

## RESEARCH METHODS PAPERS

### A DUCT-TAPE MANIPULATOR FOR POLISHING THIN SECTIONS

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**ABSTRACT:** Common duct tape can be used to inexpensively and conveniently fashion a manipulator to polish thin sections. This procedure has two parts: (1) affixing a piece of duct tape to the back of the thin section and (2) affixing a handle composed of folded duct tape to the tape applied in step one. This produces a manipulator that remains attached to the glass slide under wet conditions. When polishing is completed, the duct tape can be removed easily from the glass slide. This method improves manual dexterity during polishing and reduces loss of, or damage to, thin sections. Materials needed for this procedure are duct tape and a single-edge razor blade. Both items are inexpensive and easily obtained.

#### INTRODUCTION

Polished thin sections are commonly used for electron probe micro-analysis (e.g., Goldstein et al. 1992), cathodoluminescence (e.g., Marshall 1988), and other petrographic methods that prohibit cover slips. Polished thick sections are also commonly used for examination of fluid inclusions (e.g., Wilkinson 1994) and more recently for extraction of microsamples for stable-isotope analysis (e.g., Dettman and Lohmann 1995). Making and polishing of thin sections are intermediate steps in petrographic and geochemical research. The advent of automated thin-section polishing equipment and the use of commercial thin-section preparators has decreased the need for manual polishing of thin sections. However, for reasons of preference and/or money, many geologists still make and polish their own thin sections.

Rhodes et al. (1990) have described a glue-glove technique for grinding and polishing thin sections. While describing the Rhodes et al. (1990) technique, Wilson (1994) briefly mentions the use of adhesive tape for manipulating thin sections. However, the most commonly used method of manual polishing involves clamping a thin section in a spring-loaded slide holder (see Buehler catalog, among others, for descriptions of these devices). Potential problems associated with slide holders are: uneven positioning of the thin section, poor manual dexterity, and loss of the thin section.

Those who have made their own thin sections will likely recall the vision of a favorite thin section flying off the polishing wheel (with or without slide holder) at high velocity and the sudden deceleration on a nearby hard object. Equally annoying are wedged or partially abraded thin sections. To compound these problems, slide holders are routinely "misplaced" in multi-user rock preparation facilities. To avoid these inconveniences, an alternative method of thin section polishing is presented here.

#### PROCEDURE

##### *Duct-Tape Manipulator*

This method involves a straightforward procedure of attaching duct tape to the back of a glass slide (Fig. 1). Unroll an appropriate length of duct tape and lay it adhesive side up on a flat, dry, clean surface suitable for cutting. Making sure that your thin sections are dry and clean, place the back side (the one without a mounted sample) on the white adhesive side of the duct tape. Press gently to affix the sample. Using a razor blade or Olfa® knife, trim the excess tape from around the edge of the glass slide. Burnish the tape to the glass slide using a fingernail or burnishing tool. Cut a strip of tape, approximately three inches long (~ 8 cm), and fold as shown in Figure 1. This piece of duct tape will become the handle by which the thin section is manipulated. Affix the partially folded piece of tape to the other piece of duct tape now on the glass slide (Fig. 1). Burnish the tape-to-tape contacts. If burnished properly and depending on the quality of the duct tape, this manipulator should withstand the ravages of several polishing steps and rinses.

##### *Duct-Tape Quality*

Two types of duct tape can be purchased. Both have a gray non-adhesive side and a white adhesive side. The less desirable variety has a smooth gray surface. This variety does not burnish well and does not adhere well under wet conditions. The desirable variety has a textured gray surface (uneven rectangular grid of fibers), burnishes well, and adheres well under wet conditions. Costs are comparable and

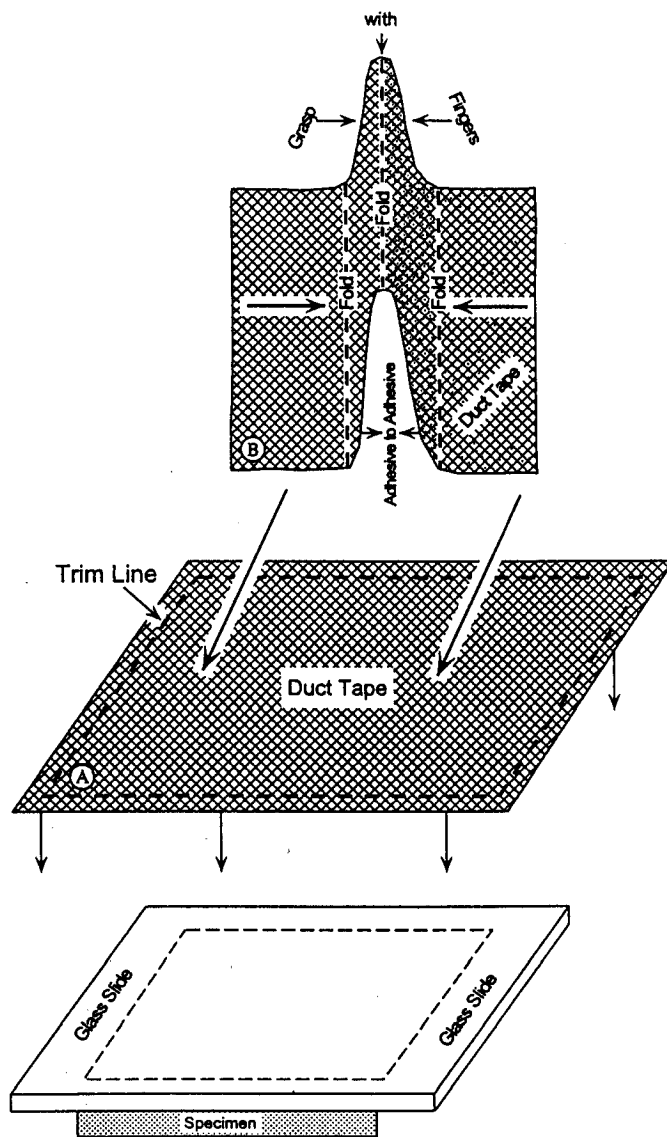


Fig. 1.—Schematic diagram of a thin section being fitted with a duct-tape manipulator prior to polishing. Part A is affixed to the back of the thin section and burnished. Excess duct tape is trimmed using a razor blade along trim line. Part B is folded as shown and attached to part A, then burnished. This fashions a small handle by which to grasp the manipulator. Parts A and B can be removed by peeling back a corner of Part A and carefully pulling the duct tape.

