The 2026 Arizona Fiber Study and the Continuing Question of the Shroud's Age

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Abstract

This paper evaluates the significance and limits of Freer-Waters and Jull's 2026 examination of archived textile fragments associated with the University of Arizona's 1988 radiocarbon sample from the Turin Shroud. While the study provides important evidence against strong forms of the repair or "invisible reweave" hypothesis, it does not constitute a new radiocarbon analysis and therefore does not establish the age of the examined fibers or resolve questions concerning the representativeness of the broader sampling region. The paper distinguishes the study's textile observations from Raymond Rogers's earlier chemical findings, considers continuing concerns regarding sample heterogeneity, and argues that unusual textile characteristics—including high thread counts, z-spun yarns, and a 3:1 herringbone twill—demonstrate the Shroud's exceptional quality more securely than they establish a particular date. It concludes that the study is a meaningful contribution but not a final resolution, and recommends transparent, independently documented future analysis of preserved Arizona fibers, including modern AMS radiocarbon testing if sufficient material remains.

Introduction

The publication of "Analysis of Textile Fragments from the 1988 Radiocarbon Samples of the Turin Shroud" by Robert Freer-Waters and A. J. T. Jull represents an important contribution to the continuing discussion surrounding the age and authenticity of the Turin Shroud.[1] Examining archived fibers retained from the University of Arizona's portion of the 1988 radiocarbon sample,

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[1] Robert Freer-Waters and A. J. T. Jull, "Analysis of Textile Fragments from the 1988 Radiocarbon Samples of the Turin Shroud," *Heritage Science* 14 (2026), https://www.researchgate.net/publication/403946154_Analysis_of_textile_fragments_from_the_1988_radiocarbon_samples_of_the_Turin_Shroud

the authors conclude that the material exhibits textile characteristics consistent with the Shroud's known weave structure and provides no evidence of repair, reweaving, dye application, or contamination sufficient to explain the medieval radiocarbon date obtained in 1988.

These findings deserve careful attention. If the fibers examined are representative of the material dated by the Arizona laboratory, the study presents a significant challenge to stronger versions of the repair or "invisible reweave" hypothesis that have been proposed as explanations for the discrepancy between the radiocarbon date and other evidence cited in support of the Shroud's antiquity.

At the same time, the implications of the study should not be overstated.

Scope and Limits of the 2026 Study

The paper is *not* a new radiocarbon analysis. Rather, it is a textile examination of preserved fibers associated with the original Arizona sample. The study therefore provides information regarding the composition and appearance of the fibers, but not their age. Demonstrating that fibers appear consistent with the Shroud's textile structure is not equivalent to establishing that the medieval radiocarbon date necessarily reflects the age of the cloth as a whole.

This distinction is particularly important because the questions addressed by Freer-Waters and Jull are not identical to those addressed by Raymond N. Rogers, a physical chemist, former director of chemical research for the Shroud of Turin Research Project (STURP), and a member of the 1978 STURP team. Rogers' conclusions concerning the radiocarbon sample area were not based solely upon the existence of a repaired corner. Rogers's findings deserve independent and direct consideration. His conclusion concerning the radiocarbon sample area rested not upon a single observation or merely the possibility of a repaired corner, but upon a converging set of

reported chemical differences—including cotton content, dye residues, gum coatings, and vanillin distribution—between fibers associated with the radiocarbon region and fibers from the main body of the cloth.[2] The 2026 study does not directly evaluate all of those chemical observations. Its findings should therefore be understood as addressing the physical characteristics of the retained Arizona fragments rather than as a comprehensive assessment of Rogers's chemical case. For this reason, the new findings should be understood as challenging *aspects* of Rogers' hypothesis rather than constituting a comprehensive refutation of it.

