The setting for the radiocarbon dating of the Shroud

Valencia, April 28-30, 2012

Emanuela Marinelli

Edward Hall (left), Michael Tite (centre) and Robert Hedges at the British Museum after revealing their findings on the shroud.

Abstract

La datación por el carbono 14, que tuvo lugar en 1988, colocó el origen de la Síndone entre 1260 y 1390 d. de C. ; pero la reconstrucción de los acontecimientos que llevaron a este análisis, y las polémicas que siguieron su realización, echan fuertes sombras sobre la validez del resultado. Los procedimientos seguidos para la realización del examen con el carbono 14 no fueron todos regulares.

La historia de los acontecimientos y de los traumas sufridos por la reliquia la convierten en un sujeto difìcil, cuya datación radiocarbónica no puede darnos datos seguros. La muestra analizada, por sus caracterìsticas particulares, no representaba toda la sábana. En consecuencia, segùn la datación por radiocarbono, no se puede decir en absoluto que la fabricación de la Síndone se remonta a la mitad del siglo XIV.

E.Hall M.Tite R. Hedges

The Shroud dating with the method of radiocarbon, performed in 1988, placed the origin of the cloth between 1260 and 1390 A.D. Can we therefore conclude that the manufacture of the Shroud must be placed in the middle of the fourteenth century?

To answer this question, however, we must first ask ourselves other questions. Have all the procedures followed for the development of radiocarbon tests been regular? May the Shroud have undergone changes that affected the radiocarbon dating? Was the analyzed sample representative of the whole cloth? The existing data allow an investigation of these issues and the conclusions will therefore gain a better ground.

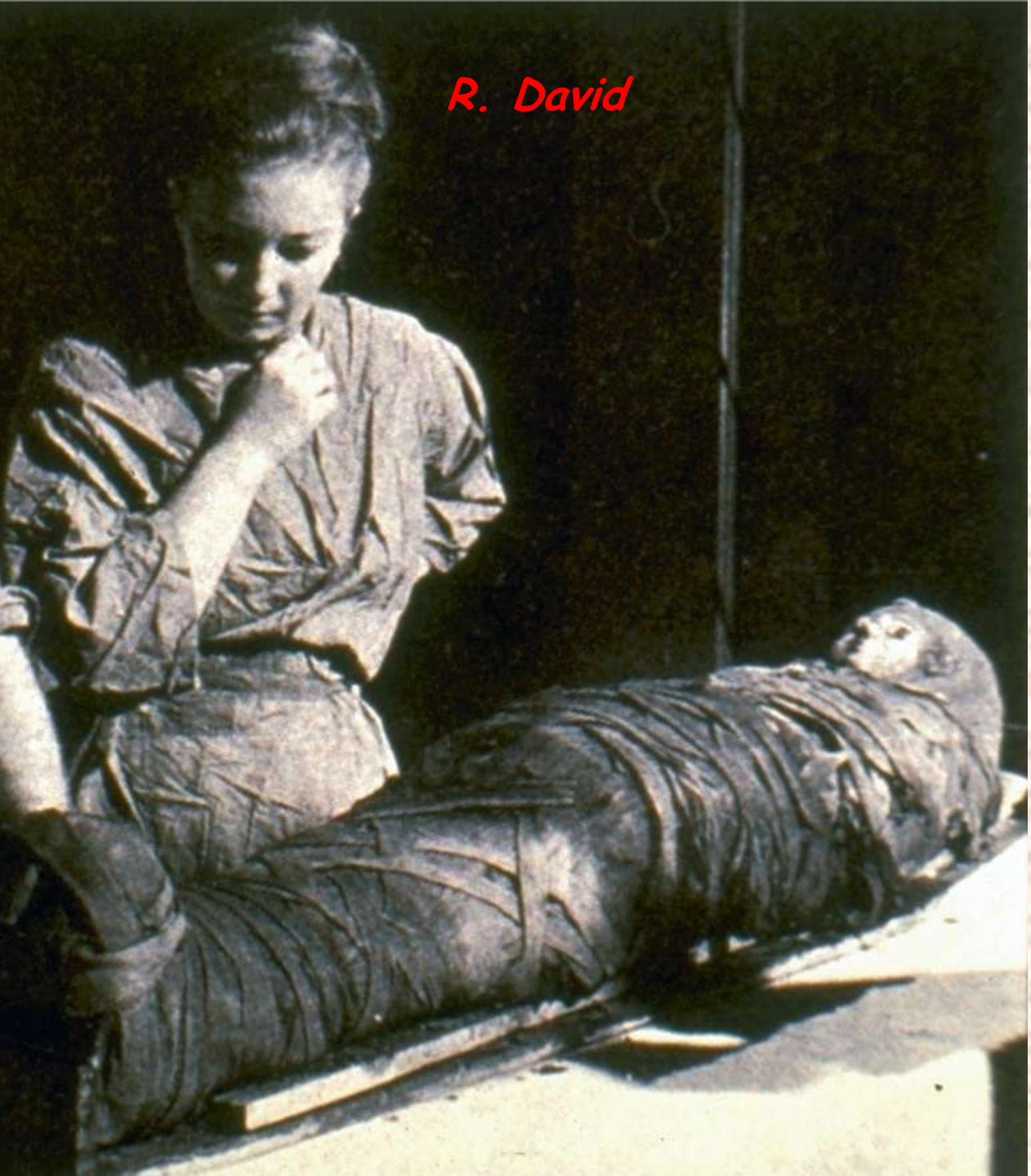
Have all the procedures followed for the development of radiocarbon tests been regular?

H.Gove

In the late 70s there were two different radiocarbon dating techniques: the conventional counting method and the new method of the Tandem accelerator developed by physicist Harry Gove and associates at the University of Rochester (NY, USA). The accuracy provided by the new method was about 150 years. But competition started among laboratories that used the new method, still not much tested on cloths, and those who continued to date with the conventional method.

In 1982 a proposal to perform the Shroud dating came informally from the laboratories of Tucson (AZ, USA), Oxford (UK) and Harwell (UK); the response, only verbal, was interlocutory, but it was specified that it was desirable perform the dating in a multidisciplinary-research context. In that year physician and biophysicist John Heller of the New England Institute for Medical Research in Ridgefield (CT, USA) sent to the University of California a thread of the Shroud extracted from the area of the sample taken from the Shroud in 1973 and examined by Gilbert Raes, director of the Institute of Textile Technology in Ghent (Belgium). The thread was divided into two parts and dated: one half turned out to date back to 200 A.D. and the other half to 1000 A.D. It should be pointed out that one of the two halves was starched.

In 1983, in order to verify the actual chance of dating the Shroud, the British Museum coordinated a comparison among six laboratories that had expressed an interest in dating the relic. They received two samples to be dated: one sample was Egyptian, made of linen and dating back to 3000 B.C., and the other was Peruvian, made of cotton and dating back to 1200 A.D. One of the laboratories, the one in Zurich, used a new method of pretreatment that introduced contamination to such extent as to move the dating of about a thousand years. And there was also another problem: the Peruvian cloth turned out to be for everybody more recent (1400-1668 A.D.) than it actually was, so it was replaced with another sample without explanation. The problems with the new method of pretreatment and the first Peruvian fabric confirmed that the radiocarbon analysis could not be considered an infallible verdict.



One of the cases of problematic radiocarbon dating is that of the mummy 1770 of the Manchester Museum (UK). The Egyptologist Rosalie David wrote in 1988: "The carbon dating provided different dates for the bones and the bandages of the mummy (the bones were approx. 800-1000 years «older» than the bandages). (…) The resins and unguents used in mummification may affect the bandages and bones in ways which affect the carbon dates. (…) From our experience, carbon dating of mummified remains and their associates bandages has produced some unexpected and controversial results". In a subsequent dating the difference between bones and bandages was reduced to 340 years.


Card. A. Ballestrero


Card. J. Ratzinger

On the advisability of dating the Shroud, Cardinal Anastasio Ballestrero, Archbishop of Turin and Custodian of the Shroud, asked the Congregation for Divine Worship and the Congregation for the Doctrine of the Faith, obtaining the nihil obstat from both. Cardinal Joseph Ratzinger, at that time Prefect of the Congregation for the Doctrine of the Faith, stated that there were no objections to date the Shroud, provided that the operation was well planned and carried out among other tests that would complete those of 1978.

FORMAL PROPOSAL FOR
PERFORMING SCIENTIFIC RESEARCH
ON THE
SHROUD OF TURIN

SUBMITTED BY THE
SHROUD OF TURIN RESEARCH PROJECT, INC

After the multidisciplinary research carried out in 1978, in 1979 the STURP (Shroud of Turin Research Project) had formed a Committee on the radiocarbon and in 1984 developed another multidisciplinary program, which aimed to answer 85 questions. One of the questions was: "How old is the Shroud"? To answer this question, the STURP would have taken six samples and have them delivered to the laboratories of Brookhaven, Harwell, Oxford, Rochester, Tucson and Zurich. The new STURP program, with the proposal of 26 tests to be performed on the Shroud, was sent to the Vatican, who forwarded it to the Pontifical Academy of Sciences and to the Congregation for the Doctrine of the Faith.

In the covering letter, Cardinal Ballestrero suggested a meeting among the scientists and engineer Luigi Gonella, professor of Physics Instrumentation at the Polytechnic of Turin and scientific consultant of the Cardinal. What happened next was thus described by Gonella: "For reasons that Cardinal Ballestrero and I were never able to understand, a deployment formed aiming at excluding any research that was not the radiocarbon dating".

The arrangements for the meeting were very painful. After many disputes and difficulties, it was settled from 29 September to 1 October 1986 at Turin seminary. Gonella commented bitterly: "It was two years since Cardinal Ballestrero proposed a meeting to discuss a proposal for a multidisciplinary research and now we find ourselves discussing only the radiocarbon dating and in a very tense climate, with unclear alternative proposals".

The meeting was attended by the physicist Michael Tite, director of the research laboratory of the British Museum in London, the representatives of the six laboratories interested in the dating and of the laboratory of Gif-sur-Yvette (France) as well. Representatives of the Pontifical Academy of Sciences and STURP, Gonella and other scientists were also present. The discussion grew hot on the size and number of the samples, their certification and the use of control samples.

W.Meacham

M.Flury-Lemberg

Everybody agreed that the Swiss textile expert Mechthild Flury-Lemberg would be entrusted with the sampling. Archaeologist William Meacham, of the University of Hong Kong, considered contamination a very serious issue. He, reminding the use of dating different samples of a site, proposed to take samples from various parts of the cloth, but Flury-Lemberg objected strongly, thinking that the borders could not be more contaminated than the rest of the fabric. STURP suggested to take samples at least in three different areas of the sheet.

H.Gove

L.Gonella

Gove insisted that no other tests on the Shroud could be performed until the date of origin was known, in opposition to Gonella who wanted the sampling to be appropriately put in the context of the other tests.

C.Chagas

The President of the Pontifical Academy of Sciences, the Brazilian biologist Carlos Chagas, sent to the Secretary of State a report on the meeting in Turin, but that report had not been read and signed by the participants.


H.Gove

Gove published it stating that it was an agreement signed during the meeting, without even informing Turin authorities. The amount of the sampling had not been defined, the opposite of what Gove wrote, but the multidisciplinary approach of the operation was actually maintained, and Gove was not satisfied.

