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Dendrochronological investigation of the bowed string instruments at the Theatre Museum Carlo Schmidl in Trieste, Italy

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ABSTRACT

The Civico Museo Teatrale Carlo Schmidl in Trieste, Italy, hosts a collection of bowed string instruments, the majority of which have been made by local violin makers in the 19th and 20th centuries. Dendrochronological analysis afforded the *terminus post quem* of 17 out of 23 bellies with significant statistical parameters. With the pooled series of all instruments, a mean chronology spanning 280 years between 1658 and 1938, named Museum Schmidl Trieste (MST), was constructed. MST correlates with numerous reference chronologies validated for Norway spruce and silver fir in the Alps and Central Europe. We exploited the width of the growth rings and the statistically most potent cross-matchings with reference chronologies for drawing hypotheses on dendroprovenance coming to the conclusion that the resonance wood of the instruments at the Schmidl-Museum mainly originated from Central Europe and the Eastern Alps.

1. Introduction

Until 1918, Trieste was the most important harbor and the fourth largest city of the Habsburg Monarchy after Vienna, Budapest and Prague. Besides being a leading commercial center, Trieste exerted a pivotal cultural role in literature and music. Musical performances, from classical music in theatres to more popular music in cafés chantants and taverns, were much loved among all social classes. The considerable demographic expansion of the town, from 30,000 in 1800 to 230,000 in 1910, was paralleled by an increasing demand for musical instruments, which were both imported and made in Trieste. Not surprisingly, the second half of the 19th century saw a boom in local production of pianos, accordions, stringed and other instruments. The art of violin making in Trieste was exerted by a few professional luthiers and a plethora of amateurs [1, pp. 93–98]. Some of the non-professional violin makers, in addition to dull or average workmanship, produced fine violins, violas, cellos and double basses that are much appreciated nowadays and sought by connoisseurs.

The legacy of the musical life in the golden years of Trieste as part of the Austro-Hungarian Empire, and beyond this period after becoming Italian at the end of the First World-War, is superbly preserved at the Civico Museo Teatrale Carlo Schmidl housed in Palazzo Gopcevich[1] that has been built 1847–1850. This is the most impressive edifice overlooking the Canal Grande in the Borgo Teresiano, named after the empress Maria Theresa, in the heart of the town. Palazzo Gopcevich constitutes *per se* a work of art with its façade plastered in a pale-yellow and brick-red zigzag pattern, finely inlaid wood pavements and either coffered, wooden or painted ceilings. The museum hosts a collection of objects and documents spanning 19th century to nowadays. Besides original theatrical costumes, opera posters, portraits of artists and an impressive collection of precious archival documents, European and extra-European musical instruments constitute a point of attraction for both amateurs and specialists. The inventory of the musical instruments and their accessories at the Schmidl-Museum comprises 780 pieces. Pianos, pump organs, aerophones and string instruments are displayed in sumptuous halls allowing visitors to appreciate their details in the

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[1] http://www.retecivica.trieste.it/triestecultura/new/musei/museo_schmidl/default.asp Available in Italian. Clicking the 'floors' (piano terra, primo piano, secondo piano) their maps are displayed with links to photos of the exhibition. The musical instruments are located in the 'primo piano' filed under the numbers 13–17.

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charming atmosphere of the palace. Noteworthy is the collection of instruments of the violin family, with violins made by luthiers based in Trieste constituting the most numerous group. A collection of finely-worked plucked instruments, from mandolins to guitars and others, complements the exhibition of chordophones.

The present study is dedicated to the dendrochronological analysis of the bellies of bowed stringed instruments at the Civico Museo Teatrale Carlo Schmidl in Trieste with special focus on the violins made by luthiers based in Trieste. Besides closely studying the technical aspects of the construction of the instruments, determining the age of the wood aims at confirming the alleged date of construction, at evaluating its provenance, and at detecting major or minor restoration interventions.

2. Materials and methods

2.1. The instruments and their makers

A total of 21 bowed string instruments and two violin bellies were analyzed by dendrochronological methods. Twenty instruments, very likely including the unvarnished viola da gamba #123 without label, were made by craftsmen based in Trieste, while the violins #987, #1069 and #3136 were made elsewhere (Table 1). As documented by existing instruments, the luthiers that worked in Trieste across the 18th–20th centuries were at least 32, but this number may be underestimated. Not all names will be given here and we mention just Vincenzo Corain, Giovanni Dollenz and his son Giuseppe Dollenz, Mario Girardi, Eugenio Weiss, Ferruccio Zanier and Francesco Zapelli for having produced fine instruments, whose tonal qualities are highly appreciated by experts. Fig. 1 shows violin #119 made by Vincenzo Corain in 1830, whose noticeable characteristic is the scroll with a V-shaped groove on the central line. One of the few 'rational violins' made by Francesco Zanier in Trieste is shown in Fig. 2. This violin (#718) corresponds to Zanier's 'Violino razionale B' described in his book 'Il Violino. Principi tecnici e costruttivi' [2, pp. 98–101].

