



**Fig. 2** The construction of the southeastern wall of Stein 29. Vertical placed planks between the outer posts. ■

## Two burnt-down houses examined

**J. P. Flamman** Vestigia, Netherlands

● **After two experimental constructions of LBK houses burnt down accidentally, Dutch archaeologists observed and recorded the formative processes. The article brings together information on the two years of the project.**

On the 31st of May 1995 at Archeon, the archaeological theme park in the Netherlands, two reconstructions of prehistoric houses burnt down. Youngsters who visited the park presumably set one house on fire, from which it spread to the other. Within one and a half hours the buildings were completely lost. Though many people had helped build these structures and more worked in them, for experimental archaeologists, this presented an unexpected possibility for new research.

The burning of two houses is not an experiment that occurs every day. In the days following the fire, archaeologists from the (now defunct) Centre for Experimental Archaeology at Archeon and the Archaeological Centre of the University of Amsterdam documented the burnt-down structures and their remains. During the fire and afterwards some interesting observations were made. Since the author was involved in the building of the houses, most of the burnt elements and internal objects were recognizable and their provenience identifiable. Two years later, during the summer of 1997, the area of one of the two houses was re-examined for any similarities and differences that may have been noticeable over time.

The construction of the houses was based on the ground plan of Bandkeramik-houses known from the area of South-Limburg, the Netherlands, dating from around 5000 BC. The houses were built during the Fall of 1993 and the Spring of 1994. During their construction several different materials and construction techniques were used in the two houses. After the fire, these differences were still traceable. In this article, these differences and some similarities are presented, as well as some interesting observations that were made two years after the fire.

## Houses

The first house that burnt down was built following the ground plan of structure #29 at the archaeological site of Stein (Modderman 1970, 90). This house was about 32 meters in length and its width varied between 6.0 and 7.5 meters (**fig. 1**). Its walls were made completely of wood. The archaeological postholes clearly showed that the wall posts were made of triangular split trees. These posts were made of oak. Between them, thinly split planks (2-6 cm) were placed to build the wall. In the northwest part of the house these planks were placed horizontally. In other areas, the planks stood vertically (**fig. 2**). At the reconstructed house the chinks between planks were filled with a mixture of wool and loam. The wall had a height of 1.5 meters.

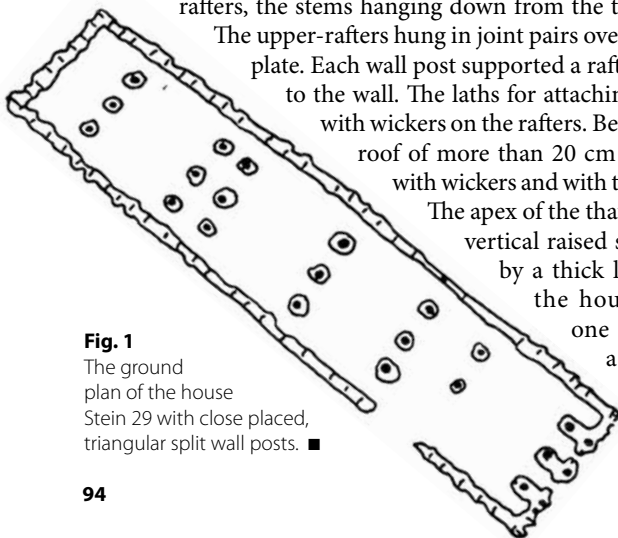
The roof bearing construction consisted of several elements (**fig. 3**). The rafters, the stems hanging down from the top ridge, were in two parts.

The upper-rafters hung in joint pairs over the ridge down to the side-plate. Each wall post supported a rafter from the side-plate down to the wall. The laths for attaching the straw cover were tied with wickers on the rafters. Between two laths the thatched roof of more than 20 cm thickness was bound again with wickers and with the cornstalks hanging down.

The apex of the thatched roof was finished with vertical raised sheaves which were covered by a thick layer of loam. The doors to the house were each made from one plank of 90 cm width and a height between 1.6 and 1.9 meters. Two of these doors closed the entrance. In the interior, cleft



**Fig. 3** The roofconstruction of Stein 29 with the short rafters from the ridge to the side plate and from the side plate to the wall posts. ■



**Fig. 1**  
The ground plan of the house Stein 29 with close placed, triangular split wall posts. ■

wooden beams served as seats around a fire-place. On shelves along the walls and on the floor stood a diversity of objects for performing different acts and activities.

