Vertebrate Microfossil Storage, the Basics and a New Technique

Matt Smith, John Day Fossil Beds National Monument

- Really a misnomer, not truly microscopic
- A Microfossil, for the purpose of this talk, is an object that ranges from around .5 mm to some arbitrary upper size limit determined by your collection storage containers

Universally recognized as the little bits that are easy to misplace.

Microfossil Storage

Problems:

- Often chemically adhered to a pin or other object
- Microfossils can be very numerous
- Curation costs per unit add up quickly for time and materials
- A poor storage system can take up a disproportionate amount of space in cramped collections
- There are a bewildering array of storage options

Periodically weigh your options to determine best practice for your museum

The Conservation Ethic is essential.

Microfossil Storage

Options Considered?

- Specimen trays
- Screw cap vials, w/pins in corks
- Screw cap vials
- Shell vials
- Shell vials, w/pins in corks
- Gelatin capsules
- Gelatin capsules in vials
- Baggies
- Cuvettes
- Micro-centrifuge cuvettes
- Etc.

Criteria:

- There are a minimum of foreign chemicals introduced.
- The specimen is held securely reducing risk of breakage or other physical damage.
- Facilitates the easy manipulation and handling of the specimen so all surfaces are available for examination.
- The identifying collection number is permanently associated with the object.
- The ratio of object size to container size is maximized to increase the amount of free collection space.

Microfossil Storage

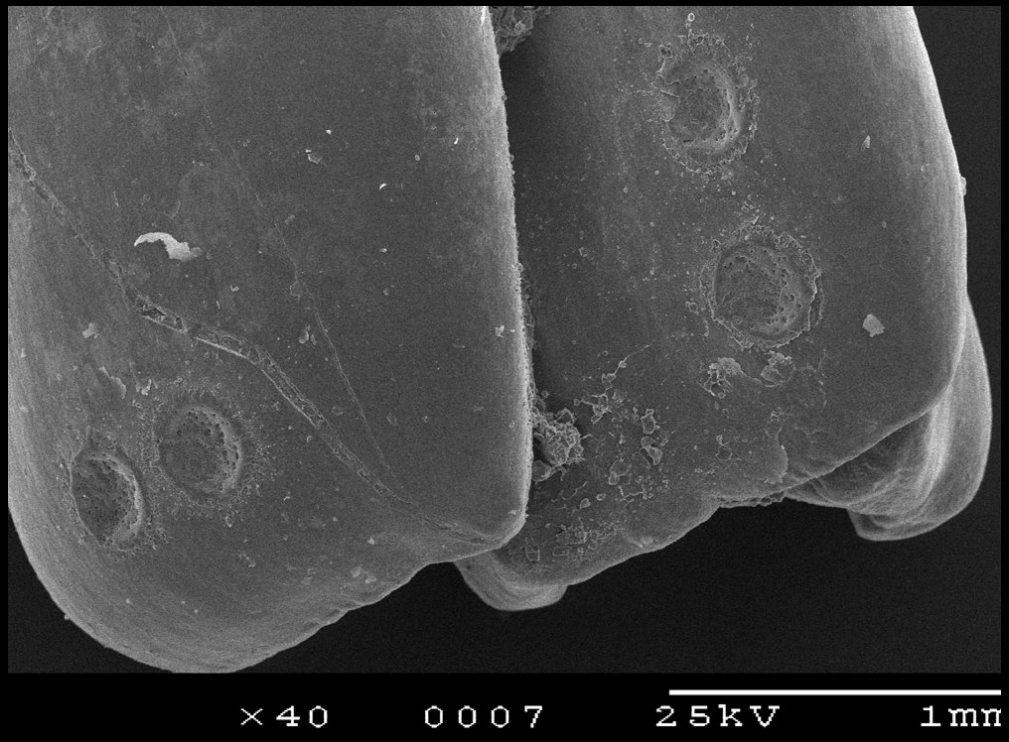


Photo courtesy of Benjamin Passey

Laser test pits were as small as 240μm in diameter, and as little as 70μm deep, and volumes ranged between 0.0016 and 0.0039mm3 (Passey, 2006).

