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The A3TEX research centre: archaeology and archaeometry of ancient textiles at the Sapienza University of Rome

Introduction

From prehistoric basketry to Roman imperial garments, textiles reflect technological advancements, economic systems, social hierarchies, gender, identity, and religious and spiritual values. Their exceptional mobility, fragility, and technical complexity make them both challenging and extraordinarily revealing for researchers. Recognising this remarkable complexity, the *Sapienza Research Centre A3TEX – Archaeology & Archaeometry of Ancient Textile* was officially established in 2023 as an interdepartmental research hub dedicated to the study, conservation, and enhancement of textile heritage.

The origins of A3TEX date back to 2016, when a network of scholars from different research fields began collaborating to address the unique challenges

posed by ancient and historic textiles. The official establishment of the centre marked a new phase in this collaboration, bringing together six key departments of Sapienza University – Antiquities, Biology, Chemistry, Physics, Modern Literatures and Cultures, and SARAS (History, Anthropology, Religions, Art, Performing Arts) – in a shared effort to build a comprehensive platform for textile research. The centre is administratively based at the Department of Antiquities and operates as a multi-institutional infrastructure that reflects Sapienza’s growing leadership in cultural heritage science.

A3TEX brings together archaeology, anthropology, materials science, conservation science, and digital technology to investigate the multifaceted role of textiles in ancient societies.



Fig. 1: Activities of the A3TEX research centre (Image: Francesca Coletti)

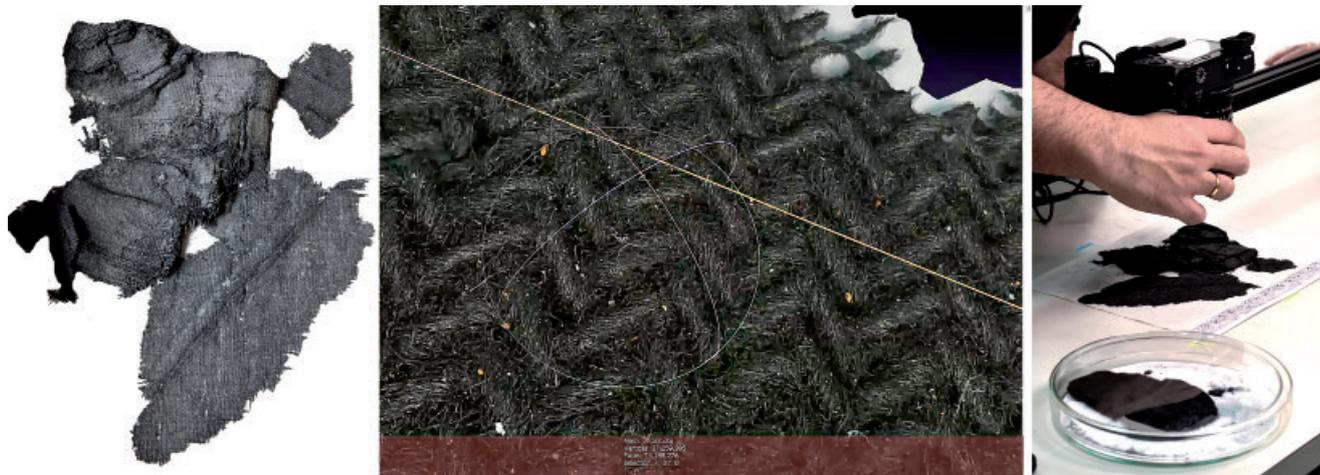


Fig. 2: Digitisation of carbonised textiles (Image: Francesca Coletti)

Agenda of the A3TEX research centre

A3TEX explores a wide range of aspects related to ancient textiles, including their material composition, production techniques, socio-economic context, and conservation strategies. A central focus lies in the study of ancient textile manufacturing, with particular attention to the entire *chaîne opératoire*—from raw materials and textile tools to finished products and their subsequent reuse over time.

At the core of the centre's mission lies an interdisciplinary vision that approaches textiles not merely as functional or decorative objects, but as sophisticated expressions of human knowledge, labour, and cultural meaning. Each fabric, fibre, or thread is treated as a bearer of narrative potential—one that reveals not only the techniques of its manufacture, but also the identities of its makers, the provenance of its raw materials, the transmission of artisanal knowledge across generations, and the cultural and symbolic value attributed to the finished object within its historical context. To reconstruct these layered narratives, A3TEX integrates archaeological research with advanced scientific methodologies and experimental reconstruction (fig. 1).

