

## GLACIAL/POSTGLACIAL TRANSITION SOUTH OF SPLÜGEN PASS: ENVIRONMENT AND HUMAN ACTIVITY

F. G. Fedele<sup>(1)</sup> - L. Wick<sup>(2)</sup>

<sup>(1)</sup> Sezione e Museo di Antropologia, Università di Napoli "Federico II", Napoli

<sup>(2)</sup> Geobotanisches Institut, Universität Bern, Bern

**RIASSUNTO** - *La transizione Glaciale/Postglaciale a sud del Passo Spluga: ambiente e attività umana* - Il Quaternario *Italian Journal of Quaternary Sciences*, 9(2), 1996, 541-550 - A iniziare dal 1986, prospezioni e rilevamenti sul versante italiano dello spartiacque alpino di Passo Spluga hanno condotto alla scoperta di 38 siti preistorici alle quote di 2000-2420 m nelle Alpi Centrali interne. Dei circa 25 siti riferibili al Mesolitico, due sono stati scavati sul Pian dei Cavalli. In accordo con i manufatti litici, le date <sup>14</sup>C identificano due fasi di attività mesolitica, concentrandosi intorno a 8200-7900 (Mesolitico antico, fase locale 1) e 6800-6350 anni reali a.C. (fase locale 2). Fuochi imputabili all'uomo negli intervalli 8500-7850 e circa 7300-6300 a.C. sono rivelati da particelle di carbone nel vicino lago Basso. Un cospicuo gruppo di siti mesolitici antichi si allinea sull'orlo nord dell'altopiano (m 2200-2260), deglaciato fin da età Bølling-Allerød. Selce e quarzo impiegati nella litotecnica indicano non solo circolazione abituale nel territorio montuoso, ma il possibile attraversamento dello spartiacque alpino. L'evoluzione della vegetazione sul Pian dei Cavalli dal Tardiglaciale all'Olocene antico è registrata da pollini e macrofossili nel diagramma del lago Basso (m 2250), ancorato a date <sup>14</sup>C. La vegetazione pioniera tardiglaciale, senza alberi, passa nel Preboreale antico a prateria chiusa, mentre i primi alberi sparsi di *Pinus cembra* e *Betula* raggiungono il lago. Segue un incremento di arbusti nani, perlopiù *Juniperus*, quindi l'espansione in massa di *Larix*, verso 7700 anni reali a.C. *Picea abies* inizia a invadere il bosco subalpino di larice e cembro verso il 7000 a.C. Le fasi mesolitiche 1 e 2 coincidono sul Pian dei Cavalli con periodi di vegetazione abbastanza aperta. Il paesaggio della fase 1 sull'orlo nord è ecotonale, corrispondendo al limite del bosco. La fase 2 è coeva con la fine dell'oscillazione climatica Venediger: il ritardo di riforestazione, unitamente agli alti valori di carbone al lago Basso, fa pensare che i frequentatori mesolitici abbiano mantenuto aperto il paesaggio locale bruciando intenzionalmente alberi giovani.

**ABSTRACT** - *Glacial/Postglacial transition south of Splügen Pass: environment and human activity* - Il Quaternario *Italian Journal of Quaternary Sciences*, 9(2), 1996, 541-550 - Starting in 1986, exploration and survey on the Italian side of the Splügen Pass watershed have resulted in the discovery of 38 prehistoric sites at elevations of 2000-2420 m in the inner Central Alps. Out of 25 Mesolithic sites, two on the Pian dei Cavalli Plateau have been excavated. In agreement with artifactual records, <sup>14</sup>C dates cluster at c.8200-7900 (Early Mesolithic, local phase 1) and c.6800-6350 cal BC (Mesolithic phase 2). Man-made fires in the 8500-7850 and c.7300-6300 cal BC intervals are indicated by charcoal particles at the nearby Lago Basso. A major group of Early Mesolithic sites lies along the plateau northern escarpment (2200-2260 m a.s.l.), deglaciated since Bølling-Allerød times. Chert and quartz raw materials reveal circulation across elevated terrain, possibly including the Alpine watershed itself. The Late Glacial and Early Holocene vegetation development on Pian dei Cavalli is shown by a combined pollen- and macrofossil diagram from Lago Basso (2250 m), tied to a <sup>14</sup>C timescale. Late Glacial treeless pioneer vegetation developed towards closed meadows during the early Preboreal, while the first sparse trees of *Pinus cembra* and *Betula* arrived near the lake. Following an increase in dwarf shrubs, mainly *Juniperus*, a mass expansion of *Larix* occurred at ca.7700 cal BC, and *Picea abies* started to expand in the subalpine *Larix-Pinus* forest around 7000 cal BC. The Mesolithic phases 1 and 2 coincide with periods of rather open vegetation on Pian dei Cavalli, the phase 1 landscape on the northern escarpment being a timberline ecotone. Phase 2 is coeval with the end of the Venediger oscillation; a delay in reforestation after this period of climatic timberline depression, coupled with high charcoal values at Lago Basso, suggests that Mesolithic hunters kept the surroundings open by burning young trees.

