oldestwoodenobjects.net – A Compilation of Wooden Goods with Remarkable Longevity

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Abstract

The website oldestwoodenobjects.net serves as a platform for the scientific community to collect, display and share early traces of wood utilization. It also serves educational purposes, to teach a wide audience about how multifunctional and durable wood can be, when wisely used. The collection of objects is large and diverse, ranging from simple tools for hunting, like spears, to musical instruments of the high culture, such as violins. The first means of transport, dugout canoes or early infrastructure, like water wells, are remarkably old. Due to weathering, early buildings or constructions are poorly or only partially preserved. But some sacred buildings that are still in use today have an impressive age. At the time of writing this manuscript, a total of 211 prehistoric and historic wooden objects from around the globe were gathered and can be compared at the online application. The oldest item on the list is from 300,000 years...
before present. To continue expanding the database, the community is encouraged to contribute new entries.

Keywords

wood utilization – scientific dating – oldest objects – longevity

1 Introduction

Wood as a raw material is tightly linked to cultural activity and thus to the development of mankind. For long, wood was the dominating material in many applications, ranging from housing and construction, tools and machines to the use as an energy source (Radkau and Schäfer 1987). The natural variability of wood, due to a high number of species with a wide range of physical and mechanical properties (Grabner 2017), but also the variability within a single tree allow for specialized applications (Walther 1802). This versatility, combined with its relatively easy processing, accounts for the predominant raw material selection in former times. The long-lasting application of wood involves technological advances, accumulated knowledge of raw material selection, processing techniques as well as design of the end products. This sophistication contributes to the longevity of wooden products, but a loss of knowledge in (traditional) wood utilization in Europe was observed in the beginning of the 20th century (Blau 1917). However, smart use of wood is more relevant than ever considering the carbon storage capacity of long-living wood products (Brunet-Navarro et al. 2017). Großmann (1922) even stated that the durability of wood is almost endless if it is dry and surrounded by fresh air or completely wet, saturated with water (depending on the wood species). Thus, examples of durable items from the past can be used as a guide to increase the lifespan of wood products now and in future.

In contrast, the average half-life (the age that 50% of the material reaches before disposal) of modern wooden panels ranges from 9 to 11 years (from 2002 to 2011 in Austria; Braun et al. 2016). Likewise, the assumed half-life of 30 years for solid wood products as given in the 4th assessment report of the IPCC (Pingoud et al. 2006) sounds ridiculously short compared to the age of some solid wood objects from the past.

While many disciplines, such as dendrochronology, building history, archaeology etc. provide evidence for long potential lifespans of wooden objects, there is no comprehensive, or even representative overview available.
The aim of this project was to explore the time-line of wood culture interactively and to make it accessible to the general public. Doing so, we not only gain knowledge on the long history of wood utilization, but also learn about the longevity of wooden goods and the big variety of wood utilization around the globe.

While it is not the goal to build an exhaustive database of all dated man-made wooden objects, we aim to build an interactive online collection as a representative overview on the oldest items for each region and object type. This display is deliberately excluding subfossil wood, which is not linked to human wood utilization. oldestwoodenobjects.net is openly available to the interested public and professionals as a “showcase” of the longevity of wood products and the cultural history of wood use. Furthermore, within this study, the provided data were used to (i) find evidence for the oldest scientifically dated wooden object, (ii) to compare different product types and wood taxa used, and (iii) identify spatial clusters in ancient product types.

2 Material and Methods

An interactive collection has been set up on oldestwoodenobjects.net to collect data of scientifically dated wooden objects with the help of the worldwide community. In order to analyze and visualize the data, meaningful categories to group the objects needed to be defined. Nine main object groups were worked out: art/ritual/musical instrument, buildings/constructions, container, fuel/lighting, furniture, infrastructure, means of transport tools and other. Each category is structured in subcategories, as can be seen in Table 1; e.g., buildings/constructions comprises the items building, completely wooden; building, subconstruction; building, wooden element; construction (e.g., stair, rack); machine (e.g., press); and other.

The database is not intended as a top score list of the oldest objects within the categories around the globe. There is no clear spatial and temporal demarcation. Everyone is invited to add data from his/her region (for example, each dendro-lab). All entries which are correct will stay in the database – even older items of the same category will show up.

