

# New Scientific Technique Dates Shroud of Turin to Around the Time of Christ's Death and Resurrection

Edward Pentin Interviews

An Italian scientist is claiming a new technique using X-ray dating shows the Holy Shroud of Turin to be much older than some scientists have stated, and that it does in fact coincide with Christian tradition by dating back to around the time of Christ's death and resurrection.

Working with a team of other researchers, Liberato De Caro of Italy's Institute of Crystallography of the National Research Council in Bari used a "Wide-Angle X-ray Scattering" method to examine the natural aging of cellulose that constitutes a sample of the famous linen cloth.

They concluded that their peer reviewed research shows the Holy Shroud is compatible with the hypothesis that it is much older than seven centuries old — the conclusion reached in 1988 using carbon dating techniques — and is around 2,000 years old.

In this April 13 email interview with the Register, De Caro, who has been investigating the Holy Shroud for 30 years, explains more about the discovery, why he believes the X-Ray technique is superior to carbon dating for determining the age of fabric fibers, and discusses other recent discoveries that also point to the Holy Shroud's authenticity.

**Dr. De Caro, please could you share with us in layman's terms your findings regarding the Holy Shroud of Turin?**

The Shroud of Turin is the most important relic of Christianity. According to Christian tradition, it is the burial shroud that would have wrapped the body of Jesus after his crucifixion. For about 30 years, I have been using investigative techniques on the scale of atoms, in particular through X-rays, and three years ago we developed a new method for dating samples taken from linen fabrics. A macroscopic example of a fabric microfiber is like that of a bundle of spaghetti: at first they all have the same length, but if you subject the bundle to accidental shocks, the more the shocks increase, the more the spaghetti breaks. As the number of shocks increases, always of the same intensity, the average length of the spaghetti decreases over time, until it reaches a minimum length.

A similar thing happens to the polymer chains of cellulose which, like spaghetti but with a section on the scale of a billionth of a meter, gradually break over the centuries due to the combined effect of temperature, humidity, light and the action of chemical agents in the environment in which they are found. Natural aging depends only on ambient temperature and relative humidity. We have therefore developed a method to measure the natural aging of flax cellulose using X-rays and then convert it into time elapsed since fabrication. The new dating method, based on a technique called Wide Angle X-ray Scattering, was first tested on linen samples already dated using other techniques, on samples that had nothing to do with the Shroud, and then applied to a sample taken from the Shroud of Turin.

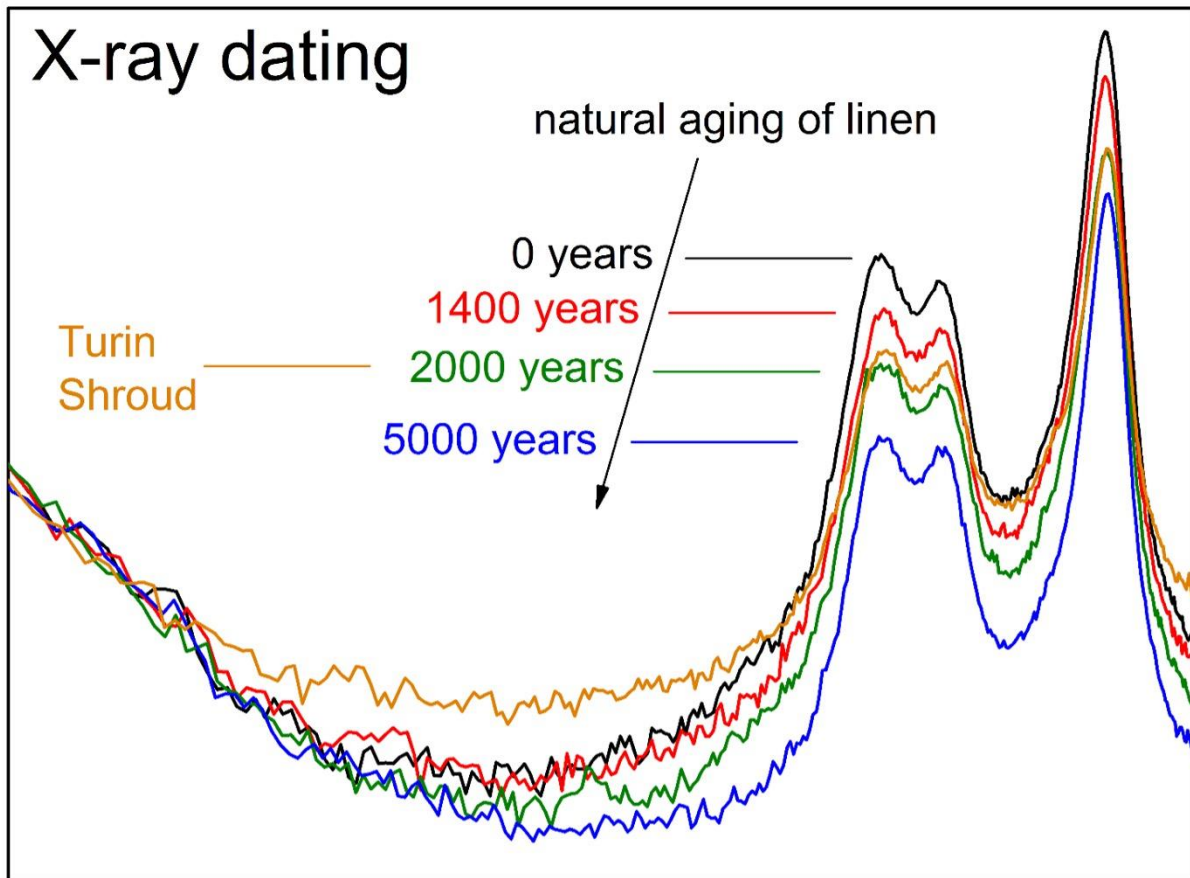
**How long did your research take and has it, or will it be, peer reviewed?**

