Lungau (Land Salzburg, Austria/Österreich)

Bern's Moorexkursion, September 2005.

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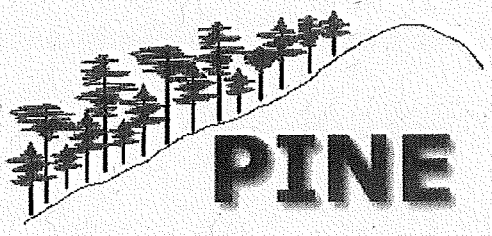
Our day excursion in Lungau will start from Prebersee.

http://www.preber.info/landschaft.php *informs us*: „Der Prebersee, ein Moorsee dessen Ufer von Hoch-, Nieder-, Übergangs- und Latschenmooren umgeben ist, ist ein optimales Rückzugsgebiet für viele seltene Pflanzen- und Tierarten. Deshalb wurde das Gebiet um den Prebersee zum erklärt. Mit der Erklärung zum Landschaftsschutzgebiet möchte man erreichen, dass das Prebergebiet in seiner natürlichen Form und landschaftlichen Schönheit erhalten bleibt. Besonders für Botaniker ist dieses Hochmoor mit unzähligen geschützen Pflanzenarten sehr interessant."

This means, freely translated by Pim: The lake of Prebersee is surrounded with various kinds of mire (bog, fen, transitional mire, mugho bog) and is a refuge for many rare plants and animals. A landscape protection area was therefore created around this lake. The aim of protection is to preserve the area in its natural form and beauty of landscape. The raised bog is especially of great interest to botanists because of its countless protected plant species.
[*Note:* countless *is exaggerated.*]

Predicting Impacts on Natural Ecotones

Pim van der Knaap, Jacqueline van Leeuwen, Brigitta Ammann



PINE is supported by the European Commission under the Fifth Framework Programme and contributing to the implementation of the Key Action "Global Change, Climate and Biodiversity"

Co-ordinator: *Sheila Hicks*, Oulu, Finland

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Excerpted from www.pine.oulu.fi (modified)

PINE investigates the potential impacts of key land-use management decisions on the European tree-line ecotones under different climatic change scenarios. The focus is on identifying critical thresholds of change, some of which may be irreversible. The aim is to inform decision makers of the consequences of their actions in terms of sustainable development, landscape change, and biodiversity. The first step will be to assess the decision-makers' and stakeholders' perceptions of environmental change and risk. We will then go on to produce a spatially explicit, dynamic forest succession model (TreeMig) tuned specifically to tree-line ecotones. The model parameters are defined using variables that initiate, control, and terminate tree growth. These are derived from cambium dynamics and an innovative multi-proxy approach in which the proxies used are tree ring width, relative density, stable carbon isotope ratios, height increment, needle production and pollen deposition. Data will be collected from a range of tree-line tree species at sites in Sweden, Finland, Austria, Italy, and Slovenia. The model will be evaluated using the past response of tree line plant communities to climatic change under varying management regimes and then used to predict changes in the tree-line ecotones in response to climatic change under different land-use change scenarios.

The northern latitudinal limit is characterised by *Pinus sylvestris*, whereas in the Alps the dominant tree-line species can be either *Pinus cembra* or *Picea abies*. PINE will collect data from 3 northern sites and 4 Alpine sites (covering all three tree species) to provide data for the development of computer models that will serve as management tools for conflict areas in Sweden, Finland, Italy, and Austria. By tuning the model for each of the ecotone types, the results will apply on a European scale.

The Alpine tree-line ecotone will be investigated using sites in Lungau, where spruce forms the tree-line; in the Southern Tyrol, where stone pine forms the

tree-line, and at the Triglav National Park, Slovenia, where spruce and larch are dominant at the tree-line, providing a contrast in the degree of continentality. The alpine data will also be supplemented with data from Mauntschas (Switzerland). The influence of grazing on the forest limit is particularly important in the Alps, where the present tree-limit is probably much lower than the climatically controlled potential tree-limit. Changes in land-use would be expected to have a very marked effect on this sensitive ecotone. In the Alps the tree-line ecotone is of great economic as well as cultural value, providing, for example, some of the best ski sites. At both the Austrian and South Tyrolian sites there is constant conflict between tourism and nature conservancy.

Holocene – Climatic Change – Palynology – Forest succession models – tree-line ecotone – Austria – Italy

Workpackages: **1**. The regional decision makers' & stakeholders' attitudes, knowledge & sensitivity; **2**. ***Pollen data collection and analysis***; **3**. Tree-ring data collection and analysis; **4**. ***Stable carbon isotope data from*** tree-rings and ***peat***; **5**. Needle and height-increment data collection and analysis; **6**. Cambium activity data collection and analysis; **7**. Calibration and sensitivity analyses; **8**. Modelling, scenario development and validation; **9**. Data management and knowledge dissemination; **10**. Data interpretation, analysis, and scientific dissemination.

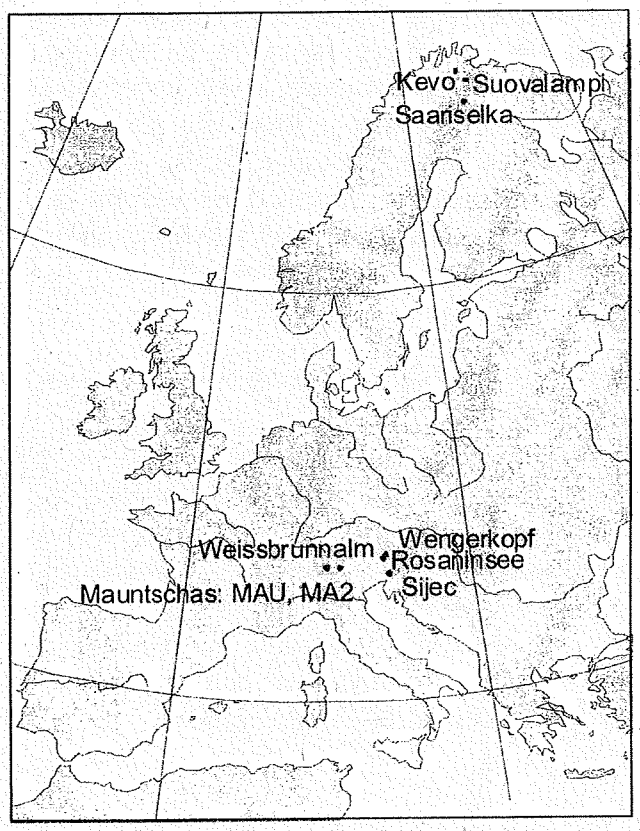
Radiocarbon dating of modern peat profiles: pre- and post-bomb ^{14}C variations in the construction of age-depth models

