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ORIGINAL ARTICLE

Plant economy during the Neolithic in a mountain context: the case of "Le Chenet des Pierres" in the French Alps (Bozel-Savoie, France)

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Abstract The analyses of archaeobotanical assemblages recovered in recent excavations in the northern French Alps permit a better understanding of the way people managed plant resources in a mountain context during the Middle Neolithic (4500–3500 cal B.C.). The aim of this paper is to shed new light on the question of crop cultivation as well as wood gathering and management from the results of the new archaeobotanical investigations at "Le Chenet des Pierres" in Bozel (Savoie, France; 1,000 m. a.s.l.). The study reveals the presence of cereals like einkorn (*Triticum monococcum*), emmer (*T. dicoccum*), naked wheat (*T. aestivum/durum/turgidum*) and barley (*Hordeum vulgare/distichon*). In addition wild fruits and nuts, probably gathered, such as hazelnuts (*Corylus avellana*), wild apples (*Malus sylvestris*), arolla pine kernels (*Pinus cembra*), sloes (*Prunus spinosa*) and raspberries (*Rubus idaeus*) were recorded. The anthracological analysis shows that the occupants exploited mostly a mixed oak forest, and the available woodland from the alluvial forest to the mountain areas. With the archaeobotanical study of "Le Chenet des Pierres" we also want to raise the question of crop cultivation in a mountain context. Although present data show that cultivation at higher altitudes is common, it is still difficult to demonstrate the inhabitants cultivated plants near their settlement during the Neolithic.

Keywords Seeds and fruits · Charcoals · Alps · Neolithic · Subsistence strategy

Introduction

There was no specific "intra-alpine" culture in the Alps during the Neolithic between 4500 and 3500 cal B.C. The archaeological assemblages show affinities with several cultures known in the inner alpine plains or in their surroundings like the Rhône valley, the Northern Italian plain or the Swiss plateau. In the earlier phases, these cultures are the Early Chasséen, Saint-Uze, square-mouthed pottery (VBQ) and Early Cortaillod, in the later phases they are the Chasséen, Lagozza, Cortaillod and Pfyn cultures (Guilaine 1998).

The archaeobotanical data is scattered over a large area. In a region defined by the Rhône valley to the West, the Jura massif to the North and the Pô plains to the South (Fig. 1), there exist only a few studies from the internal Alps. Most of the data come from sites around the alpine massif. In Northern Italy, several sites revealed domesticated plants (Rottoli and Castiglioni 2008). Only few of these are located in the occidental Alps or on their foothills, such as Arene Candide (Arobba et al. 1997; Biagi and Nisbet 1986; Evett and Renfrew 1971) and Arma dell'Aquila (Biagi and Nisbet 1986) on the Ligurian coast; Valgrana (Motella De Carlo and Venturino Gambari 2004) in Piedmont; Lagozza (Castelletti 1976), Isolino Virginia (Castelletti 1990), Monte Covolo (Biagi et al. 1993; Pals and Voorips 1979) and Rocca di Manerba (Barfield et al. 2002) in northern Lombardy; and Vela di Trento (Degasperi et al. 2006; Mottes and Rottoli 2006) in the Adige valley. In French territory,

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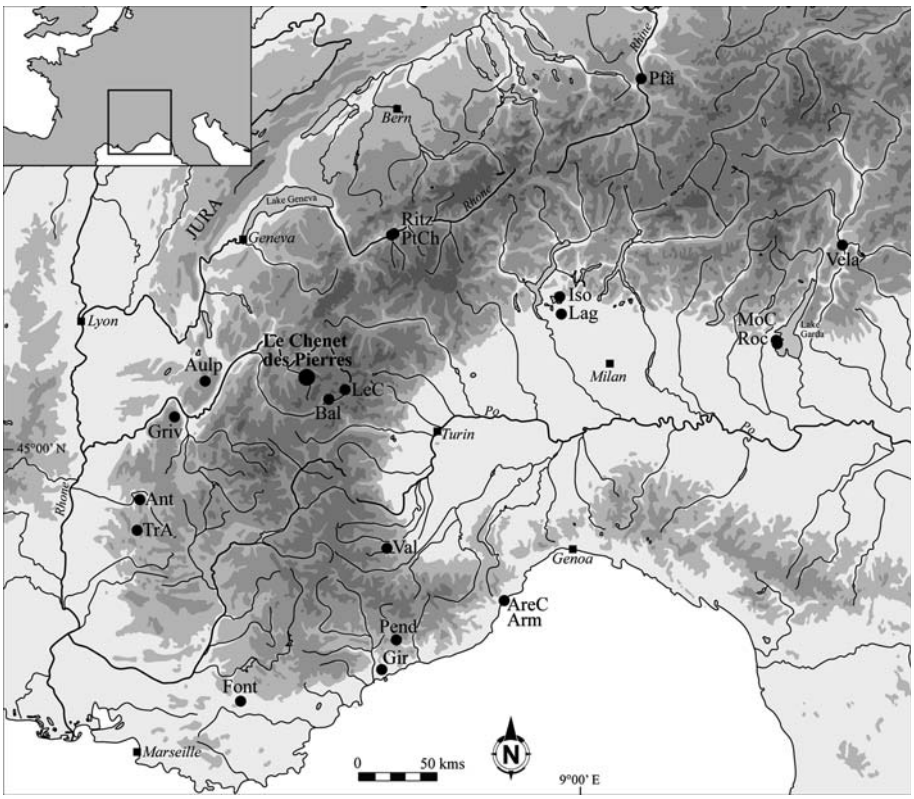

