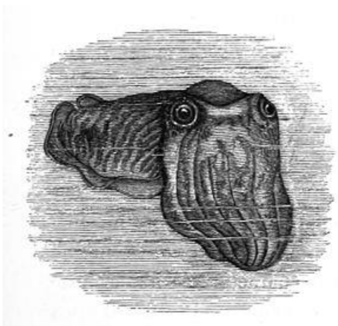
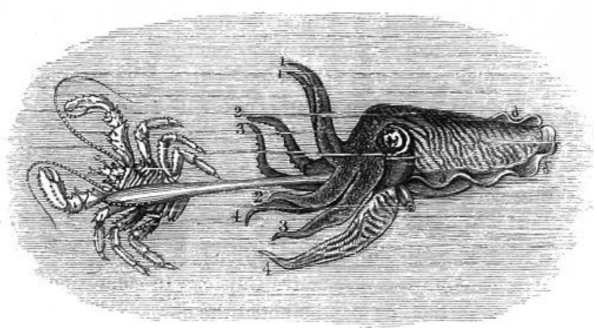
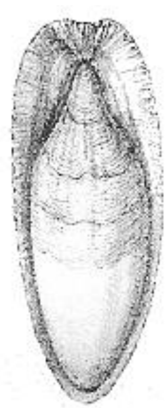
Cuttlefish Bone Casting **Barbara Mann** **bimann2@hotmail.com** **BarbaraMannStudio.com**

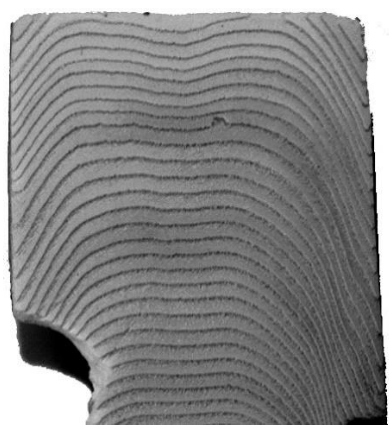




Cuttlefish are soft-bodied marine cephalopods, with a large head ringed by tentacles and an internal cuttlebone. Cuttlefish display natural camouflage, sepia ink squirting, jet propulsion and neutral buoyancy. Despite their name, cuttlefish are *not fish*; they are mollusks like an octopus.

Cuttlefish bones or cuttlebones are the internal calcareous or calcium-rich shell of the cuttlefish. They are white, chalky, surfboard-shaped shells that often wash up onto beaches. They are all that remains after a cuttlefish has been attacked and eaten.




bottom top side texture texture cast in silver

The cuttlefish bone is made up of many layers of porous, calcareous shell interspersed with tiny, gas-filled cells. This allows the cuttlefish to vary the amount of fluid to air in the shell and have neutral buoyancy.

The cuttlefish bone also protects the internal organs and forms a framework against which the muscles can pull. Some cuttlebones that are washed up onto beaches have teeth marks on them. These marks usually occur during the death struggle but are sometimes inflicted after death by hungry birds and fish while the shell is still floating in the ocean. Studying the bite marks may give some idea of the type of marine life found in that area.

All cuttlefish are "amazing." They are intelligent and exhibit quite complex behaviour. They can change both the color and texture of their skin rapidly to provide natural camouflage. Cuttlefish glide through the water by gently rippling their skirt-like fins. They have neutral buoyancy and can vary their depth easily by changing the proportion of liquid to air in their internal skeleton, the cuttlefish bones. When threatened, a cuttlefish will squirt sepia ink into the water and hurry away using a form of jet propulsion.

Cuttlefish have the ability to change color very rapidly, making them extremely good at natural camouflage. They can change color in less than a second. They also use color to signal emotions such as anger, fear and sexual arousal. They will flush deep red when agitated and then change to a mottled sand colour as natural camouflage so they can disappear into their surroundings.

Chromatophores

Embedded in the skin of a cuttlefish are numerous elastic pigment sacs called chromatophores, which are surrounded by circular muscles. When the muscles contract, these sacs are stretched out into flat discs of dense pigment and when the muscles relax, the sacs fold down into small dots of color.

Chromatophores produce the orange to red, brown to black and yellow colors of the skin. Reflecting cells that provide the cuttlefish with blue and green coloration are called Iridophores; Leucophores form white spots.