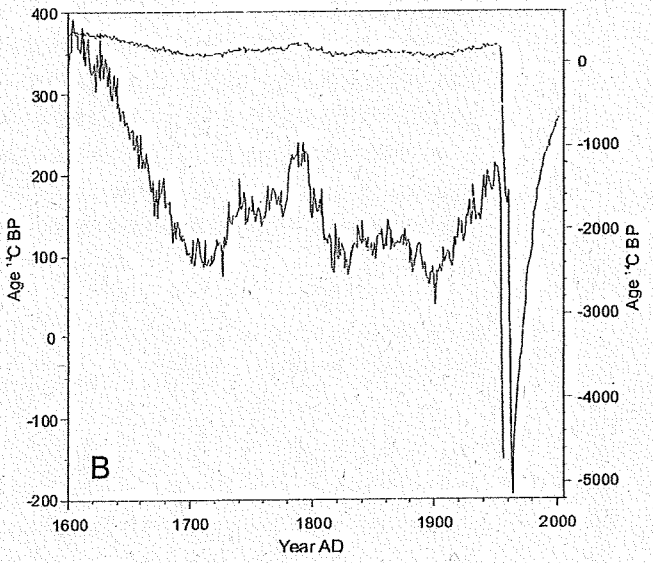
T. Goslar, W.O. van der Knaap, S. Hicks, M. Andrič, J. Czernik, E. Goslar, S. Räsänen, H. Hyötylä

Radiocarbon 47 (2005): 115-134

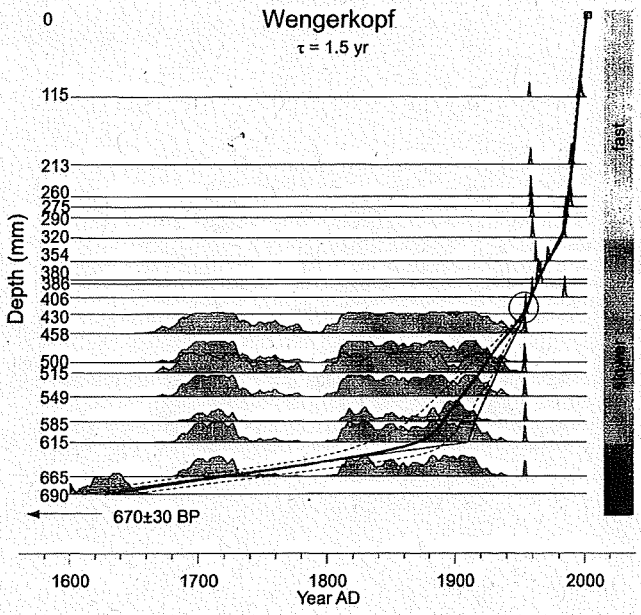
Precise radiocarbon dating of modern samples is possible due to the large bomb peak of atmospheric ^{14}C concentration in 1963 and the following rapid decline in the ^{14}C level. All the analyzed ^{14}C profiles appeared concordant with the shape of the bomb peak of atmospheric ^{14}C concentration, integrated over some time interval with a length specific to the peat section. In the peat layers covered by the bomb peak, calendar ages of individual peat samples could be determined with an accuracy of 2–3 yr. In the pre-bomb sections, the calendar ages of individual dated samples are determined in the form of multi-modal probability distributions of about 300 yr wide (about AD 1650–1950). However, simultaneous use of the post-bomb and pre-bomb ^{14}C dates, and lithological information, enabled the rejection of most modes of probability distributions in the pre-bomb section. In effect, precise age-depth models of the post-bomb sections have been extended back in time, into the "wiggly" part of the ^{14}C calibration curve.

Selected figures are shown on next page.