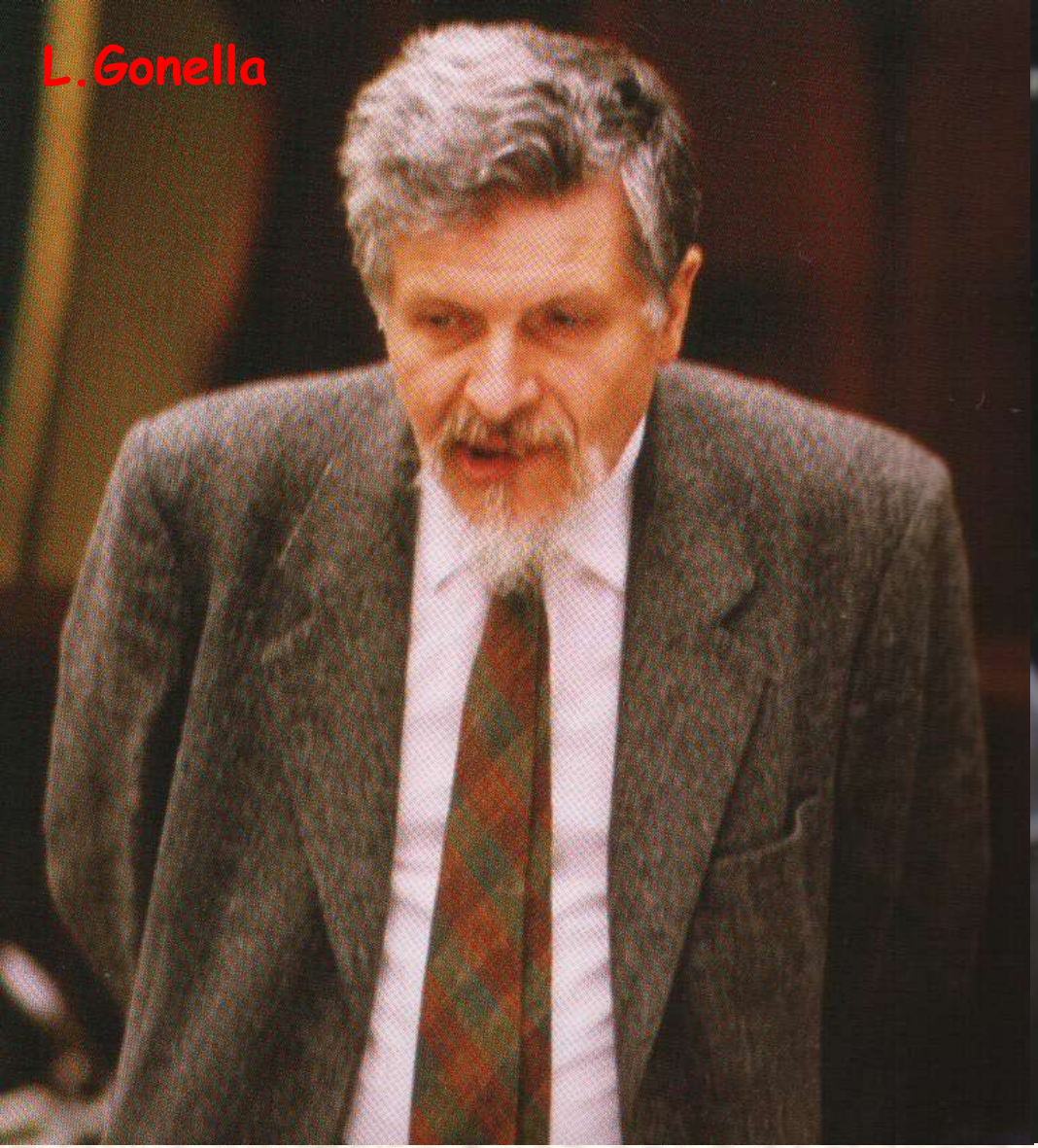
H.Gove C.Chagas

Chagas sided with Gove and wrote to the Secretary of State that STURP intended to perform tests considered dangerous by the radiocarbon experts. This taking up a position was followed by another hot period, marked by maneuvers by Chagas and Gove to prevent at all costs any other test, keeping only the dating. They reached their goal, but in May 1987 from the Secretary of State the decision came to grant the removal of only three samples. Thus, the laboratories had also to be reduced to three. The choice was made in Turin.

Gove's laboratory was excluded and furious protests broke out. Some laboratories claimed that accelerator technology was not ready yet, primarily because of the high number of spurious readings from small samples. The bulletin of the Secretary of State did not mention the other tests, which were postponed and never carried out.

From left to right: R.Hedges, D.Donahue, E.Hall, P.Damon, W.Wölfli

In this poisonous atmosphere they arrive at the meeting, held in London on January 22, 1988 in the headquarters of the British Museum. The representatives of the three chosen laboratories, the University of Arizona (Tucson), the University of Oxford and the Federal Institute of Technology in Zurich, all equipped with the new accelerator method, attend with Gonella. They admit that the blind test is impossible and claim that the sampling must be from a single site to better ensure the homogeneity of results.



Gonella agrees, to minimize the defacement of the cloth. The sampling site will be indicated by a qualified textile expert, chosen by the Custodian of the Shroud, who will entrust a person with carrying out the sampling itself. Control samples, dating from first and fourteenth century, would be provided by Tite.

From left to right: R.Hedges, D.Donahue, E.Hall, P.Damon, W.Wölfli

The representatives of the laboratories ask to attend to the sampling. They intend to come to Turin to take samples to ensure the chain of evidence.

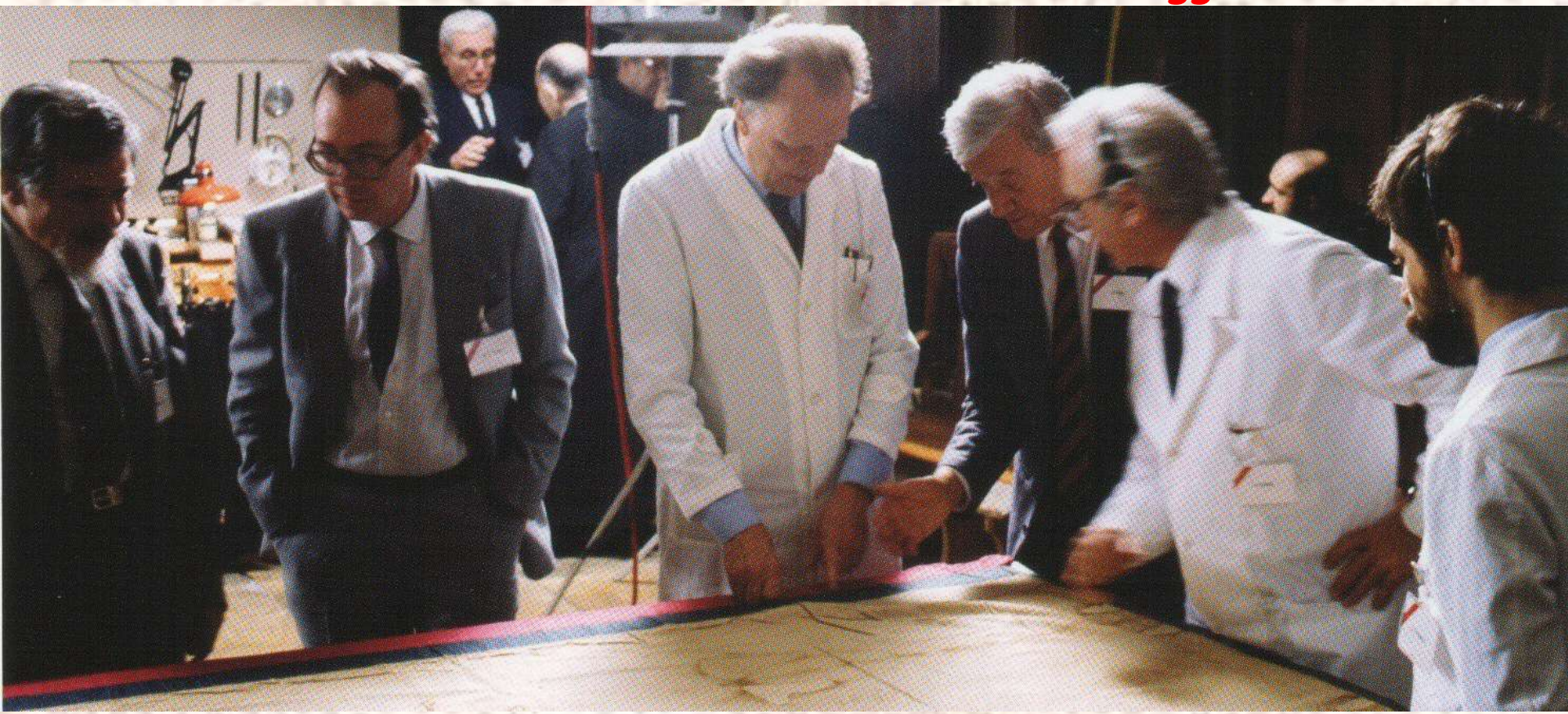
Gonella replies that their presence should not be linked to the certification of the samples but they could be admitted as guests. They committed themselves to completing the measures within three months and to maintain the strictest confidentiality. The representatives of the laboratories ask that the Custodian himself has to make the results public. Cardinal Ballestrero approved the proposals of the London meeting, leaving the point of the results public release unsettled.

Tite published a summary of the London agreements. The radiocarbon dating of the Shroud will be performed by the three laboratories of Tucson, Oxford and Zurich. Each laboratory will be provided with a 40 mg sample from the Shroud, as whole piece, not unravelled or shredded, and two known-age control samples. A blind test procedure will be adopted. The Shroud sample will be taken from a single site, away from any patches or charred areas. The removal will be undertaken under the supervision of a qualified textile expert. All the samples will be weighed, wrapped in aluminium foil and sealed in numbered stainless-steel cases.
All the operations will be certified by Cardinal Ballestrero and Tite. Immediately after the packaging of the samples, they will be all handed over to representatives of the three laboratories who will be in Turin for this purpose. All stages of the operation will be fully documented by video recording and photography.

On the completion of the measurements, the laboratories will send their data to Tite and to the Institute of Metrology "G. Colonnetti" in Turin for preliminary statistical analysis. The laboratories agreed not to discuss their results with each other until after they have deposited them for statistical analysis. A final discussion of the measurement data will be made at a meeting in Turin among representatives of the British Museum, of the "Colonnetti" and of the three laboratories, to whom identification of the three samples will be revealed in this occasion. The results as finalized at this meeting will be a basis for both a scientific paper and a communication to the public.

