

Old wood - new investigations. Dendrochronological results on mining timber from the prehistoric copper mine Kelchalm/Kitzbühel

T. Pichler¹, K. Nicolussi¹, M. Klaunzer² & G. Goldenberg²

¹ Institute of Geography, University of Innsbruck, Innrain 52, A-6020 Innsbruck

² Institute of Archaeology, University of Innsbruck, Langer Weg 11, A-6020 Innsbruck
E-mail: t.pichler@uibk.ac.at

Introduction

Metal mining activities in the Alpine region go back to prehistoric times. The earliest findings derive from the region of Schwaz/Brixlegg in the lower Inn valley, Tyrol, Austria (Fig. 1).

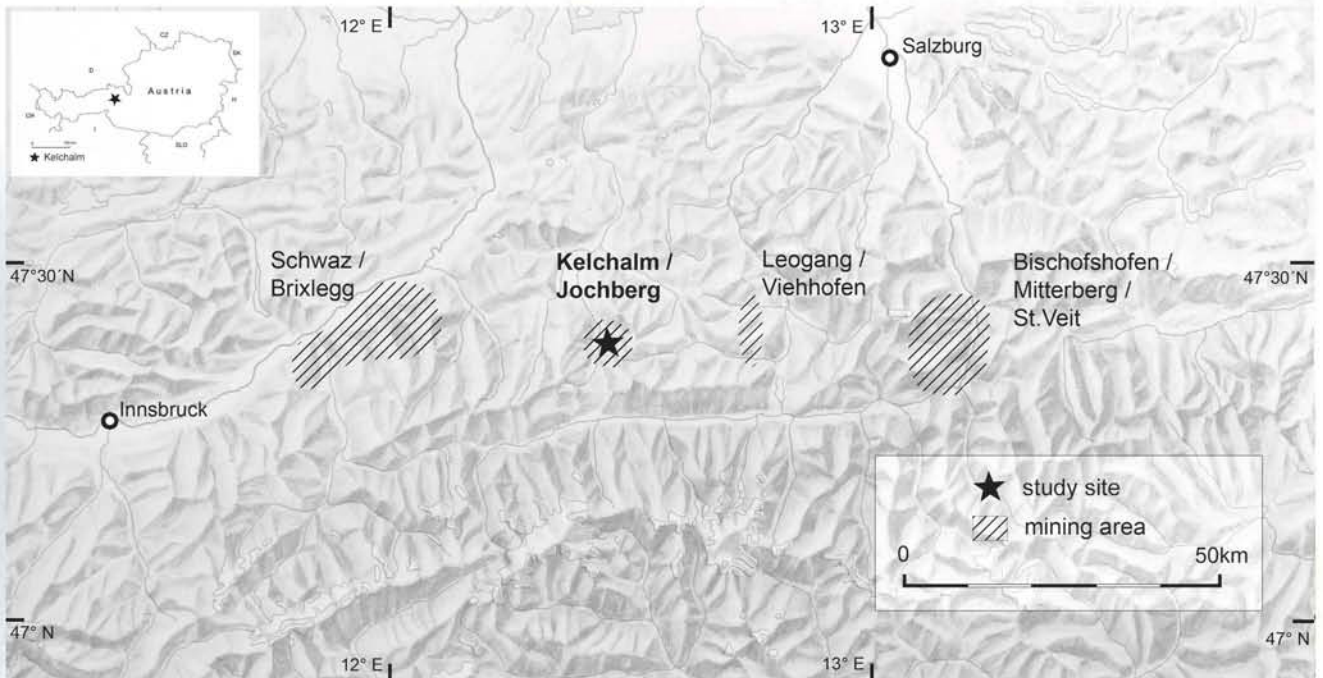


Figure 1: Location of the prehistoric copper-mining areas in the northern part of the Eastern Alps (map: *Alpen Reliefkarte - Tirol Atlas*, Institute of Geography, University of Innsbruck).