The second house that burned down was a construction based on the JK13 ground plan from the site of Geleen-Janskamperveld. This house was smaller than Stein 29, with a length of about 21.5 meters and a width between 5.0 and 5.2 meters (**fig. 4**). The wall structure differed from the other house in that there were not as many outer posts. The walls were made of wattle with a loam cover and stood to a height of 1.8 meters.

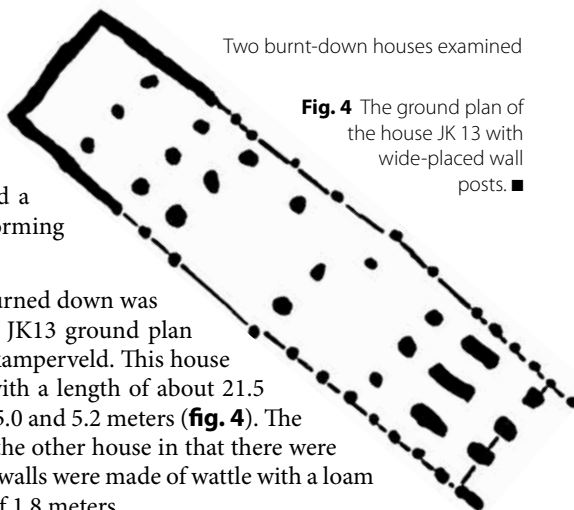
The roof of JK 13 was slightly different from Stein 29. Its rafters hung down in pairs from the top ridge down to the wall plate (**fig. 5**). The thatched cover of JK 13 was tied up on the same way as Stein 29. In other respects, JK 13's roof, doors, seats, and shelves were the same as Stein 29.

## Fire on the 31st of May

The 31st of May 1995 it was a sunny, warm, and slightly cloudy day. There was a stiff wind from the west, 4 to 5 Beaufort. At the time of the fire, more than 100 visitors were in the area of the houses.

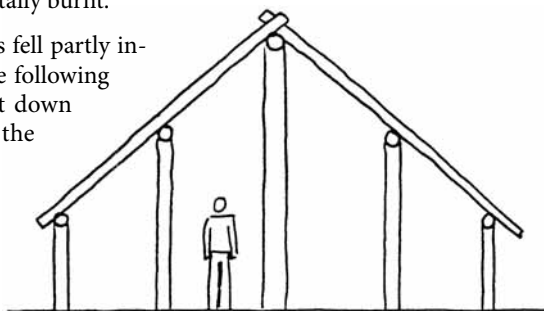
The fire started on the northwestern side of the external roof of Stein 29. It was first noticed some minutes later on the inside of the thatched roof. Because of the prevailing wind, the flames were blown over the very dry thatched cover. Within 15 minutes the whole roof was on fire. No one could approach closer than 30 meters because the fire and the heat were so hot. The extreme temperature and the flying pieces of burning straw spread the fire to JK 13, about 40 meters away. Within 15 minutes, its roof was also totally burnt.

The burning thatched roofs fell partly inside the houses and during the following 30 minutes a sea of fire burnt down the walls and the interior of the houses. For hours afterwards, everything smouldered. A third house nearly caught fire, but the intervention of the fire brigade contained the burning to only the top ridge of the building.



Two burnt-down houses examined

**Fig. 4** The ground plan of the house JK 13 with wide-placed wall posts. ■



**Fig. 5** Cross-section through the house JK 13. ■



**Fig. 6** The eastside of house Stein 29, one year before the fire. ■



**Fig. 7** Burnt-down Stein 29, seen from the northside June first 1995. The fire started on the right-corner. ■



**Fig. 8** Interior of Stein 29, one day after the fire. Benches are still in position. ■

Within one and a half hours, most of the damage was done. The fire smouldered and burned for another 30 minutes until the firemen put it out. JK 13 was extinguished with great force, but at the request of the experimental archaeologist, Stein 29 was put out with a gentle stream of water. **Figures 7 and 8** give an impression of the remains one day after the fire.

