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FUNNY WRAPPINGS—CHALLENGING YOUR RADIOCARBON LABORATORY

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ABSTRACT. Shipping radiocarbon samples from the scientist to the laboratories involves packaging and wrapping them with all sorts of bags and materials to make sure the samples arrive safely. Over the years a variety of possible and impossible package materials have arrived at our laboratory, causing problems occasionally but often being the highlight of the day cheering up the people involved. The reality of excavating important, occasionally unexpected, samples during field work sometimes includes taking samples when time is short or package materials could not be prepared. At this point, any kind of package becomes useful. Things like cigarette packets, reused office packets, tissue boxes, or medical packaging can become handy. But sometimes samples are taken, wrapped in aluminum foil, and forgotten in the desks. This article celebrates creativity, giving an overview of the many ways samples can be packed. However, using some of the less-than-ideal choices, drawbacks will be shown and possible problems explained.

KEYWORDS: aluminum foil, charcoal, radiocarbon samples, wrapping.

INTRODUCTION

Scientists and technicians are creative people, which is not only important when it comes to data creation or interpretation. It starts with taking samples, maybe not planned beforehand but as a result of an interesting find and under time pressure in less-than-ideal circumstances during excavation. We are glad that some colleagues send the samples in these packages as we admire their creativity that often becomes a highlight of the day. Hence, we receive samples in cigarette packs, in Tupperware-like boxes, in flasks for eye drops, coronavirus test packages, matchboxes, boxes for staple removers, and even paper tissues to name but a few. The following overview gives an impression of the choices. Less-than-ideal packaging materials will be explained and resulting problems highlighted. The sample IDs are anonymized.

VARIATION OF WRAPPINGS

Presented in Figure 1 are some sample wrappings and boxes that were used to send radiocarbon samples. The figure provides some interesting examples that also sometimes mirror the period, circumstances or timing the samples were taken in, such as the covid test box (M) or the Halloween centrifuge tube (G). Surely, this short list is not exhaustive, and colleagues from other facilities could provide more examples of creative packaging. More worrisome are wrappings such as eyedrop flasks or urine-test tubes, hoping those colleagues sending the samples are well and remained healthy. Matryoshka-like surprise boxes cause excitement and start guessing games about how big the sample will eventually be after opening stacks of boxes or vials followed by layers and layers of wrapping materials (see Figure 1K).

POTENTIALLY PROBLEMATIC WRAPPINGS

We do not take into account possible problems or contaminations arising from plastic bags when softener agents or other chemicals containing carbon might evaporate and enter the