Archaeological excavations (1932-1953) proved prehistoric mining even in the region of the Kelchalm (E 12°27', N 47°23'; Fig. 2). Based on the typology of ceramic and metal artefacts found together with wooden objects at the Kelchalm, Richard Pittioni stated, that the mining activities in this region started at the turn of the 2nd to the 1st millennium BC (Pittioni 1968). These wooden artefacts excavated by Richard Pittioni and Ernst Preuschen are stored in the Museum of Kitzbühel. Renewed archaeological excavations at the Kelchalm site were carried out by Michael Klaunzer and his team in 2009. The area of interest, the so-called Scheidehalde 50 (separation heap) is located close to the area, which was investigated by Pittioni and Preuschen already. Besides ceramic artefacts, some stone fragments, several bones, and a huge number of wooden samples (e.g. woodchips) were recovered.

Both, the exhibited wooden remains of the Museum Kitzbühel and the samples derived from the excavation in 2009, were dendrochronologically investigated. Some results of these dendrochronological investigations are published already (Pichler et al. 2009).

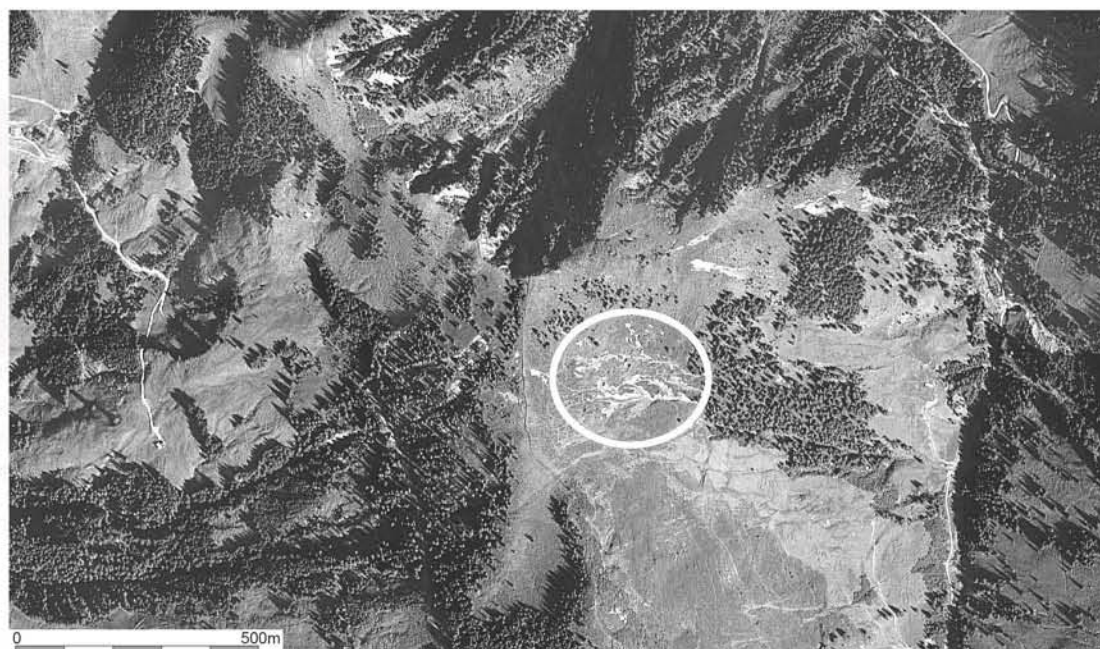


Figure 2: Aerial view of the Kelchalm copper mining site (approx. 1700 m a.s.l.). The dendrochronologically analysed objects originate from the area within the white circle (source: Land Tirol).

The main goal of this study was to date the prehistoric wooden remains from the Kelchalm site, which partially have been excavated 50 years ago. These dendro-dates will enhance the chronological understanding of the development of mining in the Alpine region. Additionally, the species used for the artefacts probably show a specific selection, according to their properties.

