Man and environment in the Palaeolithic
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The utilisation of large mammal bones in Bilzingsleben - a special variant of Middle Pleistocene Man's relationship to his environment

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Abstract
The selection of raw material used for the production and utilisation of tools constitutes an important relationship of early man to his environment. His knowledge of the nature of the raw materials, of their physical reactions plays a big part at the preparation or the usage of implements.
The Lower Palaeolithic man of Bilzingsleben demonstrates this relationship in various ways. There is, e.g. a deliberate selection of raw material which was conducted for artefact-specific reasons. Dependent on their corresponding future function, different raw materials had been selected according to their specific qualities:
1. Tough, solid large pebbles (quartzite, limestone, travertine, kristalline) appropriate for the execution of rough work.
2. Hard, brittle silex stones (flint, more rarely quartz, chert), appropriate for the production of small special tools, such as cutting, scratching, scraping, boring implements.
3. Antlers used as percussion instruments.
4. Bones (more rarely ivory) used for the production of big special tools.
5. With the tools produced from these materials wood and other organic matters were worked.
Because of the special aspect of the bones in the Bilzingsleben inventory I am going to treat bones here.
The thick compacta of the elephant extremity bones served as raw material for the production of special tools: the working features and use wear indicate that and how the Bilzingsleben man used bones as raw material. He did not only smash the bones in order to obtain handy compacta pieces, but also cut them up deliberately: the joints were cut off, the bones split with a wedge and a hammerstone. Then the bone piece was trimmed in the way stone tools were prepared, i.e. with the help of a hammerstone. Even retouched edges were produced. The result was a differentiated usage of the bones as scrapers, back-knives, wedges, chopper-like tools, dagger-like tools, bodkins, working support. It is evident that the raw material was especially selected. The thick compacta of the extremity bones of adult animals was prefered: tibia, femur and humerus. The other extremity bones are rare. Pelvis and scapula are more frequent among the remaining skeleton. They were used as working support.
It seems that they are bones from death sites and they were macerated because it was more convenient and practical for usage when they were in a state without fat and without periosteum, sinew and other connective tissue.

Key words: Middle Pleistocene, Bilzingsleben, bone utilisation

The selection and utilisation of raw material for the production of various tools represent an important aspect of the relationship of early man to his environment. His knowledge of the nature of different raw materials, especially of their physical properties, was of great importance in the usuage of the tools produced by him.

Raw materials

The archaeological evidence of Lower Palaeolithic human activity at Bilzingsleben illustrates this relationship. Evidence for deliberate artefact-specific selection of raw materials is seen at this site (Fig.1). Corresponding to the particular functions

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of the artefacts, different raw materials were selected according to their specific qualities:

1. Pebbles of tough rocks such as quartzite, limestone, travertine and kristalline were used for carrying out rough works. In most cases they were prepared, but sometimes they were used without any trimming for different works. Various marks on them are indicative of their use by humans.