**Keywords:** Early Holocene; Younger Dryas; Mesolithic; timberline; vegetation history, Splügen Pass; Central Alps

**Parole chiave:** Olocene antico; Dryas recente; Mesolitico; imite del bosco; storia della vegetazione, passo Spluga; Alpi Centrali I

### 1. RESEARCH FRAMEWORK

As an ecologically sensitive indicator, the timberline is an ideal setting for studies of environmental change and human impact, both singly and interactively. Here we report the main results of an investigation, carried out in the Italian Central Alps in combination with a successful search for early human presence, at or shortly after the Younger Dryas/Preboreal transition. Starting in 1986, exploration and survey have resulted in the discovery of 38 prehistoric sites in the upper Spluga Valley, to the southwest of the Splügen Pass watershed, between the elevations of 2000 and 2420 m above sea level. More than half of these sites are directly or indirectly relevant

to the Glacial/Postglacial transition.

From a strictly archaeological viewpoint, the early human peopling of the Alps is still a subject of scarce specific research, in spite of a growing body of important field data from certain areas in the region (e.g. the Adige Basin in the northeast). Research has especially failed to focus on the origins and dynamics of the peopling process. Attempts at understanding human peopling processes should take into account the specific environmental conditions involved, with the closest control on both geographical and chronological details. In this context again, sites and events at the timberline may offer a choice source of data for a sharper observation and deeper recognition of man-environment interaction at the early stages of Alpine peopling.

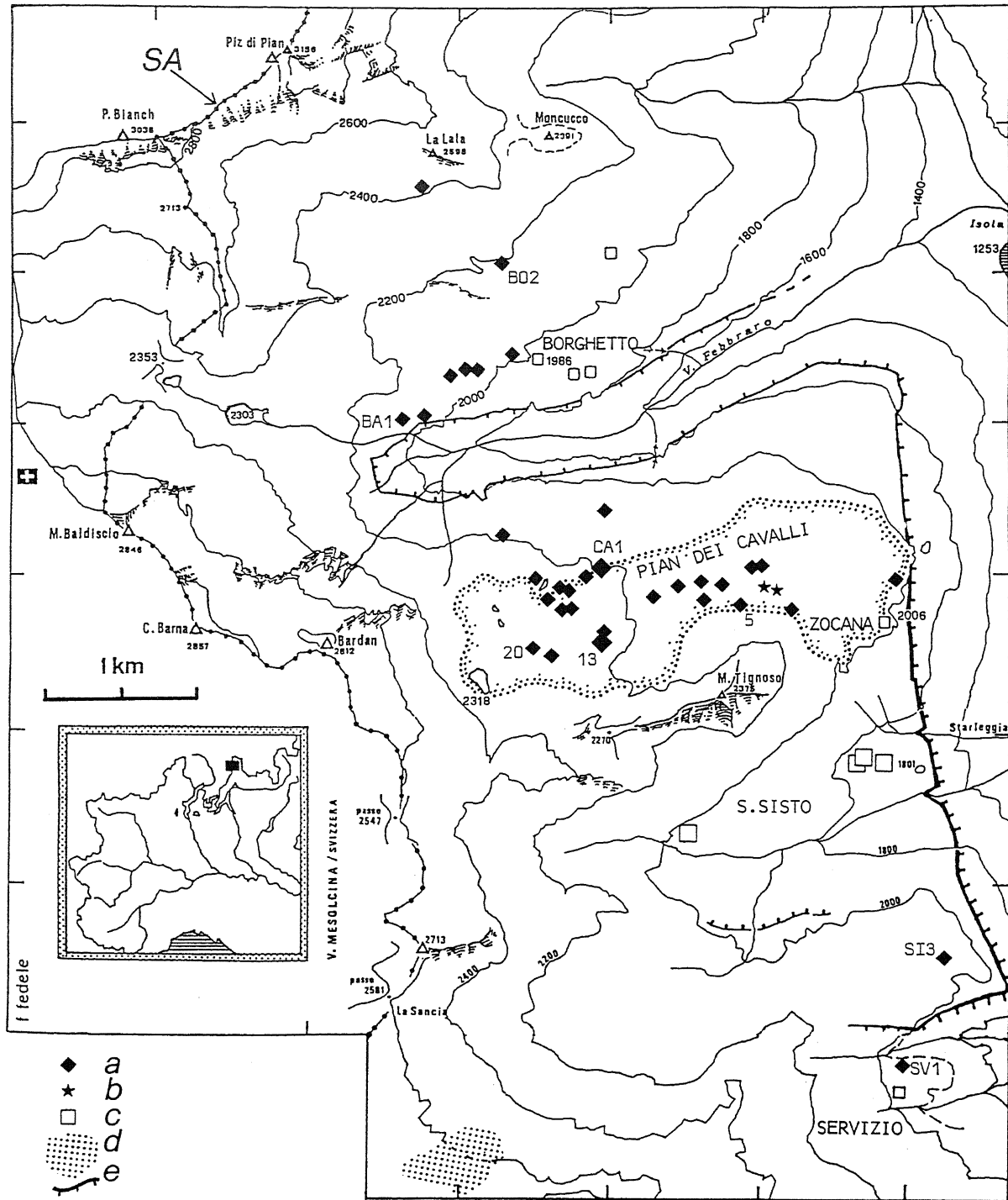


Fig. 1 - Upper Spluga Valley: distribution of prehistoric sites in the Pian dei Cavalli-Borghetto-S.Sisto study area. Legend: a = Lithic artifact sites; b = charcoal-only sites; c = summer huts or "alps"; d = Pizzo Quadro glacier; e = main escarpments; SA = Alpine watershed.

