

# Calcium-carbonate metasomatized wood and moss in Th-U age-dated spring tufas (Tyrol, Eastern Alps): significance for post-glacial re-forestation.

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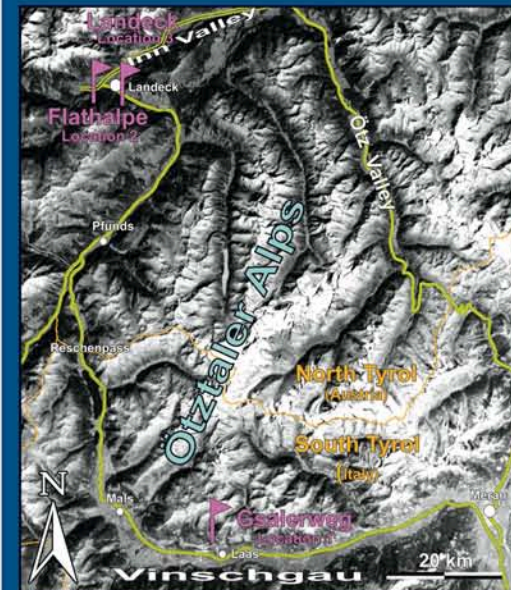


Fig. 1: overview map of Austria with area of investigations

Fig. 2:

## INTRODUCTION:

In the Tyrol, Eastern Alps, at three locations of fossil spring tufas characterized by aragonite, wood fragments and moss that became petrified by calcium-carbonate replacement are present.

Each tufa location is situated on a substrate of metamorphic rocks that, in two cases, is veneered by (reworked) Würmian glacial till. In the field, the petrified wood is of light-yellow to ocre colour, but superficially resembles unmetasomatized wood. Some larger pieces (up to 10 cm in diameter) of petrified wood may record in situ disintegration, because of rotting, into fragments parallel to the wood's graining. In the petrified wood, the cell walls became replaced by micrite whereas the cell lumina are filled by very finely crystalline, lucid cement. In-situ disintegrated larger pieces of petrified wood consist of elongate fragments with a well-preserved structure, sharply separated from patches of microsparite with clotted to „cloudy“ fabric in which the original structure is very poorly, or not at all, preserved. Alternatively, the petrified wood is riddled by pores that became filled by micrite fringes and/or by isopachous fringes of aragonite to calcitized aragonite cement. In moss tufas, the leaves became replaced by micrite whereas the moss stems left moulds that may be open or became filled by carbonate cement. To date, we observed calcified wood and moss only at tufa locations where aragonite is common to abundant. This suggests that calcium-carbonate metasomatism is driven by high degrees of oversaturation.

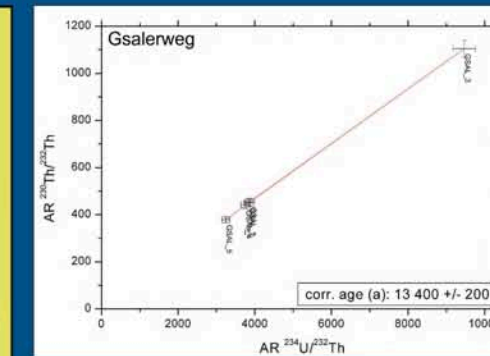
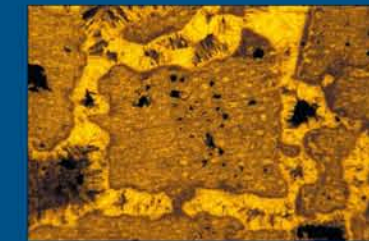
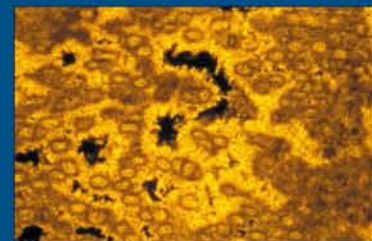
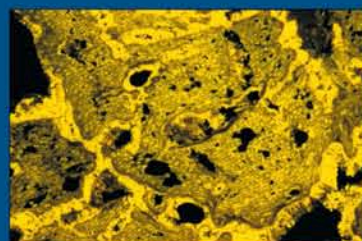
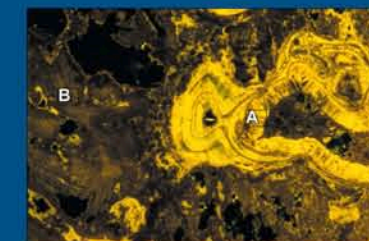
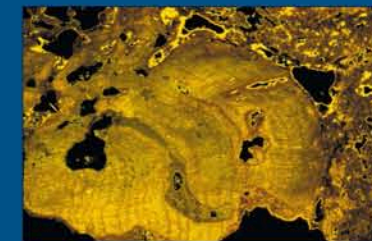


Fig. X: Isochron plot of the tufa from Gsalerweg (location 1)  
AR = activity ratio

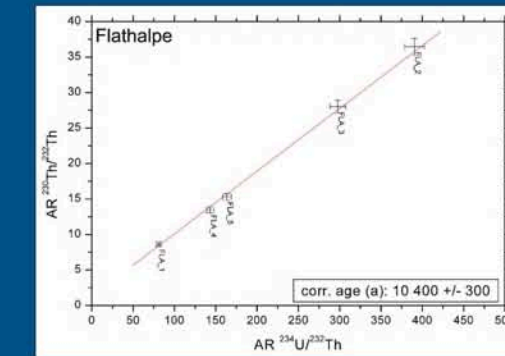


Fig. X: Isochron plot of the tufa from Flathalpe (location 2)  
AR = activity ratio

## <sup>230</sup>Th/<sup>234</sup>U age-dating results:

Th-U age-dating of aragonite cement yields an age of  $13.4 \pm 0.2$  ka bp for tufa location 1 (Gsalerweg). This location is situated on a south-facing, well-lit, intra-Alpine valley slope of exceptional relative aridity, and probably was ice-free and vegetated at that time.

For location 2 (Flathalpe), aragonite cement indicates an age of  $10.4 \pm 0.3$  ka bp. Location 2 is situated on a NW-facing slope of a glacial cirque that contained glacial ice until the terminal Würmian and, probably, during the Egesen.

Location 3 (Landeck) has not been dated.

The age-data indicate that, both, deposition of spring tufas and re-forestation proceeded readily after the Last Glacial Maximum (location 1) and after the Egesen (location 2). This is consistent with post-Würmian re-forestation as documented by other authors in areas nearby (Ötztal valley). Our data indicate that the activity of most tufa locations of the western Eastern Alps was higher during or confined to the Late Glacial to early - middle Holocene. Calcified wood may be more widespread than previously recognized and, if combined with Th-U age data, can provide new clues to deglaciation and vegetation history.