Skin Texture

Cuttlefish can also change the texture of their skin for natural camouflage. By contracting certain muscles, the cuttlefish can sprout spiky-looking projections called papillae. They can use skin textural and color changes to disguise themselves as a patch of swaying kelp, a cluster of coral or even a chunk of rock.

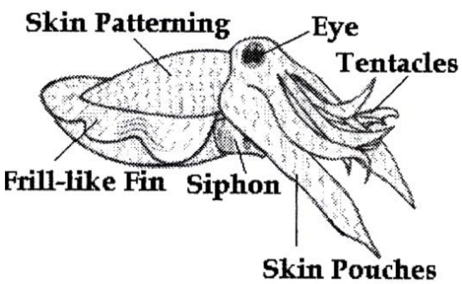
Sepia Ink

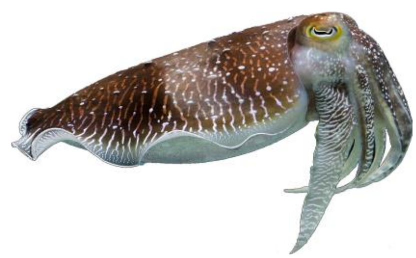
If natural camouflage fails, the cuttlefish shoots ink out at the pursuer. The sepia ink may be produced as a mucus-bound blob or as a large cloud. It is secreted from a sac near the anus and discharged through the siphon. Sepia ink ejection is usually followed by a rapid color change to confuse the pursuer. Sepia ink was once widely used in printing, art and photography.

Anatomy

Cuttlefish are soft-bodied Mollusks with short, flattened bodies and a large head. Cuttlefish skin is soft delicate, and slides easily back and forth over an oval mantle of muscle that is attached to the rigid, internal cuttlefish bone. It is covered with Chromatophores or pigment sacs which allow the cuttlefish to change color for camouflage purposes, mating rituals and to show emotions.

Cuttlefish have eight sucker-lined tentacles that are attached to the head in a ring around the mouth. They also have skin flaps along each side which shield two retractable feeding tentacles that are longer than the rest and are flattened at the end.

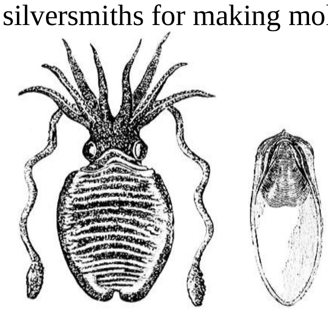




On the underbelly, there is a forward opening cavity that contains the gills and openings for the gut, kidneys and sexual organs. There is a siphon just beneath the head which helps the cuttlefish to steer and swim. Cuttlefish have large eyes with a W-shaped lens and, a transparent cover and lid. The body is edged by a thin frill-like fin which circles horizontally around the body.

Cuttlefish usually grow to between two and 12 inches long, but the giant cuttlefish grow much bigger. Giant cuttlefish are only found in the waters off southern Australia and they produce cuttlefish bones up to one yard long. Cuttlefish are only usually seen in large numbers near the shore in winter when they gather on the shallow reefs to mate and spawn.

Cuttlefish bones are a valuable source of calcium to a bird, when placed in bird cages. They can be ground into a fine powder that can be used for polishing silver or even, cleaning teeth. They are used by craft workers for sharpening fine instruments, and are used by silversmiths for making molds for casting.



The ten-armed *Sepia officinalis* and the internal calcareous shell or bone extracted from it, called the cuttlebone.

Material

Cuttlefish skeletons are composed or a chalky white material soft enough to be scraped with a fingernail. One side has a dense plastic-like layer. The skeleton shows the growth pattern of the animal in a series of irregular lines that resemble woodgrain.

Small cuttlefish bones are available through pet stores, where they are sold for parakeets, who use them to sharpen their beaks. The larger bones preferred for casting are sold through jewelry supply houses. The following description assumes a large bone, used for both sides of the mold, but many variations are possible, including the use of other materials for the back of the mold.

Direct Carving of a Cuttlebone Mold Cavity

The technique most widely used to cast jewelry today is the *lost wax investment mold process*. The ability of this process to produce consistently clean castings with a minimum of equipment accounts for its wide popularity.