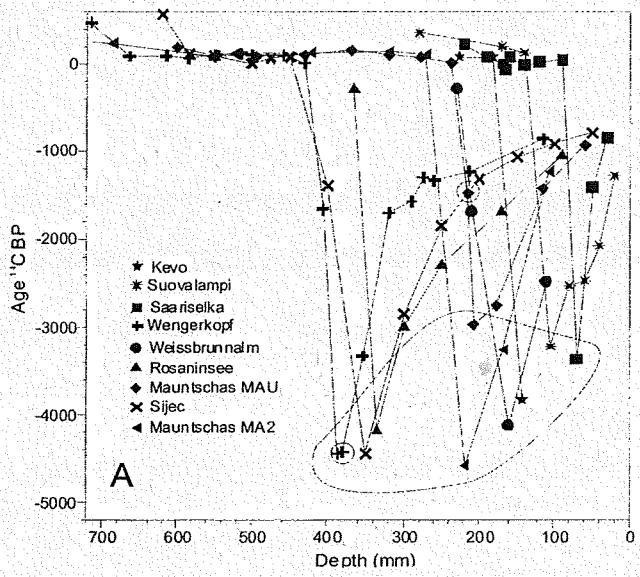




C14 calibration curve

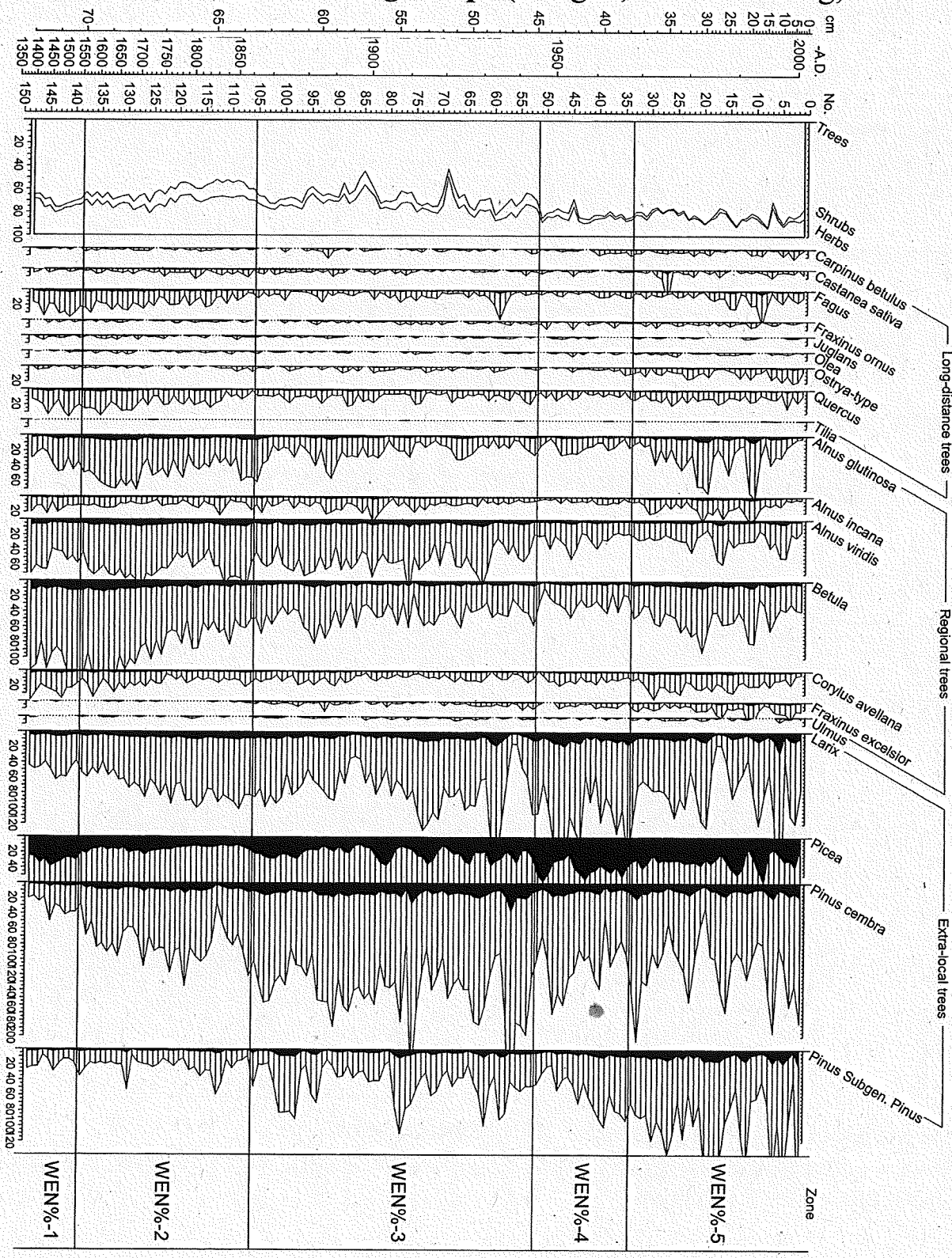


Calibration of Wengerkopf peat section

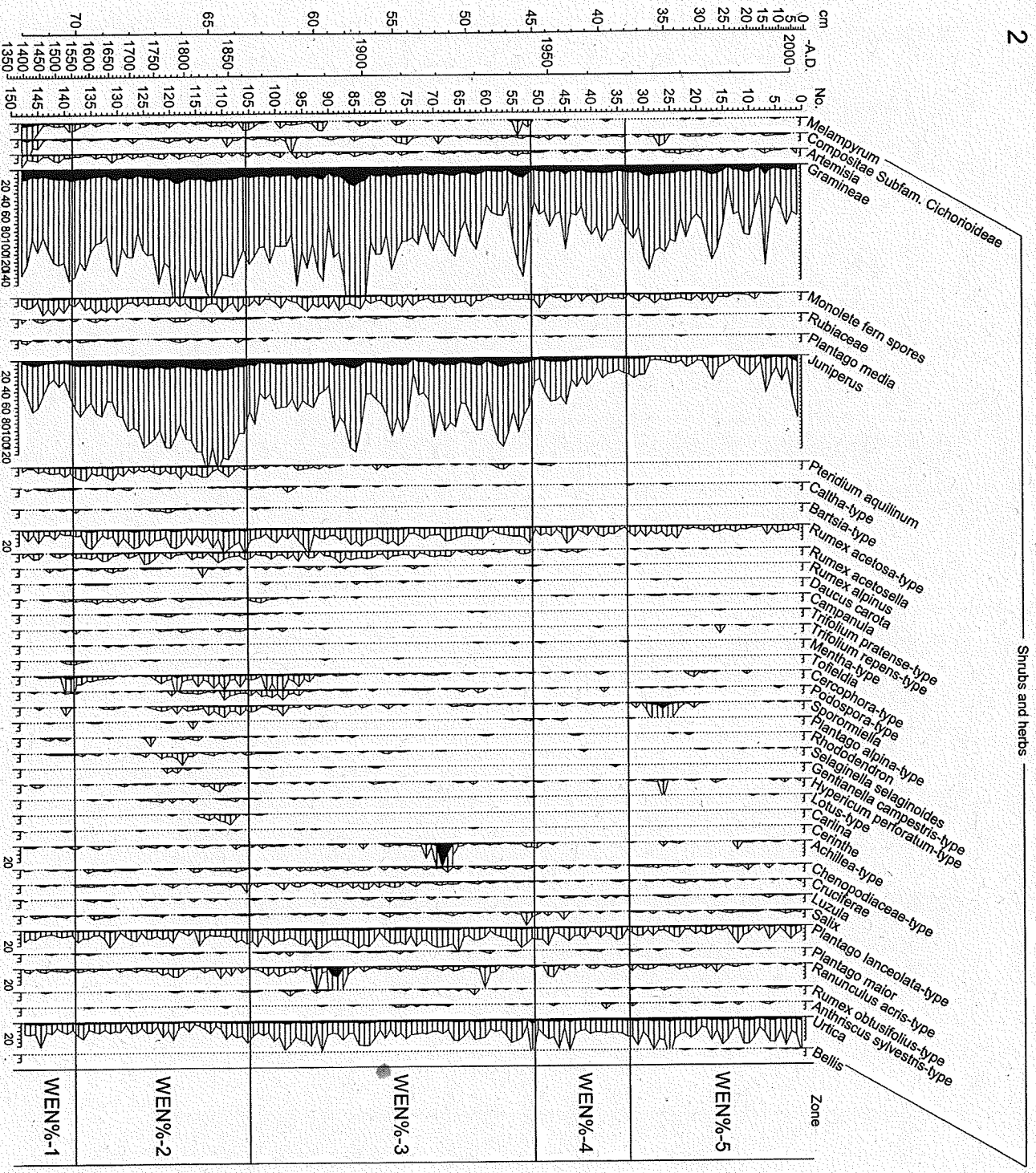


All C14 dates in all peat profiles of PINE project

Pollen diagrams from **Wengerkopf** (Lungau, Land Salzburg, Austria)

