

Air Abrasives 101

A primer to using air abrasive machines in fossil preparation

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What?

Why?

When?

How?

&

A few things I've learned
along the way.

What?

- An air abrasion unit is a tabletop sandblaster.
- Mixes compressed air and some sort of abrasive medium to etch away matrix from fossils by projecting the air/"sand" mix at ridiculously high velocities.
- Sandblasting first used on trilobites in the 1890's (!!!) by H. M. Bernard.
- Micro-sandblasting units invented in the 1940's for dental work.
- Sandblasting became paleontologically popular in the 1960's.

Why?

1. Sandblasting has the potential to prepare fine details that may not be possible using other mechanical techniques.
2. Sandblasting is often faster than other techniques (even though it is pretty slow)

Why not?

1. Sandblasting has the potential to **obliterate** fine details.
2. Sandblasting may etch bone surfaces

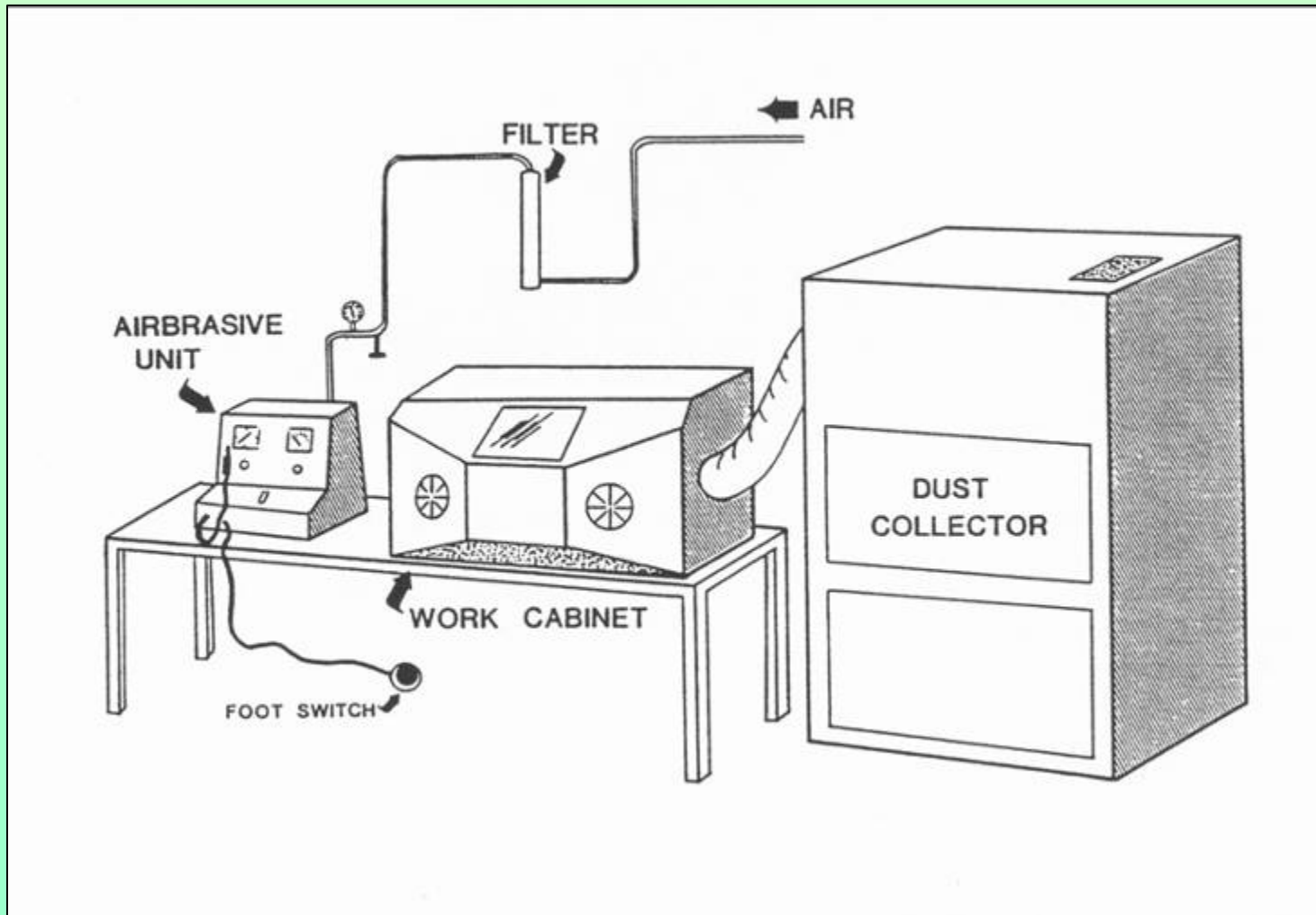
When?

