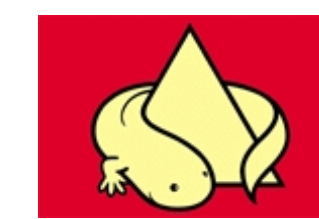


# Finds of *Bubalus murrensis* (Bovinae, Mammalia) from the Upper Rhine Valley: a focus on the complex sedimentological conditions of a quaternary fluvial system

Schreiber, H. Dieter

State Museum of Natural History Karlsruhe, Erbprinzenstrasse 13, D-76133 Karlsruhe, Germany  
e-mail: dieter.schreiber@gmx.de



## Introduction

The upper sequence of the quaternary sediments of the northern and middle part of the Upper Rhine Valley has yielded a rich sample of mammalian fossils (Fig. 1). The sample contains taxa of the last glaciation (Würmian/Weichselian) and taxa of an interglacial period (Eemian), esp. *Hippopotamus amphibius* and *Bubalus murrensis* (Fig. 2), both faunal elements of interglacial periods in the Pleistocene of Europe (see KOENIGSWALD 1988b).

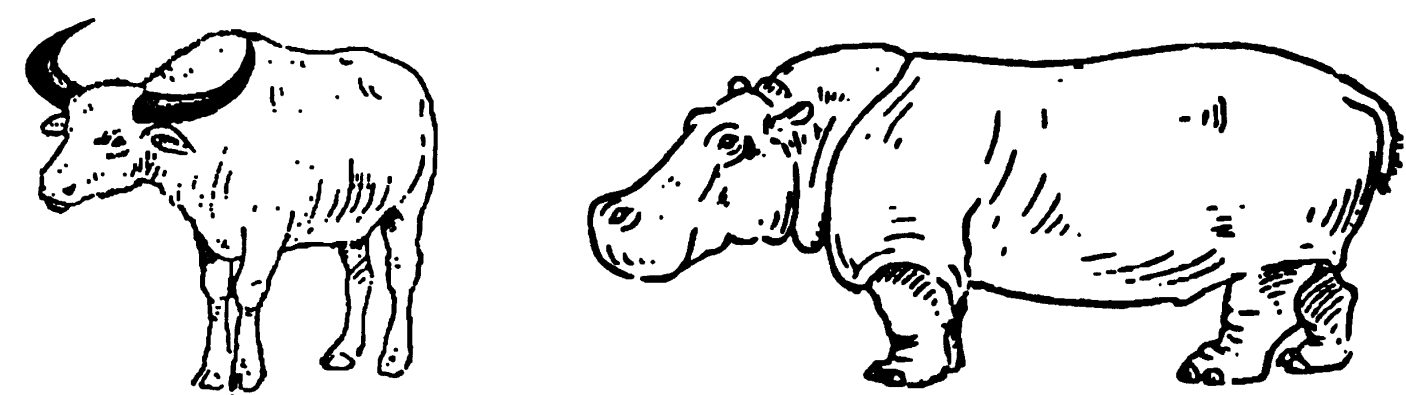


Fig. 2: Co-occurrence of *Bubalus* und *Hippopotamus* during the last interglacial in the Upper Rhine Valley.

But the stratigraphical position of these fossils can not be exactly determinate because the fossils were found in gravels which were extracted under the ground-water level by dredgers. Only the workers on the machines can notice the deep under ground level in which their extraction is active. KOENIGSWALD (1988a) discuss that subject in detail (Fig. 3).