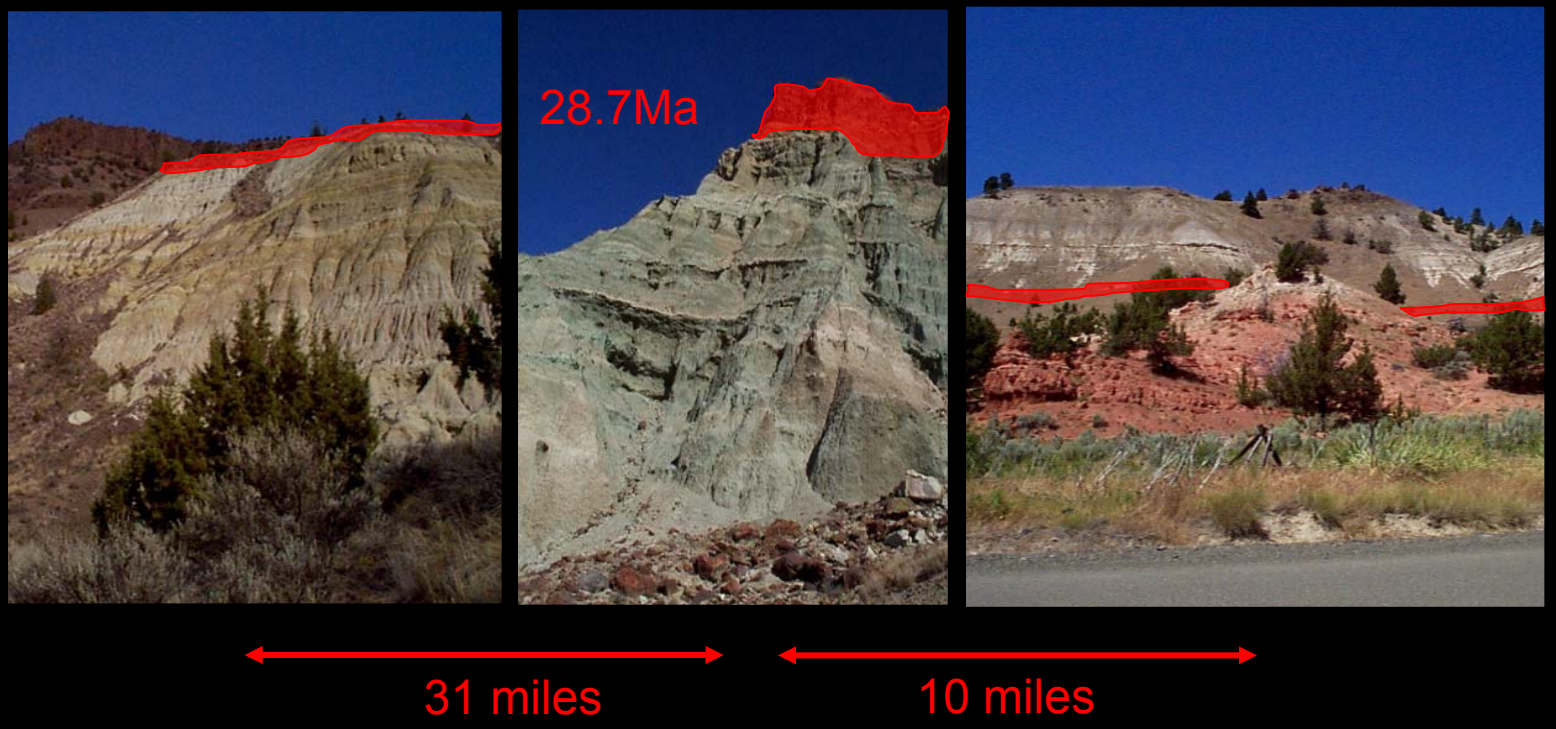
A New Twist:

In situ stable isotope analysis using laser ablation allows minimally destructive isotopic study of small or rare teeth (Passey, 2006)

Biochemical (aDNA and protein) analysis may also be feasible in the future?

Microfossil Storage

Why do small teeth matter when we have all those horse teeth?