The research started in 2019 but then the pandemic regrettably caused delays. We finally applied the new X-ray dating technique to a sample of the Shroud of Turin, and the findings of the research were published in the international journal *Heritage* after about a month of preparation and revision, during which our work was evaluated and peer reviewed by three other independent experts and the journal's editor. The research has also been highlighted on the website of the Consiglio Nazionale delle Ricerche [Italy's National Research Council].

The study was carried out in the X-ray laboratories of the Institute of Crystallography of the National Council of Research (Bari, Italy), in collaboration with Professor G. Fanti of the University of Padua.

### Has the Wide-Angle X-ray Scattering method been used before?

The first published paper from 2019 demonstrated the reliability of the new X-ray dating technique on a series of samples, taken from linen fabrics ranging in age from 3000 BC to 2000 AD (see black, red, green and blue curves in the figure below). These curves show that the sample of the Shroud of Turin (orange curve in the picture) should be much older than the approximately seven centuries indicated by the radio-dating carried out in 1988. [To see the same figure with axes and scientific detail see here].



The reliability of the new X-ray dating technique on a series of samples, taken from linen fabrics ranging in age from 3000 BC to 2000 AD (see black, red, green and blue curves in the figure below). These curves show that the sample of the Shroud of Turin (orange curve in the picture) should be much older than the approximately seven centuries indicated by the radio-dating carried out in 1988. (Photo: Liberato De Caro)

### How accurate are the methods you've used compared to the carbon dating methods previously used, particularly the research used in 1988?

In 1988, carbon-14 dating [also called radiocarbon dating, a method of age determination that depends upon the decay to nitrogen of radiocarbon] of samples taken from the Shroud by three separate laboratories indicated that it should only be about seven centuries old. Therefore, according to the results of the radio-dating, the shroud wouldn't be an authentic relic since it is from the medieval period. However, fabric samples are usually subject to all kinds of contamination, which cannot always be controlled and completely removed from the dated specimen. About half the volume of a natural fiber yarn is empty space, interstitial space, filled with air or something else, between the fibers that compose it. Anything that gets in between the fibers must be carefully removed. If the

cleaning procedure of the sample is not thoroughly performed, carbon-14 dating is not reliable. This may have been the case in 1988, as confirmed by experimental evidence showing that when moving from the periphery towards the center of the sheet, along the longest side, there is a significant increase in carbon-14 [radiocarbon].

In short, we are dealing with two dating techniques — radiocarbon and X-ray — which have very different results. In such cases, when two different techniques do not agree on a date, caution is required before final conclusions are reached. The technique of dating linen by X-ray is non-destructive. Therefore, it can be repeated several times on the same sample. Considering the results of medieval dating obtained by carbon-14, and those obtained by WAXS analysis which show compatibility with 2000 years of history, it would be more than desirable to have a collection of X-ray measurements carried out by several laboratories, on several samples, at most millimetric in size, taken from the Shroud. The technique using X-rays requires very small tissue samples, with linear dimensions even smaller than 1 mm, and this is an advantage compared to radio-dating, which usually requires much larger samples and is destructive, since only one measurement of the carbon-14 content can be made on the same sample.

