

Construction of a circular ditch system and houses of the middle Neolithic

The contribution describes the construction of a Neolithic circle ditch based on the archaeological situation from Schletz (Lower Austria) carried out to answer some questions concerning planning and organisation of work.

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Lower Austria is the stage of a bi-annual exhibition, reaching a large public. In 2005 it dealt with the phenomena of circular ditch systems from the middle Neolithic period. With regards to this, an extensive presentation of archaeological finds of that period was arranged in Wetzdorf. In an open air area a circular ditch system was reconstructed and a part of the surrounding settlement. This was based on archaeological data from Schletz/Lower Austria (Daim, Neubauer 2005). This circular ditch system was discovered in 1981 through aerial photography in which it could be seen as a dark ring in a freshly ploughed field. From May to October 262.000 visitors came to see the exhibition in Wetzdorf.

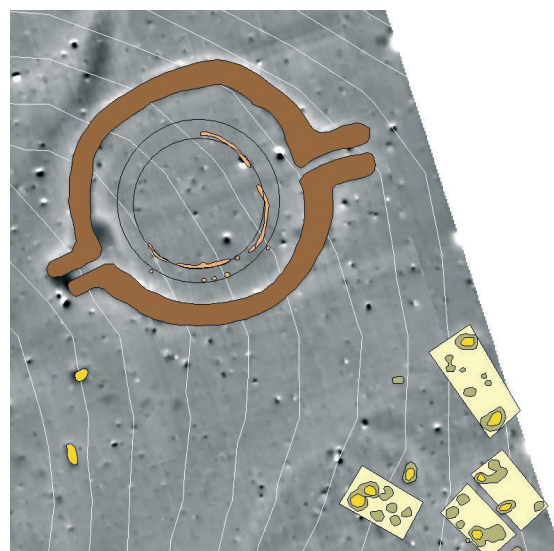
Archaeological data concerning the circular ditch

Since 1985, this archaeological site was investigated in the course of various interdisciplinary research projects. The excavations of 1985 and 1986 resulted in the find of a typical V-shaped ditch. Inside a circle of post-holes for a palisade could be identified (Trnka 1991). Archaeological finds allow us to date the whole construction to about 4900/4850 – 4500 BC. In 1995 the construction was surveyed with a magnetometer, which gave us the exact position of two entrances in the form of earth bridges and a second palisade ring of individual rectangular posts (Neubauer, Eder-Hinterleitner, Trnka 2001).

The circular ditch system of Schletz had a diameter of 44 m to the centre of the ditch with a maximal deviation of 1 meter. The ditches were

3,5 – 5 m wide and 1,7 to 2,8 m deep. The v-shaped profile was very steep. At the bottom of this pointed ditch the working traces of a pick that was used during the earth works, were still visible. Inside the ring there was a concentric ring of posts with a diameter of 24 m. A quarter of this ring and the area to the north-east entrance were excavated between 1995 and 1996. The palisade ditch had a depth of about 60 cm. The single posts of this palisade, with a diameter of 25 - 30 cm, were put together very closely to produce a compact non-transparent structure. Because of the deep foundations the height of the palisades can be estimated to be at least 2 - 3 m. In the areas of the two entrances there are corresponding interruptions. Between this palisade and the ditch there was a second concentric ring of single posts. These were put into the ground in such a way that the overworked surfaces faced exactly to one of the entrances. Inside the palisade ring no further archaeological remains were found. We estimate that since the time of the circular ditch system in the Neolithic about 1 m of the ground has been eroded.

How could people in the Neolithic time plan and carry out such big projects? It seems to be more than possible that the erection of a circular ditch system was at the request of a larger, well organized group. In many cases we have evidence for a close relationship between a circle ditch and



■ **Fig. 1**
The circle ditch of Schletz with four houses; results of the geomagnetic prospection by W. Neubauer.

a nearby settlement. Our assumption therefore is that the building of these large ring structures could have been a common project of the inhabitants of these settlements. The reconstruction of a circle ditch at 1:1 scale in Wetzdorf gave us the possibility to carry out experimental studies concerning these questions. Our purpose was to create a realistic archaeological model based on the excavation-results and on the geomagnetic survey.

The ring structure should also be presented in connection with the settlement. We tried to work with reconstructed tools based on archaeological originals made of wood, stone and bone. To a certain extent, every necessary working step from

■ **Fig. 2**
The ditch of the inner palisade and the rectangular single post holes of the outer post row.



