Acta Palaeobot. Suppl. 2: 573–580, 1999 — Proceedings 5th EPPC

A POLLEN ANALYTICAL STUDY ON THE ANCIENT USE OF A PRESENT-DAY PATH IN THE CENTRAL ALPS

DAGFINN MOE[1] and FRANCESCO G. FEDELE[2]

[1] Dept. of Botany, University of Bergen, Allégaten 41, N-5007 Bergen, Norway; e-mail: dagfinn.moe@bot.uib.no
[2] Section and Museum of Anthropology, University of Naples, Via Mezzocannone 8, I-80134 Napoli, Italy; e-mail: fedele@dgbm.unina.it

ABSTRACT. A present-day tourist path using the Baldiscio Pass (Passo Baldisco), between Valle Febbraro (upper part of Valle Spluga I) and Valle Mesolcina (CH) in the Central Alps, has been studied. The study is part of an interdisciplinary palaeoecological project.

Pollen analytical data from both terrestrial and lake sediments from Lago Grande (2304 m) close to the path, support historical records providing evidence for the use of the path during the Late Medieval period. A temporary reduction in pasture and epi- and endozooic transport of pollen is dated to the Roman period. Such transport of low altitudinal pollen by domestic animals indicates an earlier use of the path between 3,500 BP and 3,000 BP (corresponding to the late Bronze Age). Some other pollen analytical results from other high-altitudinal areas within the Alps (Hohen Tauern, Austria, and Dauphiné, France) are discussed.

KEY WORDS: Pollen, path, road, the Alps, high altitude, epizoochory, Roman Period, Bronze Age

INTRODUCTION

During historical times, numerous known roads, trackways, and paths have frequently been used between populated areas in the Alps as well as in other alpine or arctic alpine areas (e.g. Planta 1985, 1990, Lippert 1993b, Thöni 1993, Zipperle *et al*. 1994). While the use of such roads is today taken over by tourists, in earlier days hunters, farmers, shepherds, tradesmen, etc. were the main users (Fig. 2). While some of the old paths are still known, some have been forgotten. The present day known paths generally have a longer history than expected (e.g. Moe *et al*. 1988, Moe & Knaap 1990). The paths are topographically well-placed for the transfer of domestic animals, loaded horses, mules and men. The paths also were routed to avoid the most dangerous areas and the effects of bad weather. While extensive networks of paths for local use existed in the valleybottoms and on the slopes, only a limited number of pathways passed the high alpine ridges.

Evidence for contact and exchange between human groups in prehistoric times can be traced as far back as the upper Palaeolithic, and more or less regular transfers from the Mesolithic onwards have been suggested (e.g. Fedele 1992, Bagolini & Pedrotti 1992, Meyer 1992, Leitner 1995, Kozlowski 1994, Dr. Dieter Schäfer in TT 1997, Kurier 1997). The distribution of stone artefacts mapped against the distributions of glaciers, forested/unforested areas and/or fluvial systems (e.g. Djinjian 1994) may give a better understanding of the actual environment, potential for settlement, – and alternatives for routes.

The introduction of domestic animals and the need for additional pastureland increased the importance of pathways for daily and seasonal transfer. Prehistoric artefacts are rare along pathways, but the paths may be traced by evidence of local erosion/ disturbed soil and vegetation cover along the path. Endo- and epizooic transport of plant remains such as pollen of lowland fodder plants into high altitudinal areas has been discussed earlier (Moe 1973, Moe & Balle 1981, Moe *et al.* 1988, Moe & Knaap 1990) and remains may be seen along roads, especially during wintertime (Zipperle *et al*. 1994, photo page 61). Similar "exotic", or non-locally produced pollen, has also been found at low altitudes along an Early Iron age military road in Bulgaria (Panovska 1993).

As part of the interdisciplinary archaeological research work in the Spluga Valley (Valle Spluga), northern Italy (e.g. Fedele 1990, 1992, Moe 1990) (Fig. 1), available palynological data within and outside the studied area are discussed as a supplement to historical records for evidence of the earlier local use of some pathways.

INVESTIGATED AREA, THE BALDISCIO PASS

A well-known path, nowadays used by shepherds and tourists connects the valley of Val Febbraro (I) in the up-