An important aspect to characterize an object is its current condition; two groups can be distinguished: intact/in use and not intact/fragment. As an example, a door which is still in place and usable to close a room, would be intact/in use, whereas a waterlogged door which can be recognized as such but may no longer fulfill its original purpose, would be assigned as not intact/fragment. Here our definition differs from how it is determined in...
| Category                                      | Number of Objects |
|-----------------------------------------------|-------------------|
| Total art/ritual/musical instrument           | 17                |
| Mask                                          |                   |
| Panel painting                                | 3                 |
| Percussion instrument                         |                   |
| Sculpture                                     | 4                 |
| String instrument                             | 5                 |
| Wind instrument                               | 1                 |
| Other art                                     | 1                 |
| Other musical instruments                     |                   |
| Other ritual                                  | 3                 |
| Total infrastructure                          | 26                |
| Building, completely wooden                   | 26                |
| Building, subconstruction                     | 12                |
| Building, wooden element                      | 38                |
| Construction (e.g., stair, rack)              | 11                |
| Machine (e.g., press)                         | 2                 |
| Other                                         |                   |
| Total means of transport                      | 49                |
| Total container                               | 6                 |
| Backcarry                                     |                   |
| Barrel                                        | 4                 |
| Basket                                        |                   |
| Bowl                                          | 1                 |
| Box                                           | 1                 |
| Cup                                           |                   |
| Vessel                                        |                   |
| Other                                          |                   |
| Total tools                                   | 13                |
| Total fuel/lighting                           | 2                 |
| Charcoal                                      | 1                 |
| Lighting                                      | 1                 |
| Other                                          |                   |
| Total other                                   | 2                 |
| Grand total                                   | 211               |
archaeology, as it is there assigned to be intact when the form and function can be deduced.

For submitting an object to the list, the item needs to be dated using a scientific method with the date published, or the entry be done by a trusted laboratory if no publication is available. In the online form, accepted dating methods are either Dendrochronology, Radiocarbon dating or Wiggle-Matching as a combination of those two methods. If the wood was dated by a different method, it is possible to choose “other method”. As radiocarbon dating is limited to a maximum age of about 50,000 before present (Reimer 2013), other, indirect methods like thermoluminescence dating of the surrounding material are typically used. This would be accepted for archaeological finds, if surrounding material is precisely dated. A date given by dynasty (like in China) or due to the finding place (like Pompeii) is not accepted due to the often long time span of an era, although the end may have been abrupt. The goal was to set up records with proven, precise dates.

To map all records, geocoordinates as decimal degrees in the WGS84 reference coordinate system are requested and can be verified directly in the embedded map. For better visualization, an image of the recorded object can be uploaded with a maximum size of 5 MB. For several reasons, the wood taxa of the object described is also of interest. On the one hand it is relevant from a wood technological perspective, to see which type of wood was selected for which purpose. On the other hand, the type of wood also plays a major role in the state of preservation and it is also decisive for dendrochronological dating. Moreover, successful dendrochronological dating in combination with botanical identification can provide information about the origin of the wood, i.e., whether it is local or imported wood.

In order to collect the data, the participation of the international community by filling out an online form was (and still is) extremely important in order to overcome language barriers associated with regional publications. After manual validation, the objects are added to the list and are displayed on the website. In addition, a comprehensive literature review was carried out by the authors to complement the collection. Unfortunately, some organizations or authorities claim to have data on very old wooden objects, but have strict restrictions on the publication of research results, and therefore no entries of these objects could be made in the publicly available database.

3 Results

At the time of writing this paper, a total of 211 entries form 39 different countries were available (Figure 1). Europe is currently highly overrepresented with
170 samples (81%). 35% of the entries emerged from literature review, whereas the remainder was contributed by 26 different laboratories or researchers.

