AN EXTENDED PREHISTORIC WELL FIELD IN THE OPENCAST MINE AREA OF ZWENKAU, GERMANY

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ABSTRACT. In the opencast mine area of Zwenkau, Germany, many prehistoric wells and pits have recently been excavated. In this region there is generally no bone preservation and charred seeds are rare, seldom encountered in a reliable archaeological context, whereas charcoal is frequently found. From an archaeological point of view, however, charcoal from wood is not as reliable for radiocarbon dating as short-lived materials. Fortunately, many deep features were found where wood has been preserved. Over a dozen structures turned out to be prehistoric wells, some of them typologically dated by ceramics to between Early Bronze Age and Early Middle Ages. For other features without archaeological finds, ^{14}C dating was the only way to get an age. Analysis showed that different types of wells were constructed by the same culture. On the other hand, the same constructions are not characteristic for a defined cultural period and were applied over a time span of three millennia.

INTRODUCTION

In the environs of Leipzig are large deposits of brown coal that have been exploited for over a century. An area of *ca.* 500 km^2 and over 40 villages have been destroyed by mining activity, with extensive environmental consequences. After 1990 many opencast mines were closed in the former East Germany. In Zwenkau, south of Leipzig (Western Saxony) coal will be mined until 1999; archaeological excavations were begun here in the year 1993. The opencast mine at Zwenkau extends from the Weisse Elster floodplain for *ca.* 3 km toward the west, on the Saalian terrace (Fig. 1). By the end of coal mining, 230 ha will be inspected archaeologically but much less will be excavated. Though there were no indications of prehistoric settlement before 1993, since then an enormous number of archaeological sites, ranging from Early Neolithic to Iron Age and the Early Medieval period, have been discovered and excavated. It is now evident that this region represents one of the most important prehistoric sites in central Europe, permitting us to study landscape archaeology over a period of more than 7000 yr.

SITE DESCRIPTION

Though many structures from almost all prehistoric cultures have been found, the main attention was first directed to the remains of an Early Neolithic settlement (Fig. 1A) underneath Eythra, a village at the margin of the Weisse Elster floodplain, which was devastated by mining between 1985 and 1988. Typological studies of the ceramic finds from hundreds of pits, and *ca.* 50 typical house sites, many of which overlap each other, helped us identify the features with the Bandkeramik culture (Linearbandkeramik as well as Stichbandkeramik). Poor bone preservation and rare remains of charred seeds impede a direct absolute dating at this stage of research. However, due to thorough knowledge of the material remains, we know that the area must have already been densely settled from the last three centuries of the 6th millennium BC (Flomborn phase) to the first centuries of the 5th millennium BC (Campen *et al.* 1997).

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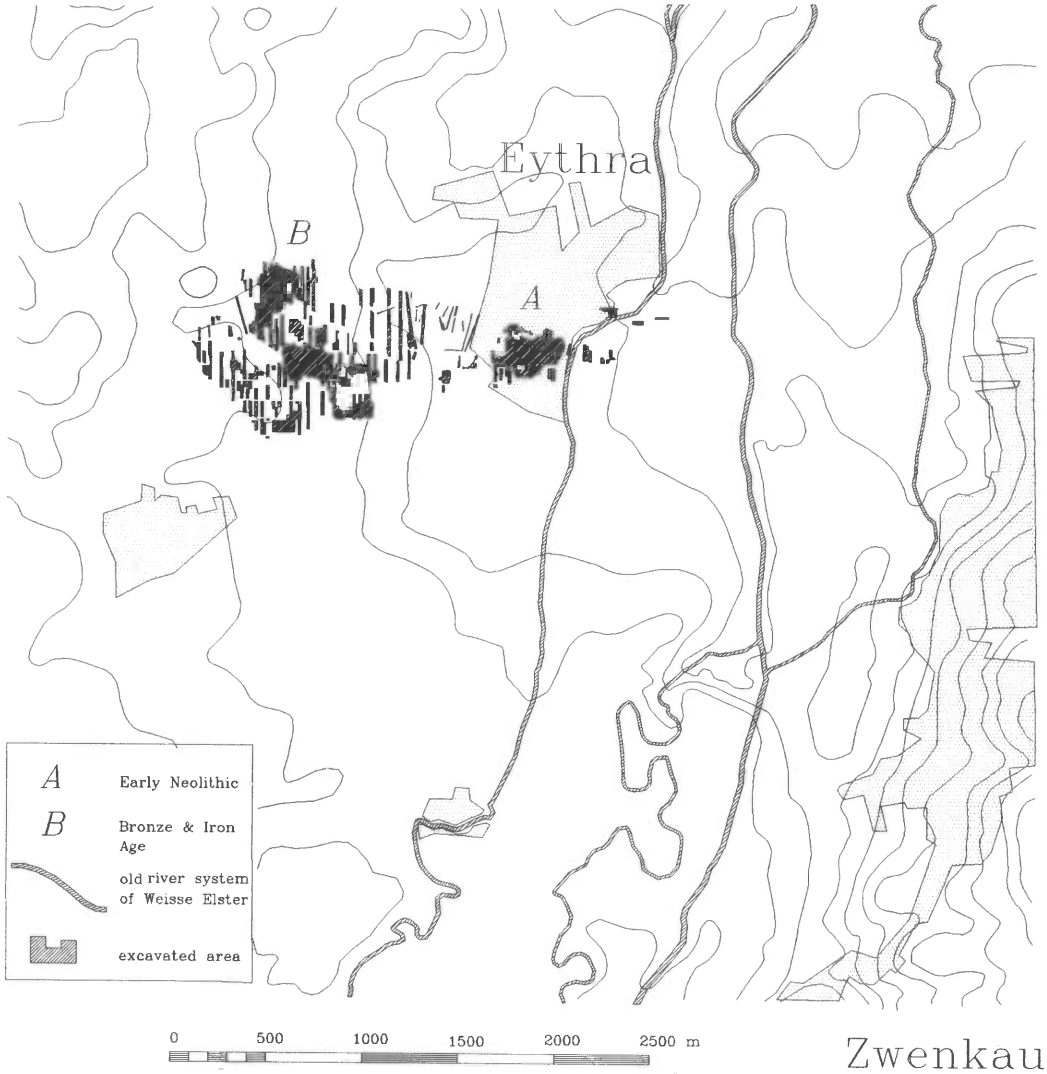