## The houses after the fire

The combustion and the collapse of the houses have yielded a lot of interesting information. By comparing the burnt remains of each construction element from Stein 29 and JK 13, it is possible to determine the relationship between certain construction elements and how they burned and where they came to rest.

## The roof

These observations were made at both houses. As a result of the intense fire, the wickers of the thatched roof burnt very quickly. Burning straw, including the laths, slid down along the rafters. Influenced by the wind, the burning straw fell in different proportions inside and outside the walls. On the east side of the house the ratio

inside:outside was about 50:50. On the west side, where the wind clearly had an influence, it was roughly 70:30 (**fig. 9**). The top ridge of both houses was finished with loam. This clayey material became fired by the blaze and fell to the east side of the buildings' interior under the influence of the prevailing wind.

The differences in the collapse of the houses, especially the roof-timber, resulted from differences in the use and construction of the rafters. In Stein 29, where each rafter from the top ridge to the wall was made of two pieces, the burning of the joints caused these rafters to fall straight down into the house, with almost the same orientation as they had been fixed on the roof (**fig. 10**).

In contrast, the rafters of JK 13 were of one piece. As a result of the heaviness of their upper part, they tipped over and lost their balance on the side-plate (fig. 11). The end connected to the other rafter on top of the ridge-plate now lay close to the wall. This was noticed on several occasions. Other rafters remained in place or slid just along the side plate and the wall outside the house.

In the end, nothing was left of the framework of the roof. Only some ridge plates, side plates and a few rafters remained. The laths and the straw of the thatched roof were entirely burnt. On the floors of the houses there was no connection found between the structural elements and the construction of the roof.

## The wall

Because there was a considerable difference in the construction of the walls of the houses, there was also a clear distinction in their remains. At both houses the burning straw fell beside the walls, thus for some time these walls were exposed to a raging fire.

The wall posts of JK 13 burnt only slightly and as a result of the extreme heat of the flames, the loam plaster on the wattle was fired. However, in spite of the high temperature for 45 minutes, only the outer 2-3 mm were fired. Beneath this layer the loam was only very well dried. This accords well with observations made during a house-burning experiment and excavation known from the Historic-Archaeological Research Centre at Lejre in Denmark (Coles 1973, Boye 1996).

In contrast, the walls of Stein 29 were made of posts and planks of oak. These walls were nearly totally burnt down to the ground. Only a few posts and vertical

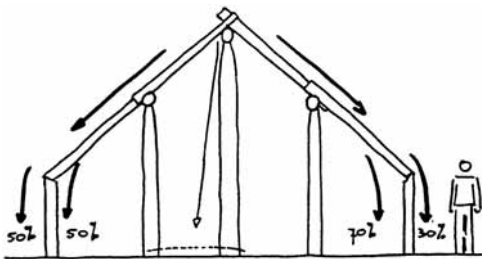


Fig. 9 The ratio of slid straw inside and outside the house. Under influence of the west wind it was on the east side 50%:50% and on the west side 70%:30%. ■

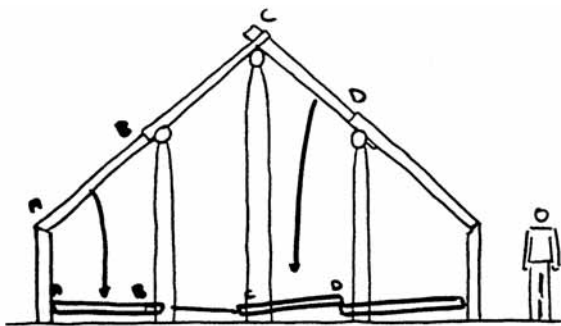


Fig. 10 Collapsing rafters in Stein 29. The position on the ground is the same as at the roof. ■

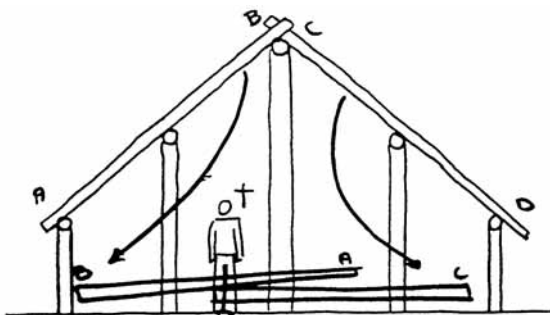


Fig. 11 Collapsing rafters in JK 13. The position on the ground is opposite of the one at the roof. ■