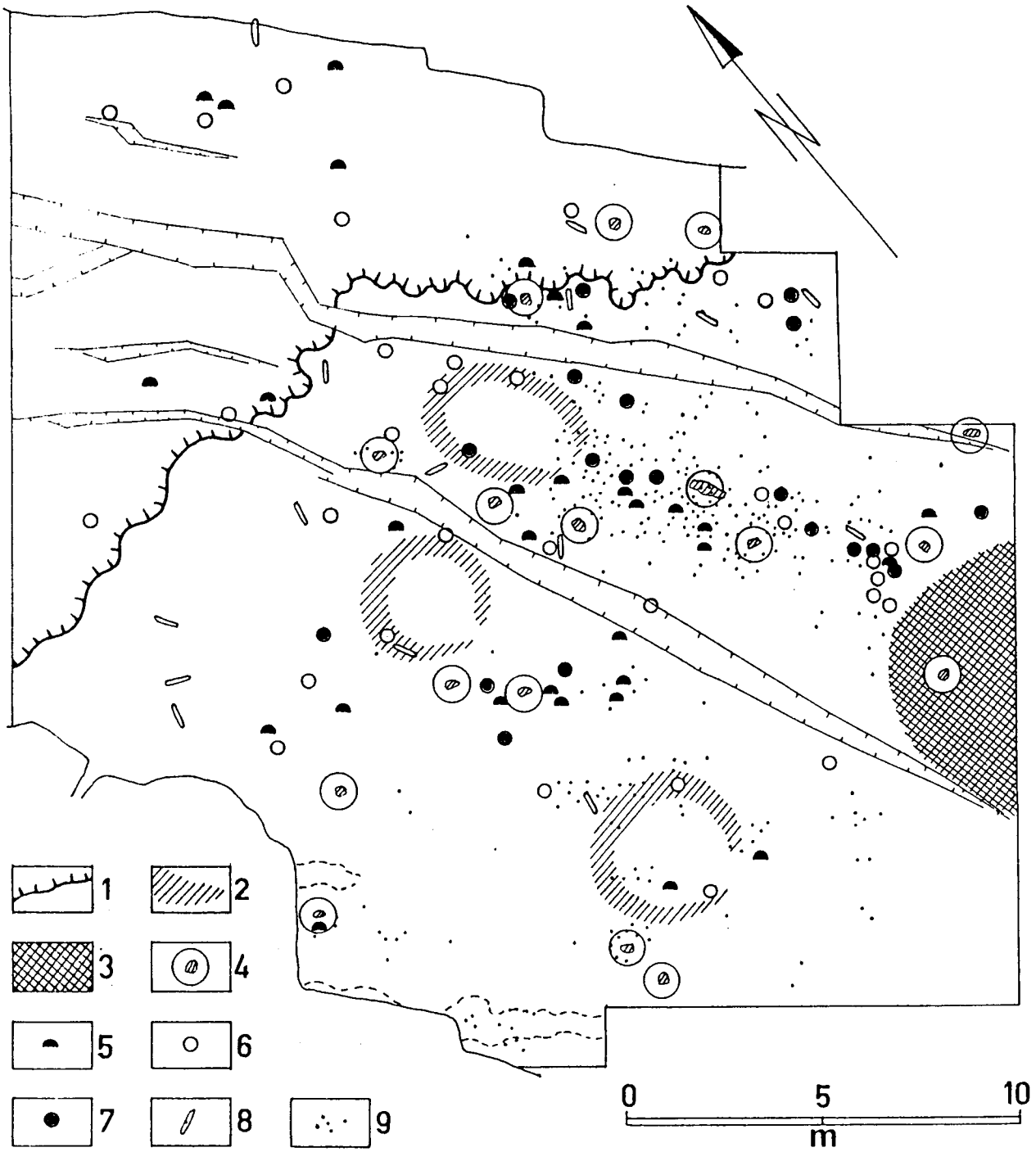

Fig. 1. Bilzingsleben. Distribution of some bone artefacts.
1 - lake edge, 2 - dwelling structures, 3 - central paved zone, 4 - workshop with anvil, 5 - bone scraper, 6 - chisel-shaped bone tool with fractured cutting edge, 7 - fractured pointed butts, 8 - very large bone scraper, 9 - bone flakes.

2. Small rounded and handy pebbles of quartz, which is a hard, brittle material, were used as hammerstones for the working of flint.
3. Hard, brittle silicious materials like cretaceous flint, and rarely quartz and chert, were the raw material for the production of small specialised tools which were used for cutting, scraping and boring.
4. Antlers from red deer (*Cervus elephas)* served as cudgels and mattocks (Fig. 2). The smooth break surfaces show that the antlers had been softened in water, probably. Most of the antler tools that have been excavated at Bilzingsleben were deposited at the lake margin and in the alluvial fan.
5. Except for skeletal remains, perishable organic materials were rarely preserved. However, they must have constituted a large proportion of raw material for the production of tools. Organic materials were worked with tools of stone, bone and antler. A relatively large amount of wood remains have been preserved, mainly of species that provide hard, elastic wood. Only in a very few cases could these remains, however, be identified as tools. These include long rod-like tools, flat spade-like or shovel-like tools, and artefacts with a hole or a hook at one end.
6. Bones constitute an important category (4.8 % bone tools) of the Bilzingsleben inventory. Bone tools, i.e. 90 % of total, are made from the thick and hard compacta of the long bones (tibia, femur and humerus) of the adult, straight-tusked elephant. It is likely that the animals utilised had died a natural death. This assumption is supported by the facts that firstly the collection of bones from natural deaths would have been simpler and less hazardous than killing these large and dangerous animals, and secondly macerated bones that contain little fat are more appropriate for working into tools. Bones from juvenile animals were not used since their lower density makes them softer and hence less appropriate for the production of tools. Scapulae, pelvis and in a few cases ribs were also used for artefact-specific purposes. The remaining 10 % of bone tools comprise artefacts made of rhinoceros and bison bones.