*Alta valle Spluga: distribuzione dei siti preistorici nell'area di studio Pian dei Cavalli-Borghetto-S.Sisto. Legenda: a = Siti con manufatti litici; b = siti di soli carboni; c = baite estive; d = ghiacciaio del Pizzo Quadro; e = scarpate principali; SA = Spartiacque alpino.*

The Spluga Valley Programme concerns the western part of the Sondrio province, Lombardy, northern Italy. This province appears to be well placed for an investigation of Alpine peopling in its ecological setting, as it encompasses the greatest portion of the Italian

Central Alps, including a sizeable amount of "inner Alpine" territory (*i.e.* the upper valleys and intermontane basins). It also presents a range of landscape types which generally differ from those common in both the Eastern and Western Alps. Prior to 1986 its earlier pre-

history, up to the 3rd millennium BC, was almost unknown (Poggiani Keller, 1989).

Over the last ten years, research results from the Spluga Valley have begun to inform on the early human presence within the Central Alps after the end of the Last Glacial. A single site might even record much earlier forays in the mountain territory, well before the Last Glacial Maximum (Fedele & Mottura, 1988; Fedele *et al.*, 1992). Additional results concern subsequent phases of colonization, from the Late Neolithic to the Final Bronze Age. For the primary data on which this paper is based the reader is referred to the programme's annual reports, regularly published in the journal *Clavenna* (Chiavenna, Centro di Studi Storici Valchiavennaschi) from 1986 onward.

## 2. ARCHAEOLOGICAL INFORMATION

### 2.1 Site distribution, age and context

The Central Alps comprise a large portion of elevated terrain of complicated physiography, between the Adige Basin in the east and the northern Piedmont region in the west. Its southern or "Pre-Alpine" border is dotted with large, usually elongated lakes. The Spluga Valley lies right north of the upper end of Lake Como (Fig. 1).

More particularly, the programme's intensive-study area was chosen along the Swiss-Italian border near the Splügen Pass, with an explicit focus on the Alpine watershed and the timberline phenomena. The Splügen district lies at the hydrographic crossroads of Europe, being placed between the upper Rhine Basin to the north (the Grisons' Rheinwald tract) and the Po Basin to the south. The Rhone and En-Inn-Danube river systems have their origins in the immediate surroundings to the west and east, respectively.

Geographic and ecological considerations were essential in selecting the area. The initial research objectives were, first, to test the hypothesis that humans had reached the inner Alps soon after the end of the Last Glacial; and second, to generate "early" archaeological sites in absence of previous clues, within an entirely unknown region (Fedele, 1985). The chosen region was also greatly different from the Eastern Alps and Pre-Alps, where the largest number of Early Holocene sites in Alpine Italy has so far been uncovered (Fedele, 1981; Bagolini *et al.*, 1983; Broglio, 1984; 1994, with references; Lunz, 1986; Dalmeri & Pedrotti, 1994, with references).

The Spluga Valley is a tectonic furrow with a north-south orientation, deeply cut into crystalline rocks. Access is difficult from all sides, including Rheinwald's. At the core of the programme's study area is the Pian dei Cavalli or Horses' Plateau (2000-2300 m a.s.l.), an isolated block of carbonate rocks, hanging high above the Spluga furrow and closely surrounded by high-altitude crystalline peaks (Figs. 1 and 2). The plateau dips east rather gently, overlooking a hanging valley to the south (San Sisto, across the Mt Tignoso klippe); on the northern side is the stepped, but altogether imposing Val Febbraro escarpment.

Portions of Pian dei Cavalli are dotted by karst

forms, such as dolines and sinkholes, while its upper "bench", which coincides with gneiss and micaschists, was carved by glacial abrasion into hillocks and hollows, these formerly occupied by lakes and ponds (only a few survive). Tardiglacial moraines and rock-falls line the southwestern tracts of the plateau. Access from valley-floors is clearly difficult from the west, in spite of some passes, and rather demanding from all the other directions; precise quantification of walking times and conditions according to all possible routes has been part of our programme.

Initial investigations on this plateau revealed the first two Mesolithic sites in 1986, including the largest and most informative, Cavalli-1 (CA1, 2200 m a.s.l.). The Spluga Valley experiment has been developing successfully up to this day (Fedele, 1992; Fedele & Buzzetti, 1993; cf. Fedele *et al.*, 1994; 1995, for the latest annual reports).

The geographic distribution of prehistoric sites is presented in Figures 1 and 2. All sites lie above the present-day timberline, in the Alpine grassland horizon. The highest Mesolithic site was found at 2420 m, directly below the Alpine watershed peak-line. Most sites tend to be poor in cultural residue, as befits a marginal area in the cultural geography and ecology of the Early Holocene.

Survey according to a replicated-sampling strategy suggests that about 70% of the Pian dei Cavalli archaeological map is a fairly representative sample of the total site "universe". Within the limits of archaeological "resolution", we believe that Figure 2 reflects a realistic, reliable pattern of circulation and stops by Mesolithic groups, albeit in a "palimpsest" state. Even considering the obliterating effects of neoglaciation (the Little Ice Age climax of ca.1800-1820 in particular), site distribution appears to be mutually exclusive with passes and lakes.

On Pian dei Cavalli as well as at Borghetto, high up on the opposite side of the next lateral valley to the north, prehistoric evidence includes some "charcoal-only" sites, radiocarbon-dated to the later prehistory and probably dependent on human activities. In several cases their cultural origin was established by anthracology in addition to test excavation (determining the feature's geometry and sediment context; *e.g.* Fedele *et al.*, 1995).

