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A QUICK METHOD FOR COLLECTING MODERN SMALL-SCALE ICHNOLOGICAL AND SEDIMENTOLOGICAL STRUCTURES

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ABSTRACT

We describe a method for collecting recent superficial sedimentary structures, such as ripples, tool marks, and trackways. The surface first is consolidated using one of a variety of materials (acrylic, Butvar, or dust hardener), and then reinforced using cellulose acetate and collected. Sediment grains and areas of sediment surface can be excised after collection and cleaned for detailed study. This method is useful on a variety of sediment sizes, and it is inexpensive and relatively quick to implement.

RESUMO [in Portuguese]

É descrito um método para a recolha de estruturas sedimentares como pegadas, marcas de ondulação ou marcas de objecto. A superfície é consolidada usando uma variedade de materiais (acrílico, resina de polivinil butiral, ou endurecedor de sedimento), e posteriormente reforçada usando acetato de celulose podendo depois ser recolhido. Os grãos do sedimento agarrados podem ser retirados depois da recolha e limpos para estudo detalhado. Este método é útil para vários tamanhos de sedimento, sendo barato e relativamente rápido de implementar.

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INTRODUCTION

Modern trackways and other ichnological traces are fundamental tools used to research fossil tracks and sedimentary structures, including ripples and tool marks. However, commonly used methods of collecting modern footprints include the laborious use of plaster or latex (Goodwin and Chaney, 1994). Both of these methods are inadequate to accurately record traces on unconsolidated substrates without crushing the print or otherwise distorting the trace or structure. In addition, neither of these methods consistently and accurately records details of the substrate's sedimentology, including grain size and sorting. These features of the sediment may influence the formation of an ichnological trace or sedimentary structure. In order to circumvent some of the problems with these other methods, we have developed a technique that records small-scale surficial sedimentary structures with little, if any, distortion, requiring less labor, and preserving more data. It is similar to the use of acetate molds in other areas of paleontology (Darrah, 1936; Rigby and Clark, 1965).

MATERIALS

Butvar (polyvinyl butyral, B76) in solution with acetone.
Thin cellulose acetate sheeting. (Available from plastics suppliers.)
Airbrush (that can spray acetone based products, such as Preval® Sprayer).
Clear acrylic spray (optional).
Plastico Magic Spray Dust Hardener (Douglas and Sturgess) (optional).
Standard spray bottle (optional).

METHOD

1. Using an airbrush, spray the sedimentary structure or track that you want to collect with low viscosity Butvar (approximately 12:1 acetone to Butvar). The use of low viscosity Butvar is done to penetrate the surface layer (through percolation due to gravity) and preserve the delicate surface for collection. Clear acrylic spray, like Krylon®, may be used instead, but it suffers from problems in field use, in that it tends to disperse too much and does not quickly consolidate the surface. Dust hardener also may be used for surface consolidation and can be dispensed from a standard spray bottle. Both dust hardener and acrylic spray require much more time to dry (1-2 hours) than does aerosol Butvar. The drying time for the Butvar will vary with temperature since the evaporation rate of acetone will be higher in high temperatures and lower in colder temperatures. The freezing temperature of acetone is far below 0 Cº. The airbrush or sprayer should not be too close to the surface because the propellants used might disturb the surface. Generally a distance of about 30 to 40 cm is adequate. Repeat applications of Butvar, allowing it to harden in between applications (usually 15 to 20 minutes depending on field conditions), until the surface is resistant to touch. Higher viscosity Butvar (approximately 10:1 acetone to Butvar) may be used for additional applications in order to better consolidate and harden the surface before removal.

2. Once the surface is consolidated and relatively dry (test lightly with finger tip), lay a sheet of cellulose acetate film over the structure. The piece of cellulose acetate should be cut to size, leaving a margin of at least a few centimeters around the structure to be collected. Coverage of larger structures or trackways can be accomplished by overlapping many smaller pieces of cellulose acetate. Spray the cellulose acetate sheet, using an airbrush filled with Butvar (low or high viscosity will work). The acetone in the Butvar will "melt" the sheet. As it dries, the sheet will harden and the Butvar will aid in bonding it to the previously consolidated surface. Spray until the cellulose acetate melts and conforms to the surface (fig.1). Application of too much Butvar may cause holes to form in the sheet and result in reduced support. Use of too little Butvar will leave patches of cellulose acetate that have not conformed and bonded well to the sediment surface. Let the cellulose acetate and underlying sedimentary surface dry. The surface of the cellulose acetate will begin to curl slightly away from the adjacent sediment surface when dry (but may not be dry in the center).

3. Surface layer can be collected. When removed from the substrate, the upper layer of sediment will come away along with a three-dimensional cast of the structure (fig.2). Acrylic spray or some other cohesive or consolidating agent (not acetone based, like an epoxy) can be applied, in the field or later in the lab, to the other side in order to prevent loss of too much sediment.

