



■ **Fig. 11** The three most important wood house building techniques of the Iron Age: f.l.t.r. residential with threshold beams, wood-workers house in post technique and store house in log cabin technique.

## *Celtic house reconstructions on the Burgberg in Schwarzenbach*

An new archaeological open air park of the Iron Age

**The article introduces the construction of Iron Age houses in the open-air museum Schwarzenbach based on archaeological findings from the local Celtic oppidum. The reconstructed area consists of seven buildings and other archaeological models such as gardens, cisterns and wooden fences. The open air museum gives insights into everyday life of the late Iron Age. Beside the wooden architecture the main topics are the economical basis of the period, besides handicrafts and skills in a late Iron Age town.**

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In the Iron Age, people used to live on single farms or in little villages. But on important places, the rich upper class founded big settlements as a sign of their influence and power. Mostly these settlements were

surrounded by defensive walls built with wood, earth and stones. J. Caesar called these town-like settlements “oppidum” and the defending structure “*murus gallicus*”. Around the valley of Oberpullendorf in Austria rich iron ore deposits were mined in the Iron Age. Up to now three big settlements from that period have been discovered in this area, on the Burgstall in Sporn, in Velem near Köszeg in Schwarzenbach.

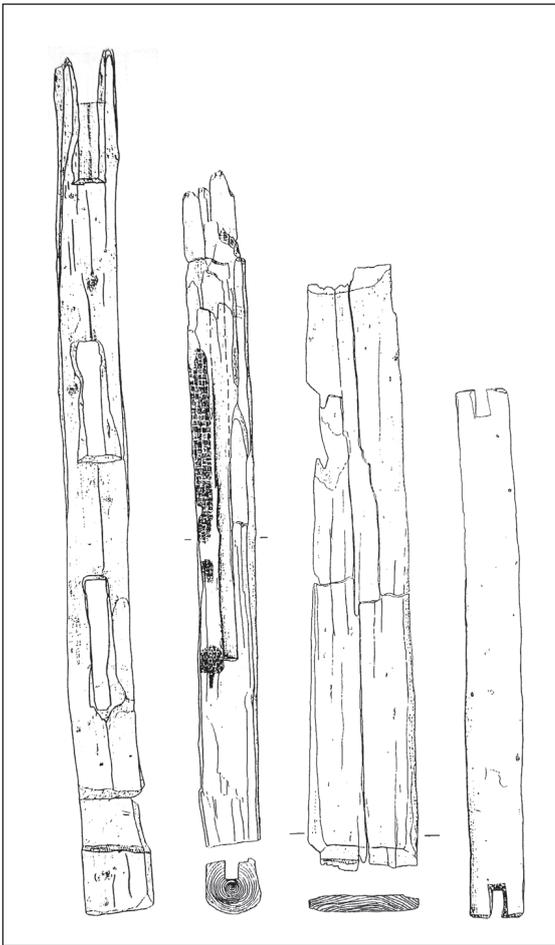
### The oppidum of Schwarzenbach

In the second century BC in Schwarzenbach, the Celts built one of the largest settlements of the eastern alpine region. It can be assumed, that the inhabitants were noblemen and traders as well as craftsmen and farmers. Probably smelted iron was reprocessed here and negotiated over. All over the Roman Empire this iron was famous as “*ferrum noricum*”. Because of its higher carbon content it was of ex-

cellent quality and could be hardened (comp. *Herdits 2000*). The oppidum of Schwarzenbach extended over an area of about 150.000 m<sup>2</sup>. It was defended by walls up to 10 m high, which can still be seen today as ramparts in the landscape (*Löcker, Neubauer, Urban, Wedekin*



■ **Fig. 1** The Burgberg of Schwarzenbach with the oppidum area seen from the air. On the top of the hill you can see a running excavation; this is where later on the house models were reconstructed.



■ Fig. 3 Preserved wooden construction parts, from Iron Age, excavated on the Dürrnberg near Saltbury.



■ Fig. 2 During the Celtic festival in Schwarzenbach there are presentations of Celtic handicrafts.