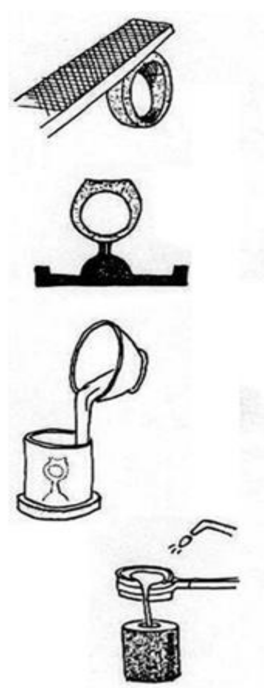
By the use of a directly carved mold cavity, it is possible to make a casting with undercuts with a cuttlebone. In this case, of course, the undercuts will destroy those parts of the mold that lock in the undercuts after a single casting. The mold cavity can be carved into only *one half* of a two-part mold in which case the result is a relief, backed up with a flat second half that forms a flat back on the casting. To be able to visualize the result before casting, an impression can be taken of the carved area with a soft material such as a *soft wax* or softened *Plasticine clay*. Take care not to exert too much pressure when taking such an impression. After examining such a result, the mold cavity can be altered by additional carving.

It is also possible to carve directly into *both halves* of the mold. If the halves must correspond, mark a center point at the top and bottom of the two parts and use these marks to line up a similarly marked drawing on tracing paper whose outing can then be traced onto the cuttle-bone.

Another method is to carve both mold halves in such a way that *parts overlap* in places to be sure they become one unit in the casting. In this case, both sides of the resulting casting arc different, and some flat parts will be seen from either side to contrast with those that are in relief.

The Lost Wax Process

1. A *model* is made of wax, or another completely combustible material.
2. The model is mounted on a wax rod, called a *sprue*.
3. The sprued model is mounted onto a base and fitted with a watertight section of pipe called a *flask*.
4. A plaster-like material, called *investment,* is mixed to a creamy consistency and poured over the model, filling the flask. Several light taps on the flask release bubbles from the mix.
5. The investment is dried and then heated (*burned out*) in a kiln to remove all traces of the model.
6. While the mold is still warm from the burnout, molten metal is poured or forced into the mold, where it assumes the shape of the original model.
7. After brief cooling, the mold is quenched in water. This breaks the mold and releases the casting.



Creating the Mold Cavity by Pressure

Cuttlebone has long been in use for casting pieces of jewelry having forms without undercuts. Such forms are suited to the limitations of the cuttlebone as a casting material, and exploit its possibilities. Cuttlebone casting is economical and relatively fast.

Cuttlebone is a white, firm, calcareous internal shell or bone of a ten-armed marine mollusk called a cuttlefish, of which there are many species varying in size from small to enormous. Cuttlefish inhabit all ocean waters, but the chief source of the cuttlebone used by jewelers in the West is the European cuttlefish *Sepia officinalis*. The bone supports the soft parts of the cuttlefish — which differs from its relative the squid in that it possesses this internal sepium shell or bone, while the squid does not. Once the creature has died, the bone is found thrown up on the shore where it is abundant, which probably accounts for the reason that in French it is called *biscuit de mer,* or "sea biscuit." These are collected, but the main source of sepium is from the cuttlefish captured for food in nets by fishermen, from which the bone is extracted.

The bone obtained from suppliers is white, clean, and dry. It should be of good quality, firm in structure and not too coarsely grained. An average size is 6 inches (15.2 cm) long by about 3 inches (7.6 cm) wide, and about 1-1/2 inches (3.8 cm) thick. Smaller and larger ones are also available. Chinese cuttlefish produce cuttlebone up to 14 inches (35.6 cm) and those extracted from tropical cuttlefish can be even larger.

Cuttlebones are often hung in the cages of captive birds who eat portions of them as a source of lime and salts, so they can often be purchased from pet shops.

The *size* and *thickness* of the cuttlebone naturally limit the size of the casting that can be made with it, especially when a single bone is used to make one object. Therefore, purchase as large a bone as you can find. The work can be made larger and deeper by using two cuttlebones for the same mold, or by planning a design that is made of several separately cast parts that are then joined by fabrication methods.