■ **Fig. 3**
For felling and cutting the oaks we used axes with stone blades.



■ **Fig. 4**
The posts of the palisade were erected by hand.



■ **Fig. 5**
We used an adze shafted on a "kneewood" to flatten the surface of the rectangular posts.



■ **Fig. 6**
Detail: the sharp blade of the adze removes a chip of wood.



reconstructing the tools, searching for raw material, the erection of the palisades to the digging of the ditches were based on original Neolithic technologies. Analysing the documentation of these experiments we were then able to estimate the whole working expenditure. In the area of the entrance we wanted to show the three steps in the use of the ditch: when it was finished, when they stopped using the ditch and when the refilled ditch could still be seen.

Reconstructing the circular ditch

We have archaeological evidence for the use of antler picks for digging the soil. But can we assume the use of wooden digging tools in that period? In Erkelenz-Kückhoven in Germany a Neolithic well was discovered which predates our circle ditch (Weiner 1995).

When the digging was finished, the workers left four wooden tools at the bottom of the well. These tools were still in good condition. For our digging experiments we reconstructed these tools, two spades and a flat fork-like shovel (Weiner, Lehmann 1998). We assume that they used baskets and wicker mats for the removal of the earth. In our experience a strong person was able to dig and remove 1,8 m³ of earth per day. Mats were very useful if placed under the working edges, so that the removed material dropped onto it and then could be easily carried away by taking the mat by the edges. In total they would have to dig and remove about 1550 m³ for one circular ditch system.

For the construction of the inner palisade we used 420 beams of oak which were about 4,2 m long. At the entrances we required 8 beams 6,3 m long. At the root end they measured between 25 -30 cm. Altogether we needed 69 m³ for this palisade. To get an idea of the effort that the acquisition of the trees must have been in Neolithic times we did some tree felling experiments. The trees were felled with stone hatchets made out of hard and tough stones, like serpentine and amphibolites, which we mounted on handles of ash wood (Winiger 1981). To create the holes to fix the handles to the stone blades, we used chisels of stag bone (Becker 1962). The practical use of stone tools led us to the

assumption, that the trees were probably felled at a height of about 80 cm above the ground. To reach the inner parts of the trees the felling notches had to be enlarged several times. The vertical length of the notches was at least about 26 – 30 cm. The trees crashed down after a felling time of 30 –35 minutes, breaks have been left out of this account. The cutting of the stems to size was also done with stone tools. We can imagine that the transportation of the wood would have been managed with animals, most likely cattle. The posts were then put into the base of the palisade ditch. In our reconstruction we erected all the trunks by hand, three to four persons were needed to hoist them up. It proved to be advantageous to set up six to seven posts and to then fix them together with a rope. We then refilled the ditch with earth and compressed it by stamping the soil down with a heavy lump of wood.

The outer palisade ring was made of single posts with diameters of up to 40 cm. Some of them were evidently rectangular in shape. We assume that they were decorated with carved or painted signs and symbols. In our reconstruction we used beams of 3,5 m in length. Experiments in the past have taught us that in Neolithic times flat, wooden surfaces were produced with stone adzes, not with axes (Lobisser 1998). The blades were probably bound onto l-shaped grown angle woods, consisting of a handle part and a branch part (Weiner, Pawlik 1995). Before shaping and smoothing the posts with stone tools the raw rectangular cross sections were formed by splitting the logs with wooden wedges and hammers. The results of our experiments confirmed that stone adzes are good tools with which to flatten and smooth surfaces (Lobisser 1998). Analysing the results of the experimental work concerning the single working steps, we can estimate the expenditure that a project like this must have created in the past. To build up the whole circle ditch structure including the palisades using original techniques would have taken 1556 days for one modern person working 8 hours a day. The pure digging work would have taken us 928 days (60% of total expenditure), the felling, shaping and erecting of the posts would have taken us 380 days (24% of total expenditure) and the producing and

repairing of the tools, stone blades, handles, antler and bone utensils, shovels, spades, baskets, wicker mats and ropes would have taken 248 days (16% of total expenditure). This does not include the effort required to prepare food, clothing and living requirements.

Archaeological data concerning houses

Right before the rising of the circle ditch culture with its painted ceramics, houses already existed as a strong tradition of the early Neolithic times with very similar structures built nearly all over Europe.

The houses were up to 40 m long and 8 – 10 m wide. The deep foundation of the posts made complicated wooden roof structures needless.

