Reconstruction of a Jomon Period Sod Roof Pit House: Burnt Pit Dwelling of Goshono Site, Ichinohe Town, Iwate Prefecture

TAKADA Kazunori NISHIYAMA Kazuhiro Asakawa Shigeo

Research from 1985 in Hokkaido indicated the possibility of Jomon period sod roof pit dwellings.¹

Amongst this research, two Late Jomon period burnt dwellings from the Sinmichi 4 Site, Kikonai Town, provided evidence of charred wood and woven charred materials or alternately burnt soil, which led MIYAMOTO Nagajiro to estimate that these had sod roofs 40-50 centimeters in the center and 80 centimeters along the outer rim. Miyamoto proposed that one of the buildings was built with rafters set in a radial arrangement upon which grasses and branches were used as the base for the sod roof, and that the other was built with sod applied on top of a thick layer of rafters. While this was thought to be a reasonable interpretation, it is unfortunate that no detailed illustrations of the structure were created.²



Figure 1 : Location of Goshono Archaeological Site

In September 1996, remains of eight burnt pit houses from the late-Middle Jomon period were discovered at Goshono site in Ichinohe Town, Nihone District, Iwate Prefecture. Of the eight buildings, seven were detected in the western research area and five of these were pit houses from the Daigi-10-Style at the close of the Middle Jomon period.³ Observation of the burnt remains and debris indicate with almost certainty that these five buildings, including one large, two medium, and two small pit houses, were habitations covered with sod roofs. In the past, the ruins of medium-size dwelling DE24 has been experimentally reconstructed based on detailed plans based on data from excavations. With this dwelling, while the layer of burnt remains forming the foundation of the roof were clearly detected, the soil sediments were andosols (kuroboku) making it impossible to examine the soil layer of the sod roof itself. However, the remains of the large-size pit house ruins of DF22 were not only well-preserved but allow one to clearly explain the process of burning that created the deposition of soil layers.

It should be noted that Ichnohe Town, as part of the Goshono Site Environment Improvement Project from 1997, plans to reconstruct sod dwellings as faithfully as possible based on research conducted up to 1999.

I. Results of Research

1. Overview of Site

Goshono site is composed of central area with pit houses distributed to the east and west of a central plaza (burial grounds) and embankment feature and groups of pit dwelling remains in the eastern, western, and Babadaira areas. The central area with the burial and ceremonial grounds is considered to be the base settlement that was likely shared the small-scale by many settlements in Goshono and the surrounding area. The burial grounds surrounds two stone circles, each of which is divided into smaller units of stone features that are comprised of several blocks of grave pits. Several pillared buildings are located next to the area surrounding the stone circles and are likely placed in a circular pattern similar to Nishida site.

The large-size pit house DF22 is located in the western research division in the central area of the site. Surrounded by four coexisting houses, DE24, DH28, DG26, and DB18, from the end of the Middle Jomon period, it may be presumed to be some sort of "main house." All five of these buildings were burnt, but because DB18 and DE24 are close in proximity it could be that one was a replacement for the other, one can reasonably assume that at least four buildings of large, medium, and small

sizes both existed and were burnt at the same time. In either case, the four or five dwellings that were the object of thisresearch are thought to have coexisted with several similar units of dwellings throughout the settlement and



Figure 2 : Feature Remains of West Research Area



Figure 3 : FD22 Building Excavation Map

have some correlation to the different blocks of grave pits.

2. Conditions of Dwelling DF22 Remains

DF22 is a long elliptical building with dimensions 8.4 meters north-south and 6.8 meters east-west with the south wall being slightly linear. Surrounding the pit house is a gentle slope descending from the west to the east. This affects the height of the pit walls, which are highest on west side at 70 centimeters and just 10-15 centimeters on the east, making a difference of 50-60 centimeters between the two sides. A stone hearth is near the southern wall inside the pit, and the distance between wall and pit is 1.6 meters and has been dug to a depth of 30 centimeters in two steps. Burnt earth was found not only inside the stone hearth but also in the excavated area located on both sides of the northern part of this circle. This area also corresponds to the hearth. The stones surrounding the hearth are mostly andesite, but it also used sandstone, granite, and chert. The pit floor is flat for the most part, although the northwest side is 20 centimeters higher than the southeast side. Although the entire surface was dug to the loam surface of the ground, in the center of the pit house (the area inside the main pillars) has tamped earthen floors (hariyuka). In contrast the floors have not been tamped along the west wall moving north in an area of 1 meter and 1.5-2 meters along the east wall. However, the entrance area around the south wall, especially on the east side, has tightly packed tamped earthen floors. It is likely that inhabitants of this dwelling used this area at the entrance and in a horseshoe pattern in the center in their daily lives where they laid mats on the ground.

