE	50	680	40	0	22.7.1993
18	25	SE	60	670	40	0	22.7.1993
19	25	SSW	45	670	30	20	23.7.1993

Skalistyj Creek Valley in the Barguzinskij Range. Syntaxonomically, this community is related to the alliance Trollio-Crepidion sibiricae Guinochet ex Chytrý, Pešout et Anenchonov 1993. The species composition is documented in the following relevé:

Terrace of the Bol'šoj Čivyrkuj River near its confluence with the Markuškina creek, area 100 m^2, plane, altitude 690 m, E_1 = 95 %, E_0 = 5 %, 19.8.1991.
E_1: *Carex pediformis* agg. 3, *Pteridium aquilinum* 3, *Fragaria vesca* 2, *Origanum vulgare* 2, *Anthriscus aemula* 1, *Thalictrum minus* 1, *Crepis tectorum* +, *Equisetum hyemale* +, *Lactuca sibirica* +, *Moehringia lateriflora* +, *Viola sacchalinensis* +;
E_0: *Ceratodon purpureus* 1, *Pleurozium schreberi* 1, *Brachythecium salebrosum 1.*

Sand-dune communities

Craniospermo-Leymetum secalini Chytrý, Pešout et Anenchonov 1993 (Tab. 3, rel. 1–4)

This species-poor community of coastal sand dunes forms a narrow strip along the Baikal shore. During storms, the habitat is disturbed by waves. This association was described from sand dunes on the Svjatoj Nos Isthmus shore (CHYTRÝ et al. 1993, see also CHYTRÝ & PEŠOUT 1992). It belongs to the alliance Oxytropidion lanatae Chytrý, Pešout et Anenchonov 1993.

Stellario dichotomae-Rosetum acicularis Chytrý, Pešout et Anenchonov 1993 (Tab. 3, rel. 5)

This is a low scrub dominated by *Rosa acicularis*. Communities of this association inhabit comparatively consolidated sand dunes in the coastal area of Baikal. At the mouth of the Bol'šoj Čivyrkuj River, these stands are rare. They were only encountered on the sand bar on Baikal shore 2 km SW of the Bol'šoj Čivyrkuj River mouth. This association, described from the sand dunes of the Svjatoj Nos Isthmus (CHYTRÝ et al. 1993, see also CHYTRÝ & PEŠOUT 1992), belongs to the alliance Oxytropidion lanatae Chytrý, Pešout et Anenchonov 1993.

Phlojodicarpus baicalensis-Festuca ovina community (Tab. 3, rel. 6–11)

This community comprises open sand vegetation occurring on the coastal dunes of Baikal near the mouth of the Bol'šoj Čivyrkuj River. The dunes inhabited by this community are not consolidated by plant rhizomes and roots but their movement is limited due their location in the shelter of neighbouring *Pinus pumila* and *Pinus sibirica* stands. A related association Oxytropido lanatae-Festucetum baicalensis Chytrý, Pešout et Anenchonov 1993 from the Svjatoj Nos Isthmus does not occur under the effect of this shelter and, consequently, the species composition is different (see CHYTRÝ & PEŠOUT 1992, CHYTRÝ et al. 1993). Both these associations belong to the alliance Oxytropidion lanatae Chytrý, Pešout et Anenchonov 1993.

Rock communities

Thalictrum foetidum-Woodsia ilvensis community (Tab. 3, rel. 12–13)

This is a community of plants inhabiting fissures and ledges of steep siliceous rocks in cool sites with high air humidity. It was only recorded on the lakeward side of a cliff above Baikal near the settlement in the mouth of the Bol'šoj Čivyrkuj River. No similar communities are known from Siberia (KOROTKOV et al. 1991). From Mongolia, HILBIG (1990a,b) describes a similar association, Aquilegio viridiflorae-Selaginelletum sanguinolentae Hilbig 1990. These communities belong to the class Asplenietea trichomanis Br.-Bl. in Meyer et Br.-Bl. 1934 corr. Oberdorfer 1977, however, their relationship to alliances remains under question.

Saxifraga bronchalis-Spiraea media community (Tab. 3, rel. 14-19)

This community is found on dry rocky slopes with very shallow soils overlaying a siliceous bedrock. The low shrub *Spiraea media* is the dominant species, accompanied by various heliophilous species of xeric habitats. This community has been found at only site with primarily non-forest rocky slopes in the middle part of the Bol'šoj Čivyrkuj River Valley 1 km WNW of the confluence with the Markuškina Creek. Similar vegetation has been described from dry sunny slopes in the upper montane and subalpine belt of the Svjatoj Nos Peninsula as Saxifrago bronchialis-Phlojodicarpetum baicalensis Chytrý, Pešout et Anenchonov 1993. From the Skalistyj Creek valley in the Barguzinskij Range, TJULINA (1981) decribes a similar vegetation. These communities appear to have certain relationships to the class Cleistogenetea squarrosae Mirkin et al. ex Gogoleva et al. 1987.

Spring, mud, fen and mire communities

Saxifraga punctata-Philonotis fontana community

This spring community was only found at one locality, a steep granitoide rock with small ledges, wet to moist from water flowing down. Although in the forest belt, this habitat is not shaded by trees because of the steepness of the rock. It is closely related to the alliances Cardamino-Montion Br.-Bl. 1926 em. Zechmeister in Zechmeister et Mucina 1993 and Epilobio nutantis-Montion Zechmeister in Zechmeister et Mucina 1993. Spring communities have not been studied in Siberia so far (see KOROTKOV 1991) and the only relevé indicated below is hardly comparable with any European association of this alliance (see Zechmeister & Mucina 1993).

Wet rock above the right bank of the Bol'šoj Čivyrkuj River 0.5 km NW of its confluence with the Dubori creek, area 6 m^2, aspect NE, slope 80°, altitude 870 m, cover E_1 = 30 %, E_0 = 60 %, 23.7.1993.

E_1: *Saxifraga punctata* 2, *Chrysosplenium alternifolium* 1, *Epilobium palustre* 1, *Caltha palustris* s.l. +, *Stellaria angarae* +;
E_0: *Philonotis fontana* 3, *Cratoneuron filicinum* 2, *Plagiomnium medium* +.

Juncus bufonius-Ranunculus reptans community

This is a low-plant community of dried-out pools in the mildly disturbed shore area of Baikal, influenced by seepage. Soil is sandy, originally probably developed under forest (*Calamagrostis obtusata-Larix sibirica* community) which was cleared by man. This community was only found in the settlement in the mouth of the Bol'šoj Čivyrkuj River. The community clearly belongs to the alliance Elatini-Eleocharition ovatae Pietsch 1973. From this alliance, only the *Carex bohemica* community has been studied in Siberia (CHYTRÝ et al. 1993, see also CHYTRÝ & PEŠOUT 1992). The *Juncus bufonius-Plantago depressa* community from the Svjatoj Nos Isthmus (CHYTRÝ & PEŠOUT 1992) also appears to have certain relations to this alliance. Compared

Tab. 4. 1 Equisetetum fluviatilis, 2–3 Hippuridetum vulgaris, 4–8 Caricetum juncellae, 9 *Carex rhynchophysa* comm., 10–15 Caricetum rostratae, 16–18 Comaro-Caricetum lasiocarpae, 19–24 Caricetum limosae, 25–27 *Comarum palustre-Carex juncella* comm., 28–30 *Chamaedaphne calyculata-Sphagnum fuscum* comm.