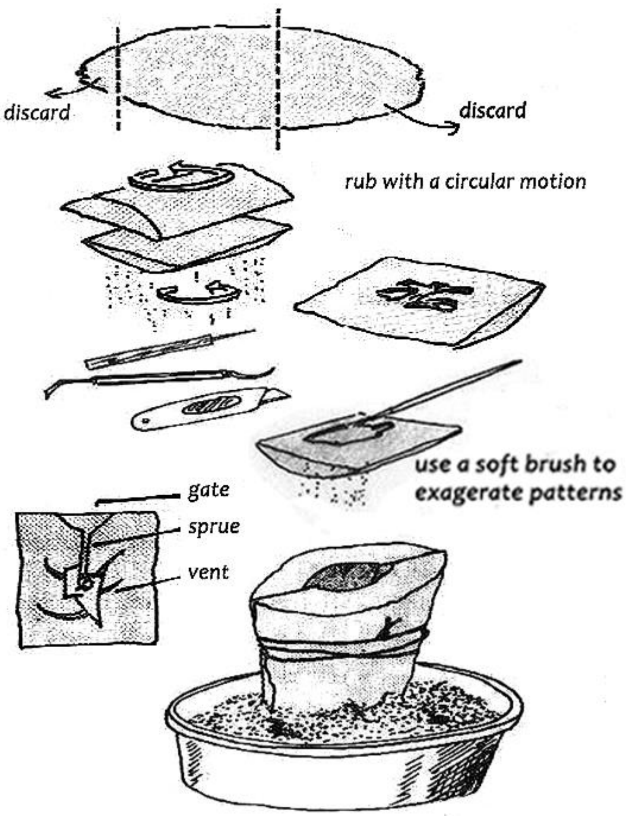
Cuttlebone is lightweight and relatively fragile. It should be handled carefully and not subjected to excessive pressures that will cause it to crumble. Its hard outer surface is easily cut through with a thin-bladed saw and the softer interior is carved with simple cutting tools. Its substance can withstand the high temperatures of molten metal without disintegration, only becoming charred.

Because it is easily crushed under pressure, cuttlebone can be used to produce a casting having either relatively smooth surface as when a smooth-surfaced model is pressed into it; or, when carving directly into it, a surface that reproduces the natural pattern and textured structure of alternating hard and soft ridges or striations. These ridges can be seen in some illustrations.

DIRECT METHODS

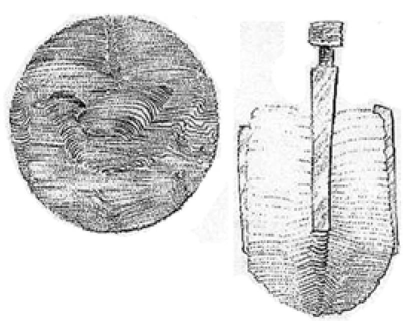
Process

1. Cut the tips from a large bone with a jeweler's saw.
2. Flatten the soft side of the bone by rubbing it on sandpaper or a rough surface like the back side of a ceramic tile.
3. Cut the bone in half. Continue flattening by gently rubbing the two pieces against one another in a random, circular movement. This is messy, so work over a trash can.
4. Carve or press the image into the bone, blowing away the dust as it forms. To accentuate the grain pattern, gently brush the cavity with a small dry paintbrush.
5. Carve a sprue or gate from the thick part of the casting to the top of the bone. Enlarge this area to a funnel shape. The sprue should be no longer than 3/4".
6. Scratch radial vents into the mold.
7. Tie the two parts of the mold together with wire or masking tape. Prop the mold up in a dish of sand. This is not essential to the process, but it is handy and will catch any spilled metal safely.
8. Melt the metal in a crucible and pour it into the mold. Allow the metal to cool for about a minute, then open the mold and remove the hot casting with tweezers. Cuttlefish molds can be used only once.



TEXTURE

The rich linear texture of cuttlefish is what makes it so appealing and at the same time so difficult to use well. While the rich texture is a tribute to Mother Nature, it is not automatically good jewelry. To make use of the texture as a designer, think in terms of contrast between heavily textured and smooth areas. These can be created by filing away or planishing selected areas of the casting, or by using cast cuttlefish sections in conjunction with fabricated sheet.