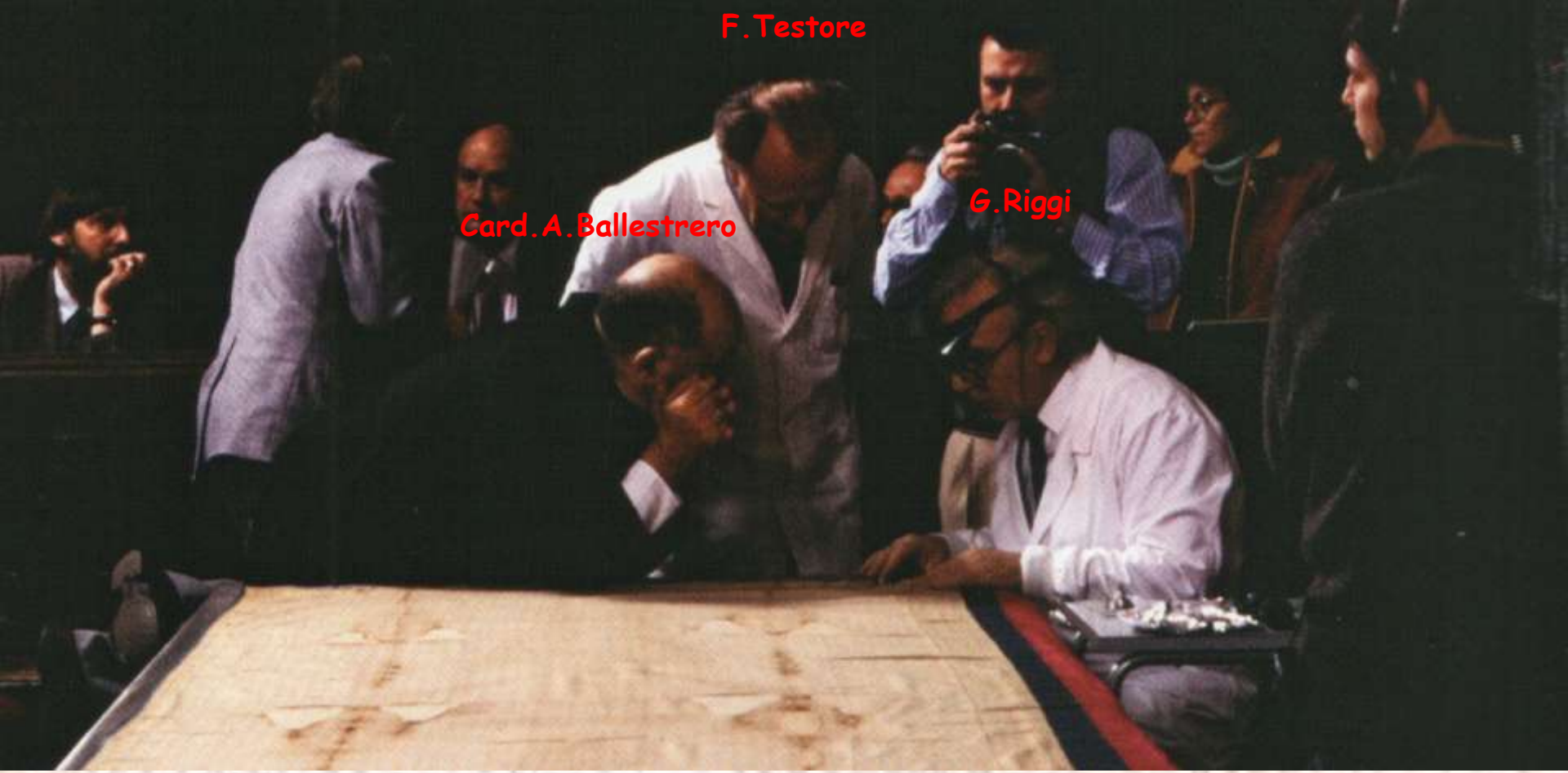
This protocol elicited the reaction of Gove, who emphasized seven points of difference from the original protocol of 1986: 1. The laboratories are reduced from seven to three. This eliminates the possibility of detecting a mistake made in the measurement by one or more of the three laboratories. Such mistakes are not unusual. 2. The use of the two dating methods has been reduced to one. 3. The amount of cloth that each laboratory will receive has been doubled. With this further material other laboratories could be included. 4. Representatives of the laboratories will not be allowed to observe the sampling. 5. The samples will not be unravelled, and thus that of the Shroud will be more easily identifiable. 6. The Pontifical Academy of Sciences was unaccountably excluded. 7. The acknowledged textile expert selected to remove the sample was replaced by an unnamed person. Gove, who had just misread the section 4, concludes: "All these unnecessary and unexplained changes unilaterally dictated by the Archbishop of Turin will produce an age for the Turin Shroud which will be vastly less credible than that which could have been obtained if the original Turin Workshop protocol had been followed. Perhaps that is just what the Turin authorities intend".

L.Gonella M.Tite F.Testore G.Vial G.Riggi

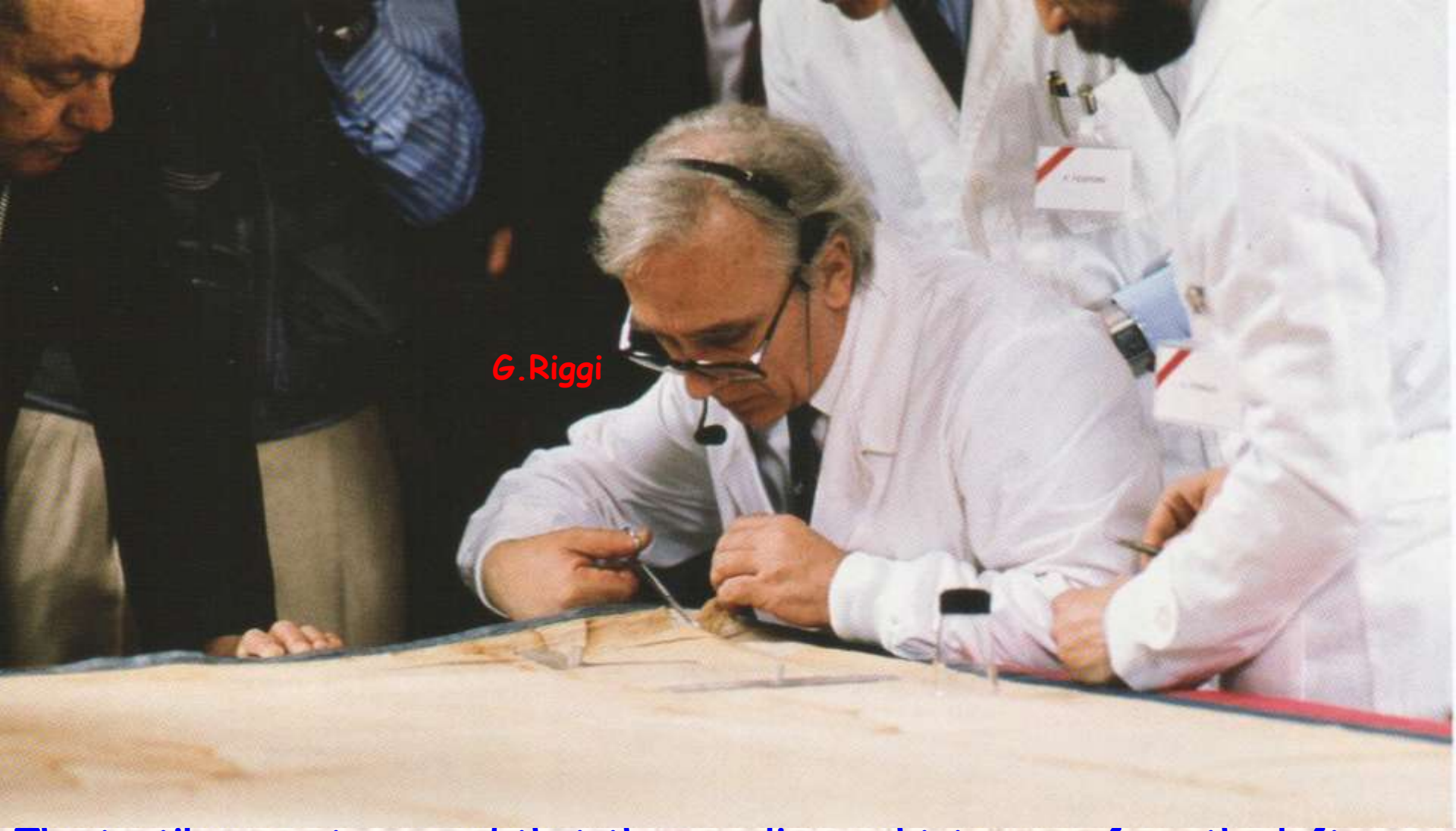


The sampling took place on April 21, 1988. The execution was entrusted to technician Giovanni Riggi in the presence of two textile experts, Franco Testore, professor of Textile Technology at the Polytechnic of Turin, and Gabriel Vial, general technical secretary of the International Center for Study of Ancient Textiles in Lyon (France). Cardinal Ballestrero, Gonella, Tite, the responsibles of the laboratories entrusted with the dating, the priests in charge of the case opening and the representatives of the Ministry for Cultural Heritage were there too.

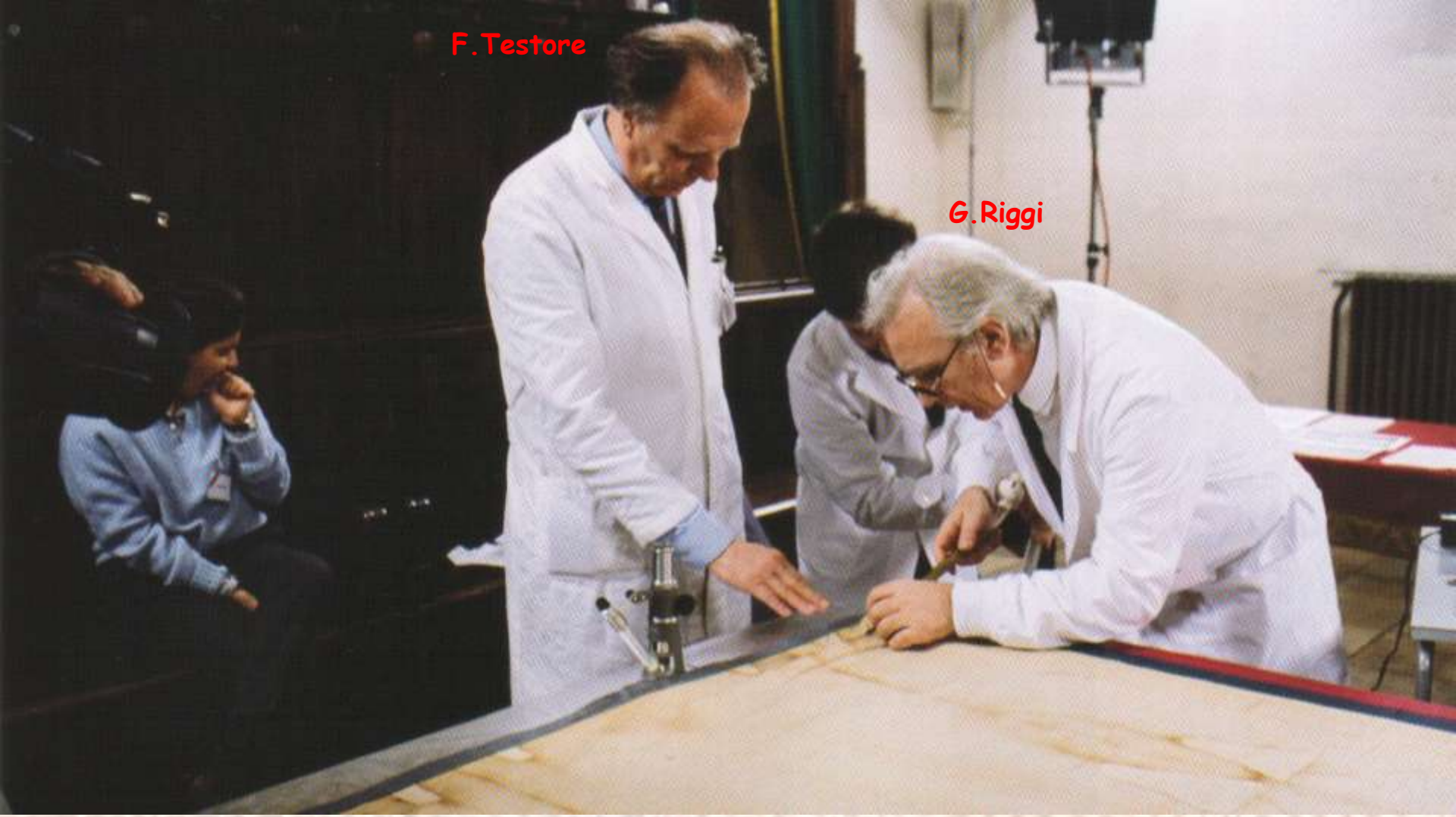
There is no report or document summarizing the actual sampling conditions and Riggi himself will comment: "Who fantasized and was not soft in criticism and accusations, perhaps was not entirely wrong; because without documents to rely on, every fantasy was possible, every doubt was permissible and every conclusion, incorrect or unjust, when not authoritatively contradicted, could be reasonable".



