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## Development of teaching materials for international course students on the ancient forest culture of the Hokkaido University Campus

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### Abstract

Many plant remains including pollen fossils, wooden artifacts and charred woods from Epi-Jomon culture (about 2000 years ago) to the Ainu culture period (about 400 years ago) have been excavated from the Hokkaido University Campus sites. Wood identification and pollen analysis have revealed the forest vegetation and wood utilization by ancient people, i.e., the ancient forest culture, for each era in this site. It is necessary to organize systematically the data concerning this ancient forest culture for showing an importance role of our campus as state property. Furthermore, the elucidation of the ancient forest culture is important because it can lead to an understanding of how ancient peoples managed forests and we may learn forest management techniques suitable for changing environment. Hokkaido University Forests has developed a course on “Environmental Science for Biological Resources” as a part of “Hokkaido University Short Term Exchange Program”, in short, HUSTEP. Therefore, we summarized a part of this ancient forest culture of Hokkaido University campus sites concisely and tried to develop teaching materials by creating display panels about this to introduce these to student from overseas, in particular the HUSTEP students.

*Key words:* Ancient forest culture, Hokkaido University campus sites, HUSTEP, Wood identification

### Introduction

The campus of Hokkaido University is appointed as a well-known place containing a buried cultural property. To develop the archaeology for Hokkaido and people lived in northern regions, we establish a new center for buried cultural property and intensively investigate on buried woody specimens.

Plant remains such as seeds, pollen fossils, wooden artifacts, natural woods and charred woods are excavated from the archaeological sites. This “natural woods” means the woods that were not charred nor processed by human. These plant remains provide available information on the estimation of ancient vegetation and ancient plant utilization in the sites. In the case of wooden artifacts, natural woods and charred woods, wood identification has been done for the estimation of ancient forest vegetation and ancient wood utilization. Wood identification is to observe cell arrangements of woods with light microscope and scanning electron microscope (SEM) and to identify what species or what genus these woods are. In central to northeastern Japan, extensive studies on plant remains, in particular natural woods and wooden artifacts, by wood identification and pollen analysis have revealed the ancient forest vegetation and the taxonomic selection of woody plants by human and their drastic changes from the Jomon period to the Kofun period (e.g., Noshiro *et al.* 1992, 2009, Noshiro 2016).

In Hokkaido University campus, some archaeological remains were found during construction work in 1979 (Yoshizaki and Okada 1981). Since then, a number of excavations have been done at Hokkaido

University campus. Nowadays, Hokkaido University campus has been designated as three archaeological sites such as K39 site, K435 site and C44 site under the law for the protection of cultural properties. Many plant remains have been excavated from these sites from the Epi-Jomon culture to the Ainu culture period. We have tried to identify woody tissues including wooden artifacts and charred woods excavated from K39 site and K435 site. These results have been reported in archaeological excavation reports “Hokkaido University Campus Sites” published by Archaeological Research Center, Hokkaido University ([http://www.hucc.hokudai.ac.jp/%7Eq16697/maibun/publications\\_h.html](http://www.hucc.hokudai.ac.jp/%7Eq16697/maibun/publications_h.html)). However, no one has summarized these results such as ancient forest vegetation and ancient wood utilization, i.e., ancient forest culture in these sites. It is necessary to organize systematically the data concerning this ancient forest culture for showing an importance role of our campus as state property. Furthermore, the elucidation of the ancient forest culture is important for because it can lead to an understanding of how ancient peoples managed forests and we may learn forest management techniques suitable for the current global climate changes from them.

Hokkaido University Forests has developed a lecture course on “Environmental Science for Biological Resources” as a part of “Hokkaido University Short Term Exchange Program”, in short, HUSTEP (Sasa and Koike 2002, Koike *et al.* 2006, 2007). To introduce “Ancient Forest Culture” of Hokkaido University campus, we created panels that summarize a part of the results of the wood identification and pollen fossil

analysis using the archeological data accumulated from excavations on the Hokkaido University Campus site.

### Preparation of display panels

Each panel is B4 paper size (250 x 353 mm) and 7 mm thick. We made a set of ten panels. A set was comprised of a panel for a campus map (Fig. 1), seven panels of summaries of forest culture (Epi-Jomon culture, Satsumon culture and Ainu culture period) (Figs. 2-8) and two panels of wood identification methods (Figs. 9-10). These panels included many photos and figures with short explanations written in both Japanese and English.

We made two sets, and one was used for the HUSTEP lecture at the Archaeological Research Center of Hokkaido University. The other was displayed at the International Student Center of Hokkaido University.

### Summary of ancient forest culture in the Hokkaido University Campus sites

We review the ancient forest culture in the Hokkaido University Campus sites as follows. We employed scientific names after Miyawaki *et al.* (1994).

#### Epi-Jomon culture (about 2000 years ago)

Plant remains such as woody tissues were found at Jinbun-syakaikagaku-sogokyoiku-kenkyuto-chiten of K39 site (The “chiten” means surveyed point in Japanese) (Kosugi *et al.* 2005). Eleven pit-dwellings, a type of ancient house, were excavated from this surveyed point and the two of them included the remains of charred wood. It was inferred that these charred woods were used for roof structures of the pit dwellings from the distribution of the charred woods. A total of 16 taxa of deciduous broad-leaved trees, including some kinds of monocotyledon, were identified by wood identification. Most common genus or species were ash (*Fraxinus* spp.; ex. *Yachidamo* [*Fraxinus mandschurica* var. *japonica*.]), and in turn Mizuki (*Cornus controversa*) and alder (*Alnus* spp.; ex. *Ke-yama-han'noki* [*Alnus hirsuta*]).