- When matrix is softer than fossil
- When there is poor matrix to fossil separation
- To remove the final layer of matrix off a specimen
- When vibrations from other tools may be harmful to the specimen
- On delicate fossils

When not?

- When matrix is harder than fossil (if you sandblast it, don't expect great results)
- When fossil is too unpetrified, or otherwise unstable
- To do major matrix removal (use aerscribes or other picks to do this)
- On delicate fossils

Main Parts



From Hannibal, 1989

Air Line Filters

Clean, Dry air is **ESSENTIAL** for air abrasives



Oil-lubricated compressor needs a coalescing filter to remove oil residue in the air.

Air Abrasive Machines



Comco



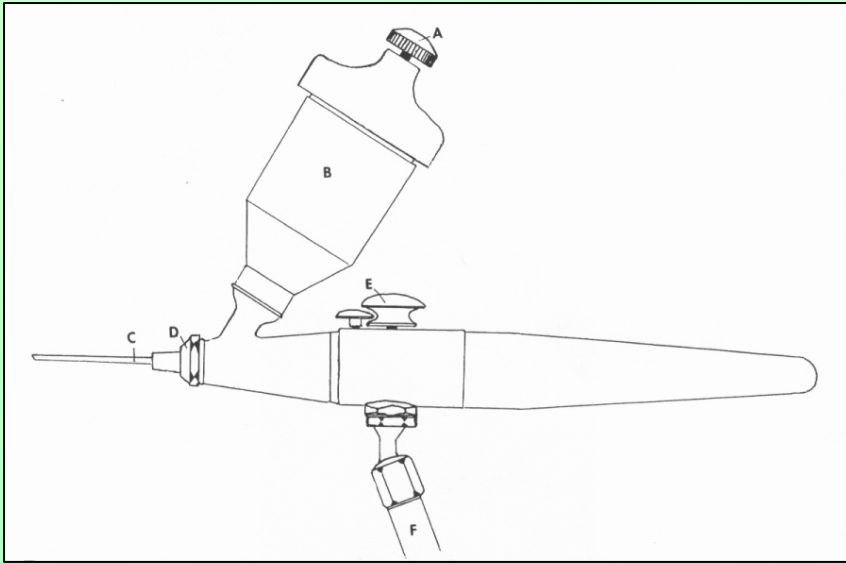
Photo thanks to Toni Culver
S. S. White



Swam-Blaster

...and others

Air Abrasive Machines



Paasche Air Eraser, modified with hypodermic needle. From Gunther, Gunther and Rigby, 1979



Eco-Blaster made by Swam Blaster



Vaniman from vaniman.com

Work Chambers



Photos courtesy of Nate Murphy, Josh Slattery and Fort Peck Paleontology, Inc.

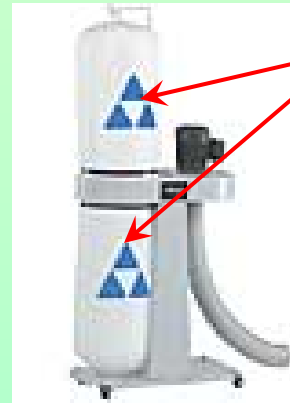
Dust Collectors



muffer



Dust Collectors



Optional 5 mil bags...
a must for fossil prep

Photo from Woodworker's Supply web site



How?

- Fill Powder Tank
- Foot pedal is the actual on/off
- Handpiece is the working end

**Airscribes remove bulk matrix;
air abrasives clean details.**



Practice on a scrap piece or a hidden corner...start with less destructive options.

Air Pressure

- 0 to 120 or so
- Adjusts by knob on machine



Practice on a scrap piece or a hidden corner...start with less destructive options.

Powder Flow

- Less to More; adjusts with knob on machine
- Less is NOT zero
- Very little difference between Less and More



Practice on a scrap piece or a hidden corner...start with less destructive options.