Name of Posthole	Diameter of Posthole		Diameter of Post Trace		Donth
	Top Edge	Lower End	Top Edge	Lower End	Depth
No. 1	32×32	22×22	26×30	22×29	60
No. 2	34×36	14×12	34×32	24×23	68
No. 3	74×72	36×39	63×62	33×34	51
No. 4	74×72	32×22	49×44	40×28	79
No. 5	46×43	32×32	36×38	34×28	80
No. 6	48×50	19×18	38×30	29×22	40
No. 7	80×78	36×32	63×66	33×33	46
No. 8	34×30	24×24	32×28	26×19	56

Posthole	Measurements	
----------	--------------	--

(cm)

Eight postholes have been confirmed. As the postholes P6 and P8 are located adjacent to each other, from the indentation it may be thought they used a split log or intentionally used two pillars in the same location. The dimensions of each posthole are listed in Table 1. In particular, the postholes P3 and P7 are quite large, indicating the use of substantially large logs.

The soil sediments in the pit are as follows.

- Layer 1: Black andosols that are fine grained and tightly packed with almost no remains. Basic stratigraphic sequence: Corresponds with "Layer II c."
- Layer 2: Black-brown andosols containing many yellow and red-brown loose rocks. Order of stratification: Sedimentary soil origin layer. The loose rocks correspond with

tephra from Towada volcano Chuseri and Nanbu eruptions, with the yellow rocks coming from the mid Early Jomon period and the red-brown rocks from the late Incipient Jomon period.

Layer 3: Subdivided into and upper-layer (Layer a) and lower layer (Layer b) with mixed brown, amber, and grayish-brown soils. Layer a is mainly brown soil. In Layer b the tone of the color is differs throughout with mixed brown, amber, and grayish-brown soil. The lower layer is particularly firm. Each consists of the same basic stratigraphy of the excavated pit, corresponding with Hachinohe volcanic tephra.⁴ The distribution of Layer a is mostly along the walls and Layer b in the center of the pit.

3. Distribution of Charred Wood and Burnt Soil

Carbonized remains were found throughout most of the pit house (see Figure 4) and may be broadly divided into the following three groups.

- Group A: Remains scattered above layer 3. All are fragments distributed throughout all of the south side and in the central area. On the same south side these fragments were excavated together with gravel (Figure 5).
- Group B: Within layer 3, well-preserved charred wood remains were distributed throughout the entire pit area. These charred remains were particularly thick along the walls and layered on top of each other. In the center the remains were floating somewhat above the floor surface. It is possible to divide the direction of these wooden remains into several directions (Figure 6).
- Group C: Excavated remains below the layers 3 along the pit floor were largely limited to the central area. The remains consisted of thin broken pieces of approximately 10 centimeters and 20-30 centimeters in length distributed no set direction. The remains were concentrated within the circumference marked by the postholes, with thin strips located inside and slightly longer pieces located outside.



Figure 4 : Distribution of Charrde Wood and Burnt Soil

Next, examining the distribution of burnt soil, as figures 5 and 6 indicate it may be identified above layer three and in layers three and two. The burnt soil in the above layer three is concentrated in the central area of the pit and is distributed throughout the same level and is comparatively thin. In comparison, the burnt soil within layer three is located below layer 3-a and the level increases as it approaches the wall. On the west wall moving south from the middle, the wall itself was burnt.

Analyzing the relationship between the charred remains and burnt soil, in the central area the charred remains from Group C are distributed above the pit floor, above which is soil from Layer 3-b, and above Layer 3-b is a thin layer of burnt soil and thin strips of charred wood. Along the pit walls, while a portion of charred remains is located on the pit floor, remains are deposited in Layer 3-a or—when there is no Layer 3-a—in Layer 3-b, above which are charred remains from Group B, and burnt soil is distributed above this these remains.