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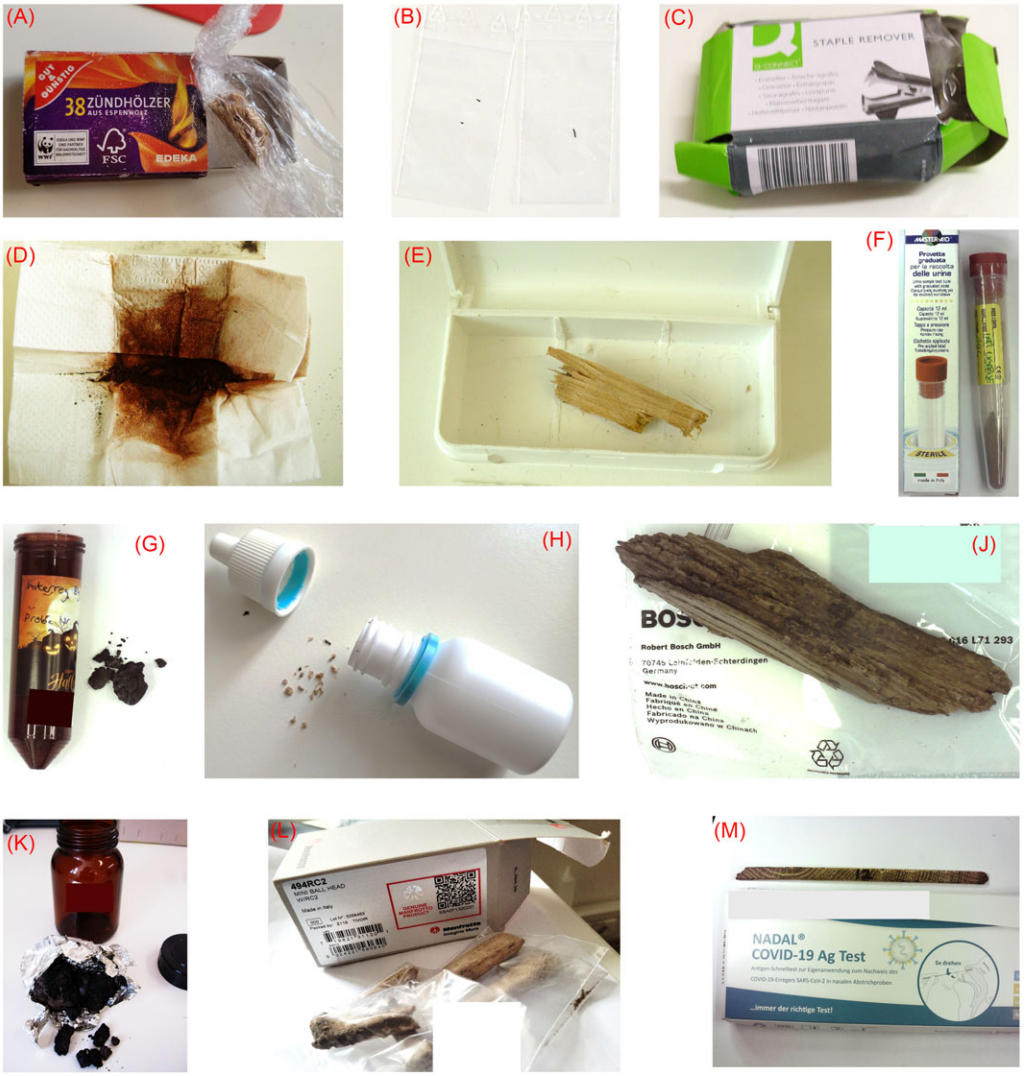

Figure 1 A–M (top left to bottom right): Funny wrappings such as matchboxes (A), tinsels of charcoal in larger bags (B), staple remover boxes (C), paper tissue (D), Tupperware-like boxes (E), or tubes for urine tests (F), Halloween tubes (G), eyedrop flasks (H), former Bosch electronic equipment bags (J), sample in crumpled aluminum foil in bottle (K), package of mini ball head (L), or—pretty up-to-date—Covid test kits (M) are really interesting ideas.

sample, as we did no specific tests on these effects. Samples that are stored in plastic bags in our laboratory for longer periods of time over many years (such as some of our internal bone standards) do not show any effect on their radiocarbon ages at all. Only very little literature is published on using plastic bags. Bryant et al. (2013) sampled seawater using plastic bags. Testing for contamination did not show any negative effects caused by softeners or similar agents used in plastics.

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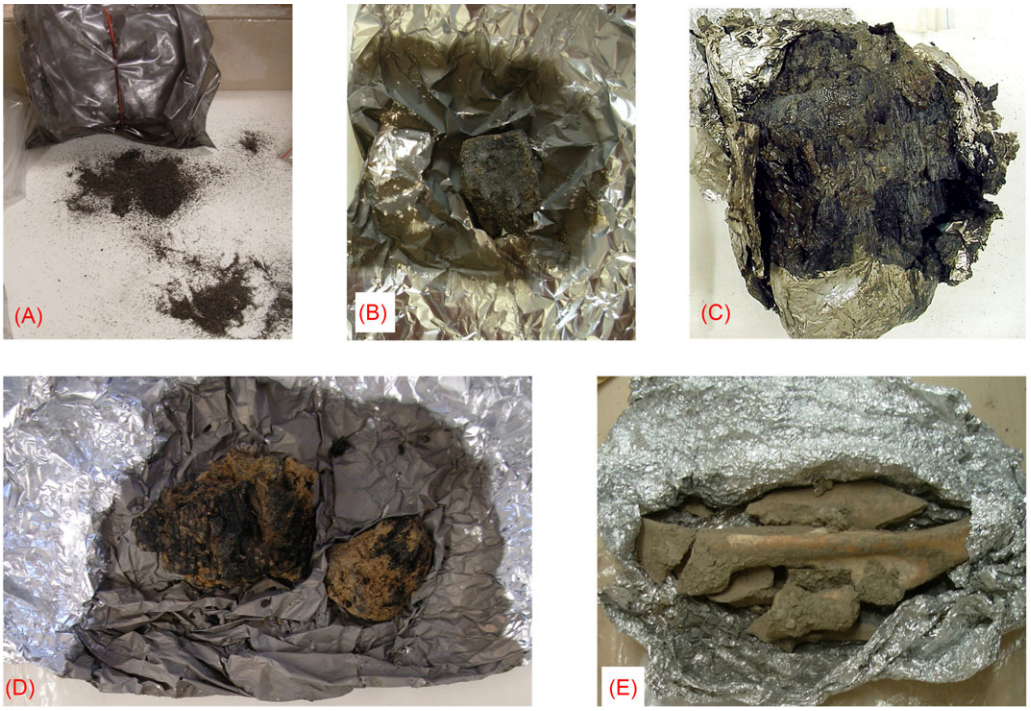