**What is your view on other theories that are said to prove the authenticity of the Holy Shroud, for example botanical evidence found in 1999, or radiation caused by an earthquake that induced the image on the shroud?**

The documented history of the Shroud spans seven centuries and all of it located in Europe. Based on the results of radio-dating, the Shroud would be seven centuries old and has always been in Europe. However, the earlier study of pollen trapped in its fibers had already shown a consistent presence of pollen from the Middle East, in particular from the ancient region of Palestine, as if the Shroud had been in that geographical area and not in Europe for a significant period of its history.

In order to be more certain about the pollen, we could go back to analyzing the Shroud with the aim of understanding in which geographical areas it might have been. In fact, our study has shown that dating depends on the average secular temperature of the geographical region in which the linen artefact was preserved. The presence of pollen or minerals typical of some regions and not of others could help clarify its 'hidden history,' its presence in other geographical regions characterized by much higher temperatures than those in Europe.

The Shroud of Turin challenges science, and each new piece of research could clarify part of the complex puzzle this relic represents. For example, the Shroud's image has yet to find a definitive explanation from those who have studied it, an explanation shared by the entire scientific community. It is as if a photographic plate had been imprinted by radiation. By studying the traces left on the plate, one tries to trace the nature of the radiation and its properties. The same could be done for the Shroud's image.

For this reason, the idea that a neutron flux could have enriched the linen fabric of the Shroud with carbon-14, distorting its radio-dating, dates back to 1989. One of two short contributions, one by T. J. Phillips, also published in the journal *Nature*, begins with these words: "If the Shroud of Turin is in fact the burial cloth of Christ, contrary to its recent carbon-dated age of about 670 years (*Nature* 335, 663; 1988 and 337, 611; 1989), then according to the Bible it was present at a unique physical event: the resurrection of a dead body. Unfortunately, this event is not accessible to direct scientific scrutiny."

Therefore, if, from a scientific point of view, one rejects a priori to investigate the hypothesis of the resurrection and the traces that it could have left on the linen cloth, it is necessary to go in search of natural phenomena that, by chance, could have caused a consistent flow of neutrons, so as to change the isotopic abundance of carbon-14 of the shroud — as the hypothesis of the earthquake, to which you refer, proposes. At this point, one has to ask: do we have evidence anywhere else in the world of at least one scientifically verified case in which a natural phenomenon has changed the isotopic abundance of a chemical element?

**Is there such evidence?**

Yes, an answer to this question can be found at Oklo, a uranium deposit near Franceville, south-east Gabon, from which the fuel for French nuclear power stations is extracted. At enrichment plants, the concentration of uranium-

235 in the ore extracted from the mines is always checked to ensure it is of natural origin. The proportion of uranium-235 in relation to all possible isotopes is fixed, and is also the same for lunar samples and meteorites.

In June 1972, a shipment arrived at Pierrelatte in France with a lower than natural composition, so much so that the authorities were alerted, and a scientific investigation began which lasted several months. It was discovered that in the past, in 17 strands of the deposit, the right conditions had been created so that the neutrons emitted in spontaneous fissions of uranium, slowed down by the water circulating in the deposit, could reproduce a chain reaction that locally reduced the natural isotopic abundance of uranium-235.

What does this example show? That sometimes, even in nature, very special conditions occur which, due to a combination of factors, make what has happened truly unique and unrepeatable. Therefore, wisdom should teach us to be very humble, respectful and prudent when studying natural phenomena, before coming to definitive conclusions that may sometimes be hasty and therefore wrong. Obviously, this is all the more true when it comes to the resurrection of Jesus Christ, a unique event in history which countless people believe. At least caution is warranted out of respect for this faith.

**How significant are your findings for the Church and will the Vatican be involved in trying to authenticate them?**

The Archdiocese of Turin more than the Vatican could be interested in this kind of research. In fact, in 2002 some threads were already taken from the Shroud and kept by the Archdiocese of Turin for future scientific studies. It would be enough to take 1-mm-long samples from these threads, combine them with other linen samples taken from other ancient fabrics of known date, and involve several laboratories in a dating experiment using the technique we have developed that uses X-rays. It could also be carried out as a blind experiment, that is, without laboratories knowing which samples are taken from the Shroud compared with those taken from other linen fabrics, to avoid any possible bias in the data analysis by the authors of the research.

**Will you be doing more work on the Holy Shroud to further authenticate its true date?**

It all depends on the possibility of having new samples to analyze. In any case, besides the Shroud, there are other important linen relics traditionally associated with Jesus, for example, the Sudarium of Oviedo or the Veil of Manoppello, which I have also studied in the past. This new dating technique is only in its infancy. It could, for example, also be extended to fabrics made from other plant fibers.

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