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THE PIT HEARTH OF THE TYTTÖPUISTO TYPE – A NON-REUSABLE FIREPLACE?

Abstract

This article presents an experiment which was made to compare two different types of fireplaces and their the capability of preserving and emitting heat. It was shown that the type suggested to be a non-reusable fireplace was significantly more effective. The reconstruction of the type is also presented. The primary research material consist of about 60 hearths recovered at the Tyttöpuisto site in Eura, SW Finland; six of them are C14-dated to 3909 ± 33 or 3792 ± 82 CAL BC. The pottery of the site is Early Comb Ware I:2, Jäkärlä style and Typical Comb Ware.

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THE BACKGROUND OF THE RESEARCH

Hearths of a specific and singular type have been discovered at several prehistoric sites in Finland. A good example is the Stone Age site of Tyttöpuisto in Eura, Satakunta (SW Finland; fig. 1), where detailed investigations of these features have been undertaken to clarify their construction and function. Tyttöpuisto was discovered in 1943 by Sakari Pälsi, who located 15 hearths at the site. No excavations were carried out, but a rough plan of the site was sketched. After Pälsi's investigations, small houses of light construction were built at the site, but they were demolished after 30 years of use; in the beginning of the 1980s only about 10 cellar pits remained as evidence of this habitation. Stone Age fireplaces were observed in the pits, and they were also the target for our excavations in 1982, when the rebuilding of the area was being planned.

In the late 1980s there were plans to build block houses at the site, and excavations were again required. The threatened area was now larger than before and it was not possible to carry out a total excavation. Field work conducted in 1988 and 1989 was begun with a radar survey, the aim of which was to locate the fireplaces and accordingly plan the excavation area. In 1961 and 1985 some 20 hearths were recorded and mapped, mainly because of occasional land-use at the site.

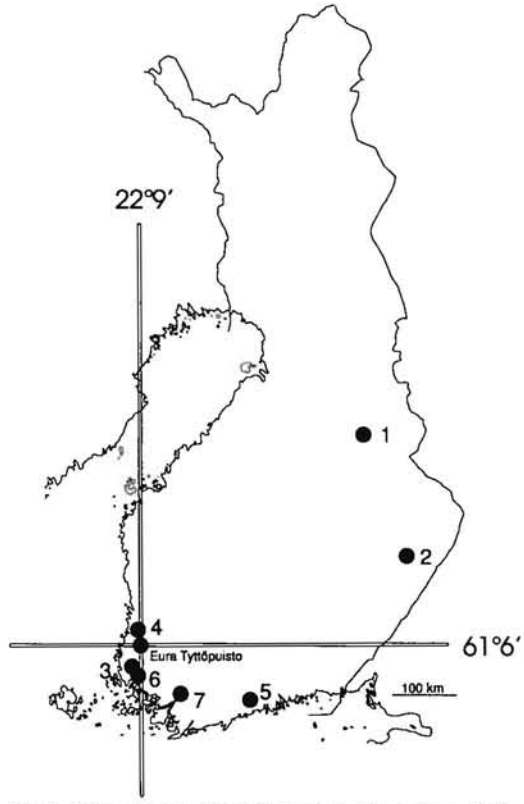

Fig 1. Map showing the Tyttöpuisto, Eura site and the other sites mentioned in the article with numbers referring to the text.