Some archaeological layers can be interpreted as the rests for walls made from split woods. But usually the walls were built in wicker technique as wattle and daub.

Sometimes the loam for the plaster was taken from beside the walls which created longish pits which were later used for waste. There are indications that the interiors of the houses were divided into various areas, which were used for cooking, sleeping and working. It seems that in this area many settlements were abandoned at the end of early Neolithic around 4950 BC (*Neugebauer-Maresch 1995*). Around 4800 BC the land was recolonized and a lot of new settlements with circle ditch structures were founded at close distances to each other. It looks as if the sparsely populated land was colonized by a new group of settlers, who brought the Lengyel culture with its typical painted ceramics with them. At the very beginning of this cultural movement there were close connections to south-east Europe. Beside the clear change in pottery work we can also recognize changes in house construction. Unfortunately only a few archaeological settlement sites which included the ground-plans of houses have been excavated in our region. Very important to our work therefore were the house constructions from Schletz and the younger one from Wetzleinsdorf (*Urban 1980*). Another archaeological site in St. Pölten-Galgenleithen produced the

fragments of a miniature clay house model (*Neugebauer-Maresch 1995*). A similar but complete house model was found at Střelice in Moravia. These models give further information concerning the construction techniques of houses. The archaeological house sites, the clay models and the results of the magnetic prospecting in Schletz indicate a trend towards smaller houses at the time. Beside the traditional houses with lengths of up to 40 m, we can prove smaller ones with lengths of up to 20 m. The majority of the house structures had no posts in the area of the side walls but frequently had small ditches. These ditches are very clearly visible at the Wetzleinsdorf-house. In the settlement of Falkenstein-Schanzboden the house borders could not be recognized clearly, but the clay floors were painted a white colour (*Neugebauer-Maresch 1995*).

Log cabin – a new wood technique at the beginning of the Lengyel culture?

The well finds from Schletz in Austria (*Windl 1994*) and from Erkelenz-Kückhoven in Germany (*Weiner 1995*) brought log cabin structures to light which date to the end of the early Neolithic period at around 5000 BC. In Erkelenz-Kückhoven even the wooden parts from oak were preserved. Oak wood is easy to split and very resistant to the soil, caused by a high content of tannic acid. The oak logs used showed that the trunks were mostly split radially into wedge shapes. The inner core wood and the sapwood was removed and the wood was flattened on a surface. In the meantime other wells of the same period have been discovered, which make clear that at the beginning of the middle Neolithic there was a new wood technology available which could also have been used for the building of houses.

Archaeological data from houses in Schletz

Around the circular ditch from Schletz a lot of pits could be shown which seem to be the remains of a settlement that was founded around 4800 BC. On the slope below, four ground plans of houses could also be detected magnetically. One of the houses has been completely



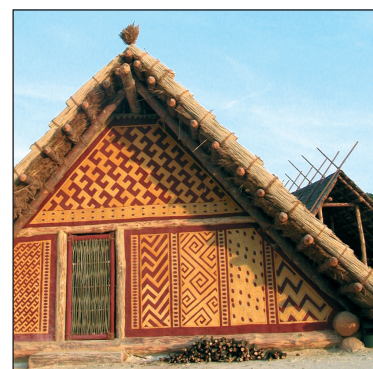
■ Fig. 7
The circle ditch structure with ornated wooden parts.



■ Fig. 8
The outer walls of house 1 were built in log cabin technique.



■ Fig. 10
To work out the notches to prevent the rafters from sliding away beside the stone tools we used chisels made of stag bone.



■ Fig. 11
House 1 in log cabin technique with typical decorations of the time on the loam wall; house 2 in post technique in the background.

excavated. This group of four houses was the archaeological basis for the house reconstructions at Wetzdorf. The excavated ground plan was clearly recognizable as an area of 7,5 to 12,2 m. They had removed the humus so that the bottom of the house was about 30 cm deeper than the normal ground level on the outside. In this floor space further pits could be made out. On the bottom of one flat pit, we found a hearth made out of loam which had been renewed several times. Beside this there were three deeper pits, which were probably used to store food in a cool surrounding.

In another flat pit there was a dome oven for baking bread and another rectangular fire place construction could have been used as a grill. Nearly the whole inner area of the house was used for various pit constructions. Together with a very rich ceramic inventory, all of this led us to the assumption that this house was not used for living in. We think this house was used as a large communal kitchen.