Figure 2 A–E (from top left to bottom right): (A) Charcoal sample escaping aluminum foil and spreading over desk, (B) charcoal sample blackening aluminum foil, (C) aluminum foil already disintegrating (best seen in the right part of the image) because of charcoal sample, (D) another example for blackening of aluminum foil because of charcoal sample, (E) example of a bone sample with sediment attached that has the same destructive influence on aluminum foil as charcoal.

PAPER TISSUES

Using paper tissues is rather dangerous as their lose fibers can easily detach and mix with or attach to a sample depending on the rigidity of the sample itself, e.g., bone or wood. Those fibers contain carbon themselves, not only in the form of cellulose but also other additives. When powder is wrapped into a paper tissue, large quantities of sample material remain there and are difficult to recover quantitatively (compare Figure 1D).

Charcoal or Wood in Aluminum Foil

For decades, the advice was usually to wrap samples into aluminum foil as this is supposed to contain no carbon. While this is mostly true besides small quantities of carbon that can attach to the surface of the aluminum foil, it unfortunately causes other problems, as can be seen from the pictures in Figure 2. Charcoal (or rather chemical substances that come in contact with the samples) and certain other sample materials (e.g., soil samples) can decompose aluminum foil, presumably because of the humic and fulvic acids or other reactive components in the samples. Apart from the obvious black coloring, the aluminum foil can completely disintegrate after a while, mixing with the sample and risking the introduction of contamination. In some cases, aluminum wrappings of multiple samples in one box disintegrated, causing the samples to mix with each other to the point that individual samples could not be separated anymore. It can be

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challenging trying to collect and remove the tiny aluminum fragments from the sample. Furthermore, trying to unwrap a sample that has already crumbled into every fold of a maybe already decayed foil will only result in having the sample spread over half of the desk and become contaminated in the worst case. This is especially true for small charcoal tinsel or sediment. It was noticed that even bone samples, when still covered with sediment, can damage the aluminum foil (see Figure 2).

An additional aspect of minor importance might be the applicability of photographic documentation of the samples, which is easier in transparent wrappings than in aluminum foil.

CONCLUSIONS

Unplanned or sudden sampling for radiocarbon dating or other methods is part of the reality during excavations (especially during rescue excavations) and field work. While the ideal way is to store samples in glass containers, often this is not feasible. Therefore, creative solutions need to be found. Three points need to be considered, however. (1) The sample container needs to be clean and uncontaminated by other carbon sources. (2) Wrappings that do contain carbon should not be able to mix with or stick to the samples like in the case of tissue paper. (3) Even though those points are largely true for aluminum foil, this might not be the best choice if samples are in danger of remaining in it for a longer period. The decomposition of the foil could cause mixing of samples with the foil, or in the worst case, with other samples in the same package. The introduction of contaminants to those samples could be the result. Specifically, wood, charcoal, sediment samples, and bone samples with sediment attached should only be wrapped in aluminum for a short period of time but not be shipped to laboratories in this way.

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