- Unlike many ungulates or carnivores, rodents and other small mammals may have home ranges of a hundred square meters or less
- Could study isotopic differences between isochronous microhabitats
- Could study isotopic diagenesis of tooth enamel from equivalent strata

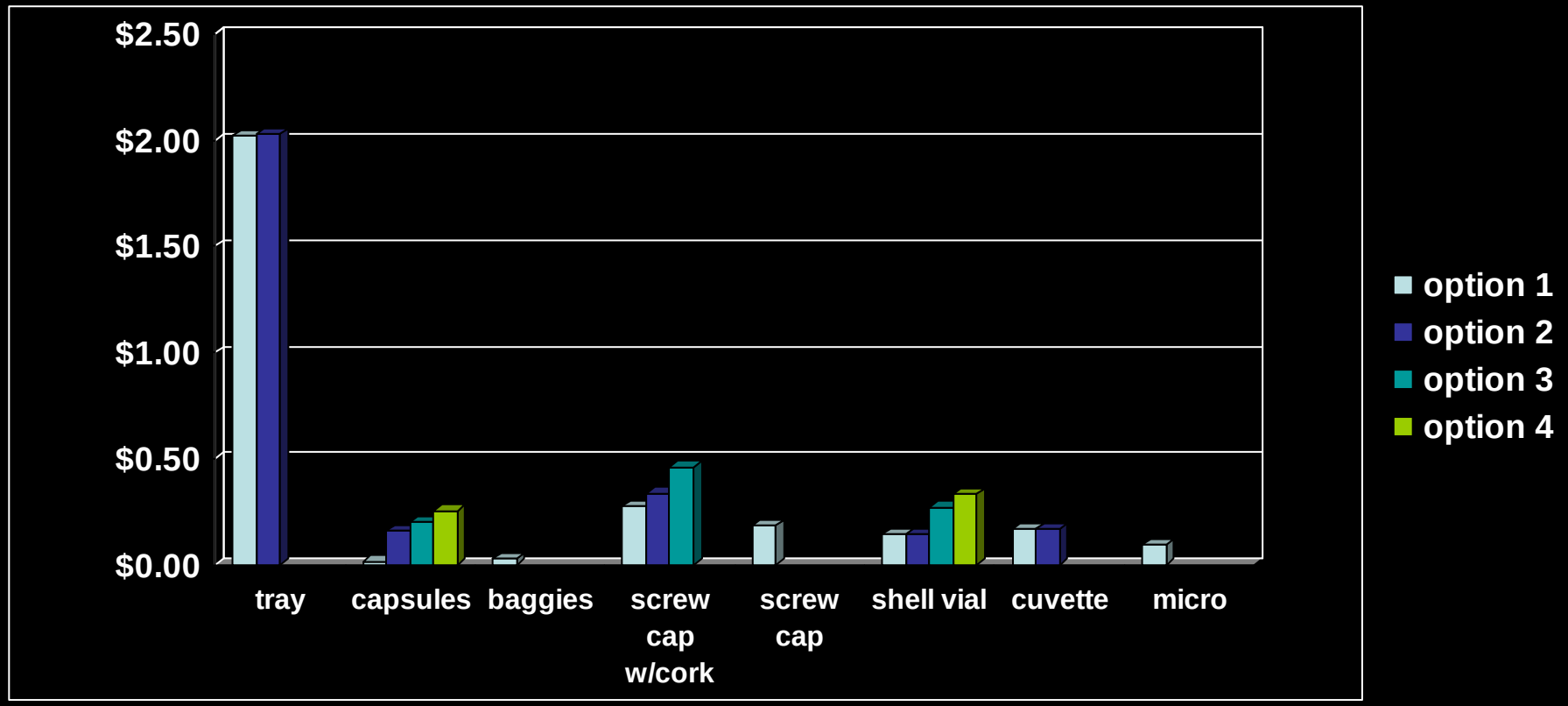
Microfossil Storage

Determining Best Practice: An admittedly subjective grading scale subject to modification