Fig. 1 Map of the occidental Alps showing the site "Le Chenet des Pierres" and other Neolithic alpine sites listed in Table 1

archaeobotanical analyses were carried out at Giribaldi (Thiébault et al. 2000), Pendimoun (Binder et al. 1993) and Fontbregoua (Courtin and Erroux 1974) in the southern Alps; Antonnaire and Trou-Arnaud in the Diois Massif (Beeching et al. 2000); La Grande Rivoire in the Vercors massif (Delhon et al. 2008); L'Aulp du Seuil in the Chartreuse massif (Martin, unpublished) Le Chenet des Pierres (this paper), Le Château (Martin and Lundström-Baudais, unpublished) and Sollières-Sardières in the Vanoise massif (Martin and Lundström-Baudais, unpublished). In Switzerland, we refer to Sion-Ritz (Martin, unpublished) and Sion-Petit-Chasseur IV (Lundström-Baudais 2008) in the Valais and Pfäfersbüel in canton St-Gallen (Rigert et al. 2005) (Table 1). The majority of archaeobotanical analyses were done on Neolithic sites north of the Alps, particularly those sites with waterlogged preservation. A large number have been investigated and were the subject of several syntheses in Switzerland (Jacomet 2004, 2007, 2008a, b; Jacomet and Brombacher 2005; Schibler et al. 2004). In the French Jura, the waterlogged sites of Clairvaux have also been intensively studied (Lundström-Baudais 1989a, b).

Despite the large number of studies from the alpine area, many of the data are not really usable, as the assemblages are too small (<50 remains), the data are not precise enough (volume of samples, quantity of remains) or the studies are still in progress (Table 1).

At present several key questions arise for the Alps connected to the function of these excavated sites, such as: what was the role of cultivation and gathering in mountainous regions? Did people cultivate cereals and pulses around altitudinal settlements, or did they bring them from the valley? Were these sites only seasonally occupied or permanent? What was their function?

The site of "Le Chenet des Pierres"

"Le Chenet des Pierres" lies in the valley of Bozel, between the Tarentaise valley and the Vanoise massif, at about 1,000 m a.s.l. (Fig. 1) at the foot of a slope exposed to the north-east, and at the bottom of the ubac (shaded side) of the "Dent de Villars" (2,284 m). Today it is situated in the montane zone and is surrounded by a beech-fir forest. "Le Chenet des Pierres" consists of several occupation sites on terraces in a chaotic jumble of rocks, deposited during the last Würm glaciation. The excavation, ongoing since 1999, is directed by P.-J. Rey (UMR 5204, EDYTEM, Chambéry) and is focused on one sector (S3) of about 30 m^2 located between two schist boulders (Fig. 2). The human presence is revealed by a complex stratigraphy composed principally of highly organic silt.

According to the radiocarbon dates the occupation S3 can be divided into two periods: the first, called phase 4, is dated between 4400 and 4000 cal B.C. (Ly 2455 (GrA): 5375 ± 45), and the second, called phase 3, between 3800 and 3600 cal B.C. (Ly 2415 (GrA): 4905 ± 40). The typology of the stone and pottery shows influences from

Table 1 Archaeobotanical data from alpine sites between 4500 and 3500 cal B.C. (Original data format: quantity, percentage, presence/absence)

