Reply to Israel Carmi (2002)

Rasmussen, Kaare L.; Plicht, Johannes van der; Doudna, Gregory; Cross, Frank M.; Strugnell, John

Published in:
Radiocarbon

Publication date:
2003

REPLY TO ISRAEL CARMI (2002): "ARE THE ^{14}C DATES OF THE DEAD SEA SCROLLS AFFECTED BY CASTOR OIL CONTAMINATION?"

Kaare L Rasmussen[1] • Johannes van der Plicht[2] • Gregory Doudna[3] • Frank M Cross[4] • John Strugnell[5]

INTRODUCTION

Carmi (2002) is a response to our study published in *Radiocarbon* 43(1) by Rasmussen et al. (2001). We noted widespread possible exposure to castor oil of the Dead Sea Scrolls (DSS) in the Rockefeller Museum in the 1950s and reported experiments showing that the AAA pretreatment used in the first 2 series of radiocarbon datings of the DSS (Bonani et al. [1992] and Jull et al. [1995]), "cannot be guaranteed to have removed all of the modern carbon in any samples if they had been contaminated with castor oil and hence could have produced some ^{14}C dates that were younger than the texts' true ages." Carmi, a coauthor of the Bonani et al. (1992) study, criticizes our analysis on 4 grounds:

1. Carmi argues that "the extant [radiocarbon] dates of the Dead Sea Scrolls do not suggest a major deviation from their palaeographic or specific ages. There is thus no indication that the pretreatment was inadequate."
2. Carmi claims that our study, Rasmussen et al. (2001), "miscalculated the efficiency of their AAA treatment from the ^{14}C data," and Carmi presents an alternative formula for calculation of the cleaning efficiency.
3. Carmi says the efficiency of the cleaning procedure of our experiments should have been calculated based on "the δ^{13}C values of the samples," and that when this is done, a dramatically different result is obtained.
4. Carmi claims that our "strategy of testing the validity of the dates of the Dead Sea Scrolls is wrong."

We believe that Carmi's response fundamentally misunderstands our paper and is in error on each of the 4 points.

ARGUMENT 1

Carmi argues that "evaluating whether or not the AAA treatment of the Dead Sea Scrolls was adequate can be done by comparing the ^{14}C dates of the scrolls with ages assigned to them using palaeographic methods and with ages of explicitly dated scrolls." Here Carmi has the argument backwards. The aim of the original datings by Bonani et al. (1992) and Jull et al. (1995) as well as Rasmussen et al. (2001) was to establish independent data for dating the DSS; these then could function as a check upon the accuracy of the palaeographic dates. To state that the margin of error of the reported ^{14}C dates in most cases do not deviate from the palaeographic dates by greater than 2.5 standard deviations is irrelevant to our experiments or point, and is not a sound justification for concluding

[1]Chemistry Department, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark. Corresponding author. Email: klr@chem.sdu.dk.
[2] Centrum voor Isotopen Onderzoek, Nijenborgh 4, 9747 AG Groningen, The Netherlands.
[3] The Danish Institute for Advanced Studies in the Humanities, Vimmelskaftet 41A, 2, Copenhagen K, DK-1161, Denmark.
[4]Department of Near Eastern Languages and Civilizations, Harvard University, 6 Divinity Avenue, Cambridge, Massachusetts 02138, USA.
[5] The Divinity School, Harvard University, 45 Francis Street, Cambridge, Massachusetts 02138, USA.

that the "the pretreatment of the samples was adequate." In addition, Table 1 of Carmi (2002) contains significant mistakes in listing the data (at items #16, #31, and #33), which is probably why Carmi did not observe potential problems with castor oil contamination. Carmi's item 16 is incorrectly labeled "Community Rule(d)," when the ^{14}C date at that item is actually that for 1QS. In addditition, item 31 is incorrectly labeled "Community Rule," with the implication it is 1QS, and listed by Carmi as free from possible exposure to castor oil contamination (true for 1QS), when the ^{14}C date at item 31 is actually that for 4QS(d), 1st sample, taken from the Rockefeller Museum, where there was possible exposure to castor oil. Also, Carmi's item 33 is incorrectly labeled as free of exposure to possible castor oil contamination, even though that text was edited by Milik, a user of castor oil, in the Rockefeller Museum.

ARGUMENT 2

There is no error in the calculations of Rasmussen et al. In fact, Carmi's Equation 1 is in complete accordance with our formulas—only in other units.