Powder Flow

- Orifice size

The hole(s) at bottom of tank that allow powder to flow from tank to hand piece.



Practice on a scrap piece or a hidden corner...start with less destructive options.



























Non carbide-lined holes can be drilled out for more powder flow

Nozzle

- Many choices available

SWAM-BLASTER™ ABRASIVE NOZZLE SELECTION CHART

NOZZLE STYLE												
ORIFICE STYLE												
	10-32 UNF MALE THREAD						3-56 UNF FEMALE THREAD					5/16-24 UNF



Powder

- Sodium Bicarbonate (“bicarb”)
- Dolomite
- Aluminum Oxide, Walnut Shells

Practice on a scrap piece or a hidden corner...start with less destructive options.

There are less costly sources of powder:

- dolomite from pottery suppliers
- bicarb from feed stores or abrasive suppliers

32 meshes per inch soil sieve

One gallon ice cream bucket



signage



Powder

- **Keep powders dry.**
- Store in plastic buckets (with lids).
- Use pin-pricked sandwich size ziplock full of silica gel inside buckets.
- Dolomite can be dried in a toaster or hot lamp.



Practice on a scrap piece or a hidden corner...start with less destructive options.

Powders

- Bicarb can be painful on the hands
 - Dolomite clings to everything, floats in the air and dries out your hands
-
- With enough direct shots, all powders will painfully remove fingerprints and associated epidermis...Ouch

Practice on a scrap piece or a hidden corner...start with less destructive options.

How?

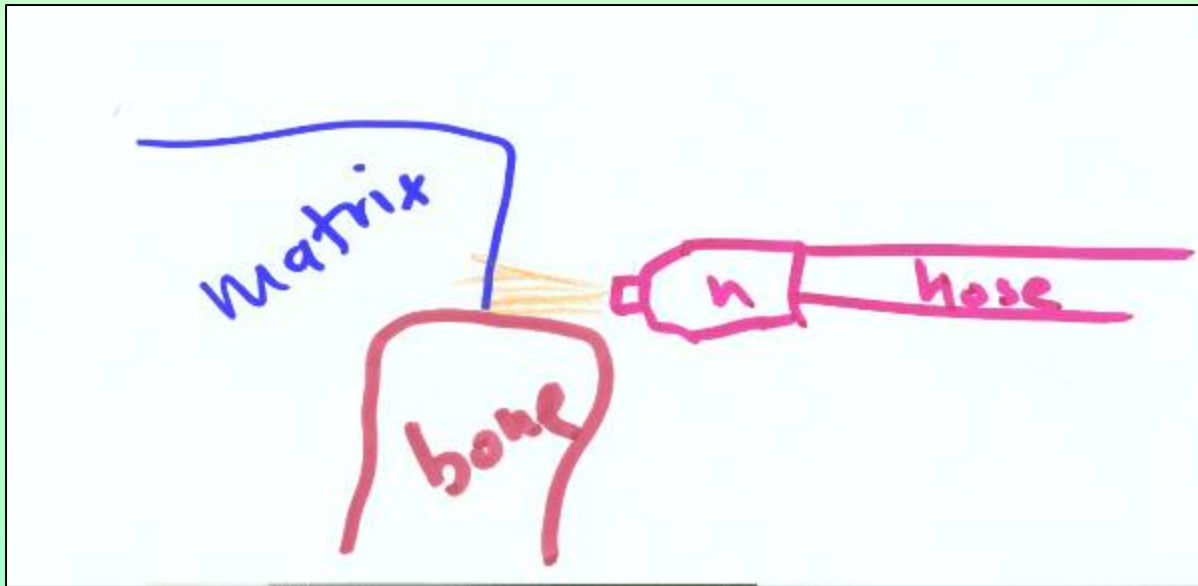
Distance and Angle

- Low angle best ($\leq 30^\circ$) **Avoid 90°**
- Don't be afraid too get close

In general, keep handpiece moving to avoid gouging fossil.