Site abbreviation	AreC	Arm	Val	Lag	Iso	MoC	Roc	Vela II/III	Vela VIII	Gir	Pend	Font	Ant	TrA	Griv	Aulp	LeC	Bal	Ritz	PtCh	Pfä
Altitude (m a.s.l.)	90	180	960	275	360	unk.	200	190	190	300	690	400	1,200	1,200	580	1,727	1,750	1,350	500	500	485
Type (Ca: cave; sh: shelter; op: open-air; w: wetland)	ca	sh	op	w	w	op	op	op	op	op	sh	sh	ca	ca	sh	sh	op	ca	op	op	op
Culture(s)	VBQ II	Impressa/VBQ	VBQ	Lagozza	VBQ	Lagozza	Chassey-Lagozza	VBQ II	VBQ II	VBQ-Chasséen	VBQ	Late Chasséen	Chasséen	Chasséen	Chasséen/VBQ	Chasséen/Saint-Uze	VBQ	Middle Neolithic II	Proto-Cortaillod	Cortaillod Petit Chasseur	Epi-Rössen
Preservation (c: charred; uc: uncharred)	c	c	c	c/uc	c/uc	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
Cerealia type (incl. cf.)			1,737		x	36		65	135	96						x	x	x	x		242
Triticum/Hordeum sp.			1,337					14	23												
Hordeum sp. (incl. cf.)	6	x	850	x	x	13	x	7	4	135	2		34%		x		x	x		x	21
"New glume" wheat (incl. cf.)									55												
Triticum sp.			96		x			1	9	22							x	x		x	21
T. monococcum (incl. cf.)			78	x	x	3	x	10	75	9		219		38%	x		x	x		x	11
T. dicoccum (incl. cf.)	10		32	x	x	39	x	6	151	57	10	730	14%	59%	x		x	x		x	6
T. monococcum/dicoccum								12	4						x					x	16
cf. *T. spelta*			138																		
T. aestivum/durum/turgidum (incl. cf.)	x		73	x	x		x		90	313	1	511	52%	3%	x			x	x	x	22
Pisum sativum (incl. cf.)			50					cf. 1	3	16										x	
Lens culinaris				x			x			6	1										
Papaver somniferum				x																	2
Linum usitatissimum				x	cf. x																1
Vol. (l; unk – unknown, * - kg)	unk	unk	30	unk	5	50	unk	~20*	unk	unk	unk	unk	unk	unk	275	41	unk	unk	~15	~100*	26

Italy: AreC: Arene Candide, Finale Ligure (Liguria); Arm: Arma dell'Aquila, Finale Ligure (Liguria); Val: Valgrana, Valgrana (Piedmont); Lag: Lagozza, Besnate (Lombardy); Iso: Isolino Virginia, Varese (Lombardy); MoC: Monte Covolo, Villanuova sul Clisi (Lombardy); Roc: Rocca, Manerba del Garda (Lombardy); Vela II/III and VIII: La Vela, Trento (Trentin). France: Gir: Giribaldi, Nice (Alpes-Maritimes); Pend: Pendimoun, Castellar (Alpes-Maritimes); Font: Fontbregoua, Salernes (Var); Ant: Antonnaire, Montmaur-en-Diois (Drôme); TrA: Trou Arnaud, St-Nazaire-le-Désert (Drôme); Griv: Grande Rivoire, Sassenage (Isère); Aulp: Aulp du Seuil, St-Bernard-du-Touvet (Isère); LeC: Le Château, Bessans (Savoie); Bal: Les Balmes, Sollières-Sardières (Savoie). Switzerland: Ritz: Avenue Ritz, Sion (Valais); PtCh: Petit-Chasseur IV, Sion (Valais); Pfä: Pfäfersbüel, Sevelen (St-Gallen)

both Northern Italy and the Rhone valley, firstly the VBQ and Saint-Uze cultures, then the Lagozza and Late Chasséen cultures. The archaeological remains are very abundant, reflecting an intense occupation. They are composed of pottery, flint and rock crystal industrial remains, bone tools, archaeozoological remains, greenstone tools, ornaments and grinding stones (Rey 2006).

Materials and methods

Archaeobotanical samples were taken systematically, closely based on the complex stratigraphy. Each phase comprises several thin layers. Hence 2 l of sediment from each 0.25 m^2 and each layer were collected. In 2004 and 2005 the excavation concentrated on the western part of the settlement area. The total volume of samples represents 66 l for phase 3 (3800–3600 cal B.C.) and 196 l for phase 4 (4400–4000 cal B.C.). In 2001, a layer in the central part of the excavation dating to phase 3 was sampled as a whole, 100 l of soil. All phases are subdivided into "sub-phases": 3I, 3III, 4I and 4II. Layer 21 belongs to phase 3I (Table 2).

All samples were wet-sieved using mesh-sizes of 4, 2 and 0.5 mm. The residues were dried in an open air and stored in plastic bags for further analyses. Seeds, fruits and other plant macroremains were identified using the modern seed reference collection of the Institute for Prehistory and Archaeological Sciences (IPAS) at Basel University.

Charcoal pieces were sorted from the 4 and 2 mm fractions only and were identified on the basis of their transverse, longitudinal and tangential sections with a reflecting light microscope (magnifications 50× to 1,000×), using the collection of modern woods of the UMR 7041 in Nanterre and with the help of an identification atlas (Schweingruber 1990).