Relevé nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
E_1 - herb layer																														
Equisetum fluviatile	5	.	1	+	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Hippuris vulgaris	.	23	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex rhynchophysa	1	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex rostrata	2	+	.	+	+	+	.	.	442444	.	.	.	3	+	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
Carex lasiocarpa	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	442	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex limosa	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	412231	.	.	.	.	.	.	.	.	.	.	.	.	.
Chamaedaphne calyculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	322	.	.	.	.	.
Oxycoccus palustris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	121	.	.	.	.	.
Andromeda polifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	112	.	.	.	.	.
Oxycoccus microcarpus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1+.	.	.	.	.	.
Carex juncella	.	.	54534	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+24	.	.	.	.	.	.	.
Carex canescens	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	+	.	1	+	2	2	2	.	.	.	.	.	.	.	.
Menyanthes trifoliata	.	.	.	.	.	.	2	.	+	.	+	.	+	1	2	+	.	222	2	.	.	.	.	.	.	.	.	.	.	.
Comarum palustre	+	.	.	+	.	1	.	+	+	.	11	+	.	.	.	+	.	.	+	.	1	2	.	2	.	.	.	.	.	.
Utricularia intermedia	.	2	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Eriphorum russeolum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	+
Cicuta virosa	.	.	.	-	.	.	.	.	.	.	.	-	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Calamagrostis langsdorffii	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.
Scheuchzeria palustris	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.	1	.	.	.	.	.	.	.	.	.	.
Carex vesicata	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Naumburgia thyrsiflora	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Juncus tenuis	.	.	.	.	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eriophorum gracile	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.
Eriophorum scheuchzeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.
Drosera rotundifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++.	.	.	.	.	.
E_0 - ground layer																														
Sphagnum majus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	45.55.	1	.	.	.	.	.	.	.	.	.	.	.	.
Sphagnum fuscum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.	34.	.	.	.	.	.
Sphagnum recurvum s.l.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.	.	.	.	+	.	.	.	.	2	33.	.	.	.	.	.
Drepanocladus exannulatus	.	2	.	.	.	.	.	.	22	1	-	2	.	.	.	2	5	1	.	+	+	.	.	5	2	.	.	2	.	.
Calliergon stramineum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	+	5	.	.	.	.

In one relevé only:

E_2: *Betula nana* ssp. *exilis* 26:+;

E_1: *Sparganium* sp. 3:+, *Carex schmidtii* 7:+, *Cardamine macrophylla* 9:-, *Salix* sp. 9:-, *Saxifraga punctata* 9:-, *Agrostis clavata* 9:+, *Poa pratensis* 9:+, *Ranunculus repens* 9:+, *Juncus stygius* 18:-, *Pedicularis karoi* 18:+, *Rhynchospora alba* 18:1, *Galium triflorum* 24:+, *Carex globularis* 26:2, *Poa sibirica* 27:-, *Anthoxanthum alpinum* 27:+, *Caltha palustris* 27:+, *Geranium albiflorum* 27:+, *Rumex acetosa* 27:+, *Senecio asiaticus* 27:+;

E_0: *Mniobryum wahlenbergii* 7:1, *Marchantia polymorpha* 9:+, *Plagiomnium medium* 9:+, *Drepanocladus uncinatus* 9:+, *Sphagnum obtusum* 11:1, *Sphagnum platyphyllum* 21:+, *Sphagnum riparium* 24:5, *Pleurozium schreberi* 26:+, *Pohlia nutans* 26:+, *Aulacomnium palustre* 26:+, *Polytrichum strictum* 26:2, *Tomenthypnum nitens* 27:1.

Tab. 4. (Headings)

Relevé nr.	Area (m^2)	Aspect	Slope (°)	Altitude	Water depth	Cover E_2 (%)	Cover E_1 (%)	Cover E_0 (%)	Date
1	25	-	0	460	0	0	95	0	20.7.1993
2	4	-	0	460	15	0	20	10	18.7.1993
3	4	-	0	460	0	0	40	0	20.7.1993
4	25	-	0	460	0	0	100	0	18.7.1993
5	25	-	0	460	0	0	80	0	19.7.1993
6	25	-	0	460	0	0	80	0	19.7.1993
7	25	-	0	460	0	0	80	5	19.7.1993
8	25	-	0	460	0	0	70	0	19.7.1993
9	25	-	0	460	0	0	95	1	19.7.1993
10	25	-	0	460	15	0	80	15	18.7.1993
11	25	-	0	460	15	0	60	10	18.7.1993
12	25	-	0	1,560	0	0	10	0	26.7.1993
13	25	-	0	460	10	0	80	10	18.7.1993
14	25	-	0	460	0	0	70	70	18.7.1993
15	25	-	0	460	0	0	70	20	20.7.1993
16	25	-	0	460	5	0	60	0	18.7.1993
17	25	-	0	460	5	0	70	0	18.7.1993
18	25	-	0	460	0	0	50	5	19.7.1993
19	25	-	0	460	0	0	70	90	18.7.1993
20	25	-	0	460	0	0	50	95	18.7.1993
21	16	-	0	1,560	0	0	15	98	26.7.1993
22	25	-	0	460	0	0	50	90	18.7.1993
23	25	-	0	460	0	0	60	90	18.7.1993
24	25	-	0	460	0	0	70	100	20.7.1993
25	25	-	0	460	0	0	55	100	18.7.1993
26	21	-	0	1,560	0	2	40	10	26.7.1993
27	25	-	0	1,610	0	0	80	30	26.7.1993
28	25	-	0	460	0	0	40	90	18.7.1993
29	25	-	0	460	0	0	25	100	18.7.1993
30	25	-	0	460	0	0	40	100	18.7.1993

with the European Elatini-Eleocharition ovatae communities (PIETSCH 1973) and Mongolian ones (HILBIG & SCHAMSRAN 1981, HILBIG 1990b), it is obvious that the Siberian community does not belong to any association described so far.

Settlement in the mouth of the Bol'šoj Čivyrkuj River, area 9 m^2, plane, 460 m a.s.l., cover E_1 = 80 %, E_0 = 0 %, 20.7.1993.
E_1: *Juncus bufonius* 3, *Limosella aquatica* 2, *Ranunculus reptans* 1, *Persicaria lapathifolia* 1, *Alopecurus aequalis* 1, *Androsace filiformis* +, *Eleocharis acicularis* +, *Myosotis caespitosa* +, *Rorippa palustris* +.

Dtto, area 9 m^2, plane, 460 m a.s.l., cover E_1 = 80 %, E_0 = 0 %, 20.7.1993.
E_1: *Ranunculus reptans* 4, *Persicaria lapathifolia* 2, *Juncus bufonius* 1, *Alopecurus aequalis* 1, *Androsace filiformis* 1, *Eleocharis acicularis* +, *Myosotis*

caespitosa +, *Rorippa palustris* +, *Juncus filiformis* +, *Matricaria discoidea* +, *Poa supina* +, *Stellaria media* +;
E_0: *Bryum pseudotriquetrum* 1.

Equisetetum fluviatilis Steffen 1931 (Tab. 4, rel. 1)

This is a species-poor community dominated by *Equisetum fluviatile*, inhabiting shallow, still waters. It was recorded in the wetlands near the Bol'šoj Čivyrkuj River mouth. In Siberian syntaxonomical literature, this association is reported from the floodplain of the Middle Lena River (Mirkin et al. 1992) and the Svjatoj Nos Isthmus (Chytrý & Pešout 1992, Chytrý et al. 1993). Its distribution is probably wider, e.g., Savič (1967) presents a relevé belonging to this community from wetlands near Posol'sk on the south-eastern Baikal shore and Hilbig (1990b) mentions an *Equisetum fluviatile* community from western Mongolia. This is a community of the alliance Phragmition communis Koch 1926.

Hippuridetum vulgaris Passarge 1955 (Tab. 4, rel. 2–3)

This is a species-poor, *Hippuris vulgaris* dominated community, inhabiting muddy substrata in infilling old river arms and on the margins of wetlands on the right side of the Bol'šoj Čivyrkuj River near its mouth. In Siberia, this community is known from Yakutian alases (Mirkin et al. 1985, Gogoleva et al. 1987) and the Svjatoj Nos Isthmus (Chytrý & Pešout 1992, Chytrý et al. 1993). A *Hippuris vulgaris* community is also reported from the Selenga River delta (Granina sec. Moložnikov 1986). This community belongs to the alliance Oenanthion aquaticae Hejný ex Neuhäusl 1959.

Caricetum juncellae Mirkin, Gogoleva et Kononov ex Chytrý, Pešout et Anenchonov 1993 (Tab. 4, rel. 4–8)

Vegetation formed by tussock-forming sedge *Carex juncella* is typical of dune slacks in coastal area of Lake Baikal near the Bol'šoj Čivyrkuj mouth. The habitat is intermittently waterlogged. Vegetation of this association is widely distributed throughout eastern Siberia, e.g. in alases of Central Yakutia (Mirkin et al. 1985, Gogoleva et al. 1987), the Middle Lena floodplain (Mirkin et al. 1992), the Svjatoj Nos Peninsula (Chytrý et al. 1993) and the Bol'šaja Čeremšana River Valley (Danihelka & Chytrý, ms.). This association belongs to the alliance Caricion appendiculatae Achtjamov, Mirkin et Urazmetov 1985.