3.1 300,000 Years of Wood Use and a Variety of Applications

Three man-made objects on the list are dated before the geological period of the Holocene. So far, the oldest wooden objects on the list are the spears of Schöningen (Germany), labelled as number 1 in Figures 2 and 3. They are made of spruce (*Picea abies*) and pinewood (*Pinus* spp.) and were dated by thermoluminescence dating of the direct surrounding dirt layer, to an age of more than 300,000 years before present (Richter and Krbetschek 2015; Sierralta et al. 2019; Conard et al. 2020). After a big time-gap, the second oldest piece, a digging stick from Spain (no. 2 in Figs 2 and 3) made from yew wood (*Taxus baccata*) and also indirectly dated using thermoluminescence, was in use about 100,000 years before present (Rios-Garaizar et al. 2018). The third oldest object on the list is a wooden pot from the south of Romania (no. 3 in Fig. 2), which dates to the very edge of the Radiocarbon dating age limit of about 50,000 years (Kozłows et al. 2015). Kozłows et al. (2015) write that the pot was probably made from yew (*Taxus baccata*).

While these three objects stand out by their age, it is worth to point out exceptional objects of each category in the Holocene period (marked by the numbers 4 to 15 sorted according to age in Figs 2 and 3). The Wyrie Swamp
boomerangs from Australia (no. 4 in Fig. 2) date back to about 10,000 BCE (Luebbers 1975). This item, categorized as “tool”/“hunting/weapon” was indirectly dated by the 14C method (by dating the surrounding material). It is one of the few documented prehistoric wooden finds in the southern hemisphere. It is assumed, that they are made from the wood of dropping sheoaks (Casuarina verticillata or stricta) which are growing above the swamp. Remarkably, the oldest item in the category “building/construction” is the Lakota Tipi (no. 5 in Fig. 2) from the Hell Gap archaeological site in Wyoming, USA, dated by 14C to 8800–10,450 BCE (Black 2017). The oldest piece in the art/ritual/musical instrument category is the idol of Shigir made from larch wood (Larix) from the middle Urals in Russia (no. 6 in Figs 2 and 3) dated by radiocarbon dating to 9600 BCE (Zhilin 2018). Known as the oldest boat of the world is the canoe from Pesse, a village in the Dutch province of Drenthe (no. 7 in Figs 2 and 3), dated to 8760±145 BCE by 14C (Beuker et al. 1997) and therefore the
Figure 3 Collage of the oldest wooden objects: (1) spears, Schöningen, Germany, photo by Pfarr P. NLD – Niedersächsisches Landesamt für Denkmalpflege, CC BY-SA 3.0 de; (2) digging stick, Aranbaltza III, Spain, from Rios-Garaizar et al. (2018), CC BY 4.0; (6) Shigir idol, the middle Urals, Russia, photo by Фальшивомонетчик, (B) Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=6982791; (7) canoe, Pesse, Drenthe, The Netherlands, from http://museaindrenthe.nl/collectie/object/27368499-69dc-0888-ab8e-252bd45f760, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=48144340, (8) water well, Droßdorf, Germany, © Landesamt für Archäologie Sachsen, from Kretschmer et al. (2016); (9) snowshoe, Gurgler Eisjoch, Italy, © Amt für Archäologie Südtirol, from Steiner et al. (2016); (10) Wheel with axle, moor of Ljubljlana, Slovenia, photo by Velušček, from Čufar et al. (2012); (11) staircase, Hallstatt, Austria, photo by Rausch/NHM Vienna, from Grabner et al. (2021), CC BY 4.0; (12) lighting chip, Hallstatt, Austria, from Wächter (2017), BOKU, holder: NHM Vienna; (13) stave barrel, Wörterberg, Austria, photo by Jahelle, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=50655161; (14) Jokhang Temple, Tibet, photo from onwardtibet.org, CC BY-SA 2.0, https://creativecommons.org/licenses/by-sa/2.0, via Wikimedia Commons; (15) chest, Ebstorf, Germany, © Wrobel 2018, Dendrochronology Hamburg, personal entry.
oldest known means of transport. The wood of the boat was identified as pine \((\text{Pinus} \text{ spp.})\).

The plank water well from Droßdorf in Germany (no. 8 in Figs 2 and 3) was dated to 5205 BCE, it still contains sapwood, the less durable outer part of a tree trunk. All parts of the well were made of oak \((\text{Quercus} \text{ spp.}; \text{Kretschmer} \text{ et al.} 2016)\). It is the oldest man-made wooden object dated by means of dendrochronology on the list. Wells were categorized as “infrastructure”.