A large number of pollen of ash and alder was found in this surveyed point by a pollen analysis. These species are typical riparian tree species. In fact, there was a buried channel near this surveyed point. Therefore, we concluded that Hokkaido University campus had been covered by deciduous broad-leaved forests near a river or swamp about 2000 years ago, and that ancient people used trees that were easily available in the surrounding forests for building pit-dwellings (Watanabe *et al.* 2005).

#### Satsumon culture (about 1000 years ago)

Among many archeological sites of Satsumon period at the Hokkaido University campus, we selected two surveyed points of this period, Kyudojo-chiten and Keitekiryō-chiten at K39 Site (Kosugi *et al.* 2008, Yoshizaki and Okada 1984).

In Kyudojo-chiten, one burned pit-dwelling was excavated and some charred wood, which had been used for making the pit-dwelling, were found. Wood identification analysis revealed that these charred

woods were willow (*Salix* spp.; ex. Bakko-yanagi [*Salix caprea*]), alder and walnut (Oni-gurumi; [*Juglans ailanthifolia*]). These species are also riparian tree species. Therefore, ancient people of this era used the same species as those in the Epi-Jomon period for building their houses.

In Keitekiryō-chiten, many wooden artifacts were found. One of them was a kind of fish trap, i.e. “Teshi”. “Teshi” (the word originated from Ainu people) consisted of piles and supplemental crosspieces. Wood identification revealed that wooden piles were mainly comprised of fir (Todo-matsu; [*Abies sachalinensis*]) and ash, and supplemental crosspieces were mainly willow and alder. From these results, it is likely that ancient people used tree species that had straight trunk, i.e. fir and ash as piles, and flexible branches of wood, i.e. willow and alder as supplemental crosspiece.

Furthermore, the results of wood identification showed that many wooden artifacts were made of ash, yew (Ichii; [*Taxus cuspidate*]), *Hydrangea* spp. (ex. Nori-utsugi [*Hydrangea paniculata*]) or maples (*Acer* spp.; ex. Itaya-kaede [*Acer pictum*]). These tree species are tree species with straight grain and moderate to high wood density and are likely to be suitable for wooden artifacts.

Pollen analyses revealed that this area was a riparian forest or swamp forest. On the other hand, it is inferred that there were relative arid areas that grow oak (*Quercus* spp.; ex. Mizu-nara [*Quercus crispula* = *Q. mongolica* var. *crispula*]) and birch (*Betula* spp. ex. Shira-kanba [*Betula platyphylla* var. *japonica*]) near this area. From the results of wood identification and pollen analysis, it is likely that people used trees from the surrounding riparian forest and they selected tree species for a specific purpose.

#### Ainu culture (about 400 years ago)

Some wooden piles were excavated in the remnants of a buried river channel of the “Sakusyukotoni-gawa” at Fuzokutosyokan-honkan-hokuto-chiten of K39 site (Kosugi *et al.* 2006). The wooden piles were identified as ash. This analysis revealed that Ainu people used ash the same way as the people in Epi-Jomon and Satsumon eras.

In conclusion, there were two ancient rivers, “Sakusyukotoni-gawa” and “Seropetsu-gawa” in Hokkaido University campus sites and it seems that this area has been a swamp or an area often disturbed by floods of the two rivers since 2000 years ago. Archeological analyses, wood identification and pollen analysis revealed that the vegetation of Hokkaido University campus site had been mainly riparian forest, and people lived on the dry natural levees near the rivers and used wood from the surrounding forests without destroying them for about 1600 years. In particular, ash, willow and alder were useful for ancient peoples.

Finally, we introduce some comments about the lecture of the ancient forest culture using these panels from some HUSTEP students as follows:

a) I was surprised at learning the ancient forest

culture even in the course of environmental science.

b) I ruminated about the ancient era by feeling some archaeological remains with my hands.

c) I could learn that ancient people selected the tree species with the knowledge of the characteristics of each wood.

d) The lecture in the archaeological center was very interesting with a realistic feeling.

