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Title: Techniques: Sealing of Museum Jars with Silicone Mastic

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Sealing of Museum Jars with Silicone Mastic

Whole and part animals are preserved intact for future study by immersing them in preservative solutions - in some cases for more than a century. Museum jars, which were made over many years and which are still in use, were made in glass roughly formed (blown moulded?) into a rectangular section. The top was then ground off flat. In order to seal the jar, a lid of flat glass is stuck over the ground top with an adhesive containing waxes or rubber. A hole drilled in the lid is used to fill the jar completely with preservative when the adhesive is firm. The hole is covered with a microscope cover slip, sealed in place with the same adhesive.

This container system has so many disadvantages that other types of container are now used. The jar is heavy and fragile, and the seal between the jar and lid frequently breaks down - thus allowing the fluid used as a preservative to escape by evaporation or spillage. However, transferring specimens into more suitable containers presents difficulties due to the expense, the limited range of sizes available and the adverse reaction between the fluid and the plastics used for some jars.

Various solutions are used for preservation - the primary aim being to inhibit the growth of microorganisms, such as bacteria and fungi, in the necessarily wet conditions in the jar. The preservatives used at the Manchester Museum for the 'spirit collection' are (solutions used for testing purposes are in brackets): (a) formalin (10% formaldehyde in deionised water, not buffered); (b) ethanol solution (70% 74 op IMS in deionised water); (c) Phenoxytol solution (1% Phenoxytol, 5% propylene glycol in deionised water); (d) glycerine/acetate solution (30ml glycerine, 2g potassium acetate in 90ml deionised water). An additional test solution (e) was the ethanol solution with 0.1% formaldehyde added.

Maintaining a spirit collection can be time-consuming, because of the frequent topping-up and resealing. This results in specimens being neglected, damaged and, in some cases, destroyed. The sealing of the jars was obviously at fault and, if this could be improved, much harm and handling of the container would be avoided.

Requirements for the adhesive/sealant are: to stick the glass surfaces together; to resist the effects of the various chemicals involved retaining adhesive and cohesive strength; to allow for easy opening of the jar for study of the specimen; to be resealable; not to harm the specimen.

Most adhesives have poor long-term adhesion to glass in the presence of water, due to the hydrolytic nature of glass, and it is for this reason that sealants for museum jars are unreliable. Only those materials that react with glass will retain a good bond. Coupling agents that react with both the glass surface and the adhesive are commonly used to increase the resistance of the join to water. Silicone sealants are widely used to join glass to itself and other materials, because, in the main, the sealants have good adhesion to glass without coupling agents.

A grade of silicone sealant (Silastic 738 RTV), which does not release acetic acid, was chosen for testing. Acids in the preservative can contribute to the breakdown of the organic material. For maximum adhesion, it is necessary to use a coupling agent (Dow Corning 1200). The procedure adopted for sealing the test solutions into the jars was in line with the manufacturer's recommendation.

The ground top of the jar was degreased with Genklene and acetone. The top of the jar and the mating surface of the lid were painted with the coupling agent (a clear mobile liquid). The jar was filled with the appropriate test solution (a - d), using a funnel to avoid splashes on the primed surface. The primer was allowed to dry for one hour. The sealant was applied to the jar top from a collapsible tube in a thin (2-4mm) bead. The lid was placed over the top and pressed lightly down to eliminate all air passages. The jar was left for 24 hours for the adhesive to cure. The process of priming and sealing was repeated on the filler hole and cover slip for the lid. The jars were not filled completely, in order that the air space remaining might increase the stresses on the join. The jars were rested on their sides, so that the solution came in contact with the adhesive.

Within a couple of weeks, the join on the jar containing formalin was leaking solution out and air bubbles in. This result was repeated in further tests. The test solution (e) was made up and sealed into a jar, in order to check that the join would withstand solutions used with specimens that had been inadequately washed out after fixing with formaldehyde.

The jars can be opened by cutting through the silicone rubber bead with a scalpel and can be resealed with fresh sealant after cleaning the cut surfaces with acetone. In the event of the system failing, it is unlikely that the jar can be reused with another sealant without regrinding the top of the jar.

After 15 months, the jars containing solutions (b) to (e) show no sign of solution loss. Indeed, one jar, when opened, was slightly overpressurised. Air diffusion through silicone rubber is quite rapid and loss of solvent might have been expected even through the small area of sealant exposed, but this was not the case.

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Manchester Museum

[Velson points out that the range of silicone adhesives has increased in the five years since this test was completed, and it may be possible to improve on the Silastic 738 RTV used here.]