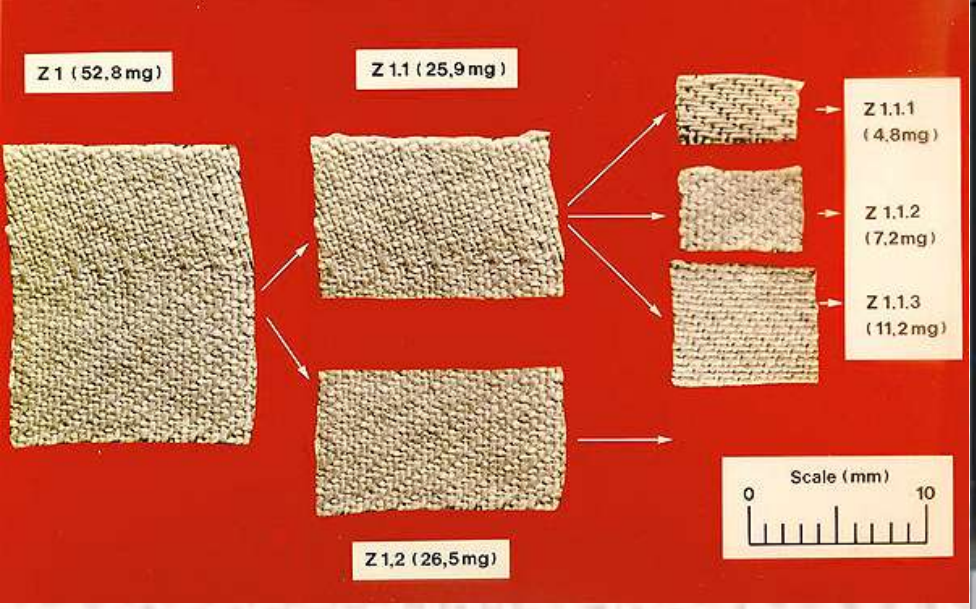
When the four floodlights were switched on, pointing toward the ceiling, the sudden increase of light caused an immediate reaction from the Superintendent of Cultural Heritage of Turin, who asked to reduce lighting power to avoid damage to the Shroud. Riggi reluctantly resigned to the request because "the poor visibility of the details of the cloth could make uncertain the observation and critical any technical precision intervention on the cloth". The variation of brilliancy put in serious trouble Testore, Vial, Tite and Riggi, who had to operate "in a generalized semi-darkness".



The textile experts agreed that the sampling ought to come from the left corner of the frontal image, where the Raes sample was already been taken. A sample larger than necessary was cut to keep a part of it in store. According to Gonella, the numbers of 7 cm x 1 cm "has often been erroneously reported as covering the entire cut"; but this is the measure that appears in the official report of the dating published in *Nature*.



In their reports, presented at the congress held in Paris in 1989, Riggi and Testore unanimously reported that the measure was 8.1 cm x 1.6 cm and that the sample was reduced in size to 7 cm x 1 cm. The trimming was necessary "for the pollution of the cloth itself with threads of a different nature which even in small amounts could have lead to variations in dating, being a later addition".

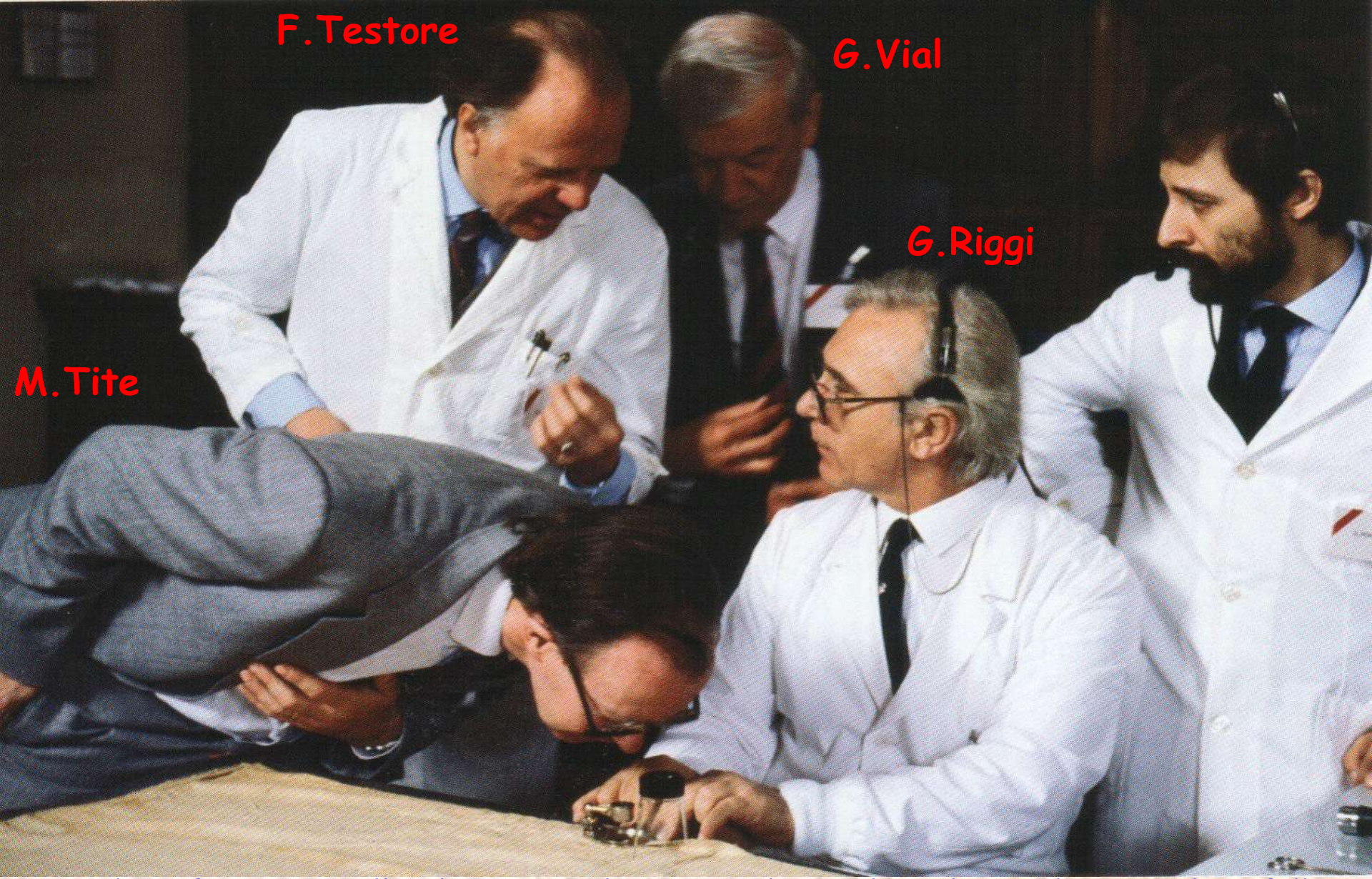


The inconsistency about weights and measurements of the Shroud samples gave way to suspicions of substitution of the cloth fragments.

Three fragments were also cut from the two control samples brought by Tite, which had orthogonal weaving. Because the distinctive herringbone twill weave of the Shroud could not have match in the controls samples, it was possible for any of the laboratories to identify the Shroud sample. Tite found it difficult to obtain a medieval control sample, so Vial brought a few threads of the cope of St. Louis of Anjou, who died in 1297.

Detail of the cope's reverse side

The samples of the Shroud and those brought by Tite, one dating back to the first century and the other to the eleventh century, were introduced in small metal cylinders. The operation took place in the adjacent capitular room at the sole presence of Tite, Gonella and Ballestrero. This delicate moment was not filmed, unlike what was settled in the London protocol.



A reader of *Nature* will ask Tite explanations: he replies that it happened to follow the blind procedure, even if this aspect was "quite illogical, because in that moment we knew that because of the unusual weaving of the Shroud, the blind test was not feasible without unravelling the samples".

Yet Tite emphasizes that the movie would have only been a memorandum, not intended to be an identification proof for the samples, of which he and the Cardinal were guarantors. In any case, he believes that moving to a separate room was "quite unnecessary".

The cases were sealed and delivered to the representatives of the laboratories, who signed a receipt bearing the dates of the two control samples.

Prelievo di campioni della Sacra Sindone per la datazione

Il 21 aprile 1988 in Torino sono stati prelevati dalla S. Sindone tre campioni di tessuto che verranno sottoposti a datazione col metodo del radiocarbonio.

S.E. il Cardinal Anastasio Ballestrero, Arcivescovo di Torino e Custode Pontificio della S. Sindone, ha presenziato all'operazione, ha certificato ufficialmente la provenienza dei campioni con la collaborazione del dott. Michael Tite del British Museum, e li ha personalmente consegnati ai rappresentanti dei laboratori d'analisi che sono venuti a Torino per riceverli di persona.

I campioni, della massa complessiva di circa 150 mg, sono stati ricavati ritagliando una striscia di circa 1 cm per 7 cm.

In ossequio alla procedura di datazione alla cieca, richiesta dai laboratori di analisi, a ciascun laboratorio sono stati consegnati tre contenitori sigillati contenenti il campione sindonico e due campioni di controllo, senza specificare quale campione sia sia stato messo in ogni contenitore. L'identificazione dei campioni, registrata in un apposito registro confidenziale, sarà notificata dopo l'esecuzione delle misure. I campioni di controllo sono stati forniti tramite il British Museum e provengono da un tessuto del I secolo d.C. ed un tessuto dell'XI secolo d.C.; un quarto campione datato a circa 1300 d.C. è stato fornito come controllo aggiuntivo.

Il sito di prelievo è stato scelto in modo da garantire che il campione appartenesse al corpo principale della S. Sindone e che la sua rimozione arrecasse il minor danno possibile al tessuto. La perizia tessile per questa scelta ed il controllo delle operazioni di rimozione è stata affidata al prof. Franco A. Testore, del Politecnico di Torino, coadiuvato da M. Gabriel Vial del Musée Historique des Tissus di Lione.

L'intera operazione è stata videoregistrata e documentata fotograficamente.

22.4.1988

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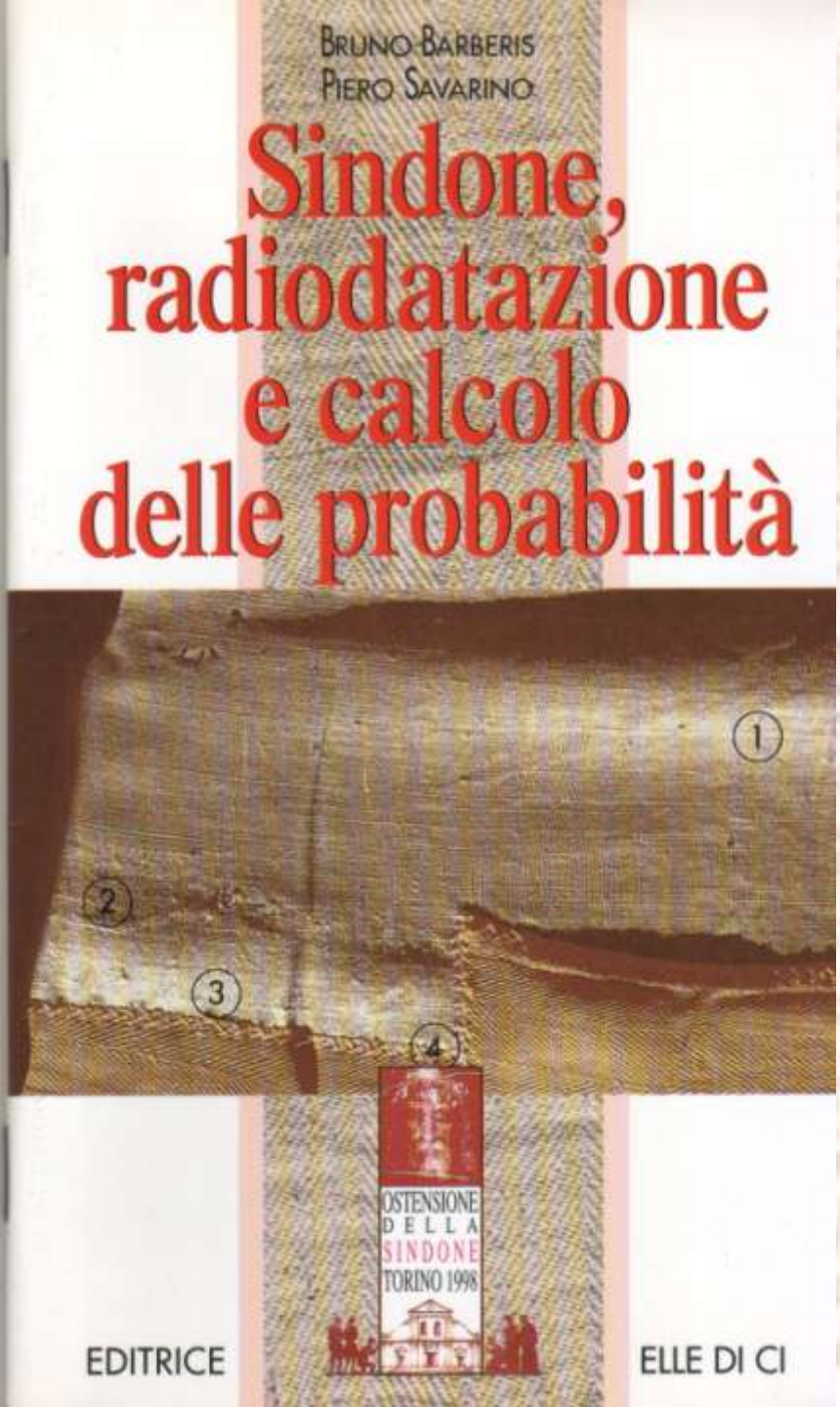
L'Osservatore Romano, 23 Aprile 1988, p.2

