



## The secret of the violins of the Cremonese school

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**Abstract:** On December 18, 1737, in his native Cremona, at the age of 93, Antonio Stradivari, a master who left behind an immortal legacy, died. About 650 musical instruments delight the ears of sophisticated fans of classical sound even today. For almost three centuries, manufacturers of musical instruments have been haunted by the question: why does the sound of Stradivarius violins look like a sonorous and gentle female voice?

**Key words:** Cremona, violin, concerto, composer, Stradivari, Amati, Guarneri, work, master, virtuoso

Violins are part of symphony orchestras, their beautiful sound caresses the ear at concerts of works by a great many composers. The best virtuoso violinists can afford to play the best instruments - violins by Stradivari, Amati, Guarneri. These instruments, created in the XVI-XVII centuries. in Cremona (Italy), still the best in the world. They have the best sound, they are very rare, they are the object of desire of the super-rich collectors all over the world, they are worth much more than their weight in gold. And no one managed to reveal the secrets of the Cremonese school of violin craftsmen. Why is that? The violin appeared as a development of the viola. She appeared in Italy and they call her violino there, indicating which instrument became the basis for the appearance of the "little viola". Its predecessor, the viola, appeared in Europe at the very beginning of the 15th century. The family of violas was very large. There were small violas and large violas. And the violino was originally a folk instrument. A product made by an artisan, the sound was of precisely artisanal quality. But in the 16th century in Cremona, Andrea Amati founded a dynasty of violin makers and began to make cellins of special quality. He was of a noble family, so when he was born is unknown. It is only known that the founder of the Cremonese school, Andrea Amati, died in 1577. The master taught his art to his sons, and they continued his work. But the most famous violin maker was his grandson Nicolo Amati. It was he who changed the shape of the violino, making it a little larger, giving it a thinner "waist" and slightly changing all other proportions of the instrument. This made the instrument the same violin that is known today. His students were Antonio Stradivari and Andrea Guarneri. Both worked as apprentices in the workshop of Nicolo Amati for many years, studying all the intricacies of creating an instrument for virtuoso musicians... There was an excellent film "Visit to the Minotaur", it perfectly shows how much selfless work was needed to at least somehow get closer to the dream - the secret of creation magnificent violins. And how much effort the work in the workshop required later. Nicolò Amati managed to prolong the existence of the Cremonese school by passing on the secret of making musical instruments to his students, while his own children and grandchildren, alas, were unable to perceive the whole complex of instrument-making technology. The same fate befell both Stradivari and Guarneri - they failed to pass on their secrets to their descendants.

Stradivari made the first violin released under his own name in 1666 and until 1683 he strictly adhered to the Amati style, but from 1688 the master began to experiment, and the closer to 1690, the larger his instruments became. The violins of this period received the code name "amatize". A sharp departure from the Amati school is revealed only in 1691, and its own type of violin is born. These are the so-called elongated violins (allonge), in which the maple is already exclusively radially cut and the sound timbre from soprano changes to mezzo-soprano. In 1698, he again returned for a short time to the Amati model, and only around 1704, at the age of 60, Stradivarius finally constructed his violin model, which no one has yet been able to surpass in perfection. Antonio Stradivari (1644–1737) created about 1,200 violins in his lifetime. Today, there are about 600 Stradivari violins left, each of which could be worth \$10 million.

Instruments made by Guarneri and Stradivari are as famous as those made by Amati. They are played by the best virtuoso musicians, they are kept in armored safes by collectors, because there were only a few hundred of them made. And then centuries passed, there were wars, fires and floods. Those violins of the Cremonese school that remain are valued at many millions of dollars, they are carefully stored, and used for playing only on special occasions. So why did the Cremonese violin-making school perish? There was a massive demand for the instrument, and the masters made each of their works for a long time and carefully, each violin was their next step towards creating an "absolutely perfect violin", each was slightly different from the others. Artisans from the manufacture of instruments, without much thought about the perfection of sound, made violins similar to those made by the masters from Cremona, they made a lot of them in order to meet the demand, so that everyone could buy a violin. The sound of these violins was not at all the same as those of Cremona, but ... this is not necessary to play in a tavern or in the salon of a nobleman. In the tavern they will not hear, and the nobleman will not understand.

Together with the masters of the Cremona school, their secrets also died: what special requirements were for wood, what to soak it in, how and how long to dry, how to impregnate, what should be the composition of the varnish, how to cover the instrument with it. There were rumors that the craftsmen of the Cremonese school, cut from dried wood, had planks of a certain type of wood, blanks for future violins, kept for several years on the bell tower of the cathedral in a place protected from rain and the sun, but open to the wind, so that the wood would be impregnated with the music of bell ringing in advance. If the secrets of violin proportions are easy to learn - just take one of the violins of the great masters and, after disassembling, measure them, then the secrets of varnish or the preparation and processing of wood are still a mystery at the present time. So why haven't the secrets of the Cremonese school been revealed for nearly half a millennium?

In 200 years of research, scholars have not come to a consensus on what makes the violins created by Antonio Stradivari, Giuseppe Guarneri and other 18th-century Italian luthiers so unique. Possible explanations included both the quality of the wood and the secret formulations of the wood varnish. But now scientists have come to the conclusion that the manufacturers processed their tools with mixtures of minerals, some of which were discovered for the first time.

A study of trace chemicals preserved in the wood of the violins confirmed that instrument makers treated them with mixtures of minerals, and some of them have been identified for the first time..

"All of my research over the years has been based on the assumption that craftsmen chemically treated the woods of their violins, and this is what caused Stradivari and Guarneri to sound great," says Joseph Nagivari of Texas A&M University..

According to Nagivari, Stradivari and other violin makers used a mixture of chemicals derived from minerals to treat the wood of their instruments to prevent damage from wood-eating organisms. At the same time, they accidentally improved the sound of finished instruments.

Scientists have found chemical traces of sodium tetraborate and metal sulfates in wood used to make violins between 1660 and 1750. Sodium tetraborate occurs in evaporite deposits formed as a result of repeated evaporation of seasonal lakes. Sodium tetraborate is still used today in a variety of laundry and cleaning products, and in the past has also been used as an insecticide and fungicide to kill pests. Copper and zinc sulfates probably served the same purpose. Alum, an evaporite mineral containing sulfur, aluminium, potassium and sodium, was added to the mixture to form a slightly acidic environment in the wood to prevent mold growth. Halite, or rock salt, was added to control moisture, to keep the wood too dry for germs and fungus, and at the same time prevent warping of the instrument caused by moisture fluctuations. "The presence of these chemicals indicates a collaboration between violin makers and pharmacists of the time. Both Stradivari and Guarneri wanted to treat their violins to prevent micro-organisms from eating away at the wood," says Nagivari.

"This new study shows that both Stradivari and Guarneri used their own method of treating wood. They may have concluded that the special salts they used to impregnate the wood also gave it some useful mechanical properties and acoustical benefits. These methods were kept secret. There were no patents at that time. When visually inspecting the finished product, it was impossible to guess what chemicals the violin had been treated with."

The scientist says further research is needed to understand how the chemicals used to treat the wood provide impeccable sound quality. Stradivari possessed the intuition of a scientist, the dexterous hands of a cabinetmaker, the keen eye of an artist, and the subtle ear of a musician. And all this, multiplied a thousand times by inexhaustible diligence, he put into his creations. Maybe it is in the talent of the master that the secret of the sound of his instruments is hidden?

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