

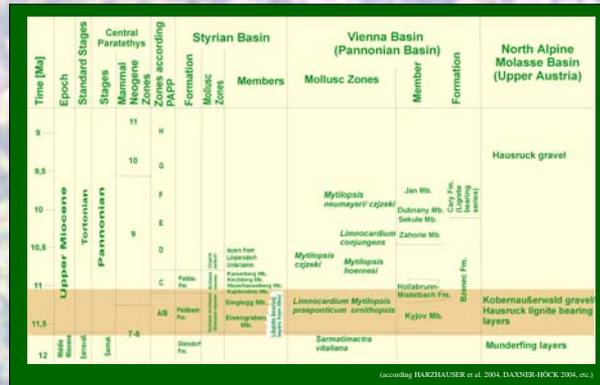
Late Miocene seed and fruit assemblages from Austria – floristic, edaphic, taphonomic and climatic aspects

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Introduction

Seed and fruit assemblages in Late Miocene sediments from the North Alpine Molasse Basin, from the Vienna Basin and from the Styrian Basin have been studied. The age of the sediments has been constrained by different methods and with different degrees of certainty: regional geology, mollusc assemblages and indirectly by an overlying mammal assemblage. The investigation of the seed and fruit assemblages revealed a high degree of conformity but also differences.



Stratigraphic overview of the Early Late Miocene

The main parts of these investigations had been carried out at the Institute of Palaeontology, University of Vienna and were funded by the Austrian Science Funds project 13742.

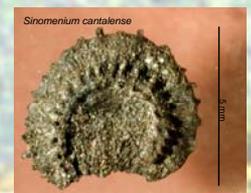
The assemblage from the former lignite opencast mine at **Hinterschlagen** (Hausruck area, Molasse Basin, Upper Austria) is well preserved and rich in species (70 taxa). The dominant elements are the Haloragaceae (*Proserpinaca*, *Myriophyllum*), representing about one third of all seed and fruit remains. Also abundant are *Suida* and *Taxodium* but several species are represented with one specimen only, such as *Mastixia amygdalaeformis*.

A clay pit near **Eberschwang** (NE margin of the Hausruck lignite area) offered an assemblage (37 Taxa), with *Sequoia*, *Asimina* and *Trigonobalanopsis*. The low percentage of hydrophytes in this assemblage is notable.

The assemblage extracted from the gravel pit near **Pellendorf**, at the NW margin of the Vienna Basin is less rich in species (16 taxa), but contains numerous Lythraceae (*Decodon gibbosus*, *Microdiptera menzelii*) and Trapaceae remains.



Palaeogeographic map with the geographic position of the investigated localities



Lignite bearing sediments from the northern margin of the Styrian Basin near **Weiz** yielded about 25 taxa, almost exclusively elements of the intrazonal vegetation (e.g. *Microdiptera menzelii*).



The assemblage from the **Mataschen** clay pit (SE Styrian Basin) includes about 60 taxa, mainly elements of intrazonal vegetation and a few elements of the mesophytic hinterland forest. Notable is the abundance of *Sinomenium cantalense*, a characteristic element of Mio-Pliocene assemblages of N Italy, but rare in sites N of the Alps.



Results

The percentage of exotic elements is generally between 40-60%. Also, in those assemblages with a high percentage of hydrophytes or generally azonal elements as Pellendorf and Weiz. Some hydrophytes occur in all or nearly all assemblages as e.g. *Eoeryale*, *Trapa*, *Decodon*, *Microdiptera*. Others, like *Brasenia* have been found yet in the Hausruck area only, *Butomus* has been discovered in Mataschen.

Comparing the assemblages of the different basins, the similarities and differences are obvious. Rutaceae, Mastixiaceae, Symplocaceae and *Trigonobalanopsis* are rare elements and probably represent accessory elements of the hinterland forest. *Butomus*, *Toddalia*, *Zanthoxylum*, *Fagus* and *Sinomenium* have been found in the Styrian Basin only; *Leitneria*, *Litsea*, *Poliothyrsis*, *Sequoia*, *Mastixia* and *Trigonobalanopsis* only in the Molasse Basin.

Some of the differences might have been caused by the local edaphic conditions. The sediments were transported from different parts of the developing Alpine orogen into the different basins and producing different edaphic conditions for the plants.

Discussion of the climatic data

A preliminary estimation of the mean annual temperatures using estimates based on the modern climatic conditions of the represented genera were nearly the same within the different basins: 14-20°C in the Styrian Basin, 17-20°C in the Hausruck area.

These temperatures are higher than indicated by other floras for that time but they are calculated by including all represented genera and not just the climatic requirements of the related modern species. The palynological investigation of the Hausruck area supports the idea of a relict area with a particular humid and warm climate (MASSELTHER & HOFMANN 2005)

The calculation of palaeoclimate is a very sophisticated work because not all taxa and genera offer reliable results. But which taxa should be excluded from the calculation, the today monospecific genera or genera, representing by very low percentages (e.g. single specimens) or all intra-zonal elements (as aquatic and wetland plants)? Zonal elements are always the best indication for the climatic conditions, but they represent also the evolution of the vegetation within their distribution area.