On the following day the Vatican Press Office issued a bulletin, published by the *Osservatore Romano*, where, among other things, it is written: "The samples, of the total mass of about 150 mg, were obtained by cutting a strip of about 1 cm x 7 cm". It is also specified that the control samples "come from a cloth dating from the first century A.D. and a cloth from the eleventh century A.D.; a fourth sample, dating from about 1300 A.D., was provided as an additional control. There is also a specification on the sampling area: "The sampling site was chosen so as to ensure that the sample belonged to the main body of the Holy Shroud and that its removal could cause the least possible damage to the fabric".

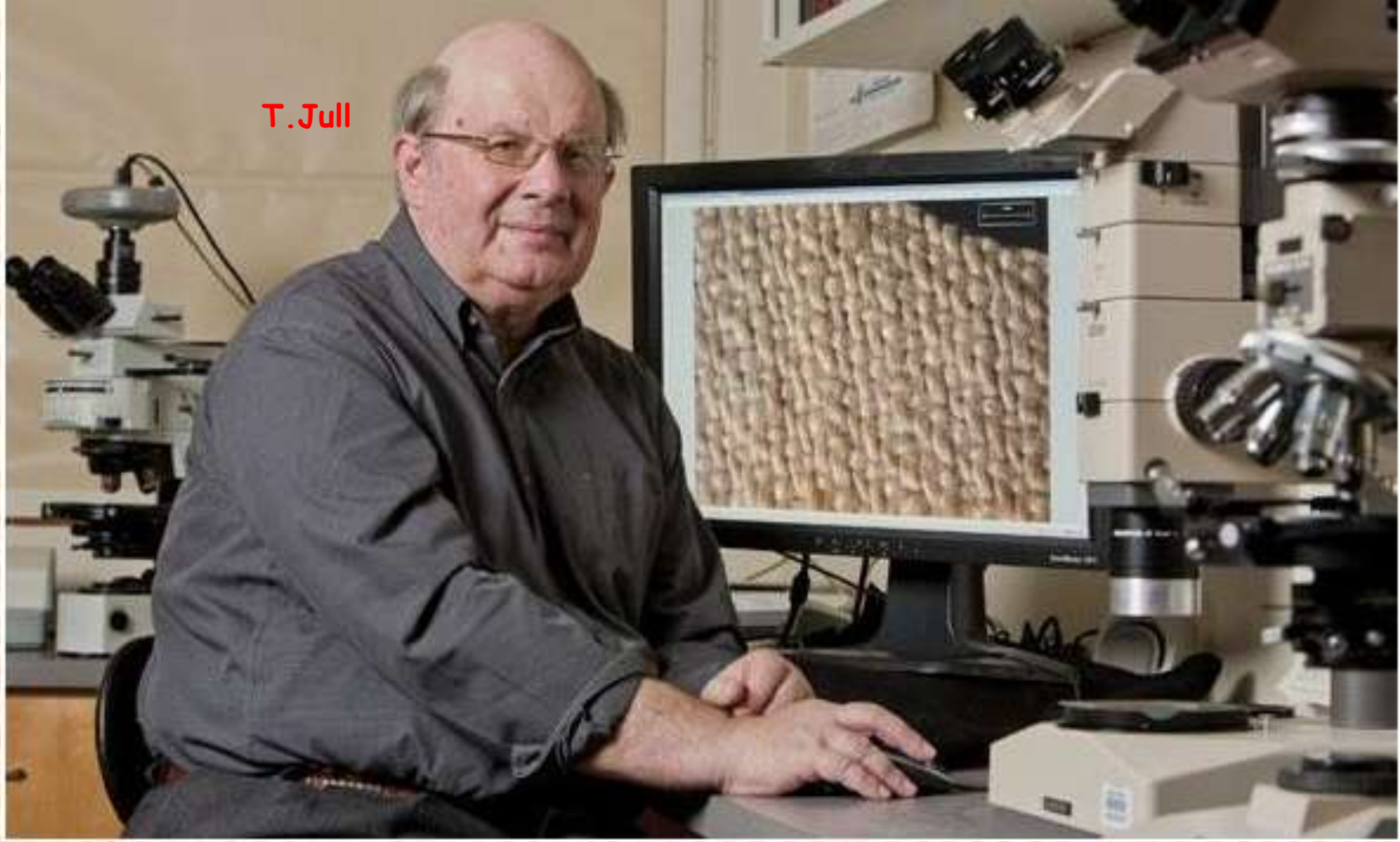
A long wait began, lasting six months. In this period, in May, there were two blatant violations of the confidentiality obligation. In Zurich, the filming of all operations by a crew from BBC *Timewatch* program was allowed. It is reported by Anglican Reverend David Sox, who was also there. Two twill weave cloths and one tabby weave cloth were extracted from the cylinders, while only the Shroud should have presented herringbone weave. Anyway, the Shroud sample was recognized, even if it was minutely smaller than it was in Turin. In the final report in *Nature*, instead, it will be argued that the control samples did not have the same weave of the Shroud. The blind procedure was abandoned. Tite will declare that the decision was taken in Turin as the samples were drawn.

Gove and his administrative assistant Shirley Brignall, with whom Gove had wagered a pair of cowboy boots, were admitted in Tucson. Gove won them. Knowing the result of the dating, Gove later softened the tone of his grievances, and declared that had the three laboratories obtained the same date, it would have been credible. In the meantime he continued to decry STURP members, which he termed "self-appointed religious zealots".

For his part, Gonella complained: "The experts of the British Museum did not trust the Cardinal and wanted to be present when the samples were taken from the Shroud, but then they did not allow a representative of the Church to watch the analysis as an observer".



Chemist Piero Savarino, professor of Industrial Organic Chemistry at Turin University, remarked: "This behavior is truly incomprehensible. It is to be considered that in legal ambit any analysis performed in the absence of the other party is rejected by the courts".



From the description given on *Nature* it is clear that in all three laboratories the samples were fully used for dating. Thereafter, on the contrary, it will be known that in Tucson part of a sample of the Shroud had been kept by chemist Timothy Jull, new director of the Tucson laboratory.

Many years ago, chemist Paul Damon, director of the Tucson laboratory, had already said it: "We have preserved a piece of the sample, if there was a dispute, to show it to the Church authorities".

The director of the Zurich laboratory, physicist Willy Wölfli, also admits that he has preserved a portion of the sample.

LATE PRICES EXTRA

TONIGHT'S WEATHER: HUMID

Evening Standard

LONDON, FRIDAY, 26 AUGUST, 1988

20p

EXPOSED: The face on the shroud of Turin

Turin Shroud is a fake

by Charles Langley

THE HOLY Shroud of Turin has been exposed as a fake by scientists at Oxford University.

The shroud was said to have wrapped the body of Christ after the Crucifixion but new radio-carbon dating tests prove it was made in about 1350.

An official announcement has still to be made by the Keeper of the Shroud, the Cardinal of Turin, Cardinal Anastasio Ballestero, but there now seems little room for doubt that it is the work of a 14th century forger.

The Christ-like figure has been an object of veneration for centuries and believers maintain that the heat generated by the Resurrection burned the imprint of the body of Jesus on to the cloth.

On Page 12 today, Dr Richard Luckett, Fellow of Magdalene College, Cambridge, and the University's Pepys Librarian, who has been closely connected with modern investigations into the history of the shroud, discusses the implications of the discovery.

No longer shrouded in mystery—Page 12

He said: "I think that as far as seems possible the scientific argument is now settled and the shroud is a fake. I suppose there will be certain people who will never want to believe it but it seems unlikely these tests could be 1300 years out.

The carbon dating laboratory at Oxford University was one of three chosen by the Roman Catholic Church to carry out tests on the shroud. The others, at Zurich in Switzerland and Tucson, Arizona, are believed to have produced similar results.

Although many Catholics may be stunned by the news, the Vatican will not be particularly perturbed. The shroud has long been regarded officially as an object "likely to prompt profitable prayer" rather than a true relic of Christ.

In fact as early as 1389 it was denounced by the French Bishop in whose diocese it was discovered as the work of an artist who, "falsely and deceitfully procured for his church a certain cloth upon which, by clever sleight of hand, was cunningly depicted the image of a man that he falsely pretended was the actual shroud in which Our Saviour was enfolded in the tomb."

Studied

The bishop added, in a letter to Pope Clement VII, that the unnamed artist later confessed what he had done.

A spokesman for Cardinal Basil Hume, Roman Catholic archbishop of Westminster, said that the hierarchy would make no comment on the shroud until they had received and studied the full report of the tests.

In July, leaks in English papers start, making a stir and reaching the climax on August 26 with the announcement on the *Evening Standard* front page: "The Shroud is a fake". Historian Richard Luckett of Magdalene College in Cambridge (UK) comments ironically the leak: "Laboratories are rather leaky institutions".

Gonella reacts indignantly when he learns that the ones responsible for the leaking of the news are actually Robert Dinegar, chemist of the Los Alamos National Laboratory in Los Alamos (NM, USA) and member of STURP, and physicist Robert Hedges of Oxford laboratory: "They still have not announced anything to us. It is an ill-mannered behavior. They gave their word. Now they betrayed it".

Also Riggi is angry: "The laboratories committed themselves on their honor to provide that nothing would have leaked. Instead, they have exploited the research, they use the rumors to promote themselves. For sure they don't come out clean".

But the director of the Oxford laboratory, physicist Edward Hall, says candidly: "Frankly, I think it was a hopeless prospect to keep the result secret. You couldn't. With the best will in the world". In the same interview, Hall said he believes the Shroud is a fake; he concedes that there is blood on the sheet, but adds: "But whether it's human or pig's blood – who knows?". Hall wants to ensure the survival of his chair after his retirement and hopes a Sunday newspaper will pay a large sum for the rights to the story of the Shroud dating. He receives one hundred thousand pounds from ITV, the independent television, BBC's rival, and a million pounds from 45 businessmen and "rich friends".

The chair is to be filled by Tite.