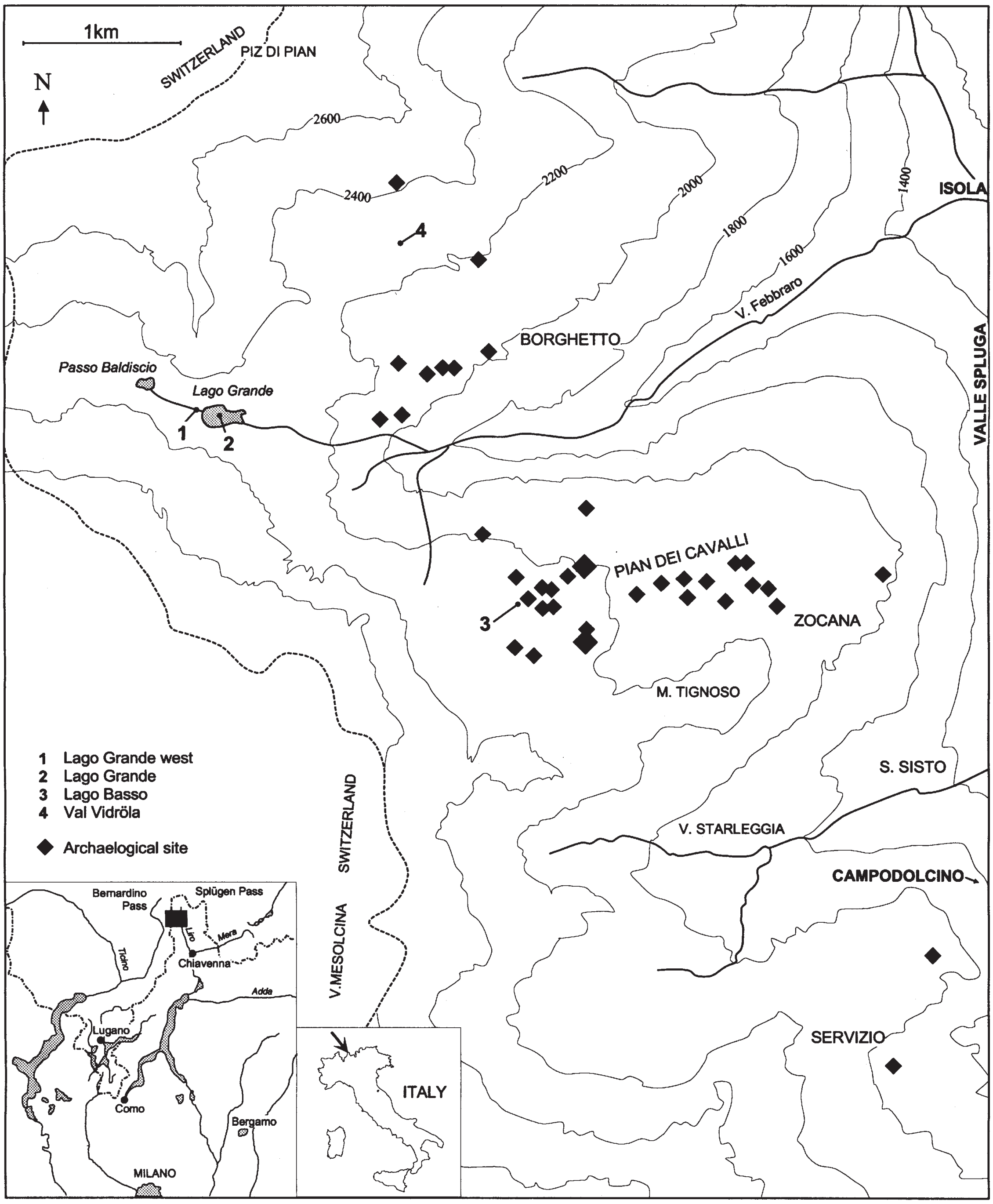

Fig. 1. Survey map of the studied area of Val Febbraro and surroundings

per Spluga Valley with Valle Mesolcina (CH) (Fig. 1). Close to the pass, the path follows the shore of Lago Grande (2304 m), 100 × 250 m diameter, situated 1,2 km east of the border with Switzerland (Fig. 1). The area has earlier been described and the lake sediments have been studied palynologically (Wick 1989, 1994b, Wick & Tinner 1997). An additional palynological study made on terrestrial material, Lago Grande "west" (Figs 1, 3), is presented in this paper.

The lake Lago Grande is partly surrounded by wet marshes, partly by drier areas. The sampling site, Lago Grande "west", lies 25 m from the western-most shore of the lake, on the southern bank of the stream, close to the pathway crossing the Baldiscio Pass. The area around the site may have been the last resting site east of the pass. The vegetation close to the site is heavily grazed and dominated by different *Carex* species, *Poa vivipara*, some *Nardus stricta* and *Deschampsia caespitosa*. Small individuals of *Salix polaris*/*S. herbacea* and *Vaccinium myrtillus* are also found.

METHODS AND RESULTS

FIELD OBSERVATIONS

Today, the path through the area from Isola (I) to Val Mesocco (CH) passes westward into the Val Febbraro, with one branch following the river/valley bottom, and up to Lago Grande (2303 m). The branch used by tourists passes through the summer farms at Borghetto Sotto (1897 m), Borghetto Alto (1995 m) (I), and then to Lago Grande. One side branch, mainly in use by shepherds is known from Val Vidröla to Lago Grande. A further pathway reaches Lago Grande from the neighboring valley, Val di Starleggia, west of Monte Tignoso (Fig. 1). This path enters the upper part of Piano dei Cavalli (I) and then to Lago Grande.

At Lago Grande the different paths join together, and today follow the north of the lake shore, crossing over the watershed at the Baldiscio Pass (2360 m), the Serraglia (2290 m) (I) and down to Alp de Baldisc' (Balnisc') (2068 m) (CH) in the Mesolcina Valley above Mesocco.

HISTORICAL RECORDS

In the central part of the Spluga Valley elements and parts of roads/tracks from the Roman period onwards have been mapped by Planta (1990). Places of possible "Prähistorische-römisch" roads between Colmanetta and Isola, and through Rofla and Viamala have also been suggested. Despite the lack of independent datings, it is likely that some of these earlier roads are from the Roman period. None of these mapped "main roads" used the Baldiscio Pass.

Historical documents are rather scanty or uninformative for this part of the upper Spluga Valley. The available information still depends on a limited number of scattered and poorly referenced records, mainly to be found in three local historical sources for the whole of Valchiavenna, all published long ago (Crollalanza 1898, Buzzetti 1909, 1928). Although interesting, a recent summary on "Historical tracks" in the valley, aimed at a general readership (Balatti & Scaramellini 1995), again entirely relies on Pietro Buzzetti's historical corpus.

However, some of the known documents support and expand the palynological findings in a promising way. In June 1203, one of the earliest dated documents, an official agreement between Chiavenna and Mesocco on the utilization of mountain pastures, records that the Baldiscio area was traditionally grazed by animals from Val Mesolcina (Fig. 1). Incidentally, the picture of the Val Febbraro summer farms emerging from this and other 13th century documents already shows a situation identical to that of today, and includes Borghetto as the main farm complexr.

More explicitly, the Baldiscio Pass turns out to have been the regularly preferred route for local alpine crossings during the 13th-15th centuries, when communications between the Spluga Valley and the upper Rheinwald, via Val Curciusa and Nufenen, became politically and economically important.