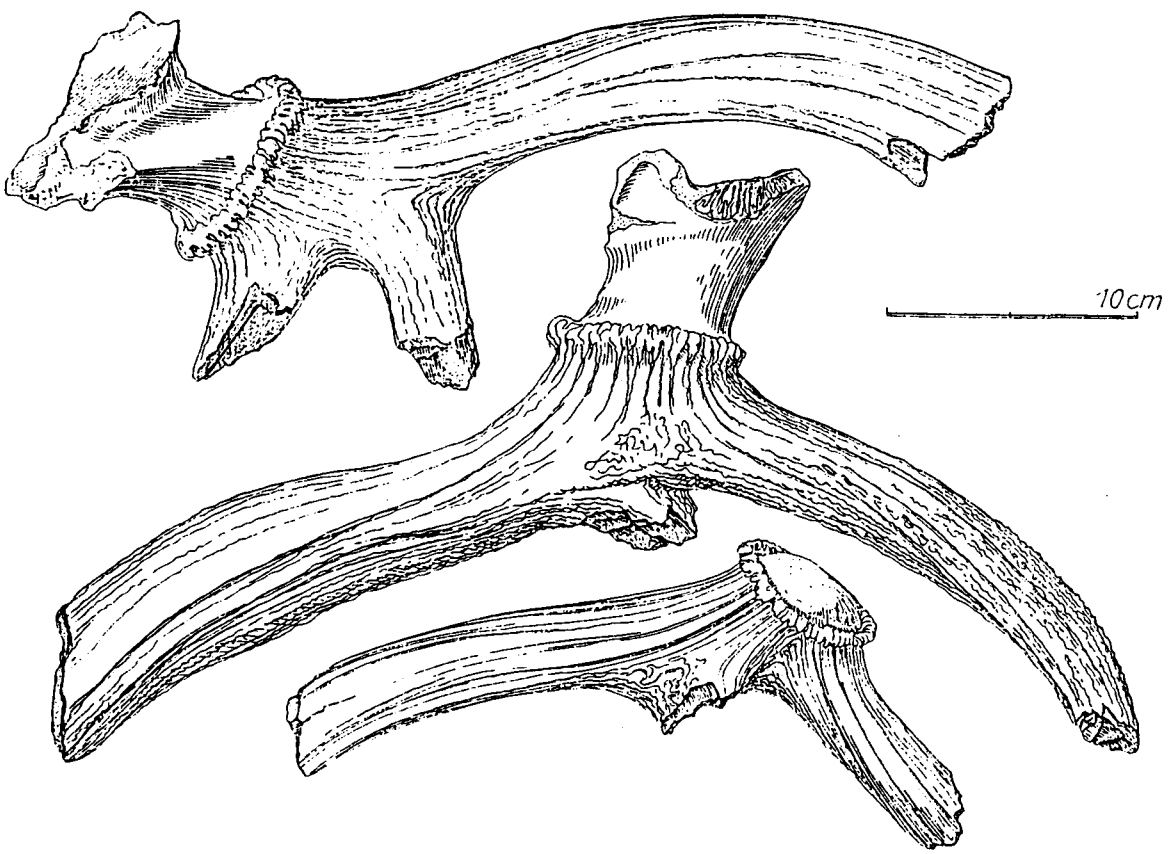

Fig. 2. Bilzingsleben. Antlers from red deer used as cudgels and mattocks.