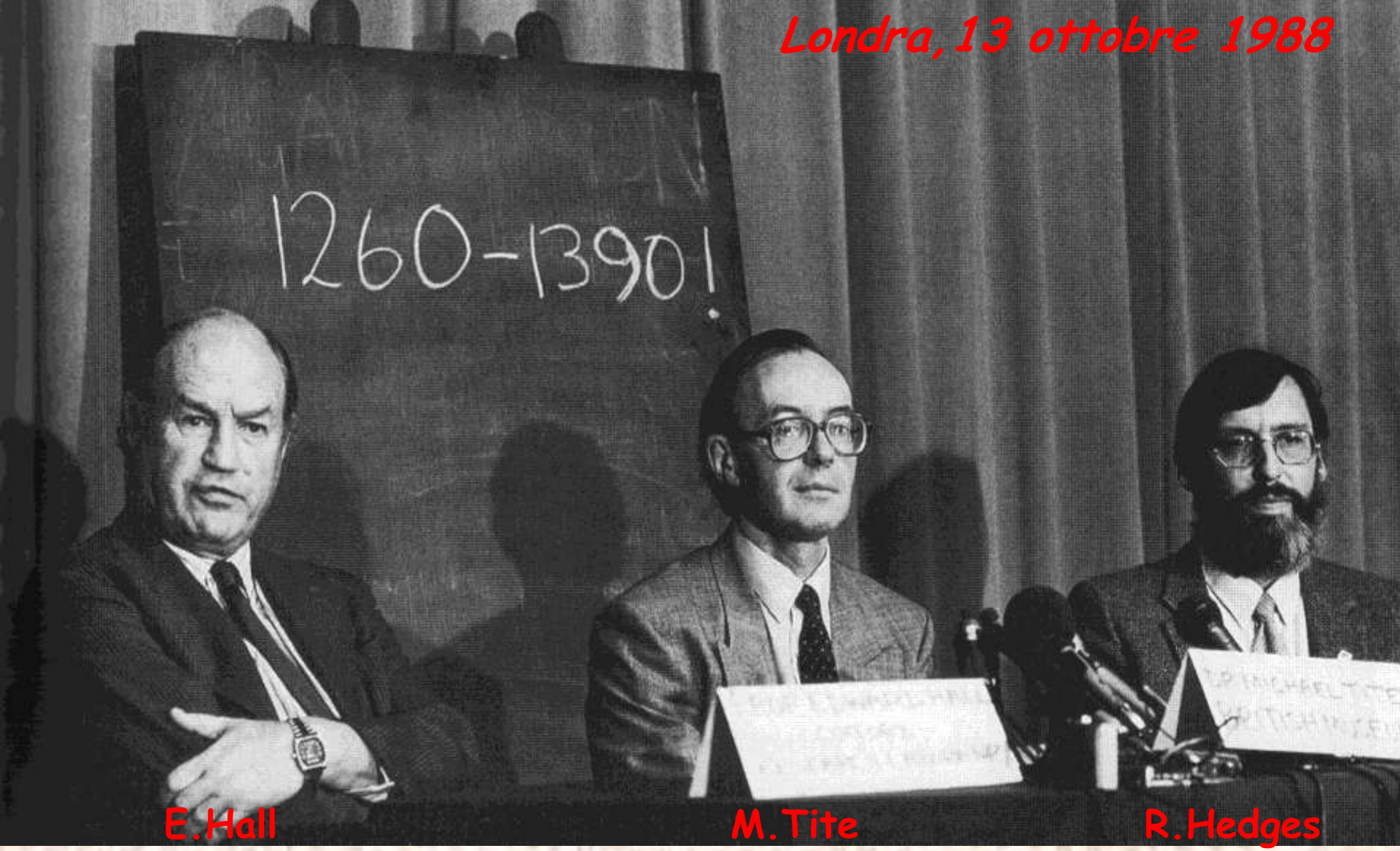
Gonella emphasizes: "Since the beginning, this story of dating the Shroud has been vitiated by publicistic aspects, to which C14 laboratories showed to be even too much sensitive".
The Cardinal's consultant, exasperated, expresses a heavy judgment: "The custodians of the cathedral of Turin behaved more seriously, kept silent about the sampling of seven centimeters of the sheet, than a group of scientists, who took the liberty of violating the secret and of announcing to scandal-seeking tabloids that the Shroud is a medieval fake. In my opinion there is an anti-Catholic conspiracy of specific milieus".


Card. A.Ballestrero

Which milieus? In a later interview, Cardinal Ballestrero will be asked this question: "In this whole affair could the Freemasonry have had a hand? And external pressures?" Cardinal Ballestrero answered: "I think it's indisputable!"

The agreements taken in London in January are completely disregarded. Not only the laboratories did not complete the measures within three months and did not maintain confidentiality, but they did not even send the data to the "Colonnetti" Institute in Turin for the statistical analysis. At this point the "Colonnetti" asks not to be involved anymore and at the Institute only engineer Anthos Bray agrees to be still committed, as a personal favor to Cardinal Ballestrero. The representatives of the laboratories do not meet in Turin as expected to prepare a scientific communication and to give notice of the results to the Custodian, who will be informed by Tite with a letter delivered by hand on September 28. Rumors are that during the summer there was a secret meeting in Switzerland, instead.

The announcement was made in Turin by Cardinal Ballestrero on October 13, in the morning.



On that same afternoon Tite and the representatives of the Oxford laboratory held a press conference in London. Behind them a blackboard stood with the date followed by an exclamation mark. Tite does not remember who put it there. Hall said that nobody scientifically trustworthy could now deny the Shroud is a fake. According to him, anyone who thinks differently might as well join the Flat Earthers.

COMUNICATO STAMPA

Con dispaccio pervenuto al Custode Pontificio della S. Sindone il 28 settembre 1988, i laboratori dell'Università dell'Arizona, dell'Università di Oxford e del Politecnico di Zurigo che hanno effettuato le misure di datazione al radiocarbonio del tessuto della S. Sindone, tramite il Dott. Tite del British Museum, coordinatore del progetto, hanno finalmente comunicato il risultato delle loro operazioni.

Tale documento precisa che l'intervallo di data calibrata assegnato al tessuto sindonico con livello di confidenza del 95 per cento è tra il 1260 ed il 1390 d.C. Le informazioni più precise e dettagliate su questo risultato saranno pubblicate da parte dei laboratori e del Dott. Tite su una rivista scientifica con un testo in via di elaborazione.

Per parte sua il Prof. Bray dell'Istituto di Metrologia «G. Colonnetti» di Torino, incaricato della revisione della relazione riassuntiva presentata dal Dott. Tite, ha confermato la compatibilità dei risultati ottenuti dai tre laboratori, la cui certezza rientra nei limiti previsti dal metodo adoperato.

Dopo averne informato la Santa Sede, proprietaria della S. Sindone, dò notizia di quanto mi è stato comunicato.

Nel rimettere alla scienza la valutazione di questi risultati, la Chiesa ribadisce il suo rispetto e la sua venerazione per questa veneranda icona di Cristo, che rimane oggetto del culto dei fedeli in coerenza con l'atteggiamento da sempre espresso nei riguardi della S. Sindone, nella quale il valore dell'immagine è preminente rispetto all'eventuale valore di reperto storico — atteggiamento che fa cadere le gratuite illazioni di carattere teologico avanzate nell'ambito di una ricerca che era stata prospettata come unicamente e rigorosamente scientifica.

Nello stesso tempo i problemi dell'origine dell'immagine e della sua conservazione restano ancora in gran parte insoluti ed esigeranno ulteriori ricerche ed ulteriori studi, verso i quali la Chiesa manifesterà la stessa apertura, ispirata dall'amore per la verità, che ha mostrato permettendo la datazione al radiocarbonio non appena Le fu sottoposto un ragionevole programma operativo in proposito.

Il fatto spiacevole che molte notizie relative a questa ricerca scientifica siano state anticipate sulla stampa, soprattutto di lingua inglese, è motivo di un mio personale rincrescimento perché ha favorito anche l'insinuazione non certo serena che la Chiesa avesse paura della scienza tentando di nasconderne i risultati, accusa in palese contraddizione con gli atteggiamenti che la Chiesa anche in questa circostanza ha portato avanti con tutta fermezza.

TORINO, 13 ottobre 1988.

ANASTASIO Card. BALLESTRERO

On the following day the Cardinal's statement appeared in the *Osservatore Romano*. In the text the evaluation of the test results is remitted to the Science.

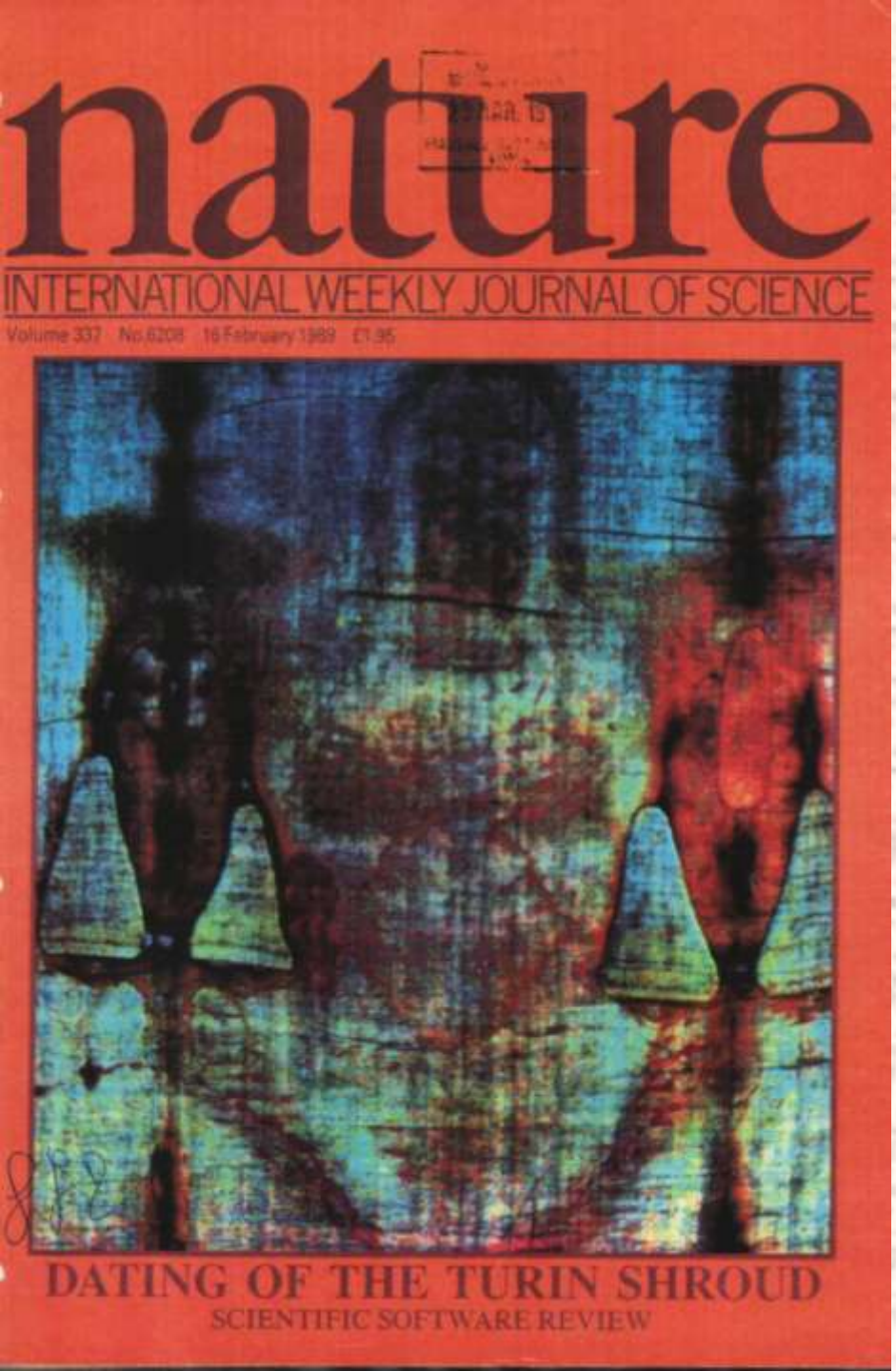
Nel 1988 proseguendo nella linea di consentire ogni competente esame atto a fornire dati obiettivi, il Sacro Telo veniva datato con il radiocarbonio. Il Cardinale Ballestrero comunicò il risultato dei laboratori che collocava la datazione del tessuto sindonico in epoca medievale. Egli dichiarava, in pari tempo, che non era in gioco nessuna questione di fede ma che si trattava di un dato scientifico la cui valutazione veniva rimessa alla scienza; nulla cambiava nella venerazione portata alla Sacra Sindone.