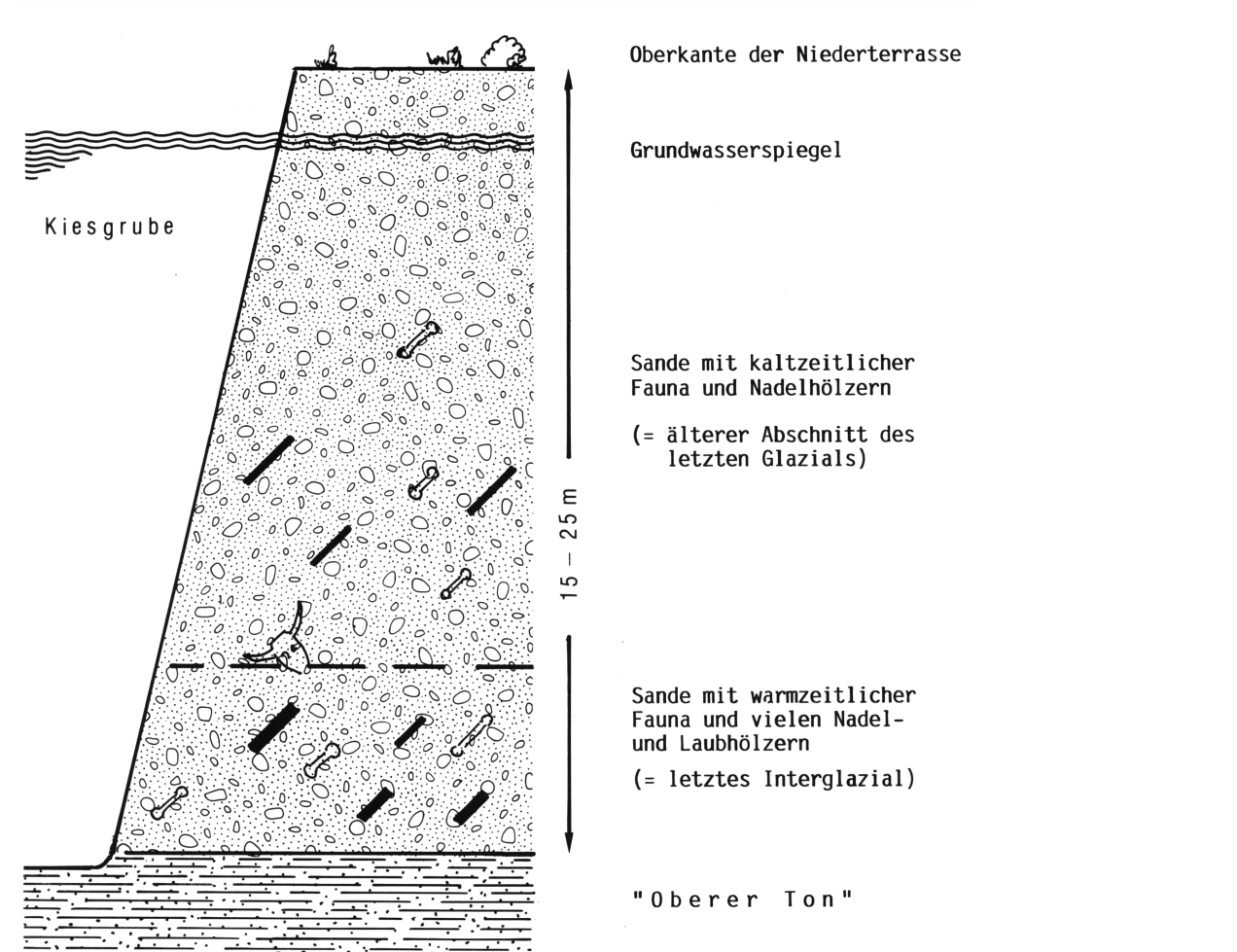


Fig. 3: Stratigraphical model of the sedimentary sequence of the deposits in the Upper Rhine Valley. Above a horizon of fine grained sediments follows at first gravels of the last interglacial and then the gravels of the last glacial (KOENIGSWALD 1988a).

## Geology and Stratigraphy

A hydrological active layer of clay and fine grained sediments exists in the northern part of the Upper Rhine Valley. This layer is called "Oberer Ton" (ARMBRUSTER et al. 1977, Arbeitsgruppe 1980) and limits the extraction of material in the gravel pits. This horizon occurs in a depth of 20 to 25 m under ground level and has laterally a discontinuous distribution (ARMBRUSTER et al. 1977). The mammalian remains occur above the "Oberer Ton"-horizon in coarse sediments. While the interglacial faunal elements (*Elephas antiquus*, *Stephanorhinus kirchbergensis*, *Hippopotamus amphibius*, *Sus scrofa*, *Capreolus capreolus*, *Dama dama* and *Bubalus murrensis*, Fig. 4) were usually found right above the "Oberer Ton" the glacial faunal elements (*Mammuthus primigenius*, *Coelodonta antiquitatis* and *Rangifer tarandus*, Fig. 4) occur in the upper part of the sequence (Fig. 3, KOENIGSWALD & LOSCHER 1982, SCHWEISS 1988, KOENIGSWALD 1988b). KOENIGSWALD (1988b) excludes a diachrone displacement because of the relative high frequency of interglacial fossils (in the northern part of the Upper Rhine Valley), their good preservation and a complete skeleton (*Elephas antiquus*, Crumstadt).