In the middle of the house there was a very big posthole which is taken as an indication of a saddle roof with a ridge beam and a rafter and lath construction. We suppose that the bottom of the rafters rested on a frame using a log cabin technique to give stability to the whole structure.

House reconstruction work

For the exhibition in Wetzdorf we had the chance to rebuild house 1 from Schletz in the log cabin technique and equip it with a complete kitchen. During the reconstruction work we wanted to find out if our ideas concerning a log cabin structure would fit with the archaeological data from Schletz. The three other houses were built in the post technique according to the miniature clay models. We used raw materials that were available in Neolithic times, for the log cabin structure we chose straight grown round logs. Our idea was to have a toolkit with replicas of original instruments and to develop different techniques using them. We tried to find out which tools were suitable for which kind of working step. We had axes and adzes out of stone, chisels made of bone and wooden utensils. The construction logs for house 1 had lengths up to 12,5 m and diameters of up to

45 cm. The wood was connected at the edges of the house by notching the underneath logs half out to get a good basis for the ones lying upon. To hack out the wood we used parallel handled axes and later for cleaning the notches we used adzes. Inside we put three posts for holding the ridge beam as in Schletz the middle one had a deeper foundation; onto this solid substructure we tied down the rafters. All of them were notched at the connecting points to prevent them moving out of position. On the rafters we fixed laths that carry the reed roof. The entrances are on the sides of the gables. One side of the house was decorated with ornaments taken from ceramics. The other three houses were built in pure post technique, the biggest about 20 m long and 8,5 m wide. The eaves beams were put directly onto the upper ends of the posts, the middle beams were supported by joists. The rafters were bound down on the beams where notches prevented them from slipping. The laths were fixed onto the rafters. The roofs were covered with bark, which was held down by round logs of small diameter.

Summary and Conclusions

We actually do not know how many persons worked on the construction of the circle ditch of Schletz in Neolithic times. It seems to be very likely that parts of the work were carried out during feasts or cultural celebrations, but we know little about the working habits of Neolithic people. Presuming that about 20 – 30 persons took part on the works, we assume that they could have finished the whole project in 55 – 80 days. But we do not think the works were done in a coherent way. The felling of the trees was probably done in winter, probably by a smaller group of specialists. We think that the time of sowing in April and May and the time of harvesting in August and September were too busy for other works. A good time for digging the earth works could have been June and July when a larger part of the population had time spare. In Schletz there lived probably 100 – 200 persons, they would have been able to raise the circular ditch system within two years. The expenditure for maintaining and cleaning the ditches in the following years would not have been a problem. The results of

the reconstruction of house 1 in log cabin technique brings us to the assumption that some of the middle Neolithic houses could have been built in this technique. People of that time would have been able to build a log cabin structure to those dimensions with their tools of wood, stone and bone. Surely they handled their tools with care, to prevent damage, for this reason we think that they used to work green – non-stored wood, and avoided the hard branch wood whenever possible.

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Summary

Zum Bau eines Rundgrabensystems und von Häusern aus dem Mittelneolithikum

Die niederösterreichische Landesausstellung 2005 beschäftigte sich mit der archäologischen Erscheinung der mittelneolithischen Kreisgräben. Dafür wurden in Wetzdorf eine umfangreiche Präsentation von Originalfunden des Mittelneolithikums publikumswirksam aufbereitet, sowie eine mittelneolithische Kreisgrabenanlage mit anschließendem Siedlungsareal wissenschaftlich fundiert in Originalgröße rekonstruiert. Die Wahl fiel auf die einfache Kreisgrabenanlage von Schletz in Niederösterreich. Es muss angenommen werden, dass die Errichtung der Kreisgrabenanlagen ein Anliegen von größeren organisierten Menschengruppen gewesen ist. Es ist sehr wahrscheinlich, dass die Errichtung einer Kreisgrabenanlage ein gemeinschaftliches Projekt der Bewohner einer Siedlung darstellt. Der Wiederaufbau einer Kreisgrabenanlage in Originalgröße für die Niederösterreichische Landesausstellung 2005 am Heldenberg bot uns die Gelegenheit, experimentalarchäologische Studien zur Errichtung derartiger Anlagen mit den umliegenden Gebäuden durchzuführen. Die Kreisgrabenanlage sollte im Zusammenhang mit der Siedlung dargestellt werden. Wir versuchten sämtliche Arbeitsschritte auch mit Werkzeugen aus Holz, Stein und Knochen durchzuführen, die Originalfunden nachgebaut wurden.