	1	2	3	4	5	6
	Chemicals ?	Protection	Accessibility	View	Fit	Cost
trays	~~medium~~	~~poor~~	~~good~~	~~good~~	~~poor~~	~~poor~~
Gelatin capsules	~~good~~	~~medium~~	~~medium~~	~~medium~~	~~good~~	~~good~~
Capsules/ vials	~~good~~	~~good~~	~~poor~~	~~poor~~	~~medium~~	~~medium~~
Baggies	~~good~~	~~medium~~	~~good~~	~~medium~~	~~good~~	~~good~~
Screw cap vials w/corks	~~medium~~	~~good~~	~~good~~	~~good~~	~~medium~~	~~poor~~
Screw cap vials	~~good~~	~~medium~~	~~good~~	~~good~~	~~medium~~	~~poor~~
Shell vials	~~medium~~	~~good~~	~~good~~	~~good~~	~~good~~	~~medium~~
Cuvettes	good	good	good	good	medium	medium
Micro-cuvettes	good	good	medium	medium	good	good

Microfossil Storage

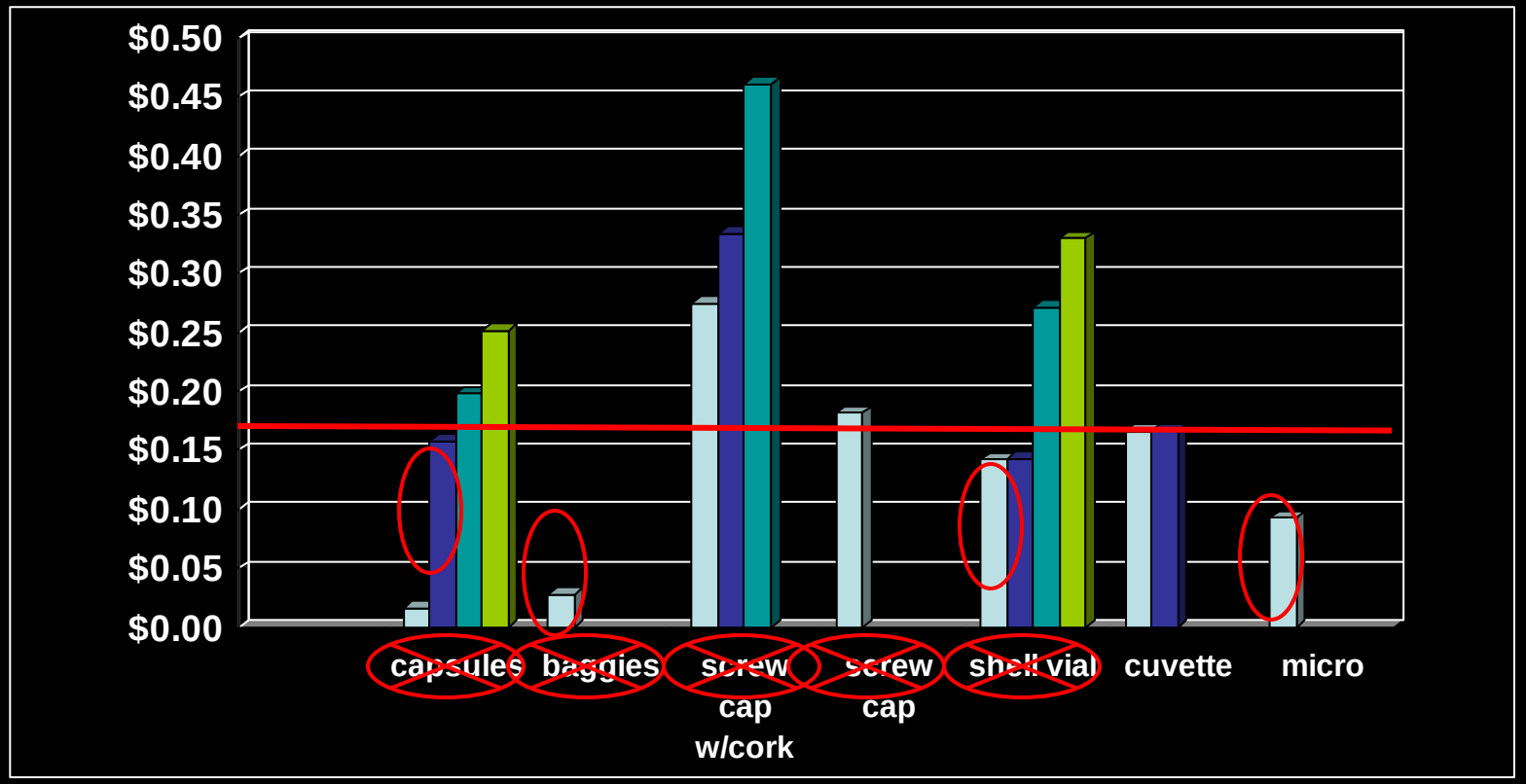
A numerical breakdown of one column (Science is all about numbers)