The inhabitants of Mesocco and Isola, the latter village located down at the Spluga Valley headwaters, had regular contacts – and frequent litigations about summer pastures – throughout the 13th-17th centuries, as recorded for instance by notarial acts and other transactions of the years 1265, 1272, 1279, 1320, 1472, c. 1480, 1496, 1648, and 1652. Meetings and clashes frequently occurred not only in the summer but during the winter, clearly hinting at the fact that the Baldiscio Pass remained open or was somehow passable during the winter.

Moreover, among these records, the document of 1472 explicitly states that the Baldiscio mule-track was used for mule and horse pack transport, as well as horse-back journey, apparently on a regular basis (Balatti 1995).

BOTANICAL METHODS AND RESULTS

The epi- and endozooic transport of pollen, seeds and other plant fragments of fodder plants from low to high-altitudinal levels has earlier been discussed (Moe 1973). An effect of such transport can clearly be seen today along pathways used by domestic animals crossing snowpatches (Fig. 2) (Zipperle *et al.* 1994). The digest-turnover in animals is estimated to take from 1 to 3 days, and along the whole path pollen originating from lowland plants are (re)deposited.

It is suggested that above the altitudinal limits for the different species involved, the amount of dispersed pollen found is more dependent on the number of animals passing or arriving from the lowland than by the number of days the animal(s) have stayed there (Moe 1973).

Soil and vegetation disturbances are frequently seen along used pathways, and very local erosion and minerogenic dust dispersal are assumed to have taken also place in earlier times, – depending on the density of the traffic.

Pollen analysis was made on a 34 cm long terrestrial core, named "Lago Grande west". The coring was made in July 1992 by hammering in 110 mm diameter hard plastic tube.

The vegetation close to the site is dominated by species such as *Deschampsia caespitosa*, *Poa vivipara*, *Carex* spp., *Epilobium* sp., *Taraxacum* sp., *Sibbaldia procumbens*, and *Gnaphalium* cf. *supinum*. In addition some individuals of *Luzula* sp., *Ranunculus glacialis*, *R. acris*?, and low *Salix* sp. were found. On more drier ground small stands of *Juncus trifidus*, *Luzula* sp., *Euphrasia* sp., *Polygonum viviparum*, and *Vaccinium myrtillus* occur.

LABORATORY WORK

The characterization of the unconsolidated sediments (Tab. 1) follows Troels-Smith (1955). Sixteen subsamples are treated chemically (including HF and acetolysis) following the guidelines in Faegri & Iversen (1989). *Lycopodium* spores were added to enable the calculation of pollen influx (Stockmarr 1971). Pollen determinations are based on Faegri & Iversen (1989) and the reference pollen collection at the Department of Botany, University of Bergen.

Two ^{14}C datings have been determined at the Laboratory for Radiocarbon Dating in Trondheim, Norway (Norwegian Research Council). The datings (calibrated according to Stuiver & Becker (1986)) gave the following results:

9,5–10,5 cm T-12943, 1090±45 BP (cal. AD 935–1000), and
11,5–12,5 cm T-12594, 1405±65 BP (cal. AD 605–680).

The palynological, stratigraphic (Tab. 1) and radiocarbon datings results are presented in Fig. 3.

The following pollen assemblage zones are proposed and used:

LPZ 4: 0.00–0.12 m, Poaceae-Chenopodiaceae-*Plantago* PAZ (Period: 1,400 BP-present day)

LPZ 3: 0.12–0.18 m, *Alnus viridis*, Polypodiaceae PAZ (Period: *c.* 2,000 BP-1,400 BP)

LPZ 2; 0.18–0.25 m, Cyperaceae-Poaceae PAZ (Period: *c.* 2,500 BP-2,000 BP)

LPZ 1: 0.25–0.34 m, Poaceae-herbs-*Plantago* spp. PAZ (Period: *c.* 3,500/3,000 BP – *c.* 2,000 BP)

– The oldest zone, LPZ 1, is characterized by low AP, but relatively high values of Poaceae, different *Plantago* taxa, herbs, fern spores and charcoal.

– Zone 2 is characterized by reduced herbs and charcoal values. AP values are low.

– Zone 3 is characterized by higher values of *Alnus viridis* and low values of pollen of anthropogenic origin such as *Plantago* and *Urtica*.