Fig. 2 View of the excavation at "Le Chenet des Pierres" between the two schist boulders (© P.-J. Rey)

Table 2 Sample volume taken from each phase at "Le Chenet des Pierres"

Phase	**4**		**3**			Total
Dates (cal B.C.)	4400–4000		3800–3600			
Sub-phases	4II	4I	3III	3I	3I/d21	
Number of samples (=number of layers)	12	16	3	7	1	39
Sample volume (l)	50	146	20	46	100	362

Results

Seeds and fruits

In total, 8,114 remains were recovered, all carbonised. The density of remains varies from 13 to 34 per litre. The average is around 21 items/l (Table 3). Phase 3, including layer 21, comprises 4,352 remains, whereas phase 4 yielded 3,762 remains.

In general the remains are fragmented but well preserved. However, the state of preservation of the cereals is often too poor to identify them to species level. The type Cerealia represents a large part of the identified remains, especially in phase 4.

In both phases, almost 60% of the remains belong to domesticated plants. Amongst them, several species of wheat: *Triticum monococcum* (einkorn) and *T. dicoccum* (emmer) were present in the form of caryopses but mainly as chaff. For naked wheat (*T. aestivum/durum/turgidum* or *T.* "*nudum*"), however, only caryopses were found. For this reason, the ploidy level of the naked wheat remains unknown. *Hordeum vulgare/distichon* (barley) is also present in the form of caryopses only. Mainly a naked form was found (Fig. 3a). These can be attributed to a many-rowed type through the presence of asymmetric grains (Fig. 3b). Beside cereals, other domesticates are represented by pulses (pea, *Pisum sativum*) and — astonishingly for a mountain context — opium poppy (*Papaver somniferum*).

Wild species include gathered plants, especially hazelnuts (*Corylus avellana*), wild apples (*Malus sylvestris*), arolla pine kernels (*Pinus cembra*), sloes (*Prunus spinosa*), acorns (*Quercus* sp.), raspberries (*Rubus idaeus*) and elder berries (*Sambucus nigra/racemosa*). Arable weeds and ruderals are also present. These do not show a high diversity and are mainly represented by goosefoot (*Chenopodium* sp.), black bindweed (*Fallopia convolvulus*) and knotweed (*Polygonum* sp.). In addition a few seeds of goosegrass/false cleavers (*Galium aparine/spurium*), sorrel (*Rumex* sp.), bristlegrass (*Setaria verticillata/viridis*) and nettle (*Urtica dioica*) were recorded. Most of the wild plants are represented by a single item. They are generally not identifiable to species level (*Bromus* sp., *Carex* sp., *Festuca* sp., *Potentilla* sp., *Teucrium* sp., *Trifolium* sp.). In some cases the state of preservation prevented identification beyond family level (Apiaceae, Caryophyllaceae, Fabaceae, Lamiaceae, Poaceae, Rosaceae, Solanaceae).

Charcoals

In total, 1,296 charcoals have been identified. Fifteen taxa are recorded (Fig. 4). They come from three types of plant communities. The first evokes a deciduous oak forest, in the collinean zone, represented by deciduous oak (*Quercus* sp.), maple (*Acer* sp.), Pomoideae, and hazel (*Corylus avellana*) to a lesser extent. The second is an open alluvial vegetation, with ash (*Fraxinus* sp.), elm (*Ulmus* sp.), elder (*Sambucus* sp.) and willow/poplar (*Salix/Populus*). The third is a plant community usually located in the montane zone and composed of pine (*Pinus nigra/sylvestris*), birch (*Betula* sp.), yew (*Taxus baccata*) and fir (*Abias alba*). Juniper, which seems to be the common juniper (*Juniperus* cf. *communis*), can belong to both the collinean and montane zones.

Discussion

At the site of "Le Chenet des Pierres", the vegetal diet was mainly based on domesticated plants with cereals (wheat and barley), pulses such as peas, and opium poppy. Regarding the proportion of the different cereal species, in both phases the importance of barley is evident. In phase 3, *Triticum monococcum* is certainly significant, as well as *T. aestivum/durum/turgidum* in layer 21 (Fig. 5). *Pisum* is present only in the second occupation phase, whereas