Il risultato della datazione medievale veniva a costituire un punto singolare, anzi in contrasto, rispetto ai precedenti risultati, i quali non erano contraddittori con una datazione risalente a 2000 anni fa. Si tratta di un dato sperimentale fra gli altri con la validità e anche i limiti degli esami settoriali che sono da integrare in un quadro multidisciplinare.

La Sacra Sindone sul piano scientifico e tecnico inoltre - faceva rilevare il Cardinale nel suo comunicato - pone problemi ben lontani dalla soluzione; le modalità di formazione dell'immagine restano del tutto misteriose e di conseguenza mancano le indicazioni - peraltro indispensabili - per conoscere le migliori procedure valide alla Sua conservazione.

Anche in futuro, come nel passato, la Chiesa prenderà in considerazione ogni seria e competente proposta operativa senza porre condizione alcuna se non quella di non recare danno alla Sacra Sindone e da attuare in congruente continuità con gli esperimenti già eseguiti.

This will not be the last official pronouncement from the Vatican. In fact, in the Bulletin of the Vatican Press Office of August 18, 1990 it is written: "The result of the medieval dating became an odd point, even in contrast, compared with previous results, which were not inconsistent with a 2000-year old dating. These are experimental data, among others, with the validity and also the limits of sectoral tests which are to be integrated in a multidisciplinary framework".



The final report of the laboratories will appear in the magazine *Nature* on February 16, 1989, four months after the official announcement of the results. Here goes this lapidary statement: "These results therefore provide conclusive evidence that the linen of the Shroud of Turin is mediaeval". But many perplexities on the event led Savarino to an opposite consideration: the results "cannot be considered axiomatically conclusive". Riggi expresses a heavy reserve on the test: "We believe that a single test, unconnected with other 25 proposed, cannot give a reliable answer".

Gonella is furious: "The gentlemen in Oxford and London misbehaved; in their attitude there is an attack to other scientists without even reading their articles. I had great respect for the University of Oxford that I no longer have. The scientists came out of this test very discredited". The advisor of the Cardinal believes that the procedure adopted by the three scientific laboratories is not flawless: "The vast majority of my colleagues are not satisfied, either by the adopted procedures, or by the conclusions. These gentlemen, moreover, shout from the rooftops that now the last word was pronounced on the question. Theirs, of course". Furthermore, he emphasizes that a preliminary chemical-physical examination lacked and the operations of pretreatment of the three samples, i.e. the techniques of removal of impurities, are questionable.

Gonella accuses the laboratories of "intoxication by success" and adds: "Misconducts there were tons. The colleagues of the 14C behaved in a disgusting manner. Those scientists have hatched a true plot to discredit the Shroud. (...) Driven by celebrity fever, those scientists began to turn their backs on their own commitments: no more interdisciplinary examinations, only 14C. They flooded even Rome with pressures so that Turin had to accept their conditions. They used the then president of the Pontifical Academy of Sciences, professor Chagas, to get the undersigned out of the way and go their own way". Gonella explains: "It was blackmail. They put us up against the wall just with a blackmail. Either we accepted the test of 14C on the terms imposed by the laboratories, or it would break out a campaign of accusations saying the Church fears the truth and is an enemy of Science".

Cardinal Tarcisio Bertone will declare: "The analysis of carbon-14 seems to have been a mistake, particularly because of prejudices, of which it is useless to speak, because the verdict was decided even before performing the analyses".

During the International Symposium, held in Rome in 1993, statistician Philippe Bourcier de Carbon listed fifteen points of failure in the radiocarbon history of the Shroud:

1. absence of a formal report of the sampling;
2. absence of a video archive on the final steps of the samples packaging;
3. in the official reports, contradictions about the cutting and the weight of the samples by people in charge of sampling;
4. breaches of the protocols initially planned for the operation of dating;
5. rejection of the usual procedure of double-blind test;

6. refusal of the interdisciplinary documentation, which is usual in the procedures for radiocarbon dating;
7. exclusion of acnowledged specialists in the Shroud, particularly American scientists who participated in previous works of STURP;
8. communication to the laboratories, most unusual, of the dates of the control samples prior to testing;
9. intercommunication of results among the three laboratories during the job;
10. disclosure to the media of the first results before the delivering of the findings;

11. refusal to publish raw results of the measurements (requested also with insistence in its official statement by the Scientific Committee which prepared the Symposium in Paris in 1989);
12. non-explanation of the unique isolation of the confidence interval of the measures performed by the Oxford laboratory compared to those made by other laboratories;
13. unacceptable value of 6.4 published in the journal *Nature* for the chi-squared statistical test on the results of the radiocarbon dosage on the Shroud;
14. rejection of any cross-debate on the statistical measures performed;

15. rejection, absolutely uncommon, of the publication of the statistical expertise of this operation, officially entrusted to professor Bray of "G. Colonnetti" Institute of Turin (requested also with insistence in its official statement by the Scientific Committee which prepared the Symposium in Paris in 1989).

Bourcier de Carbon concludes: "Such a remark of deficiencies remains completely unusual in the context of a truly scientific debate, and one can only deplore this exception to the usual ethics".

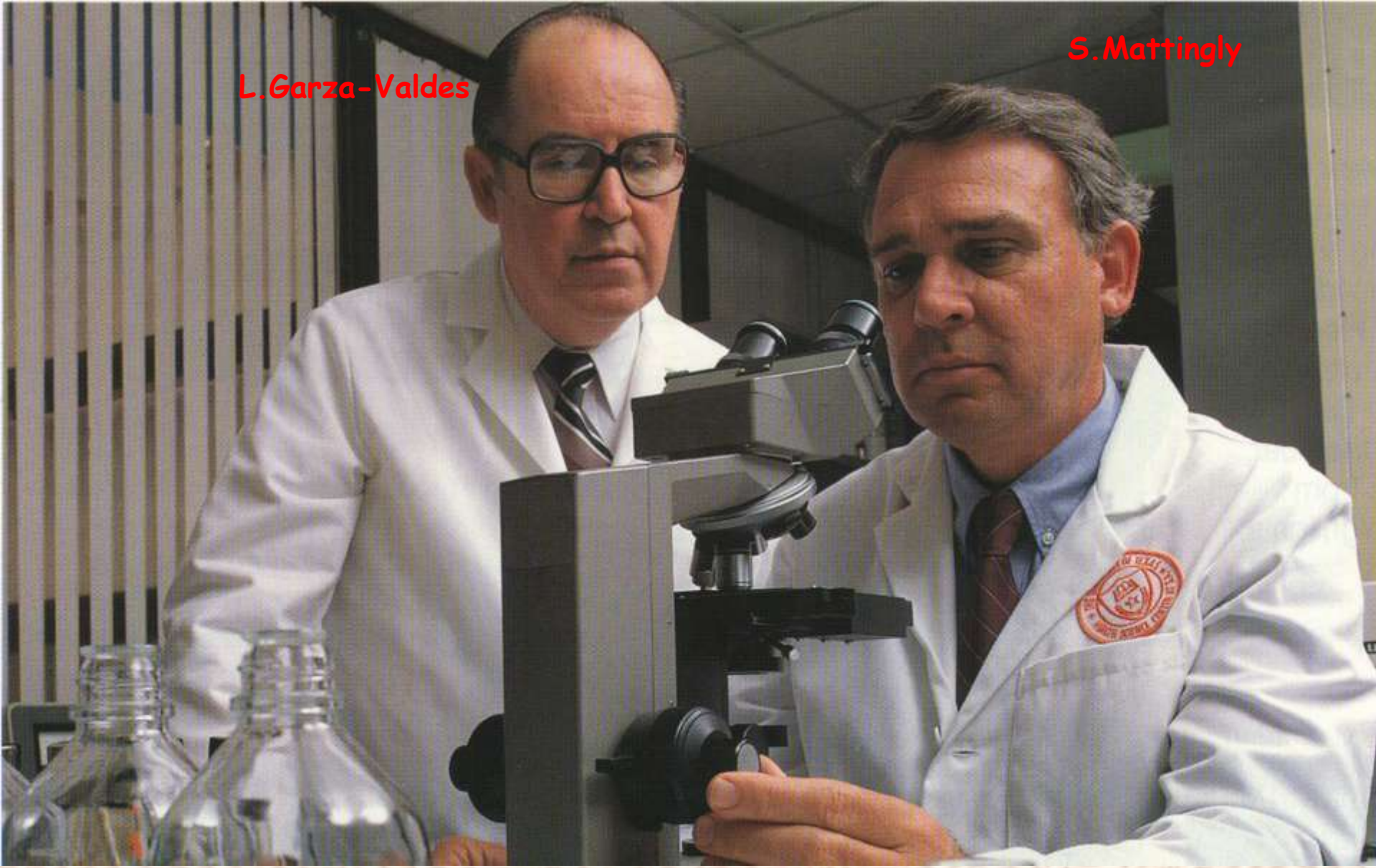
May the Shroud have undergone changes that affect the radiocarbon dating?
Was the analysed sample representative of the whole cloth?

Exhibition of 1685

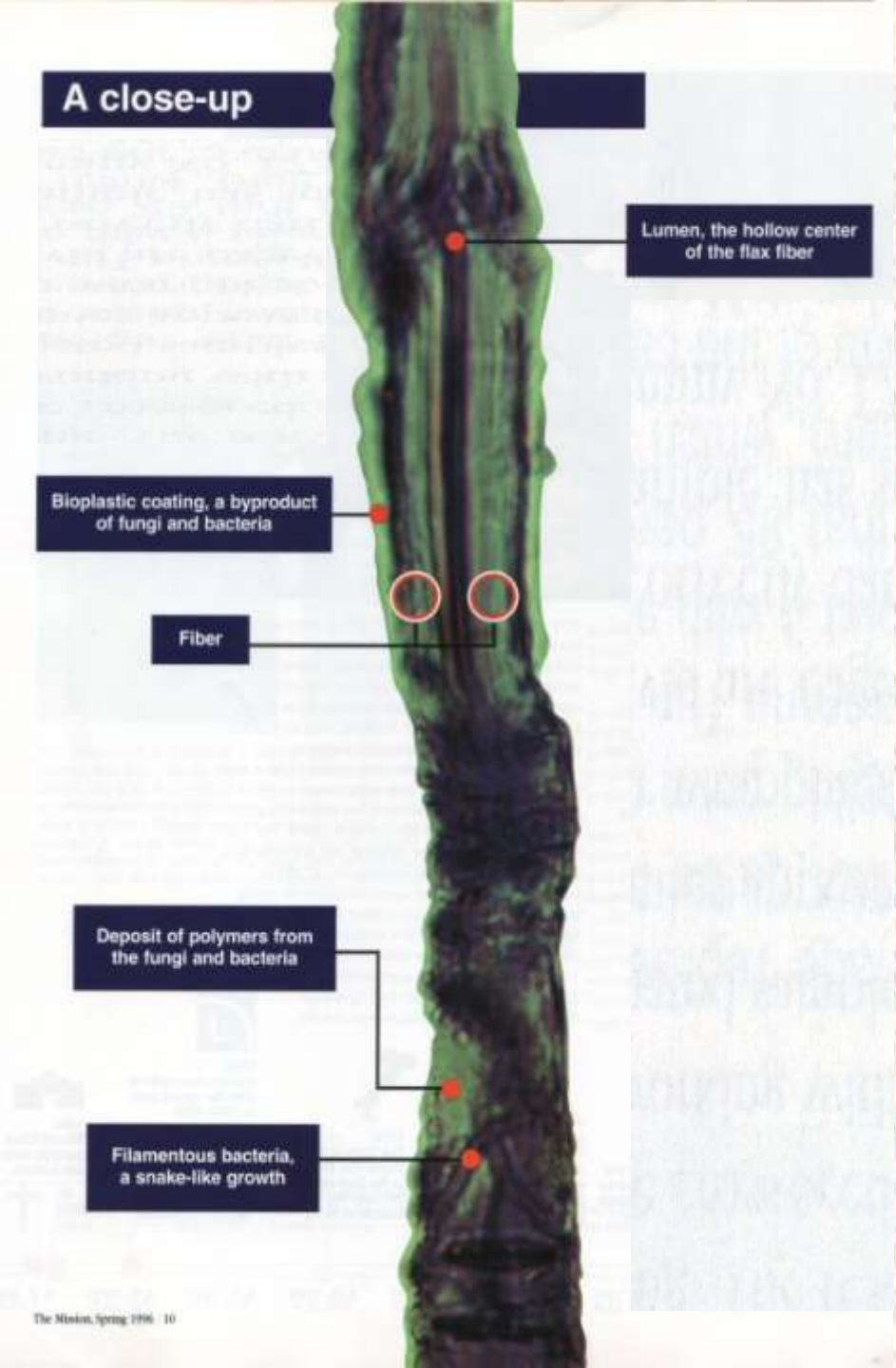
The perplexities on the appropriateness of trying the dating of a sheet that underwent many events in the course of its history added up to the doubts raised by the anomalous behavior of radiocarbon scientists. The most famous incident is the Chambéry fire back in 1532.