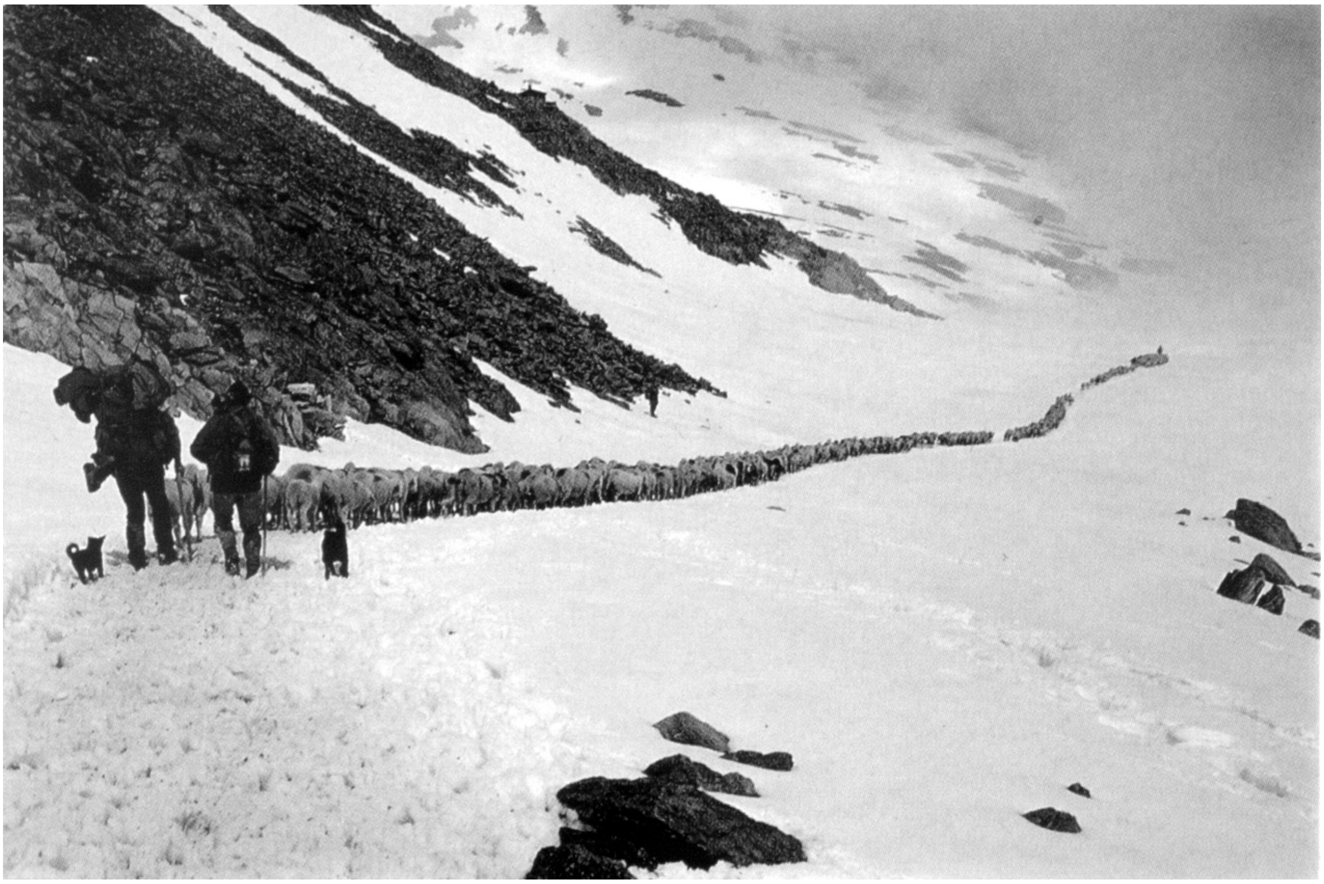

Fig. 2. Yearly transfer of sheep from South Tirol to the pastures in Ötztal (Zipperle *et al*. 1994). The snow is coloured by urine, and droppings and other types of dirt containing food remains etc. from the lowland are of special importance. (Photo Andreas Zipperle)

– Zone 4 is characterized by an increasing diversity of herbs, and traditionally anthropogenic taxa such as Chenopodiaceae, *Plantago* and high amounts of charcoal, also of local origin. AP values are low.

The diagram (Fig. 3) shows a completely tree/shrub-less area during the last 3,500/3,000 years except for zone LPZ 3. In zone LPZ 1, there is a relatively high herb diversity. Of special interest are pollen values of different *Plantago* species exceeding nearly 1%, some *Urtica*, grasses, and increases in fern spores, together with higher values of charcoal. In zone LPZ 2, a generally temporary reduction in most pollen-taxa is found. In zone LPZ 3 the pollen-influx values of *Alnus viridis* probably indicate local stands of the shrub (Engan 1996). At the same time reduced amounts of charcoal and pollen of anthropogenic origin are found. In the youngest zone, LPZ 4, increasing amounts of pollen occur. Of special interest are Chenopodiaceae, Brassicaceae, *Plantago* spp., and grasses. In the text the zone is subdivided into 3 subzones: a) 12–9 cm, b) 9–6 cm, and c) 6–0.0 cm. In the influx diagram, subzones 1a and 1c are very similar except for higher charcoal values in the older (1a) subzone. In subzone 1b, temporary higher pollen values of Asteraceae, Poaceae, *Potentilla*, *Ranunculus* spp., all of potential local origin, occur. The large amount of charcoal, especially in subzone 1a, suggests the local presence of man, and that there is probably a local source for the charcoal in most of zone 1.

Table 1. Stratigraphic description of the studied terrestrial section, “Lago Grande west”. Characterization of the sediment follows Troels-Smith (1955)

Depth	Sicc.	Elat.	Stra.	Nig.	Limus	Content
00–02 cm	3	2	2	3	1	Dg2,$Ld^2$1,Ag1,As+
02–03 cm	3	1	1	2	1	DG1,$Ld^2$1,Ag1,Gs1,As+
03–08 cm	3	2	2	3	1	Dg2,$Ld^2$2,Ag+,As+
08–09 cm	3	1	1	1	1	DG1,$Ld^2$1,Ag1,Gs1,As+
09–12 cm	3	2	2	3	1	Dg2,$Ld^2$2,Ag+,As+
12–19 cm	3	1	3	1	1	DG1,$Ld^2$1,Ag1,Gs1,As+
19–34 cm	3	2	3	3	1	Dg2,$Ld^2$2,Ag+,As+

DISCUSSION

The pollen curves of anthropogenic species (Behre 1981) in both diagrams from Lago Grande (fig. 2 and Wick 1994b) reflect changes in the use of the area, as well as changes in the pollen transport into the area. Curves showing significant pollen values of *Urtica*, *Plantago lanceolata*, and to some extent also Cerealia, are present in these two diagrams, while in the diagram from Lago Basso at 2250 m, reflecting a pasture area like Lago Grande (Wick 1989, 1994a), 2 km away (fig. 1), this elements are laking (Wick 1994a,b, Fedele & Wick 1997). It is noticeable that pollen of the different