Table 3 Carbonised plant remains from "Le Chenet des Pierres" in Bozel

Phase of occupation	4II	4I	3III	3I	d21 (3I)	Total
Sample volume (l)	50	146	20	46	100	362
Plant name and parts						
Domesticated plants						
cf. Cerealia, grain	27	277	78	50	–	432
Cerealia, grain	73	807	124	140	753	1,897
Cerealia, embryo	2	116	5	5	–	128
Triticum sp., grain	1	5	–	–	161	167
Triticum cf. *monococcum*, grain	–	–	–	–	5	5
Triticum monococcum, grain	–	4	2	3	40	49
Triticum monococcum,spikelet fork	–	5	1	40	1	47
Triticum monococcum, glume base	3	12	3	31	30	79
Triticum monococcum/dicoccum, grain	–	–	–	–	7	7
Triticum monococcum/dicoccum, spikelet fork	–	2	–	–	–	2
Triticum monococcum/dicoccum, glume base	6	47	7	34	–	94
Triticum cf. *dicoccum*, grain	–	–	–	1	21	22
Triticum dicoccum, glume base	–	4	–	2	1	7
Triticum dicoccum/"nudum", grain	–	–	–	–	11	11
Triticum cf.*aestivum/durum/turgidum*, grain	–	3	1	2	142	148
Triticum aestivum/durum/turgidum, grain	–	–	–	–	426	426
cf. *Hordeum vulgare/distichon*, grain	5	93	4	14	123	239
Hordeum vulgare/distichon, grain	4	182	15	13	253	467
Total cereals	121	1,557	240	335	1,974	4,227
cf. *Pisum sativum*, seed	–	1	–	–	134	135
Pisum sativum, seed	–	–	–	–	6	6
Papaver somniferum, seed	263	158	–	–	–	421
Total domesticated plants	384	1,716	240	335	2,114	4,789
Trees and shrubs						
Abies alba, needle	5	13	1	12	–	31
Corylus avellana, shell	19	125	28	95	155	422
Malus sylvestris, pip	–	5	6	0	27	38
Pinus cembra, shell	34	44	8	23	–	109
cf. *Prunus mahaleb*, stone	–	–	–	–	3	3
Prunus spinosa, stone	–	2	–	–	–	2
cf. *Prunus spinosa*, stone	–	1	–	–	–	1
Quercus sp., fruit	–	1	1	1	15	18
Rubus sp., seed	1	4	1	3	–	9
Rubus idaeus, seed	9	54	–	5	4	72
Sambucus sp., seed	56	233	21	13	16	339
Sambucus nigra/racemosa, seed	40	154	11	6	75	286
Sambucus cf. *ebulus*, seed	–	–	–	–	5	5
Taxus baccata, seed	–	3	2	2	–	7
Tilia platyphyllos, fruit	–	–	1	1	–	2
Ruderal and arable weeds						
Ajuga reptans, seed	1	2	–	–	1	4
Brassica/Sinapis sp., seed	–	1	–	–	–	1
Chenopodium sp., seed	105	258	15	10	39	427
Chenopodium hybridum, seed	8	25	3	1	6	43

Table 3 continued

Phase of occupation	4II	4I	3III	3I	d21 (3I)	Total
Fallopia convolvulus, seed	17	104	1	5	9	136
Galium aparine, seed	–	3	–	–	–	3
Galium aparine/spurium, seed	–	–	–	–	8	8
cf. *Hyoscyamus niger*, seed	1	–	–	–	–	1
Polygonum sp., seed	11	23	–	–	–	34
Polygonum cf. *aviculare*, seed	–	–	–	–	1	1
Polygonum lapathifolium/persicaria, seed	–	8	–	–	–	8
Rumex sp., seed	–	2	–	–	2	4
Setaria verticillata/viridis, seed	2	–	–	–	1	3
Urtica dioica, seed	2	1	1	–	3	7
Vicia angustifolia/villosa, seed	–	–	–	–	1	1
Plantago sp., seed	1	–	–	–	–	1
Verbena officinalis, seed	–	1	–	–	–	1
Miscellaneous				–		
Apiaceae, seed	1	–	–	–	–	1
Bromus sp., grain	–	–	–	–	1	1
Carex sp., seed	–	2	–	1	1	4
Caryophyllaceae, seed	2	2	–	–	–	4
Fabaceae, seed	3	19	4	10	130	166
Fabaceae Trifolieae, seed	–	1	–	–	–	1
Fabaceae Vicieae, seed	–	4	1	5	–	10
Fabaceae, pod	–	1	–	–	8	9
Festuca sp., seed	–	–	–	–	1	1
Fragaria vesca, seed	–	3	–	–	–	3
Galium sp., seed	1	4	–	1	–	6
Lamiaceae, seed	–	4	–	1	–	5
Paniceae, grain	–	1	–	–	–	1
Poaceae, seed	–	7	1	2	–	10
Poaceae, spikelet fork	–	1	–	–	–	1
Potentilla sp., seed	–	2	–	–	–	2
Rosaceae, seed	5	18	1	1	1	26
Rosaceae, spine	1	–	–	–	–	1
Silene sp., seed	–	–	–	–	1	1
Solanaceae, seed	–	1	–	–	–	1
Teucrium sp., seed	–	2	–	–	–	2
Trifolium sp., seed	3	1	–	1	–	5
Vicia/Lathyrus sp., seed	–	–	–	–	57	57
Neuroterus sp./oak apple	–	1	–	1	–	2
Buds	3	3	–	–	1	7
Foliar scar	1	3	–	–	–	4
Indeterminata shell	27	80	12	18	57	194
Indeterminata seeds/fruits	19	36	2	2	–	59
Indeterminata miscellaneous	0	21	20	26	647	714
Total	762	3,000	381	581	3,390	8,114
Concentration (l^{-1})	15.2	20.5	19.1	12.6	34	

