

**PROBLEME DER MITTELEUROPÄISCHEN
DENDROCHRONOLOGIE**

Dendrochronological investigations in Slovenia

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Introduction

In Slovenia until recently there has been no systematic approach to establish long-term continuous tree-ring series to be used as a dating tool. The country was considered a dendrochronological "white spot". Encouraged by the *Department of Archaeology - Faculty of Sciences and Arts, the Restoration Centre, the Foundation for Protection of the Natural and the Cultural Inheritance, and the Scientific Research Centre of the Slovene Academy of Sciences and Arts* we started in 1993 a three year project *Establishing dendrochronology in Slovenia*. At the same time a dendrochronological laboratory was established at *the Department of Wood Science and Technology of the Biotechnical Faculty*. The work of this first project has been continued by a current *project Dendrochronological research in Slovenia*. Both projects were funded by the Ministry of Science and Technology of the Republic Slovenia and supported by organisations who encouraged us to start the project.

The present state of research

Due to its geographical position (Fig. 1) Slovenia is characterised by large geographic, climatic, orographic and geological diversity with many biogeographically and ecologically different regional units.

When a new dendrochronological laboratory was established, no reference chronologies existed nor was there any knowledge on the possibilities to teleconnect them with those from neighbouring countries. There was also no information on cross-dating of different species. Among the most frequent and important tree species now and in the past are silver fir *Abies alba* Mill., larch *Larix decidua* Mill., Norway spruce *Picea abies* Karst., and oaks *Quercus petraea* Liebl. and *Q. robur* L.

The first chronologies were based on wood from living trees from different species and sites in Slovenia. Investigations of historic buildings, mostly in co-operation with the Restoration Centre, enabled us to prolong them and to use them for dating (ČUFAR - LEVANIČ 1998; LEVANIČ - ČUFAR 1995, 1998; LEVANIČ et al. 1997). At the same time started the investigation of timbers from Eneolithic pile dwellings in the Ljubljana Moor and collecting of subfossil stems (ČUFAR - LEVANIČ - VELUŠČEK 1997, 1998).

The silver fir *Abies alba* Mill. was most frequently investigated. Its Slovene regional chronology is 492 years long and covers the period from 1505-1996. The chronology of the larch *Larix decidua* Mill. covers the periods from 1380-1997. The cross-matching of fir and larch from Slovenia with those from other European regions was possible. For both species we also constructed several historic chronologies and the likelihood to prolong both references is good.

The chronologies of the Norway spruce *Picea abies* Karst. and oaks - sessile oak *Q. petraea* (Matt.) Liebl. and the common European oak *Q. robur* L. - are only up to 300 years long. The tree-ring patterns of spruce and oak showed great variability within Slovenia and no statistically significant similarity with those from other European regions. The investigations of both species continue. By investigating historic objects we constructed several floating chronologies which until now remained undated.

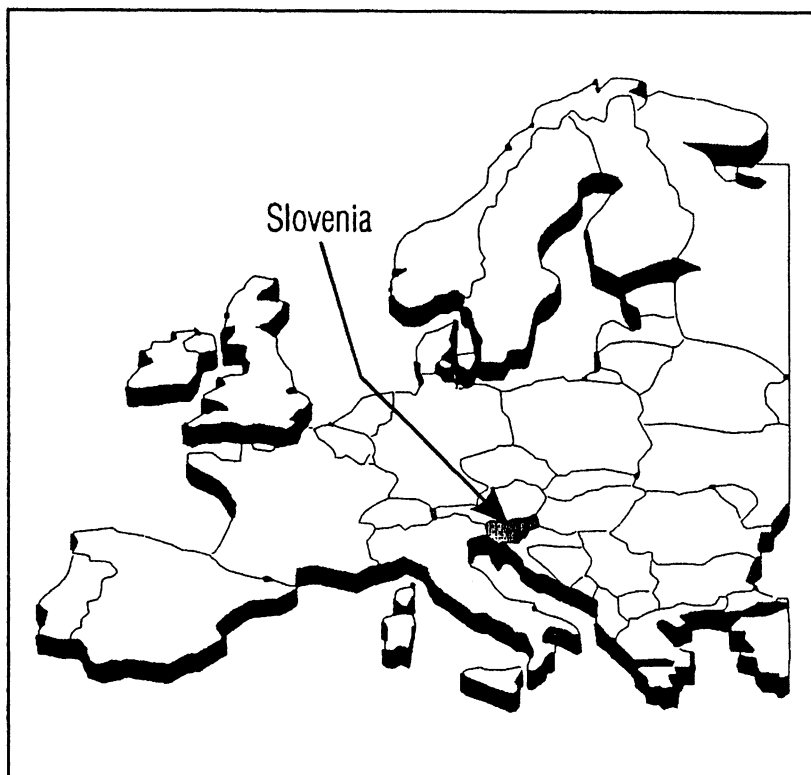


Fig. 1. Geographical position of Slovenia.

We also investigated several accidentally found subfossil oak stems from the Ljubljana Moor and in the rivers beds of Ljubljanica, Drava, and Mura. Their tree-ring series have not been dated yet and their frequency does not seem to enable us to construct a chronology.