Material and Methods

After a screening of the wooden artefacts regarding dendrochronological techniques (e.g. appropriate number of tree-rings, wood wane) tree-ring width (TRW) measurements were carried out on 57 samples (e.g. Fig. 3, Fig. 4). TRW-measurements on the selected artefacts were performed either by means of the LINTAB measuring device or image-analytic methods.

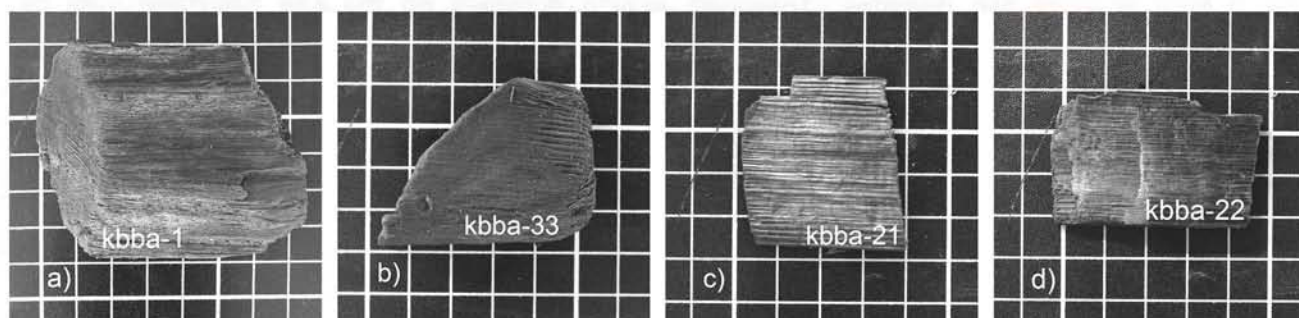


Figure 3: Dendrochronologically analysed woodchips derived from the archaeological excavation of summer 2009. a) chip with 78 measured tree rings, dendro-date 1262 BC; b) chip with 35 measured tree rings, dendro-date 1252 BC; c) chip with 38 measured tree rings, felling date autumn/winter 1243/42 BC; this chip derives from the same log as chip kbba-22; d) chip with 31 measured tree rings, felling date autumn/winter 1243/42 BC (photos: T. Pichler, 2009).

We also determined the tree species and - for samples without pith - extrapolated the pith age. Based on several measured radii per artefact, average curves of each object were established. The Kelchalm sample series were then compared with the Eastern Alpine Conifer Chronology

(Nicolussi et al., 2009) which covers the last 9111 years and consists of samples originating from higher elevations in the Eastern Alps.

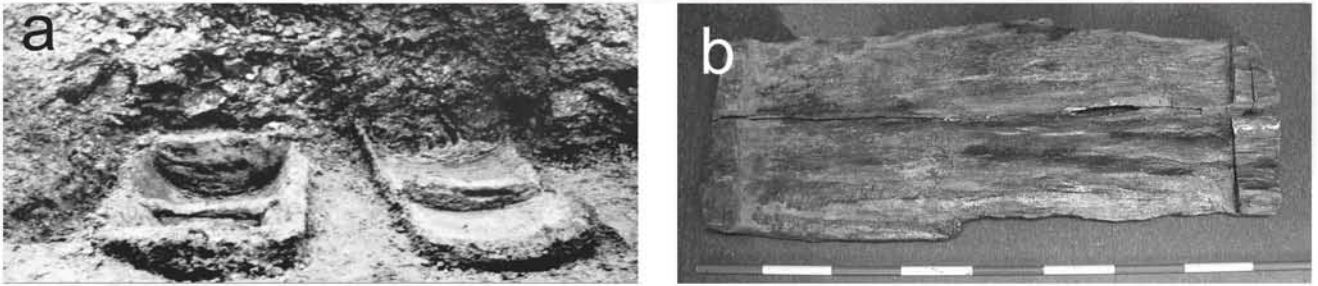


Figure 4: a) The two troughs in situ (photo: R. Pittioni, 1968, p.71). The right one (kbm-1) is dendrochronologically dated. The last measured tree ring marks the year 1245 BC. b) The current state of the analysed trough (kbm-1, inventory number 1547, length = 174 cm) during documentation at the Institute of Geography (photo: T. Pichler, 2007).