### Acknowledgements

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# 北海道大学遺跡マップ

A map of the main excavated site in Hokkaido University campus

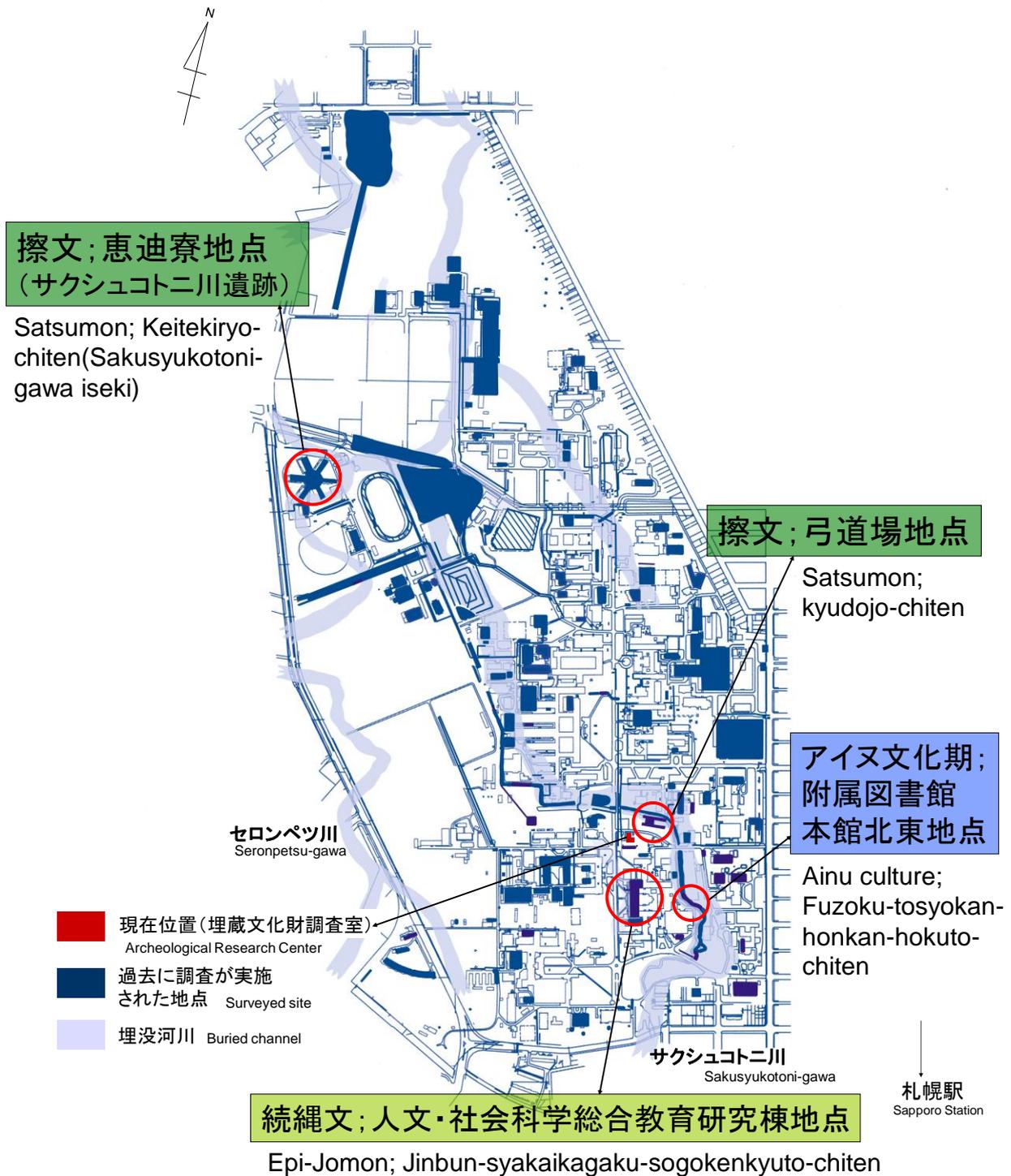


Fig. 1. A map of the main excavated sites in the Hokkaido University Campus.

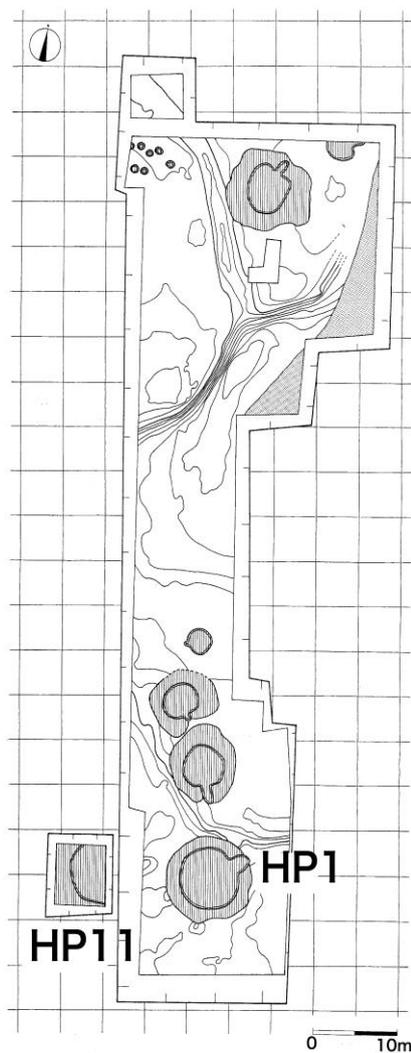
**続縄文時代 (Epi-Jomon)**

人文・社会科学総合教育研究棟地点

Jinbun-syakaikagaku-sogokenkyuto-chiten

**■出土した竪穴住居■**

Pit-dwellings excavated at Jinbun-syakaikagaku-sogokenkyuto-chiten



HP1



HP11

出典: K39遺跡人文・社会科学総合教育研究棟地点発掘調査報告書I(遺物・遺構編), 北海道大学, 2004

Quotation from "Report of the Archaeological Excavation at the K39 Site, Sapporo, Northern Japan I, Hokkaido University, 2004"

続縄文時代の竪穴住居址が計11基発掘された。  
そのうち、HP1とHP11から竪穴住居上屋構造材に使用されたと  
考えられる大量の炭化材が発見された。

Eleven pit-dwellings were excavated at this site.  
Of these pit-dwellings, two included charred woods,  
which were used for roof structure of pit-dwellings.