Two of about 20 Mesolithic sites on Pian dei Cavalli have been excavated, CA1 and CA13 (Fig. 2). These are a fraction of sites which include charcoal from burning features, or "hearths" in the more general sense. Chronological control is assured by about twenty <sup>14</sup>C measurements from excavated contexts (F. Terrasi *et al.* in Fedele *et al.*, 1994; Fedele, in press). Dates cluster at 8190-7930 and 6760-6360 cal BC, corresponding to local Mesolithic phase 1 (Early Mesolithic) and phase 2 (trapezoid-microlith Late Mesolithic) respectively.

Significantly, man-made fires in the 8500-7850 and (7300)7000-6300 cal BC intervals are indicated by charcoal particle influx at nearby Lago Basso (see below). Lago Basso is one of two surviving glacial lakes cored within the programme by the Bern University team. A dozen peatbogs in the area have been studied by a Bergen University group, Norway, but their information mostly concerns the Mid-to-Late Holocene record (D. Moe *et al.* in Fedele *et al.*, 1995).

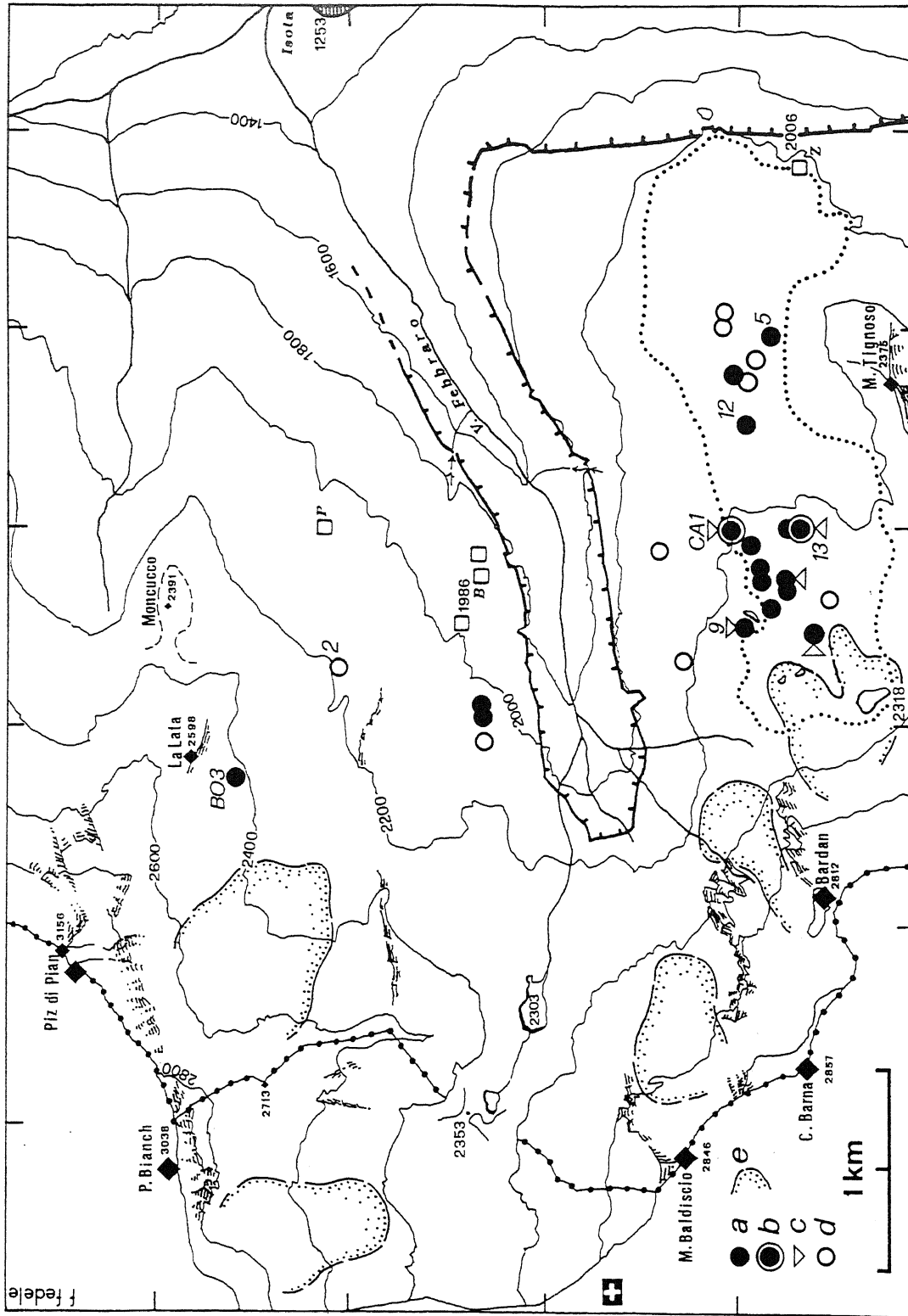


Fig. 2 - Distribution of Mesolithic sites (a) in the Plan dei Cavalli and Borghetto areas (b = excavated, c = with charcoal, d = probably Mesolithic). Hypothetical Little Ice Age snowfields are shown (e).  
 Distribuzione dei siti mesolitici (a) nelle aree del Plan dei Cavalli e di Borghetto (b = in scavo, c = con carboni, d = mesolitici probabili). Sono indicati i presunti limiti dei nevati della Piccola Età Glaciale (e).