The centre relies on a wide range of advanced diagnostics – including spectroscopy (XRF, FORS, FTIR in ATR, reflectance and transmission modes, FT-RAMAN, RAMAN, RAMAN-SERS), mass spectrometry (HPLC-HRMS), optical (OM and PLM) and confocal microscopy and scanning electron microscopy coupled with energy-dispersive X-ray spectroscopy (SEM-EDX), Mass Spectrometry-Based Proteomics, and 3D imaging – to analyse and investigate textiles, fibres, dyes and degradations using a multi-analytical strategy that ranges from

non-invasive to invasive techniques. Equally central is the experimental component: ancient textile tools are studied through trace analysis and replicated through controlled experimentation, allowing researchers to reconstruct techniques, gestures, rhythms, and procedures throughout history. This integrated approach enables A3TEX to navigate across multiple scales – from the microscopic structure of fibres to the macrostructures of production networks and cultural exchange.

A3TEX also serves as an incubator for innovative conservation strategies. The centre is actively developing new green nanomaterials and micro-invasive extraction techniques using microgels to investigate and preserve highly vulnerable textile remains. Its Mobile Laboratory (Mob Lab) brings these technologies directly into the field, enabling in-situ diagnostics, first aid and long-term conservation interventions.

The centre's digital agenda includes a fruitful collaboration with the University of Padua on the Open Access *Roman Textile Database*. This platform is designed to host and disseminate spatial, analytical, and chronological data for scholars worldwide, facilitating collaborative analysis and digital preservation of textile-related data.

A3Tex is committed to fostering collaboration with both academic institutions and external partners, including museums, research centres, and private enterprises. By offering its expertise and advanced analytical capabilities, the centre supports a wide range of projects aimed at documenting, studying, conserving, and understanding ancient textiles. Among these, the European project *TEXTaiLES*, funded under the Horizon programme, seeks to

create a comprehensive technological ecosystem for textile digitisation, utilising a combination of various acquisition techniques (photogrammetry, 3D scanning, micro-CT scanning, RTI, and multispectral imaging), artificial intelligence, and robotics to deliver tools, strategy and digital replicas for creating and populating the new European Cloud for Cultural Heritage (ECCCH) (fig. 2).

The *ArchTex* project, supported through the Marie Skłodowska-Curie Seal of Excellence and Sapienza SAPI-Excellence programme, focuses on the textile remains excavated at Herculaneum and the wider Vesuvian area. At the national level, A3TEX leads the PRIN-funded *ADigTex* project, which aims to integrate to integrate archaeology, archaeometry, and digital humanities in Roman textile research. Together, these and other research projects position the centre as a scientific hub with tangible impact on cultural heritage policies, museum practices, and international collaboration.

Beyond research and conservation, A3Tex is deeply committed to fostering the growth of the textile research field by offering training and educational opportunities. The centre provides hands-on training in its laboratories, supports thesis and doctoral research, and contributes to university curricula in Archaeology, Conservation Science, and Fashion Studies. Since 2017, Sapienza students have been able to explore textile archaeology through dedicated courses, such as *Archaeology and Archaeometry of Textiles and History, Production, and Conservation of Heritage Textiles*. Summer schools, workshops, internships,

and second-level master's programmes broaden the centre's educational outreach, engaging both professionals and early-career researchers. In parallel, A3TEX actively promote collaborative training through joint research initiatives with academic institutions and research organisations, fostering knowledge exchange and the development of a dynamic network of expertise. Internship and fellowship opportunities support the professional growth of emerging scholars, offering them the chance to engage in interdisciplinary projects and advance innovative methodologies in textile archaeology.

In July 2025, the centre organised its first summer school, titled *Archaeometry, Conservation, and Digitisation of Archaeological Textiles* (fig. 3), which combined archaeology, materials science, and cutting-edge diagnostic techniques. Through a series of lectures, laboratory exercises, and direct analysis of diverse textile artefacts, the 15 participants acquired theoretical and practical knowledge in documenting, analysing and conserving archaeological textile remains, providing critical insights into analytical procedures based on different material types and conservation status. Thanks to the participation of TEXTaiLES partners, the A3TEX Summer School introduced participants to cutting-edge digital methods and strategies for digitising, communicating and musealising textile heritage. To further enrich the training experience, participants visited the Museum of Roman Ships in Nemi, where they attended seminars and engaged in hands-on activities related to experimental and digital archaeology.