Fig. 1. The opencast mine Zwenkau and the archaeologically excavated area beginning in 1993. A. Mainly Early Neolithic settlements near the Weisse Elster river. B. Area of prehistoric settlements from the Late Neolithic/Early Bronze Age onwards.

The second field of archaeological investigations in the opencast mine region in Zwenkau (Fig. 1B) lies about 2 km west of the Neolithic villages mentioned above. No indication of the importance of this site existed until mining reached this area and excavation commenced. The area is far from any surface water, and neither were finds known nor anomalies seen in aerial survey. For this reason we were surprised by the occurrence of a huge number of prehistoric features (Fig. 2). Excavation, beginning in early 1995, has already been completed on an area of >200,000 m^2. As mining will continue until late 1999, the area under study will enlarge considerably.

By now, numerous pits, hundreds of postholes—many of which can be connected to houses—and a number of large pit-enclosures have been located and excavated. The differences in structure, along with the stratigraphic and typological information, indicate that the area must have been settled from

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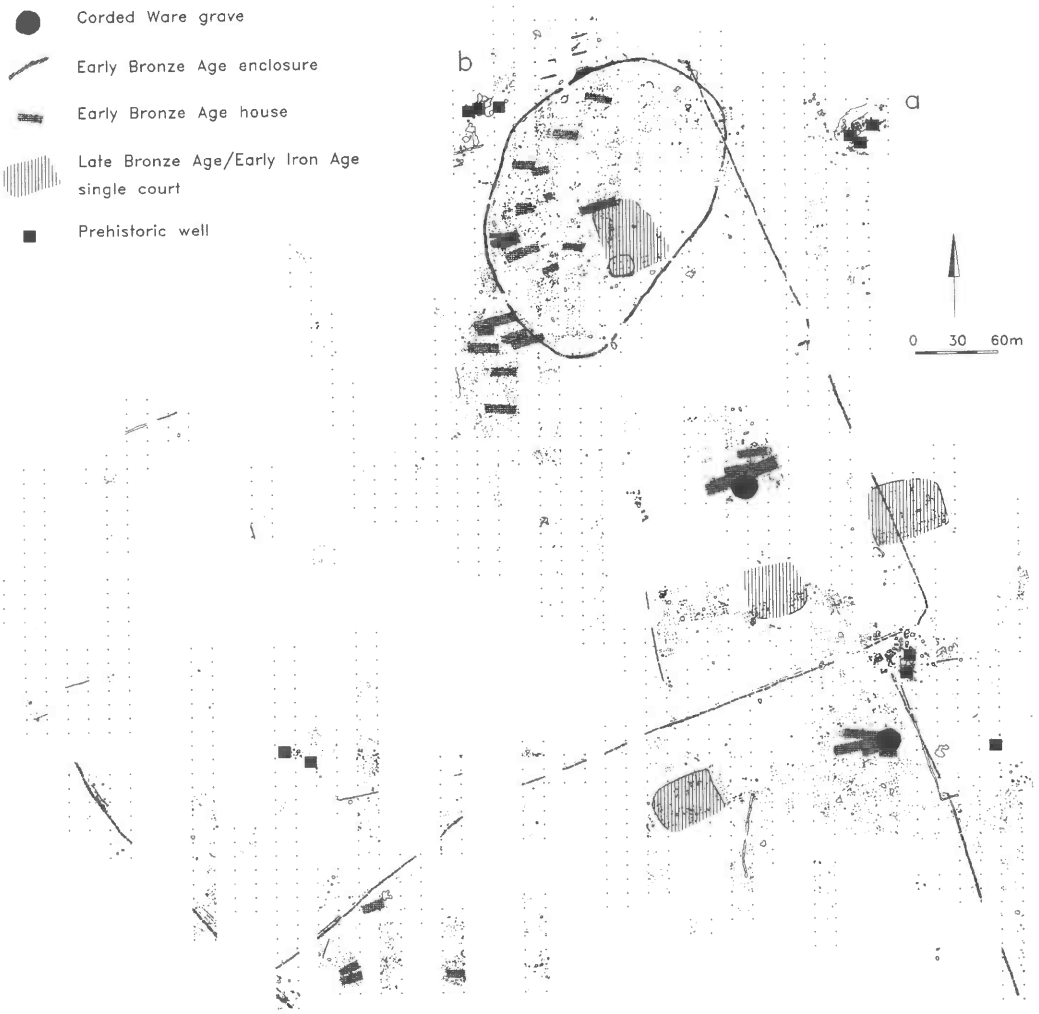

Fig. 2. Plan of the settlement on the Saalian terrace with features reaching from the end of the Neolithic to the Iron Age (a/b: concentration of wells).

the end of the Neolithic (Bell-Beaker culture) until the Late Iron and the so-called Roman Imperial Age (Römische Kaiserzeit). Although excavations are still continuing and not all material has been accurately identified, it seems to be concentrated in the Early Bronze Age (Aunjetitz culture), the Late Bronze Age (Lausitz culture) and Early Iron Age (Billendorf culture). The large number and the good quality of many structures combined with the unique possibility of large-scale excavation make this an important site in central Europe.