**Fig. 12** A team of archaeologists of the University of Amsterdam joins the experimental archaeologists of Archeon in measuring, drawing and taking pictures of the remains of Stein 29. ■



**Fig. 14** The northern fireplace with the benches still in position, two days after the fire. ■



**Fig. 15** The burstured quern in Stein 29, two days after the fire. ■



**Fig. 16** The overgrown location of the burnt house Stein 29, two years after the fire. ■

planks on the west side of the house were partially spared. The wind blew the flames to the east so these posts and planks were burnt mainly on the inside. The loam filling between these planks was also well fired and found in large quantities close to the former wall.

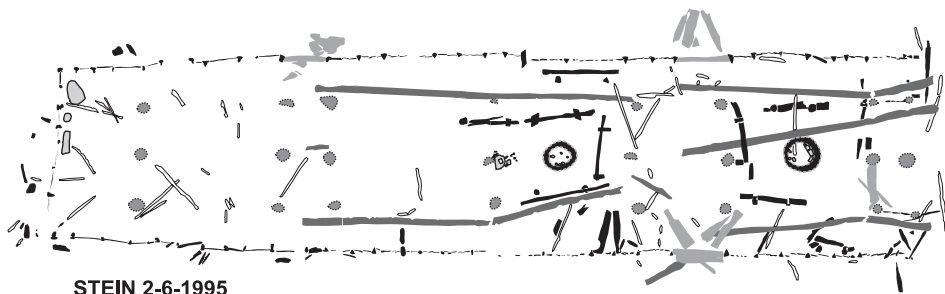
## The floor and the objects in the house

Two days after the fire, the ruins of Stein 29 were recorded like an excavation with precise measurements, scaled drawings, and photographs. A team from the University of Amsterdam interrupted one of their nearby excavations for two days to help the experimental archaeologists at Archeon (fig. 12, 13). During this documentation, special attention was paid to the loam floor and the “prehistoric” objects in the southern part of the house which had not been rescued.

Since these archaeologists, except for one, were not present during the fire and were not involved in the building of the houses, their documentation and interpretation of the remains was done in an objective manner. As a result, there were some problems in the recognition and identification of some of the smaller parts of the house remains. They were also unable to explain the extra layer of burnt loam over the east-length of the house.

## The loam floor

A relationship was noted between the thickness of the fired loam floor



STEIN 2-6-1995

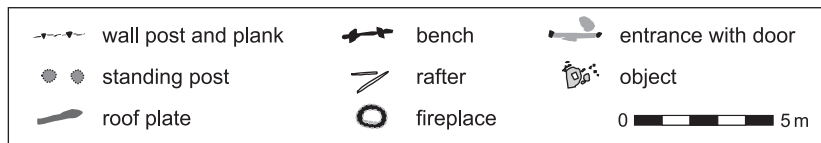
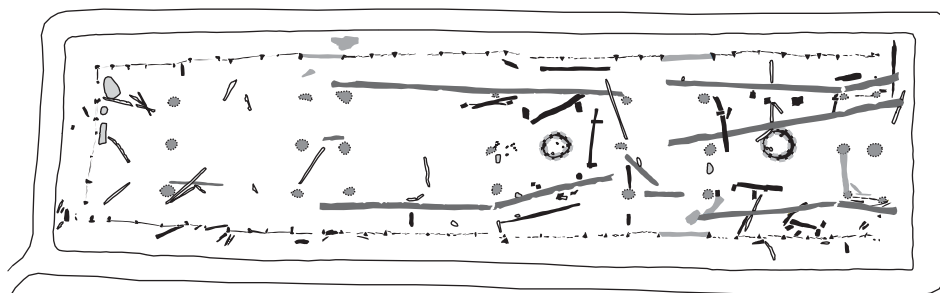


Fig. 13 The plan of the burnt house Stein 29, two days after the fire. ■

and the starting point of the fire and the direction of the wind. The fire started in the northwest corner of the house. Here, the burnt layer is rather thin, 1-2 mm. In the southeast corner, the fired loam layer becomes thicker and thicker, up to a few millimetres. This probably resulted from the intense heat of the blaze as it blew in a southeast direction, effecting this corner more than other areas.