Results and Outlook

The dominating species of the artefacts analysed dendrochronologically is spruce (*Picea abies*). Only few samples ($n=3$) such as the bottom part of the trough (Fig. 4) consist of fir timber (*Abies alba*). We think that the prehistoric miners had excellent skills of specific wood properties. They used the most appropriate ones among the wood species available for particular purposes. The wood of silver fir is not resistant to bio-deterioration, but it is well suited for water constructions.

Up to now we have been able to crossdate the tree-ring series of 25 wooden objects, which resulted in a tree-ring record spanning 153 years. These dendrochronologically analysed wooden objects date back to the early Late Bronze Age (Fig. 5). The last measured tree ring of the site chronology dates back into 1237 BC. Five samples showed well preserved wane. Three of these samples indicate felling activity outside the growing period. In detail: One sample (kbba-13) arising from the prehistoric forest show a felling date autumn/winter 1257/56 BC. The felling date in autumn/winter 1243/42 BC of the other two samples (Fig. 3c+d) found at a small place some meters off Scheidehalde 50 is in good agreement. Furthermore, the established TRW-series are highly congruent with each other suggesting that both woodchip samples derive from the same trunk. All in all the tree-ring series associated to these samples including the outermost ring vary over a time span of two decades. Therewith mining activities on the site Kelchalm may be suggested for at least the time span between 1257 and 1237 BC.

According to the results of this study it can be stated:

- i) The copper ore deposits in the Kelchalm region attracted already prehistoric men. Dendrochronological dating results reveal mining activities at this site of at least two decades. Furthermore, the accurate dendro-result dates the Bronze Age mining activities at the Kelchalm to about two centuries earlier than previous assumptions proposed by Richard Pittioni.
- ii) The species of the investigated samples is mainly spruce. In few cases the prehistoric miners used the wood of fir because of its appropriate properties under wet conditions.

The dendrochronological analysis of the timber from the Kelchalm mine contributes new data to the chronological development of prehistoric mining in the Eastern Alps. Further studies and results from this mining area and others in the central Eastern Alps are expected.