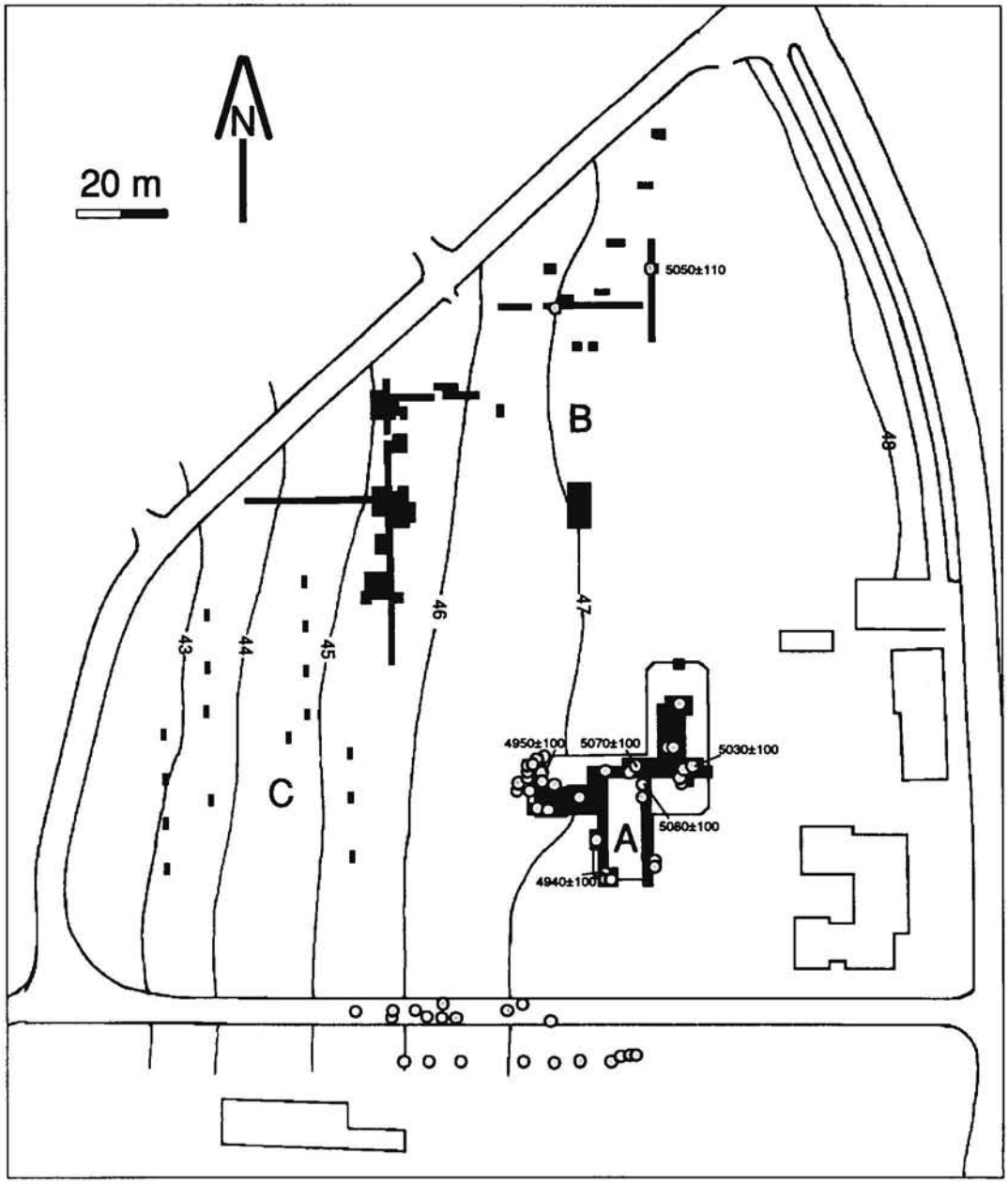

Fig 2. Tyttöpuisto area. Excavation areas A (1982), B (1988–89) and C (1989). Grey dot = hearth.

THE TYTTÖPUISTO DWELLING SITE AND THE FINDS

The dwelling site of Tyttöpuisto is situated on a terrace with a gentle western incline (fig 2.). The soil consists of sand and the vegetation is dry and mostly sparse pine forest. The ancient coastline followed the present 45-metre a.s.l. contour line, originally forming an open and wind-swept shore of a bay, which was unsheltered from all other directions except the south-west, where the summit of a nearby hill rises to a height of c. 70 m above present sea level.

The area of the site is estimated at roughly 230 x 130 metres. Excavation area A (1982 season) was situated in the south-west part of the site, where

the density of the hearths was highest, but the find intensity was relatively low (see table below). Also the cultural layer was very thin and indistinct. The potsherds found in this area represent the later phase of Early Comb Ware and the Jäkärlä style.

Excavation area B (1988–1989) consists of trial trenches and small scattered test sections, the centre of this area being situated 100 metres north of area A. In this part of the site, four hearths of the same type as in area A were discovered in addition to nine other remains of fire; the latter obviously include at least a couple of destroyed fireplaces. The find material is far more abundant than in area A, consisting of thousands of potsherds, mostly of Typical Comb Ware. Also flint arrowheads and other flint artefacts were found, which are completely lacking in area A.

Excavation area C was the westernmost area and was situated at a lower elevation than the others. Here, only test sections were excavated and both finds and constructions were almost non-existent.

Area	Potsherds	Quartz artefacts	Flint artefacts	Stone artefacts	Flakes of stone	Bone fragments
A	1809	584	–	14	266	1
B,C	7768	363	244	16	40	5

There is a clear difference in the character of the southern area A and the northern area B, although a strictly drawn border cannot be recognized. It is obvious, though, that there are two separate dwelling sites from distinct periods possibly also reflecting different function or annual use.

THE HEARTHS

A total of 33 hearths were discovered in 1982 within an area of roughly 300 square meters. Some of them were placed very close to each other (fig. 3), while others were more scattered. The estimated area of high density of hearths covers about 70x150 metres (10500 m^2), which means that the total number of hearths yet to be uncovered may well be as high as around 1000.

It is obvious that their relative number is extremely high in comparison with the general occurrence of hearths at Stone Age sites in Finland. Some of the hearths, which were almost in contact with each other, had apparent but not very significant differences in their vertical position – the sand at the site is very fine and easily transported by wind or water, and within a couple of weeks fireplaces can be completely covered by sand.

Four similar fireplaces were uncovered during excavations in 1988–1989, in addition to 11 which had been mapped in 1961 when a road was built through the site and 10 others were recorded in connection with cable digging work in 1985. 58 fireplaces of the type are now mapped (not including the features observed by Pälsi – they appear to be at least partly the same as those excavated in 1982, but they can no longer be identified with any certainty).

All the hearths were similar (fig. 4), being round and regular in form with diameters varying from 0.8 to 2.0 metres (average 1.0–1.1 metres). They all had a uniform round band of charcoal around the stones. This circular feature extended under the stones as a uniform bowl-shaped layer of charcoal. Stones were laid in 1–3 layers and the whole construction was 15 to 30 cm thick. The stones were severely burnt and splintered into small pieces. The largest stones had originally been from 30 to 40 cm in diameter, and in some cases even previously burnt and partially weathered stones had been used, which was observed from the lack of fire-cracked fragments of them.