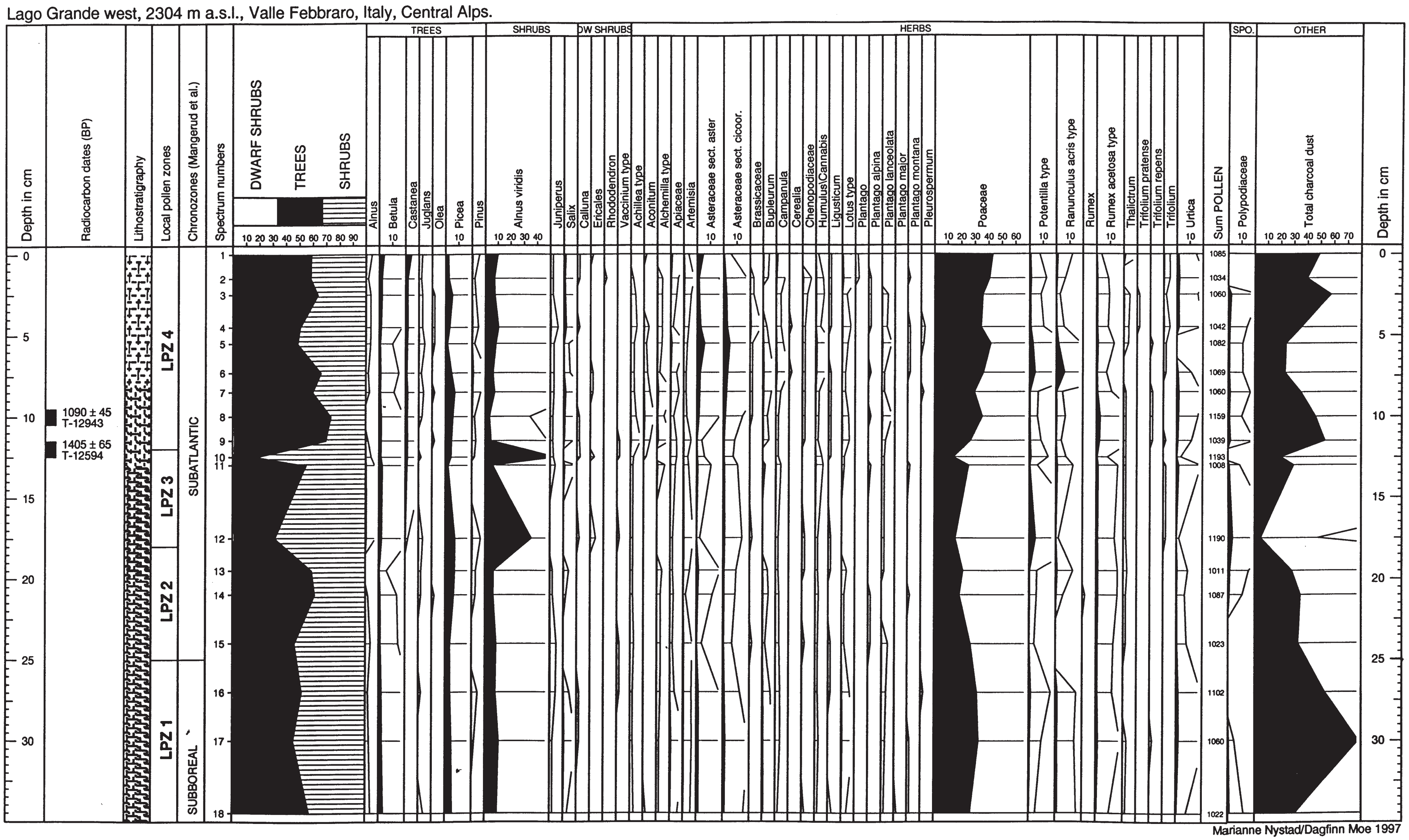

Fig. 3. A simplified influx pollen diagram from Lago Grande "west", at 2304 m asl.

anthropogenic species concerned are missing. The two areas are both grazed by horses and cattle, and should also be more or less equally exposed to regional air pollen transport. The reason for the differences in the amount of anthropogenic pollen types betweem the two sites must therefore be due to different and additional pollen transport from lower altitudes (Moe 1973).

No occurrences are recorded today of *P. lanceolata* and Cerealia growing in the area around the nearest summerfarms (e.g. Zocana (2000 m) or Borghetto 1897–1995 m (Engan 1996, Agnete Engan and Kari Hjelle pers. comm.). The pollen source area for these taxa, must therefore be found at a lower altitude.

Possible source areas for pollen of *Urtica dioica* and *Chenopodium* (probably *C. bonus-henricus*), are found at 1900–2000 m where both groe today. *Urtica* is found more frequently close to a rock shelter used by sheep at 2100 m (Moe *et al*. in prep). Only single individuals of *Chenopodium* are found. While the horses, sheep and goats traditionally stay more or less at the same altitudes throughout the summer, the cows are taken down each night to the summerfarms, at around 1900–2100 m. This daily movement may bring up new supplies of "summerfarm" – pollen from living plants as a part of the ingested fodder. For pollen of *Plantago lanceolata* and Cerealia a connection with vegetation at even lower altitudes is needed.

Differences in the taxa recorded in the high altitudinal diagrams therefore reflect differences in contact with to the actual source areas – in this case both the altitude of the summerfarms and the local year-round farms and villages on both sides of the Baldiscio Pass.

In Wick (1994b), increased values of *P. lanceolata* (incl. *Plantago* spp.) at 0.70 m were found. By extrapolation, these changes may be dated to around 800/1,000 BP, the Early Medieval period, which corresponds well with the earliest part of LPZ 4 (Fig. 3). These changes can be explained as a denser or more continuous use of the path very close by, and an anthropogenic epi- and endo-zooic dispersal of pollen. In addition grazing may be the most reasonable explanation for the reduction of *Alnus viridis*. The whole of zone LPZ 4 demonstrates continiuous anthropogenic presence and some disturbance.