Carex rhynchophysa community (Tab. 4, rel. 9)

The only relevé of stands with dominant *Carex rhynchophysa* was recorded on the Bol'šoj Čivyrkuj River bank 4.5 km SE of its mouth, in a shallow depression. Probably, the habitat was influenced by stagnating water but it becomes dry during the summer. Similar vegetation, appearing as transitional features between this community and the preceding one was described from

the Bol'šaja Čeremšana River Valley (DANIHELKA & CHYTRÝ, ms.). Syntaxonomical relations of this community are not clear.

Caricetum rostratae Osvald 1923 (Tab. 4, rel. 10–15)

This mesotrophic sedge fen is widely distributed in wetlands in the Bol'šoj Čivyrkuj floodplain near the river mouth. However, it was also recorded on the bottom of the cirque in the upper part of the valley. Its habitats are often permanently inundated or the ground-water level is near the surface. This community significantly contributes to infilling processes in wetlands. Siberian syntaxonomical literature reports the occurrence of this association from the Lower Jenisej River Valley (cf. KOROTKOV et al. 1991: 263) and the Svjatoj Nos Isthmus (CHYTRÝ et al. 1993). It belongs to the alliance Caricion rostratae Balátová-Tuláčková 1963.

Comaro-Caricetum lasiocarpae Balátová-Tuláčková et Hübl 1985 (Tab. 4, rel. 16–18)

This is a *Carex lasiocarpa* dominated tall-sedge fen, forming a successional stage probably replacing the Caricetum rostratae. It occurs in wetlands near the Bol'šoj Čivyrkuj mouth. This association was studied in the Svjatoj Nos Isthmus (CHYTRÝ et al. 1993) and similar vegetation is widely distributed throughout Siberia (cf. KOROTKOV et al. 1991, see also SAVIČ 1967). It is included in the alliance Caricion rostratae Balátová-Tuláčková 1963.

Caricetum limosae Osvald 1923 em. Dierssen 1982 (Tab. 4, rel. 19–24)

This transitional mire community is distributed both in mire complexes in the lower part of the Bol'šoj Čivyrkuj River and in a cirque in the subalpine belt. The herb layer is loose and mosses, including peat mosses, are significant components of the structure of this community. It is found on the margins of hollows on wet, slightly decomposed peat. SAVIČ (1967) mentions a *Carex limosa* dominated vegetation from the area of the Selenga River delta. This community is classified to the alliance Rhynchosporion albae Koch 1926 (see DIERSSEN 1982).

Comarum palustre-Carex juncella community (Tab. 4, rel. 25–27)

This community comprises *Carex juncella* dominated transitional mires. Its distribution in the area under study is the same as that of the preceding community. Its syntaxonomical status is transitional between the Caricion juncellae and Caricion fuscae communities and needs further study.

Chamaedaphne calyculata-Sphagnum fuscum community (Tab. 4, rel. 28–30)

This bog community represents the most developed successional stage in the wetland and mire complex near the Bol'šoj Čivyrkuj mouth. It forms hummocks up to approximately 5 m in diameter, surrounded by transitional

Tab. 5. 1–3 Calamagrostio langsdorffii-Salicetum roridae, 4–13 *Equisetum hyemale-Abies sibirica* comm. (13: post-fire variant), 14–18 *Carex canescens-Pinus sylvestris* comm., 19–21 *Calamagrostis obtusata-Abies sibirica* comm., 22–26 *Calamagrostis obtusata-Larix sibirica* comm., 27–29 *Vicia nervata-Pinus sylvestris* comm. (29: post-fire variant), 30–33 *Maianthemum bifolium-Pinus sibirica* comm., 34–42 Pleurozio schreberi-Pinetum pumilae.

Relevé nr.	1111	11111	122	22222	222	3333	333333444
	123 4567890123	45678	901	23456	789	0123	456789012
E_3 - tree layer							
Picea obovata	... 1122.4.+2.	.2112	+..	.....	...	....	.....
Abies sibirica	... 343321+44.	1	132	.....	...	....	.....
Pinus sylvestris	... .+...	2.1..	3..	44344	33.	2.2.	.....
Pinus sibirica	... ..1..+.2..	..+22	.23	.1+1.	...	3212	...2.....
Betula pendula	... .2.1.121..	23322	...	22+.2	...	..1.	.....
Larix sibirica	... .	+.1..	1..	2.3.-	2..	1.3.	..2.....
Populus tremula	... 1.....3..4	.....	..1	.....	..4	....	.....
E_2 - shrub layer							
Salix rorida	332	.....	...	.....	...	....	.....
Salix dasyclados	114	.....	...	.....	...	....	.....
Lonicera cf. *pallasii*	... +.+++..12.	+....	...	.1...	...	....	.....
Abies sibirica	... .2224.+.+.	2.++1	323	+.2+-	...	....	.....
Pinus sibirica	... +.....-...	..111	12+	.1..+	1..	2..1	.....
Duschekia fruticosa	1.. .1..1.....	.....	122	+22.1	...	....	.....
Pinus sylvestris	... .	..1+.	+..	121.+	22.	+...	.....
Pinus pumila	... ...1.....	2....	1.+	..33.	...	3334	555545544
Betula pendula	1.. ..++.....-	11221	+11	.++..	2..	.+1.	....2....
Sorbus sibirica	... 1.++....+-	....+	+..	.+1.+	...	....	.....
Picea obovata	... .1+-.....	.12.1	+..	.....	+..	....	.....
Ribes nigrum	.1. ..+...2+3+	.....	...	.....	...	....	.....
Sambucus sibirica	... .+..+	.....	.1.	1	.-.	....	.....
Rubus sachalinensis	.1. .....+...	.....	...	+....	...	....	.....
Spiraea media	... ..+.....	.....	...	+....	..1	....	.....
Salix caprea	... .+...	.....	...	.....	+-.	....	.....
Larix sibirica	... .	.....	...	...-.	1..	..1.	.....
Populus tremula	1	.....	...	.....	..+	....	.....
Juniperus sibirica	... .	.-+..	...	.....	...	....	.....
E_1 - field layer							
Calamagrostis langsdorffii	123 ...+1....1	.1..+	+..	1	.++	....	.....
Veronica longifolia	+-+	.....	...	.....	...	....	.....
Tanacetum vulgare	12.	.....	...	.....	...	....	.....
Cirsium helenioides	11. .....+.+.	.....	...	.....	...	....	.....
Elymus caninus	+1.	.....	...	.....	...	....	.....
Solidago dahurica	++. ....1.....	.....	...	.....	...	....	.....
Senecio nemorensis	.++ +.....	.....	...	.....	...	....	.....
Urtica dioica	.++ +.....	.....	...	.....	...	....	.....
Equisetum pratense	... 1122+22+22	.-..2	...	.....	...	....	.....
Gymnocarpium dryopteris	.+. +11..2222+	.....	..1	.+...	..+	....	.....
Mitella nuda	... 1+++.1+.+.	.....	...	.....	...	....	.....
Paris quadrifolia	... +.+++.++1.	.....	...	.....	...	....	.....
Oxalis acetosella	... .1++.111+.	.....	...	.....	...	....	.....
Cacalia hastata	..+ 1+.+.+1.+.	.....	...	.....	...	....	.....
Athyrium filix-femina	... 1+...--.+.	.....	...	.....	...	....	.....
Lilium pilosiusculum	... +.+...1-.+	.....	...	.....	...	....	.....
Aconitum rubicundum	... 1.++...+..	1	...	+....	...	....	.....
Milium effusum	... +++...1...	.....	...	.....	...	....	.....
Diplazium sibiricum	... +....+..1+	.....	...	.....	...	....	.....

Tab. 5. (cont.)