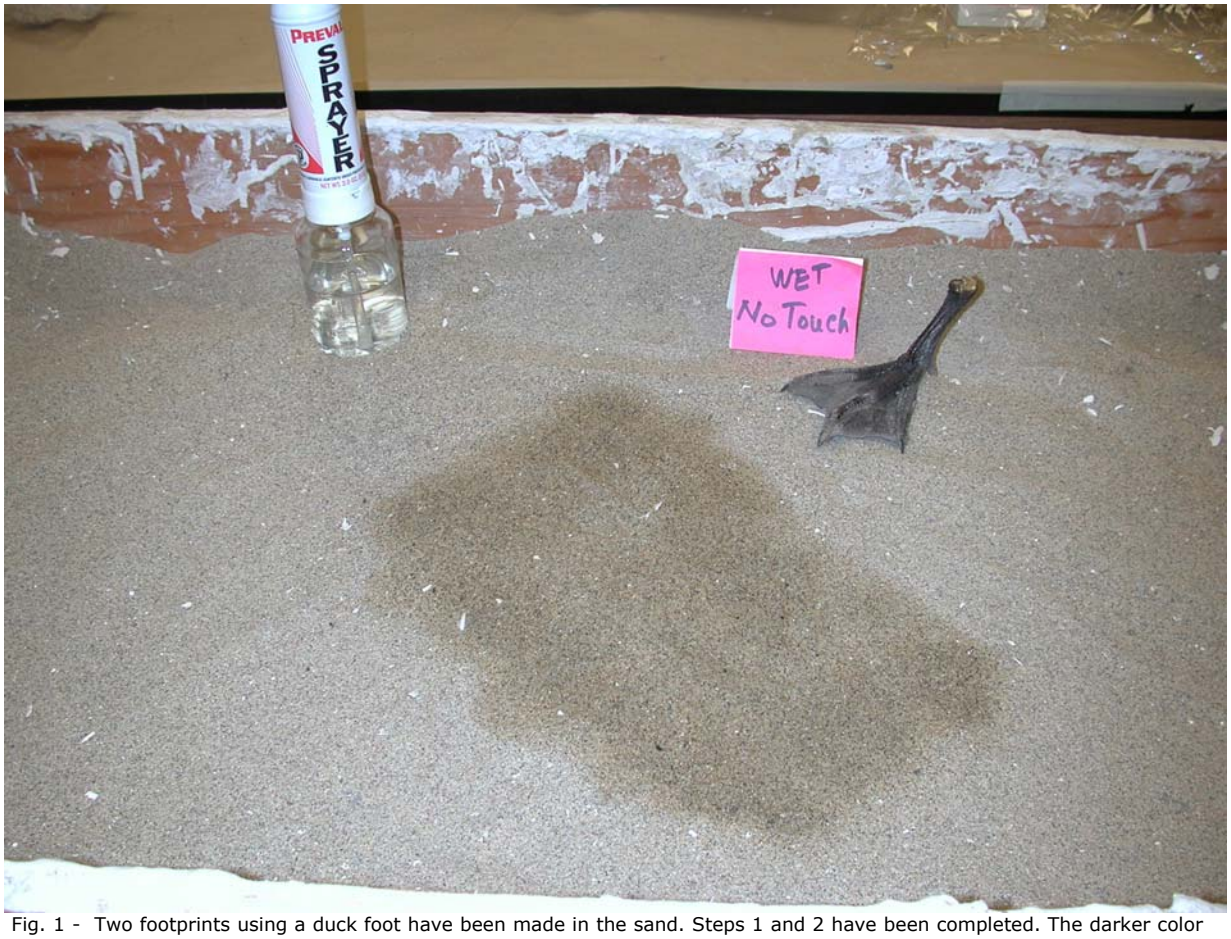

Fig. 1 - Two footprints using a duck foot have been made in the sand. Steps 1 and 2 have been completed. The darker color of the sediment indicates that the material is not dry yet and cannot be lifted from the adjacent sediment.