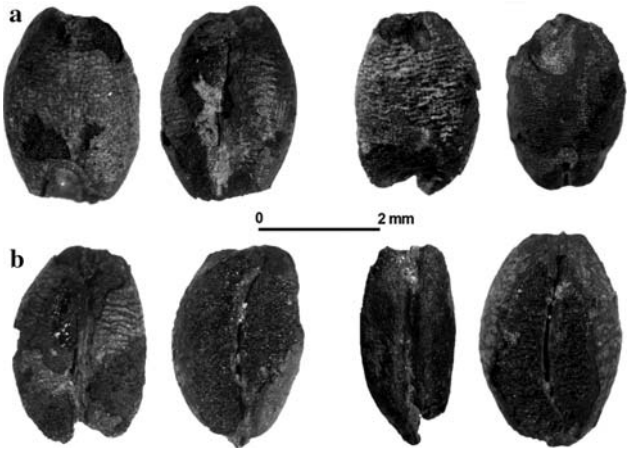

Fig. 3 Grains of barley found at "Le Chenet des Pierres" **a** grains of naked barley; **b** dissymetric grains of many-rowed barley (© L. Martin)

Papaver somniferum occurs only in the first. The domesticates assemblage of "Le Chenet des Pierres" does not give any evidence of their cultivation around the site, because there was no naked wheat and barley chaff to suggest crop processing on the site or storage. Even the presence of chaff from hulled cereals (einkorn and emmer) does not indicate local cultivation because they are mostly stored as spikelets (Sigaut 1981). Also, the small sizes of the assemblages of arable weeds prevent a precise ecological interpretation. All the weeds found have a broad ecological amplitude and can grow at lower as well as at higher altitudes.

The vegetation surrounding "Le Chenet des Pierres" provided the inhabitants with plants to be collected over a large area. The analysis of macroremains shows that several edible plants could have been gathered locally (wild apples, hazelnuts, elderberries, raspberries, sloes etc.). Neolithic people visited higher as well as lower altitudes, as shown by the presence of arolla pine kernels and acorns. Arolla pine grows between 1,400 and 2,500 m. a.s.l., whereas oak is found in the collinean zone (Rameau et al. 1993).

According to the anthracological analyses, it appears that the mixed oak forest was more exploited during the first occupation (phase 4II), whereas the humid forest and mountain vegetation were more visited later. Juniper was largely used during the second phase. It was especially frequent in layer 21. Juniper is used for medicinal purposes, its wood is hard, compact, resistant to decay and is an excellent fuel (Lieutaghi 2004). *Fagus sylvatica* (beech) is absent from the anthracological assemblage. However, we may suppose that a beech-fir formation was present at this altitude (Burga and Perret 1998), even if we do not have any local palynological data.

The significant presence of domesticated plants at "Le Chenet des Pierres" as well as at other alpine sites raises the question of crop cultivation in a mountain context. Firstly, this concerns the place where crops were cultivated.