Bone preparation

The compacta of long bones was prepared in two different ways: The long bone shafts were either smashed in order to obtain suitable splinters, or they were deliberately split longitudinally, the latter being the more frequently used technique. The method of smashing bone shafts resulted in frag-

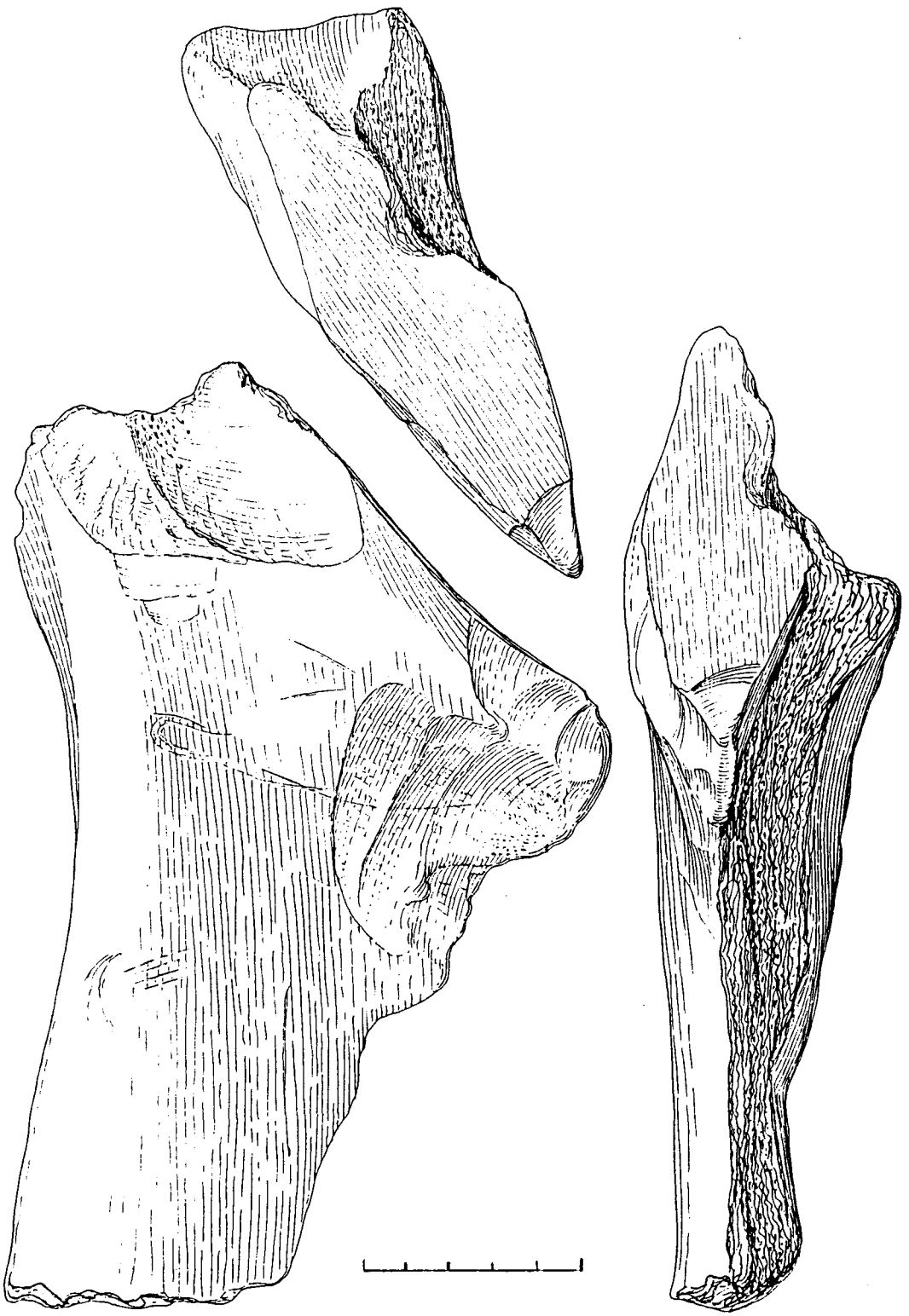

Fig. 3. Bilzingsleben. Instrument of percussion with fractured cutting edge resembling a primitve axe.

ments whose angular shapes were perfectly determined by the internal structure of the compact bone. The method produced small to medium-sized splinters that were often used without further modification if they proved to be of suitable shape.