Apart from some graves of the Corded Ware culture and only a few pits with this typical ceramic, the area must have been first settled during the Early Bronze Age. More than two dozen house sites and two large pit enclosures can be attributed to this period. During the first settlement phase, the houses are concentrated in an area enclosed by an oval-shaped ditch of *ca.* 2.7 hectares. Excavation revealed that the enclosure was often interrupted at irregular distances by gaps of different length. The profiles showed great differences in shape, ranging from a shallow and flat bottom (up to 0.3 m

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under the excavation surface) to 1.5 m V-like deep cuts into the gravel. Though postholes were sometimes found parallel to the ditch and taking into account the deep erosion, there is still no clear indication that this enclosure had an overall defensive function. Later the settlement extends over the area of the enclosure, and postholes of some houses of the same type were found to cut the refill of the ditch. Accordingly, a different enclosure was built: straight pit alignments of up to 600 m in length. The individual sections range from 2 to 6 m in length and are divided by earth bridges up to 1 m wide. The pit alignments form rectangular enclosures covering areas of more than 30 ha. Only seldom were they flanked by one, two or three rows of postholes. Stratigraphically some of them must have been younger.

Though over 2 km of this pit system has been excavated, no direct dating has been possible yet. Its relation to other features on site, and stratigraphic observations, suggest a relation with some of the Early Bronze Age houses. The pit alignment is again cut by features that can be combined to form "single courts". The smaller house structures are built up of only 4 to 9 postholes, and are sometimes surrounded by small ditches indicating a different settlement type. So far over half a dozen of the single courts have been found distributed throughout the Zwenkau opencast, from the margin of the floodplain of the Weisse Elster to the west. As dated by ceramics, they seem to belong to the Late Bronze Age and Early Iron Age, so that the change in the settlement pattern must have taken place between the Early and the Late Bronze Age (Stäuble 1997).

In addition to these settlements we have also ^{14}C-dated wood from wells and deep pits with preserved wood from other prehistoric settlements nearby. In 1996, excavations were necessary for the construction of a 90-km-long pipeline. It passed through the region south of Leipzig from west to east at a distance of a few kilometers from the opencast mine of Zwenkau, allowing a complete archaeological survey through different geographical regions (Friederich *et al.* 1997).

Methods

Archaeological Material

Despite the large amount of prehistoric remains, only a few features contained enough finds to be dated by typological means. Although charcoal is frequently found, we do not consider it to be reliable for ^{14}C dating. From an archaeological point of view, its origin is difficult to determine with certainty (Stäuble 1995). All the more important, then, was the excavation of *ca.* 15 features that were up to 4 m deep (Table 1). All of them showed more or less good wood preservation at the bottom of the pits. The different wood constructions can be interpreted as the remnants of prehistoric wells. They were typologically different, ranging from square constructions made of planks, 30-yr-old oak trunks, to round wells constructed of wattle, strips of thin wood sewed together or hollowed trunks. If available, short-lived material like wattle or twigs was favored for dating over compact wood.

Some of these features contained no finds at all, and as their location seems to have been more dependent on the occurrence of stored water than on the neighborhood of the contemporary settlement, ^{14}C dating was the only way to determine their cultural context. Except in this important case, dating by ^{14}C gives us the rare opportunity to determine the approximate age of the structure itself and not of the fill, as is usual when dating finds from pits. The latter is always connected with the interpretation of the history of the fill and is not as reliable.

Radiocarbon Dating Methodology

Most wood samples were pretreated following the standard A-A-A procedure using 1 M HCl (3–4 h at 80°C), 0.5 M NaOH (1–2 h at 80°C) and dilute HCl with $NaClO_2$ (1–2 h at 80°C) for bleaching.

TABLE 1. List of All ^{14}C-dated Wood Samples from Some Wells and Pits of Three Settlement Areas South of Leipzig

