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Non-invasive mobile technology to study the stratigraphy of ancient Cremonese violins: OCT, NMR-MOUSE and reflection FT-IR spectroscopy

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The modern violin is generally believed to have emerged in Italy in the first half of the 16th century. The scientific study of its complex stratigraphy began approximately in the 1980s with invasive standard methods, consisting of the application of analytical techniques to cross-sections of micro-samples collected from the historical violins. Only since the last decade or so, the focus of diagnostic investigations has been increasingly shifted towards the use of non-invasive approaches in order to preserve the value and the integrity of these masterpieces.

In this work, precious historical Cremonese violins, made during the Italian Baroque period by the great master luthiers of the Amati, Stradivari and Guarneri families, have been non-invasively analysed for the first time by combining optical coherence tomography (OCT), nuclear magnetic resonance (NMR-MOUSE) and reflection FT-IR spectroscopy. Portable instrumentation allowed non-invasive on-site analyses of the violins preserved at the Museo del Violino in Cremona. The aim of this multi-technique campaign, performed within the MOLAB Transnational Access - EU H2020 Project IPERION CH, was the characterisation of the stratigraphy from the outermost varnish layers to the innermost wood treatments. OCT [1] provided information about number and thickness of varnish and preparation layers, as well as detecting dispersed particles acting as fillers or colourants; FT-IR spectroscopy identified the chemical composition of the layered materials [2]; and the NMR-MOUSE investigated the wood density and elasticity, revealing wood treatments at the inner and outer surfaces of the plates [3]. The gathered results add a further valuable contribution to the knowledge of the ancient processes adopted in the Cremonese violin making workshops during the considered period and subsequent restoration efforts.

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