

Secret behind the composition of the varnish on Stradivari violins revealed

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Violin

(PhysOrg.com) -- Antonio Stradivari is the most famous instrument maker of all time. He was especially famous for his violins, which he produced in Cremona from about 1665 until his death in 1737. In particular, the legendary varnish on his instruments has fascinated musicians, violinmakers, historians, and chemists since the beginning of the 19th century -- inciting controversial speculation about "secret" ingredients. The use of analytical processes has allowed a team of scientists from various French and German institutions to shine a light on the mystery.

As the researchers led by Jean-Philippe Echard (Cité de la musique -- Musée de la musique, Paris) and Loïc Bertrand (IPANEMA -- Synchrotron SOLEIL, Gif-sur-Yvette) report in the journal *Angewandte Chemie*, Stradivari used completely common and easily obtained materials that were broadly used in 18th century decorative arts and paintings.

The team examined five Stradivari violins that have been in the collection of the Musée de la musique for at least a century: a "Long Pattern" model,

possibly from the year 1692, the "Davidoff", dated from the year 1708, the "Provigny" from 1716 (the picture shows a cross-section of its varnish with the wood at the bottom), the "Sarasate" from 1724, and the head of a viola d'amore, dated from around 1720. The researchers took samples containing both wood and varnish from carefully selected locations and subjected them to complementary spectroscopic and microscopic examinations.

"Although the five instruments were produced over a period of three decades, their varnishes are very similar," explains Echard. "Stradivari first applied a layer of an oil comparable to the oils used by painters of the same epoch, without fillers or pigments to seal the wood. We did not find a mineral-rich layer, as some earlier work suggests. The master violinmaker next applied a slightly tinted oil-resin layer. We have detected nothing that would have suggested the use of protein-containing materials, gums, or fossil resins."

The researchers found no pigments in the outer layer of the "Long Pattern" model. In earlier examinations, they found the red pigment vermilion on the "Sarasate". Now they have detected two other red pigments in Stradivari's varnish: red iron oxides and a lake pigment made of an anthraquinone dye, probably cochineal, on an alumina substrate. Bertrand indicates that a very broad array of techniques was an absolute necessity to cope with the analytical challenge of studying such complex micro samples.

Stradivari therefore used materials that were easily obtained and broadly used in his time. The use of multiple red pigments allowed him to give a variety of tints to his instruments, which are still highly praised for their beautiful appearance. Says Echard, "Stradivari thus did not use any unusual or secret ingredients, he was simply a true master of his craft."

More information: Jean-Philippe Echard, The Nature of the Extraordinary Finish of Stradivari's Instruments, *Angewandte Chemie International Edition* 2010, 49, No. 1, [doi: 10.1002/anie.200905131](https://doi.org/10.1002/anie.200905131)

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