Abstract Book

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north–west and north-east Scottish Highlands where remnants of long-lived ‘Caledonian’ pine woodlands survive. Sites with unusually old trees have been targeted and should overlap with timbers in buildings to create longer chronologies.

The first site studied is Glen Loyne in the north-west Highlands which has the oldest known living pines in Scotland. The environment is harsh and the trees are extremely slow grown. Consequently the cores are difficult to work with due mainly to extreme compression and missing ring problems. However, these problems have been overcome by using multiple cores, by setting high thresholds for accepting matches and by excluding sequences or part-sequences where ring problems cannot be resolved.

A site chronology LOYNEM2 was constructed for the period AD 1459 to 2001 (543 years). It comprises 11 trees represented by 26 cored radii. This chronology considerably extends pine coverage for Scotland, with the previous longest chronology being for Coulin, AD 1671-1978, 308 years (one of several Scottish pine chronologies made by Hughes & Schweingruber in the 1980s). LOYNEM2 matches most of these Hughes & Schweingruber chronologies and so is externally verified for the period AD 1671-1978. Internal replication of the Loyne chronology is good and even though the 15th to early 16th century portion is represented by just one very old tree, it has three matching radii.

The next study site will be Ballochbuie in the north-east highlands where conditions are better for pine growth. Cores borrowed from a previous study by the Macaulay Institute have age estimates up to 418 years and there is potential for a chronology back to circa AD 1590. This will complement the historic buildings timbers and should allow a long chronology to be established for this region. The Ballochbuie cores will be analysed this year, and a third site will be addressed next year.

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A Holocene tree-line record from the Central Eastern Alps, based on the dendrochronological analysis of living trees and subfossil logs

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The altitude of the Alpine tree-line has often been used as proxy for the climatic conditions in the Holocene epoch. The usual approach for establishing a record for this proxy is the analysis of pollen and macro remains. We analysed living trees and subfossil logs from the timberline eco-tone in the innermost Kauner valley in the Central Eastern Alps in order to assemble a Holocene dendrochronological tree-line record. Data sets comprising age and height of living Stone Pines (*Pinus cembra* L.) were collected at one site. Sections of 170 subfossil Stone Pine logs from five other sites were dendrochronologically analysed and dated. Besides using dendrochronological analyses, radiocarbon dating served as a means of obtaining the age of some logs. For most of the samples we could provide dendrochronological dates (1-year dating precision, back to 5125 B.C.) or wiggle matching dates (between approx. 7100 and 5040 B.C., dating precision with 95% probability: ± 7 years).

In the first half of the 19th century the tree-line was located at about 2180 m a.s.l. in the innermost Kauner valley. After approximately A.D. 1860 the altitude of the upper limit of the occurrence of *Pinus cembra* individuals (tree-species-line) and, being closely linked, also that of the tree-line both rose. The current tree-line (trees > 2 m) is located at 2245 m a.s.l. at the site investigated. Additionally we observed saplings up to a present (A.D. 2000) tree-species-line at approx. 2370 m a.s.l. The dendrochronologically analysed sub-
fossil logs found at up to 2410 m a.s.l. date from within the last 9000 years (between approx. 7100 B.C. and A.D. 1700). In the space of the last 4000 years the dendrochronological tree-line record is not continuous, probably due to human impact. For the time period between approx. 7100 and 2100 B.C. the dendrochronologically analysed logs show nearly continuous evidence (with only two gaps around 6490 B.C. and from 3350 to 3280 B.C.) of a tree-line which was located at least 50 m above the 1980s limit. This suggests that summer temperatures as observed in the late 20th century were at the normal or the lower limit of the temperature range which can be assumed for long periods of the early and middle Holocene epoch.

**Tree-ring research of Japanese Ceder (Cryptomeria japonica D.Don) from north-eastern Japan with respect to its dendroclimatic potential**

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Japanese ceder (Sugi) is archaeologically one of the most important tree species, uniquely distributing over the areas of main and southern islands of Japan. Although a long tree-ring chronology has ever been developed for the dendroarchaeological use, few have ever been investigated its dendroclimatic potential. In this study, we report the recent results of dendroclimatological research for living Sugi trees in Akita Prefecture, the northern-most part of Japan’s main island (Honsuu). There, old-aged Sugi trees (ca. 200 years old) are preserved in Cedar-Beech mixed forests, giving the possibility to build one of the longest dendrochronological records from living trees in Japan. The samples were taken from three locations. Ring widths were measured and each tree-ring series was crossdated both visually and statistically. During the visual crossdating, we found that it is possible to crossdate Sugi with Hinoki cypress (*Chamaecyparis obtuse* Endl.) master chronology in Central Japan. In consequence, tree-ring chronologies have been established for each of the tree sites. The climate-growth relationships were estimated by bootstrapped simple and multiple regression analyses between the residual versions for each chronology and their principal components and the local climate records (monthly temperature and precipitation). The response functions reveal that the ring width positively correlates with temperature from February to May in general. The optimal radial growth of Sugi depends on a warm late winter and spring preceding the growing period. Above-average warm temperature of this season might contribute to an earlier break of dormancy and successively to a longer period. The first principal component ($R^2=56.2\%$) additionally shows negative correlation with summer temperature (July and August), representing very similar pattern to that previously obtained for above mentioned Hinoki cypress. April temperature for the north-eastern Japan was preliminary reconstructed, using a simple linear regression.

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**Supraglacial tree-ring analyses as a tool to reconstruct the surface instability of a debris covered glacier: the case of the Miage Glacier (Western Italian Alps)**

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Miage Glacier, in Val Veny (Western Italian Alps)