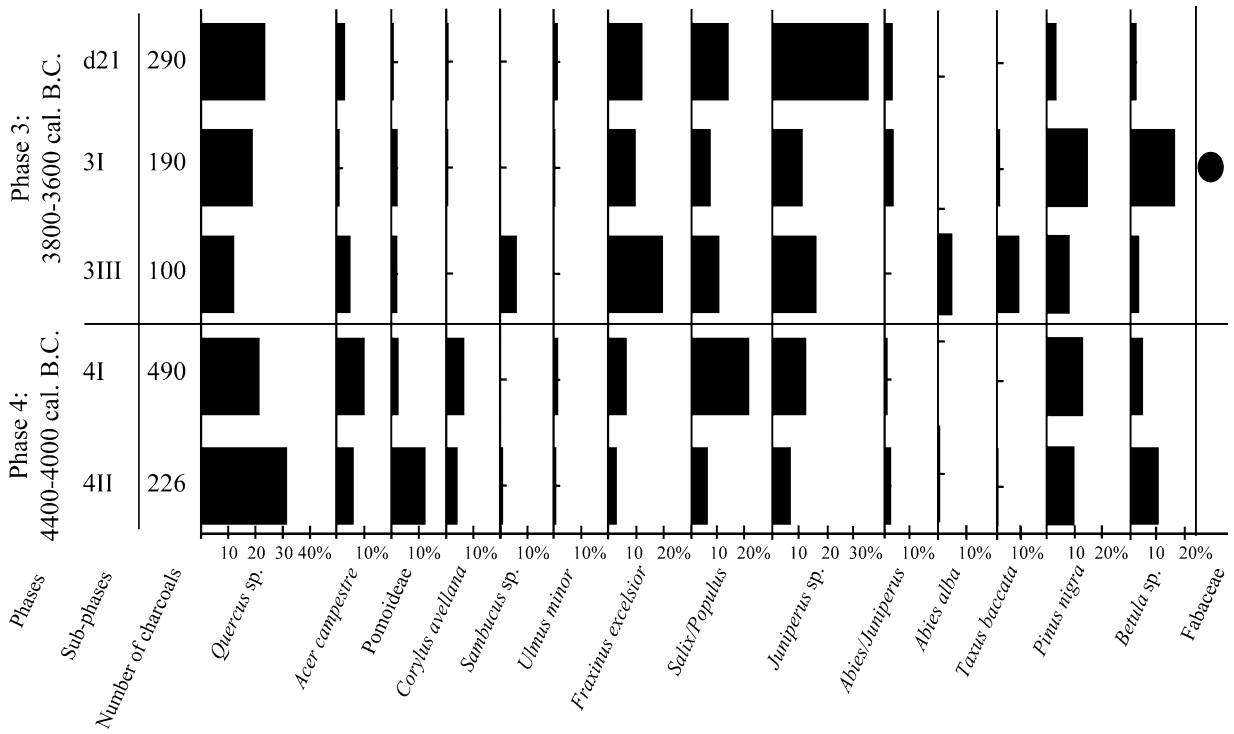

Fig. 4 Anthracological diagram from the Neolithic layers of "Le Chenet des Pierres"

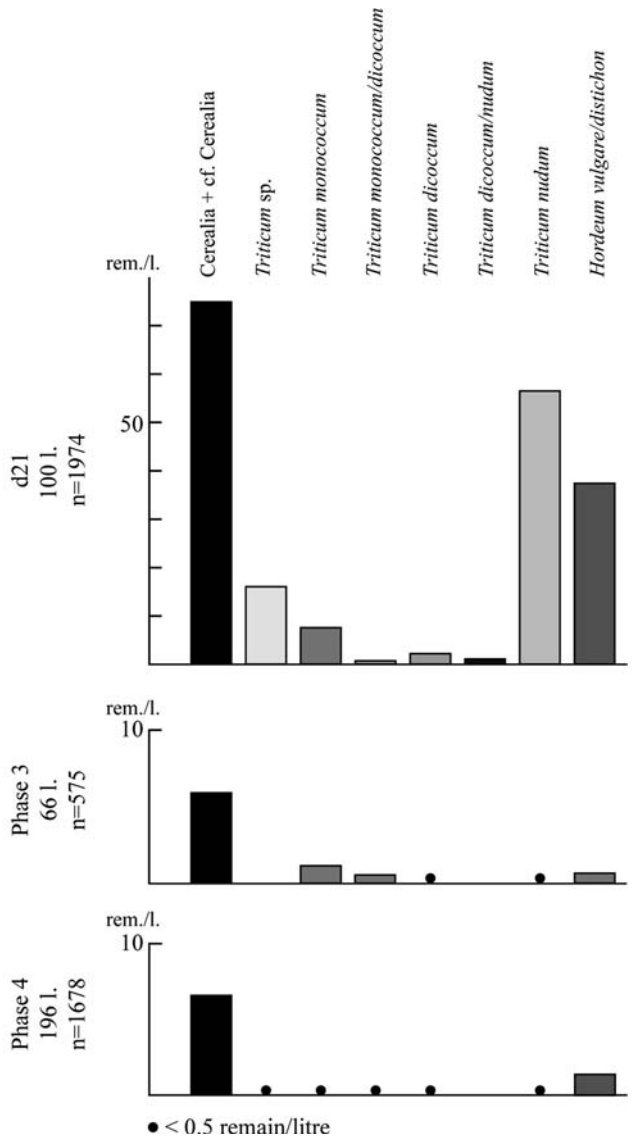

Fig. 5 *Histogram* showing the distribution of cereals species in phases 3 and 4 and in layer 21 (belonging to phase 3I)