USING A MODEL WITH CUTTLEFISH

This technique can also be used to duplicate an object that cannot be burned out for investment casting. A model can be carved in wood, for instance, or an existing metal casting can be duplicated. The model cannot have undercuts.

1. Begin as above, being sure to use a piece of cuttlefish that will allow for at least a 1/4" thickness of bone all around the model. Prepare the sides, making them so flat that when held together no light can be seen through them.

2. Determine the orientation of the model and the place where the sprue will connect with it. Press the model halfway into the bone.

3. Press the other half of the mold onto the model, distributing the pressure as broadly as possible to avoid cracking the fragile bone. Press until the two pieces are touching all along their flat surfaces. Use a file or a saw to make several notches along the outside of the two pieces. These will be used to guarantee alignment of the mold halves.

4. Gently pry the mold open and lift out the model. If the grain is to be accentuated, brush the mold cavity with a small soft brush.

5. Use a knife blade or similar tool to carve a sprue and gate into each side of the mold. Be careful that no pieces of bone lodge in the mold cavity. Scratch some radial vent lines from the heaviest parts of the casting.

6. Lay the halves of the mold together, being careful to line up the notches. Tie the assembly with wire or masking tape and prop it up in a pan of sand.

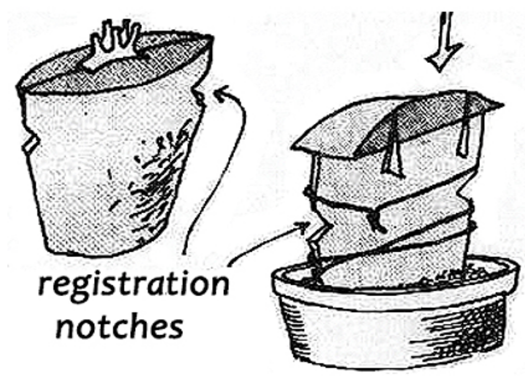
7. Melt the casting metal in a pouring crucible, adding flux twice. Pour the molten metal in a relaxed and uninterrupted flow.

A THREE-PIECE CUTTLEFISH MOLD

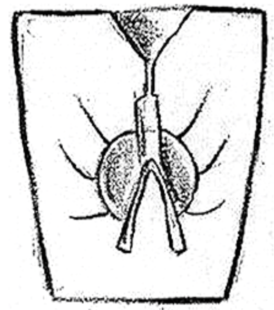
Complicated models can be accommodated with a three-part mold as shown. The lower sections of the ring shown here are treated as described above, positioned so the top section projects above the mold halves. After cutting notches the model is removed and the top of the mold is filed smooth. A thick piece of cuttlefish is filed to make a close fit against this surface.

The mold is then opened and the model is carefully set back into place. The top mold piece is pressed onto the model and more registration notches are cut. The mold is then dismantled and the model is removed. A sprue is cut and the pieces are tied together with wire.

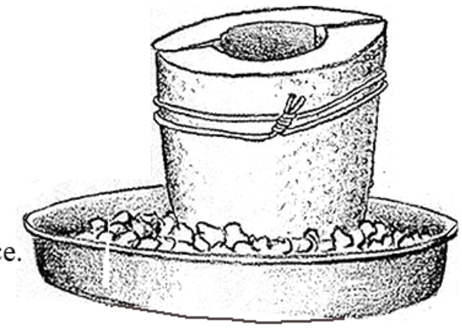
The development of rubber molds, especially the economical RTV molds, have largely replaced this once common method of duplicating metal objects.