1992). The construction of the walls consisted of big wooden box frame structures filled with earth and covered with stone walls on the outside (Wedekin 1997). The University of Vienna has been excavating this site now for over 15 years. Beside the rampart, the structures of several living houses, workshops, storage houses and agricultural buildings have been excavated and examined. In 1994 a part of the defensive wall had been reconstructed (Lobisser, Neubauer 1997).

### An archaeological open-air park on the site

For ten years, the community of Schwarzenbach has organised a three day Celtic festival presenting Celtic handicrafts, music and food. Now the presentation of Celtic life shall become a permanent venture. For this reason, the municipality of Schwarzenbach commissioned VIAS – Vienna Institute for Archaeological Science, to rebuild a part of the settlement. The open air museum gives insights into the everyday life of the late Iron Age. Beside the wooden architecture the main topics are the economical basis of the time, handicrafts and skills of a late Iron Age town (Lobisser, Löcker 2002). The reconstructed area consists of seven buildings and other archaeological models such as gardens, cisterns and wooden fences. Well made remakes of furniture, tools and utensils give an impression of Celtic life style. The community of Schwarzenbach wanted to create a historic site which will be an enrichment of the cultural and leisure amenities. Intensive studies of the Iron Age and its tool culture and of the archaeological house data were important preconditions for the mounting of scientific reconstructions. Our aim was authenticity in all details. Our reconstructions are based on the results of archaeological excavations in Schwarzenbach, on the Dürrnberg, on the Oberleiserberg and from several other Iron Age sites in Austria.

We used the same building material that was available in Iron Age. The use of the different species of wood and the visible surfaces were inspired by period wood technology (Lobisser 2005, also comp. Luley 1992).

During our work we wanted to find out which kind of tools were suitable for which work and for which wood connections. Further we tried to find out the technical limits of the instruments. All the working marks on buildings, tools and utensils came from remakes based on Iron Age finds (Jakobi 1974, Notdurfter 1979). Nearly all the work was carried out with reconstructed period tools to get experience and data that could be compared with the archaeological evidence. The setting up phase was carefully documented with photos, video and audio techniques. The toolkit for the practical work was rebuilt according to original Celtic finds and included axes, adzes, drawing knives, spoon drills, chisels, saws and awls.

### The reconstructed house models of Schwarzenbach

The house of a wood worker was post-built, according to archaeological evidence from Schwarzenbach and Hallein. It shows a square ground plan with four posts on each side. The construction elements are in oak wood, which is very resistant to decomposing factors of the soil. The posts were set in pits of about 80 cm in depth and fixed with wedge stones. The refilled material around them was compressed by stomping it with a heavy lump of wood. Following the archaeological originals from the Dürrnberg we carved slots about 7 cm wide into the sides of the posts using iron chisels (Lobisser 2005). In these slots we put horizontal logs that were v-shaped on their ends. To carve them we used axes and adzes. The entrance is located right under the gable on the front. It can be closed with a wooden door made of split and overworked planks that are connected with ridge woods and wooden nails.

The Iron Age people evidently were specialists in splitting wood to any dimension. These split boards were used for doors, walls and furniture, and they were smoothed as required. The rafter construction is based on two side beams. The spruce rafters were fixed with wooden nails. The holes for them were made beforehand with a spoon drill. To get a good hold the nails were a little thicker than the



■ **Fig. 4** The iron reconstructions of period tools which we used during the construction work: axes, adzes, drawing knife, knives, chisels, spoon drills, awls, etc.

holes so they were compressed on being hammered in. Following archaeological finds the split shingles were put on the laths and pressed down with woods. Angle of the roof is about 23°. To make sure, that the roof was waterproof the shingles were put down in double rows. The shingles were cleaved out of a larch with a diameter of 90 cm. The floor of the house is laid with fist sized paving stones.

The interior consists out of a bed and low fireplace. A trapdoor leads to a little cellar. All together it should give the impression of a woodworkers home, where he manufactured baskets, spoons and wooden bowls. There is also a wooden lathe for turning plates and dishes, which is used at special events.

