Cuttlefish Cast Pendant

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Goal

To introduce the student to an often overlooked method of direct casting that is quick, simple, and fun.

Tools & Supplies Needed

- One Cuttlefish bone
- Big huge flat rasp (Shared-see me)
- Tool of some type to carve impression into bone. Dental tools/pencils/fingernails all work well.
- Exacto Knife from box at my desk
- A Plan.
  This comes from you. What sort of pendant do you want?

Background

Cuttlefish casting is a process that goes back at least 5000 years, if not more. In basic outline it's very simple: one finds a cuttlefish bone, and carves a design into the bone. Pour molten metal into the carved out design, and the cuttlefish bone will burn, but it'll hold together just long enough for the metal to solidify, giving a casting that is an exact fit for the space that was carved out of the bone.

Why exactly one would wish to pour molten metal into the skeletal remains of a dead squid is a question that bears answering. The reasons are two: speed and beauty. Cuttlefish casting is very fast. Unlike the modern lost-wax process that typically takes a minimum of 5 hours to go from a finished wax design to cast metal, cuttlefish castings can be designed and produced in as little as 10 minutes, which makes the process ideal for creating emergency or precious metal parts in situations where there isn't time to wait for more traditional methods or suppliers. The other reason is beauty. Cuttlefish grow like trees. Every year they live, they add a new layer of bone. As they grow, these layers form a sort of 'wood grain' pattern within their bone. As the bone is carved away, this unique pattern is exposed, and is inevitably transferred to the cast metal. This texture is both unique and beautiful, and exploiting this texture is the primary reason that cuttlefish casting remains a popular tool in the metalsmith's toolbox.

Procedure

Step One:

Make a flat squid. Cuttlefish come in a variety of sizes, none of them flat. To make our pendants, we will need to contain the molten metal, lest it pour out all over the floor. To do this, we will back up our cuttlefish bones with flat pieces of soldering board to make the backside of the pendant. It is possible to cut the cuttlefish bone in half and use the two halves to form a double sided mold, but this is much more complicated. For tonight, we're going to focus on a single sided piece.

Find a cuttlefish bone that is larger than your design. You will need at least .5" clearance between your design and any edge of the bone. As they're long and thin, the top and bottom aren't likely to be a problem, but the width might be. The bones have two sides: one hard and one soft. Choose one with a maximum width of the hard part at least 1 inch wider than your design. Don't just grab the biggest squid-bit in there however, as the bigger ones are rare. Leave them for students who need them. Choose a cuttlefish bone as close to the size you need as possible. Hint: this is a good time to come up with a long, thin design. Your life will be easier. (Thin but not stringy.)

If you look at the soft side, you will notice that one end is thicker than the other, and that the thin end looks 'caved in'. That's OK, they're supposed to be that way. We're going to have to get rid of the thin end however, as it isn't thick enough to use. Find the point where the soft part of the bone gets thin enough that it dips inside the rim of the harder backside shell. Draw a line across the shell at that point, and use your jeweler's saw to cut across the hard shell there. You can cut all the way across, or just notch .5" or so into the shell from both sides, and then snap the tail off by cracking the hard shell against the edge of the bench. If it doesn't crack off easily, keep cutting until it does.

Once you have the tail off, it's time to flatten the cuttlefish. On the teacher's desk are a pair of huge rasp files. Each of them has sections that have rasp teeth (that look like claws) and sections that have normal (but huge) file teeth. Over the trash can, use the normal file sections to file away most of the soft bone that rises above the hard shell. The goal is to make as large a flat area as possible. Stop before you hit the hard shell.

Cuttlefish bones, soft side up.

Tail marked to cut off with jeweler's saw.

The tail trimmed off.

It is incredibly important that the area you are filing away ends up as a flat surface. If it doesn't, the casting won't work. To make that easier, once you get near to the hard shell, stop filing, and take the shell over to the sheets of sandpaper that I will have set out on the tables on the back porch. Set the cuttlefish down on one of these, soft side down. Then very carefully pull the bone across the sandpaper. Do not scrub. Pull once, as evenly as possible, and then look at the bottom to see if it looks like the sandpaper is biting all across. If it is, set the bone face down on the table and try to rock it with your fingers. If you feel it rock, set it back onto the sandpaper, center your fingers above the center of the 'high point' of the rocking action and pull carefully, just once more. Stop and check again. Continue until the surface is flat, and does not rock when placed on the table. If you go too far, you may have to use pliers to snap off parts of the hard shell that are getting in the way. If you think you need to do that more than once, come find me before you sand your piece into oblivion. The sandpaper cuts quickly, so it's important to be as smooth and controlled as possible.

Once you think it's flat enough, bring it to me to check.