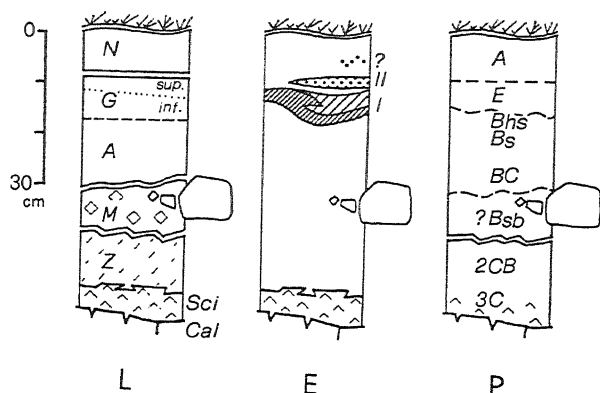


Fig. 3 - Pian dei Cavalli, site CA1: lithostratigraphy (L), ethnostratigraphy or cultural stratigraphy (E), pedostratigraphy (P). A, G, N = sandy-silty sediments; M = morainic debris; I, II = Mesolithic "hearths"; bedrock may comprise schist (Sci) and/or limestone (Cal) units. Scale at left shows the average thickness of the uneroded A-N sequence.

*Pian dei Cavalli, sito CA1: lito- (L), etno- (E) e pedostratigrafia (P). A, G, N = sedimenti sabbioso-siltosi; M = coltre morenica; I, II = "focolari" mesolitici; la roccia di base consta di scisti (Sci) e/o marmi calcarei (Cal). La scala a sinistra è semplicemente indicativa dello spessore medio della sequenza A-N non erosa.*

## 2.2 Human behaviour

The burning events recorded at Lago Basso belong in a broader series of data having direct relevance for a reconstruction of Mesolithic activities in their landscape. It is worth noting that small Lago Basso is quite close to a major group of Mesolithic sites, rather thickly distributed along the plateau's northern escarpment (2200-2250 m). Palynology (Wick, 1994a; 1994b; and this paper) and geomorphology (C. Roskopf in Fedele *et al.*, 1995) have shown this escarpment to have been ice-free since Bølling-Allerød times. The surroundings, however, may have seen snowfields during the Younger Dryas, well into the 10th millennium cal BC.

Prominent among the archaeological occurrences on the northern rim is site CA1, to be interpreted as a cliff-edge "hunting stand". So far an area of about 200 m<sup>2</sup> has been excavated and studied. The site displays an impressive series of combustion features or "hearths", mainly at ground level. Though very simple, they can be generally distinguished from tree-root hollows (see below). In spite of the relative abundance of charred plant material, bone and burnt bone are still entirely lacking.

Correlation of cultural stratigraphy with litho- and pedostratigraphy is shown in Figure 3. The cultural layer is only 10-20 cm thick and corresponds in lithology to loess-derived sandy silts (layer G). Locally, two superposed "hearth" levels were found (I and II), independent of cryoturbation involutions. The cultural layer quite generally coincides with the grey, "albic" horizon of podsol profile (E), or the contact with underlying oxide-rich, "spodic" horizons (Bhs etc.; R. Comolli & F. Previtali in Fedele *et al.*, 1995).

The base of the CA1 cultural layer probably records early episodes of Mesolithic burning, directed at the sparse, small conifer trees of the Preboreal timberline,

including *Pinus cembra*. Lobed hollows interpreted as rooted bases of trees have been recognized through excavation; in terms of size, shape, sediments and context they cannot be generally mistaken for true man-made hearth features. Broadly coeval pollen samples from CA1 indicate a rather humid landscape of tall-herb meadows at the timberline ecotone.

Burning events of this sort were closely followed by repeated but spaced-out visits and — as some data suggest — occasional instances of shelter construction. The making of tent-like shelters would be indicated by a certain spatial correlation of sediment and cultural features, including several stone slabs forming an oval (Fedele *et al.*, 1992; 1994). In their turn, shelters of some substance would imply overnight stays: an interesting behavioural novelty at high-altitude locations with a cliff-edge, wind-swept character (cf. Dalmeri & Pedrotti, 1994, for similar locations in the Eastern Alpine Mesolithic).

Human circulation on a regular basis may have continued for portions of the 8th millennium cal BC, unless the Venediger climate deterioration (see below) shifted human movement away from the inner and higher areas. The cultural effects of this climatic phase cannot yet be determined. Most of the Pian dei Cavalli Mesolithic sites seem to belong to this late 9th-8th millennium phase 1. In the case of sites without charcoal or clearly diagnostic artifact-types, the attribution to the Mesolithic (phase 1 in particular) was based on the peculiar chert types employed, as well as the fact that artifacts were eroding — or had been eroded — from characteristic Early Holocene sandy silts.

Hearth F159 at site CA1, subsequently sunk into an active karst fissure, and another locus nearby, represent a second period of human activity on the escarpment, dated at ca. 6700 cal BC, at which time trapezoid microliths make their appearance (Fedele *et al.*, 1994). The existence of other mid-7th millennium sites, such as CA13, suggests a later interval of cultural interest for the uplands (Mesolithic phase 2), possibly spanning the whole 7th millennium cal BC. Knowledge of this phase is still very scanty, however.