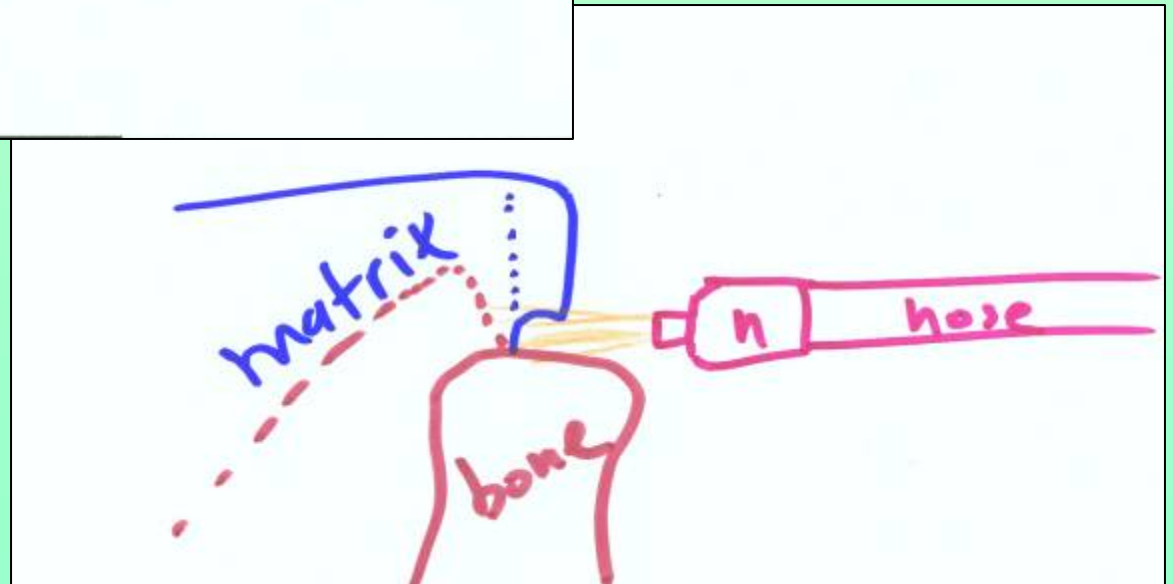


Canyoning



Works well if fossil
is considerably
harder than matrix

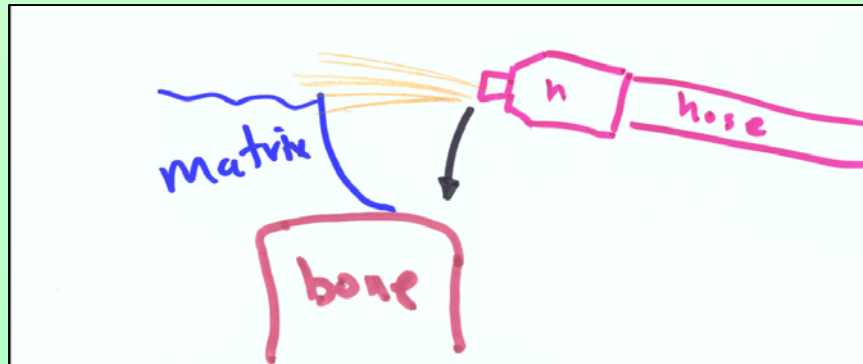
e.g. shales,
mudstones



Bone and matrix sub-equal in hardness...

Sweep

1.



Works well if bone and matrix are equally hard

e.g. concretions, sandstones

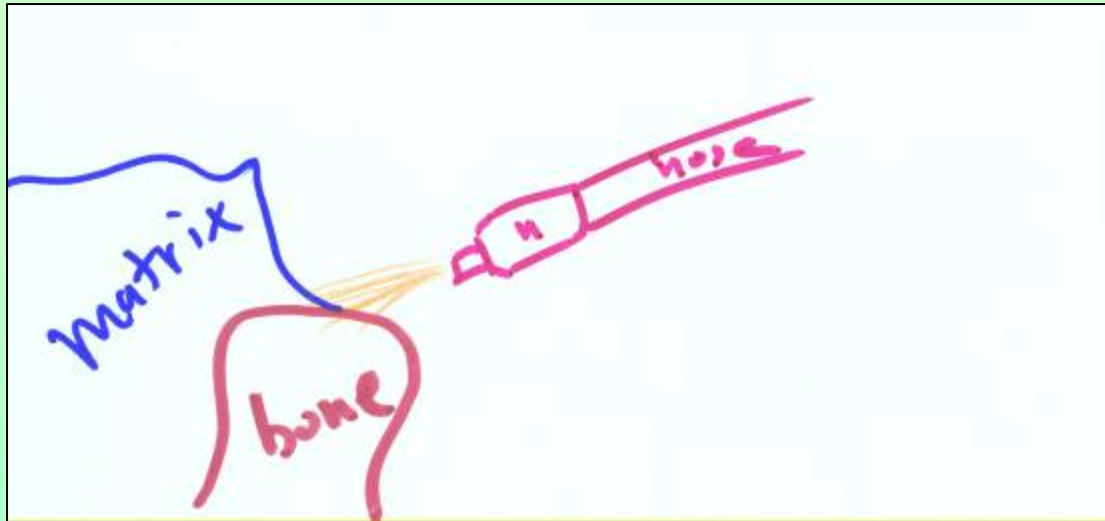
2.