Step Two:

Make a funnel. We need some way to guide the molten metal into your mold, so the next step is to carve a funnel into the 'top' end where you cut the thin bit off. Mark off a "V" shape in the center of the top of the bone with a width and height of about 1 inch. Use your exacto knife to carve this out into a funnel shape. The metal will pour in here, so your design must connect to this somehow. It is best to design your casting so that the thickest sections are at the top near the funnel, and connected to it. That way they can function as sprues to get metal out into the thinner sections of the design. Do not make a design with thin lacy bits near the funnel that the metal must move through before it hits the main body of the design. It won't. This isn't like centrifugal casting where the force of the machine is slamming the metal into the mold. Here we're relying on simple gravity, and that isn't much, so your design must help the metal as much as possible.

Cuttlefish bone with flat area and funnel carved in. Note pencil marks indicating 'safe area' to work within. Note that this safe area does not reach all the way to the bottom tip of the bone, as this individual shell became thin at the lower tip. Remember to pay attention to the actual cuttlefish bone in your hands, not just what the handout says you should be able to get away with.

Step Three:

Carve your squid. This is the point where you get to play. The cuttlefish bone is very soft. Anything harder than a fingernail will work to either carve or press a design into it. My standard tools to carve it are an exacto knife and a dental pick (from cabinet 2) for details, along with whatever other objects I want to press into the bone for variety. It is possible to simply press objects without undercuts into the bone to capture their shape. The bone won't crush all that much without breaking, so larger items need to have the underlying bone carved away first before you try to press them in. Do not carve away the full depth of your desired impression, leave some material available to crush into the form of your item. A paintbrush rubbed gently along the grain of the finished design will highlight the grain pattern. For a more pronounced effect, try rubbing gently with a toothbrush.

Things to keep in mind when you're designing:

- ***You're working in negative.*** Everything you carve ***down*** into the bone will rise ***up*** from the finished piece, and every detail that rises into the void you've carved away in the bone will be a recess in the finished metal.
- ***This isn't centrifugal casting.*** There's not a lot of force behind the metal, so you have to help. It won't flow into large thin areas. Your minimum thickness should be about the thickness of a dime for small areas. For larger areas, you should aim for about the thickness of a nickel, if not a little more, as an absolute minimum. You can go all the way up to 1/4" or thicker, but remember that these pieces will be solid. Too many thick areas and you'll have a boat anchor, not a pendant. Pay attention to your weight.
- ***Connect to the sprue.*** Make sure the metal has a clear, fast path from the funnel into the heart of the design. I tend to make my connector into the 'spine' of my cuttlefish pieces, and to make that spine the heaviest part, so that it helps feed the rest. You don't have to do this, but it helps.

Cuttlefish bone with design carved, and attached to funnel. Notice how the spine of the design forms a sprue.

Another design. Again, notice how the design radiates from a thick area attached to the funnel. Note also the little dots pressed down into the cuttlefish.

*Same design, with the vents pressed in. Note that they're short, pointed 'uphill' towards the funnel and most importantly, they do **not** reach the edge of the flat area.*

- ***Stay clear of the edges.*** Stay as far away from the edges of the bone as possible. They form the seal that keeps the metal trapped in the mold cavity, instead of running out and burning holes in the floor. Make the bulk of your design fit within the 'center' of the flat section of the cuttlefish bone. No closer than .5" to the sides or bottom, with more margin, especially on the bottom, if you can manage it. Generally, the thicker elements of the design should be in the top of the design, closer to the sprue-funnel.
- ***This is a pendant, remember?*** So make sure you add a loop somewhere near the top, or add a lump of metal that can be forged out into a bail. Look at my raccoon paw pendant for an example of using the sprue itself to make a bail.

Once your design is finished, highlight the grain pattern by sweeping out the soft bone dust with a paintbrush or toothbrush.

Step Four:

Add vents. Once the design is totally done, you need to add air vents. This is done by gently pressing the length of the exacto blade straight into the bone, so that it presses in a very thin groove. Do not pull, use the point, or cut with it. You do this in the 'upper' sides of your design, the areas that will be uppermost when the cuttlefish is standing upright with the funnel up. Two or three vents per side are all that are really required. ***Make sure that these vents do not connect with the outside of the bone.*** Make sure they all point 'uphill' towards the top of the cuttlefish as defined by the funnel. This is done to give trapped air somewhere to escape to as the metal fills the mold.