Site CA1 has produced about 700 lithic artifacts made from rock crystal, quartz, quartzite and chert. Phase 1 small-tool components (Fig. 4, above) mostly include knives, utilized blades and bladelets, borers, burins and endscrapers, as listed in order of decreasing frequency; geometric microliths and backed bladelets (Fig. 4, e) tend to be rare. Utilization of "curated", hafted tools was common, but chipping on site is documented by diminutive cores and waste from both crystal and chert. Phase 2 tool types (Fig. 4, below) include retouched and naturally-backed trapezes, one revealing its hafting through a mark of charred glue (Fig. 4, h: M).

In addition, extraordinary enough for high-altitude sites is the presence of "macroliths", either tools or manuports. Expediently obtained from local morainic stones, they were quite possibly employed in heavy-duty tasks, like wood reduction or butchery. A flake cleaver and a pick-like hammer were reddened by fire from a nearby hearth.

The chrono-typological classification of the Spluga sites is largely irrelevant for the scope of this paper (but

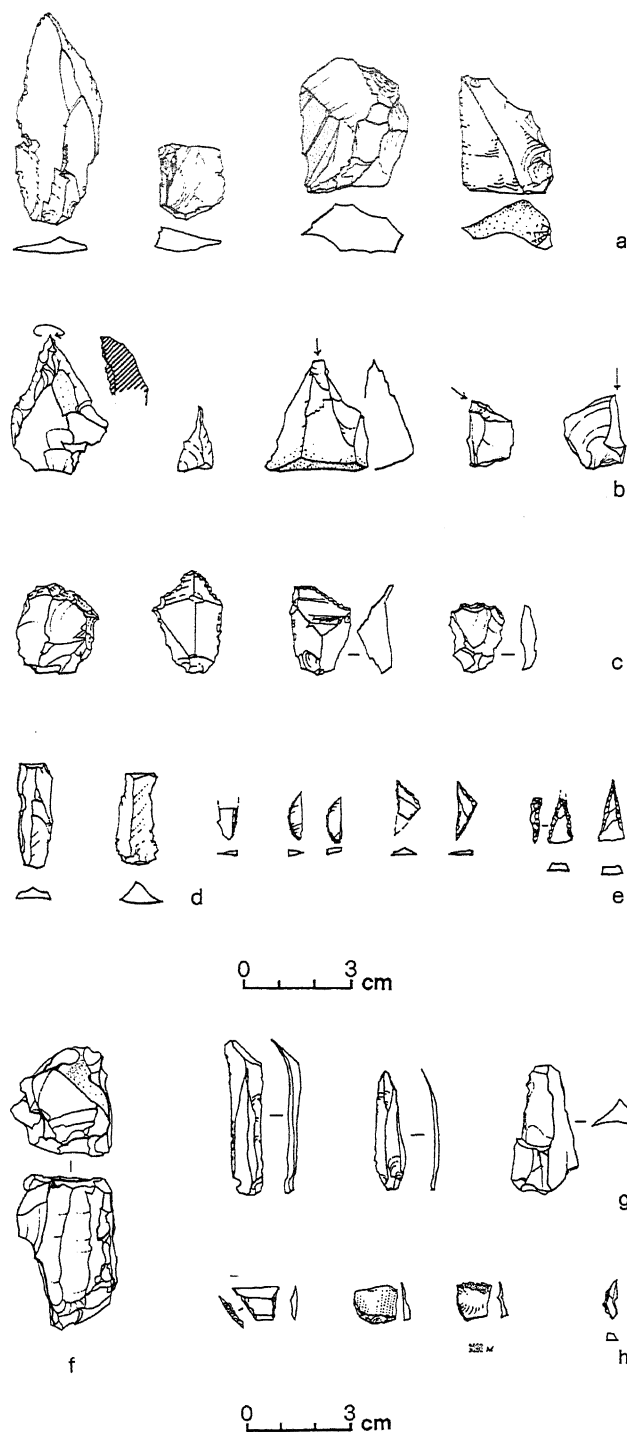


Fig. 4 - Pian dei Cavalli: a selection of artifact types representing local Mesolithic phase 1, above (from sites CA1, CA3, FE2) and phase 2, below (from site CA1, feature F159). a, knives; b, borers and burins; c, end-scrapers; d, utilized blades; e, geometric microliths and backed-bladelet fragments; f, prismatic core; g, blades and knife; h, trapezes (M = mark of glue) and crescent.

*Pian dei Cavalli: selezione di tipi di manufatti indicativi delle fasi mesolitiche locali 1 (in alto; dai siti CA1, CA3, FE2) e 2 (in basso; dal sito CA1, struttura F159). a, coltelli; b, perforatori e bulini; c, grattatoi; d, lame utilizzate; e, microliti geometrici e frammenti di lamelle a dorso; f, nucleo prismatico; g, lame e coltello; h, trapezi (M = traccia di mastice) e semiluna.*

in the Splügen area. One chert variety might be a northern type from some source on the Swiss Plateau or further away (J. Hansen, in preparation).

Thus it is not surprising that typological affinities pointing south appear to co-exist with original behavioural traits, in agreement with the peculiar geographic position of the Splügen area. Admittedly, however, originalities could be better determined on larger lithic series.