Relevé nr.	123	4567890123	45678	901	23456	789	0123	456789012
Carex globularis	...	.....	21221	...	.....	...	....	.+.....
Rubus arcticus	..+	.....1....	+++++	...	.....	...	....	.....
Caltha palustris	...	.....	+..1+	...	.....	...	....	.....
Equisetum sylvaticum	...	......+...	+..+2	...	.....	...	....	.....
Vicia cracca	...	.....+.	.+.++	...	.....	...	....	.....
Smilacina trifolia	...	.....	.+.++	...	.....	...	....	.....
Carex canescens	...	.....	.+.+.	...	.....	...	....	.....
Equisetum palustre	...	.....	.+.+.	...	.....	...	....	.....
Myosotis caespitosa	...	.....	...+1	...	.....	...	....	.....
Pedicularis resupinata	...	.....	...++	...	.....	...	....	.....
Luzula pilosa	...	.....	.....	...	--.-.	...	....	.....
Diphasiastrum complanatum	...	.....	.....	...	..1++	...	1...	.....
Lathyrus humilis	...	..+...+..1	.....	...	1....	+.2	....	.....
Astragalus propinquus	...	.....	.....	...	.....	+..	.++1	.....
Festuca ovina	1..	.....	..+..	...	.....	...	+.+1	...+....+
Aconogonon ocreatum	...	.....	.....	...	.....	...	....	1..11....
Equisetum hyemale	11.	122..12+3+	.....	...	.....	...	....	.....
Galium boreale	++.	+++..+1.1+	.....	+..	+....	..+	....	.....
Thalictrum minus	++.	+-+..-1.++	.....	...	.....	..+	....	.....
Aegopodium alpestre	...	++++++1...	++.++	..+	.+...	...	....	.....
Veratrum lobelianum	...	..-++..-..	++.++	...	.....	...	....	.....
Trientalis europaea	...	.+++1++++.	.+.++	+++	.....	...	....	.....
Linnaea borealis	...	..+121.1..	+.++1	111	.+211	...	1+11	......+..
Maianthemum bifolium	...	11112111..	...+.	+.+	+11+2	...	+1-.	.....
Pyrola asarifolia	...	.....	+..+1	1.+	++.++	...	....	.....
Rosa acicularis	...	.++.....1+	+.++-	+.+	.+++2	211	....	+.....
Vaccinium uliginosum	...	.....	1.111	...	.....	...	+++.	.....
Empetrum subholarcticum	...	.....	+.1.2	.+.	.....	...	12+1	..+.1....
Ledum palustre	...	.....	3.222	.2+	.-.2.	...	212.	.33.1-+..
Rhodococcum vitis-idaea	...	.....	1.2+1	211	12222	31.	222.	22.+3.1+2
Calamagrostis obtusata	...	++31.1212+	+...1	1++	2++..	...	....	.1+.+..+.
Chamaenerion angustifolium	11.	..-...+..+	...+.	..-	++..1	-++	....	+..+.....
Carex pediformis s.l.	.+.	+++.....2	.....	+..	1++..	+.2	....	.....
Abies sibirica juv.	+..	+.+++.....	.....	.+.	+.+..	...	....	.....
Lycopodium annotinum	...	+.+22.....	.....	+2.	..+..	...	....	......+..
Cardamine macrophylla	++.	+..+-...+.	...+.	...	.....	...	....	.....
Carex pallida	...	...++1.2..	2	+.+	.....	...	....	.....
Geranium albiflorum	.+.	...-+.....	++...	...	+....	...	....	.....
Vicia venosa	...	+++.....	...12	...	.....	..+	....	.....
Schizachne callosa	...	-1....+...	.....	+.+	.....	.+.	....	.....
Viola brachyceras	...	.....+...	.....	+..	+++..	.+.	....	.....
Vaccinium myrtillus	...	.....	..+..	..-	..+11	.1.	....	.....
Moehringia lateriflora	..+	..+..+....	.+..1	...	.....	...	....	.....
Viola uniflora	...	+++....-..	.....	+..	.....	...	....	.....
Bergenia crassifolia	...	....1.....	.....	.3.	12...	...	....	.....1...
Orthilia secunda	...	.....+	.....	+..	+...+	...	...+	.....
Matteucia struthiopteris	.+.	42.....+.	.....	...	.....	...	....	.....
Filipendula palmata	..+	++.....	.+...	...	.....	...	....	.....
Melica nutans	...	..-...-...	.....	...	+-...	...	....	.....
Rubus sachalinensis	...	.....+	.....	.+.	.....	..+	....	...+.....
Pedicularis labradorica	...	.....	..+-.	...	....+	...	.-..	.....

Tab. 5. (cont.)

Relevé nr.	123	1111 4567890123	11111 45678	122 901	22222 23456	222 789	3333 0123	333333444 456789012
Poa cf. *urssulensis*	++.	.........+	.....	...	.....	...	....	....
Equisetum scirpoides	+..	......1...	.....	...	....+	...	....	....
Hieracium umbellatum	+..	.........+	.....	...	.....	..+	....	....
Pinus sylvestris juv.	-..	....	.....	-..	..+..	...	....	....
Equisetum arvense	.1.	..+.....	...2.	...	.....	...	....	....
Adoxa moschatellina	...	-+-.....	.....	...	.....	...	....	....
Actaea erythrocarpa	...	-+...+..	.....	...	.....	...	....	....
Circaea alpina	...	11.....+.	.....	...	.....	...	....	....
Poa palustris s.l.	...	+.....	.+...	...	.....	..+	....	....
Atragene sibirica	...	.+-...-...	.....	...	.....	...	....	....
Rubus saxatilis	...	.++.....	.....	...	1....	...	....	....
Viola sacchalinensis	...	.1.....	.....	...	.-...	..-	....	....
Betula pendula juv.	...	..+.....+.	.....	...	.....	...	....	....+....
Sorbus sibirica juv.	...	...-.....	.....	...	...-.	.-.	....	....
Aquilegia sibirica	...	.....-...	.....	...	.+...	..+	....	....
Antennaria dioica	...	.........+	.....	...	....+	.+.	....	....
Pinus sibirica juv.	...	....	.--..	-..	.....	...	....	....
Vicia nervata	...	....	.....	...	+-...	+..	....	....
Pleurospermum uralense	.+.	.-........	.....	...	.....	...	....	....
Lactuca sibirica	..+	+.....	.....	...	.....	...	....	....
Carex rhynchophysa	..2	....	.+...	...	.....	...	....	....
Poa pratensis	..+	....	...+.	...	.....	...	....	....
Phegopteris connectilis	...	.+....-...	.....	...	.....	...	....	....
Luzula rufescens	...	..-.....	...+.	...	.....	...	....	....
Saussurea parviflora	...	....+.....	....+	...	.....	...	....	....
Populus tremula juv.	...	.........+	.....	...	+....	...	....	....
Duschekia fruticosa juv.	...	....	.....	.+.	.....	.+.	....	....
Ribes nigrum juv.	...	....	.....	...	....-	..-	....	....
Juniperus sibirica	...	....	.....	...	.....	.-.	....	.......1.
E_0 - ground layer								
Rhytidiadelphus triquetrus	...	1222.1.22.	.....	...	.....	...	....	....
Polytrichum commune	...	....	322.1	..1	.....	...	....	.2.....
Dicranum scoparium	...	...+.....	...+.	...	.....	...	....	.....11+3
Hylocomium splendens	...	.2221+.2..	2	+22	.....	...	....	.....2...
Cladina rangiferina	...	....	..+..	++.	...11	+..	1221	+++.2211.
Cladina stellaris	...	....	..+..	...	...++	...	232.	+...2121.
Pleurozium schreberi	...	..+2.1+23.	3.4++	534	.+.53	...	4131	144122412
Dicranum polysetum	...	......+...	..1+.	+.+	...1+	1..	+++.	....
Ptilium crista-castrensis	...	....+..1..	.....	..+	.+..1	.+.	+1..	......1..
Drepanocladus uncinatus	2..	.....++1+.	...+.	...	.....	...	....	....
Polytrichum juniperinum	+..	......+.+.	.....	...	1	...	....	....+....
Aulacomnium palustre	+..	......+...	...1+	...	....-	...	....	....
Abietinella abietina	...	.....+....	.1.++	...	.....	1..	....	....
Sphagnum girgensohnii	...	....	..1..	...	.....	...	....	.1+...+..
Plagiomnium medium	...	1.+.....	.....	...	.....	.+.	....	....
Calliergon stramineum	...	.+.....	+..+.	...	.....	...	....	....
Ceratodon purpureus	...	.....-..	.....	...	.....	+..	...+	....
Cladonia pyxidata	...	....	.....	...	.....	+..	....	......++.
Stereocaulon sp.	...	....	.....	...	.....	...	....	.....1+1.
Barbilophozia lycopodioides	+..	....-.....	.....	...	.....	...	....	....
Climacium dendroides	+..	....	.1...	...	.....	...	....	....
Bryum pseudotriquetrum	1..	....	.....	...	.....	..1	....	....