## The objects

Nothing was left from the interior except for some black benches, some still located around the fireplace. In the fireplace there stood some small ceramic vessels, undamaged, but extra fired (fig. 14). The cooking stones beside them had burst into a dozen pieces. The contents of one of the storage vessels—green



STEIN 12-7-1997

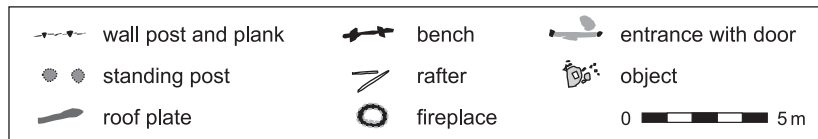


Fig. 17 The plan of the burnt house Stein 29, two years after the fire. ■



**Fig. 18** In 1997 the northern fireplace has eroded to a heap of loam and charcoal. ■



**Fig. 19** In 1997 the quern is spread in many pieces over some square meters. ■

The internal benches were found to not be in their original position and were interpreted as having tumbled.

Another observation was that the burnt surface of the loam floor was no longer visible. The whole floor was now densely overgrown and all the fired loam

peas and beans—were completely charred. The handle of a stone axe was gone and the axe itself was cracked, but it still maintained its shape. A quern made of German-Eifel basalt lava was burst by the heat (**fig. 15**).

## Two years after the fire

For two years after the fire the site of Stein 29 has been monitored regularly and some changes have been documented. In the first half year, nothing grew on the spot, except for the small places where the burnt floor was disturbed (e.g. where the thickness of the fired loam floor had been tested). At first, everybody left all the objects untouched “for the experimental research”. However, during the second year people began to collect wood and charcoal for other fires in the immediate neighbourhood. In this way, objects began to disappear. Overtime, the location of Stein 29 became more overgrown (**fig. 16**).

In July 1997, Stein 29 was again completely recorded (**fig. 17**). [JK 13 had been rebuilt during the months after the fire.] The drawings from 1995 were compared with the situation in the summer of 1997. Around the former house, a ditch of 70 cm deep was laid out as a safety-trench. Pieces of wood located along this ditch were moved away. Several wall posts and planks had broken off and these were thrown in the house.



had been trampled to a very small grit and powder. The fireplaces had eroded to heaps of loam and charcoal and the cooking stones were not recognizable anymore (fig. 18). All the intact objects had been taken away. The broken quern, however, was still there, since as a result of the fire it had become useless. Now its pieces were spread over an area of some meters. The particular parts of the quern were no longer identifiable (fig. 19).

## Conclusion

What can we learn from these burnt houses? Can we learn something that is useful for archaeology?

Burning down a house as an experiment is very dependent on a number of variables such as combustible materials, wind, weather, the location the fire starts, etc. And, of course, it is also very much related to the construction of the house. The different techniques used in joining and constructing the elements of the house have direct implications on the way a burning house will collapse. There is no standard manner in which a house burns down. A check on and comparison with the archaeological record, the most important step of an (scientific) experiment, is (often) not possible. The construction is based on archaeological information, which often completely differs from the ruins of a burnt-down house.

In short, the burning of a reconstructed house is an experiment that occurs by accident or that cannot be controlled. In such cases as “burning by accident” one has to make allowance for the documentation of the construction. Too many houses are built and not well documented. After a fire, it is too late to record the building’s construction. The documentation of a burnt house is only worthwhile if the house’s construction has been recorded. It is important to connect the burnt elements to specific parts of the original construction.

Another conclusion concerns the short period between the fire and the second documentation of the structure. Basically, this did not give very much new information; only that some objects had been moved or taken away. To understand how burnt houses will erode further requires a longer period of time. This was not possible at Archeon since the location of Stein 29 had to be abandoned for modern housing.

## Bibliography

- Boye, L., 1996: Jernalderhus i flammer. Et brandekspirement med store perspektiver. In: Meldgaard, M. and M. Rasmussen, 1996: Arkæologiske eksperimenter i Lejre, Lerje, Denmark.
- Coles, J., 1973: Archaeology by experiment. London, England
- Flamman, J., 1997: Leerzame verbrande ruïnes. In: Bulletin voor Archeologische Experimenten en Educatie, jrg. 2, nr 3., pg 3-7, Leiden, The Netherlands
- Modderman, P.J.R., 1970: Linearbandkeramik aus Elsloo und Stein. Analecta Praehistoria Leidensia 3, 's Gravenhage, The Netherlands

## Summary

### Examen de deux maisons brûlées

Après l'incendie accidentel de deux maisons reconstituées d'après les découvertes des maisons de culture linéaire, les archéologues hollandais avaient une possibilité unique d'étudier et de décrire le processus de leur décomposition. L'article résulte d'un projet de 2 ans.