2.2. Measuring tree-ring widths

The width of the growth rings of the instrument bellies was measured with same procedure as in [3], which consists of a transportable measuring unit and of a digital video camera that allows the observation of the bellies at 20 × magnification with a focal distance of 20 cm, avoiding any physical contact with the instruments. In addition, for documentation purposes and for later quality control high-resolution pictures were taken with a single-lens reflex camera.

After removing the tailpiece and the strings from the instruments, 2–6 dendrochronological series were collected from each element that constitutes the belly (Table 2). The individual series were compared straightaway and the measurements were repeated whenever any doubt about the correctness of tree-rings detection arose. In case of poor or no similarity in ring growth patterns between the first two measured radii, additional measurements were performed in different zones of the belly in order to maximize the number of growth rings available and, at the same time, to avoid errors caused by possible distortions in the veining. Where two or more tree-ring series were available for a single belly, the individual tree-ring measurements were averaged to produce a representative tree-ring series for each instrument.

The sampling scheme was adapted to the particular features of the instruments, such as the number and orientation of the wood pieces glued together to construct the belly.

2.3. Cross-dating

The mean tree-ring series for each musical instrument was checked and cross-dated visually and statistically with reference chronologies by calculating the standard cross-dating parameters:

- T_{BP}: Student's *t*-test adapted from Baillie and Pilcher [4];
- Glk: Gleichläufigkeit and its value Gleichläufigkweitswert discussed by Eckstein and Bauch [5]. In comparing two chronologies in a given time interval, Glk represents the percentage of the agreement between the sign of the growth from one year to another;
- statistical significance of Glk at the levels of 95.0%, 99.0% and 99.9%, indicated with the symbols *, **, and ***, respectively;
- overlap, i.e. the number of rings that were compared with reference chronologies and to which the statistical tests refer. Dendrochronological dating relies on statistical comparison procedures whose significance lessens as the number of tree rings available for analysis decreases. Typically, the number of tree rings analyzed should never be less than 40, while dealing with at least 70 rings represents a suitable condition though a definite threshold does not exist. This implies that the results summarized in the tables below have different meanings. For instance, a high T_{BP} value obtained with 40 tree rings is statistically less potent than the same T_{BP} value obtained with 150 rings.

Basically, the threshold of statistical significance was $T_{BP} > 4$ together with high values of Glk. Every series was compared against more than 150 reference chronologies. These included those available from the International Tree-Ring Database, http://hurricane.ncdc.noaa.gov/pls/paleo/fm_createpages.treering, and those already published for *Picea abies* of the Alps and Central Europe [6], as well as the AMC01-chronology constructed from musical instruments of the Conservatory Cherubini collection at the Musical Instruments Department of the Accademia Gallery in Florence, Italy [3], of which an updated version, AMC02, exists [7,8]. The chronologies of *Abies alba* in Slovenia (ABAL2002, span 1312–1996) and of *Picea abies* of Northern Slovenia (PC-SL-08, span 1512–2007), Jelovica, Slovenia (Jel1-11, 1862–2007) and Pohorje, Slovenia (Poh12–13, span 1808–2003) were constructed by the Department of Wood Science and Technology, Biotechnical Faculty, University of Ljubljana, Slovenia (K. Čufar).

Cross-dating was performed using the programs PAST4 (SCIEM, Vienna, Austria, http://www.sciem.com), and TSAPWin (RINNTECH, Heidelberg, Germany, www.rinntech.de/index-52147.html). For internal consistency and uniformity, since the algorithms used by different programs may generate different t-values [3,9], Table 3 below will show the values of the Student's *t*-test calculated with PAST4 software.

3. Results

Seventeen out of the 21 instruments and 2 violin bellies investigated in this study, listed in Table 1, could be dated with adequate statistical evidence (Fig. 3 and Table 2). Five violins (inventory numbers #120, #953, #987, #994, #1069) and the small cello (#124) could not be dated with acceptable criteria either because of the scarce number of measurable annual rings (< 40 rings in #120) and/or insufficient statistical correlation with the reference chronologies (TBP < 4).

The bellies of #243 and #254, made by Francesco Zapelli and Giuseppe Dollenz, respectively, consist of two parts glued with the rings growing in centripetal direction according to the classical scheme (Table 2). In both cases, the two halves are unrelated to one another and only one of them could be dated using reference

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