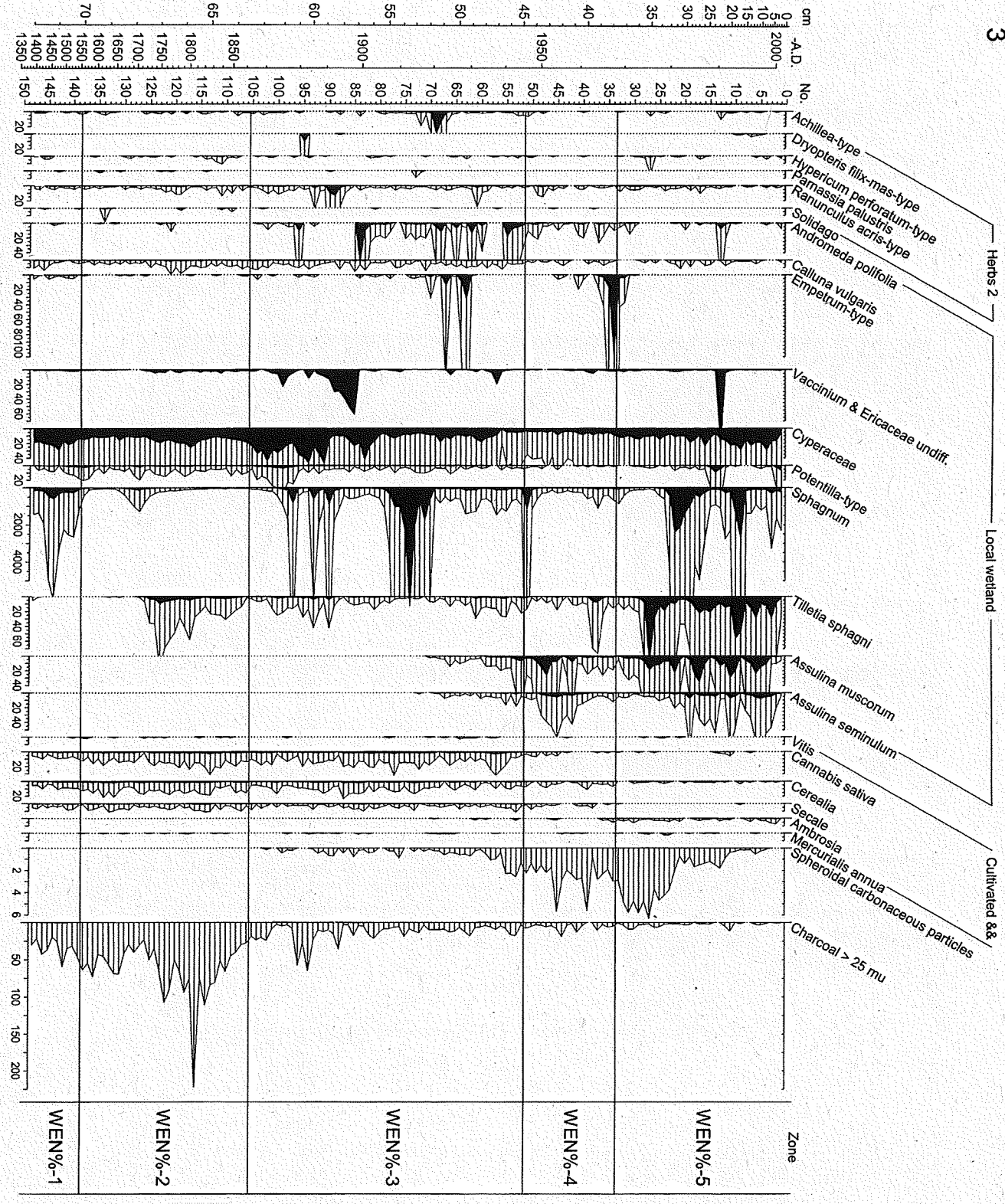


Wengerkopf pollen percentage diagram. Analysis Jacqueline van Leeuwen. **(1)**: Trees.
Pollen groups shown above: ***Long-distance trees*** do not grow in the region of Lungau today.
Regional trees do grow in Lungau today, mostly below ca. 1200 m altitude in a transitional zone between the cultural fields at the valley bottom and the spruce forests on the slopes.
Extra-local trees grow today near the pollen site on Wengerkopf.



Wengerkopf pollen percentage diagram (**2**): Shrubs and herbs.

The shown ***Shrubs and herbs*** (and some fungi) grow all in Lungau, most of them (but not all) close to the pollen site on Wengerkopf.



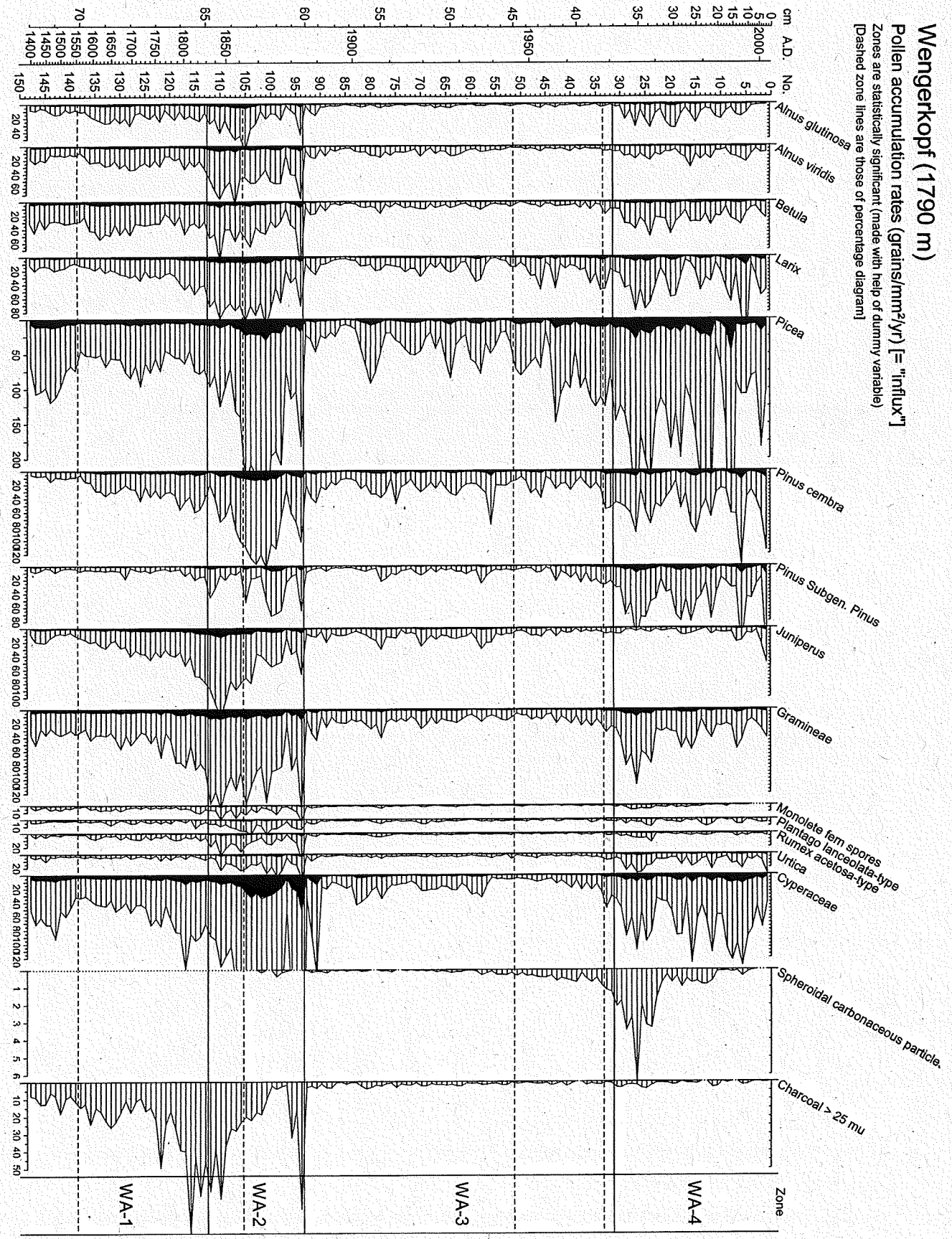
Wengerkopf pollen percentage diagram (**3**): Local plants; Cultivated plants; Not-plants.
Pollen groups shown above:

Herbs 2 are some of those that have occasional pollen peaks: a flower in the pollen sample?

Local wetland plants (and animals) grow (or grew) on the peat hummock sampled for pollen.

