Freistaat Thüringen
Landesamt für Denkmalpflege und Archäologie

THE BIRCH BARK TORCHES FROM THE KYFFHÄUSER CAVES

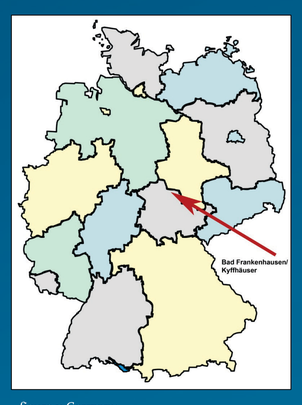

figure 1: Germany


figure 2: cleave cave

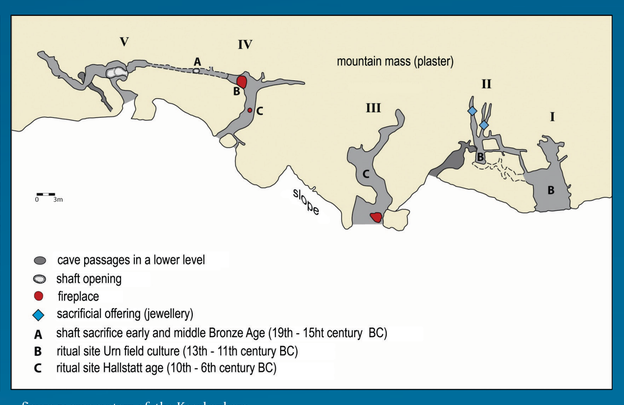

figure 3: cave system of the Kosakenberg

The cleft and cleave caves of the Kosakenberg (figure 2-3, southern Kyffhäuser, mountain formation near Bad Frankenhausen in northern Thuringia, figure 1) were systematically excavated between 1950 and 1957 (figure 4) under the supervision of Professor Dr. Günter Behm-Blancke (figure 5).


figure 4: excavation Kosakenberg 1951

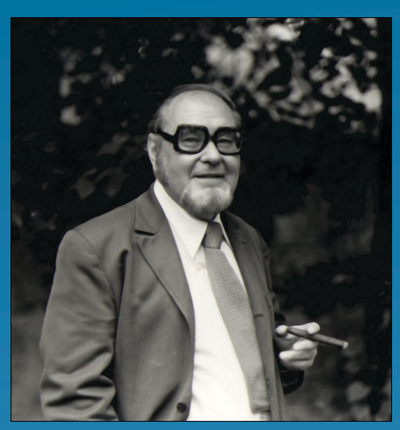
figure 5: Prof. Dr. Günter Behm-Blanke (1977)

Bones (animal and human), jewellery, tools, ceramics, grain, fragments of briquetage, wood and other organic remains were all found during the excavation of the system of 20 partially blocked up caves. These objects were deposited between the **AUNJETIZER** culture and the early Iron Age[1]. Due to the stable conditions of 95% relative humidity, temperatures between 4 and 7°C (figure 6) and being surrounded by gypsum (anhydrite) minerals the organic material was preserved within the sealed off caves. The wooden artefacts and other organic materials reacted instantly when exposed to external conditions. They shrank, formed cracks and crumbled into dust[2]


figure 6: climate control in cave 1951

figure 7: glass vials B.F. 476

figure 8: birch bark torches, dried in cave, coating with "Geiseltallack"

Attempts of stabilising them (1950) using alum or cellulose nitrate (Geiseltallack) were not satisfying[3]. Good results were achieved by slowly drying the objects enclosed in boxes or glass vials with corks or wadding (figure 7-8) in the entrance area of the cave. The wooden artefacts and birch bark torch fragments were very light, soft and brittle after the drying procedure and are also referred to as 'mummified'[4].
Most cave finds were conserved and scientifically assessed immediately after excavation. Wooden artefacts were investigated further between 1976 and 1991. The birch bark torch fragments on the other hand were kept in storage for 50 to 60 years and are due to be assessed at present. To facilitate their handling they required conservation first.