A rectangular storage house was built in a hybrid technique of log cabin style and post construction. The ground plan is about 4,1 by 6,2 m. The raw materials used were spruce and fir trees. The threshold beams were shaped rectangularly with adzes and put on stone foundations. At the corners they were fixed with slots fitting into one another. On the long sides we erected two rectangular beams which were connected with tenons to the thresholds. Between the two standing stems in the south we located a door equipped with wooden pivots to open it. The door can be blocked

with a wooden bolt that can be locked with an iron hook key. The walls consist of smaller round logs, that have been hacked half round with axes, and then connected at the corners in pure log cabin technique (comp. *Barth, Lobisser 2002, Phleps 1942*). With this kind of construction work, as was excavated on the Dürrnberg several times, the Celts had a very stable construction-technique with a small consumption of wood.

The ridge beam lies on two posts, which are fixed about 70 cm into the ground. This construction technique is a good example of the slow change from post construction to log cabin technique. The roof itself consists of a rafter and lath construction which is the basis for the shingles. The angle of this roof is about 45°. The house has a cellar for storing seed corn. It seems as if the Celtic farmers stored the corn for food and the corn for sowing the next year in two different ways. It is possible that they covered the sowing corn with loam to make it airtight (comp. *Coles 1973, Jockenhövel 1997*). The house has three windows. Inside the house we show the typical cultural plants and goods of the time, like vegetables, cereals, fruits, salted fish and smoked meat. The plants are presented in different kind of containers and vessels, such as wooden chests, ceramics, baskets, shelves, bowls and boxes.

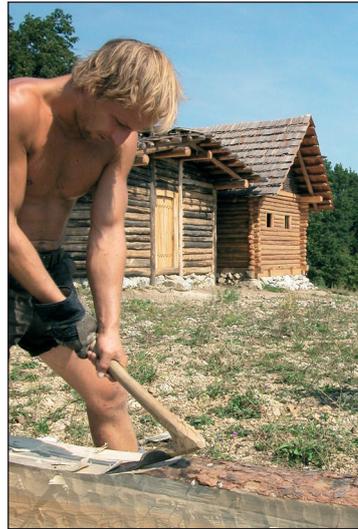


■ **Fig. 6** In the woodworkers house a wooden lathe machine was built to turn wooden vessels like plates, dishes and bowls.

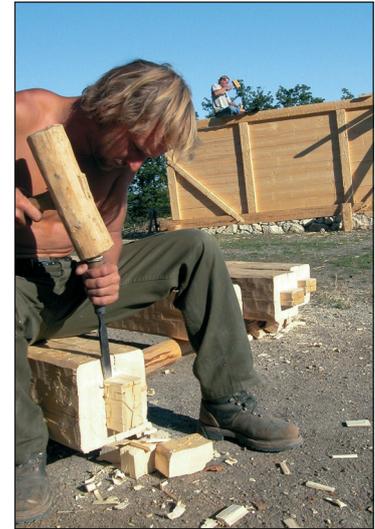
The reconstructed residence shows a very developed form of wooden construction. The archaeological data for this building stem from Schwarzenbach and from the Dürrnberg, where wood from a similar Iron Age construction has been documented. Nearly all the wood was worked rectangularly with crosswise handled adzes. The threshold frame is about 6,5 to 10,5 m and lies on a stone foundation to get a plain level on the upper sides. The wood is fixed on the edge, one into the other. Three joist beams stabilize the frame at the middle. In regular distances twelve slots were worked in with iron chisels to take up the tenons of the upright rectangular beams. On the corners these beams were fixed with diagonal supports that were worked into the standing ones and attached with wooden nails. The archaeological evidence for this technique is documented from rock paintings of the Val Caminoca and from graffiti on a ceramic vessel in Lichtenstein (*Bill 1984, Sölder 1992*, also comp. *Hinz 1989*). This method is still used today and it is the best method to get a stable wall construction of this kind. On the upper end of the standing logs were also tenons to fix five crosswise joists. This gave a good base for the roof construction. The walls themselves were built by split and smoothed horizontal boards which are let into slots in the standing beams. Boards with typi-



■ **Fig. 5** The felling and the cutting of the logs was done with iron axes shafted on natural grown „kneewoods“ of ash and beech.