Fig. 2. Pit-dwellings of the Epi-Jomon culture excavated at Jinbun-syakaikagaku-sogokyoiku-kenkyuto-chiten in K39 site.

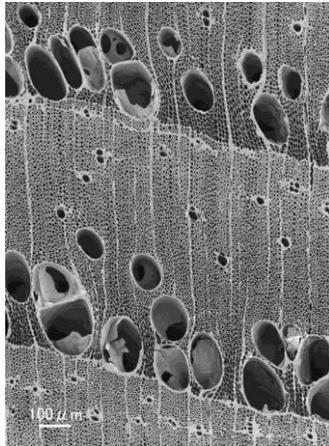
## 続縄文時代 (Epi-Jomon)

## 人文・社会科学総合教育研究棟地点

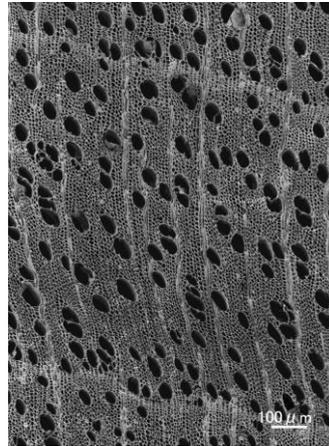
Jinbun-syakaikagaku-sogokenkyuto-chiten

### 樹種同定の結果

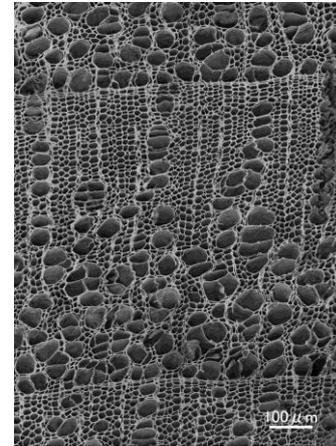
#### Wood identification from charred woods



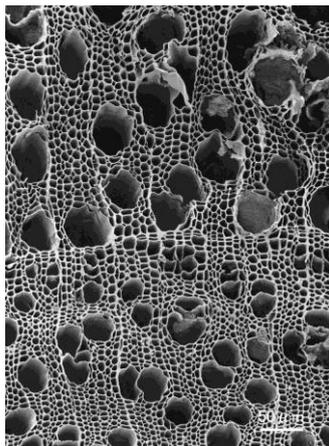
トネリコ属  
*Fraxinus* spp.  
ex. Yachidamo



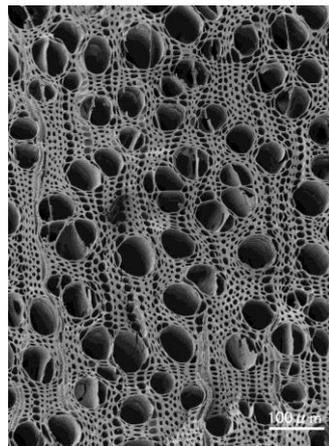
ミズキ  
*Cornus controversa*  
mizuki



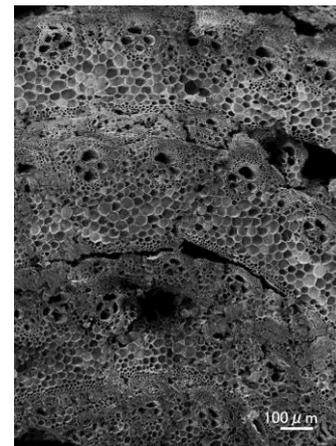
ハンノキ属  
*Alnus* spp.  
ex. keyamahannoki



ヤナギ属  
*Salix* spp.  
ex. bakkoyanagi



モクレン属  
*Magnolia* spp.  
ex. hoonoki



単子葉植物  
Monocotyledon  
ex. yoshi

出典：K39遺跡人文・社会科学総合教育研究棟地点発掘調査報告書II(自然科学分析および出土遺物・遺構考察編)，北海道大学，2005  
Quotation from "Report of the Archaeological Excavation at the K39 Site, Sapporo, Northern Japan II, Hokkaido University, 2005"

走査型電子顕微鏡(SEM)により、出土した炭化材の樹種同定を行なった。分析の結果、落葉広葉樹16属・種および単子葉植物が同定された。同定された樹種は、主に河畔林を構成するものであった。

Wood identification was made using scanning electron microscope (SEM). A total of 16 taxa in deciduous broad-leaved trees including some kinds of monocotyledon were identified from charred woods.

These identified tree species consist of deciduous broad-leaved forest near river in Hokkaido.

Fig. 3. The results of wood identification by SEM from charred woods excavated the pit-dwellings shown in Fig. 2.