Figure 6 : Layer C Charred Wood



Burnt Soil

Figure 5 : Layer A Charred Wood and Burnt Soil

II. Examination of Sod Roof Dwellings

The sedimentary soil of Layer 1 is mainly a sedimentary layer from the latter Jomon period through ancient history (fourth to twelfth centuries) and corresponds with the basic stratigraphy layer II c, indicating that a long period of time passed between the time the pit house was burnt until it was completely filled. Layers 2 and 3 may be clearly discerned from differences in soil color with Layer 2 consisting of black-brown and dark brown soil and Layer 3 of brownish loam. The stratigraphy of layer III and IV is clearly comprised of inflow of the surrounding soil after the pit house was burnt. Both divisions of Layer 3 correspond with soil from the earth removed to make the pit and, furthermore, the bottom of Layer 3-a was burnt and charred remains were distributed below it. Also, Layer 3-b is located against the pit floor and charred remains were excavated beneath it. The soil composition and distribution of burnt soil and charred remains of Layer 3-a and Layer 3-b, which show that Layer 3-b was formed with the fire and accumulated mainly in the center of the pit and

Layer 3-b accumulated thickly along the walls, and moreover as the earth below these layers is also burnt, indicate that both of these layers comes from soil located about and surrounding the pit at the time it burnt. From this it can be estimated that Layer 3-b was from soil on the roof and Layer 3-a was from the dirt roof and dirt collapsed in from the walls. Moreover, there is a disruption in Layer 3-b above the stone hearth in a circular shape in an approximate diameter of 1.5 meters that may be assumed to be the trace of a ventilation window.

III. Burning Process of Dwelling DF22

In conclusion, we wish to examine the process by which the sod roof pit house burned. The charred material from Group A and Group C were respectively located above and below Layer 3-b and distributed in similar patterns. The charred remains of Group C do not cluster in any particular direction and were excavated in broken fragments. Thus, these remains can be assumed to have fallen along with clumps of dirt from the central roof as the fire spread. The remains in Group C are approximately located within the inner part (between the supporting pillars) of the pit house. Moreover, as there were few long pieces located around the postholes or beneath the crossbeams that tied the posts together, as the posthole P1 was hollow, and as there was a break in the dirt roof of Layer 3-b above posthole P3, one is able to presume that the pillars and crossbeams forming the core structural members remained in place while roof structure inside collapsed. The remains from Group C in the central area were split into many pieces and in the surrounding area there were many longer members. This likely reflects the degree of impact of the materials upon collapsing. In short, it many be thought that the wood that fell from the high central part of the roof fragmented, whereas the materials from the lower part of the structure remained as longer pieces.

After the roof in the central area fell, the fire in the outer area (outside the central pillars) would have intensified. In particular, the area below Layer 3-a is formed from a thick layer of burnt earth that likely resulted from the fire vigorously burning along the west and north walls with the roof remaining on the pillars and beams. The outer-edge materials, including the rafters and cross pieces, the wooden slats, and the stakes and braces that supported the slats, carbonized and remained in good condition.

Following this, the roof and ridges could no longer be supported, collapsing along the walls into Layer 3-a and Layer 3-b, and the burning wood was sealed off. At this point, the wood was smothered in the earth before being completely burned. In particular, from the south wall to the west wall the slats and stakes carbonized still standing in place. In the center of the west wall the slats and cross supports fell inwards while remaining piled on top of each other.

In this way—with the inner roof collapsing first, followed by the sod roof and ridge along the walls falling in, and after a time covered in earth—this Jomon period burnt dwelling is to have remained in its well preserved condition. Finally, from the south wall to the hearth, there are well-preserved remains that are from dug out areas. These are charred remains in Layer 3-b, but there are few broken fragments but include many rather thick and long pieces. As these were excavated having fell from the south wall, it is possible that they are remains from the entrance.

(TAKADA Kazunori Ichinohe Town Board of Education, Iwate Prefecture)(NISHIYAMA Kazuhiro Nara National Cultural Properties Research Institute)(Asakawa Shigeo Nara National Cultural Properties Research Institute)

Notes

1. Hokkaido Archaeological Center (1987) Kamiiso 2 – Shinmichi 4 Site, Kikonai Town (木古内町建 川二・新道四遺跡).

Hokkaido Archaeological Center (1988) Ishikawa Site, Hakodate City (函館市石川遺跡). Hokkaido Archaeological Center (1989) Nishinopporo 12 Site, Ebitsu City (江別市西野幌一二遺跡).

