Wood and charcoal anatomy: Problems and solutions

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Summary: *Anthracology is a part of wood anatomy. The contribution presents possibilities, problems and their solutions for the analysis of charcoal. Careful sampling and the assessment of the overall findings are essential for the interpretation of the results.*

Key words: *wood anatomy, anthracology, archaeobotany, mining*

INTRODUCTION

Very early in the evolution wood was already in use. Animals used it to build nests and the use of branches for digging and poking is known. Right from the beginning of the emergence of the first humans wood demands our attention: the spears from Schöningen in the Landkreis (county) of Helmstedt are the oldest completely preserved hunting weapons of *Homo erectus* so far known and could be about 400,000 years old. The outlines of wood constructions of simple dwellings in Bilzingsleben have been dated to the same period. Yet charcoal has a far better chance of preservation than wood. Charcoal remains from forest fires are found from periods of many millions of years, long before the appearance of the hominids, who left their mark in the form of charcoals as evidence of their use of fire.

MATERIAL AND METHODS

According to the 'Hochschule für nachhaltige Entwicklung Eberswalde' 25,000 to 30,000 wood species exist worldwide. About 5000 of these species would be suitable for commercial use, but only about 1000 are actually traded. 200 to 300 wood species are of commercial importance and for these there are also identification keys available. Therefore, it is obvious that there is often a need to identify wood and wood remains. This seems plain and easy at first, but we soon realise that in this task we are often faced with almost unsolvable problems. Both wood and charcoals have a structure that is specific for the species. There are techniques to make this structure visible: by looking at splitting or breaking surfaces, thin cuts, microphotos or REM images of such samples. For this you need sample collections or good pictures of wood specimens.

In many identification keys there are images taken from just one example. This is not sufficient at all because the structural variability inside one single tree can be great. Differences in the structure of one individual can be greater than between two species from the same family. As there are often only few fragments of charcoal available, there can be no statistical assignment of microfeatures, as it can be done with present day material for comparison.

FIGURE 1: Hippophae *sp. from Tibet. Destroyed structure from the carbonization process.*

The state of the charcoal is vital for the chances of identification. Wood that has been optimally carbonized shows the microfeatures as clearly as a good sample of present day material. Depending on the processes of carbonization, the deposition in the sediment and the accompanying geological and soil chemical processes, structures can be destroyed, changed or overlaid (Fig. 1 and 2). Depending on temperature and available oxygen as well as the composition of the wood, different carbonisation can generate different charcoals. Slow burning of resin rich woods can often lead to a glassy amorphous mass almost without structures, where very tiny parts with identifiable structures can only be found with difficulty. Salts that have been dissolved in the sediment can cristallize inside empty cell spaces and through an increase of volume cause the charcoals to burst. Deposits in vessels and tracheids overlay fine structures and so often prevent us from recognizing diagnostically important features. There are chemicals that can sometimes remove such deposits successfully. But this has to be done with great care, as the fragile charcoals can easily be destroyed.

Carbonized woods can also be used for dendrochronological dating if a sufficient number of tree-rings are available. Possibly one of the most famous pieces of charcoal in this context is the charred log, labeled HH39, found in the settlement of Showlow in Arizona. On June 22nd, 1929, Andrew E. Douglass became convinced that this log closed the gap between the absolute and the floating chronologies. Immediately the famous cliff-dwellings of Mesa Verde and 40 other settlements could be dated absolutely! In alpine regions, for example, preserverd charcoals have often been found that had a connection with mining and smelting processes. In many cases these charcoals show very narrow rings. To be able to measure these rings, thin sections from these charcoals could be cut with a diamond-wire saw.

CONCLUSIONS

The analysis of charcoals produces data for the history of climate and vegetation and fire events and can provide information about the uses of wood. With careful sampling it can provide evidence for a selective use of wood species for building and tool making. The remnants also allow us to identify different crafts and techniques according to the selection of wood species and different burning temperatures.

FIGURE 2: Destroyed structure caused by minerals in vessels. Hippophae *sp., Tibet.*