

Teflon vials for radiocarbon dating



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Teflon is well known for its high performances: chemical resistance, mechanical durability and optical transparency (ultra-violet). All it makes possible its application for liquid scintillation counting especially for radiocarbon dating based on application of modern LS spectrometers like Quantulus 1220™.

It is very important to use Teflon vials for Liquid Scintillation Counting to optimize Conventional Carbon Dating. Teflon vials, at beginning, was developed for large volume, at least 7.0 ml or 3.0 ml of benzene. After that Teflon vials was developed for measurement of small benzene samples about 0.3 ml.

Each measurement performed on base of Liquid Scintillation Counter (LSC) utilizes LS vial. Different applications of LSC technique are covered by different kind of LS vials. LS vials are produced using of different materials like: glass, polyethylene, boron-silicate glass and Teflon. Most powerful are Teflon vials.

Traditional Teflon vial line

Traditionally Teflon vials, which are applicable for carbon dating, as produced by Perkin Elmer Inc. are 7.0 ml and 3.0 ml (first two on left at a photo above). Like other, on photo, at right, are presented three different holders containing 0.8 ml vial to fit in standardized size, see description below. Small size Teflon vials of 0.8 ml was designed to cover range of sample volume between 0.3 and 3.0 ml and was published: Newly Designed 0.8-ML Teflon® Vial for Micro-volume Radiocarbon Dating. (1995).

Counting performances are defined by size and by application of Teflon as material of vial. Working cycle depends on number of parts used and on additional materials involved: metal, rubber and Teflon film. Thus version B here is more suitable for continuous use.

Small Teflon vials construction

Two kind of vial (crosssection)

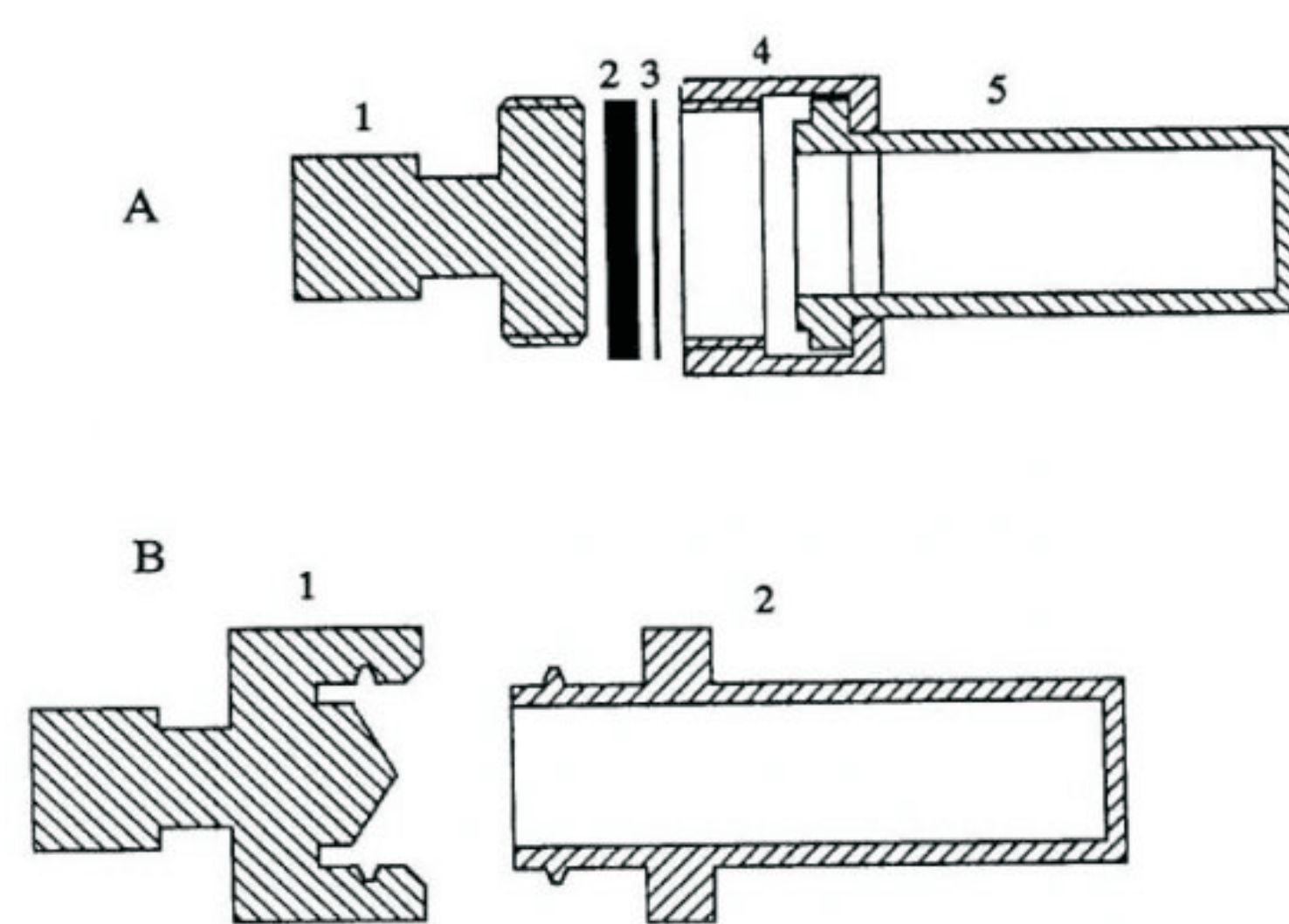


Fig. 2. Vial sections. Type A: Aluminium screw (1), rubber layer (2), Teflon® film (3), aluminium holder (4), Teflon® vial (5); Type B: Teflon® vial and cap: cap (1), vial (2)