2. MIYAMOTO Nagajirō, (1987) "Reconstruction of C Area Dwellings 1 and 2 at C Shinmichi 4 Site" (新道四遺跡C地区一・二号住居の復原). In Hokkaido Archaeological Center, Kamiiso 2 – Shinmichi 4 Site, Kikonai Town (木古内町建川二・新道四遺跡).

3. Previous research on the burnt dwellings at Goshono site has focused on the remains of the medium size dwelling DE24 and include the following publications.

TAKADA Kazunori (1997) (御所野遺跡の焼失家屋) (考古学ジャーナル)

ASAWAKA Shigeo and NISHIYAMA Kazuhiro (1997) (御所野遺跡で出土した縄文時代中期の焼失竪穴 住居群) (奈良国立文化財研究所年報 一九九七一)

ASAWAKA Shigeo and NISHIYAMA Kazuhiro (1997) (縄文時代中期の焼失住居跡とその復原(一)(二)) (日本建築学会大会学術講演梗集)

4. OIKE Shoji. (1972) "Holocene Tephrochronology in the Eastern Foot-hills of the Towada Volcano, Northeastern Honshu, Japan" (十和田火山東麓における完新世テフラの編年). The Quaternary Research (第四紀研究) 11(4): 228-35.

Reconstruction of a Jomon Period Sod Roof Pit House (2): Burnt Pit Dwelling of Goshono Site, Ichinohe Town, Iwate Prefecture

TAKADA Kazunori NISHIYAMA Kazuhiro Asakawa Shigeo

In a previous article (present journal, June 1998) we examined excavated remains of the large-size burnt pit dwelling (DF 22) at Goshono Site to infer the process of burning. In this article we specifically examine the reconstruction of the structure of the sod roof pit dwelling.

I. Structure of the Sod Roof Dwelling

1. Depth of Pit

The height of a pit dwelling cannot be determined exactly without excavating the remains of pillars. For the reconstruction of the medium size pit dwelling DE23, we located the beams and girders at a height above that of an adult Jomon person standing upright (approximately 160 centimeters from the floor). Furthermore, assuming that there was a ridge surrounding the pit, the roof was set at an appropriate gradient (approximately 35 degrees). The result of this recreated a living space of human scale that had never been seen before in reconstructed dwellings.

This method of reconstruction may fundamentally be thought effective for medium and smaller size pit dwellings, but this same method is not appropriate for the reconstruction of large-size pit houses. The reason is that the dug out pit is deep, and when conducting reconstruction one must first estimate the depth of the pit in comparison to the former ground level as well as the height of the surrounding ridge. If one is able to discern these numbers, by restricting the gradient of the sod roof to around 35 degrees,¹ it becomes possible to reconstruct the overall height of the dwelling.



Figure 1 : Building DE24 Reconstruction Model



Figure 2 : Building DE24 Cross Section(North-South Facing)

As reported in the previous article, as building DF22 is positioned on a gentle slope the west side is deepest on the west side at 70 centimeters and becomes 50 to 60 centimeters shallower on the east side. Furthermore, screening of the surface finds that the west side includes stratigraphic layer IVb and the loam layer of stratigraphic layer V and from the center moving east includes stratigraphic layers III to IVa, which are layers of andosols, and each of these corresponds to sedimentary levels from before the middle of the Early Jomon period. Consequently, the actual depth of the pit house would have been deeper.

Also, two pit houses from after the Heian Period were detected on the north and south sides of DF22, each of which had extremely shallow pits. In particular, with the pit house on the south side the floor surface was barely evident and the cooking stove had almost disappeared, the only traces of which were remains of burnt earth. A small pit house from the Middle Jomon period also had a floor that had worn away, with only the postholes and dug out hearth remaining.