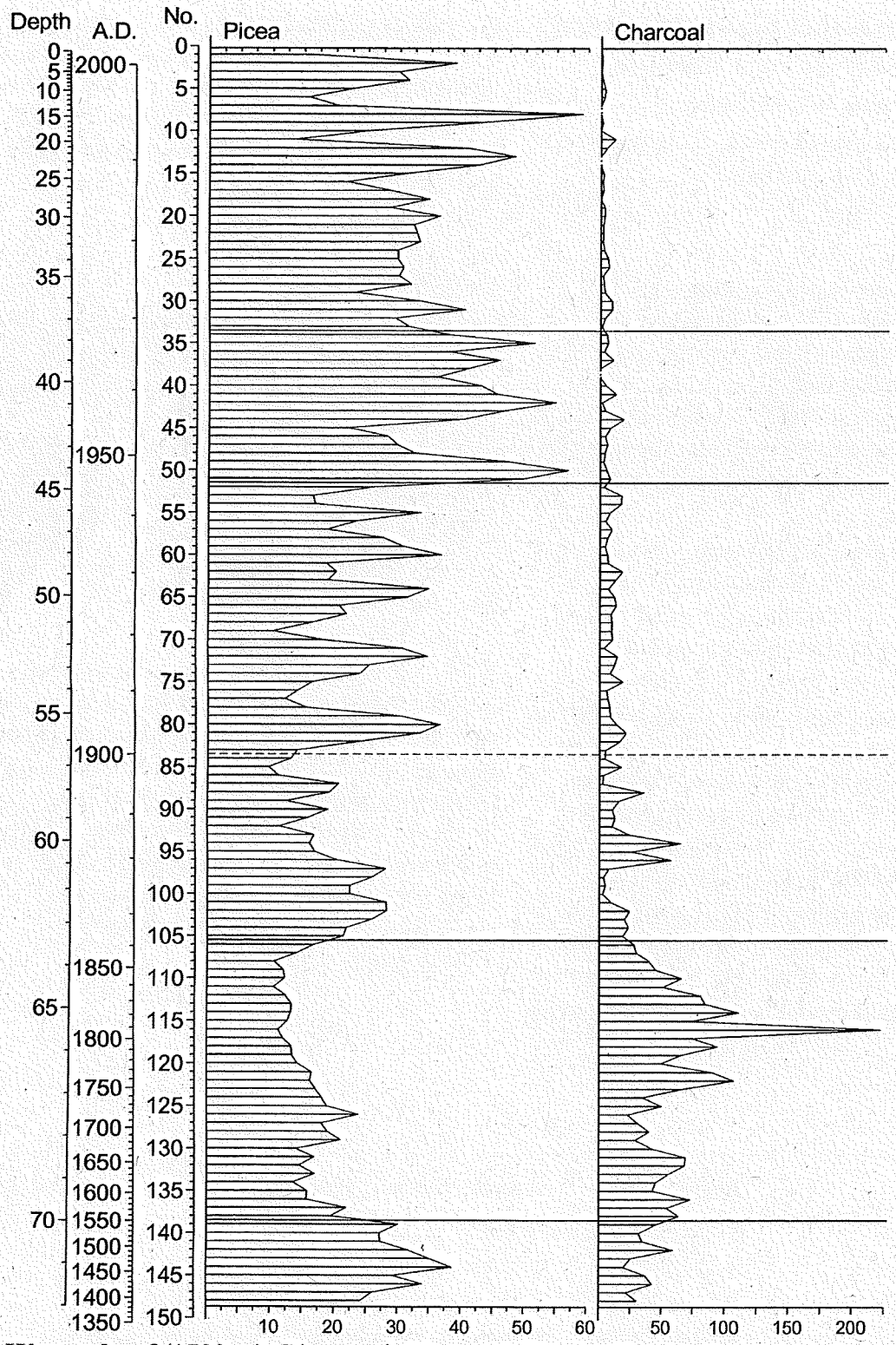
Cultivated && all concern plants from lower elevations, partly even outside Lungau.

S.P.C. (Spheroidal carbonaceous particles) is regional, **Charcoal** may in part be local.



Wengerkopf (Lungau, Land Salzburg, Austria): pollen influx diagram.

Pollen accumulation rates (informally called ***influx***) are shown above.
Compare this with the percentage diagram and notice the difference; do you see a problem?



Wengerkopf (1790 m). ***Picea*** and **Charcoal** (% of pollen sum).

AD 1900–2002: ***Picea*** pollen percentages have large fluctuations, which reflect good and bad flowering years.

AD 1350–1900: ***Picea*** pollen percentages and microscopic **charcoal** percentages seem to correlate negatively. We infer that *Picea* was used for charcoal production, very much needed for various industries.

We should now be able to answer the following question:

Why was in Lungau especially *Picea* been used for charcoal production?

Resumed peat growth in high-altitude mires across the Alps and the Jura Mountains during the 19th and 20th centuries

Per Sjögren, W.O. van der Knaap, Jacqueline F.N. van Leeuwen, Maja Andrič

Manuscript in revision

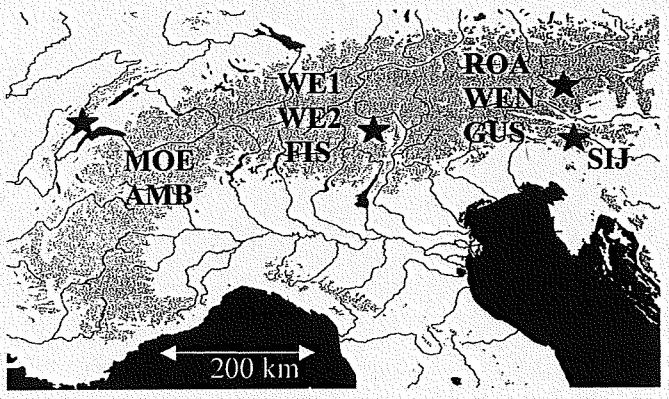
Wetlands have been severely reduced or changed by human activities (drainage, ploughing, peat-cutting) and very few natural mires remains in central Europe today. Relatively remote high-altitude mires are thus of great ecological value, but findings suggest that also these have been or are severely affected by human activities.

The upper peat layers of nine small mires across the Alps and the Jura Mountains have been analysed, dated, and compared in order to find common trends and effects in the recent development (c. 200 years) of the mires.

Ash content and dry bulk density measurements consistently show a peak in decomposition and minerogenic concentration close to the mire surface. Pollen and spore content suggest that high grazing pressure and trampling are the most probable cause of the observed pattern.

Two phases of re-initiated peat growth can be observed, one in the Jura Mountains and central parts of the Alps around the mid 20th century (AD 1940-60), and one in the eastern Alps in the early and mid 19th century (AD 1820-70).