Cost in dollars per specimen for 1000 specimens.

Microfossil Storage

A numerical breakdown of one column (Science is all about numbers)



Cost in dollars per specimen for 1000 specimens.

New Cuvette Technique

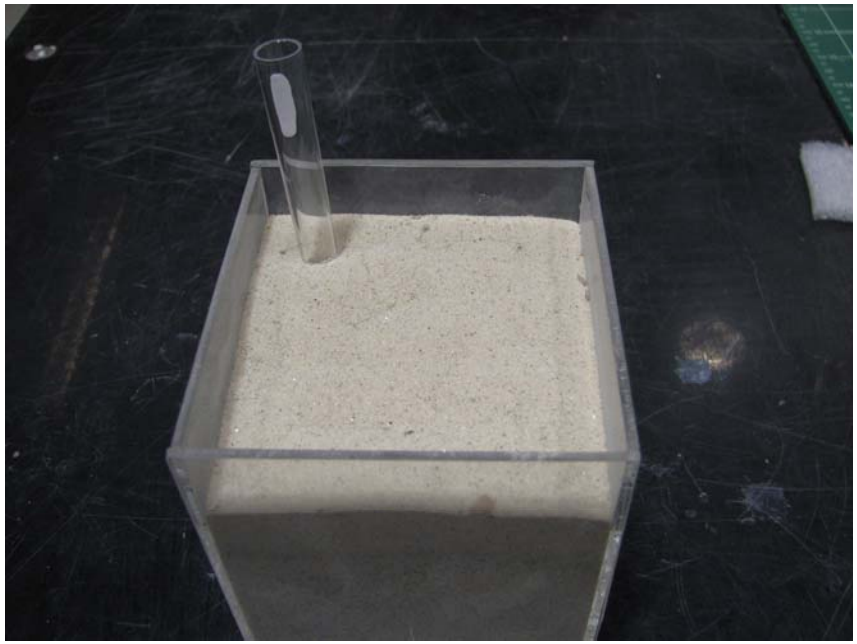
Advantages

- 208 per museum (JODA) drawer if stored as shown. Many more if stored on end.
- No chemical contamination
- Held very securely
- Protected from many natural and human threats
- Easily viewed and manipulated
- Can be grouped for various study purposes

How to do it?

Prepare the cuvettes:

- Using archival labeling materials apply a white label stripe to your cuvettes. A sand box or other organizer will allow for many cuvettes to be striped at once.



Cut your polyethylene foam

- In this case just less than ¼ inch with a slight taper is best.
- More than ¼ is too fat and won't work
- If they are too thin they rattle around and are not secure