In co-operation with the *Institute of Archaeology of the Scientific Research Centre of the Slovene Academy of Sciences and Arts* we investigated the timbers from six Eneolithic pile dwellings from the Ljubljana Moor (Fig. 2). Most frequent species in the dwellings are oak *Quercus* sp., ash sp. *Fraxinus* sp., alder *Alnus* sp., and maple *Acer* sp. (Tab. 1). For dendrochronological research oak and ash were selected. Silver fir *Abies alba* Mill. and beech *Fagus sylvatica* L. were investigated only when present in sufficient amounts. Until now we constructed 12 chronologies (Tab. 2).

Tab. 1. Percentage of wood species in the pile dwellings.

Genus	Hočevarica 1995	Hočevarica 1998	Spodnje Mostišče	Spodnje Mostišče	Založnica	Parte	Parte Iščica
<i>Fraxinus</i>	69	60	23	15	31	62	70
<i>Quercus</i>	15	16	60	53	3	33	2
<i>Alnus</i>	5	11	7	1	3	4	9
<i>Acer</i>	2	2	9	31	12	1	3
<i>Abies</i>	8	4			6		1
<i>Fagus</i>					12		7
<i>Populus</i>	1	3			12		3
<i>Carpinus</i>					6		2
<i>Ulmus</i>					12		1
<i>Salix</i>		3			3		1
<i>Corylus</i>		1	1				1

Dendrochronologically documented samples from each of the chronology were sent to *Heidelberger Akademie der Wissenschaften, Radiometrische Altersbestimmung von Wasser und Sedimenten* to be dated by radiocarbon and this analyses continue.

Tab. 2. The floating chronologies from the Eneolithic pile-dwellings in the Ljubljana Moor. (* The dating calculated for the last 1-20 tree-rings of the chronology.)

Pile dwelling	¹⁴ C dating cal BC ($\pm 2\sigma$)*	No. of investigated samples	Wood species for chronology	Length of chronology in years
Založnica		31		
Hočevarica	3679-3373	85	<i>Fraxinus</i>	63
Spodnje Mostišče 1	3535-3325	628	<i>Quercus</i>	91
			<i>Quercus</i>	159
			<i>Fraxinus</i>	95
Spodnje Mostišče 2	3535-3325	52	<i>Quercus</i>	116
Parte	2568-2309 2586-2337	242	<i>Quercus</i>	76
			<i>Fraxinus</i>	92
Parte - Iščica	2847-2557	1275	<i>Fraxinus</i>	136
			<i>Fraxinus</i>	113
			<i>Quercus</i>	78
			<i>Abies</i>	69
			<i>Fagus</i>	105

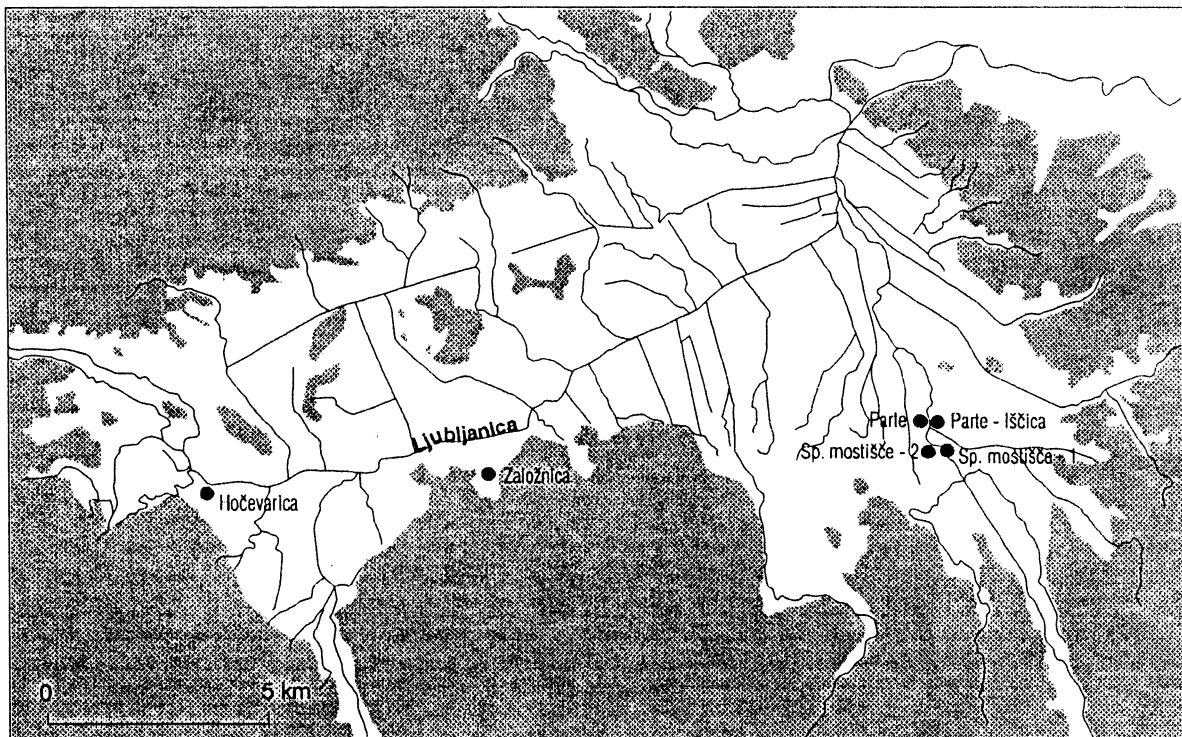


Fig. 2. Location of Eneolithic pile dwellings in the Ljubljana Moor selected for dendrochronological analyses (picture © IZA-ZRC SAZU).

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