A 3474-year alpine tree-ring record from the Dachstein, Austria

Michael Grabner 1, Rupert Wimmer 1, Wolfgang Gindl 2, and Kurt Nicolussi 2

grabner@mail.boku.ac.at
1: Universität für Bodenkultur Wien, Institute of Botany, Vienna, Austria
2: Universität für Bodenkultur Wien, Institute of Wood Science and Technology, Vienna, Austria
3: University of Innsbruck, Institute of High Mountain Research, Alpine Agriculture and Forestry, Innsbruck, Austria

Introduction

Regional multimillennial chronologies are important sources for the study of environmental fluctuations and trends, as e.g. demonstrated in Finland with *Pinus sylvestris* (Zetterberg *et al.* 1996). Such chronologies have been scarcely available from the alpine region due to difficulties and low availability of samples other than from standing trees. This poster presents the successful establishment of a multimillennial tree-ring chronology from the Dachstein area by means of intensive sampling in a high-elevation alpine lake.

Material and Methods

The Dachstein group is a triassic limestone formation of the northern rim of the Alps, with strong karst topology, high elevations (highest peak 2995 m a.s.l.) and plateau characteristics. Intensive coring of living and dead trees on the Dachstein plateau, about 1700 m a.s.l., close to the treeline, revealed robust 800-year long standard chronologies (Gindl *et al.* 1998).

Local contacts (F. Mandl, pers. communication) has led us to the small alpine lake "Schwarzer See" (47N35, 13E50, 1450 m a.s.l.). This small crater lake was surrounded by steep rocky slopes and cliffs. Dead and broken trees have dropped off and slid downwards into the lake, where they have been preserved. During a two-week campaign in summer 1999 a team of professional divers recruited through the Austrian military and dendrochronologists recovered trees from underwater to cut off disks, and returned the trees back into the water after sampling. In total, 211 trees were successfully recovered and sampled. The collection of samples represents the actual mixture of tree species growing currently in the area. Overall, 66% of the samples were Norway spruce (*Picea abies*), 21% larch (*Larix decidua*) and 13% Stone pine (*Pinus cembra*). In addition to the underwater sampling, cores were taken from live trees around the lake. All samples were dried, properly sanded and measured using linear measuring table, connected to a PC (Lintab/TSAP).

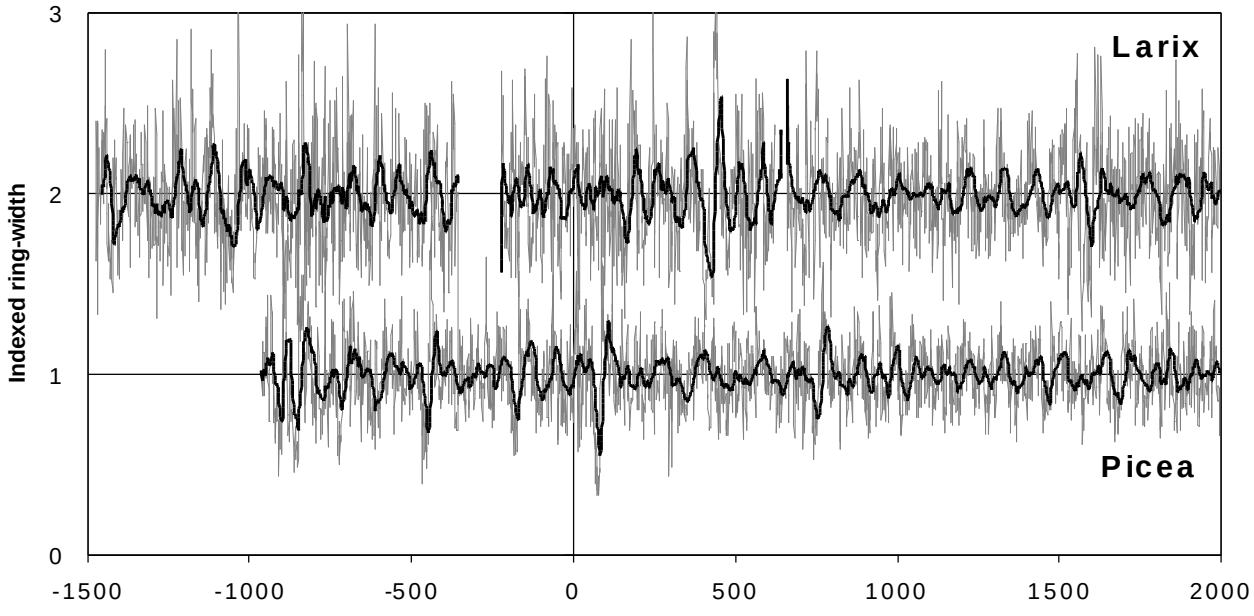

Fig. 1: Spruce and larch chronology from the Dachstein (Austria), both covering 3474 years of tree growth.

In: Kaennel Dobbertin M., Bräker O.U. (editors), 2001. International Conference Tree Rings and People. Davos, 22-26 September 2001, Abstracts. Birmensdorf, Swiss Federal Research Institute WSL.

Results

The average number of rings of the sampled underwater trees was 189 for spruce, 277 for larch and 226 for stone pine. The oldest spruce disk had 475 rings, the maximum age of larch was 718 years. Samples were crossdated with standard methods resulting in a 1500-year absolute spruce chronology and a 1200-year larch chronology. The crossdating also gave a number of floating chronologies, each of them gaping several centuries. Due to poor crossdating stone pine was not included at this stage of the project. The absolute as well as the floating chronologies were then compared and cross-correlated with regional standard larch and stone pine chronologies from Tyrol and the Swiss Alps (e.g. Nicolussi and Lumassegger 1998) which resulted in a 3474-year long spruce/larch chronology (Fig. 1). This composite chronology is solely built with samples from the Dachstein region.

Conclusion

Intensive sampling of standing trees on the Dachstein plateau and of trees preserved underwater in an alpine lake has led to several long chronologies, which were eventually combined to a continuous 3474-year tree-ring record through crossdating with standard curves from Tyrol and Switzerland. The next step will be to further improve and extend this chronology by sampling additional alpine lakes and sites in the Dachstein region. Since all the trees are well defined in terms of their growing site a high potential for long-term climate reconstructions is anticipated.

References

Gindl W., Strumia G., Grabner M., Wimmer R. 1998. Dendroklimatologische Rekonstruktion der Sommertemperatur am östlichen Dachsteinplateau während der letzten 800 Jahre. Mitt. ANISA 19: 24-28.

Nicolussi K., Lumassegger G. 1998. Tree-ring growth of *Pinus cembra* at the timberline in the central Eastern Alps: preliminary results. *Institut für Hochgebirgsforschung - Jahresbericht* 1997: 48-53.

Zetterberg P., Eronen M., Lindholm M. 1996. Construction of a 7500-year tree-ring record for Scots pine (*Pinus sylvestris* L.) in northern Fennoscandia and its application to growth variation and palaeoclimatic studies. In Spiecker H., Mielikainen K., Kohl M., and Skovsgaard J.P., eds., *Growth Trends in European Forests*. *European Forest Institute Research Report* 5: 7-18.

Editorial Keywords

long time series, water-logged wood, subfossil logs, alpine lake, Picea abies, Larix decidua, Pinus cembra, Dachstein, Alps, Austria

http://www.wsl.ch/forest/dendro2001/abstracts/ext196.pdf
Extended abstract number 196
Last update: 26 July 2001 / mk+oub