In short, the former ground level surrounding DF22 had leveled over a vast range sometime after the late Heian period. Pit houses from the Heian period are generally understood to have been built with walls 30 to 70 centimeters high, meaning that the amount of erosion in this area would have been at least 30 centimeters. Following this data, the depth of the pit for DF22 would have been 100 to 120 centimeters, above which it was surrounded by a earthen ridge. As indicated in the previous article, the layer of soil that can be considered dirt collapsed from the surrounding outer ridge was observed in the central area of the pit, and while the volume of soil may be calculated, unless the width of the ridge is determined the height cannot be reconstructed. Recently, examples from the Yayoi period including Shimo-oigosasagawai site in Takaoka City, Toyama Prefecture and Mukibanda site in Daisen Town, Tottori Prefecture found pit house remains with ridges between 2.5 and 3 meters wide. These were far larger than was previously imagined.

While no clear data was obtained on the width or height of the ridge for DF22 at Goshono site, it is possible to reconstruct the building with the depth from top of the ridge to the bottom of the floor ranging between 1.4 to 1.7 meters high. This would make it close to the height of a Jomon person. For this reconstruction, the depth of the pit including the ridge was set at 160 centimeters with a roof gradient of 35 degrees. Accordingly, the height of the pillars and beams was approximately 200 centimeters above the floor, the total height of the pit house was about 400 centimeters from floor to top, and the height from ground level was 310 centimeters.

2. The Roof and Ventilation Window

The dirt from the roof that collapsed inside the pit house forming Layer 3b was found to be a depth of 10 to 15 centimeters in the central area (inside the area demarcated by the main pillars). In contrast, the outer area (outside the main pillars) is mixed with dirt from the collapsed ridge wall, making it impossible to exactly identify the dirt from the roof. However, examining the condition of the sediments in Layer 3a and 3b it is conceivable that the dirt was thicker towards the ridge and was at least 20 to 30 centimeters thick at the walls.

From the excavated charred remains in Group B and C, the roof bed above the rafters and cross pieces was made of a mat of twigs a few centimeters in diameter. Along with these twigs it is possible that grasses and bark was also used. In fact, along the surface of the floor a number of pieces of bark from chestnut trees were identified, and powdered carbon remains were detected in a number of spots that run into the layer of dirt from the roof. These carbon materials are clearly remains from the bed of the sod roof (the plant species names other than chestnut have not been appraised).

On the top surface of Layer 3b, a depression of black-brown soil from Layer 2 has been identified (Figure 3). In particular, directly above the hearth and again on the north side, Layer 3b is broken in an area, respectively, of 100 centimeters north-south and 120 centimeters east-west and 84 centimeters north-south and 52 centimeters east-west (estimated). As there was no dirt from the roof above this, these have attracted attention as traces of windows used for ventilation. Curiously, amongst reconstructed pit dwellings in Japan, even those with thatch roof, more than a few are built without windows for ventilation of smoke. However, without ventilation the residents of pit houses would die of suffocation. The burnt dwelling remains at Goshono site represent a breakthrough in identifying traces of ventilation windows in these well-sealed dirt roof dwellings, which at the same time may be regarded an expected result.

Other than this, as may be seen in Figure 3, there are interruptions in Layer 3b in the area above postholes No3 and No7, as well as in-between postholes No8 and No5. As explained before, with No3 and No7 the pillars remained standing as the dirt from the roof collapsed. With the area between postholes No8 and No5, there is a depression approximately 5 centimeters in depth in a circular shape. Moreover, as the bottom of this depression is extremely hard, it is possible that a pillar had been standing here.

3. Investigation of Materials

Amongst the burnt wood, there many remains thought to be slats and piles to prevent cross members from falling over located especially along the south wall moving towards the west wall, as well as standing members on the north wall. The split logs with widths of 20 centimeters are the slats, while round pieces approximately 10 centimeters in diameter are the piles. The split faces of the slats were laid against the wall and the insides were comparatively curved. These slats are thought to have been located around the entire circumference of the pit wall. In front of the slats there are boards that run parallel to the wall, in the center of the west wall, the slats and cross boards fell inwards still fixed together.



In the center area the wood remains that fell with the dirt from the roof are thought to be rafters (or roof braces) as well as twigs that formed the bed of the roof. While some of these did not break, the majority was excavated in a shattered state. The powdered charcoal from the pit floor is likely from the bed of the roof that fell before the rafters collapsed. The remains excavated from just above the pit floor are likely from rafters lined up in radial and parallel configurations, and what is thought to be a lattice laid across them. In the area around the hearth and entrance, the slightly thick members lying in an east-west direction are possibly pillars and beams from the vicinity of the entryway. In addition, there are a number of thick wooden remains above the sediment soil parallel to the west wall. These are presumed to be members that kept the base of the rafters from shifting.