Un tel incendie n'a pas lieu tous les jours. Ce jour-là, il y a eu soleil et il a fait sec. Un quart d'heure après la déclaration du feu, le toit de chaume de la maison Stein 29 a été en flammes. La chaleur et de la paille incendiée ont allumé la maison JK13 à 40 mètres de là. Heureusement, les pompiers ont maîtrisé le feu qui n'allait plus se propager. Après une consultation avec les archéologues, on a laissé brûler la maison Stein 29. Les dégâts principaux se sont produits pendant une heure et demie.

Au bout de deux jours, les ruines ont été fouillées de sorte que ce soit une recherche archéologique classique. On a examiné surtout le sol en terre et les objets dans la partie sud de la maison qui étaient restés sur sa place. De même on a observé attentivement les détails constructifs parce que Stein 29 avait eu les murs en bois tandis que les murs de JK 13 étaient en clayonnage et garnis de torchis. Et leurs toits, eux aussi, ont été différents.

Pendant deux années, les ruines de Stein 29 ont été observées et enregistrées. Puis, on a de nouveau fouillé le terrain. Pour pouvoir complètement comprendre tous les processus de dépôt, il faudrait examiner le site plus longtemps ce qui, malheureusement, n'a pas été possible en raison du raménagement du lieu.

### Die Untersuchung von zwei abgebrannten Häusern

Nach dem unbeabsichtigten Niederbrennen von zwei experimentalarchäologisch errichteten Häusern der Linearbandkeramik beobachteten und dokumentierten niederländische Archäologen den dazu gehörenden Entwicklungs- bzw. Bodenbildungsprozess. Der Artikel stellt die Ergebnisse des zweijährigen Projektes dar.

Das Niederbrennen zweier Häuser ist kein Experiment, das alltäglich ist. Das Feuer brach an einem trockenen und sonnigen Tag aus; innerhalb von fünfzehn Minuten nachdem das Feuer bemerkt wurde, stand das Strohdach des ersten Hauses (Stein 29) bereits vollständig in Flammen. Die Hitze und brennende Strohfunken lösten dann den Brand des zweiten Hauses (JK 13) aus, das sich in 40 m Entfernung befand. Die Ausbreitung des Feuers auf andere Gebäude und Einrichtungen wurde durch den Einsatz der Feuerwehr verhindert, die es in Absprache mit den Archäologen zuließ, dass das erste Haus auf natürliche Weise niederbrannte. Der größte Teil des Brandschadens vollzog sich dabei innerhalb von ca. 1,5 Stunden.

Bereits zwei Tage nach dem Brand wurden die Ruinen wie bei einer Ausgrabung mit präzisen Messungen, Fotografien und maßstabsgetreuen Zeichnungen dokumentiert. Bei dieser Erfassung wurde besondere Aufmerksamkeit auf den Lehm Boden und auf den südlichen Teil des Hauses gelegt, der vollständig abgebrannt war. Außerdem wurden auch die Konstruktionsdetails genau erfasst, denn die Wände des Hauses "Stein 29" waren aus Holz gebaut, während diejenigen des Hauses "JK 13" aus Flechtwerk mit Lehmewurf bestanden hatten. Auch die Dächer waren auf unterschiedliche Weise ausgeführt.

Innerhalb eines Zeitraums von zwei Jahren nach dem Brand wurde der ehemalige Standort des Hauses von "Stein 29" regelmäßig besucht, wobei einige Veränderungen festgestellt werden konnten. Zwei Jahre nach dem Brand wurde der Bereich des Hauses "Stein 29" zum wiederholten Male untersucht. Um die Abtragungsprozesse besser verstehen zu können, wäre eine längere Phase sinnvoll gewesen. Dies war leider nicht möglich, da der Standort des Hauses von "Stein 29" für weitere Arbeiten genutzt werden sollte.