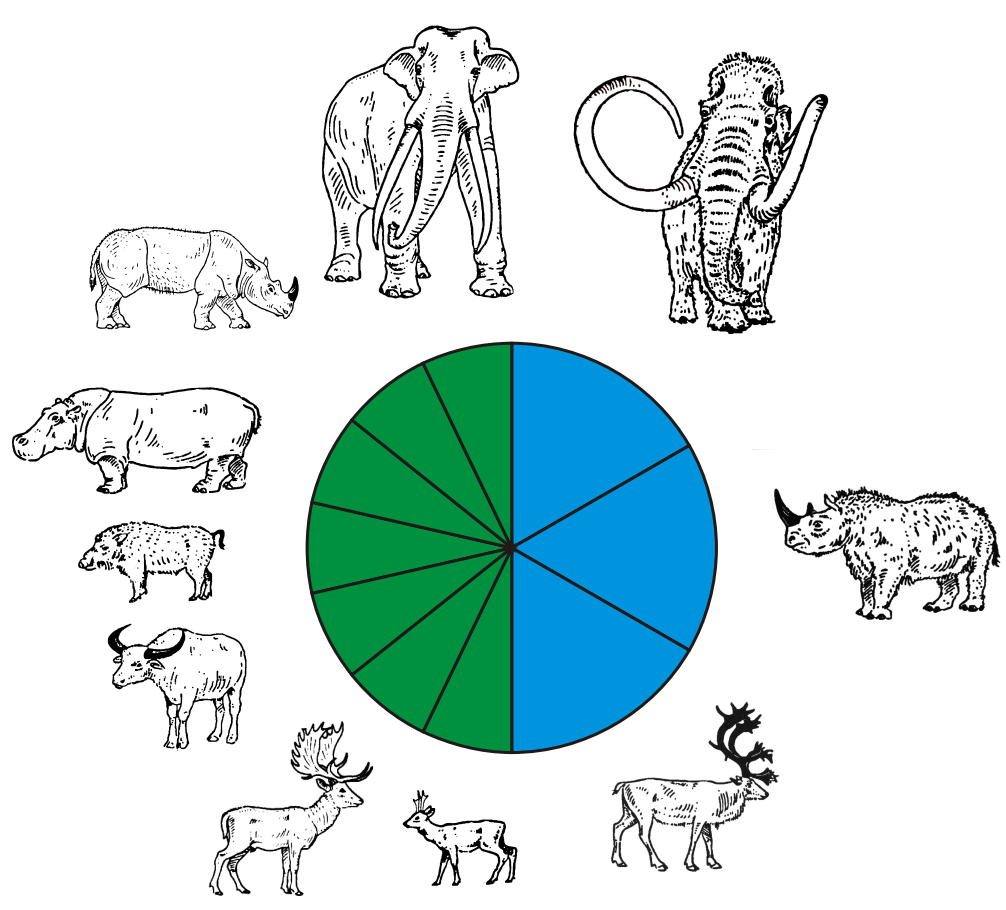


Fig. 4: Faunal spectrum in the gravels of the Upper Rhine Valley (KOENIGSWALD 1988b). On the left side in green are indicated the occurrence of the interglacial faunal elements and on the right side in blue the occurrence of the glacial faunal elements (see fig. 1). From the top to the bottom in green: *Elephas antiquus*, *Stephanorhinus kirchbergensis*, *Hippopotamus amphibius*, *Sus scrofa*, *Bubalus murrensis*, *Dama dama* and *Capreolus capreolus*; in blue: *Mammuthus primigenius*, *Coelodonta antiquitatis* and *Rangifer tarandus*.