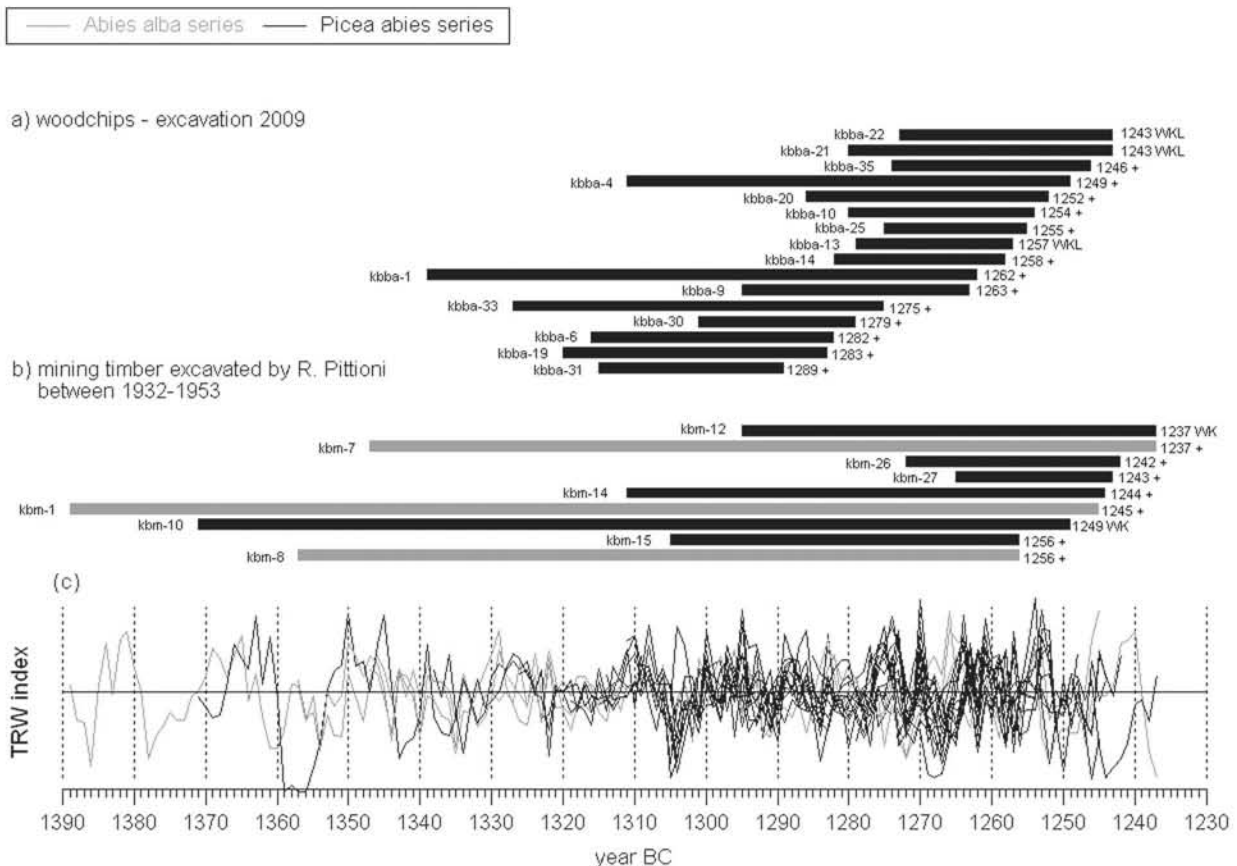


Figure 5: The dendrochronologically dated woodchips (a) excavated during summer 2009 and the wooden artefacts (b) excavated 1932-1953 from the copper mining site Kelchalm: Each bar represents a sample. The length of the bars indicates the length of tree-ring series obtained from the samples. Tree species, sample code, and calendar year of the last ring measured of each series is shown. WKL: terminal ring, logging following autumn/winter; WK: terminal ring present but latewood or earlywood not distinguishable; +: no terminal ring. (c) Synchronised tree-ring series of the dated samples.

Acknowledgements

We thank Dr. Wido Sieberer, director of the Museum of Kitzbühel for cooperation and support of our investigations. This study has been supported by the Austrian Science Fund (P-15828, SFB "HiMAT"-FF3113-G02).

References

- Pichler, T., Nicolussi, K., Goldenberg, G. (2009): Dendrochronological analysis and dating of wooden artefacts from the prehistoric copper mine Kelchalm/Kitzbühel (Austria). *Dendrochronologia* 27, 87-94.
- Pittioni, R. (1968): Der urzeitliche Kupfererzbergbau im Gebiete um Kitzbühel. In: Stadtgemeinde Kitzbühel (ed.): Stadtbuch Kitzbühel II. Vorgeschichte und Bergbau. Innsbruck, 31ff.
- Nicolussi, K., Kaufmann, M., Melvin, T.M., van der Plicht, J., Schießling, P., Thurner, A. (2009): A 9111 year long conifer tree-ring chronology for the European Alps - a base for environmental and climatic investigations. *The Holocene* 19, 909-920.

GFZ

Helmholtz-Zentrum
POTSDAM

HELMHOLTZ-ZENTRUM POTSDAM

**DEUTSCHES
GEOFORSCHUNGSZENTRUM**

TRACE

Tree Rings in Archaeology,
Climatology and Ecology

Volume 9

Proceedings of the
DENDROSYMPOSIUM 2010

April 22nd – 25th, 2010 in
Freiburg, Germany

Edited by:

Marieke van der Maaten-Theunissen,
Heinrich Spiecker, Holger Gärtner,
Ingo Heinrich and Gerhard Helle

Scientific Technical Report STR11/07