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Small Teflon vials performances

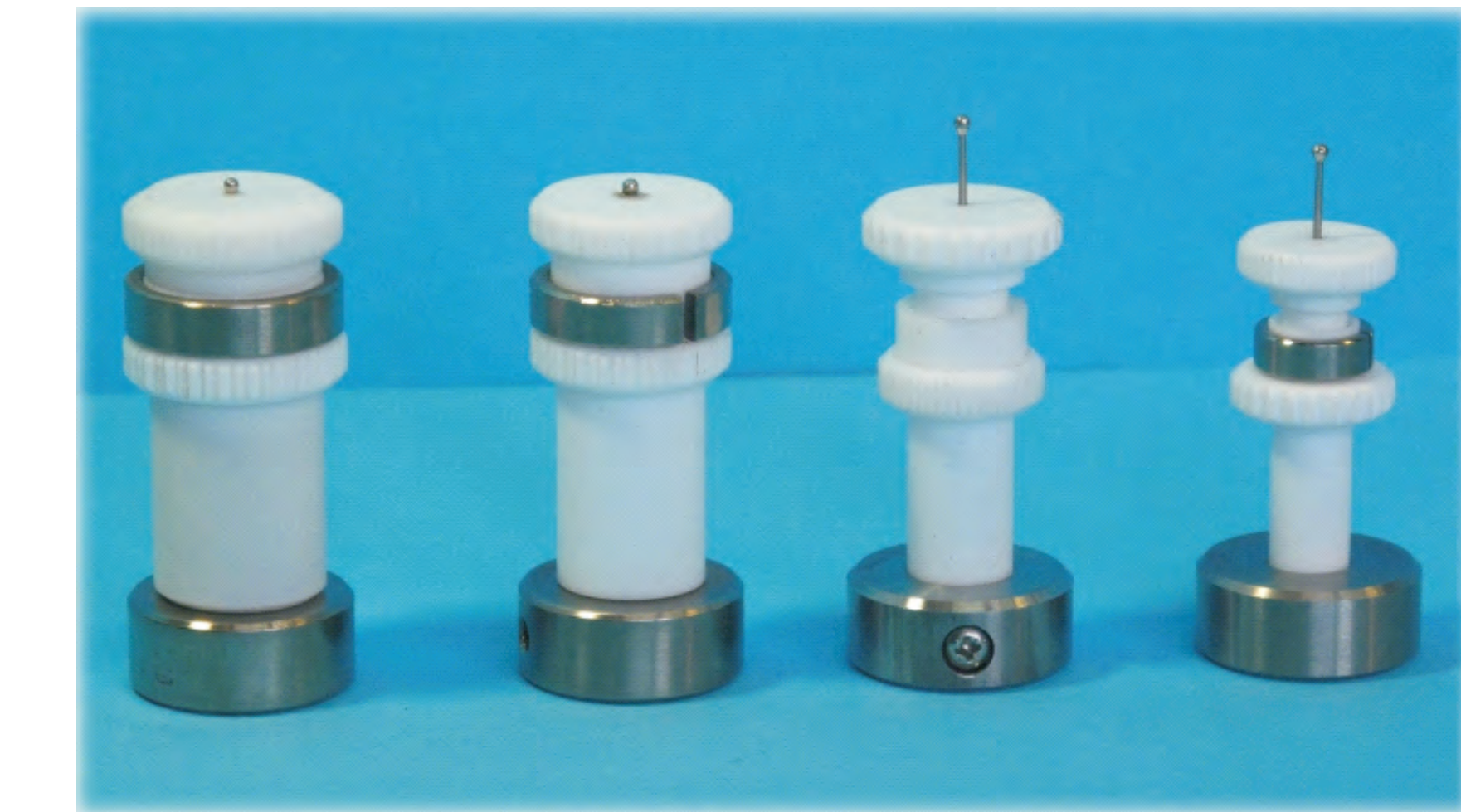
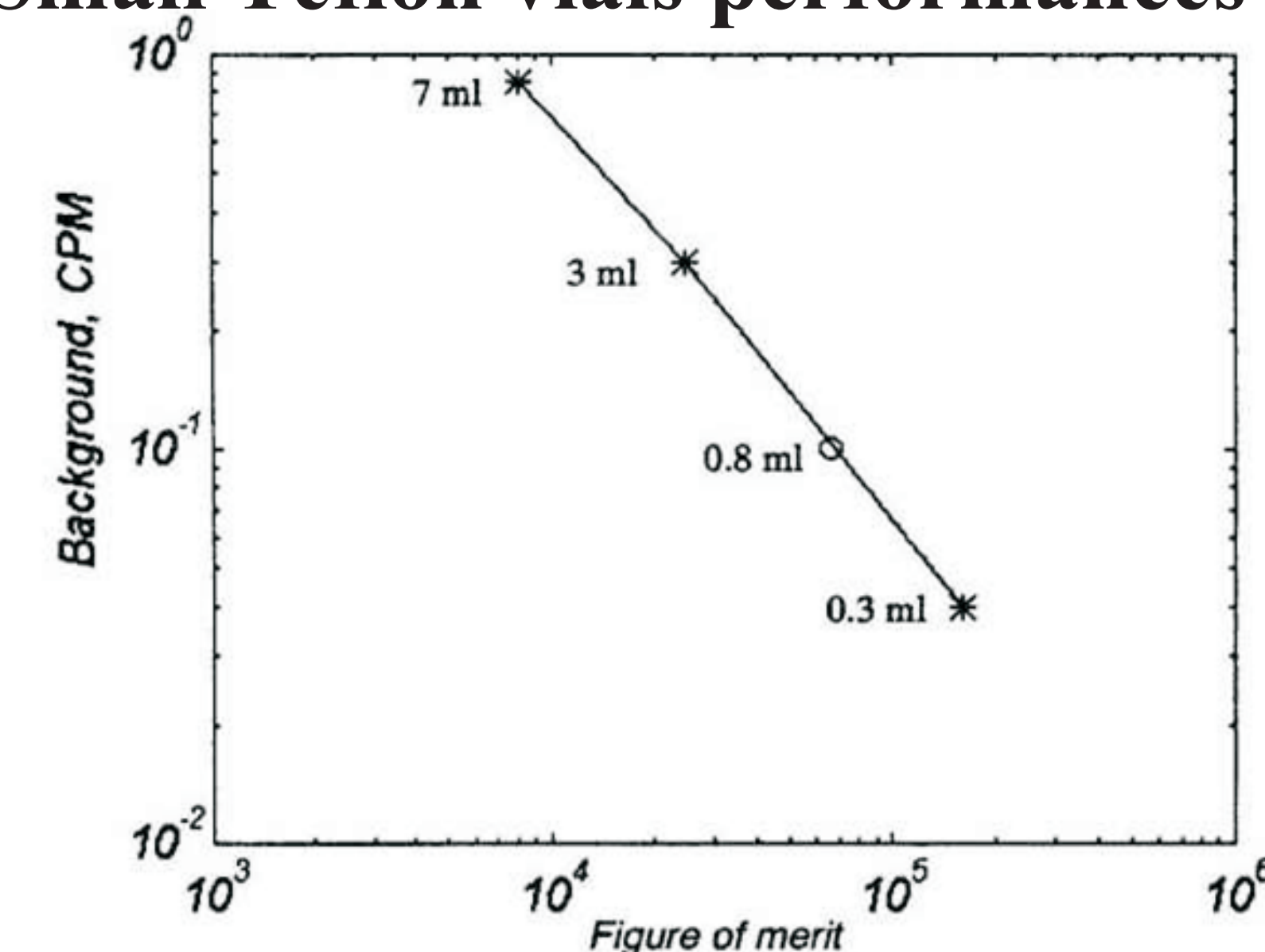
0.8 ml vial fits into row of vial volume of 7.0 ml and 3.0 ml and could be standardized with different holders. It also fits into line, which describes **FOM** - main counting performances of Teflon vials (counting efficiency and background), see, bi-logarithmic scaled plot at picture above.

Two versions of an 0.8-ml volume Teflon® vial for radiocarbon using a modern Quantulus 1220 TM liquid scintillation spectrometer, see picture below. Detection efficiency for ¹⁴C was achieved up to 82% against a background count rate of 0.1 CPM, i.e., a "figure of merit (FM) value" = 67,240.

Variety of Teflon vials

Modern concept of Teflon vial developed recently differs, see photo (above). It allows avoiding of use of screwed connection of Teflon parts. Vials use spline coupling and metal washers. They have better performances: hermetic vials have small benzene leakages ever. Standardized benzene sample volume could be ranged (bold presented on picture): **7.0 ml**, **4.5 ml**, **3.0 ml**, **2.5 ml**, **1.5 ml**, **1.0 ml**.

Small Teflon vials performances



References

1. Teflon Vials For Liquid Scintillation Counting Of Carbon-L4 Samples By G.E. Calf And H.A. Polach In Liquid Scintillation Counting - Recent Developments. 1973 Sydney, Australia. p.223-234
2. Michael Buzinny & Vadim Skripkin. Newly Designed 0.8-ML Teflon® Vial for Micro-volume Radiocarbon Dating. *RADIOCARBON*. Vol 37, No 2 (1995) PP. 743-747