Site	Feature	Lab code	^{14}C age (yr BP)	Archaeological dating	Type of well	Material
ZW-05	Well 1 (33-282,1)	LZ-1171	2457 ± 67	Early Iron Age	Square of planks	*Quercus*
ZW-05	Well 2 (34-283,19)	LZ-1182	1905 ± 65	Late Iron/Roman Imperial Age	Cylindrical form, wattle	*Salix* ?
ZW-05	Well 3 (34-284,10)	LZ-1232 LZ-1332	3530 ± 60 3660 ± 60	Indeterminate	Cylindrical form, wattle	*Quercus* *Quercus*
ZW-05	Well 5 (?) (35-284,1)	LZ-1181	1985 ± 55	Roman Imperial Age	Indeterminate if well;	Quercus ?
ZW-08	Well 7 (17-285,2)	LZ-1238 LZ-1239 LZ-1354 LZ-1242	2790 ± 65 2960 ± 75 2930 ± 55 2810 ± 55	Late Bronze Age	Square of complete young trunks	Quercus *Quercus* *Quercus* *Quercus*
ZW-08	Well 8 (16-285,3)	LZ-1235	3710 ± 55	Indeterminate	Wattle	*Salix* ?
ZW-08	Well 9 (16-285,8)	LZ-1233 LZ-1234 LZ-1237	3870 ± 60 3770 ± 60 3800 ± 60	Late Neolithic/ Early Bronze Age	Wattle and cylindrical construction of sewed wooden stripes	*Cornus* ? *Salix/Populus* *Acer*
ZW-08	Well 10 (15-285,1)	LZ-1236 LZ-1333	1680 ± 55 2220 ± 90	Indeterminate	Square of planks	*Alnus* *Alnus*
ZW-17	Well 11 (6-239,3)	LZ-1290 LZ-1293 LZ-1296 LZ-1297 LZ-1298 LZ-1331	2970 ± 55 2900 ± 55 2810 ± 55 1570 ± 80 2905 ± 55 2900 ± 60	Indeterminate	Cylindrical form, wattle with vertical stacks	Wood indet. Wood indet. *Quercus* (branch) Wood indet. *Salix/Populus* (?) Wood indet.
ZW-01	Well 12 (79-233,3)	LZ-1304 LZ-1305 LZ-1306	2480 ± 55 2440 ± 55 2460 ± 60	Late Bronze Age/ Early Iron Age	Square of planks	*Quercus* *Quercus* *Alnus* ? (bark)
ZW-14	Well 13 (36-245,1)	LZ-1325 LZ-1335	3590 ± 60 3565 ± 60	Indeterminate	Square of planks	*Quercus* (trunk) *Quercus*
ZW-14	Well 14 (40-239,3)	LZ-1326	2880 ± 60	Indeterminate	Hollowed trunk	*Salix/Populus* (?)
PEG-05	Well 1	LZ-1355 LZ-1356	1460 ± 55 1280 ± 60	Early medieval	Square of planks	Wood indet. Wood indet.
KTZ-08	Well 2 (?)	LZ-1358	1680 ± 55	Indeterminate	Indet. if well or deep pit	Wood indet.
KTZ-08	Well 3	LZ-1357 LZ-1359	2100 ± 55 2070 ± 55	Late Iron Age	Square of planks	Wood indet. Wood indet.
ZW-08	Pit 1 (16-285,4)	LZ-1231	2470 ± 70	Indeterminate	Deep pit with little wood preservation	*Quercus* ?
ZW-14	Pit 2 (26-249,8)	LZ-1289 LZ-1291 LZ-1292	2440 ± 55 2420 ± 55 2350 ± 55	Early Iron Age	Deep pit with wood preservation	Wood indet. Wood indet. Wood indet.
ZW-01	Pit 3 (79-233,2)	LZ-1299 LZ-1300 LZ-1303	2480 ± 55 2380 ± 55 2485 ± 55	Indeterminate.	Deep pit with wood preservation	*Alnus* (branch) *Alnus* (branch) *Alnus* (branch)
ZW-17	Pit 4 (7-238,1)	LZ-1307	3705 ± 55	Early Bronze Age	Deep pit with almost no wood preservation	*Salix/Populus* (?)

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In some cases, however, archaeological wood material was strongly decomposed, resulting in unusually high losses during the alkali extraction and only small quantities of a residue, which no longer had a wood-like appearance. Similar observations have been made by Zaitseva (1995).

Numerous archaeological wood samples were interspersed with extremely fine silt and clay particles that could not be completely removed and led to a noticeable ash-residue after combustion. Some of the samples proved to be strongly decomposed, giving high contents of alkali-soluble fraction and only a small amount of insoluble organic residue. If sufficient material was available, those samples were repeatedly pretreated using HCl alone or under milder alkaline conditions (0.1 M NaOH at 60°C). The concentration of alkali had a greater influence on the loss of substance than temperature and duration. Therefore the amount of alkali-soluble fraction can be reduced to about a third through application of 0.1 M instead of 0.5 M NaOH.

After washing and drying, the samples were converted to benzene and ^{14}C activities measured with a Packard Tri-Carb® 2560 TR/XL spectrometer. ^{14}C ages were calculated using the half-life of 5568 yr and corrected for isotope fractionation by normalizing the ^{13}C values to –25‰. We calibrated the ^{14}C dates with OxCal v.2.13 (Bronk Ramsey 1994) using the probability method at a 1σ confidence level.

Results and discussion

40 wood samples from 3 sites were ^{14}C-dated at the ^{14}C lab in Leipzig. All dates are compiled in Table 1.

^{14}C dating of separate fractions from the wood of well 3 (Table 1), obtained under different extraction conditions, displays that 1) no significant age differences occur and thus 2) all components have the same origin without admixture of allochthonous contaminants (Table 2), yielding reliable ^{14}C results. This confirms the findings from Zaitseva (1995). We may conclude that cellulose was decomposed and humic acids became the main component as the result of lignin decomposition. Such chemical and/or microbial wood degradation processes seem to be associated with the sediment matrix (Zaitseva 1995), which mainly consists of floodplain deposits and gleyed soils and could be favored by the use of wood specifically in wells with an often varying water table and intermittent ventilation.

