PART TWO

THREE DIMENSIONAL IMPRESSIONS

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INTRODUCTION

Often you will find physical evidence at crime scenes in the form of three dimensional impressions made by shoes, tires, tools, or other objects. Casting such impressions provides the opportunity for closer and easier comparison with the original object.

According to Charles M. Bozza, a photograph will rarely have much value in attempting to individualize an impression to the object that made the mark.[1] While his statement may be an over generalization, the potential certainly exists for overlooking a great deal of detail when criminalists rely only on photographs. By not making a cast the criminalist may be reduced from a finding of certainty, based on individual characteristics, to one of mere possibility, based only on class characteristics.

A three-dimensional cast, made using the proper casting materials and techniques, can disclose virtually all of the detail present in the impression. The amount of detail recorded will, of course, depend on the amount of individual detail in the original object and on the nature of the material in which the impression is made.

For example, a shoe impression in fine soil or good "packing" snow will often disclose very minute detail. An impression of the same shoe in gravel or old, crystallized snow, on the other hand, will seldom disclose much useful detail because of the coarse, broken nature of the medium in which the impression was found.

You must always bear in mind that it is often very difficult to determine how much detail is actually present in an impression until you have produced a cast and carefully examined it later in the identification laboratory.

CASTING MATERIALS

We will examine several different casting materials:

(a) plasters and stones for impressions in soil or sand;

(b) sulphur and Snow-Print Wax for impressions in snow;

(c) elastomer impression materials and modelling clay for small impressions such as tool marks;

(d) alginate for intermediate casts of bite marks and other body wounds.

Many other materials have been used with good results and their omission from this paper should not be construed as an indication that they are not suitable. The materials presented here are chosen simply on the basis of easy availability, moderate cost and proven suitability for the intended purpose.

IMPRESSION STONES AND PLASTERS

Large impressions, such as footwear and tires, are most conveniently cast with some form of gypsum impression material such as dental stone or laboratory plaster. These materials are extremely finely ground and are thus capable of reproducing the smallest detail which can be recorded by most types of soil or sand in which such impressions are likely to be found. While silicone rubber has been suggested for this purpose, it is prohibitively expensive in the quantities that would be required even for a single cast.

There are several methods of manufacturing gypsum materials which result in different characteristics in the finished products. The least expensive process results in a product which produces a soft, weak cast. Plaster of Paris and Dental Plaster are in this category.

Dental Stone and Laboratory Plaster are made using a more complex manufacturing technique which results in a much stronger product. Casts made from these materials have three to four times the tensile strength and many times the surface hardness of Plaster of Paris.[2,3]

Compression Strength

The following is an example of the compression strengths of several common types of gypsum material:

Plaster of Paris	-	1500 PSI
Dental Plaster	-	2000 PSI

Lab Plaster	-	5000 PSI
Dental Stone	-	6000 PSI
Die Stone	-	12000 PSI

The completed, cured cast needs to have sufficient compression strength and surface hardness to allow for cleaning, for examination and for handling at court, without danger of damage to the fine detail.

Plaster of Paris, with a compression strength of only 1500 PSI, does not fit these criteria. Dental Plaster, at about 2000 PSI, is hardly any better.

Dental Stone and Laboratory Plaster are quite good at 6000 and 5000 PSI respectively, either one being adequate for most impressions.

The hardest material, known as Die Stone, hardens to 12,000 PSI but is more expensive and not usually necessary for capturing footwear and tire impressions.

Setting Time

The following list gives times to initial set of typical materials at room temperature:

Type	**Setting Time**
Plaster of Paris	5 - 10 mins.
Dental Plaster	20 - 30 mins.
Lab Plaster	10 - 15 mins.
Dental Stone	10 - 20 mins.

Size stability of the Cast

One of the advantages of having a cast of a crime scene impression is that, in some cases, comparative measurements can be made between the cast and the original object. For this to be meaningful you must use a casting medium having a negligible shrinkage or expansion factor. Because dental work requires a high degree of accuracy, virtually all dental casting materials are suitable for forensic work.

Gypsum-based materials expand as they cure, not shrink as might be expected.

Plaster of Paris has an expansion factor on the order of 0.25% or more. In the average full footwear impression, this will mean a change in overall length of less than 1 mm and correspondingly less over the short distances usually involved in comparative measurements.

Dental Stone, with an expansion factor of 0.10% or less will exhibit a maximum increase in length of only 0.3 mm.

Type	**% Expansion**
Plaster of Paris	0.25% or more
Dental Plaster	0.19% or less
Lab Plaster	0.10% or less
Dental Stone	0.04% to 0.10%

Although, for practical purposes, any of the materials listed above have sufficient size stability for identification work, it is the consideration of strength which governs our choice.

Size of the Impression

With respect to footwear impressions, it should be noted that even though the cast itself has size fidelity, the impression may be much shorter or longer than the actual footwear.

This will be evident mainly in the toe and, to a lesser extent, in the heel but is negligible in the central portion of the impression. It is a factor of the weight of the individual combined with the direction of force of the footstep and the density of the soil. The heel sinks down and forward as the weight is first applied. The toe may slide down and forward as the step is completed or may push backwards as the subject pushes off to the next step.

For this reason, it is usually not practical to attempt to determine shoe size from this type of footwear impression.

CASTING WITH DENTAL STONE

For ease of explanation, this paper refers mainly to the casting of footwear impressions but the techniques are equally applicable to the casting of any other marks of a similar nature, such as tire impressions or animal tracks.

Also in the interest of simplicity, all gypsum impression materials will be referred to as stone. The method of use is the same for all, so there will be no adjustment needed to the described methods whatever product you use in your own unit.

Equipment Required

The equipment required will depend to some extent on your choice of technique. The following equipment would make a good basic kit:

- impression stone - 500-600 gm per heel impression, up to two kg for a large footwear impression, more for a tire impression. The stone should be packaged in waterproof containers such as plastic bags. (See below for pre-measured method)
- mixing container - a plastic pail, large plastic jug, or plastic bags and twist ties
- container for water
- stirring implement - paint stick, etc.(if using the no-measure method)
- scoop, to transfer plaster to mixing container. (if using the no-measure method)
- retaining form - commercial adjustable form or strips of cardboard, about 75mm wide by 1m long
- soil Hardener - bottle of shellac diluted with wood alcohol, (about 25% shellac or less) or some type of fixing spray
- sprayer - for application of hardener. (Commercial aerosol handi-sprayer is most convenient - it must deliver a fine mist)
- spray bottle for water. (Also must deliver a fine mist)
- release agent - talcum powder
- powder atomizer and/or powder insecticide sprayer
- rubber ear syringe - or similar large rubber bulb
- large tweezers or forceps
- long-handled cotton swabs
- small bottle mineral oil
- waterproof felt tip marker
- 3" - 4" putty knife

Keep all of the above materials packed in a kit, ready for use when needed.