Later excavations revealed only four hearths of this type, although the investigated area was now larger. A few other traces of fire were also observed, but they were more irregular and obscure in form.

RECONSTRUCTION OF THE HEARTHS

How can the solid charcoal layer under the stones be interpreted? It is possible that the stones were placed into the fire while it was still burning, but this does not explain the bowl shaped form of the hearths. One reasonable suggestion is that a pit was first dug to a depth of 20 to 30 cm. Dry and suitably inflammable material was put into the pit, which was then sparsely covered with long wooden beams. Stones were laid over them and the construction was lit (fig. 5).

The advantage of this type of fireplace is obviously that the stones prevent the fire from flaming too rapidly, permitting them to absorb as much heat as possible. The construction may collapse, but even then the stones preserve the heat for a considerable time. The disadvantage is that this kind of hearth can be used only once. The stones may perhaps be used twice or even three times, but the moisture inside them will make them split into small pieces at high temperatures.

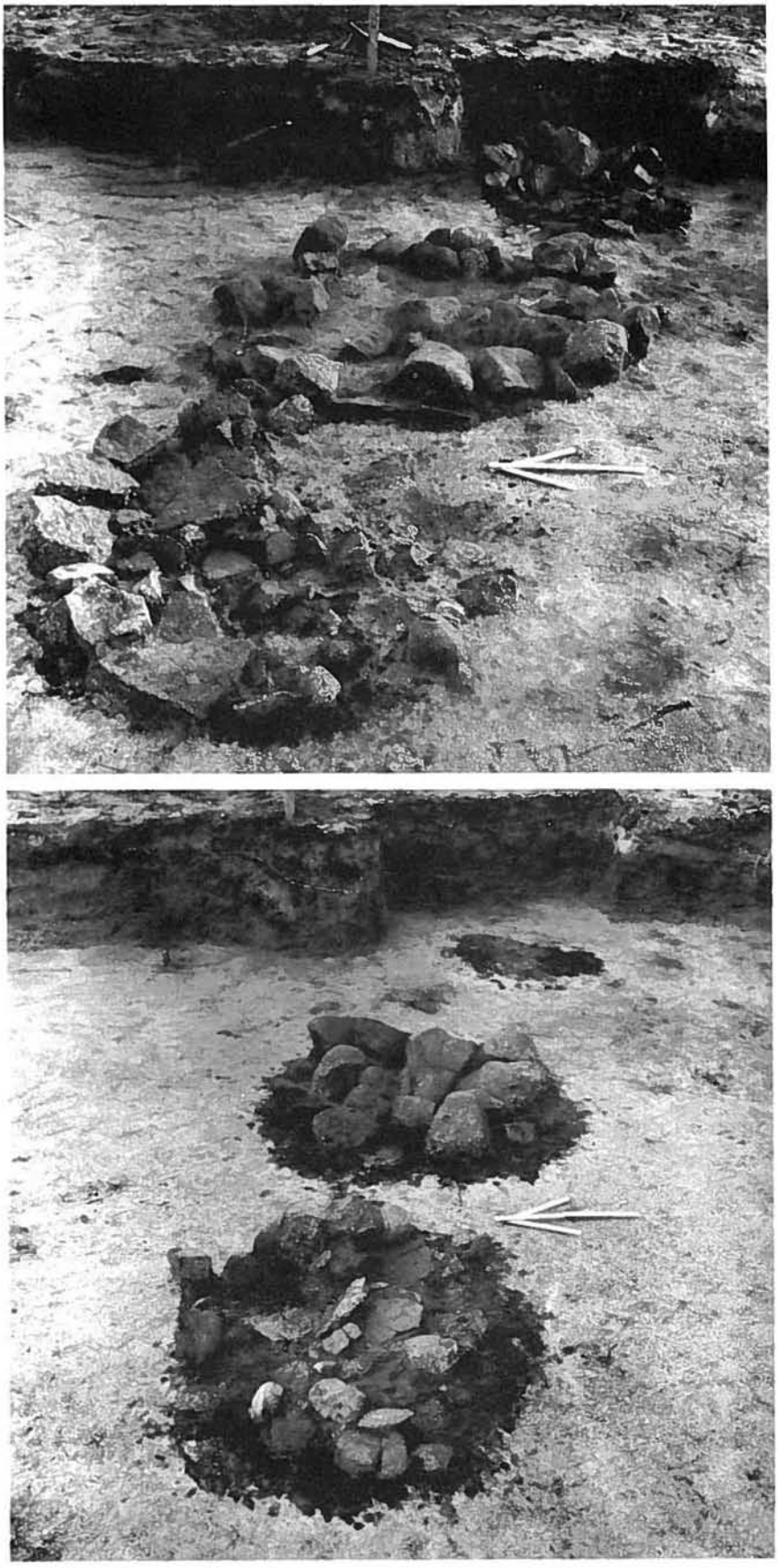

Fig. 3a–b.
A group of three hearths nos. 20,24,25 a) as they were found and b) at a level 10 cm deeper. Photo: National Board of Antiquities/A. Vikkula 1982.