The method of deliberate splitting was more important, as shown by the larger number of pre-

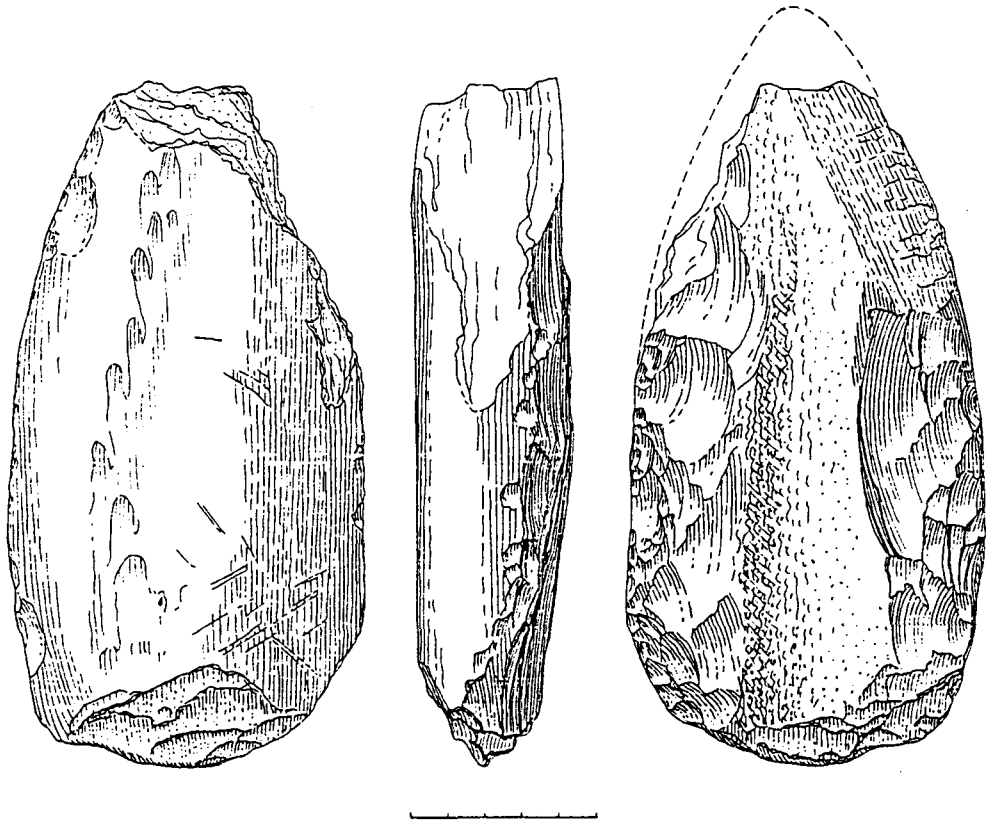

Fig. 4. Bilzingsleben. Handaxe-like tool with ventral and facial retouches.

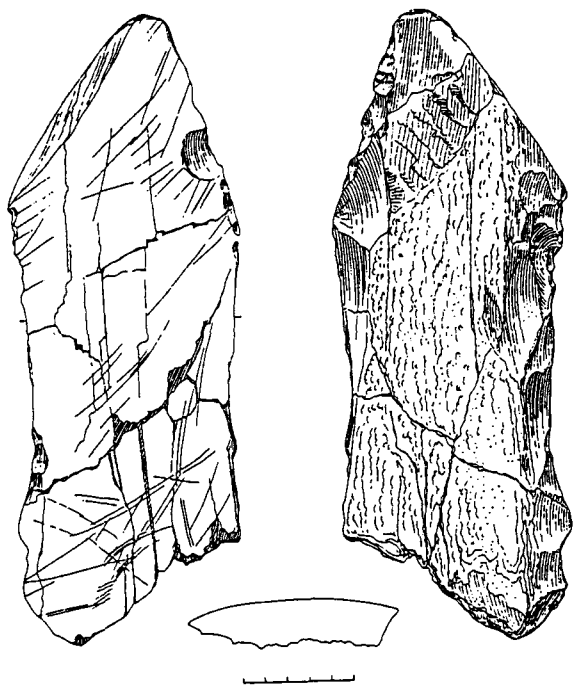

Fig. 5. Bilzingsleben. Scraper-shaped tool with retouched edges.