Likewise, caution should be exercised before interpreting the absence of evidence for repair as evidence that no heterogeneity existed within the sampling region. The authors examined a limited quantity of surviving material and acknowledge that the analyzed fragments represent only a small and potentially non-uniform subset of the original sample.[3] As with any sampling study, conclusions are necessarily constrained by the quantity and representativeness of the available material. The study found no evidence of repair or reweaving within the fibers examined. It does not follow that every question concerning the representativeness of the broader sampling area has therefore been resolved.

The study also leaves unaddressed broader statistical questions that have been raised concerning the 1988 radiocarbon results. Various researchers have argued that the measurements exhibit

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[2] Raymond N. Rogers, "Studies on the Radiocarbon Sample from the Shroud of Turin," *Thermochimica Acta* 425, nos. 1–2 (2005): 189–94, https://doi.org/10.1016/j.tca.2004.09.029; Raymond N. Rogers, *A Chemist's Perspective on the Shroud of Turin* (2008), https://realseekerministries.wordpress.com/wp-content/uploads/2022/11/ray-rogers-a_chemist_s_perspective_on_the_shroud_of_turin.pdf; John L. Brown, "Microscopical Investigation of Selected Raes Threads from the Shroud of Turin" (technical report, 2005), https://www.shroud.com/pdfs/brown1.pdf.

[3] Freer-Waters and Jull.

patterns suggesting possible heterogeneity within the sample region.[4] Whether such arguments ultimately prove persuasive is beyond the scope of the present discussion. Nevertheless, these issues are not addressed by the textile analysis itself and therefore remain subjects for continued investigation.

Textile Sophistication and Chronological Inference

A particularly interesting aspect of the discussion concerns the authors' observations regarding the textile itself. Freer-Waters and Jull note the unusually high thread counts, z-spun yarns, and 3:1 herringbone twill weave structure present in the Shroud and suggest that these characteristics indicate a more technologically *advanced* period than that represented by the archaeological control samples.[5]

The observations themselves are valuable. The inference, however, warrants caution.
Rarity alone does not establish chronology. An artifact may be unusual because of date, geography, intended function, economic value, specialized manufacture, or simple survival bias within the archaeological record. Consequently, the observation that the Turin Shroud differs from most surviving textiles of a given period does not, by itself, demonstrate that it originated outside that period.

Indeed, the Shroud presents a methodological challenge because its textile characteristics appear unusual regardless of the chronological framework adopted. Comparable examples are scarce not

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[4] Marco Riani, Anthony C. Atkinson, Giulio Fanti, and Fabio Crosilla, "Regression Analysis with Partially Labelled Regressors: Carbon Dating of the Shroud of Turin," *Statistics and Computing* 23, no. 4 (2013): 551–61, https://doi.org/10.1007/s11222-012-9329-5; Tristan Casabianca, Emanuela Marinelli, Giuseppe Pernagallo, and Benedetto Torrisi, "Radiocarbon Dating of the Turin Shroud: New Evidence from Raw Data," *Archaeometry* 61, no. 5 (2019): 1223–31, https://doi.org/10.1111/arcm.12467

[5] Freer-Waters and Jull

only in earlier periods but also in later centuries. The scarcity of parallels may therefore establish the exceptional nature of the textile more securely than it establishes its date.

Comparative textile studies are most persuasive when supported by extensive populations of comparable artifacts. The Turin Shroud remains unusual precisely because such close parallels are lacking. Whether this atypicality is best explained by chronology, geography, specialized production, economic status, or some combination thereof remains an open question. Textile history offers cautionary parallels: elite and specialized textiles can display thread counts, fineness, and technical refinement far exceeding ordinary fabrics from the same chronological setting. Exceptional construction may therefore reflect intended function, workshop specialization, access to superior raw materials, or social status rather than chronology alone.[6]

This observation becomes particularly relevant when viewed within the historical context of the Gospel accounts. The burial cloth purchased by Joseph of Arimathea is described as a fine linen cloth acquired specifically for burial.[7] Such descriptions would naturally suggest a textile of unusually high quality rather than an ordinary fabric representative of the broader archaeological record. This observation neither proves nor disproves authenticity. It merely cautions against treating exceptional textile quality as a chronological indicator in itself.