PROCEDURE

Protect the Impression

If it is raining, snowing or windy when you find an impression, immediately cover it with a box or a sheet of cardboard or plywood to protect it until you are ready to work on it.

Photograph the Impression

Despite having noted earlier that a cast is better than a photograph alone, the best practice is to have both. Should anything go wrong during the casting process you then have a possible second chance. Without the photograph you would have nothing at all.

Medium distance shots show orientation and location in relation to the surroundings. Closer views provide a record of the shape of the impression. Close-up record shots, taken as described below, show as much of the fine detail as can be recorded photographically.

Position the camera perpendicular to the impression not to the ground. Set a scale on the same level as the most detailed portion of the impression. You may be able to use a damaged area in the impression in which to lay the scale. Otherwise you may have to dig a small trough to one side in order to place it on the same plane as the impression.

Illuminate the impression with light source at 40-60º from vertical. On a bright sunny day, unless the sun happens to be in just the right place, you may have to cast a shadow over the impression and provide the angled light with a reflector card or a flash unit. Because of the difficulty of seeing exactly how the fine detail will be recorded when using flash, it will be wise to shoot extra negatives, varying the position of the flash head and perhaps bracketing the exposure.

Clean Out the Impression

Loose debris, which may have blown or fallen into the impression, should be carefully lifted out. Pick out loose lumps of earth, small twigs, leaves or papers with tweezers. Be careful not to try to remove anything, such as leaves and twigs, which may have become embedded in the impression as it was formed. You may destroy the whole impression by pulling on what appears to be a leaf stem only to find that it is attached to a large buried leaf.

You can remove particles that are too small, or too fragile, to grasp with tweezers by carefully touching them with a cotton swab that has been dipped in mineral oil. They will stick to the swab long enough for you to be able to lift them out of the impression.

If there is a damaged area in the impression which does not contain any useful detail you can simply

blow the loose dirt into that area using a rubber bulb, such as an ear syringe.

Squeeze it gently and "chase" the small particles into the damaged area. Do not squeeze hard or you may damage the actual impression.

Strengthen the Impression

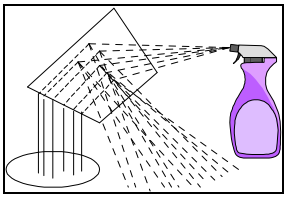
Before pouring the stone you must evaluate the chances of the impression being damaged by the weight of the stone. An impression which was made when the soil was damp may have since been dried out by the sun and wind. Even though fine detail is present the impression may now be very fragile. In this condition it may well break up as the stone is poured. You will probably be able to judge this condition as you are cleaning out the excess debris. If you have any doubt, take steps to strengthen the impression.

The simplest method is to dampen the impression with water. The water tends to bind the particles of soil or sand together sufficiently well to support the stone as it is being poured.

You will need a sprayer that will give a very fine mist. If large droplets of water are produced by the sprayer they will damage the fragile impression. Neither should the sprayer give too powerful a spray. Be sure to check these features before making your purchase. The types used for indoor plants are often satisfactory.

Hold the sprayer a foot or more away and allow the fine spray to drift down onto the impression from the upwind side until the whole impression, including the sides, is thoroughly dampened but not running wet. If the wind is very strong, provide protection to prevent the spray from blowing away, e.g., a cardboard box with top and bottom removed.

In strong winds it may be necessary to use a deflector card to "bounce" the spray into the impressions.



Make sure that the edge of the card is not over the impression because the water will run off the edge and damage the detail.

Another, old, technique that works in any type of soil or sand is a spray of dilute shellac-alcohol solution. The ratio that works best is about 25-30% shellac dissolved in methyl alcohol.

Spray the shellac solution in the same manner as the water, working slowly to give the mixture a chance to soak in. For the average full footwear impression, about 75 to 100 ml will usually suffice. Wait about 15 minutes or so to give the mixture a chance to dry. It is best to give several light sprays with a short wait for drying between coats. The result is a thin film which does not hide the fine detail but which gives the impression considerable strength.

Be sure to thoroughly clean the sprayer after use, before the shellac sets.

Other types of sprays, such as hair spray or ignition spray, may also provide the necessary strength and have the added benefit of already being in an aerosol container. You will need to experiment to determine how well they support the impression and whether the spray provides a sufficiently fine mist.

Apply a Release Agent

One writer has suggested that a release agent is not always necessary.[4] If you use shellac, however, a release agent will almost always make the cleaning of the cast much easier. When using nothing, or just a plain water spray, for strengthening the impression we have found that the type of soil or sand affects the ease of cleaning. Because applying the release agent is such a simple process, and because it may enhance contrast in the photograph of the impression, we recommend that you use it every time.

The traditional literature suggests some sort of oil spray as a release agent. However, O'Hara and Osterburg recommend the use of a fine layer of talcum powder[5]. It works very well and is much cleaner to work with. Talcum has the additional advantage that, while it is being applied, the contrast of the impression is often markedly improved and a photograph taken at that time will sometimes show fine detail more clearly.

The talc is sprayed onto the impression through a powder insufflator (atomizer) or, in larger quantities, using a powder insecticide sprayer. Blow the talc in from upwind and allow the powder to settle onto the impression. In strong winds you may have to use the deflector card. Apply a layer of talc all over the

impression until it is evenly covered. You are not trying to hide the soil, just to put a thin layer on the whole surface.

Lloyd claims to have found tetrafluorethylene (TFE) to be superior as a release agent[6] but other tests have indicated that it is not as effective as talc.

Build a Retaining Wall

In order to restrict the cast to a reasonable and easily handled size you will need to place a retaining wall around the impression. The wall will also ensure that the amount of stone poured forms a sufficient thickness that it will not easily break. Without the wall you may end up with a large but thin cast shaped like a dinner plate.

You can use strips of cardboard or metal to make the retaining wall. Seventy-five mm wide strips about a meter in length will be long enough to form an oval shape around a shoe impression. The adjustable metal forms that are commercially available are a bit more work because they must be cleaned after each use. The cardboard is simply discarded after the cast has set.

Staple or paper-clip the cardboard strip into an oval large enough to contain the impression while leaving about 25mm space all the way around. Press it gently down into the soil or sand, being careful not to collapse the sides of the impression. Pull the dirt up around the outside of the wall so that there are no gaps underneath through which the stone could escape as it is being poured. Remove any dirt or sand which may have fallen into the impression as you set the retainer in place.