Table 2. Results of ^{14}C Analysis of Different Fractions of Decomposed Wood from Sample Well 3 (ZW-05, 34-284,10)

	Pretreatment procedure			% Alkali-soluble	Dated		$\delta^{13}C$	^{14}C age
Sample	1 M HCl	0.5 M NaOH	$HCl/NaClO_2$	comp.	fraction	Lab code	(‰ PDB)	(yr BP)
5/9	4 h/80°C	2 h/80°C	2 h/80°C	n.d.	Insoluble*	too little substance		--
A	3 h/80°C	1 h/60°C	1 h/80°C	(*ca.* 40)	Insoluble	LZ-1232	–26.1	3530 ± 60
B	3 h/80°C	--	--	--		LZ-1332	–25.7	3660 ± 60
D 1	2 h/80°C	1 h/80°C	--	*ca.* 42	Soluble**	LZ-1360	–26.1	3540 ± 60
D 2	2 h/80°C	1 h/80°C	1 h/80°C		Insoluble	LZ-1361	–25.85	3710 ± 80
	0.1 M NaOH							
C 1	2 h/80°C	2 h/80°C	1 h/80°C	*ca.* 15	Soluble	too little substance		--
E 1	2 h/80°C	5 h/80°C	--	*ca.* 25	Soluble	LZ-1363	–26.2	3610 ± 80
E 2	2 h/80°C	5 h/80°C	1 h/80°C		Insoluble	LZ-1362	–25.7	3630 ± 80

*Alkali-insoluble fraction; ** alkali-soluble fraction (humic acids); n.d.= not determined

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Where possible, we preferred to date wood from the construction of the wells as opposed to those samples taken from the fill of the structure. This was not possible, however, for five features with no wooden structure at all. As the pits were up to 4 m deep they must have reached the groundwater level, so that wood preservation was possible. Yet there is no archaeological information demonstrating that these regular and deeply dug pits had once been wells, where a wooden structure was missing. Measuring the ^{14}C content of some pieces of wood found in the fill made it possible to date three of them to the Early Iron Age. In one case (ZW-14: 26-249,8) this was confirmed by the ceramic evidence, whereas pit ZW-01: 79-233,2 was first attributed to the Late Bronze Age culture on the basis of the settlement context. The third pit (ZW-08: 16-285,4) had no archaeological material that could be used for typological dating but contained some pieces of wood (probably oak) for ^{14}C dating. A pit 3.5 m deep was found dug in Kitzen (KTZ-08, 2), at the archaeological excavations for a pipeline, about 8 km west of Zwenkau. The ^{14}C age determination of some indefinite pieces of wood at the bottom again gives us the only indication of the approximate age of this feature. The excavations ended in December 1996, but we still lack precise information about the age of this site. Nevertheless, it must have often been settled from the Bronze Age onwards, so that dating this feature between the 3rd and 5th centuries AD confirms settlement activity up until the Roman Imperial Age. This was also confirmed by excavations on a second pipeline in 1997, where a pit house and a similar deep feature was found some 150 m away, which contained a fibula dated to the same period. A fifth pit with single wood pieces preserved in its fill comes again from Zwenkau (ZW-17: 7-238,1). The only ^{14}C date provides an age of the last two centuries of the third millennium BC, in good agreement with five almost complete vessels (Fig. 3) that can be attributed to the Early Bronze Age Aunjetitz culture.

A similar good agreement is found for the wells, which are mainly concentrated in two areas: wells 1–5 in the northeast (Fig. 2a) and wells 7–10 in the northwest (Fig. 2b) of the of the oval-shaped

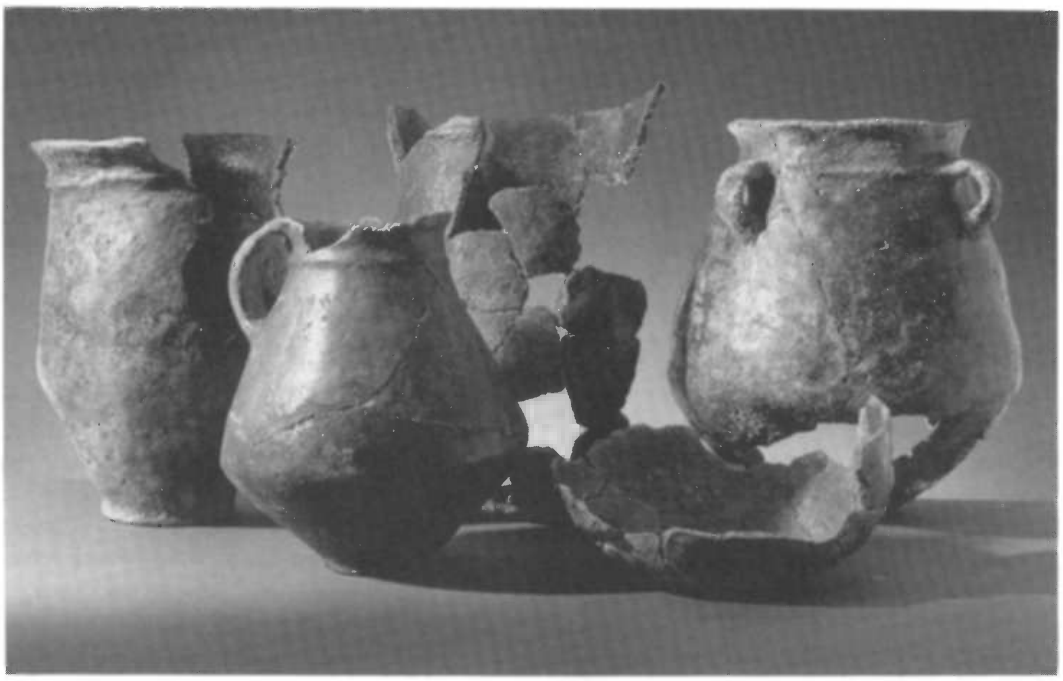

Fig. 3. Five vessels of the Early Bronze Age culture found in the fill of a 4-m-deep pit (ZW-17, 7-238,1)

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enclosure. Only a few (wells 11–14) are spread over the whole southern excavation area reaching from the western end halfway to the LBK settlement at the margin of the Weisse Elster floodplain. Four wells could be dated to the Early Bronze Age Aunjetitz culture (Table 3).