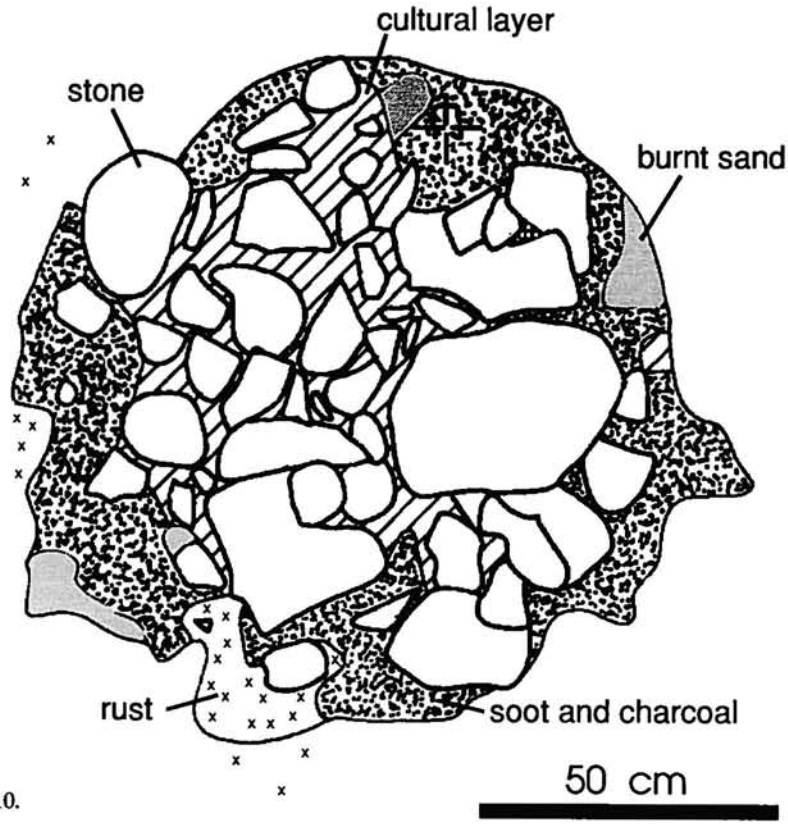

Fig. 4. Drawing of hearth no. 10.

THE EXPERIMENT

On a cool day of September a test was conducted to investigate the differences betweem the two types of fireplaces (fig 6). The "non-reusable" type (1) was made according to the assumptions described above and a "traditional" type (2) was built in the usually accepted way with a layer of stones was under the wood fuel. Both had the same amount of material, but it was not possible to put all the wood at same time into the traditional type. Wind conditions were the same for both hearths, as they were only 1–2 meters from each other.

The hearths were lit at the same moment. The non-reusable fireplace begun to collapse after half an hour and the fire was totally extinguished after one and a half hours. Wood was added twice to the traditional one between 15 and 45 minutes and its flames died out two hours after being lit.

Measurements were begun two and a half hours after lighting using two completely similar devices. They were made of 5-litre tins with a thermometer placed through the bottom of the tin with the scale outside the tin and the mercury inside it. The tin was laid on the stones with the bottom up until the mercury bar stopped rising and the temperature inside the tin could be registered (fig. 7). This took about 10 minutes. The tins were allowed to cool after the measurement. This procedure was repeated 9 times every half hour so that the last measurement was taken seven hours after lighting, and both tins were used on both fireplaces alternately. The ambient temperature was 8–10°C.

The decline of the temperature in both fireplaces was fast initially but became slower during the measured period. But the differences were clear. The temperature that the non-reusable fireplace produced in the tin at the first measurement was 204°C and went slowly down to 51°C at the end. The traditional fireplace was considerably less capable of emitting heat – the corresponding starting temperature was 126°C and after seven hours not much more than ambient temperature (16°C). In all, the non-reusable fireplace cooled 2–3 hours slower than the traditional one (fig.8).