## Middle Upper Rhine Valley

In the middle part of the Upper Rhine Valley the upper sequence of the quaternary sediments are characterised by coarse grained sands and pebbles called "Oberes Kieslager" (OKL) above a fine grained sediment called "Oberer Zwischenhorizont 2" (OZH2) (Fig. 1, 5, 6, BARTZ 1982, WERNER et al. 1995). The OZH2 is correlated with the "Oberer Ton" of the northern part of the Upper Rhine Valley (SCHWEISS 1988) but it differs in the following points: grading up into coarser sediments, gets more gaps laterally and less hydrological active (ARMBRUSTER 1977, AG Hydrogeologische Kartierung Karlsruhe-Speyer 1988, WERNER et al. 1995). The OZH2 occurs in a depth of 15 to 35 m under ground level and does not limit the extraction in the gravel pits (WERNER et al. 1995).

## *Bubalus murrensis* from Büchenau

The interglacial faunal elements occur above the fine grained sediments of the OZH2 (esp. *Bubalus* from Huttenheim out of 20 m deepness, or *Hippopotamus* from Brühl out of 21 to 24 m deepness). The glacial faunal elements occur in the higher levels. But there is one exception: *Bubalus murrensis* from Büchenau (Bruchsal) (Fig. 1). The left fragment of the skull was extracted in 10 m depth under ground level together with teeth of *Mammuthus primigenius* in 1966. The gravel pit of Büchenau is located in the area of an upthrow fault block in the ground (Fig. 1), a tectonic structure on the eastern border of the Upper Rhine Valley. The quaternary sediments are reduced to coarse deposits with 15 m thickness in the south of Karlsruhe and with 50 m thickness in the

