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13. PREPARATION OF ACETATE PEELS

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INTRODUCTION

Acetate peels are replicas of etched surfaces embedded in sheets of cellulose acetate. These replicas are usually so detailed that the fine structure of shells and various sedimentary rocks can be easily studied under a light microscope. Because these peels can be quickly and easily produced, the procedure is now commonly used in most geologic laboratories.

APPLICATIONS OF THE TECHNIQUE

Geologists have used acetate peels for a variety of purposes since the 1930s (Stewart and Taylor, 1965). In vertebrate paleontologists have made peels of virtually every fossil group with a carbonate shell, from brachiopods and bivalves through corals and bryozoans, even when the specimens are still embedded in the rock matrix. Paleobotanists have long used acetate peels to study fossil plant microstructure, especially with "coal balls". Sedimentary petrologists often make acetate peels of carbonate rocks to reveal depositional and diagenetic textures and crystallization patterns (Friedman and Johnson, 1982, p. 108-115); peel techniques have even been modified for sulfate and sulfide rocks (Jennings, 1972; Mandado and Tena, 1986).

There are several advantages of the acetate peel technique over standard thin-sectioning. The peel procedure is considerably simpler and faster, and it requires less equipment. Since a peel produces a two-dimensional replica of an etched surface, the problems in some thin-sections of depth interpretation and interference can be avoided. Peels can also be made with minimal destruction of the specimen, since the etched surface need not be a particular standard size and only a single saw cut is necessary. This latter advantage is especially useful when serially-sectioning a specimen.

Acetate peels may be used as photographic "negatives" and projected through an enlarger to make negative-contrast prints. This technique works best with small, well-detailed peels. Excellent photographs of larger

peels can be made following the dark-field illumination technique outlined by Sorauf and Tuttle (1988).

Adequate acetate peels can only be made of surfaces that are differentially etched, so they are of limited usefulness with partially or wholly-silicified samples. And, of course, mineralogic information in an acetate peel is usually confined to a two-dimensional view of crystal boundaries, so thin sections are preferred for detailed petrologic analyses.

EQUIPMENT AND SUPPLIES

The following materials are required for the production of acetate peels:

Trim saw with diamond or carbide blade for cutting specimen
Lapidary wheel
Range of grinding powders, smallest size 1000
Distilled water in a squeeze bottle
2% Hydrochloric Acid in a shallow dish
Cellulose acetate sheets (optimal thickness is approximately 0.2 mm)
Scissors or razor blade
Acetone in a squeeze bottle

For best results, it is recommended that a piece of plate glass, a polishing pad and a supply of tin or nickle oxide polishing powder also be available.

Cellulose acetate sheets are commonly sold in stationery stores as "overhead projector pages".

PROCEDURE

1. Select and cut specimen with trim saw so that the section desired is smooth and planar.

2. Grind the surface to be studied on the lapidary wheel with the range of grits, ending with size 1000, until it is as smooth as possible. If the materials are available, polish the surface to a mirror-like finish. The smoother the surface, the better the detail in the final acetate peel.

3. Thoroughly clean and inspect the polished surface.

4. Etch the surface approximately 20 seconds in 2% hydrochloric acid. Different materials may require slightly longer or shorter etching times. Change the acid after every few samples to maintain the 2% strength. Do not touch the etched surface.

5. Gently rinse the etched surface with distilled water. Tap water may

also be used, but it sometimes contains impurities that interfere with the acetate sheet replica process.

6. Allow the specimen to dry thoroughly.

7. Prop specimen with etched surface uppermost and inclined at a slight angle.

8. With scissors or razor blade, cut a piece of acetate to easily fit the etched surface.

9. Wet the entire etched surface with acetone, allowing a slight accumulation on the lower edge of the inclined specimen.

10. Quickly lay the acetate sheet over the etched surface, starting a t the edge with acetone accumulation and pushing the acetone upwards along the specimen face. This ensures that a sufficient amount of acetone is trapped between the surface and the descending acetate sheet.

11. Very gently smooth (with dry fingers) the acetate sheet over the etched surface to remove bubbles and ensure adhesion.

12. Wait until thoroughly dry (about 15 minutes, depending on the size of the specimen) and then slowly peel the acetate sheet from the etched surface. To avoid later curling of large peels, it is sometimes desirable to wait 24 hours before removing the acetate.

13. If the peel has grains adhering to it, a gentle washing in 2% hydrochloric acid usually removes them.

14. Trim the peel with scissors or razor blade to the desired size.

15. A quick mount may be made by compressing the peel between two glass slides. A drop of optical oil (with a refractive index approximately equal to one) placed on the surface of the peel usually improves the microscopic detail visible.

16. Permanent mounts can be made by placing the peel on a slide under a coverglass with standard balsam mounting material. Heating the slide may, of course, distort the peel.

WHEN BAD THINGS HAPPEN TO GOOD PEELS

Too many bubbles. -- Sometimes specimens are too porous to hold the necessary layer of acetone long enough for adhesion to the acetate sheet. If this is the case, the sample may be embedded in epoxy or thermoplastic. Peels of imbedded materials are prepared by the same procedure outlined above. When interpreting a peel from an embedded specimen, remember that the original void space is now filled with the embedding medium and will

stand out in relief.

Undetailed portions of peel. -- These patches may result from silicification of the original specimen (which are unetched), an inadequate acid etching time, acid that is too weak, grease on the etched surface, or application of too little acetone.

Wrinkled peels. -- The acetate sheet may be too thin or too much acetone was used.

Tears in the peel. -- This may happen if the acetate sheet is removed before the acetone has completely dried. A sheet that is too thin may also tear.

Inadequate fine detail. -- Usually this happens when the original surface was not well polished. Sometimes an acid that is too strong will destroy microstructural detail.

HEALTH AND SAFETY HAZARDS

Grinding grit suspended in the air is a serious respiratory hazard; it can be easily avoided by using grits in water slurries rather than in the common dry shaker cans. All acids, including dilute hydrochloric, must be handled with standard laboratory cautions. Prolonged topical exposure to acetone may cause inflamed, dry skin; inhalation may produce headaches, bronchial irritation and, in excessive amounts, narcosis. Always work in a well-ventilated environment. Acetone also is flammable.

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