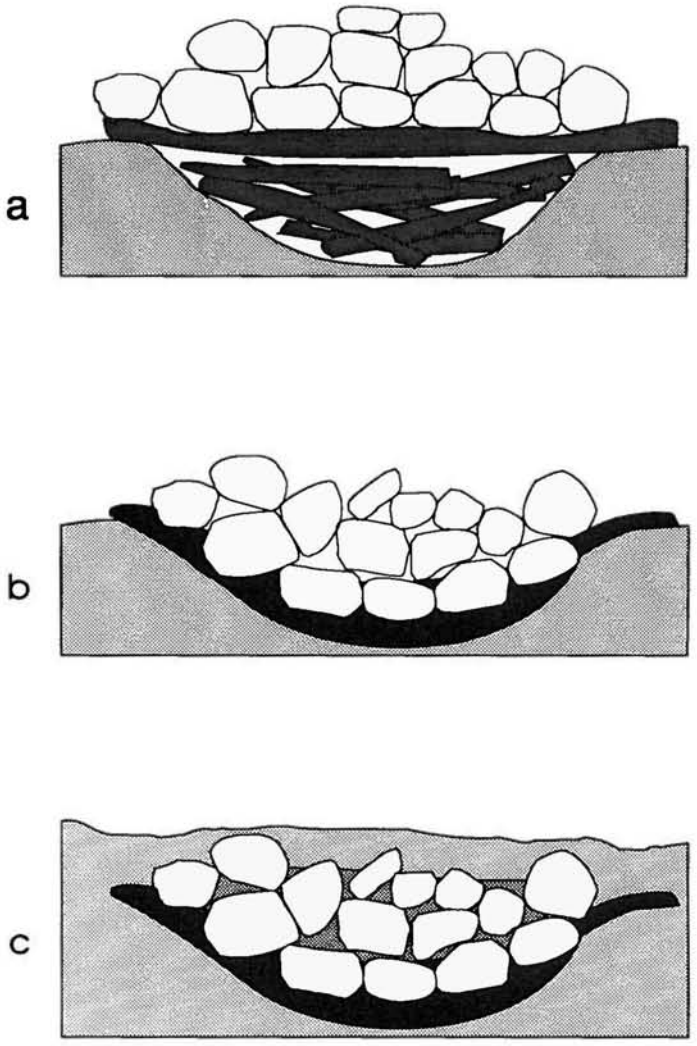

Fig 5. Suggested version of the phases of a) reconstructing, b) collapse and c) covering of a hearth of the Tyttöpuisto type.

THE DATING OF THE HEARTHS

Some of the hearths have been C14-dated at the Dating Laboratory of the University of Helsinki and all the dates are based on the 5568 year half-life. Five charcoal samples were taken from the hearths excavated in 1982 (map fig. 2; Hel-1801, 4950 ± 100; Hel-1802, 5030 ± 100; Hel-1803, 5070 ± 100; Hel-1804, 4940 ± 100; Hel-1805, 5080 ± 100), and was taken from a non-reusable fireplace excavated in 1988 (Hel-2722, 5050 ± 110). The results definitely showed that the period of occupation reflected by these fireplaces was comparatively short (fig. 9).

Two other radiocarbon dates must also be mentioned, although they were not obtained from hearths but from charcoal and soot pits. These samples gave recent (Hel-2721; 280 ± 90) or Iron Age dates (Hel-2720; 760 ± 90), and may be ignored in this respect.

In trying to assess the possible age range of these hearths two approaches can be taken:

either 1: each charcoal sample is assumed to date different historical events, and therefore each date is independent of all others;

or 2: each charcoal sample is assumed to date the same historical event.

Fig 6a–c.
Experiment: a) the hearth of the Tyttöpuisto type before lighting, b) the traditional hearth before lighting and c) both fireplaces are burning. Photo: A. Vikkula.

Fig. 7. The measuring equipment.

In case 1 the individual dates (Conventional Radiocarbon Age, or CRA, see Stuiver and Polach 1977) can be calibrated using the Northern Hemisphere calibration curve to yield ages which are in calendrical years CAL AD/BC. This yields six probability distributions which can then be pooled and scaled to give unit area. The process was carried out by Dr Foss Leach, Museum of New Zealand (see Leach 1972, 113–116). This shows a median age of about 3820 BC with 68 % confidence limits of about ±150 years. It may seem surprising that the final standard error is greater rather than less than that of the original dates. However, if one considered the case of adding two identical Gaussian distributions, the product would be identical to both, rather than have a narrower spread. It is therefore not surprising that six slightly different dates yield a final age range which is greater than any one of them.

In case 2, however, quite a different picture emerges from the analysis. What we are effectively assuming is that one single charcoal sample has been split into six sub-samples and sent to different radiocarbon dating laboratories. Alternatively, one sample is counted for six times as long. In this case, the six CRA values which result can be pooled together using an algorithm which weights the means according to the standard errors. The calculation has been made using the Radiocarbon Calibration Program rev 3.0.2 by University of Washington, Quaternary Isotope Lab (Stuiver – Reimer 1993, 215–230). This yields a new CRA of 5019 ± 42 years. Notice the considerably smaller standard error.

We may use the statistical test following the procedure of Ward and Wilson (1978, 20–21; see e.g. Shott 1992), determining T', where

$$T' = \sum_{1}^{n}(A_i - A_p)^2/E_i^2$$

and where in this case n=6, I=1,,,,,n, A_i = mean of each date, E_i^2 = variance of each date and A_p=5019 (the pooled mean of the dates). We get T'=1.73. The degree of freedom is n-1, and looking up the tables of chi-square distribution we find that the limit P value of 0.05 is 11.10, which means that the samples are statistically the same at 95 % confidence level. The same program was used as above.

This pooled date also requires secular correction. Again, the same program was used and the secular correction curve for the Northern Hemisphere for this period was selected. The age ranges can be given as follows:

% area enclosed	CAL BC age ranges		relative area under probability distribution
68.3 (1σ)	CAL BC	3935–3879	0.39
		3869–3859	0.07
		3841–3822	0.12
		3803–3759	0.36
		3728–3720	0.05
95.4 (2σ)	CAL BC	3942–3875	0.32
		3874–3709	0.68

The best estimate of the true calendrical age of this archaeological horizon at the 95 % confidence level is thus either 3909±33 or 3792±82 CAL BC. Such an ambiguous result is unavoidable, given the present uncertainty about small fluctuations in the atmospheric C14 values over such a short period 5000 years ago (fig. 10).