■ **Fig. 7** The construction parts for the residential were shaped rectangular with iron adzes.



■ **Fig. 8** Residential: the tenons and the according slots were worked out with chisels.

cal pressing traces have been found on the Dürrenberg. The joist beams make the base for the two side roof beams. The door was spared out in the wall and can be opened by turning two wooden pivots. The door can be blocked with a fall bolt lock and a wooden key made according to archaeological and ethnological models.

The middle beams of the roof construction lie on square columns and are also stabilised with diagonal supports. The rafters were set on the roof beams and fixed with notches and oak wood nails. To produce the holes for the nails we used a spoon drill.

The quality of iron improved at the end of Iron Age. The spoon drills got better as well, which might have led to a common use of this fixing technique. The laths are nailed on the rafter and on top of them we fixed the split larch shingles. The gables were shut tight with boards and wicker work. Inside there are two rooms, one with a wooden floor and a ceiling. The smaller one has a cellar. A division into two rooms could be proved several times with Celtic house ground plans (*Lobisser 2005*). The room with the wooden floor we equipped with a bed and typical clothing for men and women of the time. The second bigger room got a stamped loam floor, in which you can see a round fireplace surrounded by a low wickerwork wall and an iron kettle on a chain. Further there are rebuilt utensils made from wood, ceramic, bone, metal, loam and textiles.

People in the past were forced to work with natural light. For this reason it is likely, that some workshops are open constructions, without being closed off on all sides. Simple roofs might have pro-

tected the workers from rain, sun and snow. Our ceramic workshop wants to give an idea of such a construction. The building is based on four oak posts and has a slanting roof with two beams, rafters and laths, all fixed with wooden nails. The roof itself is made out of bark pieces, where a single piece is more than 1 m<sup>2</sup>. These had to be removed from the logs in Spring time when their water system starts to circulate. There was little time to get them on the roof because the bark dried quickly and then broke. The walls to the north and the west are closed with smaller upright standing logs. Under this protecting roof we reconstructed a ceramic kiln with an extra fire room and a heat dome for the pots all according to archaeological data from lower Austria. With this kind of kiln it is possible to fire ceramics to more than a 1.000 °C.

Beside the big threshold house the post-built buildings still played an important role. We excavated some of them in Schwarzenbach. Post-built houses were used as workshops, stables, stores and agricultural buildings of all kinds. To show up the theme of domesticated animals, we reconstructed a stable in post construction. It has a groundplan with a dimension 4,5 by 6,5 m. For this building we set 10 posts in the ground, four of them found a use as doorposts for two entrances. The slope was levelled with a stone



■ **Fig. 10** The posts for the stable house were placed in pits in the ground. We erected them by hand.

foundation. The construction consisted of two side wall beams and a ridge beam, which were based on the posts. On each roof side we put 8 rafters and laths on the beams. All the parts were fixed with slight notches and wooden nails. The roof itself was made out of reed tied to the lath construction (Schrader 1998). In the Iron Age they used strings and ropes made of fibres from the inside of elm and lime tree bark or from young shoots of willow. In the late Iron Age they might have used hemp fibres to a greater extent as well.

The vertical elements of the wicker walls were made of small split oak boards, that were worked out to a lentil shaped diameter. The bottom ends were burned until they went black and charcoally, and put into the ground. On the upper end they were fixed to the beams. For the wicker walls we used young shoots of hazel and willow. The side branches we cut away with knives and small axes. Afterwards the wicker walls were covered with loam. The mixture of the plaster consisted of loam, straw, sand and water. It turned out to be best to mix these materials dry, and then water altogether down to a good consistency. The works had to be done on both sides of the wall in one go, to get a good connection of the loam. The two doors were made of wooden planks.