Mixing the stone

Mix up sufficient stone so that the cast can be poured in one batch. Impression stones are not expensive and it is better to mix up too much than not enough. However, if you should find that you require more, a second batch can be quickly mixed and added. It will bond to the previous pour if the time interval is not more than about five minutes.

You can mix the impression stones in either of two ways.

The original method is to add the plaster to the water without stirring until the proper amount has been added and then stir the mixture. This is the "no measure" method.

The second method is to carry pre-measured quantities of stone in plastic bags and add a measured quantity of water to the bag.

Each method is explained below.

The "No Measure" Method

Use a small plastic pail or large plastic jug as a mixing container. Line it with a heavy plastic bag, such as a 4.5 litre sized freezer bag. Pour in the water. For a heel impression, approximately 200 ml will be sufficient. For full shoe impressions you will need about 600 ml and for tires you may need a litre or more.

Sift the stone across the whole surface of the water without stirring. Allow it to sink to the bottom. When it begins to form a pile about 15 - 20 mm above the water level you will have close to the proper proportion of stone to water.

You now have two options. Gently stir the mix until it has a uniform consistency or seal the plastic bag with a twist tie and knead the mixture. When stirring, do it slowly to avoid introducing bubbles which then will interfere with the accurate recording of detail in the impression.

When completely mixed it should have a smooth consistency, comparable to pancake batter. Ensure that there are no lumps of dry powder remaining.

If necessary, add small amounts of water or stone to adjust the mix to the proper consistency.

A mixture that is too thin will take longer to cure but will record the detail accurately. It may not, however, have the full tensile strength of a correctly mixed cast.

A mixture that is too thick will not conform to the small crevices of the impression and the cast will have lines across the face where the stone did not flow together to form one continuous piece. Add water and remix before you pour.

The Pre-measured Bag Method

This method was suggested by Vandiver in 1980.[7] It is a more exact method of proportioning the water and stone and is also more convenient and cleaner. It simply requires that you place a measured quantity of stone in a plastic bag. Then when you want to make a cast add a specified quantity of water to the bag and knead it until all of the stone is wetted and has become a smooth mix of the correct consistency.

A full footwear impression will require roughly 1.8 kg of stone, to which you will add approximately 600 ml of water. About 600 gm of stone and 200 ml of water will suffice for a heel impression. Experiment with the particular brand of stone that you have available to determine the exact proportions. It may change each time you obtain a different brand or a new supply.

It is more convenient to pre-measure several bags of dental stone at your office and carry them in a kit rather than trying to measure it in a wind at the scene. If you carry several heel impression sized bags you can also use them for partial sole impressions or you can combine two or three bags for larger impressions.

Larger casts such as tire impressions may require five or six bags. Divide impressions larger than that into more than one cast or run the risk of producing a cast which is too unwieldy to handle and too easily broken.

The only other requirement is a measuring container for the water. Water should be available at most crime scenes.

Manufacturers of Dental Stone provide instructions for mixing which will result in the development of maximum strength of the cast. Using more water creates open pores in the set mass and weakens the cast.[8] However, using their recommended proportions results in a mix which is too thick for our purposes. Increasing the water content about 25 - 30% results in a satisfactory mix without sacrificing too much strength.

Pouring the Stone

Do not pour the stone directly into the impression because the weight will damage the fine detail. Cut a corner from the bag and allow the stone to run onto a wide-bladed spatula or scraper held about one centimetre above the surface and to one side or end of the impression inside the retaining wall. Move the spatula along the length of the impression, allowing the stone to flow off the spatula and cover the bottom completely. Once you have a layer of about a centimetre thick in the impression you can pour directly on top of it, without using the spatula, providing that you do so gently and slowly from close to the surface until the impression is filled.

Smooth the surface of the cast with the spatula and leave it to set.

Curing (setting)

Within a few minutes after you have poured the cast a layer of water will form on top. Soon after that the water will disappear and the cast will have a dull, non-reflecting appearance. A short time after this occurs, perhaps seven to ten minutes into the process, the stone should be firm enough to retain the markings you make on the back of the cast. (see below for details on marking the cast.)

From this point there will be no visible change in the cast. However, the stone and water produce an exothermic chemical reaction, i.e., the mix gives off heat as it cures. By feeling it with your hand, you will notice that it gets quite warm. When it starts to cool the chemical reaction is complete. This will take about twenty minutes to one half-hour.

Note that although the initial reaction is complete the cast will not reach full strength until it has cured for about twenty-four hours. If there is some urgency the cast can now be removed but it must be handled with great care since it will not have developed much strength. It is preferable to wait until the cast is completely cold.

Be very careful while handling and transporting the cast back to your office. Do not let anything touch the impression side of the cast and **resist the temptation to clean off any of the dirt** which still adheres to it.

At the office place the cast somewhere safe to allow it to fully cure and develop maximum hardness before working on it.

Marking the Cast for Identification

As it begins to set, scratch identifying information onto the back of the cast. Include the date, place, your initials and, if making more than one cast, an identifying number or letter. The latter will enable you to describe exactly where that individual impression was located. Sketches, or extra photographs showing the casts in place, will also assist in this identification.

With this information embedded in the stone surface there can be no question later about which cast came from which location. If needed, further information can be added with a waterproof felt-tip marker after the cast is completely cured.

Cleaning the Cast

You can clean the cast after it has cured for twenty-four hours. The larger clumps of dirt can be brushed off with your fingers. Do not use a brush or scraper because of the danger of damaging the fine detail.

Remove the remaining dirt by washing the cast using a pressurized car wash sprayer. Lay the cast on the floor and pass the spray over it two or three times. If the spray has a very high pressure use the edge of the flow or, if it is adjustable, use a medium pressure or a fan shape rather than a needle spray.

Because the spraying takes only about fifteen seconds, the water softens the dirt and flushes it away quickly before the stone surface gets soaked enough to be softened and damaged.

If you have used a lower grade of casting material, such as Plaster of Paris, the water will dissolve the surface of the cast. You will see white residue rinsing off which indicates that the fine detail is being washed away. This will not occur with Dental Stone although laboratory tests indicate that even Dental Stone will be damaged if scrubbed with a brush while washing.

If you must use a running faucet to wash the cast under, keep the time to a minimum so that the cast does not become water soaked and softened, and do not use a brush or anything abrasive. An ordinary garden hose can be used with a nozzle to provide a strong stream.

If you have used shellac or a similar material to strengthen the impression and you find that it is adhering to the cast, it may be possible to remove it by swabbing the area with wood alcohol and washing gently.

