



Original article

Tree rings as criteria for selection of timber for building of chapels in the Republic of Karelia

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ABSTRACT

Data on the quality of timber used for building chapels – small buildings for public worship, enabled determination of visual criteria used for the selection of timber in the Republic of Karelia, located in the north-western part of the Russian Federation.

It was revealed that as for the majority of timber structures in the region, Scots pine (*Pinus sylvestris* L.) logs were selected for the chapels. Trees perceived as 'Holy' such as spruce (*Picea abies* Kr.), were not used in these worship structures, in contrast to practices in the neighboring Leningrad Region. The age of the logged trees was 100–150 years, with a high proportion of young trees.

Data obtained proved convincingly that compared with huge parish churches, selection of timber for these small chapels was not so strict. Multivariate analysis of variance showed that an ethnological factor played a significant role in the selection of wood for the buildings. Mature trees with narrow tree rings were preferred for worship structures preserved in villages populated by Karelians – the Baltic-Finnic tribe living in the region since ancient times.

In villages with a dominantly Russian population, young pines with wide annual rings were dominantly used. A correlation between the height of the structures and the average diameter of the logs used was found with the coefficient of determination high in Karelian villages and lower in Russian villages.

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1. Introduction

Historic timber structures are an essential part of the world cultural heritage.

There are facts supporting the idea that the search for timber for building purposes has always been based on deep knowledge and traditions (Kaila, 1997; Larsen and Marstein, 2000; Kisternaya and Kozlov, 2006). For instance, the most durable species were selected for the structures. In the north of Europe Scots pine (*Pinus sylvestris* L.) was preferred to spruce (*Picea abies* Kr.), whereas larch (*Larix sibirica* Ledeb.) was rare and more highly valued than Scots pine. In the Archangelsk Region (Russia) larch was used for the lower timber sets carrying higher loads, and pine was used for the rest of the house (Permilovskaya, 2005).

Tree ring characteristics (their width and number) and the approximate age of the tree (younger or older) were probably used as visually recognisable characteristics for grading timber. The reliability of visual grading methods is however still questioned (Glos, 1995).

The age of trees was an important criterion for selecting timber. It was recommended to select pine trees in mature stands growing on sand or rock. Old building guidelines determined the appropriate age of trees as 140–200 years (Kaila, 1997).

It is known that pine logs with narrow annual rings and high resin content were selected for valuable religious structures (Kisternaya and Kozlov, 2006). In the 37-m high Transfiguration Cathedral (1714 CE), which is included as a part of the Kizhi Pogost site in the UNESCO list of the World Cultural Heritage, narrow-ringed wood was used for lower timber sets of the structure. Upper parts were mostly built of wide-ringed wood with lower density. Thus, stronger logs were used in the load-carrying parts of the structure, and the weight of the structure was reduced using looser timber for the upper part (Kozlov et al., 2000).

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Table 1
Chapels under research. Chapels marked by an asterisk were moved to the Kizhi museum in 1970–1980's.