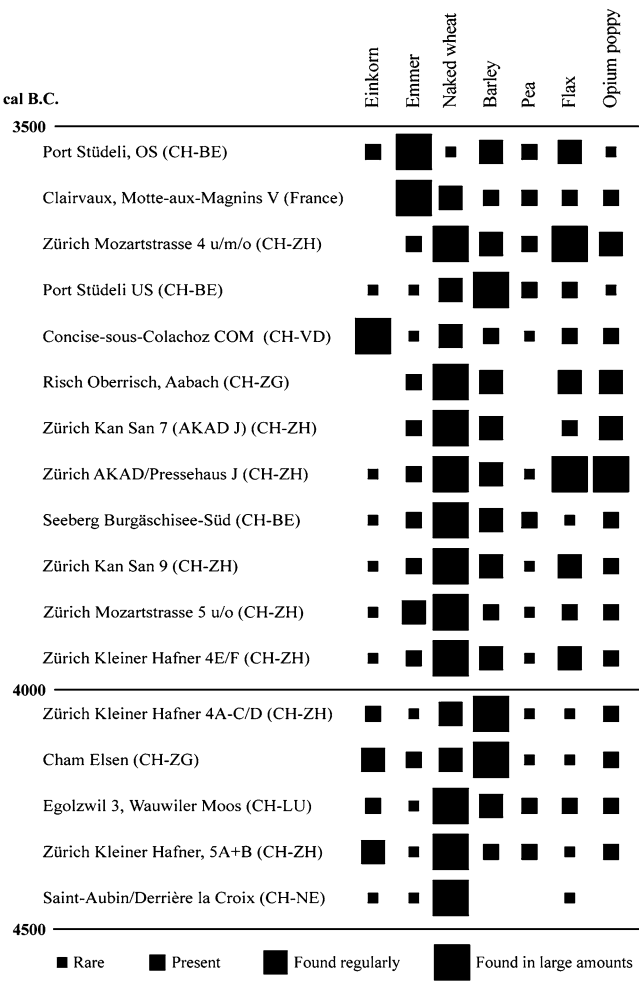

Fig. 6 List of waterlogged sites occupied between 4500 and 3500 cal B.C. in the Northern part of the Alps. The size of the *squares* shows the relative proportion of *Triticum monococcum*, *T. dicoccum*, *Hordeum*, *Linum* and *Papaver somniferum* by site (from Jacomet 2008b) *CH* Switzerland; *BE* Bern, *LU* Lucerne, *NE* Neuchatel, *VD* Vaud, *ZG* Zug, *ZH* Zürich

Off-site palynological analyses indicate that, even if cultivation at altitude was isolated, signs of it have existed since the Neolithic. In the French Alps, the presence of cereals at higher altitude is rare, however, a few sites show their early presence since the beginning of Neolithic (De Beaulieu and Goeury 2004). For example in the Lake Lauzon (Devoluy massif, 1,980 m a.s.l.) cereal pollen is reported from the start of the Subboreal (Argant et al. 2006). In Switzerland, near Sion in the Valais, palynological analysis of Lake Mont d'Orge (620 m. a.s.l.) also shows the presence of cereal pollen since the beginning of the Neolithic (Welten 1977). In Val Camonica in Northern Italy, cereal pollen has been found in Pian di Gembro at 1,350 m a.s.l. during the Middle Neolithic (Pini 2002).

Moreover, according to historical and ethnological sources domesticated plants identified on archaeological sites can grow at altitudes over 1,000 m a.s.l. Niederer (1980) emphasises that spring wheat can "go up very high" as well as barley which is cultivated throughout the Alps. According to Niederer, peas grow up to 1,750 m a.s.l.; in the Central Valais it can even reach 2,000 m a.s.l. (S. Jacomet, personal communication). In the village of Termignon en Vanoise, only a few kilometres from Bozel, fields surround the village at 1,350 m a.s.l. There wheat and barley is growing as well as peas in the gardens near the houses (Meilleur 1985). In the village of Ceillac in the Queyras massif more to the south, *Triticum* and *Hordeum* are also cultivated near the settlement, at an altitude of 1,300 m a.s.l. (Boilève and Witt 2003). *Papaver somniferum* can also grow at higher altitudes in the Alps, for

example in Saanen (Bern) at around 1,000 m (personal observation) and in Erschmatt (Valais) at 1,300 m. a.s.l., where wheat, barley and peas also grow in a botanical garden.

Interestingly the assemblage of "Le Chenet des Pierres" is close enough to the assemblages found in the lake dwellings of the northern alpine foreland to make some comparisons (Fig. 6). At the main sites investigated, *Triticum aestivum/durum/turgidum* and *Hordeum* are almost always predominant, which is also the case at "Le Chenet des Pierres". The naked and many-rowed form of *Hordeum* that occurs at our site is also widespread in the lake dwellings. *Pisum* and *Papaver somniferum* are also present.

Finally, we do not know if occupants stayed the whole year round or only visited the site between spring and autumn. The archaeobotanical spectrum does not give evidence about the period of occupation. Fruits gathered only in summer (apples, sloes, elderberries, raspberries) can also be dried and kept for winter. For example dried apples have been found in Neolithic sites (Brombacher 1995). However, the richness and the quantity of artefacts would indicate permanent occupation.

Conclusions

At the Neolithic site of "Le Chenet des Pierres", cereals are well-represented, principally naked wheat and barley. It is not possible to tell from the plant material if they were cultivated in the near surroundings or brought from the lower valleys. However, palynological and historical data show that cultivation is possible at that altitude. It seems that the populations who lived in "Le Chenet des Pierres" had the same domesticated plants as populations living in the plains. Further botanical analyses of Neolithic sites in the Alps will permit a quantitative approach. Thus, it will be possible to estimate the importance of each domesticated species, to improve the knowledge of the wild species assemblages, and to address questions of gathering and agrarian practices. Finally, the question which remains open is: did the people from the plains visit the Alps during summer, for instance for some summer farming or was there an "inner-alpine" population?

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