



# A dissolvable support jacket for preparation of thin arthrodire and shark specimens from the Upper Devonian Cleveland and Bedford Shales utilizing Carbowax 4000

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## Abstract

Complete preparation of large arthrodire and shark specimens that are thin and delicate, and entirely embedded in a hard, or mineralized matrix can be difficult; particularly so if your lab is not set up for acid prep, or the specimen is not compatible to acid reduction, thus requiring mechanical preparation. This is where Carbowax 4000 can be a great aid. The use of Carbowax to support fossils for preparation is not a new idea; work having been done on microvertebrates. The techniques employed here are somewhat similar, but on a larger scale. One side of the specimen is completely prepared, leaving a backing of matrix. The prepared surface should then be treated with thin glue as a sealant, and fillers applied, as the situation dictates. A pseudo mold set up is constructed around the specimen, and Carbowax 4000 applied directly to the prepared and sealed surface. The size and thickness of the jacket will vary depending on the fossil. After the wax cures, the specimen can be flipped and the remaining matrix removed. An added advantage of a Carbowax 4000 jacket is that after preparation is completed, the wax can be reclaimed by dissolution in a warm water bath and subsequent dehydration. Setting up the support jacket is time consuming, but if properly constructed, the rewards are worth it. It will allow you to work with confidence, with little fear that the fossil will fracture. If fracturing does occur, the jacket should hold the pieces securely until glue can be applied. A Carbowax 4000 dissolvable jacket should permit complete or near complete preparation of most thin fossil specimens. Detailed anatomy can be revealed that would otherwise be impossible to expose via mechanical preparation alone.



After the fossil has been completely prepared on one side, small cracks should be injected with thin glue or another consolidating agent. Larger cracks filled with plaster or another filler of your choice. An application of thin Butvar 72, or Paraloid B-72 may be necessary on selected areas, or over the entire surface of the fossil, especially if the fossil is porous or friable. However, if the fossil is sufficiently solid, this may not be necessary. Utilization of fillers, thin Butvar, or Paraloid B-72 would be up to the discretion of the individual Preparator in their evaluation of the particular fossil they're preparing.



Wooden Base And Clay Overlay - Above CMNH 50238 unidentified arthrodire anterior lateral

Choose a base, (in this case wood), appropriate to the size of the specimen, allowing enough room peripherally to construct a suitable retaining wall around the fossil. Cover the base with aluminum foil, (taped in position), as a separator for the clay. Otherwise, heat from the wax will bond the clay to the base. Aluminum foil is preferable to wax paper as a separator; warm wax will fuse the clay to the paper, and is troublesome to remove.

Fabricate a clay base, or overlay, appropriate for the size of the fossil, (again, leaving enough room for the retaining wall). Lay this atop the aluminum foil separator. Situate the fossil on the center of the clay, matrix side down. Embed the specimen in the clay base by cutting out a depression in the shape of the fossil, as in setting up a mold; completely sealing the edges, leaving only the previously prepared surface exposed.

## Retaining wall

After the fossil is securely embedded in the clay, position the retaining wall around it. (In this case a thin, malleable aluminum) 3/4 to 1 inch from the fossil. Clay walls can be used, but tend to become malformed from the heat of the wax. Coat the clay overlay and retaining wall with petroleum jelly as a release agent for the Carbowax, otherwise the wax as it cools will fuse to the clay, making it difficult to separate. Be careful not to get petroleum jelly on the fossil surface.



4. Melting Wax  
To melt the wax, a double boiler set-up is used consisting of a 750-watt lab hot plate, ring stand, metal pot, and a 1000 ml beaker.



Pouring Wax - Above CMNH 6323 Right lower jaw of Ctenacanth shark with an unidentified element outlined in red.  
Warm the surface of the fossil with a hair dryer before pouring on the wax. The wax will adhere better to a warm surface. Let the Carbowax cool before pouring on the specimen. Hot wax will melt the clay, and possibly damage the fossil. Carbowax 4000 congeals slowly, so you should have ample working time before it solidifies. The wax is friable, so it's important to make the bed generally thick, i.e. not too thin at the edges. The amount of wax will vary with individual specimens. Mark the internal side of the retaining wall, well above the "high point" of the fossil to insure good coverage and a solid bed. If you have any doubts about the thickness or solidity of the bed, pour on extra wax. Warm the surface of the jacket first with a hair dryer to insure good adhesion before pouring on additional wax. Let the jacket set for a full 24 hours. In most instances Carbowax 4000 can be removed from the surface of the specimen with relative ease. If in doubt, as always, a small test section is advised first.

## Heat Production During Preparation Process

During the course of preparation heat may be generated from at least two different sources, notably lamps and grinders. This, combined with the friability of Carbowax 4000, can negatively affect the integrity of the jacket, so it's important to make it thick enough.

## After Specimen Is Prepared

When the specimen has been completely prepared, and before removal from the wax, it may again be necessary to inject small cracks with thin glue, and if necessary coat the entire surface, depending on the porosity or friability of the fossil. Larger cracks or gaps can be filled with plaster or another filler you deem appropriate. Below CMNH 50237 Large, thin nuchal plate from unidentified arthrodire.



## Removing Wax From Fossil

After the fossil has been completely prepared, and stabilized to your satisfaction, you can remove it from the wax. Place the specimen in a container, with enough warm water to cover it. If you choose, you can carve away a comfortable amount of wax beforehand, being careful to save the shavings for recycling. This will minimize the amount of time the specimen is immersed. In the case of two related elements, it's sometimes advisable to leave a certain amount of matrix to retain their exact orientation and/or stabilize them. As certain types of matrix may be prone to swelling or disaggregating in water, these should be approached with caution. - Below CMNH 6323 Right upper jaw of Ctenacanth shark with anterior end attached.



## Recycling Wax

After the wax has been dissolved, and the fossil safely removed, you can reclaim the Carbowax by pouring the water with the dissolved wax in it, into a cake pan. Set it aside until all the water has evaporated. This will leave a layer of wax in the bottom of the pan. Using a putty knife, rotate the wax and break it up. Moisture generally collects in the bottom of the pan, so you'll need to let it dry out a bit longer after rotating. You may find that the clay and petroleum jelly has discolored the wax, but this does not seem to negatively affect its properties for future use in this procedure. However, it's probably a good idea to segregate this wax and designate it for dissolvable jacket use only.

## Materials

Many, or all of the materials will already be part of most well stocked preparation labs, or are readily available:

- Carbowax 4000 (Polyethylene glycol)
- Petroleum jelly
- Clay Base (wood or other material)
- Double boiler, consisting of pot, 1000 ml beaker, and ring stand set-up
- Brush for applying petroleum jelly
- Clay working tools
- Thin Butvar or PVA
- Some material for creating retaining walls
- Masking tape
- Cake pans
- Instant read thermometer
- Hair dryer

References:  
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