Figure 6 : Building DF22 Reconstruction Cross Section(East-West Facing)

II. Igloo-Shaped Sod Roof Dwelling

1. Reexamination of the Alignment of Central Posts

Eight central postholes have been identified at building DF22. Amongst these, No6 and No8 each used split logs that are thought been used in tandem. Assuming this, DF22 should be recognized as having been constructed with 7 central pillars. Furthermore, one should be careful to notice that line connecting the pillars does not form a heptagon, but rather appears as a long-narrow pentagon. Correspondingly, the pit house itself does not form an elliptical shape, but rather appears as if one side has been cut off, thereby creating a shuttle (or bullet) shape. This is somewhat different than the medium-size pit house DE24. Additionally, whereas most of the postholes are located equidistant to the walls (between 100 and 120) centimeters, postholes No1 and No2 on the south side are located 50 centimeters to the wall. This wall located near the stone hearth is very likely to have been the entryway and forms a straight line at the edge of the pit. As a result, the shape of the pit is not an ellipse but takes on a shuttle-shape.

Next, we wish to examine the relationship between the pillars and condition of the pit with the charred materials though to be the rafters (or roof braces). The rafter remains are aligned in a centripetal pattern between No4 and No6 opposite the entrance. On the flat side between No2 and No4 as well as between No6 and No1 the rafters have slanted towards the entrance and collapsed parallel to each other. In essence, the semicircular part of the shuttle-shaped dwelling was built with a fan of rafters, whereas the other parts used parallel rafters and these fell towards the entrance when burned in the fire.

2. Reconstruction of the Superstructure

From the above discussion, DF22 is thought to be a sod roof pit house built with a gabled entrance and a hipped roof circular structure at the opposite end. That is, it is a shelter covered in dirt similar in appearance to an igloo (kamakura) with an entrance dug into the side of a mound of snow. Examined ethnographically, it is similar to the toi-chise ("house of dirt") of the Sakhalin Ainu,² although built without the chimney used in these dwellings. With this kind of igloo shaped sod roof building, the ventilation window presents a great contradiction. For this reconstruction, one window was built with a push-up door above the hearth on both sides of the roof ridge and another between the rear roof and the ridge of the main building. The actual structure, however, is unclear. Also, the Koryak of Kamchatka Peninsula, the Aleut of the Aleutian Islands, and North American Indian peoples such as the Thompson and Modoc built pit houses with windows that were used for going in and out of the building. This kind of folk living was seen in ancient groups such as the Mohe in ancient Manchuria and Mahan in the southern Korean peninsula, and in ancient Japan the Tsuchigimo clans were vividly depicted in the" Fudoki" as living in dwellings reminiscent of these window-entry pit houses. However, window-entrance pit houses are always built with side-entrances, with the window used by adult men and the side-entrance by women and children, or in other cases with the window-entrance used in winter and the side-entrance used during summer. At Goshono site, it is not possible to say that there were no dwellings with window-entrances, for the above reasons DF22 was built similarly to the igloo-shaped toi-chise built by the Sakhalin Ainu, with the main entrance located along the wall near the stone hearth.



Figure 7 : Building DF22 Reconstruction illustration Model

(TAKADA Kazunori Ichinohe Town Board of Education, Iwate Prefecture)(NISHIYAMA Kazuhiro Nara National Cultural Properties Research Institute)(Asakawa Shigeo Nara National Cultural Properties Research Institute)

Notes

1. The experimental construction of DE24 based on reconstruction plans took place in 1997, but as the gradient of the roof near the entrance was too shallow (approximately 5 degrees), rainwater gathered and soaked in. If the gradient of a sod roof dwelling is too steep the dirt will run off and if too shallow it will soak in, thus limiting the possible gradient. (TAKADA Kazunori「縄文土屋根住居の 実験的復原」(Experimental Reconstruction of Jomon Sod Roof Dwellings). 『人類誌集報1998』 (Reports of Human Action and Society 1998) 131–39.

2. YAMAMOTO Yuko (1933) Karafuto Ainu no Jukyo (Dwellings of the Karafuto Ainu). Kenchiku Shinsho 10. Tokyo: Sagami Shobo