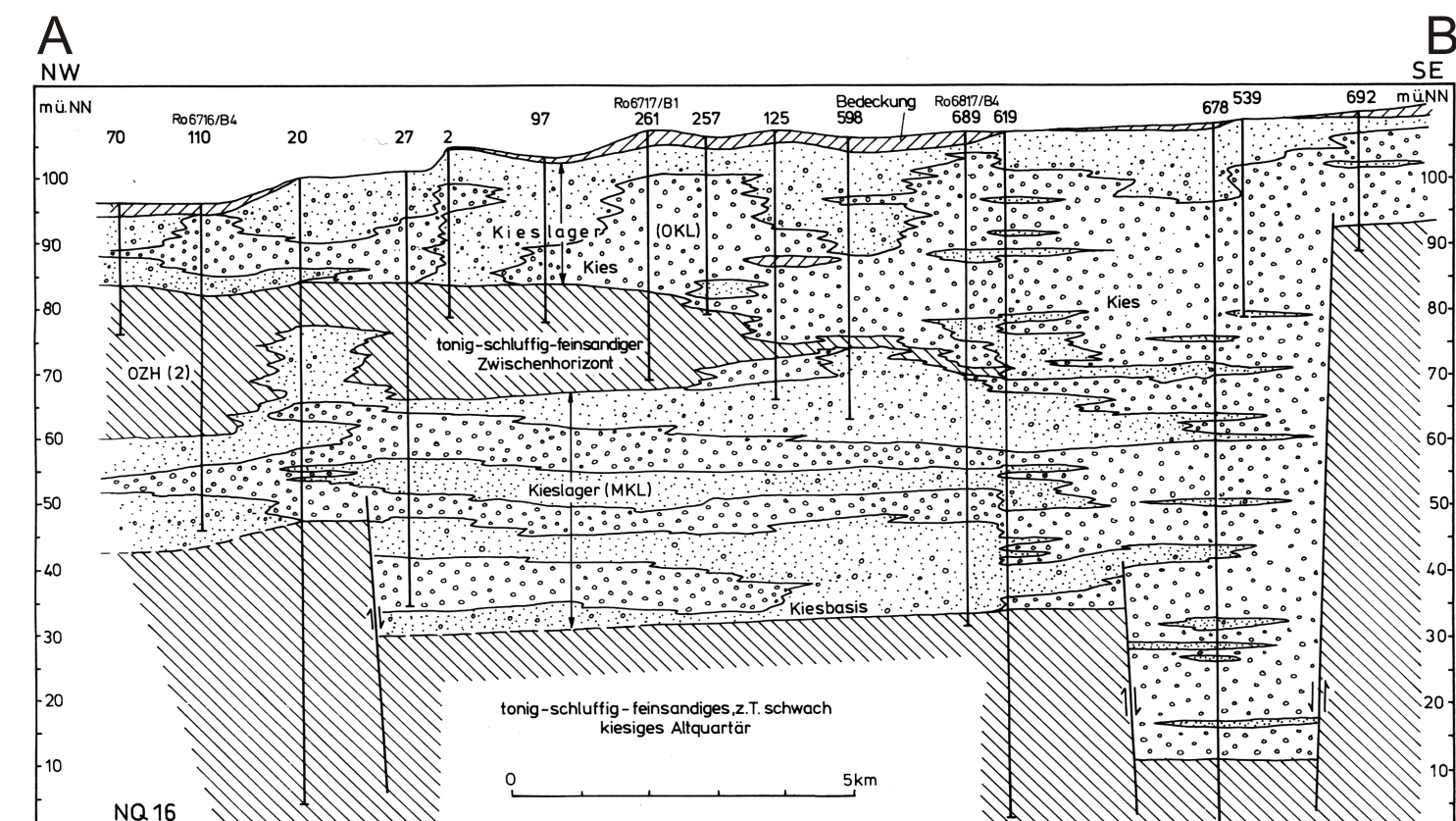


Fig. 5: Geological W-E profile of the eastern part of the Upper Rhine Valley between Mannheim and Karlsruhe (WERNER et al. 1995).

north near Bruchsal (BARTZ 1982). The "Oberer Ton"-horizon is not known in that area (WERNER et al. 1995). The fragmentary specimen of *Bubalus* with marks of displacement is assigned by SCHREIBER & MUNK (2002) as an allochthonous find caused by a diachrone displacement.

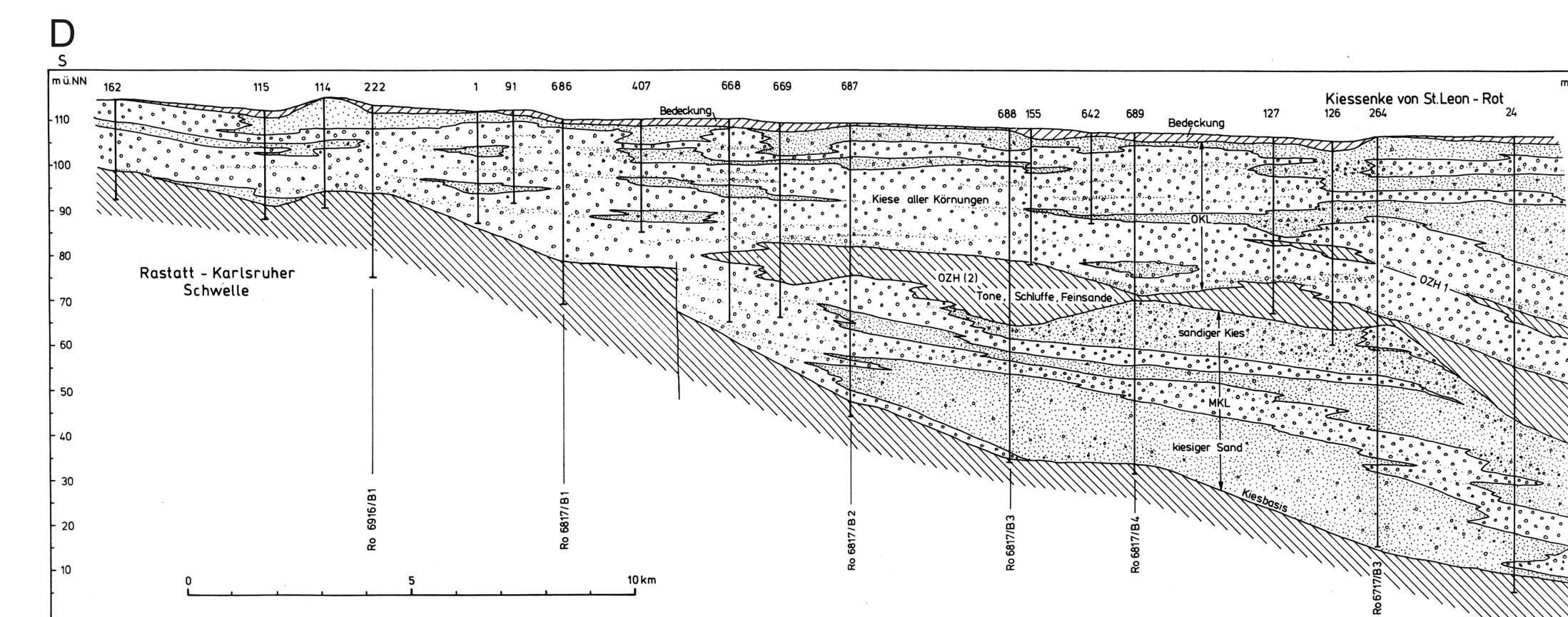


Fig. 6: Geological S-N profile in the north of Karlsruhe (after WERNER et al. 1995).