Using an archaeological find from Schwarzenbach we reconstructed a bakery with a dome oven made of loam. The house was built in post construction with a saddle shingle roof. Another residence was built on the museum area where we give young people a chance to spend a night in the open air park. The mounting of the house gave us the possibility to further experiments with Iron Age wood construction techniques. We built the house in a hybrid technique of lock cabin style and threshold house type style. The results of our work showed us that nearly all known period wood connecting techniques could be combined very usefully in many different ways.

Water supply must have played a very important role on the site in Iron Age. As yet we have no archae-



■ **Fig. 9** Residential: Threshold construction with rectangular shaped beams, vertical bolt board walls and the substructure for the rafters. Note the supporting diagonal woods on the corners.

ological evidence for the solutions of that problem in the oppidum of Schwarzenbach. To clarify/demonstrate this problem in the open air area we built a model of a well and a cistern. The whole open air park is surrounded by a wooden fence built with hot turned loops of spruce branches and young needle trees of different kind.

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## Summary

### Keltische Hausrekonstruktionen auf dem Burgberg in Schwarzenbach Ein neuer archäologischer Freilichtpark zum Thema Eisenzeit

Seit 1991 führen Archäologen in der späteisenzeitlichen Keltenstadt Schwarzenbach in Niederösterreich archäologische Ausgrabungen durch. Dabei wurden sowohl die

Befestigungsanlage, die heute im Gelände noch deutlich als Wall sichtbar ist, als auch spezielle Innenbereiche der Siedlung, wie Handwerksbereiche, Marktplätze, Händlerstraßen und die Wohnhäuser der adeligen Bevölkerung untersucht. Bisher konnten mehr als 20 Hausgrundrisse dokumentiert werden. Das Oppidum, wie Julius Caesar diese Anlagen nannte, von Schwarzenbach weist eine Innenfläche von etwa 15 ha auf. Es ist anzunehmen, dass die Bewohner Adelige und Händler, aber auch Handwerker und Bauern waren.

Die Präsentation des keltischen Lebens sollte in Schwarzenbach zur Dauereinrichtung werden. Deshalb hat die Gemeinde Schwarzenbach das VIAS - Vienna Institute for Archaeological Science der Universität Wien mit der Errichtung eines archäologischen Freilichtbereichs betraut, in dem Teile der keltischen Stadt wieder aufgebaut wurden. Das Freilichtmuseum soll Einblicke in das Alltagsleben der eisenzeitlichen Bevölkerung im 2. und 1. Jahrhundert v. Chr. vermitteln, wobei neben der Architektur der Gebäude die ökonomischen Grundlagen der Menschen dieser Zeit und das Handwerk in einer keltischen Stadt im Vordergrund stehen. Die Architekturmodelle wurden vor allem nach archäologischen Befunden von Schwarzenbach konzipiert und errichtet. Die Rekonstruktion der Holzbauteile und Holzverbindungstechniken orientieren sich an Fundstellen, wo sich Holz aus der Eisenzeit erhalten konnte. Beim den Aufbauarbeiten kamen in erster Linie nachgeschmiedete keltische Werkzeuge zum Einsatz. Den Kelten stand bereits ein entwickelter Werkzeugsatz zur Verfügung, der sich aus Tüllenbeil, Lappendechsel, Ziehmesser, Löffelbohrer, Reißnadel, sowie aus Stemmbeiteln mit unterschiedlich breiten Schneiden und aus Schnitzmeißeln mit runden Schneiden zusammensetzte. Die Häuser der Kelten waren fast ausnahmslos aus Holz erbaut. Dabei handelte es sich oft um langrechteckige Bauten mit Innenflächen zwischen 30 und 70 m<sup>2</sup>. Es gab jedoch auch kleinere Nebengebäude. Wir können drei grundlegende Hausbautechniken unterscheiden: der Pfostenbau, der Blockbau und der Ständerbau auf Schwellen, der bereits eine frühe Form des Fachwerkbbaus darstellt. Das Freilichtgelände am Burgberg in Schwarzenbach besteht aus sieben Gebäuden bei deren Errichtung diese Techniken angewendet wurden.