Tab. 5. (cont.)

Relevé nr.	1111 11111 122 22222 222 3333 333333444 123 4567890123 45678 901 23456 789 0123 456789012
Brachythecium erythrorrhizon	... .-..... ...+. ... .+.
Dicranum fuscescfacea	... .-+... ....
Herzogiella turens	... .++... ....
Pohlia nutans	... .+-... ....
Rhizomnium pseudopunctatum	... .1.... ....+ ... .
Brachythecium reflexum	... .-1.. ....
Ptilidium pulcherrimum	... .-.. .... +.. ....
Cladonia gracilis	... .+.. ... .+... ... .
Hypogymnia physodes	... .+ ... . +.. ....
Ptilidium ciliare	... . +.. ....+
Stereocaulon alpinum	... .1 ....1....
Umbilicaria mammulosa	... .1+..
Cladina arbuscula	... .1.+.

In one relevé only:

E_3: *Populus suaveolens* 9:2, *Salix caprea* 13:1, *Duschekia fruticosa* 22:1;

E_2: *Padus racemosa* 4:+, *Ribes spicatum* 8:1, *Salix rosmarinifolia* 15:1, *Salix krylovii* 15:+, *Spiraea salicifolia* 15:-, *Rosa acicularis* 22:1;

E_1: *Artemisia* cf. *leucophylla* 1:+, *Carex juncella* 1:+, *Hieracium* sp. 1:+, *Saxifraga punctata* 1:+, *Taraxacum* sp. 1:+, *Chamaenerion latifolium* 1:-, *Trollius kytmanovii* 1:-, *Angelica decurrens* 2:+, *Carex aterrima* 2:-, *Alopecurus pratensis* 3:+, *Myosotis scorpioides* var. *nemorosa* 3:+, *Ranunculus repens* 3:+, *Myosotis krylovii* 4:+, *Viola* sp. 4:-, *Galium triflorum* 5:+, *Hieracium* cf. *narymense* 5:+, *Paris verticillata* 5:+, *Ribes spicatum* juv. 5:+, *Doronicum altaicum* 8:+, *Equisetum variegatum* 9:1, *Carex lanceolata* 10:1, *Artemisia tanacetifolia* 10:+, *Botrychium lunaria* 10:-, *Geranium eriostemon* 10:-, *Carex schmidtii* 15:3, *Equisetum fluviatile* 15:+, *Galium uliginosum* 15:+, *Hierochloë odorata* 15:+, *Lathyrus pilosus* 15:+, *Ranunculus propinquus* 15:-, *Spiraea salicifolia* juv. 15:-, *Carex falcata* 17:+, *Geranium vlassovianum* 17:+, *Oxycoccus palustris* 17:+, *Lonicera* cf. *pallasii* juv. 17:-, *Geranium coeruleum* 18:1, *Luzula parviflora* 18:+, *Poa sibirica* 18:+, *Pinus pumila* juv. 19:-, *Lathyrus pratensis* 22:+, *Lycopodium clavatum* 26:+, *Spiraea media* juv. 27:+, *Pyrola minor* 28:+, *Silene repens* 28:+, *Cirsium serratuloides* 29:+, *Dendranthemum zawadskii* 29:+, *Hieracium ganeschinii* 29:+, *Scorzonera radiata* 30:-, *Arctostaphylos uva-ursi* 33:2, *Campanula rotundifolia* 37: +, *Rhododendron aureum* 42:3, *Anthoxanthum alpinum* 42:-;

E_0: *Stereocaulon tomentosum* 1:2, *Peltigera aphthosa* 1:+, *Brachythecium starkei* 4:2, *Brachythecium rutabulum* 5:+, *Paraleucobryum longifolium* 8: +, *Cephalozia bicuspidata* 9:-, *Tetraphis pellucida* 9:-, *Blepharostoma trichophyllum* 9:-, *Lophozia* cf. *longidens* 11:-, *Rhytidiadelphus subpinnatus* 12:+, *Sphagnum recurvum* 14:2, *Sphagnum wulfianum* 14:1, *Sphagnum capillifolium* 15:2, *Pseudobryum cinclidioides* 15:2, *Sphagnum squarrosum* 17: 3, *Drepanocladus aduncus* 17:+, *Sphagnum quinquefarium* 18:2, *Calliergon richardsonii* 18:+, *Usnea longissima* 18:+, *Alectoria sarmentosa* 20:+, *Dicranum muehlenbeckii* 21: +, *Barbilophozia barbata* 21:-, *Polytrichum strictum* 23:1, *Peltigera* sp. 25:+, *Cetraria* sp. 25:+, *Cladonia* sp. 25: -, *Cladonia cornuta* 26:1, *Hedwigia ciliata* 27:1, *Parmelia omphalodes* 27:+, *Parmelia taractica* 27: +, *Grimmia ovalis* 27:+, *Cynodontium* sp. 27:+, *Hypnum cupressiforme* 27:+, *Brachythecium rivulare* 28:+, *Eurhynchium pulchellum* 29:+, *Dicranum* sp. 30:+, *Cetraria cucullata* 31:+, *Polytrichum piliferum* 33:1, *Cladonia digitata* 36:+, *Cladonia amaurocraea* 38:2, *Racomitrium heterostichum* 39:1, *Tetralophozia setiformis* 39:+, *Cladonia chlorophaea* 39:+, *Cetraria nivalis* 41:+.

Tab. 5. (Headings)

Relevé nr.	Area (m^2)	Aspect	Slope (°)	Alti-tude	Cover E_2 (%)	Cover E_2 (%)	Cover E_1 (%)	Cover E_0 (%)	Date
1	100	-	0	500	0	50	40	30	21.7.1993
2	50	-	0	610	0	50	60	0	22.7.1993
3	50	-	0	460	0	70	60	0	19.7.1993
4	200	-	0	500	60	10	95	20	21.7.1993
5	400	-	0	500	70	25	50	40	20.7.1993
6	300	-	0	500	60	20	90	40	20.7.1993
7	400	N	15	1080	80	20	45	50	24.7.1993
8	400	N	5	1080	10	75	50	95	24.7.1993
9	100	-	0	480	70	0	40	15	19.8.1991
10	400	SW	3	660	85	10	60	3	20.8.1991
11	400	-	0	960	85	5	20	80	20.8.1991
12	100	NW	2	510	80	40	80	60	21.7.1993
13	400	-	0	760	80	5	35	0	22.7.1993
14	200	-	0	460	40	20	40	90	20.7.1993
15	400	-	0	460	50	10	55	60	19.7.1993
16	200	-	0	460	50	20	60	80	20.7.1993
17	400	-	0	460	20	35	75	65	20.7.1993
18	400	SSW	5	460	50	15	85	60	19.8.1991
19	400	SSE	5	560	35	45	20	95	22.7.1993
20	200	NE	10	540	60	60	80	50	19.7.1993
21	200	-	0	490	40	60	20	80	21.7.1993
22	400	S	10	480	80	10	30	0	19.7.1993
23	400	S	10	470	75	15	35	5	19.7.1993
24	200	-	0	560	60	70	30	90	22.7.1993
25	400	-	0	580	60	50	30	95	19.8.1991
26	400	SW	3	660	70	5	45	55	19.8.1991
27	200	SSW	40	540	50	50	40	10	21.7.1993
28	400	S	3	680	45	20	10	80	22.7.1993
29	200	SW	45	790	70	5	30	5	23.7.1993
30	400	-	0	460	50	40	40	90	18.7.1993
31	200	-	0	460	20	70	40	50	18.7.1993
32	200	-	0	460	50	50	40	80	18.7.1993
33	400	-	0	460	10	70	40	15	18.7.1993
34	100	-	0	460	0	80	15	5	19.7.1993
35	100	NE	15	480	0	80	50	60	19.7.1993
36	100	NNE	15	510	10	90	40	70	19.7.1993
37	100	-	0	460	10	90	5	5	19.7.1993
38	100	SW	5	460	0	70	60	70	19.7.1993
39	100	ENE	30	1150	0	80	5	70	24.7.1993
40	100	N	20	1420	0	80	5	90	25.7.1993
41	100	S	30	1420	0	70	3	20	26.7.1993
42	25	SE	20	1570	0	70	45	50	26.7.1993

mires. Similar vegetation has been described as Chamaedaphno-Pinetum pumilae Chytrý, Pešout et Anenchonov 1993 from the Svjatoj Nos Isthmus (CHYTRÝ et al. 1993). This community belongs to the alliance Sphagnion medii Kästner et Flösner 1933.