served pieces. First, the articular ends of the bone were cut off, then the shafts were split with the help of wedges and hammerstones applied to the long edges. This is shown by the successive wedge marks that are recognisable on them. The marrow was probably then removed. Pieces were trimmed to shape with hammerstones. Upper Palaeolithic working techniques such as cutting, sawing, carving and polishing were not applied.

The working edges of bone tools were often fashioned with a hammerstone in the same manner that was used to prepare stone tools. Bulbs of percussion, radial fractures and pressure cones are indicative of the trimming technique, which could be unifacial, ventral and less frequently bifacial. The retouched edge obtained by this preparation technique formed a relatively sharp working edge that would not wear rapidly with use. In some instances the sharp, long edge produced by the initial splitting of the bone was used unretouched for cutting and scraping. The different forms of bone tool can be compared with flint tools. We think, for instance, that the bone scrapers were used instead of scrapers made of flint because the raw material for flint tool production might have been insufficient or was not easely accessible. However, we also note that the production of a bone scraper may have been less complicated than the production of a flint scraper.

Functions of bone tools

Approximately 120 bone tools were produced in the above-mentioned way. The specific forms of bone tools reflect their different functions, as follows:

Chisel-shaped tools

Chisel-shaped tools (35 % of total bone tools) and chisels. The chisels are 15 to 25 cm in length and were used for chopping. Their cutting edges were fractured. The chisel-shaped tools seem to have been used like choppers for the working of soft material, perhaps of animal hides lying on a hard work support. Their fractured corners, butts and cutting edges exhibit rounded surfaces. A specialised type, resembling a primitive form of axe, consists of a bone splinter with a cut-out grip-like part and a convex projecting cutting edge (Fig. 3). Its use as an axe is indicated by fracture patterns on the working edge. Another bone piece is shap-