## Conclusions

The find of the waterbuffalo from Büchenau is an example for the exception which proves the rules. The stratigraphical model (Fig. 3) applied in the northern Upper Rhine Valley is supported by most of the finds in the middle part of the Upper Rhine Valley. But there is still no possibility for direct observations of the sedimentary structures and the arrangement of the fossils in the sediment. For example, the situation in the gravel pits of Eggenstein (see Fig. 1) is not clear caused by the lack of informations. Similar to Büchenau the extraction in the pits (2) and (3) is very shallow and there occur finds of interglacial faunal elements. A diachrone displacement of the remains could be possible in that case too.

Fluviatile deposits like those of the Upper Rhine Valley are complex three-dimensional structures (see Fig. 5, 6, 7) in which small scaled structures of different ages could occur in the same level. The stratigraphical determination of fossils and the geological interpretation of the deposits in the Upper Rhine Valley could be different to the general situation and has to be proved in any case.

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Fig. 7: The fluvial system of the Upper Rhine Valley in historical time. The map shows the positions of the river and its channels in the 19th century, at 1700, 1600, in the 14th century and older. This historical development is a good example for the dynamics of a fluvial system in the Upper Rhine Valley.

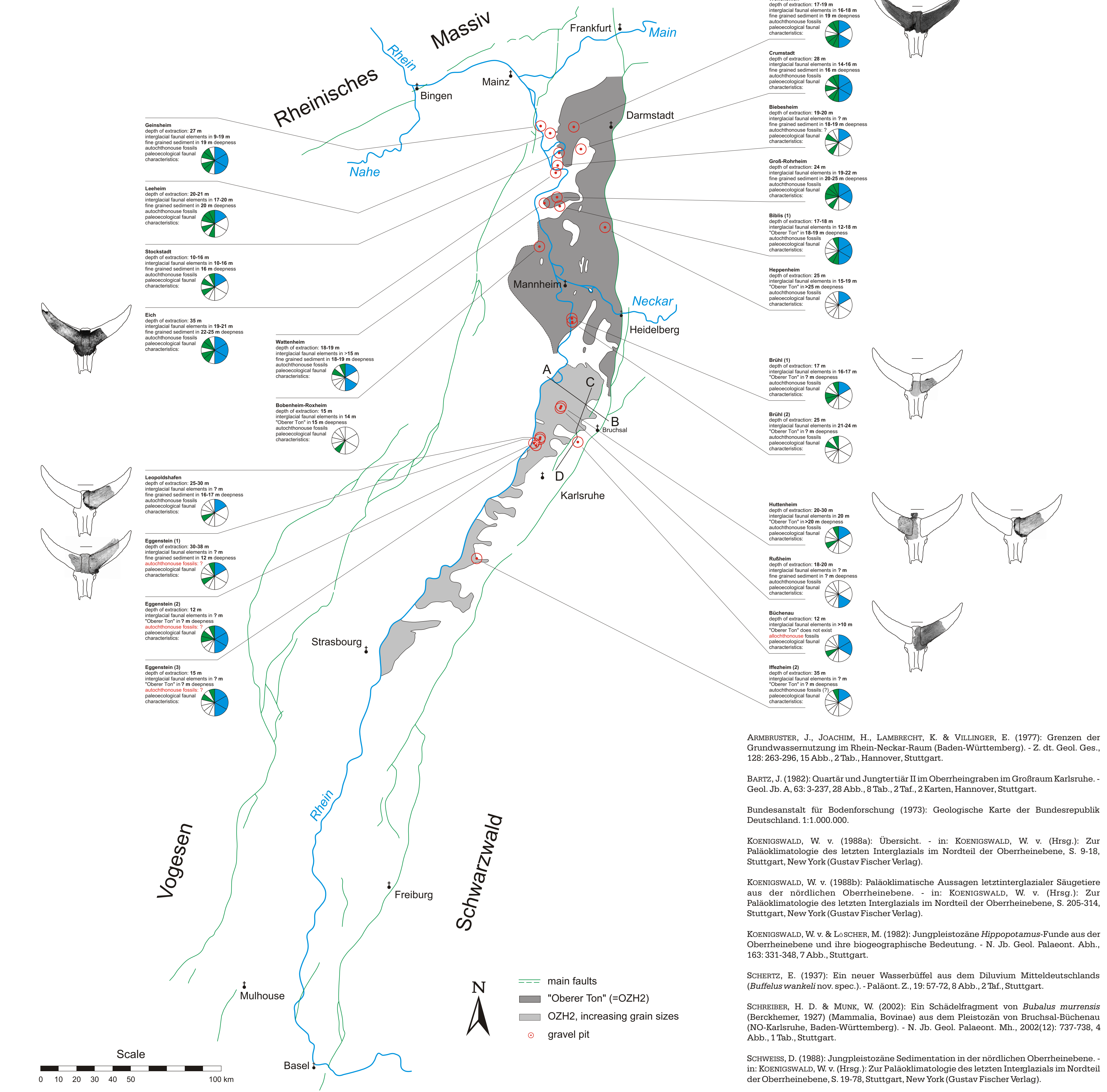
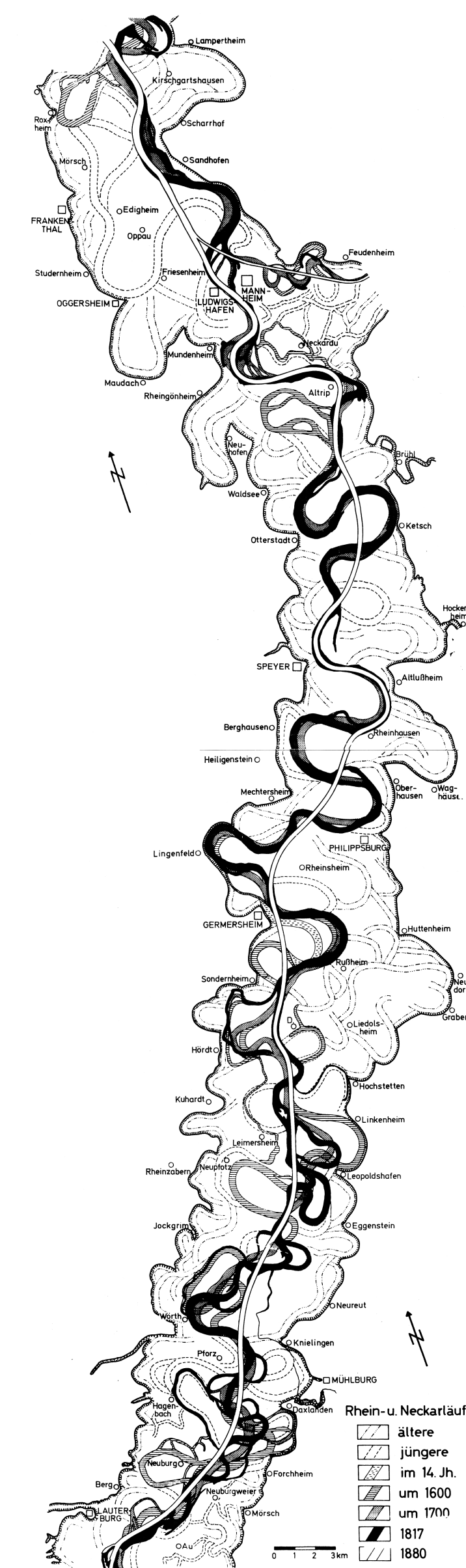
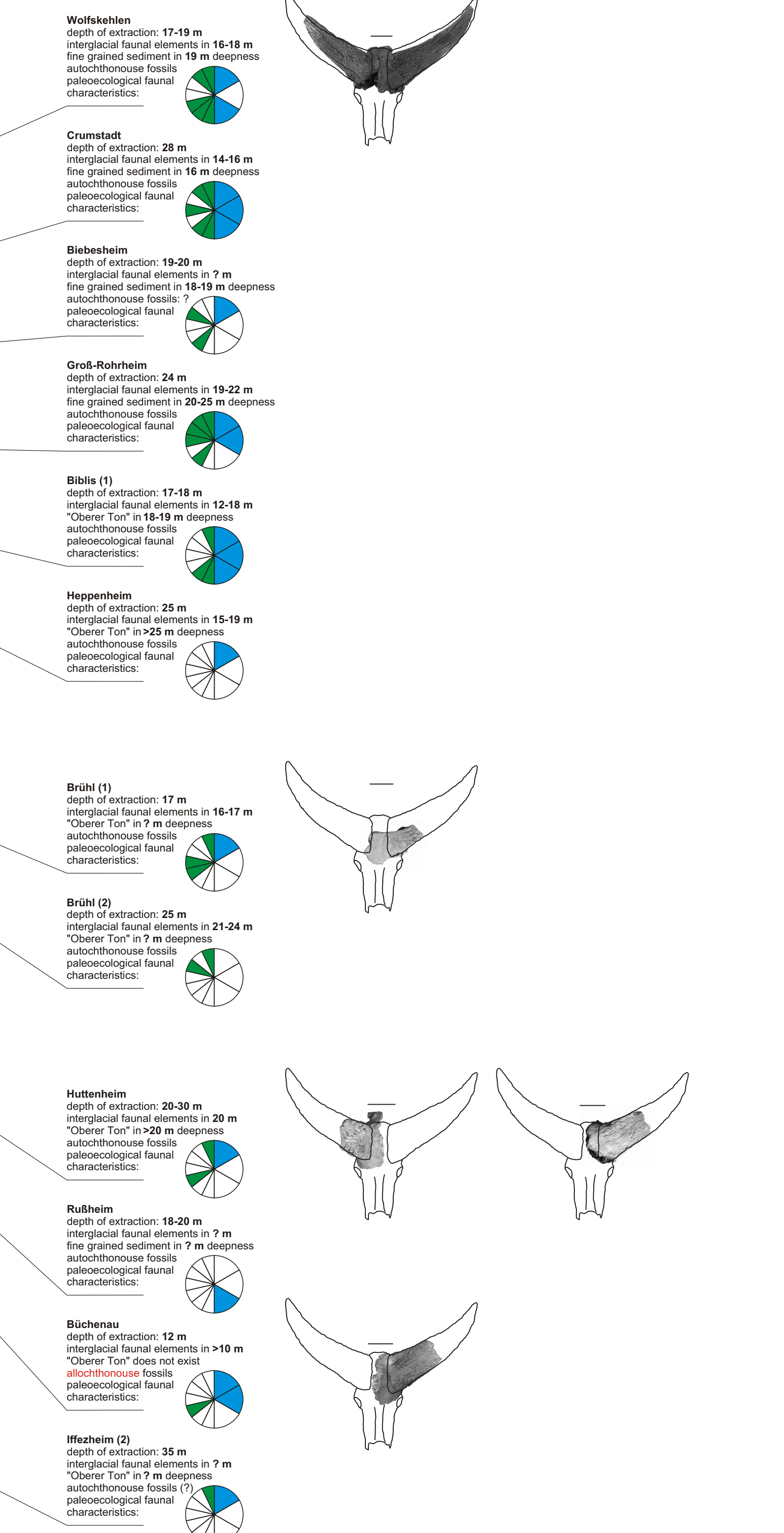


Fig. 1: Gravel pits in the Upper Rhine Valley which have yielded a rich sample of pleistocene mammals. The figure based on a geological map of Germany (Bundesanstalt für Bodenforschung 1973) and the contribution of the horizon "Oberer Ton/OZH2" based on maps in SCHWEISS (1988), WERNER et al. (1995) and WERNER et al. (1997). Skull fragments of *Bubalus murrensis* (BERCKHEMER, 1927) in relation to a dorsal outline of the skull from Schönebeck, E-Germany

(SCHERTZ 1937, pl. 3, Fig. 2 below). Eich: PW1983/103, NMM (NEUFFER & IGEL (1983#); Leopoldshafen: SMNS 6816.13.5.79.2, SMNS; Eggenstein (1): SMNS 6816.15.8.86.5, SMNS; Wolfskehlen: no number, AG Felsberg-Museum, Beedenkirchen (KOENIGSWALD 1988#); Brühl (1): SMNS 6517.5.11.73.9, SMNS; Huttenheim: SMNS 6816.5.4.77.20 and SMNS 6816.5.5.86.9, both SMNS; Büchenau: Qp/20, SMNK (SCHREIBER & MUNK 2002#).



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