Shrub, forest and krummholz communities

Calamagrostio langsdorffii-Salicetum roridae ass. nova (Tab. 5, rel. 1–3, nomenclatural type: Tab. 5, rel. 2)

This is a shrubby willow community inhabiting gravelly terraces, banks and beds of mountain rivers. Principal ecological factor determining the development of this community is natural disturbance caused by current, especially during high water from spring snow melting. The soil is poorly developed in spaces between boulders and rubbles. This community was studied on the river terraces in the V-shaped section of the valley from the confluence with the Markuškina creek downstream. It also occurs in the Bol'šaja Čeremšana River Valley (DANIHELKA & CHYTRÝ, ms.). Vegetation of this type, representing an eastern vicariant of the European alliance Salicion eleagni (see e.g. MOOR 1958) has not been studied in Siberia yet (see KOROTKOV et al. 1991). Some river-side willow communities have been described from the lower Lena area (CAJANDER 1903).

Equisetum hyemale-Abies sibirica community (Tab. 5, rel. 4–13)

This is a coniferous floodplain forest ("dark taiga"), occurring on the bottom of the V-shaped river valley up to approximately 1100 m a.s.l. It is developed on sandy, partially gravelly river terraces. In these habitats, flooding may only occur for a short span in spring. In spring, oscillations of the water table may be comparatively frequent. In summer, however, ground-water level lies at a depth of several dozen centimetres. Similar forests are so far poorly known in Siberia. Some of the stands described by ŽITLUCHINA & ALIMBEKOVA (1987) and ŽITLUCHINA & MIRKIN (1987) may be compared with this community, however, there are some differences in species composition and ecology.

Classification of this community, as well as the other forest communities into higher syntaxa is difficult because there is a number of usually narrowly conceived alliances described in Siberia (Guinochet 1982, ŽITLUCHINA & ALIMBEKOVA 1987, ŽITLUCHINA & MIRKIN 1987, ŽITLUCHINA 1988, ERMAKOV et al. 1991 etc.), often based on a limited amount of relevé material having originated from comparatively small areas, and presented without any clear definition of relations to the alliances described by the other authors, including the „classic" alliances of BRAUN-BLANQUET et al. (1939) which also come into consideration in Siberia. Similarly, a number of coniferous forest associations have been described independently by the above-mentioned authors and by HILBIG (1990a,b) and there are evidently some overlaps in syntaxonomical schemes among these authors. That is why, until there is a syntaxonomical revision, we consider better not to describe coniferous forest communities as new associations.

Carex canescens-Pinus sylvestris community (Tab. 5, rel. 14–18)

Mixed forests of this community inhabit flat surfaces with high ground-water level in the lowest altitudes of the Bol'šoj Čivyrkuj Valley, where the floodplain is wide. Permanently wet soil induces paludification which is indicated by the occurrence of hygrophilous herbs and mosses. Due to poor drainage, coniferous trees are less vigorous, forming an open canopy in which birch finds suitable conditions for its establishment. This community may be considered identical with that described from the Svjatoj Nos Isthmus (CHYTRÝ & PEŠOUT 1992), although its species composition is different to some extent. Syntaxonomically, this community is close to the alliance Betulion pubescentis Lohmeyer et Tüxen in Tüxen et Oberdorfer 1957.

Calamagrostis obtusata-Abies sibirica community (Tab. 5, rel. 19–21)

This is a coniferous forest ("dark taiga") inhabiting mesic, drained habitats with comparatively high air humidity, e.g., windward slopes exposed to Lake Baikal or higher terraces on the bottom of the valley in its lower part. This community was also described by DANIHELKA & CHYTRÝ (ms.) from the Bol'šaja Čeremšana River Valley. Similar forests are widely distributed in the Baikal area (MOLOŽNIKOV 1986). From the Barguzinskij Range, fire forests are described in detail, namely in TJULINA (1976, 1981). From the West Sayan Mts., similar forests dominated by *Pinus sibirica* and *Abies sibirica* were described ŽITLUCHINA & ALIMBEKOVA (1987, see also ŽITLUCHINA 1988) as Abieto-Pinetum sibiricae.

Calamagrostis obtusata-Larix sibirica community (Tab. 5, rel. 22–26)

This association comprises coniferous forests with canopy formed of "light taiga" trees: *Larix sibirica* and *Pinus sylvestris*. It occurs on mesic habitats with deep soils, usually on the higher river terraces or gentle slopes at lower altitudes near the Baikal shore. This community was also described as *Carex pediformis-Larix sibirica* community from the Svjatoj Nos Isthmus (CHYTRÝ & PEŠOUT 1992). In the present paper, that name is refused to avoid confusion with Carici pediformis-Laricetum sibiricae Ermakov in Ermakov et al. 1991. Similar forests are common in the Baikal area (MOLOŽNIKOV 1986), West Sayan Mts. (ŽITLUCHINA & ALIMBEKOVA 1987, ŽITLUCHINA & MIRKIN 1987, ŽITLUCHINA 1988) and northern Mongolia (HILBIG & KNAPP 1983, HILBIG 1990a,b).

Vicia nervata-Pinus sylvestris community (Tab. 5, rel. 27–29)

This is the pine forest ("light taiga") on xeric south-facing slopes. Soil is usually shallow, stony to gravelly. This community is usually developed in the middle altitudes remote from Baikal where air humidity decreases. Due to xeric conditions, steppe herbs occur in the field layer. This community is known from the Svjatoj Nos Peninsula where it inhabits south-facing slopes on eastern leeward side of the mountain range (ANENCHONOV ined., CHYTRÝ

ined., Pešout ined.) and from the Nestericha River Valley, flowing from eastern slopes of the Barguzinskij Range (Chytrý ined.). Analogous types are probably widely distributed throughout the Baikal area (see Mološnikov 1986, for further references) and they are reported from the West Sayan Mts. (Žitluchina & Mirkin 1987, Žitluchina 1988), south-western Siberia (Ermakov et al. 1991) and northern Mongolia (Hilbig & Knapp 1983, Hilbig 1990b).

Maianthemum bifolium-Pinus sibirica community (Tab. 5, rel. 30–33)

This community is confined to sandy areas on the Baikal shoreline, forming small patches of open woodland with *Pinus pumila* in the understorey. These habitats are cool because of the climatic influence of the lake, with high air humidity and frequent occurrence of fogs. However, sandy soil is drying out quickly. That is why, together with the psammophytes, some plants of subalpine belt are present in the field layer. These forest patches are spatially related to krummholz patches on coastal dunes (see below). This community was described from the Svjatoj Nos Isthmus by Chytrý & Pešout (1992) as *Padus avium-Pinus sibirica* community and from the Bol'šaja Čeremšana River Valley (Danihelka & Chytrý, ms.). Tjulina (1976) reports similar communities from Sosnovka Bay on the north-eastern Baikal shore.

Pleurozio schreberi-Pinetum pumilae ass. nova (Tab. 5, rel. 34–42, nomenclatural type: Tab. 5, rel. 35)

This community includes krummholz stands with *Pinus pumila* in the subalpine belt above the alpine timberline at approximately 1100 m. At leeward sites of the summits, it may approach the altitudes up to 1800–2000 m. Soil is usually shallow, often containing large boulders on mountain slopes. The field layer is poor in species; in many sites it is almost completely absent. However, a ground layer with bryophytes and lichens is present elsewhere in these stands. Besides its occurrence in the subalpine belt, *Pinus pumila* stands are also present on the cool habitats of the shore sand dunes and on the slopes immediately above the Baikal shoreline. This phenomenon was described by Tjulina (1967, 1976) as a lower sub-golcy (= subalpine) belt. From our observations in the north-eastern Baikal area, we conceive of these stands, unlike Tjulina, as scattered occurrences of vegetation originating in the subalpine belt, rather than a well-distinguished vegetation belt. This community is widely distributed in the whole northern Baikal area, where Mološnikov (1975) described a number of narrowly conceived community types that largely belong to this community. This community belongs to the alliance Vaccinio-Pinion pumilae Suzuki-Tokyo 1964. In phytosociological literature using the Braun-Blanquet approach, no similar communities have been described from other regions of Siberia and the Far East (Korotkov et al. 1991) and the Japanese association Vaccinio-Pinetum pumilae Maeda et Shimazaki 1951 slightly differs in its species composition (see Miyawaki 1980-1989).

