Silicone Molds

Certain materials have, what is called in the field of art conservation *inherent vice*, meaning that the material deteriorates all by itself over time. This is true of silicone rubbers used for molding fossil specimens. There are several terms used when referring to the use of silicone molds:

> ***"Useful life" or "mold life"*** - refers to the approximate number of pulls (i.e. how many casts) that can be obtained before the quality of the cast degrades. When casting microfossils, very little degradation is acceptable. Change in surface texture can be seen under a binocular microscope after as few as a half dozen casts, and can become quite noticeable after a dozen pours. It may be possible to obtain 20-30 useable epoxy casts from molds, but their utility for microscopic study may be far inferior to the first six created in the run.
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> ***"Library life"*** [glossary link] in the field of mold making is defined as the storage stability of a mold and how long such a mold can be stored for eventual use without degradation. Industry representatives specify that when they refer to library life, they mean for a fresh, unused mold for which the rate of deterioration is dictated by the inherent properties of the room temperature vulcanizing (RTV) silicone alone. Thus, once a mold is used to produce a cast, the term library life is moot as the effects of the casting material is now a factor. Preparators are then essentially referring to the shelf-life of a used mold – i.e. how long it can be stored in a museum's collections and still produce a useful cast.
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> ***"Shelf life"*** – is how long the pre-catalyzed material will last before its properties begin to change and may not perform as expected.

Choosing a casting resin

Choosing the best casting resin for a particular project depends upon many factors

- Epoxy – *is often chosen to cast small fossils requiring extremely high resolution.*
- Polyurethane – *is often used to create light-weight medium-large molds. It cures quickly and produces little heat while curing thereby causing less degradation of the mold.*
- Polyester – *is a good choice for larger casts. It is cheaper and less hazardous to the heath of the user than either epoxies or urethanes.*

Anecdotal evidence suggests that molds used for casting microfossils in epoxy degrade much faster than those used to cast in polyester. Since both casting agents produce similar exothermic reactions it is presumed that chemical attack from the epoxy compounds are primarily responsible for the degradation. Exposure to various casting resins does not greatly accelerate the *inherent* degradation of the silicone itself, but it certainly accelerates the *effective* degradation of the material.

Greg Brown, Chief Preparator of Vertebrate Paleontology at the University of Nebraska State Museum writes that "most of the newer addition-cure platinum-catalyzed silicone RTVs [glossary link to RTV] are much more resistant to chemical attack than the traditional, condensation-cure tin-catalyzed silicone RTVs and have a much longer "after-use" shelf life." Silicone is not formulated for 'archival' projects and so the industry does not tend to think about the long-term life-expectancy of the products. The typical

signs of ageing and degradation are loss of tear strength, tensile strength and elongation, and increased hardness. Therefore, the catalysts designed for fast cure and short demolding times are not be recommended for making molds that will be stored for extended periods or for long-term use.

This is an area that merits further research and study but some strategies that have been shared by preparators for extending the library life of molds include:

- Pouring the original mold to exhaustion to make as many casts as could possibly be expected for use and throwing the mold away.
- Saving the second pour as a master set to remold later (this may results in better quality casts than using a deteriorated original mold)
- "Baking out" a mold to remove the hardeners, plasticizers and other materials that leach out of the casting materials and are gradually absorbed into silicone molds. A slow, gradual bake-out at 93°C (200°F) for eight hours or a rapid bake-out at 204°C (400°F) for two hours can be used. Although this is recommended on the Dow Corning website, heat generally speeds chemical deterioration of materials.
- Not casting from a mold at all until there is a need to make several casts at once since making a single epoxy cast and putting the mold on the shelf for a year or so will certainly cause the mold to degrade more quickly than if you shelved the mold for a year unused.
- Sealing the mold in a "Ziploc" style polyethylene bag.
- Cold (e.g. refrigerated) storage of molds.

Manufacturers websites often have useful information on how best to use their products. Check out the following:

- Dow Corning Technical Library [http://www.dowcorning.com/applications/search/content/default.aspx?WT.svl=1&bhcp=1]
- Dow Corning moldmaking applications http://www.dowcorning.com/content/moldmaking/
- Dow Corning molding products Q&A http://www.dowcorning.com/FAQ/faq_search.asp?DCWS=Moldmaking&DCWSS=&ind=013&2ndlevel=

Information courtesy of Greg Brown, University of Nebraska State Museum