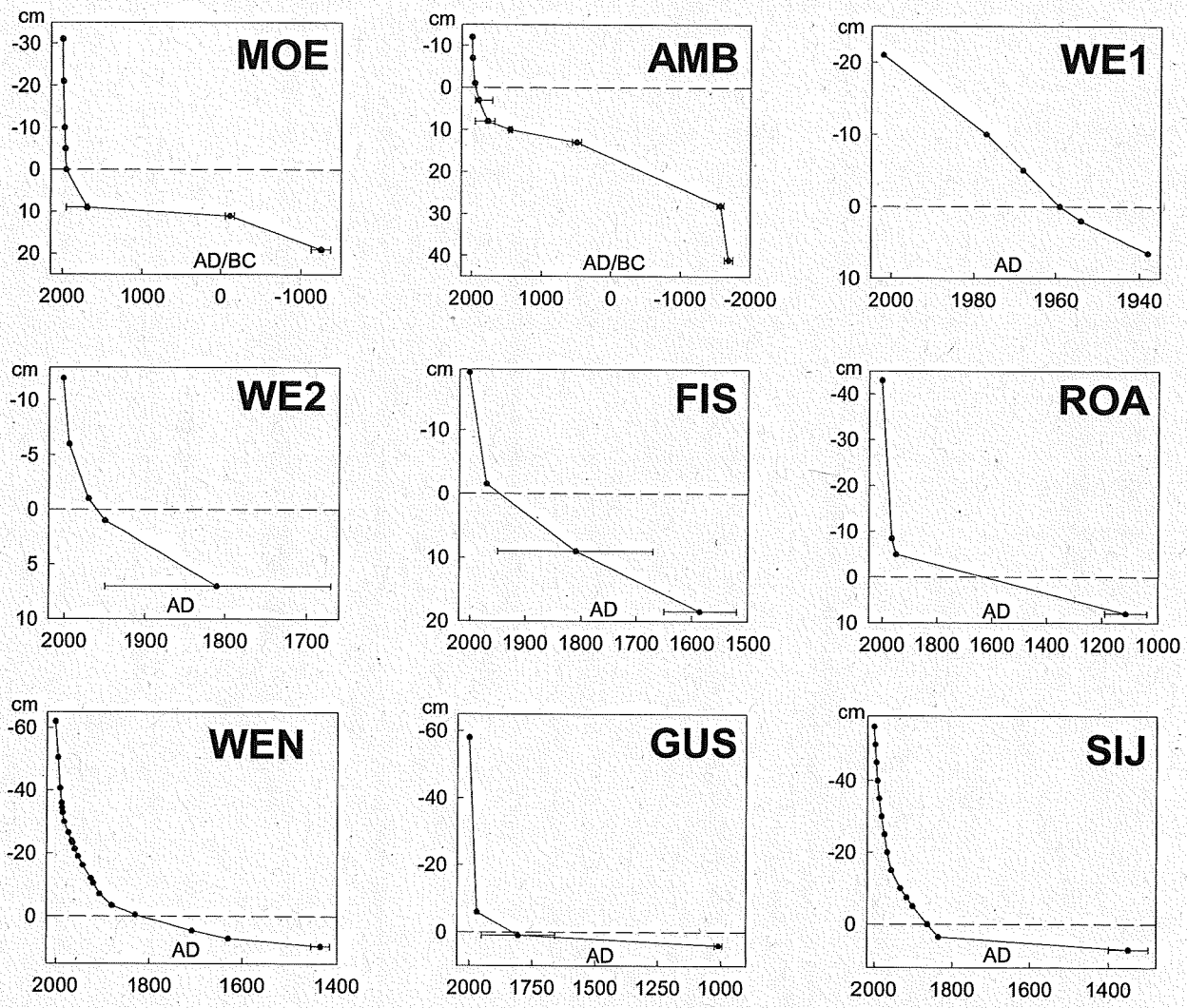
As a result of grazing slow and uneven peat accumulation is common in deposits that cover the past 2000 years. This should be taken into consideration in planning the sampling strategy for palaeoecological or palaeoclimatological investigations.



Many high-altitude mires are or have been heavily damaged by grazing. Fast peat growth is initiated locally soon after the grazing regime falls below a critical level, and the mires will return into a natural state with time, unless invaded by wooded species. Most high-altitude mires are not in a stable state, which must be taken into consideration when evaluating ecological functions, values and future development.

Sites:

Code	Site name	Region	Altitude	Surface vegetation	Mire size	Edge distance
MOE	Le Moé	Swiss Jura Mnts	1300 m	Sphagnum lawn	12 ha	20 m
AMB	Les Amburnex	Swiss Jura Mnts	1370 m	Sphagnum lawn	0.1 ha	15 m
WE1	Weissbrunnalm 1	Ultental, S Tyrol	2070 m	Sphagnum hummock	1.5 ha	10 m
WE2	Weissbrunnalm 2	Ultental, S Tyrol	2070 m	Sphagnum lawn	1.5 ha	6 m
FIS	Fischersee	Ultental, S Tyrol	2060 m	Sphagnum hummock	0.5 ha	12 m
ROA	Rosaninalm	Lungau, Austria	1830 m	Sphagnum hummock	0.5 ha	17 m
WEN	Wengerkopf	Lungau, Austria	1790 m	Sphagnum hummock	0.25 ha	12 m
GUS	Gr. Überling Schattseit-M.	Lungau, Austria	1750 m	Sphagnum hummock	12 ha	100 m
SIJ	Šijec	Pokljuka, Slovenia	1200 m	Sphagnum hummock	16 ha	60 m

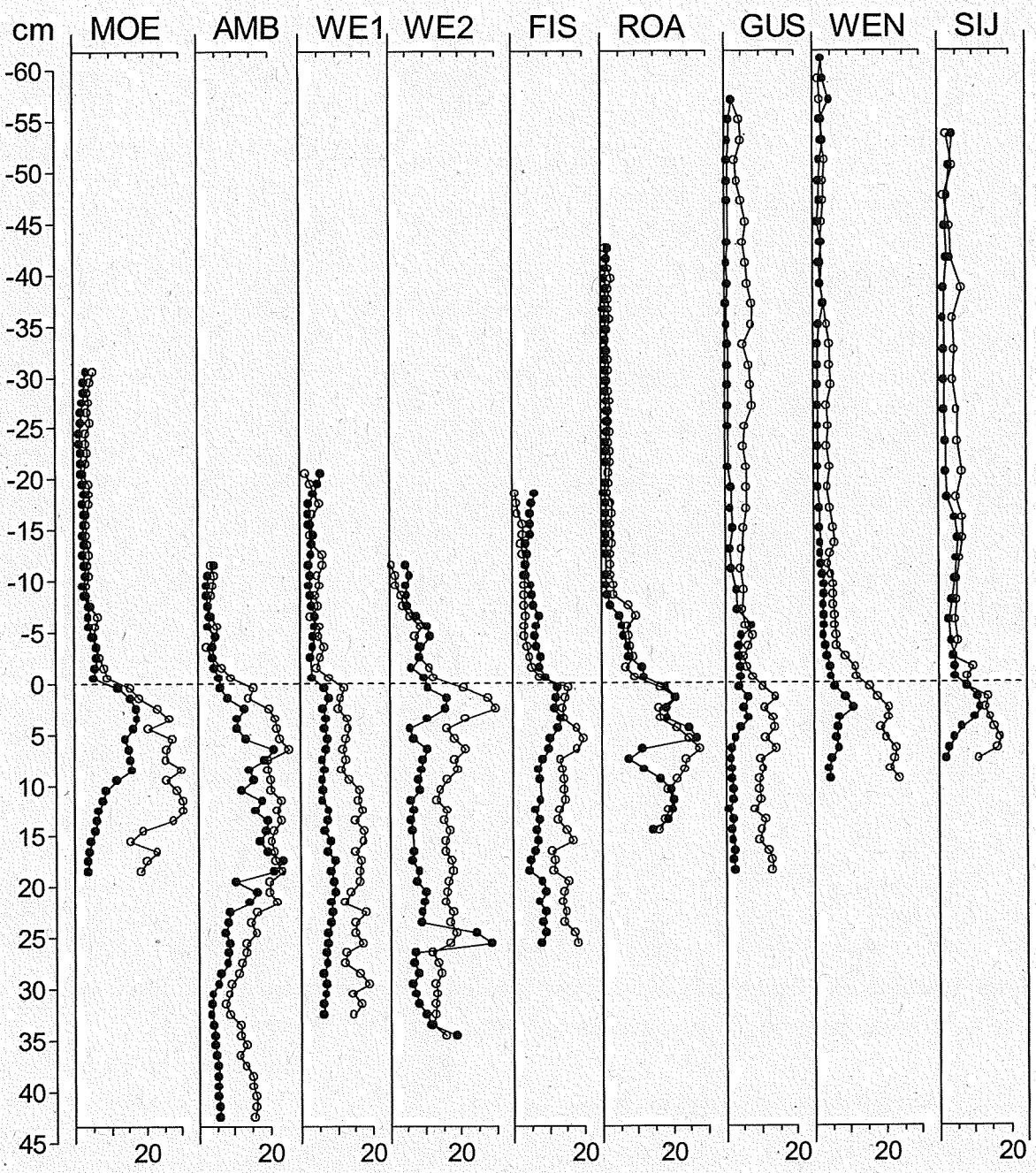


Depth-age relationships are shown above. Dashed line is transition from decomposed to more well-preserved peat; depth is relative to this transition.