The Pian dei Cavalli escarpment sites have been interpreted as hunting stands, possibly to be connected with some sort of selective animal killing (migrating red deer?) (Fedele, 1992; Fedele & Buzzetti, 1993). The currently available data are insufficient to prove — but apparently do not contradict — this kind of hypothesis (Fedele, 1993). In the case of CA1, re-frequentation of the same site during two periods several centuries apart is considered to have implications for the cognitive appropriation of territory by Mesolithic groups (Fedele, in press).

### 3. VEGETATION HISTORY AND PALÆOECOLOGY

Lago Basso (2250 m a.s.l.), a small lake with a water depth of only 80-100 cm, turned out to be an ideal locality for the reconstruction of Early Holocene palæo-environments because of its situation close to the major Mesolithic sites in the northern part of Pian dei Cavalli (Fig. 2, near site 9). Its altitudinal level near the alpine timberline makes it possible to a certain degree to separate man-induced vegetation changes from timberline oscillations caused by climatic changes.

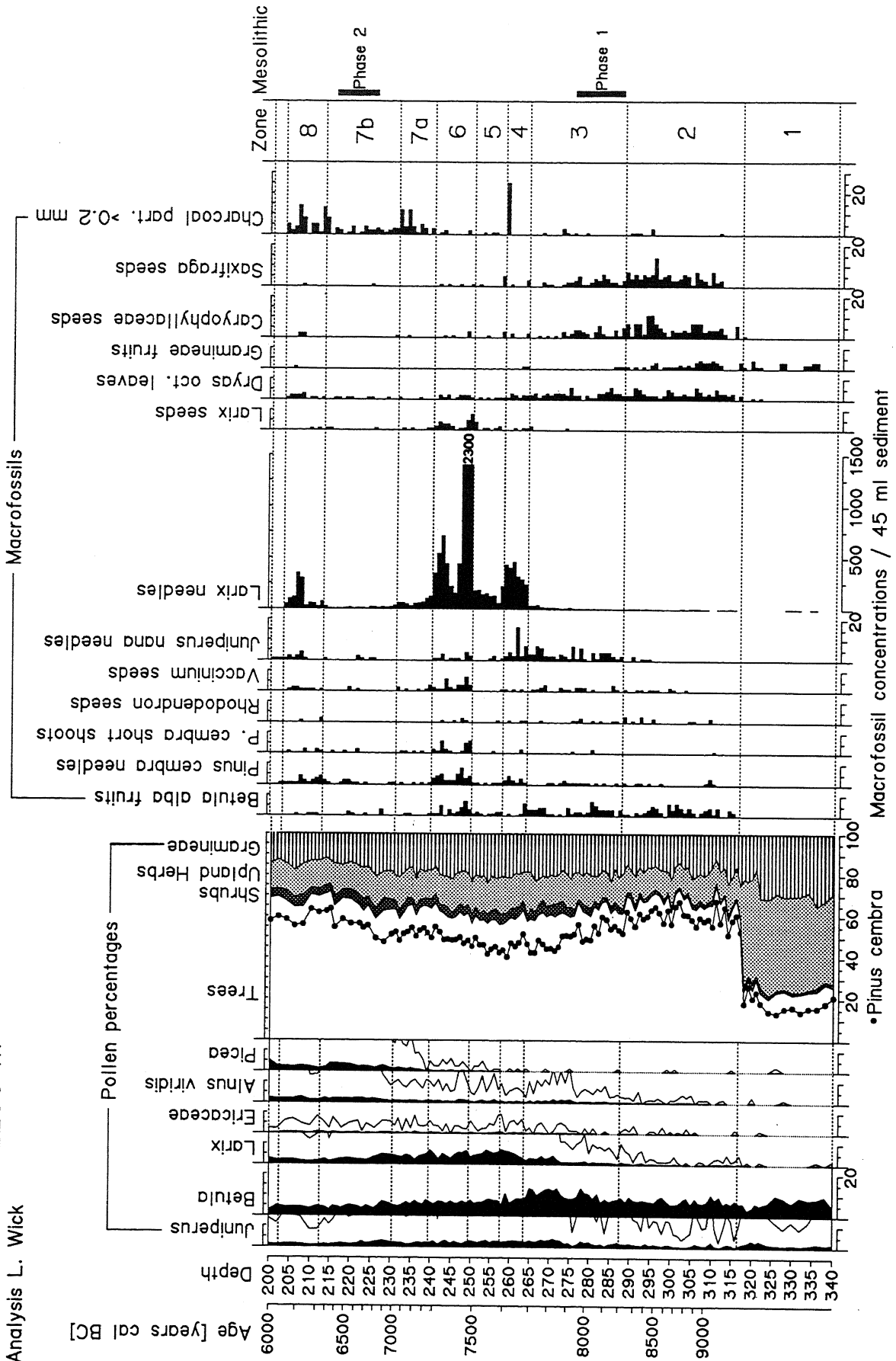
An important and useful feature of the Lago Basso core was the frequency of macrofossils throughout most of the sequence (Fig. 5). We wish to stress that the information provided by macrofossils was essential in arriving at an interpretation which was as little biased as possible by the well-known factor of medium- and long-distance pollen transport.

see Fedele, 1992, and the programme's reports for *interim* discussions); research itself rather focussed on problems of behaviour and circulation. Already in Mesolithic phase 1, although "ethnic" markers in artifact types vaguely evoke affiliation with a southern tradition (on the basis of geometric microliths), chert and quartz materials strongly suggest circulation across elevated terrain, probably including the Spluga-Mesolcina interfluve or even the Alpine watershed itself. Good-quality rock crystal is more common in the Mesolcina Valley to the west than

Fig. 5 - Pian dei Cavalli, Lago Basso (2250 m a.s.l.): pollen and macrofossil diagram showing the most significant species; Mesolithic phases on the right.