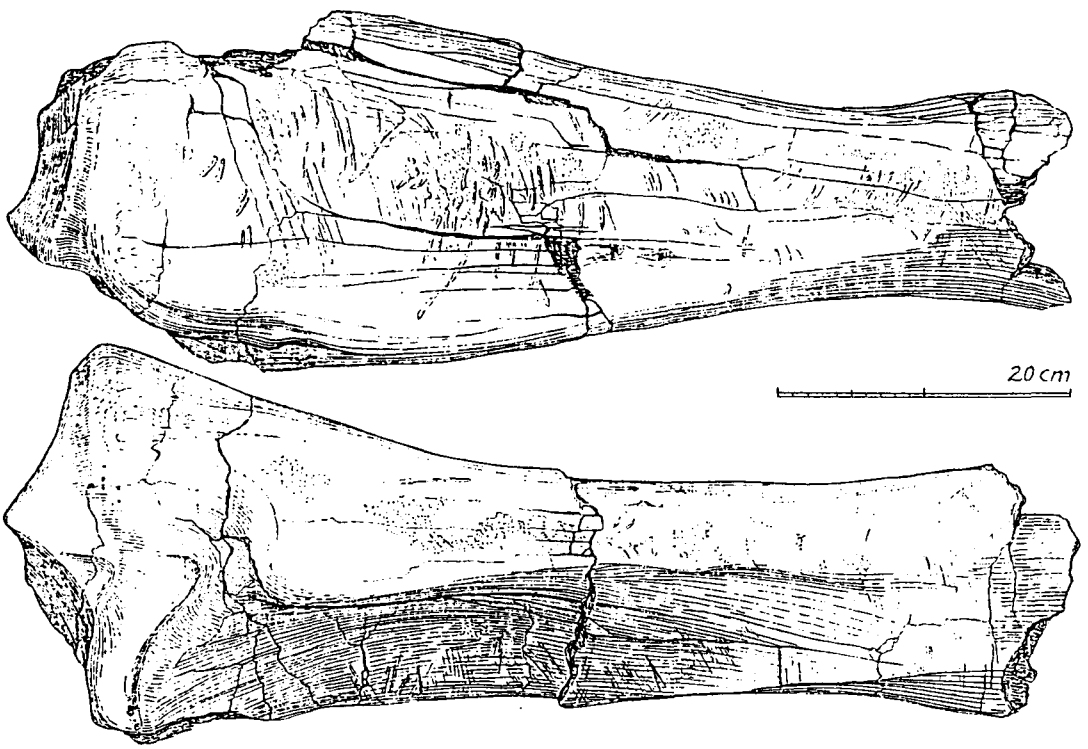

Fig. 6. Bilzingsleben. Tibia from straight-tusked elephant used as anvil exhibiting a great number of marks on the upper surface.

ed like a hand-axe, showing ventral and facial retouching (Fig. 4), other large bone splinters were used as cudgels, as shown by fractures on their long edges.

Scraper-shaped tools

Scraper-shaped tools (22 % of total). The length of these tools ranges from 10 to 25 cm, and their function is indicated by use wear and marks of edge preparation. They have a worked grip-like part produced by flaking one of the long edges. The working edge is in many cases retouched (Fig. 5). Other similar tools are long triangular splinters of compacta bone which have been worked in a similar fashion to backed knives made of stone. Their cutting edges are bifacially retouched. Some chopped ribs also have scraping edges, while others exhibit scar fields on their working surfaces.

There is another special group of bone tools consisting of large scrapers with a maximum of between 25 and 80 cm. These are long pieces longitudinally split from the femur or humerus of elephants. After removal of the marrow, one long edge was ventrally retouched with a hammerstone