Carmi is proposing another formula for the percent of oil left in the parchment. In his formula the percent of oil left varies between 0 and 100%, corresponding to a variation from no retention to the saturated state. This is incompatible with the units used throughout the calculations of Rasmussen et al. We used weight percent of oil (e.g. 0.01 grams of oil/gram of sample) in the parchment in our Equations 1–4. Thus, in Rasmussen et al. no oil retention corresponds to PCT = 0% (as in Carmi's formula 1), but saturation does not correspond to PCT = 100%. In addition, Carmi incorrectly quotes our values in Table 2 (7, 12, 6, 8 wt%) as "retained", where it rightly says "removed." It is easily shown that the 2 calculations indeed are identical: e.g., take the number in column 5 in our Table 3, divide by the number in column 6, and multiply by 100, 15/22 * 100 = 68% [Carmi's value: 67.9%].

ARGUMENT 3

The reason that the oil removal values calculated by Carmi (2002) on the basis of the $\delta^{13}C$ measurements come out approximately similar to those he calculated from our ^{14}a results is that (as noted above) Carmi used, in effect, the same formula that we did, except that Carmi's was based on absolute percentages. Had we calculated the oil removal percentages based on the $\delta^{13}C$ values using our formula we also would have come up with more or less the same results as those based on the ^{14}a results. However, as stated very clearly in Rasmussen et al., we maintain as a methodological point that one should make the calculation on the basis of the ^{14}a results rather than the $\delta^{13}C$ values, even though it would result in little difference in actual results either way.

ARGUMENT 4

It is not a shortcoming of the Rasmussen et al. testing strategy not to have dated saturated parchment samples without AAA pretreatment. It is essential to the experiment that all the samples have been subjected to the same pretreatments, i.e., that all the samples in one run have experienced identical AAA pretreatments, identical burning procedures, and identical graphitization procedures. The AAA procedure removes some (minute) parts of the samples as well as some of the contaminants. Therefore, the weight of the parchment will not necessarily be the same before and after the AAA cleaning, and it is not certain how much of the parchment was removed. If the AAA were applied to some samples and not to others, it would destroy the ability to calculate the oil retention accurately. This part of Carmi's comment is therefore irrelevant.

Carmi concludes that "it is clear that the AAA treatment removed less than 50% of the castor oil and old oil from the soaked parchments." And that is exactly what we concluded. Carmi accepts the results of our experiments showing that AAA is ineffective in removing castor oil from parchment samples, but asserts that this finding is irrelevant for dating the DSS ("the pretreatment of the samples was adequate"). We think it is relevant that the pretreatment used in the ^{14}C datings of the DSS is incapable of removing a contaminant to which most of the Qumran texts have had known significant possible exposure. The reports of exposure come from the original team of editors working on the texts in the Rockefeller Museum, two of whom were coauthors of the Rasmussen et al. (2001) paper as well as the present reply. The description in Rasmussen et al. (2001) of potential exposure and risk, therefore, stands as an eyewitness account.

CONCLUSION

Points 2, 3, and 4 presented in the paper of Carmi (2002) are either erroneous or irrelevant. The Carmi paper is therefore reduced to a statement that constitutes a backwards argument, namely that all but four of the extant Bonani et al. and Jull et al. ^{14}C dates are not in disagreement with the palaeographic dates, if 2 other cases among those 34 affected by unknown contaminants are ignored, and therefore there is no cause for concern that AAA pretreatment is incapable of completely removing castor oil. We reject this reasoning and conclude that nothing in the comment of Carmi (2002) gives cause to revise our original conclusion concerning castor oil contamination.

Finally, we note that inadequacy of AAA alone to remove contamination from parchment was also recently shown by Donahue et al. (2002).

REFERENCES

Bonani G, Ivy S, Wölfli W, Broshi M, Carmi I, Strugnell J. 1992. Radiocarbon dating of fourteen Dead Sea Scrolls. *Radiocarbon* 34(3):843–9.

Carmi I. 2002. Are the ^{14}C dates of the Dead Sea Scrolls affected by castor oil contamination? *Radiocarbon* 44(1):213–6.

Donahue DJ, Olin JS, Harbottle G. 2002. Determination of the radiocarbon age of parchment of the Vinland Map. *Radiocarbon* 44(1):45–52.

Jull AJT, Donahue DJ, Broshi M, Tov E. 1995. Radiocarbon dating of scrolls and linen fragments from the Judean desert. *Radiocarbon* 37(1):11–19.

Rasmussen KL, van der Plicht J, Cryer FH, Doudna G, Cross FM, Strugnell J. 2001. The effects of possible contamination on the radiocarbon dating of the Dead Sea Scrolls I: Castor oil. *Radiocarbon* 43(1):127–32.