Excerpt from article "Understanding the 1988 Carbon Dating of the Shroud" by Robert Rucker

Nuclear engineer Robert Rucker, speaking at a 2019 conference in Ancaster, Ontario CANADA, discussed the AD 1260-1390 dates the labs produced. He had some interesting observations on the labs' interpretation of the data they used. The rest of the material below is from his proceedings paper. He wrote,

[…] This is claimed to be a two sigma or 95% range. This means there should be a 95% probability the true date for the Shroud is between 1260 and 1390 AD. Based on this, Damon *et al*. (https://www.shroud.com/nature.htm) stated in both the abstract and the conclusion that, "These results provide conclusive evidence that the linen of the Shroud of Turin is mediaeval." When the raw data for the 1988 radiocarbon dating was finally obtained" from the British Museum in 2017, it was learned that one of the peer reviewers of this paper (Professor Anthos Bray) recommended this concluding statement be removed from the paper, presumably because it was not justified by the analysis of the data. However, *Nature* published this paper without removing this concluding statement, thus ignoring the recommendation of Professor Bray. The dates obtained by each laboratory are given in Table 1.

Table 1. Carbon Dates (AD) from Each Laboratory

Subsample	Oxford	Zurich	Arizona
1	1155 ± 65	1217 ± 61	1344 ± 41
2	1205 ± 55	1228 ± 56	1376 ± 45
3	1220 ± 45	1315 ± 57	1197 ± 51
4		1311 ± 45	1318 ± 49
5		1271 ± 51	1274 ± 40
6			1410 ± 37
7			1249 ± 47
8			1249 ± 47
Weighted Mean	1200.8 ± 30.7	1273.9 ± 23.7	1303.5 ± 17.2

The three values obtained by the Oxford laboratory and the five values obtained by the Zurich laboratory are from Damon *et al.* The eight values obtained by the laboratory in Tucson, Arizona, are from Casabianca *et al* (https://www.academia.edu/38607635/Radiocardon_Dating_of_the_Turin_Shroud_New_Evidence_From_Raw_Data). *[Note: "Radiocarbon" is misspelled as "Radiocardon" in the link but the link is correct.]*

Objections to the 1260-1390 AD Date for the Shroud

There are at least 14 other date indicators that are consistent with the first century and contradict the 1260-1390 date.

*Two of the laboratories that did the 1988 radiocarbon dating obtained statistically different dates. The difference between the dates from Arizona (1303.5 ± 17.2) and Oxford (1200.8, ± 30.7) is 1303.5 - 1200.8 = 102.7 years. The uncertainty of this difference is obtained from the square root of the sum of the squares of the individual uncertainties = square root of (17.2 squared+ 30.7 squared) = 35.2. The difference between the dates from Arizona and Oxford is thus 102.7 ±35.2. But l02.7 /35.2 = 2.9, which means the dates from Arizona and Oxford are statistically different at the 2.9-sigma level because 2.9 exceeds the normal acceptance level of less than or equal to 2.0 sigma. This indicates the radiocarbon dates were statistically different for the samples sent to Arizona and Oxford, as though the samples came from different pieces of cloth. This should not be true since both samples were cut from the same cloth close to one another. This suggests that an unexpected factor had altered the C14/C12 ratios of the samples.

*The average dates from the three laboratories show an increase of about 36 years per cm (91 years per inch) of distance from the bottom of the cloth. This means that the dates are a function of (depend on) the location on the cloth […].

* The statistical analysis in Damon et al. used a chi-squared statistical test to determine whether the variation in the dates exceeded the variation allowed by the measurement uncertainties. This process found that for the three standards (labeled samples 2, 3, and 4 in Damon *et al*.), the variation in the dates was reasonably consistent with their uncertainties (significance level p = 0.9, 0.5, and 0.3), but this was not true for the samples from the Shroud (labeled sample 1 in Damon *et al*.). Why would this be? In paragraph 23 of Damon *et al*., which begins, "More quantitatively," it is stated that since "it is unlikely that the errors quoted by the laboratories for sample 1 fully reflect the overall scatter" they decided to use "the scatter of results" to estimate the uncertainties. This is the key mistake in the analysis of the data because it fails to allow for the possibility that the measured dates had been affected by an unexpected factor that produced a systematic error in the evaluation. When the original measurement uncertainties produced by the normal experimental and calculational process are used, instead of those calculated from th scatter of results, the chi-squared statistical analysis indicates that the variation in th measured dates likely exceeds the variation allowed by the measurement uncertainties. There is only a 1.4 % chance they are consistent, if the analysis is performed as in Damon *et al*. for the three standards that were run at the same time as the Shroud samples. The 1.4% is below the usual acceptance level of 5.0%, and thus indicates an unexpected factor probably caused the measured dates to different from the true date, which in statistical analysis terminology is called a systematic error. Since the magnitude of this systematic error cannot be known, the credibility of the 1260-1390 date range should be rejected.

*In his Ancaster paper, Rucker cites in a footnote an article of his sixteen different indicators of the age of the Shroud. In his original version of that footnoted article available on his web site (http://www.shroudresearch.net/hproxy.php/summary-of-scientific-research-on-the-shroud-of-turin.pdf), he mentioned fourteen (see pages 11-14 in the aforementioned link).