Punch a Hole

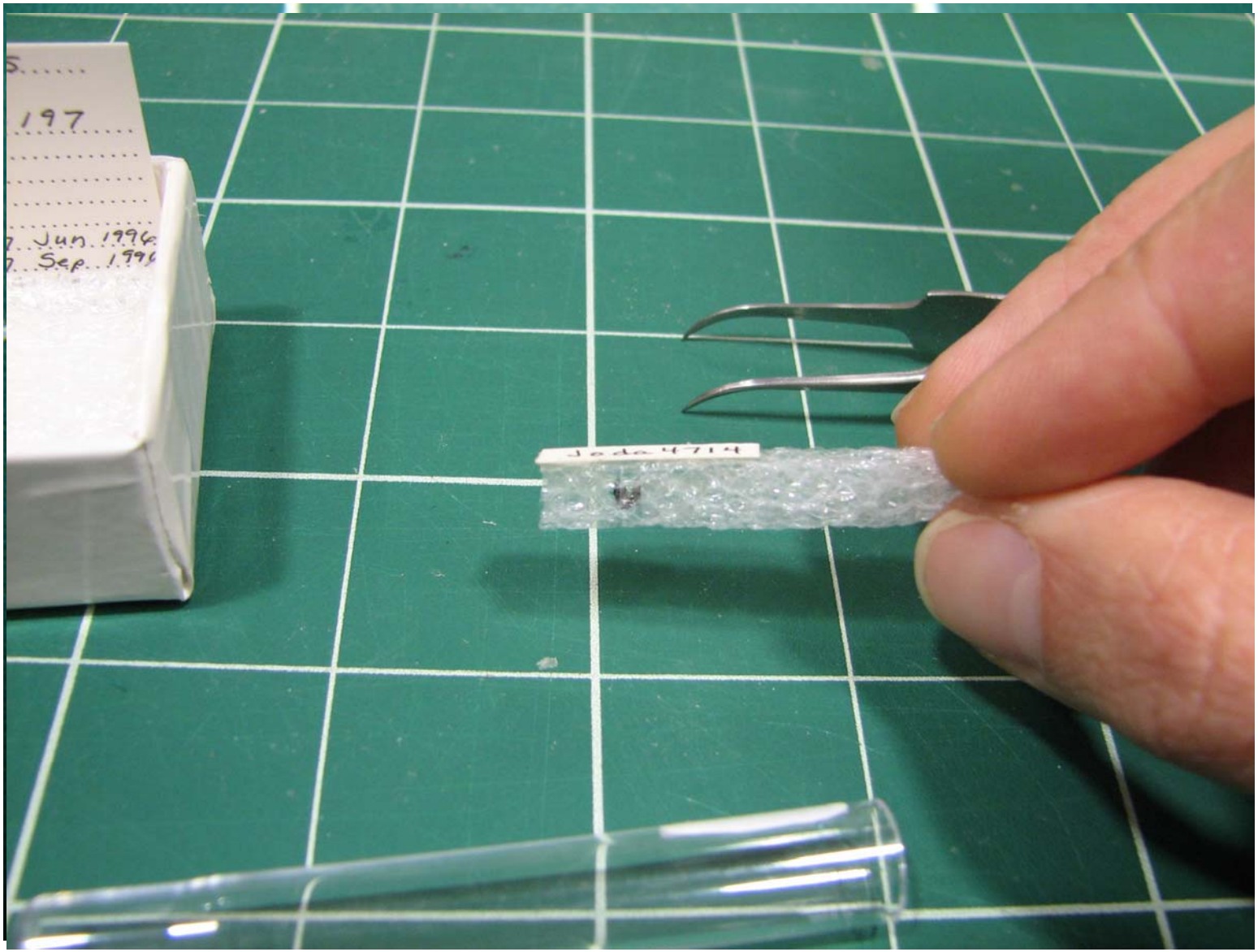
- Different teeth will require different hole sizes
- Leather punches come in a variety of small sizes.
- Or use different diameters of heated wire, dental probes, etc.

Glue on the specimen number

- Write the specimen number on heavy weight, acid free paper
- Use an applicator to add thick archival adhesive on either side of the hole
- Don’t get glue in the hole or bad things could happen

Wait till the glue dries and add your specimen

The fit should be secure and display the diagnostic surfaces



Put the specimen in a tube

- If the fit is “too tight” take out the tooth and carefully trim the edges of the foam stick.
- It should ease into the tube, and then get a little compressed. This will hold the specimen securely.

Cap it and you are nearly done

- In some cases part of the polyethylene will still protrude from the cuvette, that is OK.
- If all is perfect the tab will expand out when you remove the cap.
- If not, all is not lost, they are easy to hook and pull out with a dental probe

Number and tray it out

- Write the collection # on the cuvette with archival ink being careful not to scratch off the white coat
- Apply an archival clear coat
- Line a 3x4 inch or 4x6 inch tray with ¼ inch foam
- Fill the tray with specimens in numeric order

Organize the labels

- Either place them between the foam and tray along one edge
- Or, if there are ID modifier labels or additional information put them in a baggie
- Keep them in the same order as in the box so researchers can easily find the right label

Microfossil Storage

What have we learned one year later?