The main disadvantage of leaving it on is that the discolouration, which is usually patchy, makes photographing the cast more difficult. This could be overcome by smoking the whole cast with magnesium smoke but it would be an awkward task to perform.

Impressions partly filled with water

You will sometimes locate impressions in which water has collected. Some of the water can be removed by using an ear syringe to suck it up. If you do so, be careful not to disturb any fine silt which may be in bottom of the impression. If disturbed, the silt will cloud up and then settle again onto the impression, perhaps obscuring some of the detail.

If you are able to remove almost all of the water you can then pour the cast in the normal way.

If a pool of water still remains simply dust dry Dental Stone into the water as if you were using the no-measure method of mixing. Sprinkle it evenly and slowly across the surface and allow it to settle into the impression. Continue until about a one centimeter layer of stone has built up in the flooded portion of the impression. It may still be under water.

Then mix and pour the remainder of the cast in the normal way, by carefully pouring onto a spatula over the area on which you have just worked. The two lots of stone will bond together providing that new material is poured before the original stone begins to set.

Impression completely under water

Impressions under several inches of water are difficult to restrict to a cast of reasonable size because the stone tends to spread as you sprinkle the powder over the surface.

One way to minimize the spreading is to sprinkle the dry stone powder into the water over the whole impression, until you have built up a thickness of a few millimetres of stone. This will protect the impression from damage as you go to the next step.

Next, carefully place a retaining wall into the water around the impression, pushing it down into the stone. With the retaining wall in place you can then continue to build the thickness of the cast by sprinkling more stone into the impression.
Trying to put a retaining wall in place before you start sprinkling the stone is likely to disturb the fine silt in the puddle. This will then resettle and is likely to obscure some of the detail in the impression.

Once you have a safe thickness (about one cm) built up, mix and pour the remainder in the normal way. Do not let the mixed stone drop into the impression, use the spatula to break the fall. The "cushion" built up by sprinkling the stone will then prevent any damage to the fine detail.

Since stones and plasters react with water to cause an exothermic reaction they are able to cure while completely submerged. Unless the water is very cold there should be little difference in curing time from the normal "dry-land" procedure.

One advantage of this type of cast is that there will be little dirt adhering to the surface and you will be able to see the results almost immediately. It is still necessary to wait twenty-four hours, until it is completely cured, before giving the cast a thorough cleaning.

Modifying Setting Time

It has been suggested that accelerators and de-expanders should be added to the dry stone powder before mixing. Cassidy suggests the addition of a teaspoon of potassium sulphate to 25 - 30 ounces of water (4 - 5 grams to 700 - 850 ml of water).[9] This was desirable when using Plaster of Paris or Dental Plaster.
It is not recommended when using Laboratory Plaster or Dental Stone. The addition of too much potassium sulphate to a mix may result in actually slowing the setting time and it may cause efflorescence on the surface of the cast after a few weeks.

The manufacturers already are using what they consider to be a maximum useful amount of de-expander (potassium sulphate, Rochelle Salts, or a combination of both).[10] It is not recommended that any accelerator/de-expanders be added to Dental Stone.

Modifying Plaster of Paris or Dental Plaster

For those who do choose to use Plaster of Paris or Dental Plaster, the use of modifiers will provide a faster setting time and a better setting expansion. Four materials are generally recommended.

Clark recommends making a saturated solution of potassium sulphate and using one part of this to 10 parts of the mixing water.[11] A saturated solution is about 10%. The addition of about 10 grams (two teaspoons) of potassium sulphate to one litre of mixing water will provide the correct concentration of 1%.

A 100:60 mixture of Dental Plaster and water, using 1% potassium sulphate in the water, will have an initial set time of about 10 minutes and a final set time of about 15 minutes, at room temperature. (The times for dental plaster mixed with plain water are about 30 minutes to initial set and 45 minutes to final set.)

Clarke also mentions the use of potassium alum at a concentration of about 1.5%. The setting times utilizing alum are about the same but the mix tends to be more viscous. This results in retention of air bubbles and loss of some fine detail, although the surface is very smooth.

Lloyd suggests the use of Rochelle Salt (sodium potassium tartrate) and borax.[12] This is a very expensive method and provides no significant advantages.

Many old articles and texts recommend the use of salt. Salt will weaken the cast and is not recommended.[13]

Unless there is some pressing reason for using Plaster of Paris or Dental Plaster (such as obtaining it free!) it is preferable to use Dental Stone which works extremely well just as it comes from the container. The difference in cost is negligible.

Summary

Casting with Dental Stone is easy, relatively inexpensive and yields much finer detail than can be seen in many photographs of three dimensional impressions. The casts lend themselves to easy comparison with the original object since both are three-dimensional.

Ensure that the materials are readily available when required. Put together a kit of materials that will be readily available and complete when you do need it. Be sure to replenish it after every use or you will find it empty just when you need it most!

Practice the skills from time to time to ensure that when you do need to make a cast you will be able to do so without any difficulty.

Suggested Materials for a Casting Kit

Stapler	Ear syringe
Box of staples	Mist sprayer
Box of paper clips	Water bottle
Cardboard strips	Pump powder sprayer
Scissors	Powder atomizer
Tweezers	Deflector card
Cotton swabs	Elastomer kit
Mineral oil	Elastomer mixing pad
Felt tip marker	Spatula (1/2")
Lumber crayon	Putty knife (3")
Grease pencil	

Several pre-measured plastic bags of dental stone. Six bags sufficient to make one heel impression each and two bags large enough for a whole footwear impression would be a good basic kit.

CASTING IN SNOW

Because of the weight of Dental Stone and the heat given off during the curing of the cast we cannot use this material directly for capturing impressions in snow. The snow simply melts and the weight of the stone then destroys the impression.

Snow impressions can, however, be cast using one of two methods, poured sulphur or spray wax. These are discussed below.

The type of snow which best allows casting is the type which makes the best snowballs. Firm packing snow. You can easily test for this by picking up a handful of snow and squeezing it in your hand. Then open your hand. If the snow stays together in the shape of your palm and fingers, it will also support good detail in an impression. Light, fluffy snow usually will not support an impression or will be destroyed when the casting material is applied. Crystalline snow which forms after a thaw-freeze cycle will not support the fine detail that we are looking for in an impression.

CASTING WITH SULPHUR

Sulphur is used in molten form and therefore any form of sulphur is suitable for the purpose, including, sublimated (highly refined), flowers (unrefined waste product), prills (small beads or split beads, used in industry) or block (larger, brick sized pieces). Since any form is satisfactory, the cheapest possible source is the best.