The historical data thus corroborates the palynological evidence that the Baldiscio Pass and area remained locally pre-eminent for several centuries from the end of the Roman period, within the framework of both intervalley mobility and summer pasture exploitation and control, the latter usually from Mesocco.

Between LPZ 1/2 and LPZ 4, LPZ 3, dated to between *c.* 2,000 BP and 1,400 BP, shows the occurrence of local stands of *Alnus viridis* indicating reduced pasturing in the local area. This reduced activity phase corresponds well with the Roman Age.

In the "Lago Grande west" diagram, earlier phases of anthropogenic activity can be traced in zone LPZ 1 and to some extent also in LPZ 2. The high charcoal values in LPZ1 are similar to those of LPZ 4. Suggested dates for the earliest phase are about 3,500/3,000 BP (Fig. 2). Similar scattered amounts of anthropogenic pollen such as Cerealia, *Plantago* spp. and *Artemisia* dated to *c.* 3,000 BP (Wick 1994b, fig. 2), support the conclusion that the path w used as far back as the Bronze/Final Bronze Age (cf. Della Casa 1997a, b (Mesocco); Fedele 1989 [Borghetto Alto]; Moe *et al*. in prep). Lack of *Alnus viridis* in LPZ1 and 2 as in LPZ4 may indicate pasturing during these periods.

In the nearby Val Vidröla (Fig. 1), values of more than 1% of *Urtica* pollen in each spectrum are found from approximately 3,800 BP onwards (Moe & Hjelle 1999). The values must be interpreted as an effect of continuous supply of pollen from at least "summerfarm" altitude or below, and an earlier use of the earlier mentioned "shepherd-path" from Val Vidröla to Lago Grande is likely. Increased values of *Plantago lanceolata* in the same diagram from about 2,500 years BP show a stronger local presence of man (Moe & Hjelle 1999), altitudes probably including frequent connection with lower altitudes.

COMMENTS ON AVAILABLE POLLEN-ANALYTICAL DATA OUTSIDE THE STUDIED AREA

Several palynological studies at higher altitudes within and outside the Alps, are supposed to reflect earlier transport and/or transfer along pathways. An old assumed Roman Age road/trackway system from lower to higher altitudes has been studied in the Badgastein-Mallnitz region (Hohen Tauern, Kärnten, (A) (Lippert 1993b)). In the study, two radiocarbon-dated pollen sequences situated very close to the actual "road" were studied (Kral 1993). The first, "Moor 300 m OSO vom Oberen Bockhartsee", at 2060 m asl. was *c.* 10–12 m from and *c.* 3–4 m below the still visible road. The second, "Moorstelle am Wegverlauf", at 2040 m asl., was directly connected to the road (Kral pers. comm.). Both pollen diagrams have phases with meadow pollen, which probably originated from local pastures or perhaps from a nearby summerfarm. Increased amounts of weed and Cerealia pollen, however, correspond with increased minerogenic content in the sediment. These changes firstly reflect an increased supply of pollen from lower altitudes, and secondly, reflect some local soil disturbances or erosion followed by dust dispersal. The most reasonable activity which could combine these causes of change is the use of the nearby path/road.

For the site "Moorstelle am Wegverlauf, 2040 m" a slight increase around AD 100–200 is seen, with an expansion in Medieval time at AD 1,260/1,290. At the other site, "Moor 300 m OSO vom Oberen Bockhartsee", a marked increase is dated to AD 55/135, while only a slight increase in Cerealia-pollen occurs around 15 cm. This last change may correspond to the late increase in the first diagram (Kral 1993). This conclusion corresponds with the written sources (Haider 1993).

Earlier human influence and use of the local area is seen in both diagrams. In the diagram from "Moor 300 m. etc." at 0.70 m, the dating, 1,445/1,590 BC, may mark an earlier use of the same trasé as a path in the Bronze Age (Lippert 1993a). In addition to giving information about general vegetation changes, the very detailed diagrams therefore also give a minimum age for the use of the road.

From other areas, outside the Alps conclusions about the earlier use of road/trackways/paths as far back as prehistoric times have made. Strong indications of use are seen in a diagram very close to "Das Winterweg", (Oberaargletscher (CH)) (Ammann 1976), and a minimum age for the of the road has been suggested as Medieval time (Moe & Knaap 1990).

From Dauphiné in the western Alps (F), large amounts of pollen of anthropogenic species are found in a pollen-analytical study from Les Gypsiéres (Col du Galibier), at 2500 m asl. (Wegmüller pers. comm., Wegmüller 1977). The site is situated close to a path crossing the pass at Col du Galibier. Based on the amount of anthropogenic pollen down to the 120 cm level in the diagram, it is suggested that this an effect caused by the human use of the pass. Unfortunately, the start of this phase it not 14C-dated, but an age around 2.000 BP is suggested by to the *Juglans* curve.

Outside the Alps, similar pollen-analytical nterpretation is made on data from sites close to trackways at higher altitudes. From Portugal and Norway use of paths are dated to the Medieval period, and Roman period, Bronze age and the upper Neolithic (Moe *et al.* 1988, Moe & Knaap 1990, Hjelmtveit 1995, Mo 1996).

The effect by endo- and epizooic pollen transport by domestic animals needs to be included in the interpretation work. Studied pollen-analytical sites only linked to pathways may give additional very valuable information about connection/ contact between communities back as far as Neolithic.

