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 \textit{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\%7Efq16697/maibun/publications.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 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 \textit{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

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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 Jibun-syakaikagaku-sogokyoiku-kenkyu-ken-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’nokei [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 Keitekiryo-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 Keitekiryo-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 “Serometsu-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. Archaeological 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.

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References


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

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

Distribution pattern of the excavated woods in pit-dwelling, HP1

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

枝材
Teshi
Branch wood

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.

Quotation from “Sakushu-Kotoni-Gawa Site, Hokkaido University, 1986”
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 Keitekiryo-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

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さ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.

出土材の樹種同定 Wood identification

木口面 Transverse section
枡目面 Radial section
板目面 Tangential section

トネリコ属 Fraxinus spp. ex. yachidamo

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”.

出典: 北大構内の遺跡 XIII, Hokkaido University, 2003
出典: 北海道立旭川美術館・北海道立近代美術館, 1992
出典: 早川茂男, “蝦夷絵集成(図録巻)”, 番町書房, 1973
出典: 早川茂男, “蝦夷の風俗画 -小玉貞良から平澤屏山まで-”, 北海道立近代美術館, 1992
出典: 北大構内の遺跡 XIII, Hokkaido University, 2003
木材の構造

Wood structure

木口面
Transverse section

柾目面
Radial section

板目面
Tangential section

広葉樹(環孔材)の場合
Hardwood (porous-ring wood)

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

試料採取 Sampling

炭化材採取 Sampling

試料調製 Making specimen

Sticking onto specimen stubs with electron-conductive glue

Coating with gold-palladium

試料台に接着
Observation by scanning electron microscope (SEM)

電子顕微鏡観察および同定
Microscopic observation & wood identification

顕微鏡観察および同定
Microscopic observation & wood identification

出典: 島地 謙・伊東隆夫. 図説 木材組織, 地球社, 1982
Quotation from "Zusetsu Mokuzai Soshiki, K. Shimaji and T. Itoh, Chikyusha, 1982"

出典: 福島和彦・船田 良・杉山淳司・高部圭司・梅澤俊明・山本浩之編. 木質の形成, 海青社, 2003

SEM micrographs by Dr. Yuzou Sano

Fig. 10. Methods of wood identification using SEM.