General pattern and layers (see figure on next page):

Layer	Lower limit	Upper limit	Ash %	Dry bulk density	Description	Peat accumulation
5	-3 to -8 cm	-12 to -61 cm	Very low	Very low	Loose Sphagnum	Fast
4	0	-3 to -8 cm	Low	Low	*Sphagnum*	Fast
3	3 to 10 cm	0	High	High	Decomposed, dust	Intermediate
2	5 to 20 cm	3 to 10 cm	Low	High	Decomposed, compacted	Slow
1	-	5 to 20 cm	Low	Low	Rather decomposed	(Intermediate)

The clearest pattern noted in the peat stratigraphy of small high-altitude mires across the Jura Mountains and the Alps is the occurrence of decomposed peat close to the mire surface (Layer 2 and 3; high dry bulk density, low peat accumulation rate, high pollen concentration). In the upper part of the decomposed peat an increased minerogenic influx is observed (Layer 3; high ash content). Below the decomposed peat "normal" moderately decomposed peat occur (Layer 1), and above it well-preserved fast-growing *Sphagnum* peat (Layer 4 and 5).



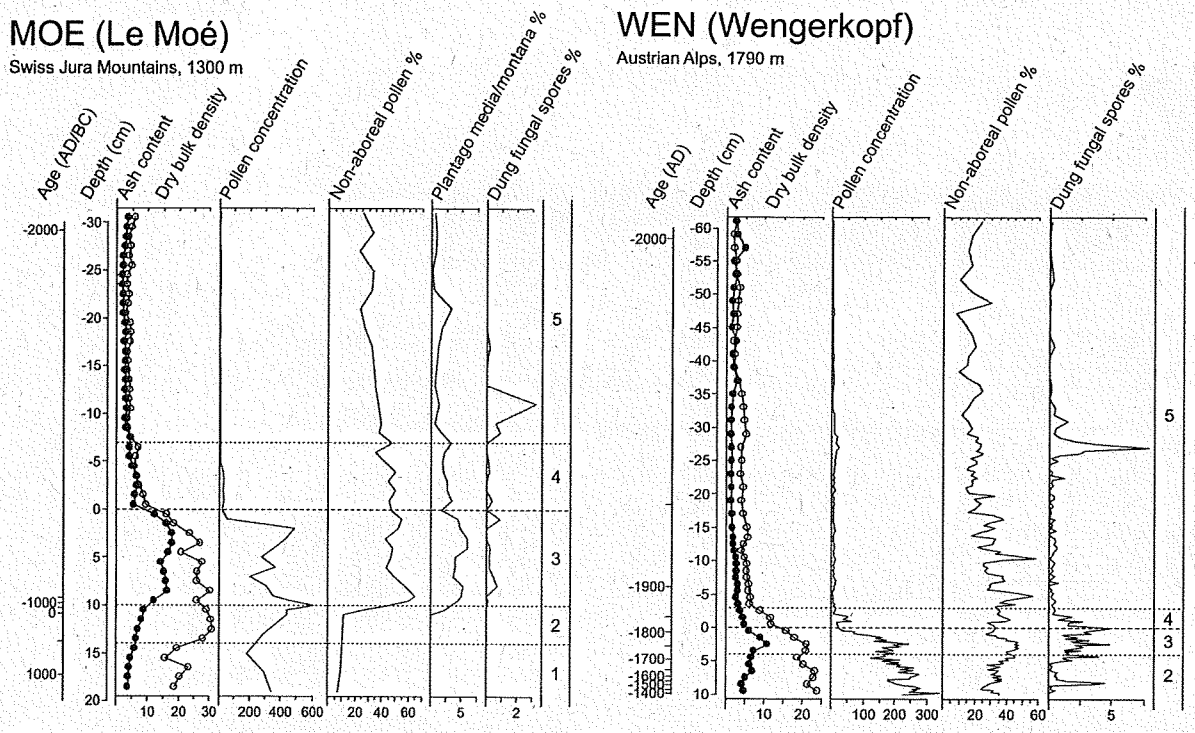
Dry weight (dry bulk density); ***Loss-on-ignition*** (ash content).

Comparison between sites of ash percentage (● dots) and dry bulk density (o circles).

The transition from decomposed to more well-preserved peat is marked with a dashed line.

Depth is relative to this line and the lowest negative depth constitutes the peat surface.

Past vegetation:



There seem to be two phases of re-initiated peat growth, one in the early and middle 19th century (c. AD 1820-1870), and another in the middle 20th century (c. AD 1940-1960).

Historically the strongest grazing pressure in the region occurred around the end of the 19th century (Bätzing 2003), a time period where no initiation of peat growth is recorded.

Large hummocks that were established before the period of grazing maxima may have been protected from trampling by their own size and by *Juniperus* and other shrubs growing in the hummock.

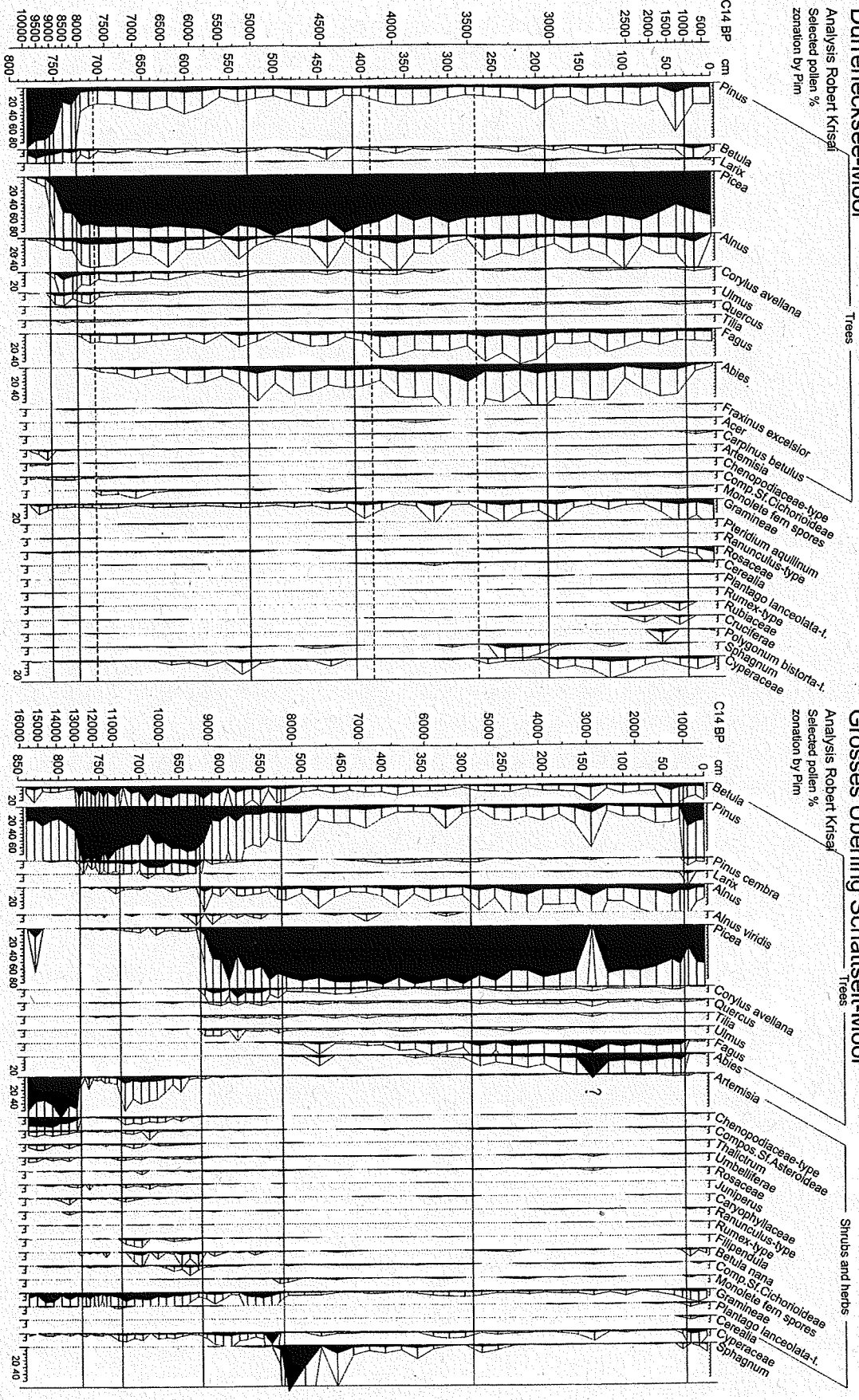
Krisai, Robert, Burgstaller, B., Ehmer-Künkele, U., Schiffer, R. & Wurm, E., 1991 (appeared 1993):