In general... keep the handpiece moving up and down or sideways

Then release foot pedal...
don't dwell on bone

Bone and matrix sub-equal in hardness...



Direct aim at
matrix/bone interface is
less than optimal



Edge of spray

For very delicate bone surfaces

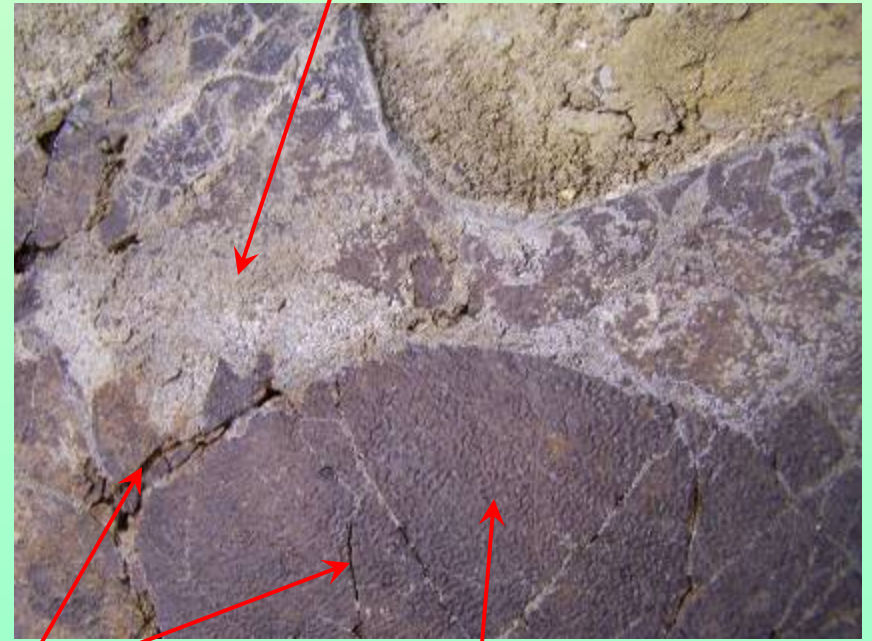
e.g. articular surfaces on Lance Fm.
bones



Once you've exposed the bone surface, avoid blasting it any more.

Removing preservatives

Turtle shell with vinac coating, and some matrix



Good candidates for epoxy putty fill

Vinac removed with sandblaster

As with other techniques, stabilize potential fly-away pieces before they fly away

Paperwork

- A note should be made in the specimen files that a specimen has been sandblasted, so researchers will be aware of any possible tool marks.

Recycle your powder?

- All manufacturers say emphatically NOT to do so.
 - (Is this a powder-selling scheme or an actual safety/maintenance issue?)
-
- Bicarb, not very well
 - Dolomite, in an emergency
 - AlO_2 recycles well

Advanced Sand-blasting

Used in conjunction with a microscope



Boom

Barlow Lens

Easily Replaced
1/4 inch Glass,
(beveled edges)