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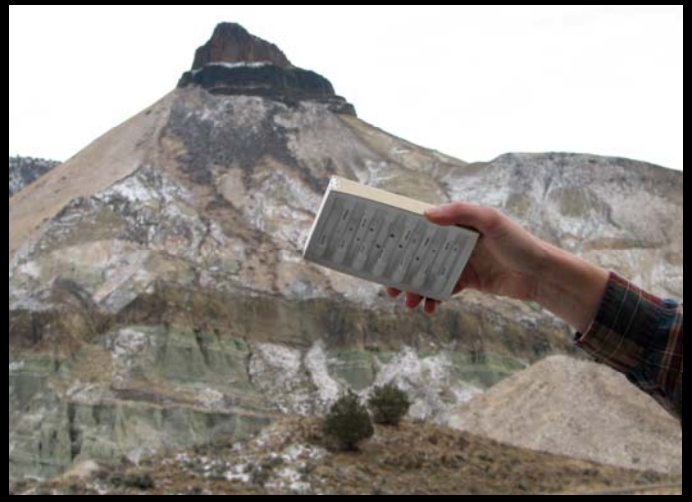


- Ethafoam is not the best polyethylene foam for this process, the large cell size may “swallow” some very small teeth.

- Crystal clear polystyrene cuvettes are brittle and display stress fractures

- Some microfossils are too large for the cuvette technique

- Not found to be desirable by some researchers who want to stick to pin and cork techniques

Alternatives

Ethafoam is not the best polyethylene foam for this process, the large cell size may “swallow” some very small teeth:

Velora, Plastazote, or some other high density polyethylene foam may be more appropriate and adds very little (~.014 cents) to the cost of storage.

Alternatives

Crystal clear polystyrene cuvettes are brittle and display stress fractures:

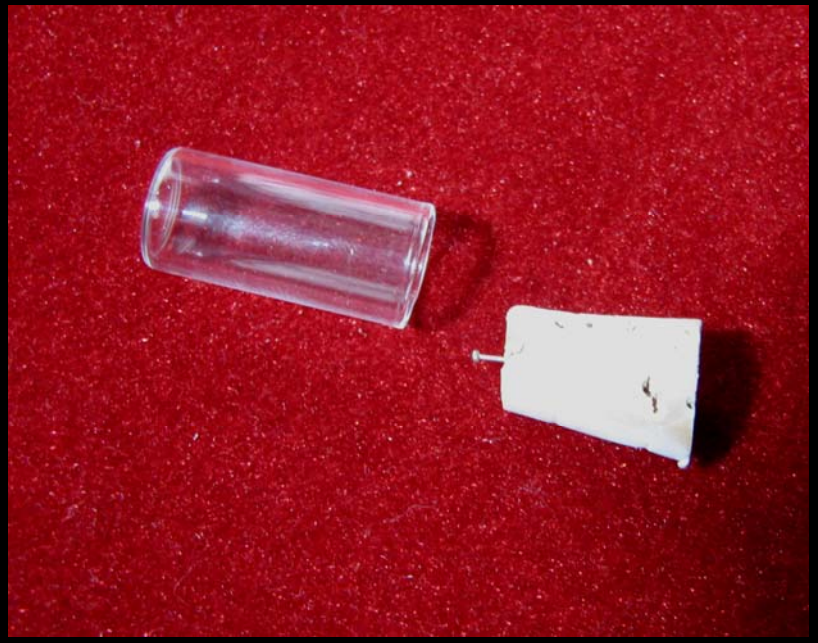
•Softer cap material such as cork or polyethylene rope may not stress the cuvettes as much

•A different cuvette material such as polyethylene may not be as clear but may be “good enough” if you are already using gelatin capsules

Alternatives

Some microfossils are too large for the cuvette technique:

The lowest cost, “chemical free”, alternative would be a larger diameter shell vial filled with polyethylene rope and possibly a cork for water proofing.