are typically under \$5.00 (US) depending on the size of the roll. This, together with a single-edge razor blade (typically under \$2.00 (US) for a package of 10), is all that is needed to fashion over 100 thin section manipulators.

##### *Removal of Duct Tape*

One must use some caution in removing the tape from the back of the thin section. To remove the tape, place the polished thin section face down on a non-abrasive

surface (e.g., a table top covered with paper or cloth). Loosen the tape from a corner of the glass slide and slowly pull the tape off the glass slide. It is important to apply pressure evenly to the glass slide because it may fracture. If necessary, use a razor blade to remove the duct tape. If adhesive remains on the glass slide, remove using a razor blade and/or isopropyl alcohol. Duct-tape manipulators are not reusable.

#### Advantages

The advantages of this method include: (1) increased manual dexterity while polishing; (2) a reduction in the number of damaged or lost thin sections; (3) the ability to polish any size thin section (including large-format thin sections); (4) thin-section polishing is not limited by the availability of a thin-section holder; and (5) thin sections fitted with a duct tape manipulator can be placed on their edge to avoid scratching during changes in grit sizes.

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## A RAPID, LIGHTWEIGHT SEDIMENT PEEL TECHNIQUE USING POLYURETHANE FOAM

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#### INTRODUCTION

A number of materials have been used for the preparation of peels from loosely consolidated sediments (Klein, *in* Carver 1971). Lacquer, glues, latex, plaster of Paris, and various resins have been successfully used under a variety of conditions. Some of these techniques are time-consuming and involve heavy equipment or materials, making them unsuitable as a routine field tool (see Table 1). In addition, most of these materials are applied by painting or spraying onto the sediment surface, and these activities can often disturb minor structures or friable fossils.

A technique for obtaining unconsolidated sediment peels using two-part polyurethane (poly-isocyanurate) foam is described here. It is simple, rapid, and inexpensive and has the advantage that the method of application does not disturb sediment structures, as can brushing or spraying. Peels are rigid and transportable within 30 minutes. Because of its speed and lightness, a single field worker can easily collect several peels in the course of a day's work.

Polyurethane foam is a useful peel material because it expands and adheres te

naciously to exposed surfaces. Because it expands into voids, peels can be taken from sediments that have three-dimensional relief.

Polyurethane foam is a thermoplastic compound, formed by mixing diphenylmethane diisocyanate and polymerizers. It is commonly used for cavity wall insulation, boat buoyancy, and supporting roof tiles. Because of its low density and rigidity it has been used as an alternative to plaster of Paris jackets in the field extraction of fossil vertebrate remains (Carrick and Adams 1969). It is available from suppliers in high-density and low-density grades. Six liters of foam are produced from one liter of high-density foam mix, and thirty liters from one liter of low-density mix. We have successfully used both low-density, and a 50/50 mixture of low- and high-density. These produce twenty-four and fifteen liters of foam from one liter of mix, respectively. For larger peels, or where cobbles are involved, we recommend the latter. High-density foam alone produces good peels, but it is much heavier and more expensive, with no appreciable advantages. The reaction is exothermic; foam production is less at low temperatures. Therefore in these conditions low-density foam may be preferable. Before mixing high- and low-density foam

TABLE 1.—Summary of the main materials and techniques used to make sediment peels.

Technique	Total Time	Sediment Size	Complexity	Materials Weight	Moisture Tolerance	Backing Material	Application	Reference
Polyurethane Foam	30 minutes	Silts-cobbles	Low	Light	Moist tolerant	Optional	"Slap" method	This article
Cellulose Lacquer	72 hours +	Clays-gravel	Moderate	Moderate	Requires drying	Cheesecloth + mount	Spray and painting	Shell Research NV (1966)
PVA Glue	25 hours	Clays-sand	Moderate	Moderate	Wet tolerant	Muslin cloth	Spreading	Heezen & Johnson (1962)
Latex Liquid	24 hours +	Sand to gravel	High	Heavy	Wet tolerant	1-2 layers of cheese-cloth	Painting	McKee (1966)
Latex Spray 77	1 minute + drying	Clays-gravel	Low	Light	Wet tolerant	Styrofoam or wood	Spraying	Yasso & Hartman, 1972
Epoxy Resin	3-12 hours	Up to 4 cm clasts	High	Heavy	Wet tolerant	Not necessary	Painting or spraying	Burger <i>et al.</i> (1969)
Polyester Resin	48-72 hours	?	Moderate	Heavy	Moist tolerant	Cheesecloth	Pouring or spraying	McMullen & Allen, 1964
Portland Cement	5-8 hours	Up to small boulders	High	Very heavy	Moist tolerant	Wire mesh	Spray-dusting	Hattingh <i>et al.</i> (1990)
Acrylic Resin	3 hours +	Up to small gravel	Low	Light to moderate	Dry	Cheesecloth and board	Spraying or painting	Lindholm, 1980; Moiola <i>et al.</i> (1969)