ACKNOWLEDGEMENT

We would like to thank Jan Berge and Marianne Nystad for preparation and analyses work, and to Prof. Dr. Samuel Wegmüller, Prof. Dr. Friedrich Kral, Wien. for cooperation and use of unpublished data. A special thanks to the head of the Institut für Botanik der Universität Innsbruck for allowing DM working facilities, to Dr. Klaus Oeggl, Dr. Oeggl-Wahlmüller and Dr. Sylvia Peglar for discussions and suggested improvements to the paper.

The field and laboratory work was financed by Italian research money for the "Central Alps Project" (FGF), Olaf Grolle Olsens legat (University of Bergen) (DM), and by the Norwegian Research Council (DM).

REFERENCES

AMMANN K. 1976. Der Oberaargletscher im 18., 19. und 20. Jahrhundert. Zeitschrift für Gletscherkunde und Glazialgeologie, 12(2): 253–291.

BAGOLINI B. & PEDROTTI A. 1992. Vorgeschichtliche Höhenfunde im Trento-Südtirol und im Dolomitenraum vom Spätpaläolithikum bis zu den Anfängen der Metallurgie. In: Höphel F., Platzer W. & Spindler K. (eds.). Der Mann im Eis. 1. Universität Innsbruck: 359–377.

BALATTI M. 1995. Sui pascoli contesi del passo Baldiscio. Valtellina e Valchiavenna. Bollettino Camera Commercio di Sondrio 1995, 11: 21–29.

BALATTI M. & SCARAMELLINI 1995. Percorsi storici di Valchiavenna. Chiavenna: Museo della Valchiavenna.

BEHRE K.-E. 1981. The interpretation ofthropogenic indicators in pollen diagrams. Pollen et Spores, 23: 225–245.

BUZZETTI P. 1909. La Rezia chiavennasca velle epache preromana, romana, barbarica. Como. (Reprinted Bologna 1989).

BUZZETTI P. 1928. Il Passo dello Spluga e le strade Chiavennasche. Como.

CROLLALANZA G.B. 1898. Storia del Contado di Chiavenna, 2nd. ed. Chiavenna. Tipografia ed. Giovanni Ogna. (Reprinted Bologna 1980).

DELLA CASA P. 1997a. La formazione d'un paesaggio archeologico: la Mesolcina. Archäologie der Schweiz, 20(1): 15–24.

DJINDJIAN F. 1994. L'influence des frontiéres naturelles dans les déplacements des chasseurs-cueilleurs au Würm récent. Preistoria Alpina, Museo Tridentino di Scienze Naturali (Trento), (1992), 28(2): 7–28.

ENGAN A. 1966 (unpubl.). Borgetto sotto, Northern Italy. University of Bergen, Department of Botany, Bergen.

FAEGRI K. & IVERSEN J. 1989. Textbook of pollen analysis. (4ed.). Fægri K., Kaland P.E. & Krzywinski K. (eds.) John Wiley & Sons, Chichester.

FEDELE F. 1989. Il sito BO1 a Borgetto: Etŕ del Bronzo? In: Fedele F., Kvamme M., Mottura A. & Wick L. Preistoria e paleoambienti della Valchiavenna, campagna di recherche 1989: Pian dei Cavalli, Baldiscio e Spluga. – Clavenna (Chiavenna), 29: 62–64.

FEDELE F. 1990. Terminal Palaeolithic Hunters within the Alps. Discoveries near the Splügen Pass, Italy. In: Moe D. & Hicks S. (eds.) Impact of Prehistoric and Medieval Man on the vegetation: Man at the forest Limit. Pact Journal, 31: 81–85.

FEDELE F. 1992. Steinzeitliche Jäger in den Zentralalpen: Pian dei Cavalli (Splügenpass). Helvetia Archaeologica, 89: 2–22.

FEDELE F. & BUZZETTI M. 1993. Pian dei Cavalli: sui passi dei primi uomini nelle Alpi. Museo delle Valchiavenna, Chiavenna.

FEDELE F. & MOTTURA A. 1988. Preistoria e paleoecologia umana della Valchiavenna: Campagna 1988, Borgetto e Alta Val Febbraro. Clavenna (Chiavenna), 27: 9–49.

FEDELE F.G. & WICK L. 1997. Glacial/Postglacial transition south of Splügen Pass: environment and human activity. Il Quaternario, 9(2): 541–550.

FEDELE F., CIARALDI M., HANSEN J.W., MOE D., MOTTURA A. & ROSSKOPF C. 1990. Preistoria e paleoambienti della Valchiavenna, ricerche 1990: Pian dei Cavalli e Valle Spluga. Clavenna (Chiavenna), 29: 13–91.

HAIDER P.W. 1993. Historische Überlegungen zu den römischen Strassen über den Korntauern und Mallnitzer Tauern. In: Lippert

A. (ed.) Hochalpine Altstrassen in Raum Badgastein-Mallnitz. Böcksteiner Montana, VWGÖ, Wien, 10: 249–276.

HJELMTVEIT S.M. 1996. Blomsterstöv forteller stölshistorie i Fana. Bergen Museum (University of Bergen)Yearbook (1995): 44–49.

KOZLOWSKI S.K. 1994. The west Carpathians and Sudeten at the end of the Upper Palaeolithic. Preistoria Alpina, 28(2): 127–137.

KRAL F. 1993. Ein pollenanalytischer Beitrag zu archäeologischen Fragen im Gasteiner Raum. In: Lippert A. (ed.) Hochalpine Altstrassen in Raum Badgastein-Mallnitz. Böcksteiner Montana, 10: 203–217.

KURIER (ed.) 1997. Sensationeller Fund über Steinzeitmenschen. Kurier (Innsbruck), 3rd. April 1997.

LIPPERT A. 1993a. Das archäeologische Umfeld seit dem Neolitikum. In: Lippert A. (ed.) Hochalpine Altstrassen in Raum Badgastein-Mallnitz. Böcksteiner Montana, 10: 137–183.