*Pian dei Cavalli, lago Basso (m 2250): diagramma pollinico e dei macrofossili, relativo alle specie più significative; fasi mesolitiche sulla destra.*

LAGO BASSO 2250 m  
Analysis L. Wick



The results of pollen and macrofossil analysis from the base of the 355 cm long sediment core from Lago Basso indicate that the area was already free of ice in the Bølling or Allerød (Wick, 1994a; 1994b). During the Late Glacial the raw soils were covered by an open, treeless pioneer vegetation dominated by Gramineae, *Artemisia*, Chenopodiaceae, and other heliophilous herbs.

At the beginning of the Preboreal the forest limit formed by *Pinus cembra*, *Larix* and *Betula* started to rise very quickly. The local vegetation was a species-rich mosaic of open pioneer formations (with *Dryas octopetala*, *Saxifraga*, Caryophyllaceae etc.) and continuous meadows when the first trees of *Betula* and *Pinus cembra*, together with *Rhododendron* and *Vaccinium*, arrived near the lake.

In a second phase of reforestation (Zone 3, 8200-7700 cal BC) dwarf shrubs dominated by *Juniperus nana* were important, and *Larix* started to spread. A continuous decrease in macrofossils of pioneer plants suggests that the vegetation cover became more and more closed. At about 7700 cal BC there was a mass expansion of *Larix*. An open *Larix-Pinus cembra* forest with a rich tall-herb and dwarf-shrub understory covered the surroundings of the lake until about 1500 cal BC, when the timberline was pressed down by man in order to enlarge the alpine pastures (Wick & Tinner, in preparation).

The timberline reached its highest position, at an elevation of about 2300 m, probably in the Boreal or early Atlanticum. *Picea*, continuously expanding in the subalpine forest since 7000 cal BC, arrived near Lago Basso at around 4700 cal BC.

The macrofossil diagram from Lago Basso (Fig. 5) shows very distinct changes in concentrations of macrofossil remains of trees and dwarf shrubs, indicating timberline fluctuations caused by climatic changes. They can be correlated to climatic oscillations recorded in the Austrian and Swiss Alps on the basis of glacier advances and palaeobotanical evidence (Zoller, 1960; Patzelt, 1977; Bortenschlager, 1984; Wick & Tinner, in prep.). The most important climate deterioration during Mesolithic times was the Venediger oscillation, dated to about 8700-8000 radiocarbon years BP, or 7700-6900 cal BC (Patzelt & Bortenschlager, 1973; Patzelt, 1977), most likely consisting of several minor oscillations. It is recorded in the Lago Basso core in zones 4 to 7.

Tracing Early Holocene human presence at the timberline by palaeobotanical methods can be quite difficult, because the cultural impact on the vegetation was probably only local and considerably less pronounced than in the Neolithic, when people started to drive domestic animals into the alpine pastures. In any case, disturbance of the subalpine forest by man could result in the same effect as a climate-induced timberline oscillation: a decrease in the concentrations of tree macrofossils in the lake sediments. Thus for a reliable interpretation of the palaeobotanical record a good time scale based on <sup>14</sup>C datings and a strong relationship to archaeological data are required.

In addition, charcoal particles in the lake sediments can provide information about fires near the lake that can be natural as well as man-made. Oeggl & Wahlmüller (1994) have shown that natural fires were rather frequent

in the Early Holocene subalpine *Larix-Pinus* forests. The charcoal peak in zone 4 of the Lago Basso diagram most likely can be attributed to a natural forest fire.

According to the <sup>14</sup>C dates obtained from Lago Basso (the time scale in Fig. 5 is based on nine calibrated <sup>14</sup>C dates) and from two of the archaeological sites, the forest limit was located somewhat below Pian dei Cavalli during the early Mesolithic (local phase 1). On the plateau's northern rim, the environment of the sites was a timberline ecotone. This can be described as a transitional zone between closed forest and alpine meadows (Holtmeier, 1985) characterised by a well developed dwarf-shrub vegetation with *Juniperus nana* and Ericaceae (cf Fig. 5, zone 3) and scattered trees of *Betula* cf. *pubescens*, *Pinus cembra*, and possibly some *Larix*. The herb vegetation was dominated by meadow plants and tall herbs on better soils, and by pioneer plants in less favourable habitats. According to their characteristics, charcoal fragments in the sediments of Lago Basso indicate local fires.

Interestingly, the beginning of the local Mesolithic phase 2 coincides with the end of the Venediger oscillation at about 6900-6800 cal BC (Fig. 5, zone 7b). The late Mesolithic hunters started to visit the area before the *Larix-Pinus cembra* stands were able to recover from the climatic deterioration recorded in zone 7a. Despite scattered *Larix* and *Pinus cembra* trees, the vegetation again was quite open during this period.

Because no evidence yet exists for a climatic cooling in the Alps that could have caused a timberline depression over a period of several hundred years immediately after the end of the Venediger oscillation (Wick & Tinner, in prep.), the open structure of the vegetation as shown in zone 7b is likely to be due to the action of local influences near the lake. High charcoal frequencies in the lake sediments support the idea that the late Mesolithic "hunters" may have kept their environments open by burning young trees.

## ACKNOWLEDGMENTS

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