Sublimated sulphur is available from laboratory chemical supply companies, but is very expensive since it is highly refined for pharmaceutical use. It is unnecessary to purchase this type.

Because sulphur is a by-product of certain industrial operations, it is often available from those sources in lump or block form at very low prices. Check the industries in your area.

Prill sulphur, mentioned in Cassidy's book[9] is no better than any other type of sulphur. Because it is not fine powder it tends to be a little less messy to use, especially outside in a breeze.

It is also available in powdered form from agricultural or horticultural suppliers. If purchasing from those sources, make sure it is pure sulphur, containing no additives.

Method

While it may seem contradictory to use hot, molten sulphur to cast a snow impression, the process works very well in practice. The secret lies in the ability of sulphur to revert to a solid from a liquid as a result of only a very slight drop in temperature.

When brought to the correct temperature, and poured into the cold impression, the sulphur instantly solidifies, capturing the fine detail before the snow has time to melt.

Preparation

Since snow impressions are cast only in cold weather it is advisable to minimize the time spent at the actual site by making preparations well in advance. Melting the sulphur from a stock supply takes time and can be messy when done outside in the wind. You can do the initial preparation in the laboratory and then set the sulphur aside until it is needed.

First, obtain two or three saucepans of about three to four litre capacity (visit the local rummage or garage sales). The best ones for the purpose are thick-walled cast aluminum or iron.

Fill a saucepan with sulphur, in whatever form you have available. Then heat it slowly at a moderate temperature (approx. 200°C or 400°F) until it has the appearance and consistency of corn syrup. Keep adding sulphur until the pan is full. Do not try to speed up the process by increasing the heat. The sulphur will simply thicken to a toffee-like consistency and prevent you from easily adding more powder or stirring the mixture.

Once the pan is full remove it from the heat and allow it to cool. It will form a solid block in the pan which is a more convenient and clean way of carrying it to the crime scene.

Heating the sulphur in the field

For field use, a propane or naptha camping stove will provide adequate heat and will be easy to control. Situate the stove in a sheltered area, out of the wind. Set the stove at medium heat. Outside in the cold it will be tempting to attempt to speed up the heating process. Remember that heating it at too high a temperature will only give you the toffee-like consistency and slow down the overall process. Be patient!

Melting sulphur produces fumes which have a mild smell and are non-toxic. You may heat it indoors on a kitchen stove if that is more convenient. The ordinary stove hood will remove the smell.

It is unlikely, when melting the sulphur as described above, that the sulphur will catch fire. You should, however, be aware that burning sulphur produces sulphur dioxide which has a characteristic bad smell and is toxic. Avoid breathing these fumes.

If it does catch fire when you are working outside in sunlight, the pale blue flames will be difficult to see but you will immediately recognize the odour. Move to the upwind side of the pan and then throw snow onto the surface of the sulphur to extinguish the flames. If it ignites when you are using a stove indoors, immediately carry the pan outside so that the fumes will be quickly dispersed and where you can then deal with it as above. Unlike a grease fire, the flames will be quite low and should not cause a problem when carrying the pan but do not spill the mixture.

The melt will take about thirty minutes, since low heat must be used. If it does become overheated and thickens, do not pour it since the thickened sulphur will retain the heat and will then melt the impression before forming a hard cast.

Cool it by placing the pan in the snow and then bring it back to the correct consistency before pouring the cast.

If you are heating the sulphur out of doors you will more easily be able to monitor its progress as you prepare the impression.

Preparation of the Impression

As with any impression you will need to remove any debris which has fallen or been blown into the impression. Often this is simply snow which has been blown or knocked into the impression after it was made.

As usual you will need to take photographs before you pour the cast. This is a challenge when the impressions are deeply embedded in the snow.

The next step is to construct a pouring trough into which the molten sulphur will be poured. Pouring it directly onto the impression may cause damage at the point first struck by the relatively large volume of hot sulphur.

The trough is simply a small table-spoon sized area having three sides, the open side being adjacent to the edge of the impression. Form the trough next to the highest portion of the impression so that the sulphur will flow from the trough out over the impression and down into the lower areas as you pour. You may first have to make a small pile of snow to place the trough slightly higher than the impression.

As you begin to pour, the sulphur initially flows over the impression in a thin layer, which sets immediately as it contacts the cold snow. The continued pouring then builds up the necessary thickness to provide sufficient strength for removing the cast from the snow. Even if the heat then melts the snow the fine detail has already been captured.

In order to prevent the sulphur from escaping from a shallow impression, or to restrict the cast to just the part of the impression that you wish to record, build a low containment wall of snow. Because snow impressions are often fairly deep this step will not always be necessary.

Pouring the sulphur

When the sulphur is completely melted, take the pan to the impression and allow it to cool by setting it in the snow with the lid off. Keep stirring occasionally to equalize the cooling throughout the whole pan.

As it cools, small crystals, having an appearance similar to that of ice forming on water, will begin to appear on the surface of the molten sulphur. Each time you stir, the crystals will melt again as you bring hot sulphur up from the bottom of the pan. When you stop stirring the crystals will take some time to reform. As the sulphur batch cools this time will be reduced. When the crystals form again immediately after you stop stirring, the sulphur has cooled to the proper temperature of about 46°C (115°F).

In this state the sulphur will instantly solidify if the temperature is now dropped quickly by even one degree.

Give the melt a final stir and pour with a steady, moderately fast speed, into the pouring trough, continuing until the impression is full. As the sulphur hits the snow you will see it solidify and the following material will flow over the solid part until it too hits cold snow and solidifies.

You should pour until the cast has a thickness of at least 10 mm. Sulphur has little tensile strength and therefore is very brittle when set, so do not skimp on the thickness.

This is where a heavy-walled pan is better than the cheap thin-walled aluminum pans. With the latter type the heat is transferred so quickly that the sulphur solidifies in a layer 1-2 cm thick on the bottom and sides of the pan while it is still too hot in the centre to pour. This results in you having very much less molten sulphur to pour to form the cast. A heavy-walled pan, on the other hand, retains the heat better, allowing the sulphur to cool more evenly so that there is less stuck to the pan when the melt reaches the proper pouring temperature

Allow the cast to cool and solidify, which may take 5 to 15 minutes depending on air temperature. If the snow is only a thin layer on the ground lift the cast before the melted snow underneath refreezes and traps it in place. At this stage it will have a dark yellow translucent appearance rather than the opaque pale yellow of the cold sulphur with which you started.