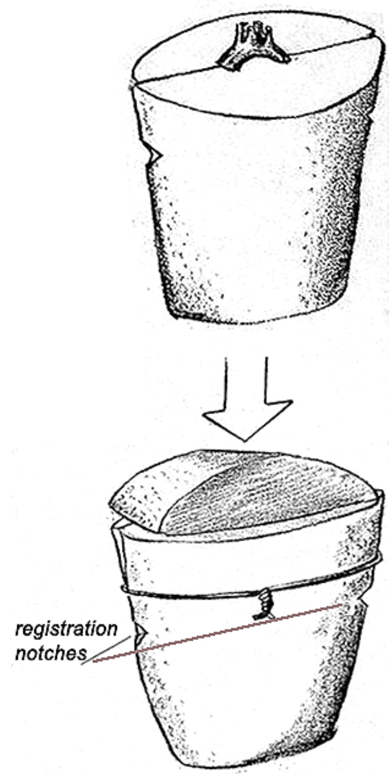
Cuttlefish Process



1. Carve a sprue or gate from the thick part of the casting to the top of the bone. Enlarge this area to a funnel shape. The sprue should be no longer than an inch.
2. Scratch thin radial vents into the mold.
3. Tie the two parts of the mold together with wire or masking tape and prop the mold up in a dish of sand. This is not essential to the process, but it is handy and will catch any spilled metal safely.
4. Melt the metal in a crucible and pour it into the mold. There will be a characteristic odor, the smell of the burning fish skeleton. Allow the metal to cool for about a minute, then open the mold and remove the hot casting with tweezers. Cuttlefish molds can be used only once.



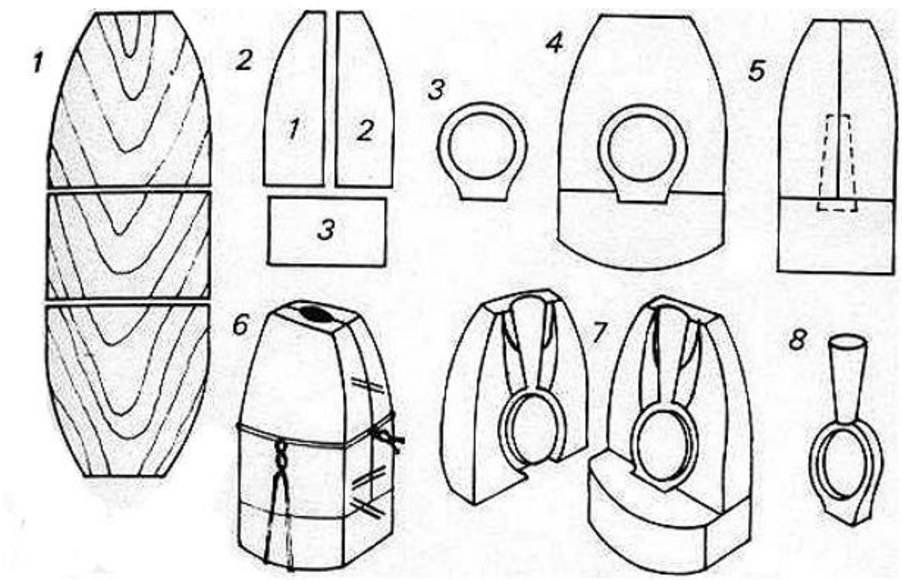
A Three-Piece Cuttlefish Mold



Complicated models can be accommodated with a three-part mold as shown. The lower sections of the ring shown here are treated as described above, positioned so the top section projects above the mold halves. After cutting notches, the model is removed and the top of the mold is filed smooth. A thick piece of cuttlefish is filed to make a close fit.

The mold is then opened and the model is carefully set back into place. The top mold piece is pressed onto the model and registration marks are made, either in the form of notches or lines with a thin marker. The mold is then dismantled and the model is removed. A sprue is cut, and the pieces are tied together with wire or masking tape.

Though the development of rubber molds has largely replaced this method of duplicating metal objects, it was once a common practice among jewelers.



USING A THREE-PART CUTTLEBONE MOLD TO CAST A RING – another view
1. The cuttlebone cut into three parts
2. The three parts assembled (1, 2, 3)
3. The ring model
4. Front view of the ring model in place between the three parts
5. Side view showing the position of the ring model in the mold
6. The mold assembled and tied with soft binding wire, ready for casting. The diagonal lines on the sides are scratch lines over the parting line between mold parts, put there to simplify their correct alignment.
7. Part 1 of the mold removed after casting, with the other two parts and the casting still in place
8. The casting with attached spree, removed from the mold

RECOMMENDED BOOKS – many available used online:

The Complete Metalsmith, 1991, Tim McCreight
Metal Techniques for Craftsmen, 1968, Oppi Untracht
Jewelry Concepts and Technology, 1882, Oppi Untracht
The Design and Creation of Jewelry, 1961, Robert Von Neumann
Contemporary Jewelry, 1970, Philip Morton
Silversmithing, 1983, Rupert Finegold and William Seitz