№	Name	Village, district	Dating according to archival documents	Dendrochronological dating	Notations in Fig. 1
Karelian villages					
1.	Chapel of the Descent of the Holy Spirit on the Apostles	Ahpoila	Early 17th c.	1670	1
2.	Chapel of St. George the Victorious	Veshkelitsa	Late 17th c.	1695	2
3.	A chapel	Kishkoila	Second half of the 18th c.	1760	3
4.	St. Dmitry Solunsky Chapel	Pengiselga	Mid-18th c.	1745 1763 (belfry)	4
5.	A chapel	Syargilahta	First half of the 18th c.	1798	5
6.	Chapel of St. Nicholas the Wonderworker and Prophet Elijah	Chujnavolok	Second half of the 18th c.	1797	6
7.	Chapel of the Nativity of the Virgin Mary	Man'ga	Second half of the 18th c.	1720	9
8.	Chapel in the name of the Smolensk icon of the Mother of God	Kinerma	Second half of the 18th c.	1746	10
9.	The chapel in the name of Three Holy Hierarchs*	Kavgora	18th–19th cc.	1745 (eastern part) 1890–1891 (western part and belfry)	7
10.	The Archangel Michael chapel	Ershi	19th c.	1849	17
11.	Chapel in the name of the Kazan icon of the Mother of God	Manselga	19th c.	1864 1903 (a passage)	18
Russian villages					
12.	Chapel of the Vernicle*	Vigovo	Second half of the 17th – first half of the 18th c.	1710s, 1760s (belfry)	11
13.	Chapel of the Annunciation (the 'Sign' of the Mother of God)	Korba	18th c.	1760s, 1824 (belfry)	12
14.	Sts. Kyrik and Iulita Chapel	Vorobji	Last quarter of the 19th c.	1867	14
15.	Chapel of the Mother of God the 'Consolation of All the Afflicted'	Eglovo	Second half of the 18th – first quarter of the 19th c.	1721	15
16.	Chapel of Sts. Paraskeva and Varlaam of Khutyn	Podjelniki	18th c.	1791–1795 1860 (Belfry)	13
17.	Sts. Peter and Paul Chapel*	Tipinitsy	Early 18th c.	1705	16
18.	A chapel	Berezovka	Late 18th – early 19th c.	1748	8

In contrast, hardly any data on the selection of timber for more every day construction (building dwellings, household structures and small worship buildings) is available. In the Russian North, village chapels along with huge parish churches played an important role in spiritual life. A chapel differs from a church in that it has no altar. Hence, they were used only for private or collective prayers. Construction of chapels was not controlled by official church authorities and they preserved a genetic connection to living and household structures. Archival data concerning the erection of the chapels is very limited because nearly all church archives were lost during the Soviet period. At the same time there is written evidence that chapels were built by peasants by themselves. Meanwhile the churches were built by invited carpenters and controlled by official church authorities (Pettersson, 1950). Nowadays chapels are a valuable part of wooden cultural heritage and the ICOMOS "Principles for preservation of historic timber structures" (1999) recommend that during a repair old members should be replaced with timber displaying similar natural characteristics.

Therefore any data on the quality of timber and grading characteristics used for selecting timber for historic timber structures are of great value for conservators and restorers, as well as for foresters.

The aim of this research is to study the quality of timber used for building chapels in the Republic of Karelia and to find visual criteria used for the selection of timber for small worship structures.

2. Study objects

The Republic of Karelia, located in the north-west of Russia, is known as a treasury of historic timber structures. Carpentry tradi-

tions were introduced to the region in the 14th c. from Novgorod the Great – the biggest economic and cultural center of Northern Russia during colonization of northern lands. Building traditions reached a peak in the 18th c. when the world-famous churches on Kizhi, in Kem' and Kondopoga were built. Since the 14th–15th cc. western regions of the present-day Republic of Karelia were populated by Karelians and eastern regions by Slavic newcomers. This Ethnic distribution was quite stable in the 17th–19th cc. but in the 20th c. changed due to many sociological and political reasons (Taagepera, 1999). Eighteen chapels located in the southern part of the Republic of Karelia were surveyed (Table 1, Fig. 1). They were erected in districts of the Republic of Karelia which according to historic documentation had a Karelian and Russian population at the time of construction (Ogorodnikov, 1879).

The chapels in Karelian and Russian villages are timber-framed structures with a similar but not simultaneous evolution. Traditionally, a refectory and a passage with a belfry were added to the actual worship premises during several phases of construction, which could take several centuries.

Architectural research showed that chapels in Russian villages evolved faster compared with Karelian villages (Orphinskij and Grishina (2004). Chapels as well as dwelling houses in Karelian villages have more archaic constructive details compared with Russian building which are of the same age (Orphinskij and Grishina 2004, 2009).

The date and duration of construction for the chapels considered in this study was determined by archival sources and then detailed by dendrochronological analysis (Table 1). The oldest chapels were dated to 1670 and 1695. They are situated in Karelian villages

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