Two of them contained no finds and were constructed of wattle (wells 3 and 8). Well 3 was found during excavation of a huge irregular feature together with younger wells, whereas well 8 was found in the neighborhood of another Early Bronze Age well (no. 9). The filling of well 8, which showed at least three construction phases, contained an almost complete vessel, typical of the Aunjetitz culture, and ceramics of the Corded Ware culture. Three ^{14}C dates between 2340 and 2200 cal BC (1σ) fit well with the archaeological context. This well is important not only because it demonstrates a simultaneity between Late Neolithic and Early Bronze Age cultures, but also because of its special construction. It consisted of 0.2-m-wide stripes of bast sewed together at their ends with grasslike material, forming a cylinder. This feature, with a diameter of *ca.* 0.8 m, was deepened at the margin of a bigger pit and was sustained by a semicircular construction of wattle. This was built up using twigs of different species including *Acer*, *Populus* or *Salix* and *Quercus*. In a later phase, the pit of the first well was extended asymmetrically. Inside, a similar cylindrical structure was found, but it was not as well preserved. Nearby, another well (no. 8) built of wattle was discovered. Though one side of it broke down in ancient times, it was obvious that the construction must have had a square form. Apart from scarce remains of a bast vessel, no typologically datable finds were made inside, but the stratigraphic relation to the Late Neolithic/Early Bronze Age well 9 suggested a similar archaeological membership. One ^{14}C date (LZ-1235) confirms this. Another cylindrical wattle construction built of oak branches lacked any archaeological information about its age. Though it was first thought to belong to the Late Iron Age because of its proximity to wells 2 and 5, the first ^{14}C date contradicts this. It was thus checked by other samples (Table 2) which confirmed the derivation from the Early Bronze Age culture. The last well dated to this period (no. 13) showed a different construction type. It was built of oak planks with notches on its ends. Containing one almost complete undeterminable vessel, it could be definitely dated by two ^{14}C samples to the Early Bronze Age (Table 1).

Three wells dated to the Late Bronze Age (well 7, 11, 14; Table 3), show that *ca.* 1000 yr later the construction type did not necessarily change. Again we found a cylindrical wattle construction (well 11), though it was smaller in diameter. The construction is hard to interpret, as it contained many wooden stakes buried vertically in the ground. They all reached under the walls of the wattle construction. The filling contained many small sherds, which are not diagnostic. Only one ornamented sherd can be dated to the Late Bronze Age, which is also confirmed by a great number of ^{14}C dates. There is nonetheless one exception (LZ-1297), which has been omitted in the calibration of the combined ^{14}C dates per feature.

Yet another type of well (no. 14) was discovered southeast of the main field of the settlement. The structure at the bottom of a pit consisted of a hollowed trunk ^{14}C-dated to between 1210 and 990 cal BC (1σ). As there were no archaeological finds from it and no other settlement structures around it, ^{14}C was the only means of dating this new type of well. The same is true of the best-preserved well (no. 7), the construction of which was *ca.* 1.2 m in height (Fig. 4). The four sides of the well were built up using pieces of 1.1-m-long young oak trunks, held together by notches. The construction was secured by two vertical trunks stuck into the ground at the edges of the square. Though wood preservation was quite good and many of the trunks were complete—all pieces still included bark—no dendrochronological dating was possible, as many of the trees used were younger than 30 yr at felling. Besides, an anomaly in growth disturbed *ca.* 10 to 15 of the tree rings, making age determination impossible. Four ^{14}C dates on the trunks may be divided into two groups (Table 3), showing

Table 3. Calibrated Sequences (Bronk Ramsey 1994) of the Combined Data per Feature