How does one treat such unusual artefacts from birch bark? An acceptable solution for the treatment of over 100 torch and birch bark remains had to be found.
Samples were examined using SEM to gather information about these extraordinary artefacts. Gypsum crystals were found embedded in the cellular structures (figure 10-11). This explains the high proportion of ash or rather minerals that was also found in the other wooden artefacts[5]. The analysis of lignin and suberin has not yet been completed.


figure 9: cork layer B.F. 484

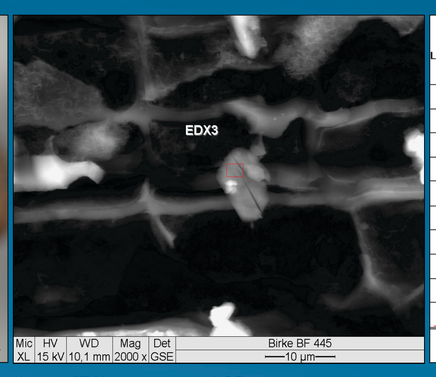

figure 10: SEM image gypsum crystals B.F. 445

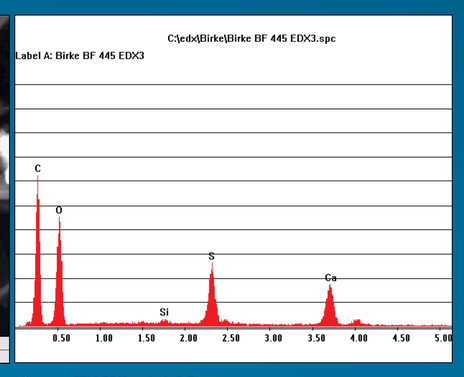

figure 11: SEM EDX analysis B.F. 445

Soil was attached to the untreated bark fragments and they were brittle (figure 9, 13-15). Layers of bark separated along breaking edges (figure 12). Cleaning trials were carried out on fragments that could not be associated with any artefact. Wet cleaning using water, ethanol and acetone weakened the materials condition further. The different layers swelled to varying degrees and drying caused tension. Ethanol and acetone further caused the top layer to cockle. This effect remained after drying. Rolling the surface with wetted cotton swabs equally did not result in a satisfying cleaning effect.

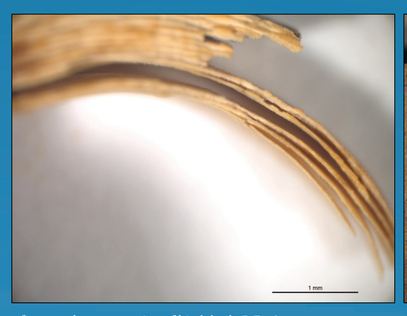
figure 12: layer separation of birch bark B.F. 484


figure 13: before treatment with air abrasion B.F. 483


figure 14: after treatment with air abrasion B.F. 483

Dry cleaning with brushes was just as dissatisfying as the brushing left marks on the surface. Good results were achieved with air abrasion using 1-50µm micro glass beads with a 0.4mm steel nozzle at 0,2-0,5bar. Details such as small holes (stitching holes) and decorations became apparent after the removal of soil (figure 13-14).


figure 15: B.F. 476 before treatment

figure 16: B.F. 476 after treatment


figure 17: B.F. 476 in box in PE-film cover

The surface was unstable and powdery after cleaning, which made any handling of the birch bark fragments difficult. Consolidation was therefore required. Samples were treated with Paraloid B72 and Mowital B 30 H applied using different techniques (brushed, sprayed, dipped). Best results were achieved by immersing the fragile birch bark fragments into a solution of Mowital B 30 H in isopropanole (30 to 60 seconds). There was no darkening and no glossy appearance as often found with Paraloid B72 (figure 16). The birch bark fragments will not be stored in glass vials anymore but in acid free boxes covered with a PE-film until their scientific assessment (figure 17).

1 G. Behm-Blanke, 1976, Zur Funktion bronze- und früheisenzeitlicher Kulthöhlen im Mittelgebirgsraum, in *Ausgrabung und Funde 21*, Weimar, p.82
2 H. J. Ersfeld, 1955, *Funde der Vorzeit*, Weimar, p. 16
3 G. Behm-Blacke, 2005, *Höhlen, Heiligtümer und Kannibalen*, Leipzig, p. 126
4 H. Jacob, J. Cott, 1991, Holzreste aus bronzezeitlichen Höhlen im Kyffhäuser bei Bad Frankenhausen, in *Alt-Thüringen 26*, Weimar, p. 142
5 R. Kommert, 1991, Anatomische, chemische und physikalisch-mechanische Untersuchungen von bronzezeitlichen Hölzern, in *Alt-Thüringen 26*, Weimar, p. 152

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