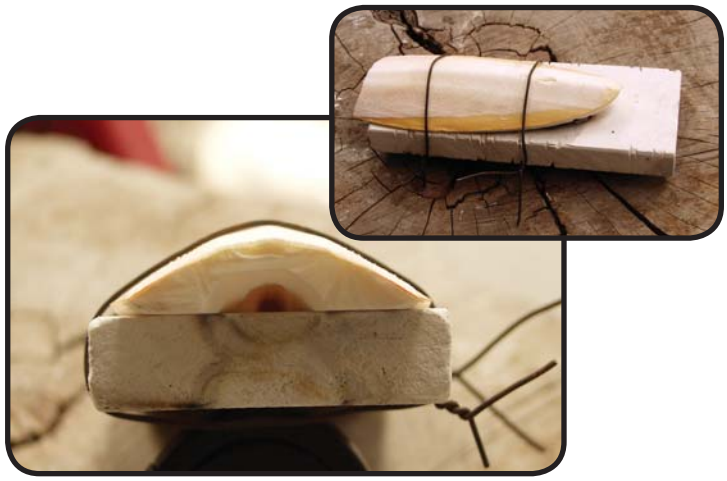
Step Five:

Let Brian practise his Pyromania. The steps from here all involve the mechanics of setting the mold up for casting, and then melting the metal.

I'll go over the final steps so that you know what they are, but I'll be handling the torch, so these steps are my problem, not yours.

Once your vents are cut, bring me the mold for final inspection. If everything's OK, I'll take it and then use heavy binding wire to wire it onto one of the flat soldering boards. This is where the flatness of your cuttlefish surface from step one becomes important: The bone must seal perfectly against the flat solder-

The bronze piece cast from the mold on the previous page. Note how the dots that were pressed down into the bone have become points rising up out of it.



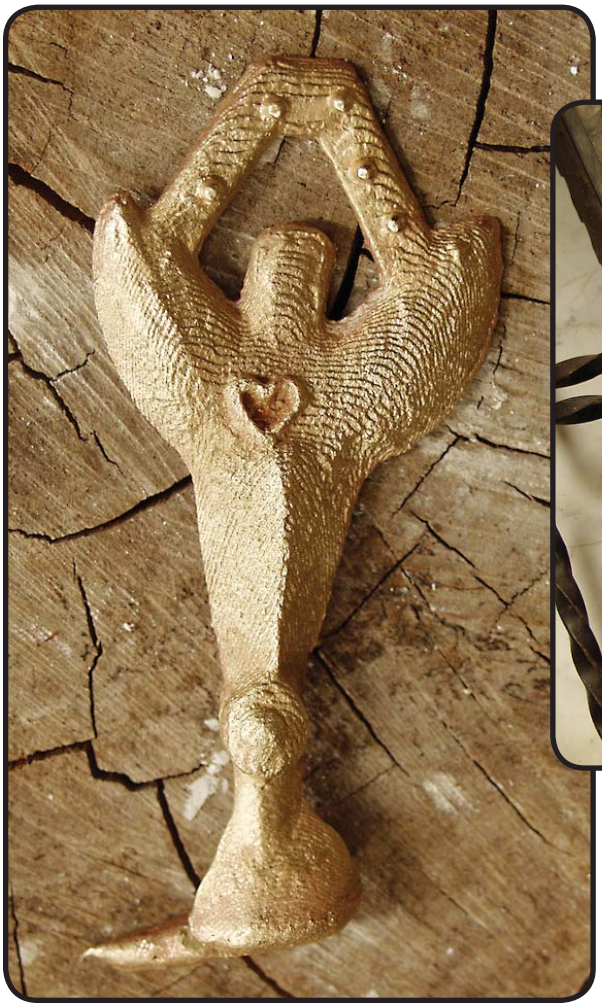
Cuttlefish wired to soldering board. Not light visible between the bone and board. No light visible through the inside of the mold.

Melting the metal in a ceramic crucible.

ing board. If there are any gaps, the metal will slide through them and escape, incinerating your carefully carved design on the way. As this is generally considered bad, I will be looking for gaps or spots where I can see light through the mold as I wire it down. Minute gaps can be corrected for by torquing the wire down more tightly, but there is a risk of snapping the bone if the wire is too tight.

Once that's done, the bone will be propped up in a fireproof pan full of pumice stones, and the metal melted and poured. As soon as the metal hits the cuttlefish, it will start to burn, giving off the wonderful, distinctive odor this technique is famous for. The castings will be cool enough to quench in 15-20 seconds. The next step is to clip the binding wire, and carefully quench both the metal and the cuttlefish bone. Once the bone's completely soaked, it can be thrown away, but you must make sure it has been quenched, otherwise there is a risk of a hot cuttlefish starting a fire in the trash can.

At this point, you will have a cast metal piece that is exactly the shape and size of the pattern you carved into the cuttlefish. Now begins the cleaning.



Pouring the molten metal into the mold from the top of page 4
The burning cuttlefish bone
The cast piece freshly removed from the mold, and the burnt wreckage of the mold after casting.