Richard Austin (1936-1990) was a metalsmith and author, with several hundred articles to his credit. After his death I was given custody of an extensive collection of manuscript material-mostly on the technical issues of metalworking.

This text represents the first effort to organize the material—an attempt merely to group the files by topic. None of this is finished, and the text makes reference to illustrations that were never done-illustrations which were stored separately in any case, making it extremely difficult to bring the parts together.

It is unlikely that I will ever be able to spend the time to sort this all out. But it seemed a shame to let these articles languish unread by those who might benefit from them in some small way. So I have decided to release them in their roughly sorted form in the hopes that someone may find them useful.

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OTHER CASTING TECHNIQUES
(OUTLINE)

GENERAL:

This third book in the series might end up shorter than the first two although I'm really not sure at this point. The material would cover all of the common "craft" casting techniques except investment. In a way it will be a book on "poured" casting. It will be biased toward larger sized objects and other metals such as pewter which are suitable for larger projects. At the present time investment casting is the "glamour boy" of the jewelry hobby. In a way this is rather unfair to the other traditional methods of casting. Each of these techniques has a particular character that shows through in the nature of the finished product. Part of the content will be to deal with designing projects which take advantage of, or support the particular character of each technique. The techniques will be of broad interest craftsmen as diverse as gumsmiths and model railroaders. The mold materials to be discussed would be those listed on the following page.
OTHER CASTING TECHNIQUES

I. Stone
   A. Tufa
   B. Soapstone
   C. Sandstone
   D. Slate
   E. Marble

II. Plaster
    A. Conventional
    B. Reinforced - Filled

III. Sand
    A. Half Shell
    B. Full Shell
    C. Cored

IV. Cuttlefish bone

V. Cement

VI. Carved Investment

VII. Silicone Rubber
OTHER CASTING TECHNIQUES

At the present time investment casting is the "glamour boy" of the jewelry hobby. In a way this is rather unfair to the other traditional methods of casting. Each of these other techniques has a particular character that shows through in the nature of the finished product. If you want to try your hand at jewelry casting without a lot of expense, if you would like to make jewelry with a "particular look" or if you just enjoy mastering metalworking techniques I think that you will find something here. Many of the methods discussed here are suitable for the production of larger parts in metals other than gold or silver. For this reason they will be of interest to craftsmen as diverse as gemsmiths and model railroaders.
NOTES

CASTING IN TUFA STONE

L.J. March 1977 P.2708

1. Volcanic tuff or tufa - formed from volcanic ash or dust. Three major types: Vitric Tuff composed of glass fragments, Crystal Tuff of crystal chips, Lithic Tuff from pulverized pre-existing rock.

2. Sand Casting among early Indian work limited to Cuni, Lanyade in late 1880's and early 1890's. Sand derived from powdered sandstone, sugar water binder and stone back plate.

3. Main areas should be at least ¼" thick.

4. Pretreat the mold with carbon from candle or torch.

5. Mold should be slightly preheated. Clamps or wire hold the halves together.
CASTING
ALTERNATE METHODS

In recent years there has been a rapid increase in the variety of casting equipment available for limited production jewelry casting. This proliferation of equipment has been a mixed blessing. On the positive side, it has brought jewelry casting within the financial means of a wide new audience. On the negative side, there has been considerable frustration due to various types of casting failures. Much of this disappointment could be avoided by a better technical understanding of how the casting process works. A number of complex factors influence the success of the casting process. These include the physical properties of the metal alloy, the mold material, the pattern material and design, and the specific casting process employed. There are a variety of jewelry casting methods which can be segmented as follows:

Gravity Methods
  . Sand Casting
  . Stone Mold
  . Cuttlefish Bone
  . Investment

Pressure Methods (Investment)
  . Vacuum
  . Air
. Steam
. Centrifugal
. Combination

Although we will deal with the various techniques in more detail a few generalizations can be made. In most cases gravity casting provides a poorer quality of detail than any of the pressure methods. However, in a number of methods, gravity casting allows for reuse of the pattern or mold. Since most pressure methods require the use of investment (and lost wax) the pattern and/or mold cannot be reused.
STONE CASTING

The only functional requirement of a casting mold is sufficient heat resistance to maintain its integrity long enough for the metal to cool. It must be in some form which will allow the artist to impress his design upon the material. Historically, clay and stone were two of the commonest materials. Stone casting has been used for thousands of years in almost all parts of the world. It is a relatively obvious solution to primitive problems of metallurgy. Some of the more common mold making materials have been soap stone stiatite, tufa and slate. It's interesting to note that slate molds were quite commonly used for very early versions of the "lead soldier".

The character of the objects a person designs is strongly influenced by cultural heritage and training. It is somewhat less obvious that design is also strongly influenced by the material of construction and the techniques available to shape and form the material. Stone mold casting is a good example of the influence of the fabrication technique on design. If you think about the limitations of this method it is obvious that it is best suited for flat objects with no undercuts. The simplest way to approach the technique is to incise a pattern of V grooves into a flat piece of stone. This can be done with a simple tool and it
eliminates most of the alignment problems of having detail carved in both halves of the mold. If you view the problem in this way, the general nature of the design of a great deal of older, American Indian jewelry is a logical outcome. Various linear and scroll forms were incised as V grooves into tufa stone which was cast in silver.