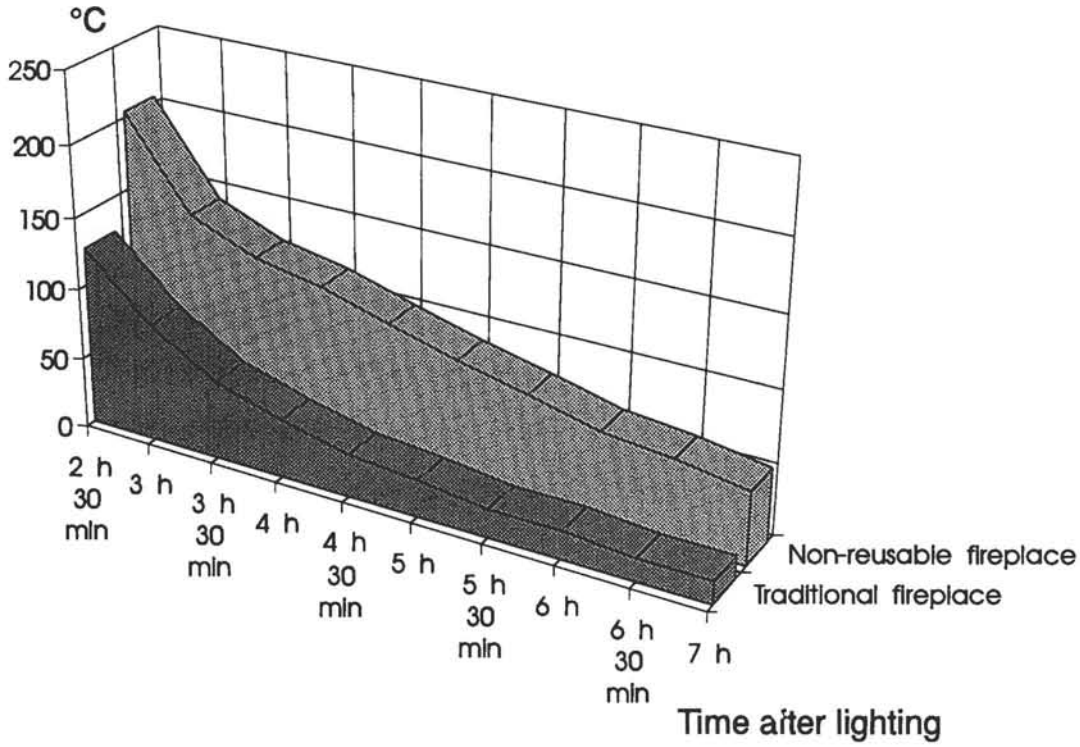

Fig. 8. Graph showing the rate of drop in temperature 2 h 30 min – 7 h after the hearths were lit.

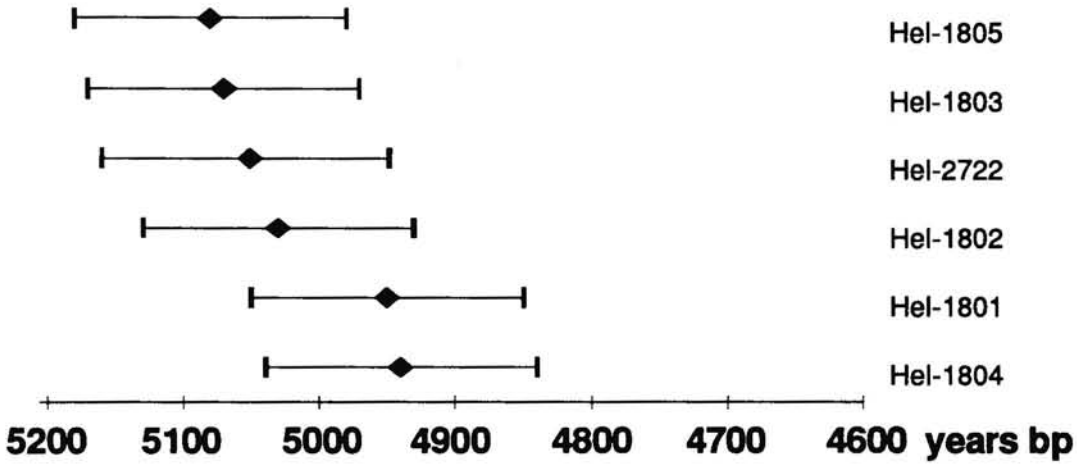

Fig. 9. Graph showing the conventional radiocarbon dates.