Dust Collection

Lighting

Continuous
Zoom

Lighting inside box

Silicone rubbed into all
internal joints

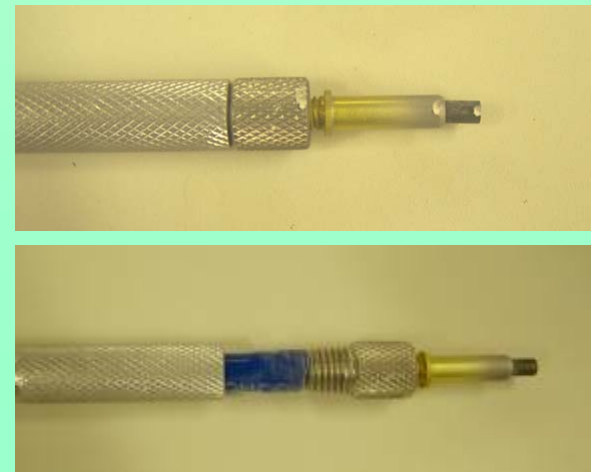
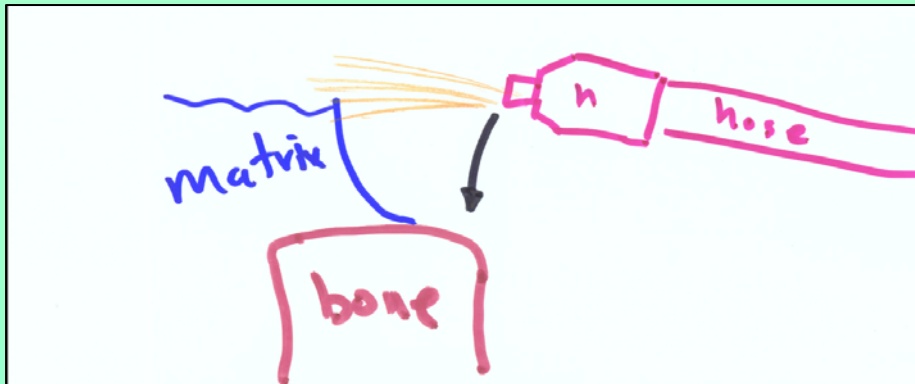


Foam or sandbag

Keep Aircsribes within reach

Sand-blasting under microscope

- Lower scope to almost onto glass... focus is done by lowering or raising the specimen
- Turn down air pressure. For very fragile stuff, use the “sweep” technique described earlier
- Use small orifice size and small nozzle (minimizing powder flow)
- Remove (unscrew) grip part of handpiece
- **This can get fairly intense**
- **Practice on a scrap piece or a hidden corner...start with less destructive options.**



Maintenance

- Sweep out box occasionally (wear a mask)
- Clean out dust collector system regularly (Use a mask)
- Make any PVC pipes (dust collector) easy to take apart
- Keep powder dry, esp. dolomite
- Occasionally dry silica gel and drain other filters
- Polish glass if it gets etched

- Replace pinch valves in Swam Blaster units
- Comco sells a tune-up kit they suggest doing yearly

Swam Blaster Pinch Valves

When you lift off the footpedal and air keeps coming out, it's time to replace pinch valve.



Polishing Glass



H₂O

Polishing pad

Cerium oxide



Dremel tool or random orbital sander much more effective than elbow grease

Safety Concerns

- **Always, always, always** do sandblasting in a work chamber with dust-collector turned on.
- Bicarb can hurt the hands, consider wearing gloves
- Sandblasting away fingerprints is painful
- If dust collector doesn't suck well enough, clean it out or use a face mask
- Remove watches and jewelry
- Dolomite may cause static electricity buildup in dry climates. Ground the handpiece



A few tidbits I've learned along the way

- Swam Blaster works best with initial puff of powder
- Comco has a more steady stream of powder
- Keep powder tank at least half full
- Fill tank every time compressor turns on
- Do final powder removal with empty tank– (Swam Blaster tank is easier to empty)
- Screw foot pedal to a board
- Use one, and always the same sandbag or foam piece inside work chamber
- Sandblasting is good for removing aircscribe marks on matrix
- Baby ziplock filled with silica gel placed in powder tank can help keep powder dry (zip it closed and pierce it with pinholes)
- Put opened powder bags into a 3 or 5 gallon bucket with lid to keep it dry (also with a bag of silica gel)
- Powder (esp. dolomite) dries hands... do not be afraid of Mary Kay
- I dream of buying a two-tank machine