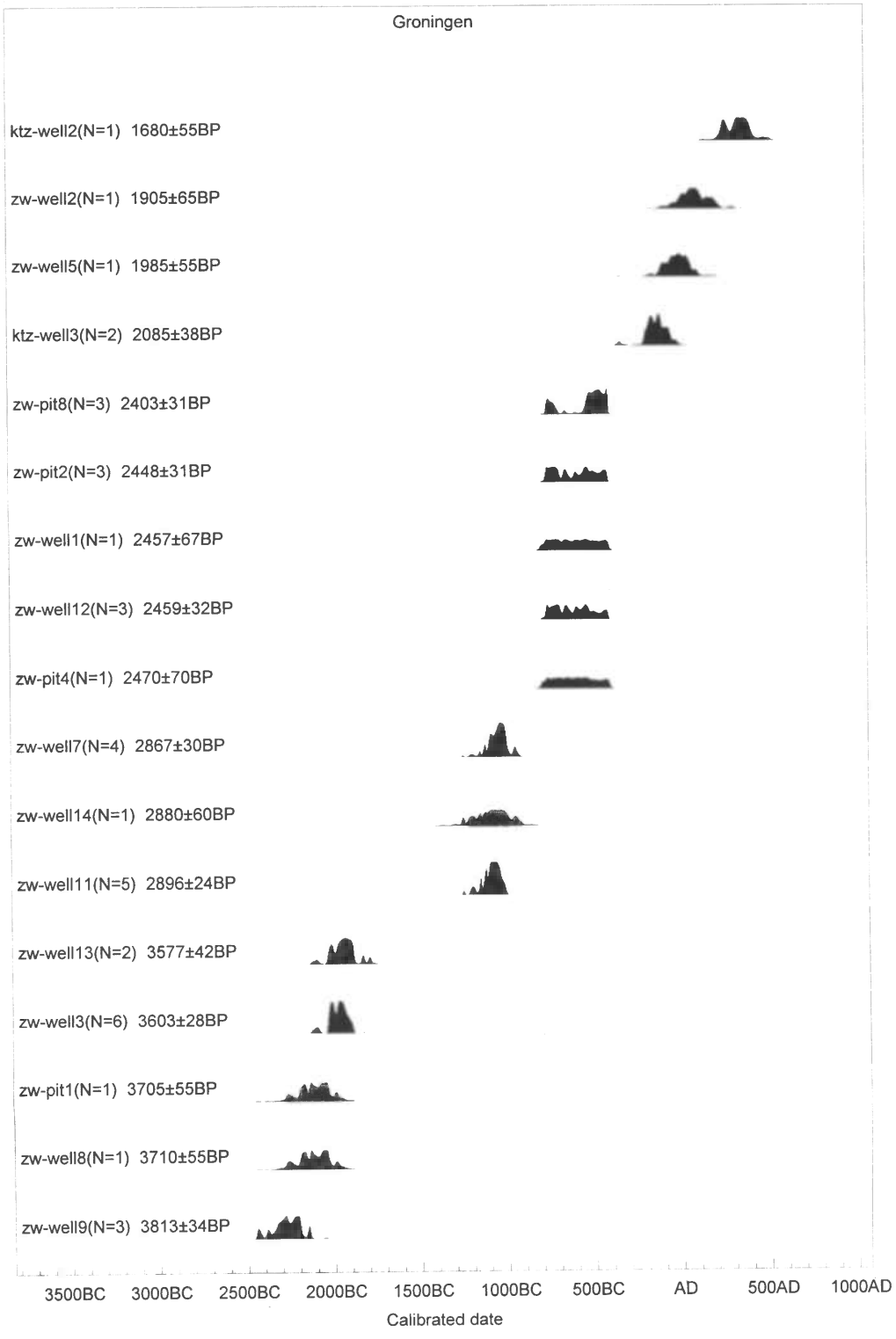

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Fig. 4. Young Bronze Age well constructed of oak trunks, many of them belonging to the same oak which was *ca.* 30 yr old

a slight difference in age that does not cover the same period at the 68.2% confidence level. Two almost complete vessels found at the bottom of the well can be dated to the Late Bronze Age, supporting the younger age, though the fill could have been younger than the well itself.

Small finds, impossible to date typologically, were found in two other square wood constructions (well 1 and 12). Compared to the former ones, both were built of oak planks, fitted together through notches (Fig. 5). Three ^{14}C dates from well 12 and one from well 1 clearly point to the Early Iron Age period. The oak planks of well 1 were best preserved, so that a determination of its dendrochronological age was possible. The tree must have been cut *ca.* 689 BC, which confirms and specifies the rather wide calibrated interval of LZ-1171. Including the wood samples from some deep pits (pits 1–3, see above) they all fall into the Hallstatt plateau between 2400 and 2500 BP (Table 1), which covers *ca.* 350 yr from 750 to 400 cal BC (Table 3), resulting in much larger calibrated age intervals. Kilian, van der Plicht and van Geel (1995) conclude from the comparison of high-resolution AMS dating of Holocene raised peat bog deposits in the Netherlands with other peat profiles and the ^{14}C record that this time period was marked by a cooler and wetter climate. This climate change is considered as one of the most clearly defined shifts during the Holocene and there is considerable evidence of it from several sites in Europe and other continents (van Geel, Buurman and Waterbolk 1996). Though this period is well represented in the archaeological material from Zwenkau, we cannot yet differentiate between the Late Bronze Age and the Early Iron Age cultures in the settlement structures. Good correlation is lacking between some of the archaeological and ^{14}C-dated structures on the one hand and the single courts and houses on the other. As for the settlement location in relation to the river system, we can state that traces of the Neolithic cultures are found only near the river, whereas all archaeological cultures from the Late Neolithic/Early Bronze Age

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Fig. 5. Early Iron Age well (no. 1) of oak planks

onwards (from the end of the third millennium BC until the first centuries AD) concentrate on the Saalian terrace at some distance from the Weisse Elster floodplain.

