

The very beginning of anthracological investigation

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Summary: *Modern anthracological research with lots of technical equipment and physical and chemical measurements seems to be a fairly young subject in science. However, the technical literature of the Renaissance and the Baroque is full of hints concerning anthracological investigation, long before microscopes and computers were in use. The most amazing comments were written by Vannoccio Biringuccio in 1540. He wrote about charcoal which was found in ruins more than 400 years old. One page before this he describes that there is a visible difference between the sizes and qualities of wood and several techniques of carbonisation. Of course these observations were not used for answering questions like ours today. The main interest in research about charcoal concerned the search for the best charcoal for different technical processes. On the whole the old literature contains a broad knowledge about the possibilities of using charcoal. This knowledge could be interesting and useful today for interpreting anthracological samples from pre-industrial working-places.*

Key words: *renaissance and baroque literature, technical charcoal use, history of anthracology*

INTRODUCTION

Before fossil coal was used as main fuel for industrial sites, the energy support was based on charcoal. For this reason the technical literature of the renaissance and baroque period, but also the technical and scientific literature of the 19th century contains a lot of information about the possibilities of using charcoal and wood as fuel in general, but also much detailed information about the usage of different wood species for charcoal production. The quality of charcoal is often a main topic, and it seems that not every kind of charcoal fits for every technical process. The need of identifying different charcoals and checking the quality before buying it was based on an early form of anthracology, developed over centuries and combining physical, chemical and economical research.

SOURCES AND CONTENTS

The oldest mention of different kinds and qualities of charcoal is from the Roman period. Plinius distinguishes between charcoals from soft and hard wood and knows that iron-smelters try to choose charcoal from *Quercus*, *Fagus* and *Carpinus* (Plinius nat. hist. lib. 16, 27).

In the renaissance period the old Greek and Roman way of scientific thinking again was the foundation of modern natural science. The oldest hint about anthracological research in order to find out something about the properties of different charcoals in this period seems to be the Venetian book “de la pirotechnia” from Vannoccio Biringuccio, 1540. Biringuccio found out, that the quality of charcoal depends on the technique of charcoal-burning, the age and diameter of the tree and the dryness of the wood. In his opinion it is important for every metal-worker to be able to distinguish between these different kinds of charcoal for a good producing

process. While he confirms the knowledge of Plinius concerning the use of charcoal from hard woods for iron-smelting, he describes the use of charcoal from *Populus*, *Salix*, *Abies* and *Acer* as waste because of the higher consumption. Charcoals from soft woods (at Biringuccio every kind of wood except *Quercus*, *Fagus* and *Carpinus*) can be used for any unspecific work while only charcoal from *Betula* can not be used by gold- and silversmiths (Biringuccio, 1540, 61 v).

One paragraph, where he describes a typical archaeological-anthracological research demands special mention: Biringuccio reminds of the discovery of charcoals below an at least 400 year old ruin, and he concludes that the charcoal must be older. In this context the durability of charcoal is mentioned first. (Biringuccio, 1540, 62 v).

Due to the forth growing use of artillery and the need for good gunpowder several kinds of charcoal where tested in the 17th century. The artillery lieutenant J. C. Plümicke (1821, 146-147) investigated old orders about the quality of gunpowder and quoted a French law from 1669, where all woods of *Frangula* where signed over to the powder mills.

Further, extensive investigations about wood and charcoal where published by Hannß Carl von Carlowitz in 1713. He was responsible for a sustainable forest-management in order to produce charcoal for ironworks in the mountains of Saxony (Germany). Besides the invention of the still valid rules of sustainable forest-management, he investigated different kinds of carbonisation techniques in order to find the most effective one. In general, the charcoal from kilns gives the best charcoal; stumps and twigs, charred in a pit (as it was usual until the 19th century) only gives small charcoal-pieces, which are useless for industrial usage (Carlowitz, 1713, 391). The deputy-forester Speck (1821) also gives a hint for unpopular stump and oak-

charcoal in context with the copper mill near Flensburg (Schleswig-Holstein, Germany). In the opinion of Carlowitz (1713, 391) and Speck (1821, 17-23) the best charcoal for iron or copper works, as already known, is charcoal from hard wood; the biggest size of charcoal pieces can be reached by charring one year dried coppices (Carlowitz, 1713, 391). Big charcoal pieces are important for the draught inside the furnaces. These results were also confirmed by charcoal-investigators from France (DuHamel du Montceau, 1762, 14) and Sweden (AF Uhr, 1820). In this context DuHamel describes the problem of too fast and ineffective burning kilns due to the use of dried wood. He also mentions the problem of sparking oak-charcoal, which is not very pleasant for the workers. The authors also agree on the lowest amount of charcoal by the use of big logs respectively wet or fresh wood because of the risk of incomplete carbonisation (Carlowitz, 1713, 391; DuHamel du Montceau, 1762, 13).

The investigation of DuHamel du Montceau shows a wide knowledge about the physical and chemical properties of different kinds of charcoal. In general, he distinguishes between "braise" (charcoal made by extinguishing a fire with water) and kiln-charcoal. He has a clear idea about the fact that the amount of air during carbonisation leads to clearly visible differences: braise is soft and consists of small pieces with a crumbed and matt surface, kiln-charcoal is hard, contains bigger pieces and has a bright surface. Kiln charcoal is burning much hotter than braise. During carbonisation the wood loses different gases and fluids. DuHamel identified a small amount of sulphur, tar or wood-oil, a kind of alcohol (methylen), burning gases (acetylene) and a kind of acid (vinegar). By burning kiln-charcoal a suffocating gas (carbon monoxide) arises (DuHamel du Montceau, 1762, 5-8). In comparison to fossil coal, charcoal has better reducing properties (DuHamel du Montceau, 1762, 11).

While the technical literature about charcoal loses its importance during the industrial revolution in the 19th century, the knowledge of the properties of charcoal was used in the archaeological context again. D. F. Unger investigated some Roman graves and determined diameters and species of the burned woods inside the graves (as Biringuccio did more than 300 years before). He compared his samples with samples from J. D. Büsching and E. v. Berg (1830) and assumed a spread of coniferous wood in northern Germany during the last centuries.

DISCUSSION

For many sciences as history, physics, (al)chemistry or music there will be the question raising, whether the research of the renaissance and the baroque period is "real science" or just some kind of upper class excitement. We have to accept that most of the older interpretations are differing from ours today, as ours will differ from future ones. But still some of the old scientists are quoted widely today (just think about Plinius, Newton or Linné).

This short overview of research on charcoal before the 20th century shows the quality of the old knowledge about the subject. In contrast to current research, the old scientists and foresters could not use microscopes, diagnostic machines or computers. Instead of the microanatomic differences, they distinguished the different kinds of charcoal just by view, like a carpenter distinguishes different woods, but lots of their observations can be confirmed or specified with our methods today. Unlike today, the main questions about charcoal before the 19th century were predominately economic ones, even if the idea of archaeological-anthracological research is first mentioned in the 16th century. In the meantime, the paleoclimatic and ecologic research seems to be quite modern.

CONCLUSION

As in every science time is going on and methods, questions and observation-methods are changing, but the main point is still the same: we get information from charcoal. The old observations, even if the old interpretation differs from ours today, can give important hints to be able to discuss the economic situation of archaeological working sites. The old knowledge about the different types of charcoal also helps us distinguishing kilns from extinguished fireplaces. The old anthracological research also enables us to reconstruct old charcoal-burning processes, which can be helpful for building up and running experimental kilns. In a humorous sense, at least we can be proud to follow one of the oldest sciences in the world (besides theology, of course).

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