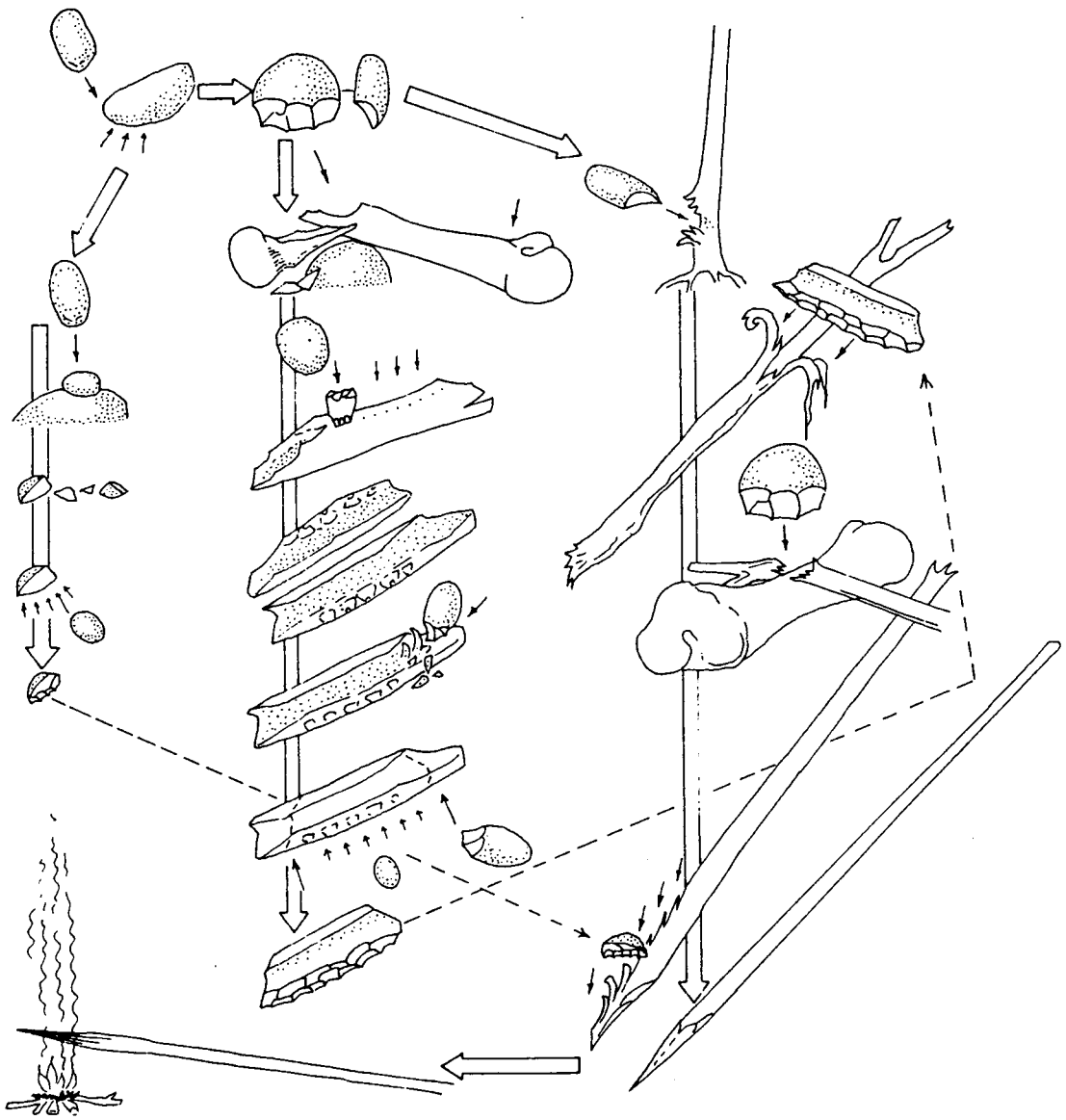

Fig. 7. Bilzingsleben. Differentiation and complexity of manufacture and usage of the Bilzingsleben bone artefacts (Mania 1990). In different stages of manufacture, with the help of different tool kit, a special finished object for daily use is produced, in this case a wooden spear.

until a straight scraping edge was prepared. The tool was pulled with both hands in the direction towards the human body, as shown by corresponding directional use marks on the working edge. The rounded surfaces on the cutting edge and projections show that the tools were preferentially used for working organic materials such as wood, hides and bark.

Dagger-like tools

Dagger-like tools are elongated, split pieces from the ulnae of bison and rhinoceros. A grip-like part was fashioned from the proximal joint surface and the distal ends show fracturing and pointed tips. The distal ends had been cut off at a point depending on the tool's function. The shafts were split with the help of chisels or wedges.

Bodkin-like tools

Bodkin-like tools have pointed butts which are rounded by usage. This type consists of the struck-out base of the scapular spine, a bone part that is particularly hard and solid. Rounded and polished surfaces of the thin, trimmed end are attributed by the use wear. Similar tools were made from the longitudinally split metapodials of bison, horse and deer, even pointed at the distal end. In one case, the end of a horse's metapodial was used, the marrow was removed from the shaft, and the proximal end stuck to form a point which shows scar fields produced by usuage.

Work supports

Practical work supports are provided by the natural shape of the scapula and pelvis. The scapular spine (crista) was broken off, so that the bone could be placed in a stable position on its flattened surface. Striking, chopping and cutting marks on the smooth medial surface are indicative of the activities carried out on it with tools. Flat rhinoceros scapulae were practically appropriate as work support where cutting activities were carried out with flint knives. They show many cut marks on their surfaces. The somewhat vaulted elephant scapulae were less suitable for this purpose, and so rougher working was probably carried out on them. An elephant tibia was also used as a support for chopping wood (Fig. 6), as shown by the wood fragments scattered around this working station.

Conclusion

The utilisation of bone compacta in particular shows how early humans at Bilzingsleben made use of their knowledge and experience of the environment in deliberately and effectively selecting raw material to make specialised tools (Fig. 7). The typical forms of these tools reflect a special pattern of use. Detailed anatomical knowledge as well as a recognition of the physical properties and qualities of the raw materials are shown in the manufacture of these tools.