Die Moore des Ost-Lungaues – Heutige Vegetation, Entstehung, Waldgeschichte ihrer Umgebung. Sauteria 5: 1-240. 8 maps. Institut für Botanik, Salzburg.

On the next page follow short pollen diagrams of two mires made by Robert Krisai. We may pass one or both mires during the excursion, if the weather allows this rather long walk. The following two quotations from the book testify the value of the mires.

From Page 203: "Das Große Überling-Schattseit-Moor is mit ca. 10 ha eines der Größten des Gebietes; es gehört wol zu den Schönsten Latschenhochmooren der Ostalpen."

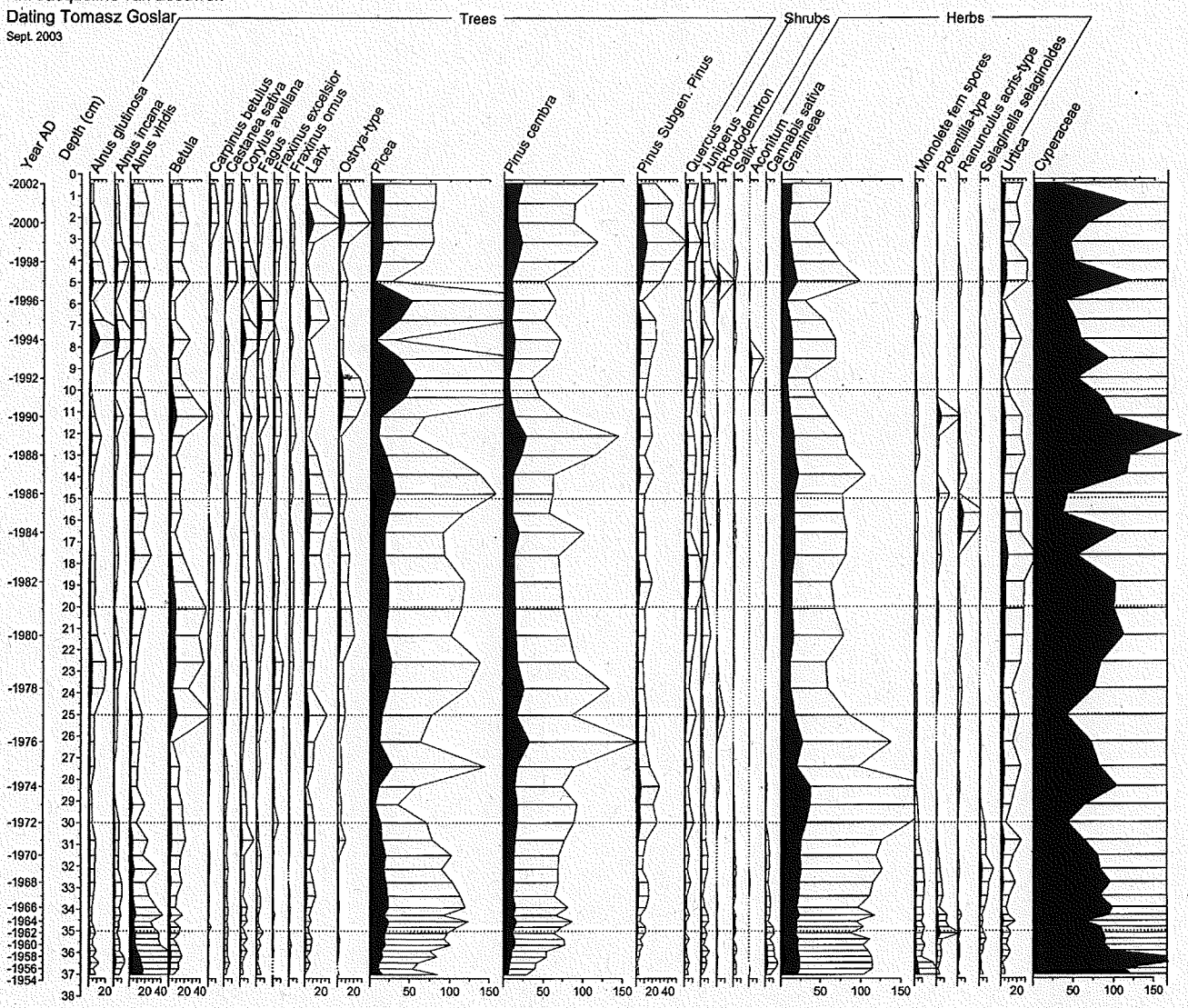
From Page 204: „Auch die Mulde des Dürrenecksees gehört zu den landschaftlichen Kleinodien des Gebietes."



Pollen diagrams of two sites in Lungau near Wengerkopf, analyzed by Robert Krisai. See EPD for details.

Rosaninsee (2050 m), Lungau, Austria

An. Jacqueline van Leeuwen
Dating Tomasz Goslar
Sept. 2003



Rosaninsee is a lake above the actual forest limit formed by *Pinus cembra*, with much *Larix* and some *Picea* admixed, and few patches of *Pinus mugo* on slopes. The pollen diagram is made from a *Sphagnum fuscum* hummock in a wet fen with very little peat formation. The base of the *Sphagnum fuscum* plants is dated to AD 1972.

The vegetation of the mires around Rosaninsee were investigated in 1976 by Krisai & Peer (1980):

Krisai R & Peer T 1980. Vegetationskundlich-ökologische Untersuchungen an drei Ostalpenmooren. In: Abel E & Maier R (Eds) Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich 118/119: 38–73.

END OF LUNGAU