As there is no category for clothing, the snowshoe from the Gurgler Eisjoch (no. 9 in Figs 2 and 3) near the Italian-Austrian border was entered under the category “other”. The radiocarbon date shows a timespan from 3811 to 3710 BCE, it was made from birch wood \((\text{Betula} \text{ spp.}; \text{Steiner} 2016)\). Definitely worth to mention is the oldest wooden wheel with an axle from the moor of Ljubljana in Slovenia (no. 10 in Figs 2 and 3), dating to about 3140 BCE. The wood was identified as ash \((\text{Fraxinus} \text{ spp.}; \text{Velušček} \text{ et al.} 2009; \text{Čufar} \text{ et al.} 2010; \text{Čufar} \text{ and Velušček} 2012)\).

The staircase from Hallstatt in Austria, (no. 11 in Figs 2 and 3) is dated by means of dendrochronology to 1146 BCE. Not all parts of the construction are of the same age, the given date refers to the oldest piece of the staircase, dating with a waney edge. The wood used for the construction of the staircase is spruce \((\text{Picea abies})\) and fir \((\text{Abies alba})\) and one special part from beech \((\text{Fagus sylvatica}; \text{Grabner} \text{ et al.} 2021)\). Worth to mention are also the lighting chips (small, oblong, split pieces of softwood that were used for lighting) where countless pieces were found in the prehistoric salt mines of Hallstatt in Austria (no. 12 in Figs 2 and 3), the oldest one with a waney edge dates to 757 BCE. These lighting chips are almost exclusively made from fir \((\text{Abies alba}; \text{Grabner} 2017)\). Number 13 in Figs 2 and 3 is made of spruce \((\text{Picea abies})\), a stave barrel from Wörterberg in Austria which was dendrochronologically dated to 100 AD without waney edge and thus the second oldest container on the list.

An extraordinary and well-preserved example is the Jokhang Temple in Tibet from Tibetan juniper \((\text{Juniperus Tibetica}; \text{no. 14 in Figs 2 and 3})\) dated by \(^{14}\text{C AMS}\) to 420 AD (Scharf \text{et al.} 2013). The oldest furniture on the list is a chest from oak wood \((\text{Quercus} \text{ spp.})\) in the Ebstorf monastery in Germany (no. 15 in Figs 2 and 3) dated by dendrochronology to 1159 AD (Wrobel 2018).

### 3.2 Oak and Softwoods are Dominating

Objects made of oak \((\text{Quercus} \text{ spp.})\) were by far the most frequently entered (87 pieces). But also, the group of soft woods, including pine \((\text{Pinus} \text{ spp.}; 27 \text{ pieces})\), spruce \((\text{Picea abies}; 18 \text{ pieces})\), silver fir \((\text{Abies alba}; 13 \text{ pieces})\) and larch \((\text{Larix} \text{ spp.; 7 pieces})\), was well represented. Because of the wide availability (at least in the northern hemisphere), the good workability, and strength to weight ratio softwood was a popular choice. But, also the fact that oak and
softwood taxa are well suited for dendrochronological dating, accounts for the large number of objects added to the list. Other wood taxa are only entered in smaller numbers.

4 Discussion

The website "oldestwoodenobjects.net" allows a glimpse into the early days of wood utilization. A total of 211 entries analyzed in this study lead to tentative conclusions only.

4.1 There Might Be Older Wooden Objects

By far the oldest objects on the list are the spears from Schöningen, dating back to 300,000 years before present (research question i). However, only scientifically dated objects (direct or indirect) are included, for which a publication exists or the date was entered by a trusted laboratory. The list is far from comprehensive, probably because some organizations or authorities keep their research results under lock and key. Also, some objects cannot be included, as the used methods are unclear or dates are only very rough estimations (for example, Chinese and Pharaonic dynasties). Hence, the Clacton spear from England made from yew-wood (Taxus spp.) which is claimed to be the oldest known man-made wooden object with an age of 400,000 years (Allington-Jones 2015: 273) is not included. This piece cannot be added to this collection, as no exact dating was carried out. There is also a chance that we missed items in private hands with owners having no interest to share information.