Acknowledgements. The authors are very grateful to all the colleagues who kindly determined cryptogams: Dr. Ivan NOVOTNÝ (Brno) – mosses, Dr. Josef DUDA (Opava) – liverworts and Mgr. Broněk GRUNA and Dr. Antonín VĚZDA (both Brno) – lichens. The English text was improved by Mr. Jeffrey A. VANDERZIEL. This work would be impossible without logistic support of the Zabajkal'skij Nature National Park; we are particularly indebted to Mr. Alexandr BEKETOV (Ust'-Barguzin). We are also indebted to all our Czech, Russian and Austrian friends who contributed so much to the success of the expedition.

References

Bardunov, L.V. (1992): Očerk brioflory Sibiri [Outline of the bryophyte flora of Siberia]. – 96 pp., Nauka, Novosibirsk. [In Russian.]

Barkman, J.J., Moravec, J. & Rauschert, S. (1986): Code of the phytosociological nomenclature. Ed. 2. – Vegetatio **67**: 145–195. Dordrecht.

Braun-Blanquet, J. (1964): Pflanzensoziologie. Grundzüge der Vegetationskunde. Ed. 3. – 865 pp., Springer, Wien and New York.

Braun-Blanquet, J., Sissingh, G. & Vlieger, J. (1939): Prodromus der Pflanzengesellschaften. 6. Klasse der Vaccinio-Piceetea. – 123 pp. SIGMA, Montpellier.

Cajander, A.K. (1903): Beiträge zur Kenntniss der Vegetation der Alluvionen des nördlichen Eurasiens. I. Die Alluvionen des unteren Lena-Thales. – 182 pp. Helsingfors.

Chytrý, M. & Pešout, P. (1992): Plant communities of the Svjatoj Nos Isthmus, Lake Baikal. – In: Mlíkovský, J. & Stýblo, P. (eds.): Ecology of the Svjatoj Nos wetlands, Lake Baikal, pp. 183–217, Ninox Press, Praha.

Chytrý, M., Pešout, P. & Anenchonov, O.A. (1993): Syntaxonomy of vegetation of Svjatoj Nos Peninsula, Lake Baikal. 1. Non forest communities. – Folia Geobot. Phytotax. **28**: 337–383. Praha.

Daniëls, F.J.A. (1994): Vegetation classification in Greenland. – J. Veg. Sci. **5**: 781–790. Uppsala.

Danihelka, J., Anenchonov, O.A. & Chytrý, M. (ms.): Vascular plants of the Bol'šoj Čivyrkuj River Valley, Barguzinskij Range.

Danihelka, J. & Chytrý, M. (ms.): Some plant communities of the Bol'šoja Čeremšana River Valley, Barguzinskij Range.

Davydov, V.I., Malyšev, A.A., Arsent'ev, V.P. et al. (1980): Geologičeskaja karta Burjatskoj ASSR. Masštab 1:500 000 [Geological map of the Republic of Buryatia. Scale 1:500 000]. – Aerogeologija, Moskva. [In Russian.]

Dierssen, K. (1982): Die wichtigsten Pflanzengesellschaften der Moore NW-Europas. – 382 pp., Conservatoire et Jardin botaniques, Genève.

— (1984): Vergleichende vegetationskundliche Untersuchungen an Schneeböden. – Ber. Deutsch. Bot. Ges. **97**: 359–382. Berlin.

Elvebakk, A. (1994): A survey of plant associations and alliances from Svalbard. – J. Veg. Sci. **5**: 791–802. Uppsala.

Ermakov, N.B., Koroljuk, A.Ju., Laščinskij, N.N. (1991): Florističeskaja klassifikacija mezofil'nych travjanych lesov južnoj Sibiri [Floristic classification of the mesophilous herb-rich forests of southern Siberia]. – 96 pp. SO AN SSSR, Novosibirsk. [In Russian.]

Gjaerevoll, O. (1956): The plant communities of Skandinavian alpine snow-beds. – Kongel. Norske Vidensk. Selsk. Skr. **1**: 1–405. Trondheim.

Gogoleva, P.A., Kononov, K.E., Mirkin, B.M. & Mironova, C.I. (1987): Sintaksonomija i simfitosociologija rastitel'nosti alasov Central'noj Jakutii [Syntaxonomy and symphytosociology of the vegetation of alases of Central Yakutia]. – 176 pp. Izdatel'stvo Irkutskogo universiteta, Irkutsk. [In Russian.]

Guinochet, M. (1982): Notes de phytosociologie sigmatiste prises en Siberie meridionale. – Doc. Phytosoc., N.S. **6**: 295–301. Camerino.

Hadač, E. (1971): Snow-land communities of Reykjanes peninsula, SW. Iceland (Plant communities of Reykjanes peninsula, part 4). – Folia Geobot. Phytotax. **6**: 105–126. Praha.

— (1985): Plant communities of the Kaldidalur Area, WSW Iceland. Part 1. Syntaxonomy. – Folia Geobot. Phytotax. **20**: 113-175. Praha.

— (1989): Notes on plant communities of Spitsbergen. – Folia Geobot. Phytotax. **24**: 131-169. Praha,

Hilbig, W. (1990a): Neu beschriebene Pflanzengesellschaften aus der Mongolischen Volksrepublik. – Feddes Repert. **101**: 189–206. Berlin.

— (1990b): Pflanzengesellschaften der Mongolei. – Wiss. Z. Univ. Halle 1990/39 (P44): 1–146. Halle.

Hilbig, W. & Knapp, H.D. (1983): Vegetationsmosaik und Florenelemente an der Wald-Steppen-Grenze im Chentej-Gebirge (Mongolei). – Flora **174**: 1–89. Jena.

Hilbig, W. & Schamsran, Z. (1981): Zwergbinsengesellschaften in der Mongolei. – Feddes Repert. **92**: 557–561. Berlin.

Hill, M.O. (1979) TWINSPAN: A Fortran program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes. – Cornell University, Ithaca.

Imetchenov, A.B. & Matvejčuk, S.A. (1990): Klimat i vody [Climate and waters]. – In: Imetchenov, A.B. et al. (eds.): Priroda Zabajkal'skogo nacional'nogo parka [Nature of the Zabajkal'skij National Park], pp. 20–28. BNC SO AN SSSR, Ulan-Ude.

Koroleva, N.E. (1994): Phytosociological survey of the tundra vegetation of the Kola Peninsula, Russia. – J. Veg. Sci. **5**: 803–812. Uppsala.

Korotkov, K.O., Morozova, O.V. & Belonovskaja, E.A. (1991): The USSR vegetation syntaxa prodromus. – 346 pp. Vilchek, Moscow.

Krasnoborov, I.M. (ed.) (1988): Flora Sibiri. Lycopodiaceae-Hydrocharitaceae [Flora of Siberia. Lycopodiaceae-Hydrocharitaceae]. – 200 pp. Nauka, Novosibirsk. [In Russian.]

Krasnoborov, I.M. & Malyšev, L.I. (eds.) (1992): Flora Sibiri. Tom **5**. Salicaceae-Amaranthaceae [Flora of Siberia. Vol. **5**. Salicaceae-Amaranthaceae]. – 312 pp. Nauka, Novosibirsk. [In Russian.]

Malyšev, L.I. & Peškova, G.A. (eds.) (1979): Flora Central'noj Sibiri [Flora of Central Siberia]. I., II. – 1048 pp. Nauka, Novosibirsk. [In Russian.]

— — (eds.) (1987): Flora Sibiri. Araceae-Orchidaceae [Flora of Siberia. Araceae-Orchidaceae]. – 246 pp. Nauka, Novosibirsk. [In Russian.]

— — (eds.) (1990): Flora Sibiri. Tom **2**. Poaceae (Gramineae) [Flora of Siberia. Vol. **2**. Poaceae (Gramineae)]. – 361 pp. Nauka, Novosibirsk. [In Russian.]