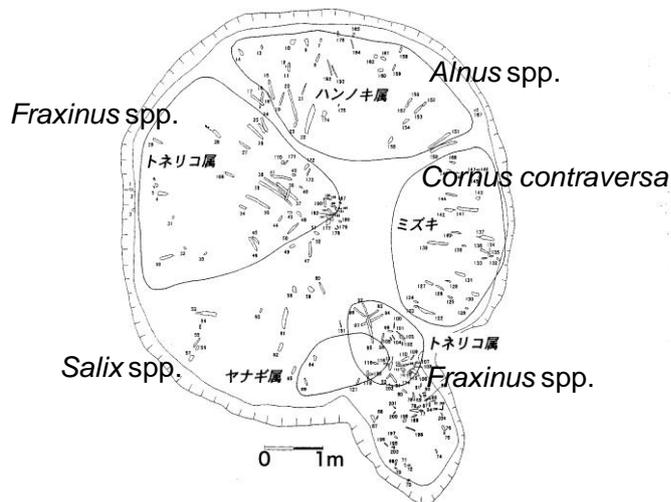
## 続縄文時代 (Epi-Jomon)

## 人文・社会科学総合教育研究棟地点

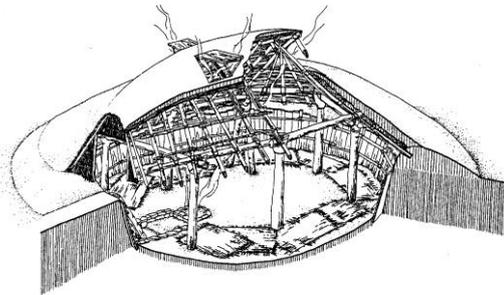
Jinbun-syakaikagaku-sogokenkyuto-chiten

### 続縄文時代の竪穴住居建築における木材利用

Wood utilization for building of pit-dwellings in Epi-Jomon



HP1内における樹種分布  
Distribution pattern of the excavated  
woods in pit-dwelling, HP1

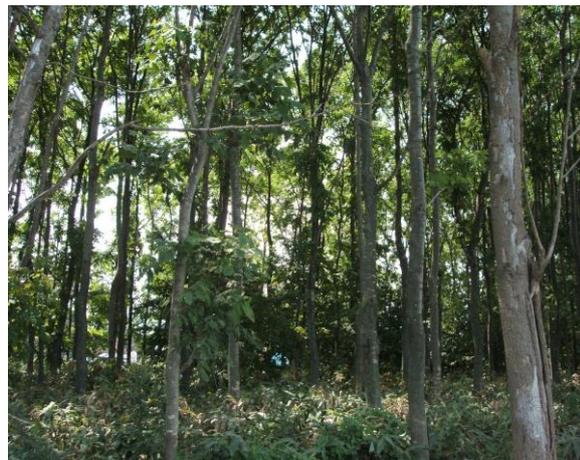


出典: 浅川滋男編. 先史日本の住居とその周辺. 同成社, 1998.  
Quotation from "Senshi Nihon no Jyukyo to sono Shuhen  
(Edited by S. Asakawa), Douseisha, 1998"

参考: 縄文時代の竪穴住居復元図

Reference: Model of the reconstructed  
pit-dwelling in Jomon

続縄文時代、北大キャンパス内に  
河畔林が広がっていた。  
当時の人々は、これらの林から、  
トネリコ属やヤナギ属やミズキなど、  
通直で使いやすい樹木を選んで、  
竪穴住居を建築した。



札幌市郊外のヤチダモ林  
Ash forest in the suburbs of Sapporo

Photo by Y. Watanabe

We concluded that Hokkaido University campus have been vegetated by deciduous broadleaved forest near river about 2000 years ago and that ancient people used trees that were easily available in surrounding forests for building pit-dwellings.

Fig. 4. The ancient forest culture of the Epi-Jomon culture in the Hokkaido University Campus area.

## 擦文時代 (Satsumon)

## 弓道場地点 Kyudojo-chiten

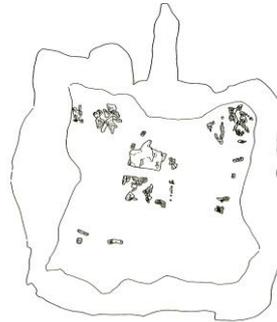
### 擦文時代の竪穴住居建築における木材利用

Wood utilization for building of pit-dwellings in Satsumon



発掘された竪穴住居

The excavated pit-dwelling in Satsumon



竪穴住居址平面図

出典：北大構内の遺跡XV平成18年度調査報告，北海道大学埋蔵文化財調査室，2008  
Quotation from "Hokkaido University Campus Sites XV, Archaeological Research Center, Hokkaido University, 2008"



擦文時代の竪穴住居復元  
Reconstruction of pit-dwellings  
in Satsumon

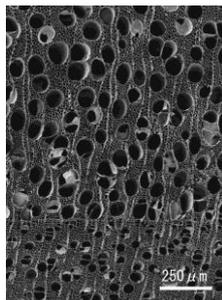


復元された住居内部  
Reconstruction of the interior  
in pit-dwellings

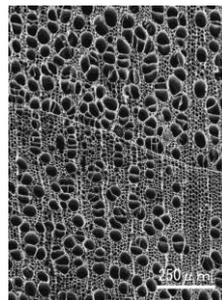
出典：野村 崇・宇田川洋輔・新北海道の古代3  
擦文・アイヌ文化，北海道新聞社，2004  
Quotation from "Shin Hokkaido no Kodai 3, Satsumon-Ainu Bunka, (Edited by T. Nomura and H. Udagawa), Hokkaido Shimbun Press, 2004"

### 樹種同定の結果

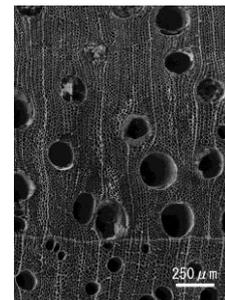
The results of wood identification



ヤナギ属  
*Salix* spp.