In two additional wells, ceramics have been excavated that date them to the Late Iron Age/Early Roman Imperial Age (well 2 and 5). Both were ^{14}C-dated to somewhere in the ranges cal AD 10 to 200 and 60 cal BC to cal AD 80, respectively. While the latter had no clear wood construction and cannot be definitely identified as a well, feature ZW-05, 34-283,19 (well 2) found next to it was well preserved. It consisted of a cylinder with a diameter of 1.5 m and about the same depth constructed with twigs of *Salix* (Fig. 6). The last two wells discussed in this paper were discovered during the excavations of the 90-km-long pipeline. They were of similar construction (both square wells built of planks), but were dated differently based on the few artifacts found in their filling. The first (KTZ-08, well 3), excavated near the deep pit discussed at the beginning, could be dated to the Late Iron Age in accordance with the ^{14}C age (Table 1). Well 1 (PEG-05) was found *ca.* 6 km south of the sites from the mining area in Zwenkau, on the margin of the floodplain of the Weisse Elster. Although only partly excavated (because the lower part of it was not directly endangered by the trench of the pipeline), some finds suggest that it belongs to the Slavic period. Two ^{14}C dates (LZ-1355 and 1356) restrict it to between the 6th and 8th centuries cal AD of the Early Middle Ages, although the two dates do not overlap at the 1σ confidence level. The location and age of the well confirms the use of the landscape from the Neolithic onward, consistent with the excavation results of Zwenkau. Almost 15 yr ago, another Early Slavic well was found north of Eythra (Herklotz and Stuchly 1987) and was ^{14}C-dated by the Berlin lab (Bln-3254: 1400 ± 50 BP). No finds are known from this period on the Saalian terrace. They are concentrated in the immediate vicinity of the Weisse Elster, in the same area where people settled mainly during the Early Neolithic period. Since

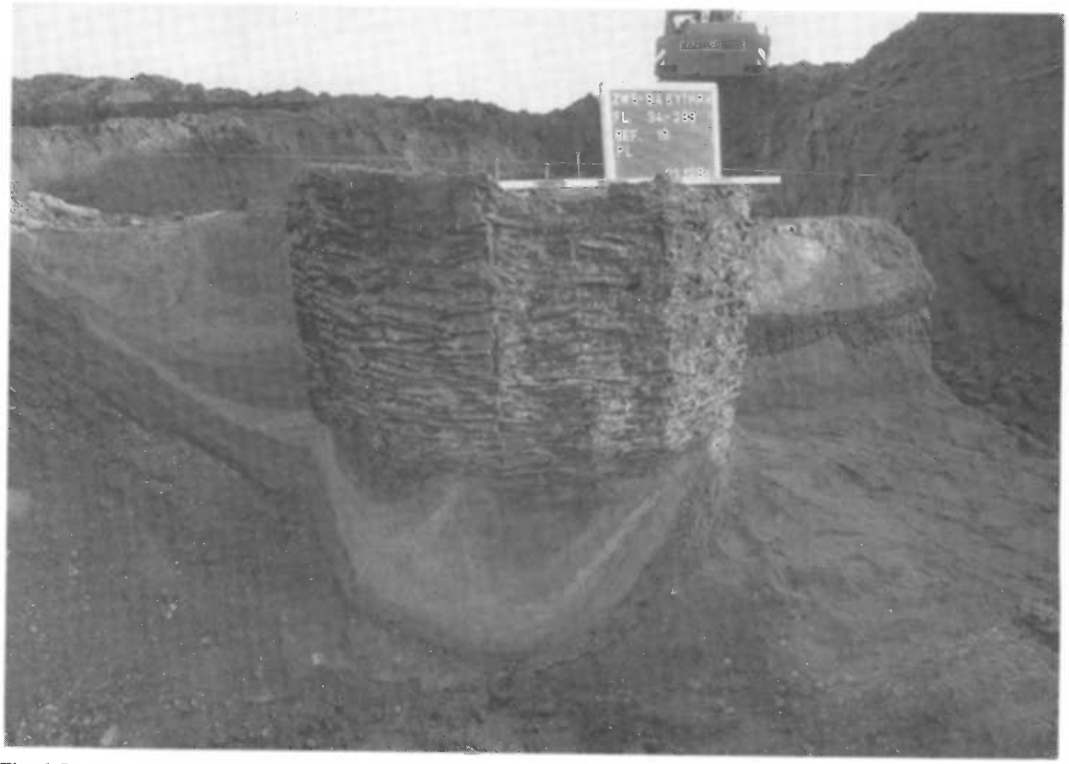

Fig. 6. Late Iron Age / Roman Imperial Age well (no. 2) constructed of wattle from *Salix*

then, nothing has changed in the settlement distribution, as some centuries later the historical epoch begins in this region with the first mention of Eythra in AD 976. Settlement was restricted to this area and is oriented toward the river, whereas the land west of it was used for agriculture. The opencast coal mine is the latest transformation of the region's surface. In the future, a large lake will be created here, changing the region's economic history from agricultural *via* industrial into touristic.

Conclusion

In the opencast mine area of Zwenkau, Germany, many prehistoric wells and pits have recently been excavated where wood for ^{14}C dating was preserved. If available, we preferred short-lived material like twigs and wattle or wood from the well construction itself rather than material from the fill of the wells to obtain more reliable results.

Many features could be typologically dated by ceramics and provide ^{14}C dates consistent with the expectations derived from archaeological finds. For those wells whose ages were not determinable by typological means based on ceramics, the ^{14}C method was the only means to determine the approximate age and to define their cultural context. Only a few ^{14}C dates do not fit in to the archaeological classification. In these cases some ^{14}C analyses have to be repeated and the archaeological context must carefully be proved once again.

By ^{14}C dating of the wooden structures, we find different types of wells to have been constructed during the same culture, whereas the same constructions can be observed over almost 3000 yr from the Neolithic and Early Bronze Age to Early Middle Ages.

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