Alternatives

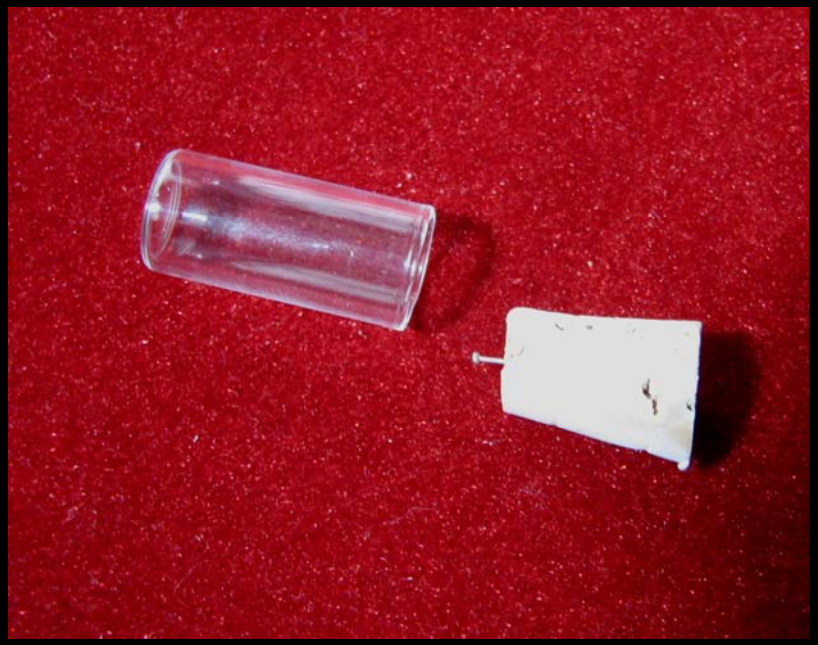
Not found to be desirable by some researchers, staff members who want to stick to pin and cork techniques :

•Try “the-times-are-changing” argument

•Review your technique and give careful consideration to your pin adhesive.

•Because many microfossils are screen washed, and presumably not sensitive to water, a water soluble adhesive may be desirable. Assuming that the adhesive is “truly” reversible.

•Resins reversed in organic solvents may be particularly undesirable because of any organic residues left behind.



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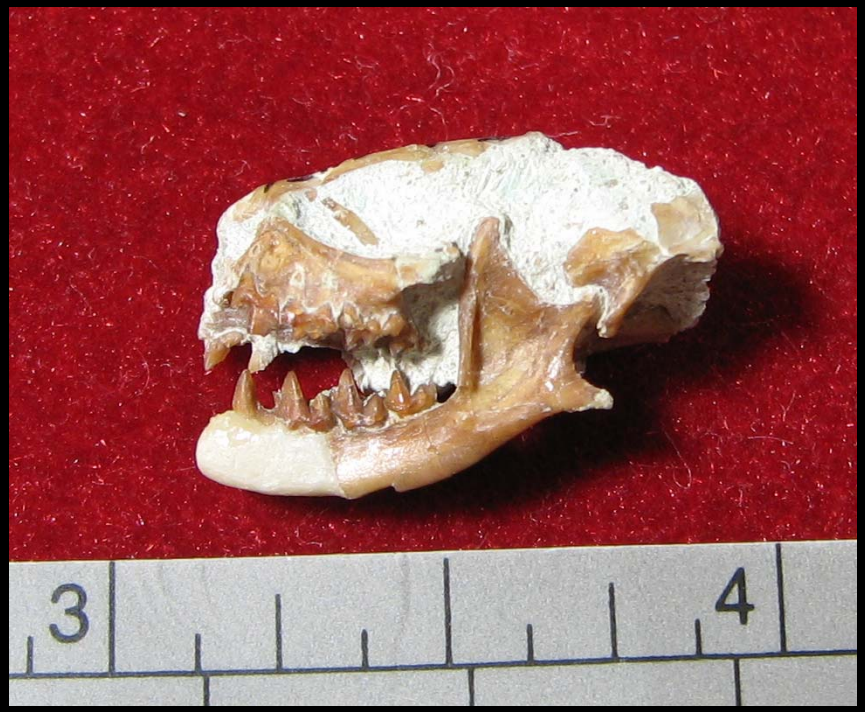

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