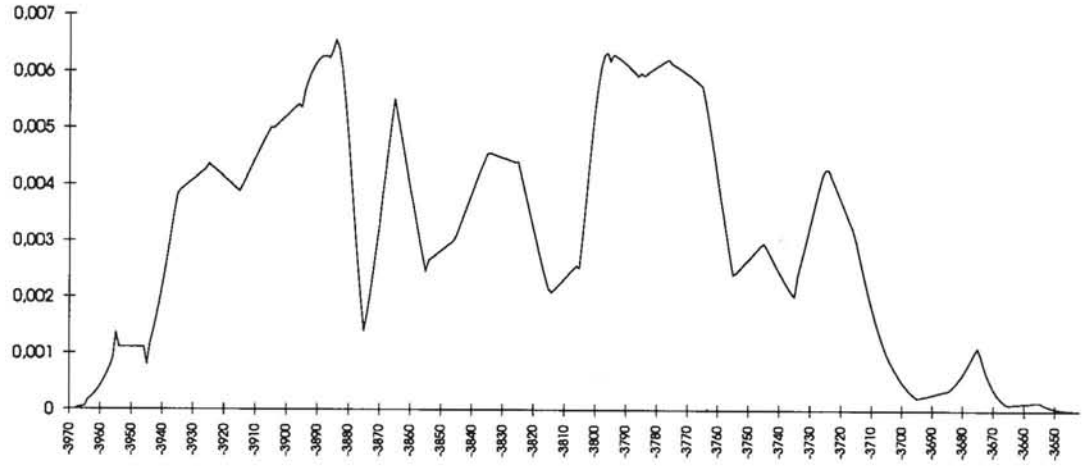

Fig. 10. Combined probability curve of the calibrated pooled mean 5019 ± 42 bp of the six dates showing the annual probability of each CAL BC year.

OVERVIEW OF SOME C14-DATED HEARTHS OF THE TYTTÖPUISTO TYPE IN FINLAND

After the Tyttöpuisto hearth type was defined, several sites with similar hearths have been excavated, and it has become obvious that the type is quite common. The sites listed below are only examples of radiocarbon-dated fireplaces and they do not show the true frequency of the type (numbers refer to the map in Fig. 1).

1. Räätäkangas, Sotkamo, Comb Ware Sär I

At the Stone Age dwelling site of Räätäkangas in Sotkamo, Kainuu, a typical Tyttöpuisto hearth was uncovered during excavations in 1985. The radiocarbon age was 5440 ± 100. The potsherds found at the site were mostly of the so-called Säräisniemi I style and the dating falls within the range of its appearance, even though C14-dates have shown that the style is much older than previously assumed. A smaller number of potsherds of the late Typical Comb Ware phase or even the late Stone Age have also been collected at the site, but nothing was found in the C14-dated fireplace itself, or even close to it. Three destroyed hearths with only a couple of weathered stones and some charcoal were also uncovered.

2. Pörrinmökki, Rääkkylä, Typical Comb Ware

The Pörrinmökki dwelling site is situated on the SW slope of the Jaamankangas ridge in Rääkkylä, North Karelia. The site is large but consist of many small concentrations, where a large number of Typical Comb Ware potsherds have been collected in ditches. Only a small part of the area has been excavated, in 1989–1991. Two terraces can be observed in the investigated area; the ceramics in the upper part were mostly Asbestos-Tempered Ware, and the lower one mainly represents Typical Comb ware and the Asbestos Ceramic style of Pöljä and Kierikki, as well as the Early Metal Period. On the upper terrace, a fireplace of the Tyttöpuisto type was revealed. The diameter was about one metre and stones were burnt and splintered into pieces of different size. It gave the C14-dates 5270 ± 100 bp (Hel-3222) and 5090 ± 100 bp (Hel-3223).

3. Nästinristi, Laitila, Late Comb Ware

The Nästinristi dwelling site in Laitila, Finland Proper is a large complex with nine sub-surface pit graves, 14 cairn graves, 12 hut-floor depressions, large numbers of potsherds and other dwelling site material from the Typical and Late Comb Ware. 33 fireplaces were revealed in an area of about 3700 square metres and almost half of them were

pit-hearths of the Tyttöpuisto type. Some of them were close to the graves and seem to have some connection with them. The graves have been dated on the basis of finds, elevation and C14-dates to the time of Uskela Ware. Also the only radiocarbon dated fireplace falls within this period (Hel-1346, 4740 ± 100 bp; Hel-1347, 4710 ± 100 bp; Vikkula 1986, 6–8, 16).

4. Panelia, Kiukainen, Bronze Age

In 1987 a small excavation was conducted close to one of the largest burial cairns in Finland: Kuninkaanhauta (The King's Grave) cairn in Kiukainen, Satakunta. A large fireplace was revealed within a circular stone setting. It was 2 metres in diameter and stones were badly burnt and splintered. The C14 dating gave the result of 2470 ± 110 bp (Hel-2538). The sparse find material consists of a few potsherds from the Bronze Age.

5. Jönsas, Vantaa, Early Metal Period

The Jönsas dwelling site in Vantaa, Uusimaa was used for a very long period. The earliest finds date back to the Mesolithic Stone Age, the Suomusjärvi period, and the youngest are from the Early Metal Culture. All the radiocarbon dated hearths were equal in form to those at Tyttöpuisto, but larger (diameter 1,5 to 2,0 m) and the stones were smaller and more splintered. Datings are 2920–2080 bp with standard deviation of 100–130 (Ojonen 1983, 14–20).