Be very careful to ensure that the sulphur has had time to set all the way through. It will first form a crust on the top and bottom because of the cold snow and air but will still be molten in the centre. The thicker you have made the cast, of course, the longer it will take to cool and set all the way through. Attempting to lift it before it is fully set will result in you breaking through the crust, destroying the cast and getting molten sulphur on your hands. Be patient!

Even when fully set the cast will be very brittle and easily broken although the surface is quite resistant to damage from rubbing. Ensure that it does not get dropped or bumped while you are transporting it back to your office.

Once back at the office you can strengthen the cast by embedding it in a support pad of dental stone.

Mix up a batch of dental stone. Make it thicker than normal, about the consistency of peanut butter. This will prevent the sulphur cast from sinking into the stone mixture. To help the stone grip the cast, tack a few small lumps of sulphur to the back of the cast. Heat one surface of the lump until it softens and then place it in contact with the sulphur cast.

Pour the stone into a suitable container such as a cardboard box lid or a bed of sand. Then carefully place the cast onto the surface of the stone. Press it down to ensure that it is firmly embedded but not so far that the stone starts to overlap the impression side of the cast.

Alternatively, you can set the cast face down in a bed of sand. To ensure that the cast remains tightly embedded, with no space around the edges where the dental stone can get underneath, it helps if the sand is damp. Build a cardboard retaining wall and pour the dental stone over the cast to a thickness of about 15-20 mm. Again, lumps of sulphur stuck to the back of the cast will assist in ensuring good adhesion between the two materials.

Vandiver recommends adding fibreglass to the molten sulphur and claims that it will increase the strength by about fifty percent. He recommends adding about five percent by weight of 1/8" to 1/4" pieces of milled fibreglass.[14] The very small size of the milled fibres should not interfere with the ability of the sulphur to record the fine detail of the impression. This method should be considered as an alternative to the bed of stone. It will not be necessary to do both.

Health and Safety Considerations

Sulphur is not toxic in powdered or lump form but if you are handling it in powder form you should wear a non-toxic particle mask so that you are not breathing in the dust.

Like many otherwise harmless powders, it can be explosive if the dust is dispersed finely in the air in the presence of flame. When using an open flame burner to melt the sulphur take care not to allow clouds of sulphur powder to be formed in the vicinity.

As noted earlier if the sulphur catches fire and burns while melting, it gives off sulphur dioxide gas which, in sufficient concentration, is toxic. These fumes, if inhaled, will combine with the moisture in the respiratory system to form a weak sulphurous acid, which will be irritating to the mucous membranes. Stay upwind and, as noted earlier, put out the flames by covering with snow or, if indoors, carry the pan outside.

If stored in a damp area, sulphur will combine with the moisture to form weak sulphurous acid. Store it in plastic and keep it dry.

Keeping in mind the above comments, sulphur, used properly, does not present any significant hazards.

SPRAY WAX METHOD

An alternative way of recording impressions in snow is the spray wax method.

The spray wax used for this purpose is a commercial product supplied in aerosol cans. The idea originated in Sweden from experiments using spray-on imitation snow for Christmas decorating. Although the spray-on wax available in Sweden apparently worked well, a suitable brand was not found in Canada. Snow-Print Wax™ has solved that difficulty.

Snow-Print Wax™ is coloured red or orange for easier visibility on the snow surface.

The method requires that you spray the snow impression with the wax material to a thickness of two to three millimeters. This records the detail of the impression and acts as an insulator. Dental stone can then be poured inside the wax layer without the exothermic reaction melting the snow before the stone has an opportunity to set.

Some users have failed to realize that the impression is reproduced on the wax, not on the stone. The stone is only there as a support for the impression. Cleaning off the wax removes the evidence!

Procedure

First spray a light coating onto the impression from about 10 - 12 inches away on the upwind side. Do not get too close otherwise the force of the spray may damage the impression. Allow it to drift across the impression and watch as the detail in the impression

stands out more clearly because of the contrasting colour of the wax. At that point photograph the impression again.

Continue to build up the wax by applying two or three light, even layers at two or three minute intervals. The aim is to ensure that the entire impression, including the sides, is covered with a layer of wax. Any gaps or thin areas will permit the stone to pass through and damage the impression. Try to build a layer about 2 - 3 millimeters thick over the whole impression.

When the spray is not actually being used to coat the impression, keep it warm in a coat pocket, or your vehicle or other heated area to prevent the cold from decreasing the pressure. If this happens it will tend to come out of the container in "spits" which will cause uneven spraying. Clean off any build-up of material around the spray nozzle. Occasionally the orifice will plug up. The supplier has anticipated this problem and supplies several spray nozzles with each can of wax.

After the layer of wax has set for five minutes or so, mix up and pour a thick, warm mixture of dental stone on top of the wax. This can be mixed a little thicker than a normal stone cast since you are not recording fine detail on the stone, but simply supporting the wax. Take care to ensure that the stone does not overflow the wax coating and get between the wax and the impression.

Cover the impression with cardboard or a newspaper to retain the heat as the stone cures. Remove the cast as soon as the stone has hardened or it may freeze into the surrounding ice and snow. Trying to pry the cast loose will destroy the wax impression.

The wax surface is extremely fragile and you must take great care when handling and transporting the cast. Keep it in a cold, shady area if you are continuing to work at the scene. Transport it in the trunk of the vehicle where there will be the least amount of heat. (Check for warm areas caused by exhaust pipes under the trunk) Do not allow other items to touch the wax surface, including any protective wrapping. It is best transported in an open box.

Whenever possible photograph the cast with electronic flash since it will quickly melt if you place it close to studio lights.

The wax never hardens and we are not aware of any method to strengthen this surface.

Cost

The wax is rather expensive and you will need a minimum of two cans so that one can be kept warm while you are using the first. A full footwear impression will require almost a full can of wax, tire impressions may require several cans.

EVALUATION OF THE TWO METHODS

During classes at the College, casts have been made on numerous occasions utilizing both Snow-Print Wax™ and sulphur methods, side-by-side in the same snow.

Most of these casts were made in January or February, in temperatures ranging from just above freezing to about minus twenty degrees Celsius. Snow conditions varied from ice with a thin covering of powder snow, to good packing snow, to spring-like "corn snow".

In virtually every case the sulphur method produced finer detail. Note, however, that these results are diametrically opposed to those reported by William J. Bodziak in his book "Footwear Impression Evidence"[15]. It must also be pointed out that on many occasions neither method produced the fine individual detail necessary for individualizing the footwear.

Both methods have advantages and disadvantages. Because of the wide range of temperatures in Ontario, and the consequent varied snow consistencies, you would be best advised to try both methods in your own area. Then make your own comparisons and select the method which best suits your conditions.