The Broader Context and Future Research

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[6] Ann Pollard Rowe, *The Art and Archaeology of Ancient Peru* (New Haven: Yale University Press, 1994), 168–75; Mary Frame, "The Visual Images of Fabric Structures in Ancient Peruvian Art," in *The Junius B. Bird Pre-Columbian Textile Conference*, ed. Ann Pollard Rowe (Washington, DC: Textile Museum, 1979), 47–80; Elizabeth J. W. Barber, *Prehistoric Textiles: The Development of Cloth in the Neolithic and Bronze Ages with Special Reference to the Aegean* (Princeton, NJ: Princeton University Press, 1991), 31–36.

[7] Matthew 27:59; Mark 15:46; Luke 23:53.

The significance of the present study should also be evaluated within the broader context of Shroud research, where multiple independent lines of evidence have been advanced both for and against authenticity. Long before repair hypotheses were proposed to explain the radiocarbon date, researchers associated with STURP identified characteristics of the image that continue to generate discussion, including its superficiality, apparent photographic negativity, three-dimensional information content, and the absence of a generally accepted mechanism capable of reproducing all observed image characteristics simultaneously.[8]

Whether these observations support authenticity remains debated, but they lie outside the scope of the Arizona textile study and are neither resolved nor made irrelevant by it. The Shroud question involves radiocarbon dating, textile analysis, chemistry, image formation, archaeology, history, and documentary evidence; progress will come through the convergence of these independent lines of inquiry, not from any single experiment.

The retained Arizona fibers were not subjected to new radiocarbon testing. The study therefore offers conclusions about their textile characteristics, not their age. If sufficient material remains, modern AMS testing should be considered under fully transparent conditions. High-resolution imagery, chain-of-custody records, laboratory procedures, calibration methods, and raw data should be publicly available for independent review, with qualified researchers representing differing perspectives involved in the process. The aim should be not to defend a predetermined conclusion, but to maximize confidence in the data. Because questions about the 1988 sampling

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[8] John P. Jackson, Eric J. Jumper, and William R. Ercoline, "Correlation of Image Intensity on the Turin Shroud with the 3-D Structure of a Human Body Shape," *Applied Optics* 23, no. 13 (1984): 2244–70, https://doi.org/10.1364/AO.23.002244; John H. Heller and Alan D. Adler, "Blood on the Shroud of Turin," *Applied Optics* 19, no. 16 (1980): 2742–44, https://doi.org/10.1364/AO.19.002742.

procedures and data accessibility have persisted for decades, such transparency would benefit every side of the discussion, whatever the result.

Conclusion

Freer-Waters and Jull contribute evidence against stronger forms of the repair hypothesis and add important data concerning the Arizona radiocarbon sample area. Their study, however, does not resolve the Shroud's age or authenticity, which remain cumulative questions not settled by any single line of evidence. This is especially important in light of earlier work by M. Sue Benford and Joseph G. Marino, who argued from documented sample photographs and the reported distribution of the 1988 dates that the radiocarbon region may have been heterogeneous.[9] The preserved Arizona fibers offer a valuable opportunity for further investigation; if tested under transparent, independently documented conditions, they could substantially advance understanding of one of history's most studied and debated artifacts.

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[9] M. Sue Benford and Joseph G. Marino, "Evidence for the Skewing of the C-14 Dating of the Shroud of Turin Due to Repairs," paper presented at the Worldwide Congress *Sindone 2000*, Orvieto, Italy, August 28, 2000, https://www.shroud.com/pdfs/marben.pdf?utm_source=chatgpt.com; M. Sue Benford and Joseph G. Marino, "Discrepancies in the Radiocarbon Dating Area of the Turin Shroud," *Chemistry Today*26, no. 4 (2008): 4–12, https://www.shroud.com/pdfs/ohiomarino3.pdf; Joseph G. Marino, *The 1988 C-14 Dating of the Shroud of Turin: A Stunning Exposé* (2024).