ハンノキ属  
*Alnus* spp.



オニグルミ  
*Juglans ailanthifolia*  
Onigurumi

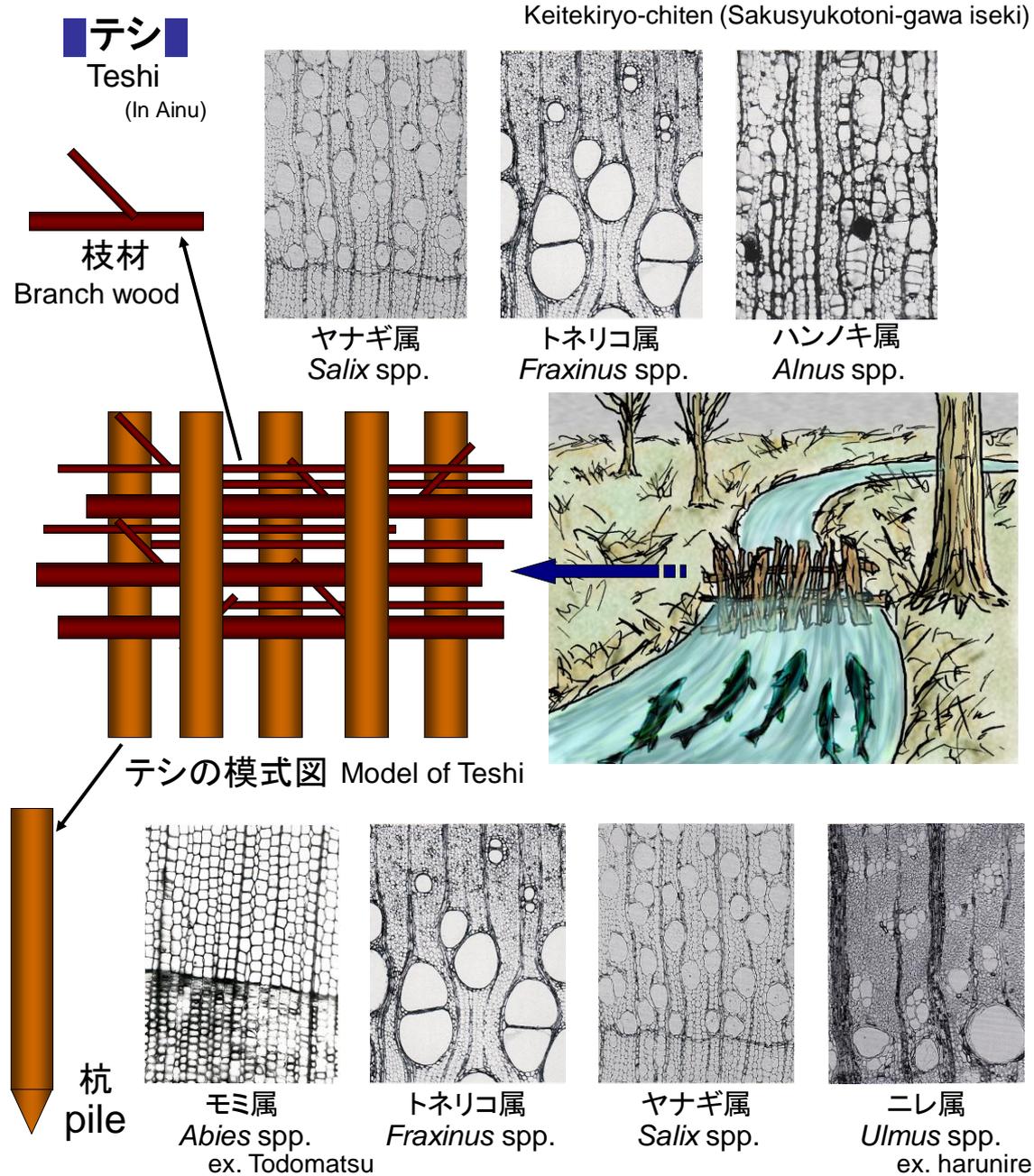
出典：北大構内の遺跡XV平成18年度調査報告，北海道大学埋蔵文化財調査室，2008  
Quotation from "Hokkaido University Campus Sites XV, Archaeological Research Center, Hokkaido University, 2008"

擦文時代においても、続縄文時代と同様、周囲の河畔林から通直な樹木を切り出して竪穴住居建築に使用していた。

In Satsumon, ancient people used the same species from surrounding forests near river as those did in Epi-Jomon.

Fig. 5. A pit-dwelling of the Satsumon culture excavated at Kyudojo-chiten and the results of wood identification from charred woods excavated at this pit-dwelling by SEM.

## 恵迪寮地点(サクシュコトニ川遺跡)



サクシュコトニ川遺跡では、テシ(魚を捕るための仕掛け)が発見された。テシでは、幹が通直なモミ属やトネリコ属などの丸材や割材を杭として打ち込み、横木として曲げやすいヤナギ属の枝材を組み合わせて使用した。

Teshi (the word originated from Ainu), a kind of fence for catching fish, was found at Sakusyukotoni-gawa site. Ancient people used trees which have strait stems, i.e. fir and ash as piles, and flexible branch woods, i.e. *Salix* as supplemental crosspiece.