ELASTOMER MATERIALS

For casting tool marks or similar small impressions, probably the best choice is one of the synthetic rubber impression materials (elastomers), available from dental suppliers. A similar material, Mikrosil, is specifically compounded for criminalistics use and sold through the suppliers of fingerprint equipment.

These materials are generally compounds of polysulphide, silicone or polyether. Vinyl polysiloxene is also suitable, but generally more expensive.

When choosing an impression material, consider the following factors:

- Cost
- Shelf life
- Dimensional stability
- Rigidity (overall shape retention)
- Effect of temperature on catalyzation
- Ease of release from the impression
- Photographic reproducibility

Some of these factors to not apply to use of the materials in dentistry for which they were designed. You will thus need to determine the suitability of these materials for field use in extremes of temperature.

Cost

Elastomers vary widely in cost, depending upon the particular compounds used. Since most of them will perform satisfactorily for identification purposes it is often best to simply select the cheapest.

Another consideration, however, is to weigh the cost of a particular material against its shelf life and how much you are likely to use in that period of time.

For example, if you use the elastomer only infrequently it may be more economical in the long run to pay a little more for a kit of material having double the shelf life of a cheaper product.

Shelf Life

Unless you are likely to use a whole kit within one year, you should purchase material having a two year, or longer, shelf life. Out of date material either becomes too thick in the tube to work or will not catalyze and remains uncured in the impression. Be sure to check the expiry date when purchasing the materials, "bargains" often turn out to be close to the expiry date when purchased.

Dimensional Stability

There is slight variation in dimensional stability from type to type and between different types from the same manufacturer but these are insignificant for identification work. Any of them will provide sufficient accuracy for criminalistics work.

Rigidity

Most brands are supplied in several viscosities or weights, the names differing with the manufacturer.

The thinnest is syringe or light-bodied which is generally too liquid for the types of casting performed in identification work.

Next is regular or tray grade, which is probably the most useful for our purposes and is especially recommended if you will be buying only one type.

The other two, heavy bodied and putty grade, are much stiffer materials which do not flow easily and thus do not conform to the minute details in the impressions. They are not recommended for making the initial cast because of the difficulty of working them down into the tiny crevices of the impression.

They are useful as reinforcement over a thin cast formed of the regular bodied material. Unless you have need of them on a regular basis they are rather expensive to keep in stock.

Effect of temperature

Most of these compounds are formulated to catalyze in four or five minutes at room temperature. When used at crime scenes in cool weather the setting period is considerably extended and the compound may not ever fully set in really cold conditions.

In such conditions it may be possible to add a little more catalyst to help speed the process. One brand, Mikrosil, is provided with both slow set and fast set catalysts which help to take care of extremes of temperature.
Even in cold temperatures the materials will catalyze if heat can be provided in the immediate area of the cast. Simply cupping the hand over the cast for a few minutes will often suffice. Other approaches, such as warmth from a hair dryer, an electric heater, a lamp or a chemical heat pack will make it possible to use the material in these conditions.

Ease of Application

One of the problems encountered in field use is ensuring the material remains in an impression on a vertical surface, such as a door or window frame, until it sets. While the apparently obvious solution may be to use a heavier grade of elastomer, we would simply be exchanging one problem for another. In this case, because the heavier material does not flow easily, there is a tendency to trap air bubbles.

Where a bubble is trapped the material does not touch the surface. As a result, no detail is recorded in that area. The solution is to use a medium bodied material and support it so that it cannot flow out of the impression before it has set. A cup, fabricated of modelling clay, placed around and below the impression will often suffice. Wide masking or duct tape may also be used.

Another alternative is to back up the light weight material with a block of putty weight material, also available from the same sources. Once mixed, you can use it in place of the modelling clay.

An alternative method is to mix a quantity of the putty weight material with the appropriate catalyst, shape it into a ball with the fingers and cover one side with a piece of cling wrap. Press it gently into the mark, using just enough pressure to flatten it to a disc about 10 mm thick. Hold it in place and allow it to set. Then remove it from the impression and strip away the cling wrap.

Next, mix a small quantity of thinner-bodied material, place it carefully into the mark and press the prepared putty grade backing into it. Hold it in place until the new material sets and then carefully remove it.

If both grades of material are of the same family they should bond together. If they do not, they can be cemented with the adhesive available from the product manufacturer.

Ease of Release from the Impression

Elastomers are flexible and most will usually release, even from an undercut mark. Some of them, however, have relatively low tensile strength. If there is any tendency for these materials to stick to the broken wood fibres it may be very difficult to remove them from the impression without tearing the cast. This is a particular problem with some of the polyether materials.

Silicone release sprays and dry film lubricants are available to help overcome this problem. Cadco™ brand silicone release spray, available from Cadillac Plastics outlets and tetrafluoroethylene (Teflon™) dry film lubricants (i.e. - Crown #6075) are examples.

A readily available, and easy to use, release agent is metallic fingerprint powder. Simply dust the impression with the powder, ensuring that all crevices are covered, then make the cast in the usual way. A thin layer of powder is sufficient to enable the elastomer to release easily and will not obscure any of the detail of the impression.

Photographic Reproduction:

Most elastomer impression materials are opaque and are fairly easy to photograph. However, there are some brands, or some grades of a single brand, that are somewhat translucent. When attempting to photograph casts made of these translucent materials the light passing through the cast tends to eliminate the shadows which you are trying to produce with the studio lighting. Under these conditions recording the fine detail is very difficult.

The problem can be overcome in two ways.

The first is to simply add a small quantity of white fingerprint powder, talcum powder, zinc oxide, titanium dioxide, or similar light coloured material to the base material and mixing it in well before adding the catalyst. Quantities are not critical and can easily be determined by experimentation.

The object is simply to make the elastomer opaque. If there is some reason to darken the colour (such as when using elastomer to lift a light powdered fingerprint) add black or dark grey powder instead of white.
Note that the darker colours of elastomer also tend to obscure some of the fine detail and can be improved for photography by the method described below.

The second way of creating an opaque surface is to coat the cast, after it is fully set, with magnesium smoke. This creates a fine, off-white, even finish on the cast which will not obscure the detail. It also

greatly improves the contrast of the shadows cast by your lighting.

The procedure is quite simple. Cut a piece of the magnesium ribbon about 75 to 100 mm long and support it by one end in a pair of tweezers or pliers, over a fire-proof surface. Light the ribbon and hold the cast in the smoke just above the flame, being careful not to allow the flame to burn the cast.

