

## COMMENTS ON THE USE OF EZEE-FILTERS™ AND ULTRAFILTERS AT ORAU

Fiona Brock<sup>1</sup> • Tom Higham • Christopher Bronk Ramsey

Oxford Radiocarbon Accelerator Unit, Research Laboratory for Archaeology, University of Oxford, Dyson Perrins Building, South Parks Road, Oxford OX1 3QY, UK.

**ABSTRACT.** We report variations in age of recent batches of ultrafilter humectant, and also clarify the pore size of Ezeefilters™ used at the Oxford Radiocarbon Accelerator Unit (ORAU).

### ULTRAFILTERS

At the Oxford Radiocarbon Accelerator Unit (ORAU), Vivaspin™ 15 30 MWCO kDa (molecular weight cut-off kilo Dalton) ultrafilters (Sartorius) were first introduced to the pretreatment of bone samples for <sup>14</sup>C dating in 2000 (Bronk Ramsey et al. 2004) and have been used in the pretreatment of the vast majority of bones dated at the laboratory since 2002 (Brock et al. 2007). We apply stringent cleaning procedures to the ultrafilters before use to remove the humectant applied to the surface of the filters by the manufacturers to ensure that no contamination from the filters is transferred to the samples (Brock et al. 2007). As part of the quality assurance procedures in place to monitor the effective use of ultrafilters, the humectant is collected from 1 ultrafilter from each batch and AMS dated. In Brock et al. (2007), we reported that the humectant from batches of ultrafilters used at ORAU in 2003–2004 ranged in age from 12,325 to >35 kyr BP, and that from 3 subsequent batches used between 2005–2006, the humectant was post-bomb in age (1.0146–1.0395 F<sup>14</sup>C). Since this publication, the humectant from a further 23 batches of Vivaspin 15 ultrafilters has been dated. Twenty-one of these gave modern dates, ranging from 1.0323 to 1.0701 F<sup>14</sup>C. However, humectant from 2 batches manufactured in 2011 (batch numbers 11VS1512 and 11VS1457) dated to 5316 ± 31 and 5660 ± 45 BP, respectively.

We therefore highlight that it should not be assumed that ultrafilter humectant is exclusively either modern or background when either testing ultrafilter cleaning protocols or when using them routinely, and advise that the humectant from each batch of ultrafilters used by individual laboratories is dated as part of thorough quality control procedures. It is also essential to continuously monitor the date of known-age bone with both recent and background age, so that corrections can be made for any carbon added during the entire pretreatment process (Wood et al. 2010).

### EZEE-FILTERS™

Since the 1990s, Ezeefilter™ separators (Elkay, UK) have been employed at ORAU during both ABA pretreatments and to remove particulate matter from samples after the gelatinization stage of bone pretreatment. We first reported their use in Bronk Ramsey et al. (2004), where the pore size was stated to be 100 µm. In subsequent publications, the pore size has been reported as 9 µm (Brock et al. 2007, 2010a,b; Stynder et al. 2009; Zazula et al. 2009; Wood et al. 2010). However, in 2010, it was brought to our attention that the supplier's website stated pore size to be 60–90 µm. The supplier has confirmed that the filters themselves have remained unchanged during this period, and that the product consists of a medium-porosity hydrophilic high-density polyethylene (HDPE) filter with pore sizes that range from 45–90 µm. This is more consistent with the conservative value of 100 µm originally reported by Bronk Ramsey et al. (2004). Subsequent confusion appears to have arisen

<sup>1</sup>Corresponding author. Email: Fiona.brock@rlaha.ox.ac.uk.

from Elkay's 1996 catalog that stated "Elkay Ezee-Filter™ separators are a fast, effective way to filter particulate matter down to 8 microns." Elkay are unsure where this value originated from, and we assume that the very low pore size in the older catalog may have been a misprint, and should have instead read 80 µm.

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