— — (eds.) (1993): Flora Sibiri. Tom **6**. Portulacaceae-Ranunculaceae. [Flora of Siberia. Vol. **6**. Portulacaceae-Ranunculaceae]. – 310, Nauka, Novosibirsk. [In Russian.]

Matveyeva, N.V. (1994): Floristic classification and ecology of tundra vegetation of the Taymyr Peninsula, northern Siberia. – J. Veg. Sci. **5**: 813–828. Uppsala.

Mirkin, B.M., Gogoleva, P.A. & Kononov, K.E. (1985): The vegetation of Cetral Yakutian alases. – Folia Geobot. Phytotax. **20**: 345–395. Praha.

Mirkin, B.M., Kononov, K.E., Gogoleva, P.A., Burtseva, E.I. & Naumova, L.G. (1992): The floodplain grasslands of the Middle Lena-river. II. Classification. – Folia Geobot. Phytotax. **27**: 247–300. Praha.

Mirkin, B.M., Manizabar, N., Muchametšina, V.C., Alimbekova, L.M. & Oniščenko, L.I. (1983): Vtoroe približenie klassifikacii rastitel'nosti pojm MNR. I. Obščaja charakteristika i obzor klassov Vaccinio-Piceetea Br.–Bl. 39 em Pass. 63 i Betuletea rotundifoliae kl. nova [Second approach to the classification of the floodplain vegetation of Mongolia. I. General characterization and review of the classes Vaccinio-Piceetea Br.–Bl. 39 em

Pass. 63 and Betuletea rotundifoliae cl. nova]. – Ms. [dep. VINITI, Moscow, No. N2048-83].
Miyawaki, A. (ed.) (1981-1989): [Vegetation of Japan]. Vol. 1–10. – Shibundo, Tokyo. [In Japanese.]
Mološnikov, V.N. (1975): Kedrovyj stlanik gornych landšaftov Severnogo Pribajkal'ja [Krummholz of the mountain landscapes of the northern Baikal area]. – 203 pp. Nauka, Moskva. [In Russian.]
— (1976): Klimatičeskie uslovija [Climatic conditions]. – In: Tjulina, L.N. (ed.): Vlažnyj pribajkal'skij tip pojasnosti rastitel'nosti [Humid Baikal type of altitudinal vegetation pattern], pp. 14–24. Nauka, Novosibirsk. [In Russian.]
— (1986): Rastitel'nye soobščestva Pribajkal'ja [Plant communities of the Baikal area]. – 272 pp. Nauka, Novosibirsk. [In Russian.]
Moor, M. (1958): Pflanzengesellschaften schweizerischer Flussauen. – Mitt. Schweiz. Anst. Forstl. Vers.-Wesen **34**: 221-360. Zürich.
Nordhagen, R. (1943): Sikilsdalen og Norges fjellbeiter. En Plantensosiologisk monografi. – Berg. Mus. Skr. **22**: 1–607. Bergen.
Peškova, G.A. & Malyšev, L.I. (eds.) (1990): Flora Sibiri. Tom 3. Cyperaceae [Flora of Siberia. Vol. 3. Cyperaceae]. – 361 pp. Nauka, Novosibirsk. [In Russian.]
Pietsch, W. (1973): Beitrag zur Gliederung der europaischen Zwergbinsengesellschaften (Isoëto-Nanojuncetea Br.-Bl. et Tx. 1943). – Vegetatio **28**: 401-438. The Hague.
Položij, A.V. & Malyšev, L.I. (eds.) (1988): Flora Sibiri. Rosaceae. [Flora of Siberia. Rosaceae]. – 200 pp. Nauka, Novosibirsk. [In Russian.]
Razzhivin, V.Yu. (1994): Snowbed vegetation of far northeastern Asia. – J. Veg. Sci. **5**: 829–842.
Santesson, R. (1984): The lichens of Sweden and Norway. – 333 pp. Uppsala and Stockholm.
Savič, N.M. (1967): Posol'skoe boloto [Posol'sk wetland]. – In: Tichomirov, B.A. (ed.) Geobotaničeskie issledovanija na Bajkale [Geobotanical investigations at Baikal], pp. 302–342. Nauka, Moskva. [In Russian.]
Tjulina, L.N. (1967): O tipach pojasnosti rastitel'nosti na zapadnom i vostočnom poberež'jach severnogo Bajkala [On the types of altitudinal vegetation pattern on west and east shore of North Baikal]. – In: Tichomirov, B.A. (ed.): Geobotaničeskie issledovania na Bajkale [Geobotanical investigations at Baikal], pp. 5–43. Nauka, Moskva. [In Russian.]
— (1976): Vlažnyj pribajkal'skij tip pojasnosti rastitel'nosti [Humid Baikal type of altitudinal vegetation pattern]. – 319 pp., Nauka, Novosibirsk. [In Russian].
— (1981): Rastitel'nost' južnoj časti Barguzinskogo chrebta [Vegetation of the southern part of the Barguzinskij Range]. – 84 pp. Nauka, Novosibirsk. [In Russian.]
Walker, M.D., Walker, D.A. & Auerbach, N.A. (1994): Plant communities of a tussock tundra landscape in the Brooks Range Foothills, Alaska. – J. Veg. Sci. **5**: 843-866. Uppsala.
Westhoff, V. & van der Maarel, E. (1978): The Braun-Blanquet approach. – In: Whittaker R.H. (ed.): Classification of plant communities, pp. 289–399. W. Junk, The Hague.
Zechmeister, H. & Mucina, L. (1993): Vegetation of European springs: High-rank syntaxa of the Montio-Cardaminetea. – J. Veg. Sci. **5**: 385–402. Uppsala.
Žitluchina, T.I. (1988): Sintaksonomija lesov Sajano-Šušenskogo biosfernogo zapovednika [Syntaxonomy of forests of the Sajano-Šušenskij Biosphere Reserve]. – Bjull. Moskov. Obšč. Ispyt. Prir., otd. biol. **93**(3): 66–76. Moskva [In Russian].
— (1989): Sintaksonomija vysokogornoj rastitel'nosti v central'noj časti Zapadnogo Sajana. [Syntaxonomy of high mountain vegetation of the central part of the West Sayan Mts.]. – Biol. Nauki **1989**(6): 74–80. [In Russian]. Moskva.
Žitluchina, T.I. & Alimbekova, L.M. (1987): Sintaksonomija rastitel'nosti Sajano-Sušenskogo zapovednika. II. Klass Vaccinio-Piceetea Br.-Bl. 39 in Br.–Bl., Siss, Vlieger 1939

[Syntaxonomy of vegetation of Sajano-Sušenskij Reserve. II. Class Vaccinio-Piceetea Br.–Bl. 39 in Br.-Bl., Siss, Vlieger 1939]. – Ms. [dep. VINITI, Moscow, No. N3358-V87].

Žitluchina, T.I. & Mirkin, B.M. (1987): Sintaxonomija rastitel´nosti Šušenskogo zapovednika. I. Fiziko-geografičeskie uslovija i klass Irido-Laricetea cl. nova. [Syntaxonomy of vegetation of Sajano-Šušenskij Reserve. I. Nature conditions and the class Irido-Laricetea cl. nova]. – Ms. [dep. VINITI, Moscow, No. N3357-V87].

Žitluchina, T.I. & Oniščenko, L.I. (1987): Sintaxonomija rastitel´nosti Sajano-Šušenskogo zapovednika. III. Klassy Betuletea rotundifoliae Mirkin et al. 1983 i Aconito-Geranietea cl. nova [Syntaxonomy of vegetation of Sajano-Šušenskij Reserve. III. Classes Betuletea rotundifoliae Mirkin et al. 1983 and Aconito-Geranietea cl. nova]. – Ms. [dep. VINITI, Moscow, No. N3359-V87].

Addresses of the authors:
Dr. Milan Chytrý, Department of Systematic Botany and Geobotany, Masaryk University, Kotlářská 2, CZ-611 37 Brno, Czech Republic.
Dr. Oleg A. Anenchonov, Institute of Biology, Buryat Scientific Center, Siberian Branch of the Russian Academy of Sciences, Sach'janovoj 6, 670042 Ulan-Ude, Buryatia, Russia.
Dipl.-Ing. Jiří Danihelka, Administration of the Landscape Protected Area Pálava, Náměstí 32, CZ-62901 Mikulov, Czech Republic.