Wir wissen nicht, wie viele Personen sich am Bau einer Kreisgrabenanlage beteiligt haben, doch dürfen wir sicher an größere Gruppen, etwa die Einwohnerschaft einer Siedlung denken.

Möglicherweise wurden Teile der Bauarbeiten auch im Zuge von kulturellen Festen durchgeführt. Wenn wir die Ergebnisse unserer experimentellen Detailstudien hochrechnen, dürfen wir annehmen, dass im Neolithikum 20 – 30 Arbeiter die Anlage in 55 – 80 Tagen fertig stellen konnten. Wir glauben jedoch



nicht, dass die Anlage in einem Zug gebaut wurde. Das Fällen der Bäume könnte etwa im Winter von einer kleineren Gruppe von Spezialisten durchgeführt worden sein. Für die Grabungsarbeiten hätten sich vor allem die Monate Juni und Juli, die zwischen Saat und Ernte lagen, angeboten. In Schletz lebten etwa zwischen 100 – 200 Personen. Diese hätten den Bau einer Kreisgrabenanlage in zwei Jahren bewältigen können. Unsere praktischen Erfahrungen beim Bau von Haus 1 als Blockbaukonstruktion bestärken unsere Vermutung, dass es im Mittelneolithikum neben Pfostenbauten auch bereits Blockbauten gegeben haben könnte. Die Menschen dieser Zeit hätten Blockbauten mit ihren Werkzeugen aus Holz, Stein und Knochen errichten können. Sicher haben sie dabei ihre zeitaufwendig herzustellenden Werkzeuge sehr bedacht eingesetzt, um Schäden zu vermeiden. Die neolithischen Holzhandwerker haben wohl in erster Linie grünes frisch geschlagenes Holz verarbeitet und harte Astbereiche wenn möglich gemieden.

Zwischen Mai und Oktober haben an die 262.000 Menschen die Ausstellung besucht.

Construction d'un système de fossés circulaires et de maisons du Néolithique moyen

A l'occasion de la biennale dans la Basse-Autriche, en 2005, on a réalisé une vaste exposition archéologique au sujet des rondelles du Néolithique moyen. A Wetzdorf, on a présenté un grand nombre d'objets découverts datés de cette époque-là. D'après les fouilles provenant de Schletz (Basse-Autriche), on a reconstitué une rondelle et une partie de l'habitat voisin. On peut supposer une collaboration organisée de plusieurs personnes à la construction de la rondelle. Il est probable qu'il s'agit d'une œuvre collective des habitants du site. La reconstitution de la rondelle pour la biennale est devenue une occasion extraordinaire pour effectuer une recherche

expérimentale sur ce type de construction et sur les maisons. On a travaillé avec des outils en bois, pierre et os, reconstitués d'après des pièces archéologiques. On ne sait pas le nombre précis de personnes qui ont collaboré à la construction de la rondelle de Schletz au Néolithique. S'il s'était agi de 20-30 personnes, elles auraient construit la rondelle en 55 - 80 jours, autant qu'on s'appuie sur les résultats de l'expérimentation. Toutefois, les auteurs ne pensent pas qu'on ait bâti toute la construction d'un seul coup. L'abattage des arbres a été exécuté en hiver, par un petit groupe de spécialistes. Pour le creusement, il est à présumer les mois de juin et juillet, période entre les semailles et moisson. Il est possible qu'une part de travaux ait eu lieu dans le cadre de fêtes. A Schletz, il y a eu 100 - 200 habitants. Ils auraient été capables de finir la rondelle en 2 ans. L'expérience acquise grâce à la reconstitution de la maison 1 de construction faite de poteaux a renforcé l'hypothèse que ce type de constructions existait à côté des maisons à poteaux depuis le Néolithique moyen. Les outils d'époque en bois, pierre et os ont permis de réaliser une telle construction. Certes, les préhistoriens ménageaient leurs outils pour éviter des endommagements. C'est pourquoi qu'ils travaillaient un bois vif et ils contournaient, si possible, des nœuds durs.

Depuis le mai jusqu'à l'octobre 2005, vers 262 000 visiteurs sont venus voir cette exposition.

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■ Fig. 9 House 1 with log cabin structure, inner posts, ridge beam, rafters and laths.

Fig. 1, 2: graphic and photo by W. Neubauer; Fig. 3, 4, 6, 7, 9, 10 and 11: photos by W. Lobisser; Fig. 5 and 8: photos by H. Humberger.