Building a work chamber

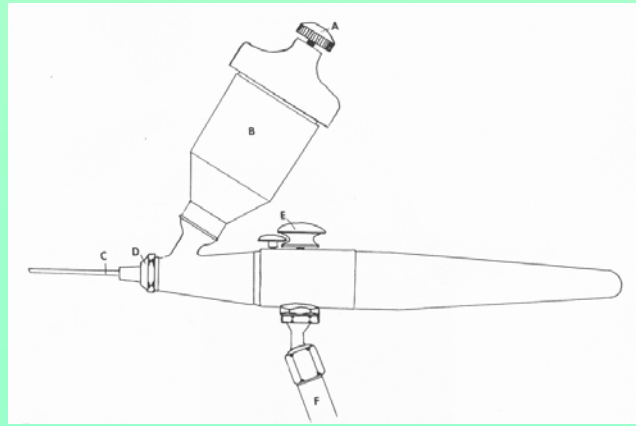
- Internal lights, (not mounted on floor of box), in addition to external lights
- Microscope on boom, that can swing into and out of position
- Easily changed 1/4 inch thick glass (beveled edges)
- Hole for dust collector should be above floor of box
- Silicone bead along all internal edges (smoothed with fingertip)
- Keep aircsribes within reach; store them outside the work chamber, use them inside the work chamber
- Hinged lid or sides
- In emergency, large cardboard box and storm window will do (use a mask)
- **White insides**
- **Rubber sleeves optional (the lower the suction, the more necessary)**
- **Drier hose can be used to extend and direct suction**
- **Use 1/8 inch weather-stripping under glass to keep powder from escaping**
- **Use mirror mounts to mount glass**
- **Two holes for hands (more for big work chamber), and a third for tools**
- **Make dust collector hoses easily removable**
- **Consider putting the chamber on wheels**
- **If system leaks powder use a mask**

This just in...

“Does anyone have experience with dental or the lower cost industrial microblasters? I know that there is very little about [air-abrasive machines] that is worth \$2000.”

Matt Brown, in email to the prelist listserve, 24 Sept 2007

So, what about these smaller, cheaper units?



Waterblasting?

Jan Kresten Nielsen and Sten Lennart Jakobsen, 2004. EXTRACTION OF CALCAREOUS MACROFOSSILS FROM THE UPPER CRETACEOUS WHITE CHALK AND OTHER SEDIMENTARY CARBONATES IN DENMARK AND SWEDEN: THE ACID-HOT WATER METHOD AND THE WATERBLASTING TECHNIQUE *Palaeontologia Electronica* 7(4)

Pressure washer



Figure 3.

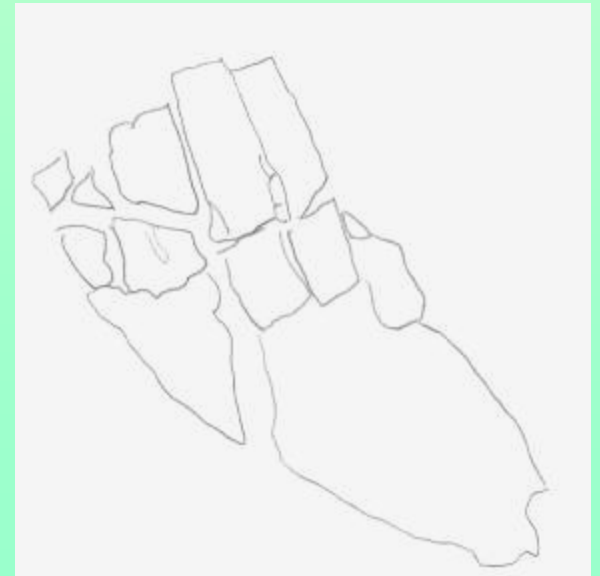
**Paasche airbrush with
carborundum powder
in water**



Figure 7.

Photos from above source

Eocene Crocodylian Jaw



Eocene Crocodylian Jaw



Carbowax



A Final Thought...

The learning is in the doing.

Thanks to...

- Mary Allemand, Rocky Mtn. Oil Testing Center, Midwest, WY
- Nate Murphy, Phillips County Museum, Malta MT
- Fort Peck Paleontology, Inc.
- Toni Culver and Laura Wilson, University of Colorado
- Matt Brown, Petrified Forest National Park
- Steve Pfaff, Tate Museum Volunteer, Hand Model and Glass Polisher
- John Swam, Crystal Mark, Inc.
- Tim Whelan, Comco, Inc.
- Nick Albanese, S. S. White
- Greg Miller, Vaniman Manufacturing Co.