出典:サクシュコトニ川遺跡, 北海道大学, 1986

Quotation from "Sakushu-Kotoni-Gawa Site, Hokkaido University, 1986"

Fig. 6. Model of "Teshi" (a kind of fish trap) of the Satsumon culture excavated at Keitekiryō-chiten and the results of wood identification from woods comprised of this "Teshi".

## 恵迪寮地点(サクシュコトニ川遺跡)

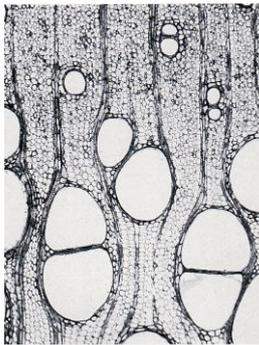
Keitekiryō-chiten (Sakusyukotoni-gawa iseki)

### ■木製品■ Artifacts made of wood

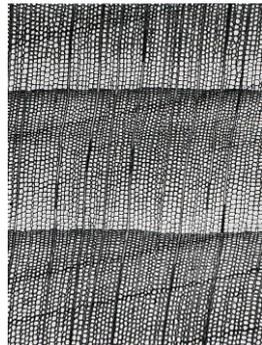


#### 木製品の発掘写真

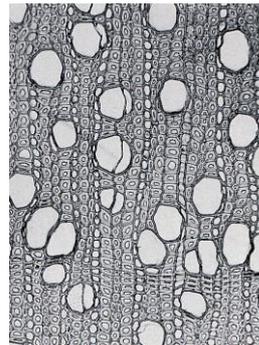
Photographs of the excavated artifacts at Sakusyukotoni-gawa site



トネリコ属  
*Fraxinus* spp.



イチイ  
*Taxus cuspidata*  
Ichi



アジサイ属  
*Hydrangea* spp.  
ex. noriutsugi



カエデ属  
*Acer* spp.  
ex. itayakaede

出典: サクシュコトニ川遺跡, 北海道大学, 1986

Quotation from "Sakushu-Kotoni-Gawa Site, Hokkaido University, 1986"

またサクシュコトニ川遺跡では、多数の木製品も発掘された。これらは、材構造が緻密で堅い、丈夫な樹種を選択して作られていた。

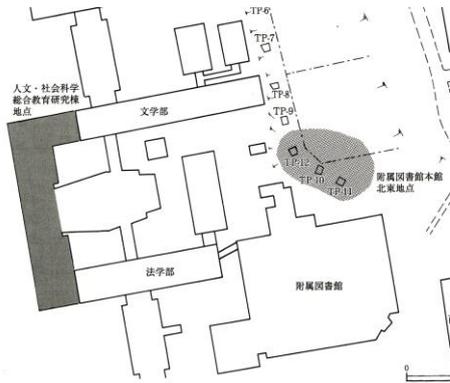
At Sakusyukotoni-gawa site, many artifacts made of woods were found. Ancient people chose tree species that have dense and hard wood structure and made artifacts from these trees.

Fig. 7. Examples of wood artifacts excavated at Keitekiryō-chiten and the results of wood identification of these wood artifacts.

## アイヌ文化期 (Ainu culture)

## 附属図書館本館北東地点

Fuzoku-tosyokan-honkan-hokuto-chiten



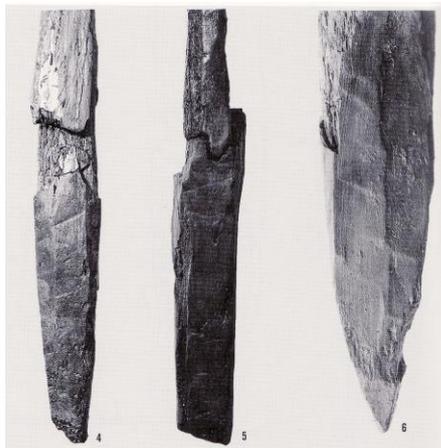
遺跡の地図 Map of this site

本遺跡では、サクシュコトニ川の跡からテシに使ったと考えられる杭が発見された。これらの杭は、すべてトネリコ属であった。この時代においても、トネリコ属が用いられていたということは、非常に興味深い。

At this site, some piles were found inside ancient Sakusyukotoni-gawa.

These woods were identified as ash.

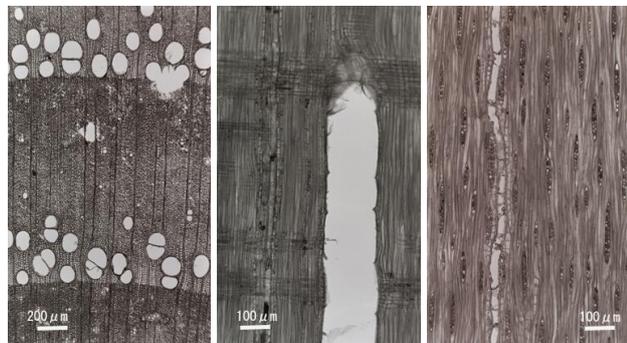
This analysis revealed that Ainu people used ash as same as in Epi-Jomon and Satsumon-era.