### Reconstructions d'habitats celtés à Schwarzenbach: un parc archéologique sur l'âge du fer.

Le projet portait sur la reconstitution expérimentale d'une partie de l'oppidum de Schwarzenbach (IIe av. J.-C.). Grâce à la richesse et à la qualité de ses ressources en fer, le site devait être influent, comme

en témoignent ses vestiges: un ensemble fortifié de 15 hectares protégé par une enceinte de 10 m de haut. Il est fouillé depuis une quinzaine d'années par l'Université de Vienne.

L'intérêt et la représentativité des découvertes a poussé la commune de Schwarzenbach à commander à l'Institut Viennois de Recherches Archéologiques (VIAS) une reconstitution partielle de l'oppidum.

En 1994 une partie du rempart avait déjà été reconstruite et le site accueillait des animations festives. Le projet de parc archéologique correspondait donc à une extension de ces reconstitutions pour donner à voir une image des modes de vie de la fin de l'âge du fer: habitats, ateliers mais aussi mobilier et accessoires de la vie quotidienne. Le tout a été fait dans une réelle démarche d'authenticité historique: sources archéologiques fiables, matériaux de construction originaux et outils reconstitués. Ce point de vue a permis une réelle analyse scientifique des opérations de reconstruction.

Ont ainsi été reconstruits une menuiserie (habitat et atelier), un grenier (4,1 × 6,2 m) et une maison d'habitation (6,5 × 10,5 m) meublée et équipée d'accessoires en bois, céramique, os, terre et métal.

Conformément aux analyses archéologiques, les ateliers reconstitués sont partiellement ouverts pour permettre un éclairage à la lumière du jour:

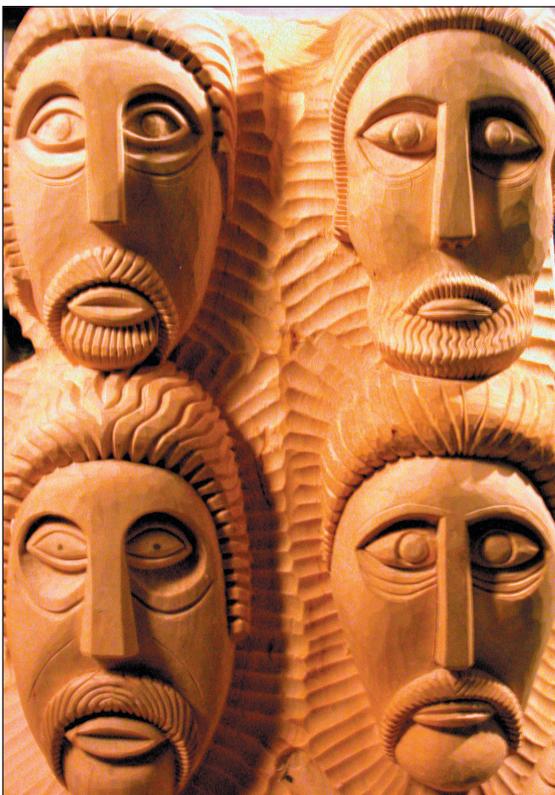
- Pour la conception de la céramique, un four fonctionnel permet une chauffe à plus de 1000 °C.
- Une étable reconstituée évoque la pratique de l'élevage
- Une boulangerie a également été reconstruite avec son four en terre

Un deuxième habitat a été reconstitué pour les activités pédagogiques, comme l'accueil d'enfants pour une nuit dans le parc.

Enfin, le problème de l'approvisionnement en eau de l'oppidum n'ayant pas encore été résolu, une citerne expérimentale propose une hypothèse de fonctionnement.

Le parc archéologique de Schwarzenbach offre donc un mélange efficace entre reconstitutions expérimentales et médiation vers un public large.

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■ Fig. 12 The wood working tradition of the Celts was highly advanced: we are sure that there was also a big tradition for carved wooden sculptures.