The ribbon is slow to light but then burns very rapidly with a dazzling white light. Be sure to hold it over a non-flammable surface in case a piece breaks off as it is burning.

Just sufficient smoke should be applied to give a thin even coating to the surface of the cast. If inspection reveals that detail is obscured, brush the white coating off and try again.. Magnesium ribbon is available in 25 gram rolls from laboratory suppliers of chemicals.

This technique is also very useful when photographing the end of a tool for illustration purposes, particularly if it is shiny or multi-toned, because of a combination of dirt, rust, paint, etc. The coating of magnesium smoke will neutralize the variations of tone on the surface. Shadows, cast by cross lighting, now show up in strong contrast to the white smoked surface and the three-dimensional details are very easily observed.

Method of Use of Elastomers

The elastomer impression materials are all used in much the same way. The standard materials are supplied in two tubes, about the size of toothpaste tubes, one of which is the base material and the other the catalyst. Any smooth, non-porous surface will suffice for mixing although the manufacturers usually supply mixing pads with the kits. Because of the viscosity of the elastomers it is best to use a spatula with a fairly stiff blade.

The manufacturers of the materials will provide directions for the proper use of their own products.

The general method is to lay out equal length strips of base and catalyst side-by-side on the mixing surface. Be sure to maintain the full diameter of the nozzle of each tube. It is this diameter which provides the correct proportions of base to catalyst, providing that you make the two strips of equal length.

If an opacifier is required, at this point it should be thoroughly combined with the base material, as noted above.

Using the spatula, thoroughly combine the base material and catalyst. The two materials are of contrasting colours so that it will be obvious by the streaky colour whether the materials are properly mixed. If any unmixed material remains it will not set and therefore the detail of the impression in that area will not be recorded.

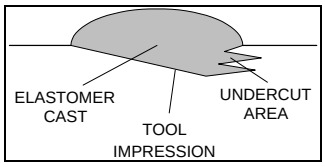
Mix it fairly quickly, preferably within about one minute. Total working time with most of these materials is about two to three minutes.

Then place the material into the impression, being careful not to trap air bubbles. This is best accomplished by starting with a small amount on the tip of the spatula and carefully working it into the corners or crevices of the impression. The balance of the material can then be carefully added.

Build up the mass to a thickness of about 10 mm to ensure that the finished cast will be satisfactorily rigid and dimensionally stable for comparison purposes. Do not scrimp on the amount of material.

After the cast has thoroughly set (about ten minutes at room temperature, longer if cold), very carefully loosen it and remove it from the mark.

If you work slowly around the edges, gradually loosening it, the cast can usually be removed with little or no damage.



Occasionally, some small fragments of the cast will break off in undercut areas of an impression in wood.

There will be no identifiable detail in that area of the impression so it will probably be of no consequence.

The danger is that the cast may tear across the area containing the impression made by the flat side of tool. This is where the majority of the identifiable

detail will be found. For this reason it is better to purchase the stronger elastomers.

When you have freed it from the impression, inspect the cast to ensure that there are no air bubbles showing. If you see any which may be interfering with potential detail, make another cast.

MODELLING CLAY

Ordinary modelling clay, such as Plasticine and Klean Klay is inexpensive, readily available and will record fine detail. However, because it has little tensile strength and does not set, it has limited use for casting tool impressions and for making test impressions.

It can only be used in impressions that are shallow and not undercut. Since it does not set, it must be handled very carefully after a cast is made so that no deformation occurs. Storing a cast in a refrigerator will usually ensure that it maintains some rigidity.

To make a cast

- take a piece of modelling clay a little larger than a golf ball
- knead it in your hands until it is quite soft and pliable
- press it flat (to about fifteen millimetres thick) on a smooth surface such as a windowpane or counter top
- thinly coat the smooth surface with a metallic fingerprint powder to provide a release agent
- press the powdered side firmly into the impression with the palm of your hand
- using great care not to deform the cast, remove the modelling clay from the impression

If a test impression of a tool is required the same general procedure is followed except that the tool is pressed into the prepared clay. Since it does not damage or alter the tool in any way, this is a useful procedure when you are trying to determine exactly which part of the tool could have made the crime scene impression.

Photograph the cast, paying special attention to the positioning of the lights. Hot studio lights will quickly soften the modelling clay and cause it to sag and thus be deformed. Be sure to keep them well away from the cast, even if this means that you must use longer exposures.

Depending on the colour of the clay you may be able to improve the contrast with magnesium ribbon smoke as described earlier.

ALGINATE

Another of the dental impression materials used in criminalistics is Alginate. It is used in the dental field to make intermediate moulds of gross dental impressions, i.e. impressions of the whole mouth. These are then used to make models for the production of dentures.

An irreversible hydrocolloid, when mixed with water Alginate forms a solid which cannot then be redissolved. It is supplied in the form of a powder which is mixed with water for use. Providing that it is kept dry, it seems to have an indefinite shelf life and is quite inexpensive.

When it first sets, the alginate mould is a pliable, opaque, gel-like material. It must be used while it is in this condition, since it has poor dimensional stability, shrinking as much as 50% or 60% as the water evaporates. Once it is dry, alginate becomes very light, hard and, because of the shrinkage, much smaller than life-size and useless for our purposes.

In spite of these drawbacks, the material has some limited use in criminalistics. Perhaps the most useful application is as an intermediate mould to cast body parts bearing bite marks or wounds.

You will need to build a dam around the wound or bite mark to confine the alginate to the area you are casting, much as you put a retaining wall around a footwear cast. This can be done quite easily with plasticene.

Mix the material according to directions on the can, making sure that no dry powder remains. (When making your initial purchase, ask for the measuring kit, which is separate and provided free on request.)

When fully mixed, the alginate should flow easily and can be poured into the dammed area.

NOTE: If you are going to cast a bite mark first take swabs for saliva from the affected area to submit to the forensic laboratory.

The alginate will set in about five minutes and can then be removed from the surface. Check the face of the cast to ensure that no air bubbles were trapped which could interfere with the fine details of the bite or wound. If any bubbles are present you should make another cast.

If you will not immediately be making a stone cast from the alginate you must wrap it in wet cloths to prevent it from drying out and shrinking. It can be kept safely this way for only two to three hours at room temperature before the shrinkage makes it useless. If you leave it in your car in the hot sun it may not last very long!

When you use the alginate mould to make a stone cast, provide some support so that the weight of the stone does not deform it.

Although the alginate has been developed to go into the mouth, and is therefore not likely to cause infection, you should be cautious of using the material on a live victim if the skin is broken. If you feel you must do so, get permission from the victim and medical personnel first, preferably in writing.

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