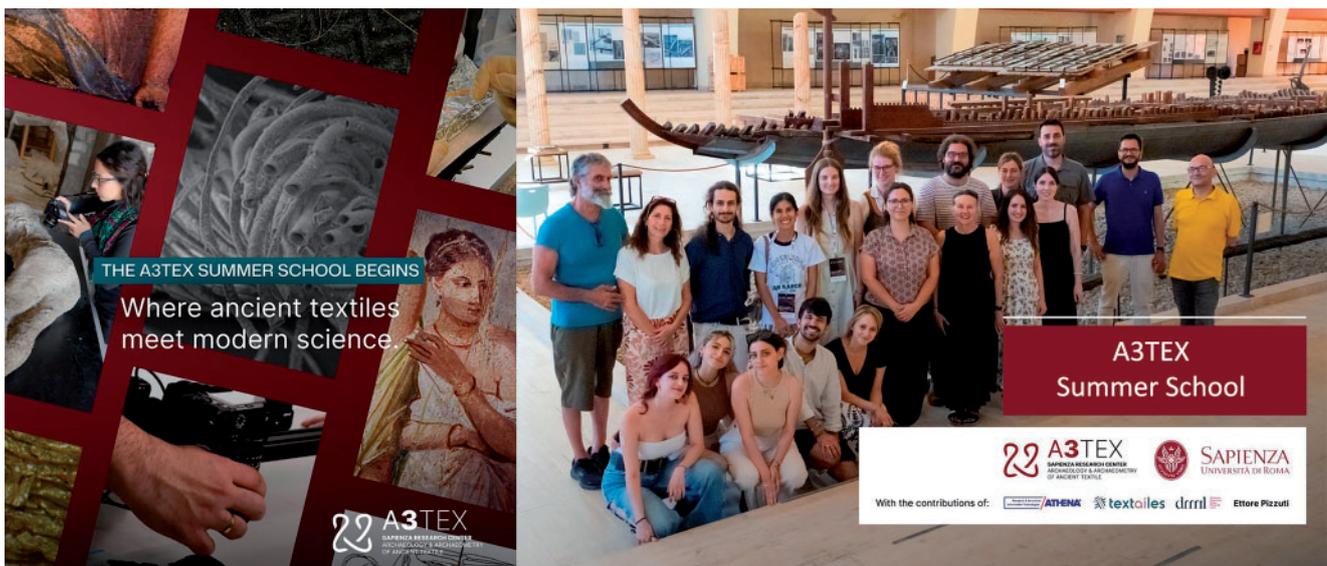


Fig. 3: A3TEX Summer School, <https://www.a3tex.com/summer-school/> (Image: Francesca Coletti)



A3Tex is also committed to expanding its collaborations with both the public and private sectors. The centre actively seeks partnerships that foster joint research initiatives, where its expertise in textile analysis and conservation can contribute to advancing the field.

Whether through collaborative research with other universities or heritage preservation projects with public institutions, A3Tex aims to serve as a catalyst for scientific innovation and knowledge exchange in the field of ancient textile studies. In this sense, A3TEX is not only a centre of research, but also a space of intellectual hospitality. By weaving together disciplines, technologies, and people, the centre aspires to become an open and dynamic hub for knowledge sharing, fostering research and collaboration among scholars and institutions dedicated to textile heritage.

The A3TEX team

Director: Marco Galli, full professor in Classical Archaeology, Department of Science of Antiquities.

Scientific board: Giorgia Annoscia, Emanuela Borgia, Roberta Curini, Marta Andrea, Michelina Di Cesare, Gabriele Favero; Antonio Ferrandes, Vanessa Forte, Rita Francia, Luciano Galantini, Marco Galli, Cristina Lemorini, Anna Maria Iuso, Annalisa Lo Monaco, Alessandro Lupo, Lucia Mori, Davide Nadali, Nucara, Paolo Postorino, Laura Sadori Alessandro, Lorenzo Verderame.

Researchers: Francesca Coletti, Vanessa Forte, Alessadro Ciccola, Ilaria Serafini

Laboratories: Department of Science of Antiquities, LTFAPA Laboratory of Functional and Technological analysis of Prehistoric Artifacts, Cristina Lemorini; Department Environmental Biology, Laboratories of Inorganic and Organic Materials. Gabriele Favero; Department of Chemistry, Laboratory of Mass

Spectroscopy, Proteomics Manuel Sergi; Department of Physics, Laboratory of Infrared Spectroscopy IRS1 and High Pressure Optical Spectroscopy Laboratory, Alessandro Nucara and Paolo. Postorino; Dep. SARAS, LAD Laboratory of Digital Archaeology, Julian Bogdani.

Acknowledgements

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The TEXTaiLES project brings together 10 partners from 8 countries, each contributing specialised expertise in archaeology, conservation, artificial intelligence, robotic engineering, 3D modelling, and cultural heritage digitisation. For more information, see https://research-and-innovation.ec.europa.eu/research-area/social-sciences-and-humanities/cultural-heritage-and-cultural-and-creative-industries-ccis/cultural-heritage-cloud_en.

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