6. Pyheensilta, Mynämäki, Pre-Roman Period.

The dwelling site of Pyheensilta, Mynämäki, in SW Finland has been dated to the Late Stone Age according to the finds, and also the elevation corresponds to the Late Stone Age shore line. Two hearths were revealed during excavations in 1978. They resembled the Tyttöpuisto fireplaces both in shape and in size. The radiocarbon samples taken from stone setting I gave the ages of 2390 ± 110 and 2080 ± 110 and that from stone setting II 3120 ± 100 bp. Under the stones and the charcoal layer a number of unburnt ringed seal bones were found, which led to the conclusion that the fireplaces had been use rather for ceremonial purposes than for preparing food (Väkeväinen 1978, 82–84).

7. Ketohaka, Salo, Iron Age

A total of 22 hearths have been discovered and investigated at the Ketohaka dwelling site in Salo, SW Finland. Judging from written description and photographs we can conclude that at least hearths nos. 12, 13, 18, 19 and possibly no. 16 are of the same type as those at Tyttöpuisto. The C14 datings of these hearths gave results from 1910 to 1390 bp with error margins of 100 to 110 years. House reconstructions have been made according to the post-holes and burnt clay, but none of the hearths seem to have a connection with the buildings. In one of the hearths large fragments of burnt clay were also found, which were TL-dated to 1840 ± 180, but no connection between the clay and fireplace structure was observed (Uino 1986, 56–59, 85–87, 92).

CONCLUSIONS

Only a very few hearths of the non-reusable type are described above. The construction seems to be very common and not at all "mysterious", as has been suggested (Väkeväinen 1978). Distribution maps were not made this time because of the general nature of the type. Although the construction in all the above-mentioned fireplaces is the same, there are some differences in their size, density and the degree of weathering of the stones. Only at the Tyttöpuisto site is the density of fireplaces surprisingly high, and this is so far the only place where C14-dates point to a very brief period of use of them.

In conclusion, we may say that the suggested reconstruction of the hearth type proved it to be possible and useful, as it can emit heat 2–3 hours longer than a traditional hearth. The experiment was made only to compare the two types and both test hearths were therefore smaller than the average size found at dwelling sites.

The advantage of the non-reusable type is that it makes it possible to forget heating the hut or cot tage for several hours. In the experiment, the stones emitted a temperature of almost +90°C into a small but cold tin for 4 hours after the actual fire had gone out. This cannot, of course, be compared with a much larger dwelling construction, which, on the other hand, would already be warm. In addition, larger fireplaces than those tested absorb more heat and are also able to emit it in greater quantities. It is obvious that this kind of fireplace is able to keep a hut or house warm through the night, and after the flames have died and the smoke holes are closed, the inhabitants may sleep without anyone having to take care of the fire.

The advantage of being able to forget heating is

naturally a phenomenon of cold areas, and even there of the cold periods of the year. The disadvantage is the very strong weathering of the stones which prevents their use more than 2 or 3 times. Many Stone Age sites are on sandy soil and it can be very difficult to find stones, for example at Tyttöpuisto. This becomes even more difficult during the winter, when the earth is covered by snow. It is also obvious that the mineral composition of the stones causes differences in the need of material – e.g. the very common *rapakivi* stone (rough red granite) of SW Finland is not very hard and breaks easier than many other rocks. This phenomenon cannot be verified because of the lack of information in excavation reports.

People may of course have collected stones for this purpose already in the summer, but it appears that the fireplaces were used during the autumn season when the ground is not yet covered with snow and stones are still visible for collection. Unfortunately a comparison between the appearance of the type and the osteological material has not yet been made – such a study could shed new light on the periodicity of Stone Age habitation and living conditions.

At Tyttöpuisto there were no traces of any huts around the hearths, which means that the constructions were very light and portable, and this concerns also the other Stone Age sites described above. Some of the Bronze and Iron Age hearths may have been used inside a building, whereby they were unpacked and rebuilt every evening at the same place. This also explains why the need to use stones that were already very weathered and splintered – as at Panelia in Kiukainen – was greater than at more open Stone Age sites.

This might even explain the appearance of the so-called *skärvstensrösen* (Sw.), cairns of fire-cracked stones, at the Bronze and Iron Age sites on the Ostrobothnian coast and in the Åland Islands. The cairns have been explained as a product of seal-hunting and train-oil cooking practices as they are mostly found on the coast and the archipelago, where farming was not very successful in the earlier stages (Gustavsson 1980, 72–78; Gustavsson 1986, 57–64). This explanation might be valid, if we disagree about the connection of the Tyttöpuisto type and the cairns of fire-burnt stones. If we agree, we cannot accept seal-hunting as an explanation, as the hearth type appears throughout Finland – also by small lakes where seals did not live during the Stone Age.

Using a little more imagination, we may even suggest that the hearth construction of the Tyttöpuisto type was later used either to heat drying barns (Fi. *riihi)* or as a sauna oven. At any rate, it is not reasonable to assume that either of these was the original function of the type, because the oldest dated hearths are almost two thousand years older than the earliest evidence of farming in Finland (Vuorela – Lempiäinen 1988, 33–45). The best explanation is the simplest one, arising from the basic needs of men and animals – food and warmth.

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ABBREVIATIONS

SM = Suomen Museo. Published by the Antiquarian Society of Finland.

SMYA = Suomen Muinaismuistoyhdistyksen Aikakauskirja. Published by the Antiquarian Society of Finland.