LIPPERT A. (ed.) 1993b. Hochalpine Altstrassen im Raum Badgastein-Mallnitz. Böcksteiner Montana, Wien, 10.

LEITNER W. 1995. Der "Hohle Stein" – eine steinzeitliche Jägerstation im hinteren Ötztal, Tirol (Archäologische Sondagen 1992/93). In: Spindler K., Rastbichler-Zissering E., Wilfing H., Nedden D. zur & Northdurfter H. (eds.) Der Mann im Eis – Neue Funde und Ergebnisse. Springer-Verlag, Wien: 209–213.

MEYER W. 1992. Der Söldner von Theodulpass und andere Gletscherfunde aus der Scheiz. In: Höphel F., Platzer W. & Spindler K. (eds.) Der Mann im Eis. Vol. 1: 321–333, Universität Innsbruck, Innsbruck.

MO P. 1996 (unpubl.). Kulturvegetasjonens utvikling for et stølsområde i Vindedalen, Aurland kommune, Sogn og Fjordane. University of Bergen, Dept. of Botany, Bergen.

MOE D. 1973. Studies in the Holocene vegetation development on Hardangervidda, southern Norway. I. The occurence and origin of pollen of plants favoured by man's activity. Norwegian Archaeological Review, 6(2): 67–73.

MOE D. 1990. Richerche paleobotaniche sulla torbiere. In: Fedele F., Ciaraldi M., Hansen J.W., Moe D., Mottura A. & Rosskopf C. Preistoria e paleoambienti della Valchiavenna, riscerche 1990: Pian dei Cavalli e valle Spluga. Clavenna (Chiavenna), 19: 48–50.

MOE D. & BALLE O. 1981. Grønne sauer og hva ull kan inneholde. Naturen (Universitetsforlaget, Oslo), 1: 47–48.

MOE D. & HJELLE K.L. 1999. Mesolithic human adaption to changing alpine/subalpine vegetation in the Central and Eastern Alps, based on a vegetational historical study from Val Febbraro, Spluga Valley 9Italy). Universitätsforschungen zur Archäologie, 55: 207–214.

MOE D. & KNAAP W.O. van der 1990. Transhumance in mountain areas: Additional interpretation of three pollen diagrams from Norway, Portugal and Switzerland. In: Moe D. & Hicks S. (eds.). Impact of Prehistoric and Medieval man on the vegetation: Man at the forest limit. PACT Journal, 31: 91–105.

MOE D., INDRELID S. & FASTELAND A. 1988. The Halne area, Hardangervidda. Use of a high mountain area during 5 ooo years – interdisciplinary case study. In: Birks H.H., Birks H.J.B., Kaland P.E. & Moe D. (eds.) The cultural landscape – Past, present and future. Cambridge Univ. Press, Cambridge: 429–444.

MOE D., MAUDE E.A., FEDELE F.G., KVAMME M., WICK L. (in prep.). Vegetational changes and presence of man in the low- and subalpine zone in Valle Febbraro, upper Valle Spluga (Central Alps) northern Italy during Holocene.

PANOVSKA H. 1993. Vegetation history in south Pirin Mts. for the last 6000 years. In: Tonkov S. (ed.) Excursion booklet – Palynological sites in western Rhodopes mountains and Pirin mountains (Excursion booklet. Sofia University "St. Kliment Ohridski", Sofia: 8–13.

PLANTA A. 1985. Die Erforschung alter Wege und Strassen. In: Planta A. (ed.) Verkehrswege im alten Rätien, 1: 7–25.

PLANTA T. 1990. Alte Wege am Splügenpass. In: Planta A. (ed.) Verkehrswege im alten Rätien., 4: 37–152.

STOCKMARR J. 1971. Tablets with spores used in absolute pollen analysis. Pollen et Spores, 13: 615–621.

STUIVER M. & BECKER B. 1986. High-precision decadel calibration on the Radiocarbon Time Scale, AD 1950–2500 BC. Radiocarbon, 28, 2B: 863 – 910.

THÖNI G. 1993. Gammel alpetradisjon – Den store saueforflytningen. Vi Menn (Oslo), 18: 102–104.

TROELS-SMITH J. 1955. Charcterization of unconsolidated sediments. Danmarks geologiske undersægelser, 4(3): 1–73.

TT (APA (ed.)) 1997. Feuerstelle verriet Alter der Ur-Tiroler. Tiroler Tageszeitung (Innsbruck), 77, 3rd. April 1997.

WEGMÜLLER S. 1977. Pollenanalytische Untersuchungen zur spät und postglazialen Vegetationsgeschichte der französischen Alpen (Dauphiné). Verlag Paul Haupt, Bern.

WICK L. 1989. Richerche paleoambientali: palinologia dei sedimenti lacustri. In: Fedele F., Kvamme M., Mottura A. & Wick L. Preistoria e paleoambienti della Valchiavenna, campagna di recherche 1989: Pian dei Cavalli, Baldiscio e Spluga. Clavenna (Chiavenna), 29: 60–62.

WICK L. 1994a. Early-Holocene reforestation and vegetation change at a lake near the Alpine forest limit: Lago Basso (2550 m asl), northern Italy. Dissertationes Botanicæ, 234: 555–563.

WICK L. 1994b. Vegetation development and human impact at the forest limit: Palaeoecological studies in the Splügen pass area (North Italy). Monografie di Natura Bresciana, 20: 123–132.

WICK L. & TINNER W. 1997. Vegetation changes and timberline fluctuations in the Central Alps as indicators of Holocene climatic oscillatiuons. Arctic and Alpine Research, 29: 445–458.

ZIPPERLE A., RACHEWILTZ S.W. de & TOGNI R. 1994. Transumanza – Weideplätze wechseln. Edition Sturzfluge, Bozen (I)/ Löwenzahn, Innsbruck (A).