Physicist Thomas Phillips of Harvard University in Cambridge (MA, USA) thought of a radiocarbon enrichment caused by neutron irradiation that would be emitted from the body of Christ during resurrection.

A spectroscopic investigation carried out by chemist Alan Adler of the Western Connecticut State University in Danbury (CT, USA) is particularly interesting. From the Shroud samples taken by STURP with sticky tapes in 1978, nineteen fibers were extracted, representative of the different zones of the Shroud. These were compared with other fifteen fibers taken from three threads of the radiocarbon sample. The patterns obtained show differences in chemical composition, further confirmed by peak frequency analysis. In particular the radiocarbon samples are not representative of the non-image areas that comprise the bulk of the cloth. This difference was also supported by the scanning electron microprobe analysis that showed gross enrichment of the inorganic mineral elements in the radiocarbon samples, even compared to the waterstain fibers taken from the bulk of the cloth. In fact, the radiocarbon sample's fibers appear to be an exaggerated composite of the waterstain and scorch fibers, thus demonstrating that it is not typical of the non-image sections of the main cloth.



Leoncio Garza-Valdes and Stephen Mattingly, two microbiologists at the University of Texas Health Science Center in San Antonio (TX, USA), noticed that some Shroud fibers are coated with a layer of bacteria and fungi that cannot be removed with conventional cleaning methods.



This coating can affect the dating also by 500-600 years. The research by Garza-Valdes and Mattingly drew the attention of Gove, who believed that the layer could not move the dating of more than one hundred years. However, he observed that the bandage of the mummy of an ibis, whose bands showed the same bioplastic coating of the Shroud, appeared by 400-700 years younger than the bones.

Sindonologists Joseph Marino and M. Sue Benford provided some evidence of the existence of an "invisible" mending dating to the sixteenth century in the area where the sample for radiocarbon analysis was taken, including differences in thread color and size and weave pattern.

Chemist Raymond Rogers of Los Alamos National Laboratory in Los Alamos (NM, USA) stressed that in the Raes sample some cotton fibers were identified.

Rogers observed that the fibers of the Raes sample and those of the sample used for the radiocarbon dating appear coated and impregnated by a yellow-brown amorphous substance which is not present, however, in the fibers of other areas of the Shroud. Rogers concludes that the sample used for radiocarbon dating was not representative of the original Shroud cloth due to the existence of a mending. Chemist Robert Villarreal of Los Alamos National Laboratory in Los Alamos (NM, USA) confirmed and continued Rogers' research.

A robust statistical analysis of the 1988 Turin Shroud radiocarbon dating results

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Abstract

Using the 12 published results from the 1988 radiocarbon dating of the TS (Turin Shroud), a robust statistical analysis has been performed in order to test the conclusion by Damon et al. (1998) that the TS is mediaeval. The 12 datings, furnished by the three laboratories, show a lack of homogeneity. We used the partial information about the location of the single measurements to check whether they contain a systematic spatial effect. This paper summarizes the results obtained by Riani et al. (2010), showing that robust methods of statistical analysis can throw new light on the dating of the TS.

Keyword: ANOVA, Forward Search, Robust methods, t-statistics, Turin Shroud.

1. INTRODUCTION

The results of the 1988 radiocarbon dating [1] of the TS were published as providing conclusive evidence that the linen fabric dates from between 1262 and 1384 AD, with a confidence level of 95%.

However, after publication of the result, many speculated that the sample had been contaminated due to the fire of 1532 which seriously damaged the TS, or to the sweat of hands impregnating the linen during exhibitions, others that the date was not correct due to the presence of medieval mending and so on. We give references to some of these concerns in Section 7.

The purpose of this paper is to summarize the results obtained in Ref. 2 which show how robust methods of statistical analysis, in particular the combination of regression analysis and the forward search [3] combined with computer power and a liberal use of graphics, can help to shed new light on results that are a source of scientific controversy. Throughout we analyse only numbers from the data given in Ref. 1.

2. DESCRIPTION OF THE DATA

The samples for radio carbon dating were taken from a strip of material cut from one corner of the TS. The strip was divided into five parts; the three parts on the right of Figure 1 were sent to laboratories in Arizona, Oxford and Zurich. Arizona also received the fourth, smaller, part on the left. A larger part on the left of Figure 1 was taken by the Arcidiocesi of Turin as a "Riserva".

Figure 2 indicates the cutting of the strip in question.

These samples were divided into a total of 12 sub-samples for which datings were made. The resulting dates ranged from 591 BP for a reading from Arizona, to 795 BP from Oxford.

3. HETEROGENEITY ANALYSIS

Damon et al. [1] noticed that the data show some heterogeneity, which they assessed using a chi-squared test. In this section we instead use the analysis of variance to test whether these 12 observations can be considered as homogeneous, i.e. as 12 repeated measurements coming from a single unknown quantity.

More formally, a general model for observation j at site i is

$$y_{ij} = \mu_i + \sigma v_{ij} \varepsilon_{ij} \quad (i = 1, 2, 3; j = 1, \ldots, n_i), \qquad (1)$$

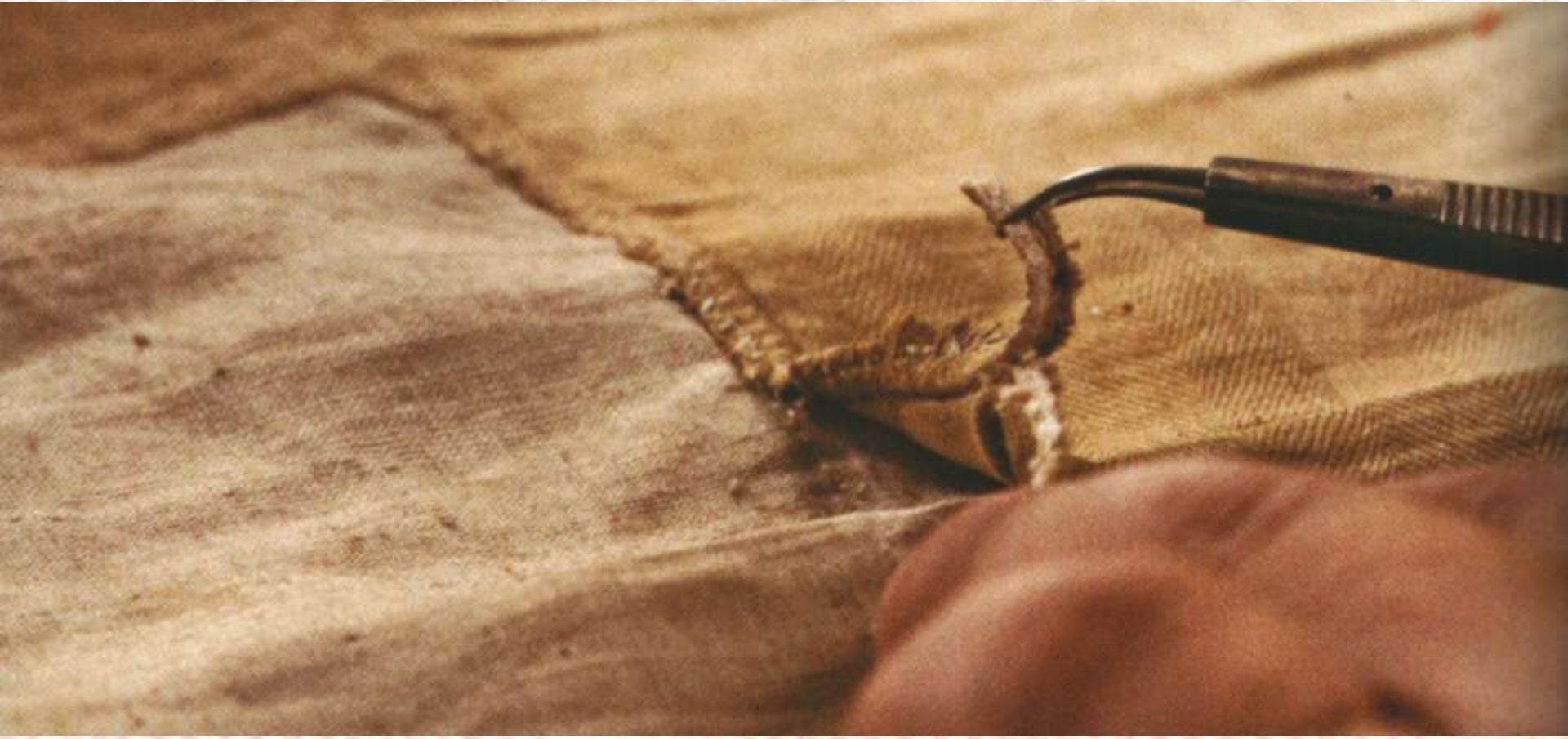
where the errors ε_{ij} have a standard normal distribution.

Our central concern is the structure of the μ_i; at this point whether they are all equal. However, before proceeding to the test this hypothesis we need to establish the error structure. Riani et al. [2] suggest the three following possibilities

1. **Unweighted Analysis**. Standard analysis of variance: all $v_{ij} = 1$

Strong criticisms was leveled even against the statistical analysis of results. Engineer Ernesto Brunati and chemist Remi Van Haelst expressed many doubts on the statistical analysis published in *Nature*. Brunati's calculations were confirmed by two professors of Statistics at *La Sapienza* University of Rome, Livia De Giovanni and Pierluigi Conti. In addition, four scientists from different universities stressed the heterogeneity of the media for the dating of the Shroud cloth. Relying on their calculations, it must be considered as likely the presence, in the analyzed piece of cloth, of an environmental contamination, which has acted in a non-uniform, but linear way, adding a systematic effect that is not negligible.

Conclusions



The heavy shadows thrown on the whole course of radiocarbon dating of the Shroud were never dissipated. Not all the procedures followed for the completion of the radiocarbon test were regular. The history of the events and of the traumas suffered by the relic make it a difficult object, whose radiocarbon dating cannot provide reliable data. The analyzed sample, because of its peculiar characteristics, was not representative of the whole sheet. Consequently, according to the radiocarbon dating performed in 1988, it cannot be definitely stated that the manufacture of the Shroud should be placed in the middle of the fourteenth century.