Investment casting replaced the vast majority of stone mold casting applications. As a practical matter, anything you might wish to cast in a stone mold can probably be done just as well or better as a lost wax casting. In spite of this, I feel that stone mold casting is a good technique since it imposes a particular kind of discipline on the craftsman. For those of you who do not have centrifugal or vacuum equipment, it is a handy way to cast an occasional small part for integration into a fabricated piece.

Prepare a small, shallow, cardboard box like the one shown in Figure 74. Prepare two of these and put a coating of wax or paint on the inside. Fill them with either investment or plaster and set them on a level place to harden. When they're hard you can take a piece of coarse sandpaper and flatten the matching faces. The balance of the steps in the photograph indicate the general procedure. If you're going to have a two part mold, with details in both halves, you need some kind of fairly accurate aligning system.
Probably the simplest of these is to drill a hole through both blocks and drop a metal pin or nail through the hole before the parts are wired together. If you're going to do very much of this you can prepare a template which lines up with the locking pins and allows you to transfer the pattern in precisely the same place on both halves of the mold.

The process of working in an investment or mold making material also has another curious possibility. There are times when it is difficult to prepare a complex form which is finished on both sides. As a simple example, let's consider making a hemisphere with a good finish both inside and outside. A quick way to do this is to prepare a hemispherical piece of investment which matches the inside of the part to be constructed. This hemisphere is carefully finished by whatever means seem appropriate. Wax is then built up over the hemisphere and the whole part, investment and all, is incorporated into a larger mold. As long as some locking mechanism is provided to securely bond the new investment to the old, you can usually get a good part. Wire pins can be used for reinforcement.

If you want to try some genuine stone casting, tufo stone is usually the easiest to locate. A few of the craft suppliers still provide random size blocks of this material. It's
soft and easy to work. Slabs can be prepared with a hacksaw and coarse sandpaper. If you'd like to try your hand at soapstone carving, I've found the simplest way to get a piece of good quality soapstone is to look for an old soapstone sleigh warmer. These were slabs of soapstone that were preheated and used to keep people's feet warm in the days before automobiles and heating systems. If you scrounge around the antique shops, these can still be found at a relatively reasonable price and one warmer will be enough to do several projects. This material can also be cut with a hacksaw. It is particularly handy since it is already usually in a slab about one inch thick. The photograph in Figure 78 is an example of an old warmer with a corner removed for another project.
ALTERNATE TO STONE CASTING

The specific character of a persons designs are strongly influenced by cultural heritage and training. It is somewhat less obvious that design is also strongly influenced by the materials of construction and the techniques available to form the materials. Stone mold casting is an excellent case in point. Molds made of slate, sandstone and soapstone have been used for thousands of years. The limitations of the method make it obvious that it is best suited for flat objects with no undercuts. The simplest way to approach the technique is to incise a pattern of vee grooves in one side of the mold. This is easy to do with a simple tool and it eliminates most of the alignment problems of having detail carved in both mold halves. If you view the problem in this way the design of a great deal of American Indian jewelry is a logical outcome. The specific type of stone used can also contribute the surface texture of the object. For example, a sandstone texture is often used in contemporary American Indian jewelry.

As a practical matter most objects you might wish to cast in a stone mold can be done just as well as a lost wax casting. In spite of this I feel that stone mold casting is a good technique to learn since it imposes its own stern discipline on the craftsman. Because of the problems in getting and working suitable stone for molds I have developed a substitute method that works well, is cheap and fast.
Basically the process is to carve the mold into precast slabs of investment.
SAND CASTING

The metal frame used to build up, hold and align the actual sand mold, consists of two parts. These two parts must be constructed in such a way that they can be fitted together and disassembled with reasonable precision. Normally, this is done by having a pair of locating holes in one half of the frame and a pair of pins in the other half. The two segments of this frame are referred to as the cope and the drag. To make it easy to remember, the cope is the half of the flask with the locating holes and the drag is the half of the frame with the pins. When you are actually set up to cast the cope is normally on the bottom and the drag is placed on top.

The sand used for the model is a good enough insulator to retain heat for an extended period of time. For this reason, you should be sure to let the model cool sufficiently before attempting to remove the casting. Since the sand is relatively easy to remove there is no reason to hurry this process. I would normally allow a sand casting to cool for fifteen to twenty minutes and it may still be way too hot to handle when you knock it out of the sand. Remember, that even if the casting doesn't look hot, it can give you a pretty bad burn.

Actually, the investment casting of pewter is a very simple and straightforward process (insert segment from final portion of cannon article).
SAND CASTING

Example Project - Pewter Concho Belt

Advantages:
   Good for repetitive items
   Large Size is possible
   Inexpensive
   Work with all types of material

Disadvantages:
   Difficult with non planar porting line
   Cores are a problem
   No undercuts are practical
   * Not too much detail possible (or fine parts)
   * Cool mold means thicker section

*Cement will help this.
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