発掘された杭

A kind of piles excavated at this site

## 出土材の樹種同定 Wood identification



木口面

柱目面

板目面

Transverse section Radial section Tangential section

トネリコ属 *Fraxinus* spp. ex. yachidamo

出典：北大構内の遺跡XIII 平成13・14年度調査報告 北海道大学, 2003

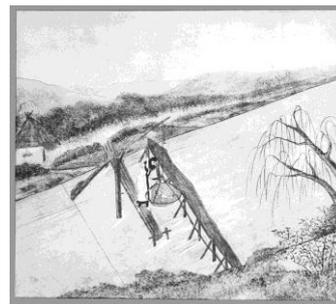
Quotation from "Hokkaido University Campus Sites XIII, Hokkaido University, 2003"



「蝦夷人川魚を捕る図」平澤屏山作

出典：北海道立旭川美術館・北海道立近代美術館。「蝦夷の風俗画-小玉貞良から平澤屏山まで」, 1992

Quotation from "Ezo no Fūzokuga -Kodama Teiryō kara Hirasawa Byōzan made-, Hokkaido Asahikawa Museum of Art and Hokkaido Museum of Modern Art, 1992



「鮭漁り」

出典：高倉新一郎編。「アイヌ絵集成(図録巻)」, 番町書房, 1973

Quotation from "Ainu e shūsei (zurokukan), (Edited by S. Takakura), Banmachi Shobo, 1973

アイヌ民族の漁の様子を描いた絵

Pictures of Ainu people's fishing

Fig. 8. Piles of the Ainu culture period excavated at Fuzoku-tosyokan-honkan-hokuto-chiten and the result of wood identification of these piles. These piles are inferred to be used as a part of "Teshi".

**木材の構造**  
Wood structure

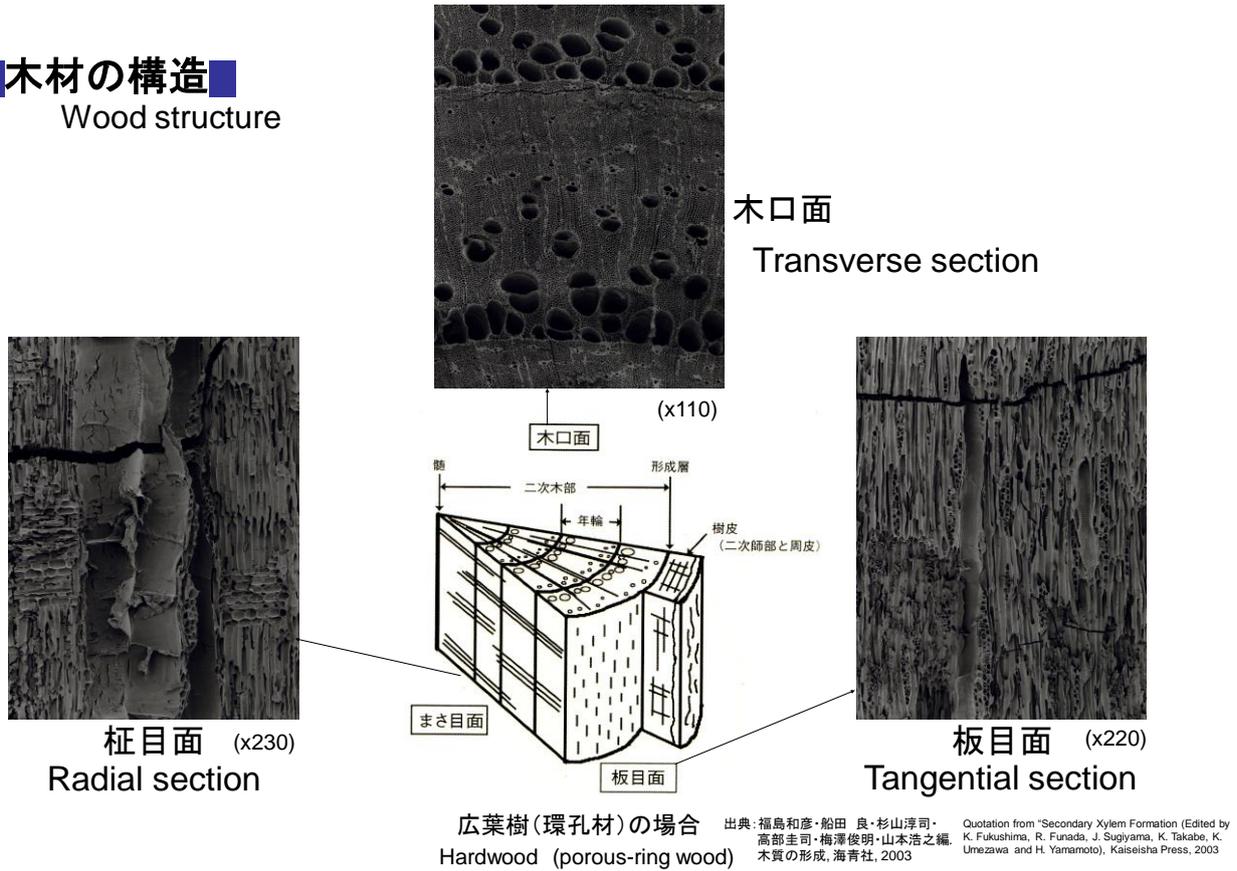


Fig. 9. The explanation of wood structure.

**樹種同定を行なうまでの作業手順**  
Methods of wood identification



Fig. 10. Methods of wood identification using SEM.