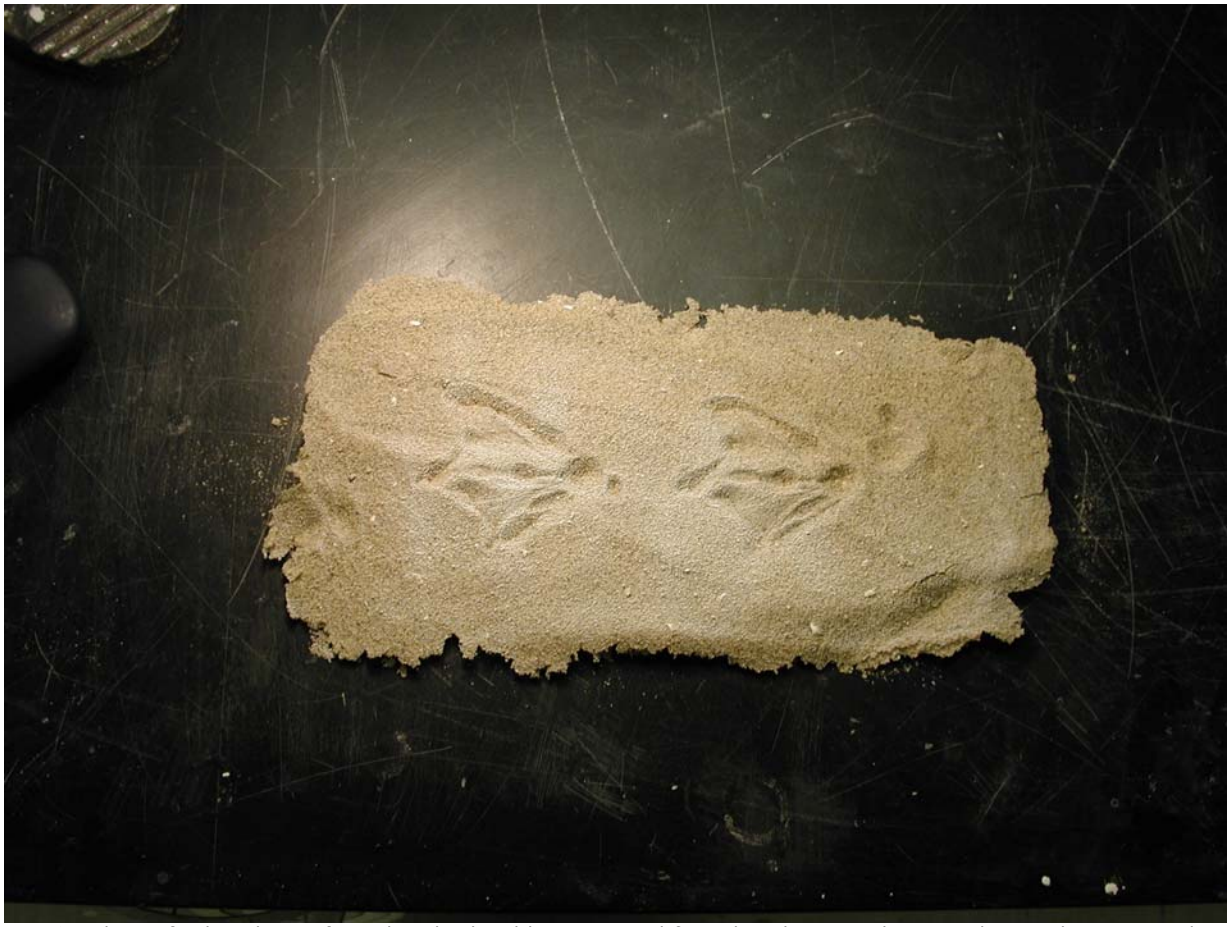

Fig. 2 - The artificial trackway after it has dried and been removed from the adjacent sediment. It has not been trimmed or otherwise modified. Notice the retention of the three-dimensional shape of the footprints.

DISCUSSION

Both methods (acrylic or Butvar) are useful in a controlled laboratory setting. However, use of spray acrylic in the field except under very calm wind conditions is problematic. Wind tends to disperse the acrylic more than Butvar sprayed with an airbrush. In addition, the use of the cellulose acetate and Butvar (both mobilized by acetone) aids in the formation of a firmer bond between the consolidated surface and the cellulose acetate. We only used cellulose diacetate, but other forms of cellulose acetate (cellulose triacetate, cellulose acetate butyrate and others) likely can be substituted, but are not as readily available. This method also provides semi-permanent preservation. However, molds should be stored at low temperature and humidity away from other chemicals in order to lengthen the life of the mold. This method can be done solely with Butvar, using many spray applications. However, the cellulose acetate provides significant support and tear resistance. Both the cellulose acetate and Butvar can be removed with acetone, thereby returning to the original unconsolidated sediment.

The final result of this method is a lightweight three-dimensional "peel" of the sediment surface with the underlying sediment (with grain size and sorting) preserved (fig.2). This method requires relatively little preparation of materials (no plaster mixing or retaining walls needed). While plaster will crush and distort during its application and latex tends to shrink (Goodwin and Chaney, 1994), the final result of the cellulose acetate application undergoes little, if any distortion or shrinkage. We have been unable to measure any shrinkage in the preserved structures. The collected surface can be trimmed with scissors or a knife to remove any excess, and particular regions can be excised, in order to be studied in greater detail. Even the individual sediment grains of a section can be removed and cleaned completely with application of acetone. Details of environmental conditions, including location, wind speed, and temperature, can be written onto the collected surface. All of the materials are readily available at art stores, plastic suppliers (acetate sheeting ~500m^2 for ~$100), and other paleontological supply companies. The airbrush's cost is approximately $2. The cellulose acetate is not toxic and does not pose a health risk. Acetone is highly flammable and should be used (even with Butvar) in a well-ventilated area away from open flames. The method is useful on a variety of substrates from clay to coarse sand, and it is quick (taking as little as 10 minutes in dry calm conditions), cheap (under $10 per application), and easy to do.

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