Thus, oldestwoodenobjects.net presents the oldest scientifically verified wooden object, but it is almost certain that for many end use categories older objects do exist. For instance, excellently preserved furniture has been found in the tomb of Tutankhamun dating from ca. 1323 BCE, or from Pompeii, Herculaneum from Roman times which were most likely only dated by context but not separately by scientific methods or at least not explicitly published or entered to the list. Our literature search was limited, because many archaeological finds are often published in the local language. In web-pages in English, often the precise dates are not given (at least the details of dating). Up to now, hundreds of persons (labs) were asked to entry (via the International Tree Ring Database discussion forum, personal emails as well as promotion at scientific conferences).

4.2 Several Factors Contribute to Object Age

Wood is a biodegradable organic material, this fact complicates research on early wood use, as it is only preserved for a very long time in very specific
circumstances. Only in totally wet (i.e., anaerobic), or totally dry conditions, wood longevity is virtually unbounded (Großmann 1922). Due to differences in taxa durability and a great variability in environments as well as their interaction, the image of the early wood utilization will always remain a distorted one.

Before the people started to settle down, more than 10,000 years ago, they lived as hunters and gatherers. At this time, tools and also containers were critical equipment. It is remarkable that this phase of human history can be depicted on this dataset on the basis of individual finds (3 objects).

Of the nine categories introduced, eight contain objects with an age of several thousand years. In the remaining category of furniture, the chest from the Ebstorf monastery in Germany is still several hundreds of years old. Giving the remarkable age of objects found across all categories we can deduce that the assigned class has no strong causal relationship on object age (research question i). This is to be expected, as the object class is of no further importance once an object gets conserved in totally wet or totally dry conditions. However, if we filter the data for objects being still intact or in use, the oldest items get dominated by buildings and sculptures.

When analyzing taxa distribution, we observed a high number of softwoods, beside oak. Taxonomic identity has a strong influence on durability and preservation condition, due to a great variability in anatomy, density and chemistry (Grabner 2017). However, a meaningful analysis of the influence of taxa on the object age gets hampered by the fact that the success rate of dendrochronology strongly depends on the analyzed taxa as well. The most frequently added taxa was oak which might be due to its particularly good durability, widespread use (in the area were most entries do exist at the moment) and suitability for dendrochronological studies (Schweingruber 1983). Due to the low number of entries it is not possible to find relationship between region and wood taxa up to now (research question ii).

4.3 Spatial Clusters Represent Sampling Bias

As already mentioned, the entries on the list are very unevenly distributed in geographical location and limited in number. Thanks to good direct contacts to the European community studying (pre-)historic wood utilization, many entries could be generated for finds all over this continent. But there are still sizable empty areas on the map on other continents, especially in South America and Africa. One reason for that might be the density of early population, which was much lower there, than in Asia and Europe in prehistoric and historic times (Klein Goldewijk 2010). This fact makes the probability of finding man-made objects much lower. This in turn influences where researchers put their focus. It is likely that there are additional wooden objects in North America and Asia that should be included in the list too. Thus, while there are
certainly regional differences in the cultural history of wood use, the spatial
distribution as displayed on oldestwoodenobjects.net represents rather the
origin of the contributing individuals than the actual presence of wooden arte-
facts in a region (research question iii). As the project further evolves, we will
rely strongly on the participation of on-site researchers, because many finds
are only published in local journals and thus difficult to access by the interna-
tional community.

4.4 A List But Not a Comprehensive Database
There is already a good and mature approach for gathering wood finds and
examining and comparing objects, their design, purpose, and selection of
wood taxa. The database WOODAN (Haneca et al. 2022; www.woodan.org)
with its beginnings in The Netherlands represents a comprehensive collec-
tion which makes this information available to the general public. The idea of
oldestwoodenobjects.net was to record and compare the most extraordinary
wooden objects worldwide – to give an overview on age, distribution and wood
taxa. In most cases, details about the finds and objects can be found in the
given references within the list.

5 Conclusions and Outlook
Up to now, very interesting objects and data can be found in our list, which
can be used for promotion of wood use and wood culture, as well as to start
some scientific analyses. We hope that it is attractive now for other labs and
individual colleagues to insert new data.

In order to provide a more comprehensive timeline of early wood use the
website will stay online, open for the public. As it is an ongoing process to find,
examine and date ancient wooden objects, the list will be extended continu-
ously. Also, in the future, all new entries will be checked and activated by us
(BOKU) in order to have a continue quality assurance.

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