A SIMPLE PALEOBOTANICAL TRANSFER TECHNIQUE

RALPH E. ABBOTT AND MAXINE L. ABBOTT
Departments of Geology and Botany, University of Cincinnati, Cincinnati 21

A simple technique for the removal of entire compressions from shales has been recently developed. The new technique is essentially a modification of M. L. Abbott's (1950) "A Paleobotanical Transfer Method," in which sheet acetate and colorless nail polish are employed. The latter method as well as the one to be described herein are laboratory techniques. Consequently, both are preliminary in that the ultimate goal is the development of a simple method by which compressions may be removed from shale under field conditions. Data at hand strongly suggest that the ultimate goal will be attained in the relatively near future.

In recent months, users of the sheet acetate-nail polish method have experienced some difficulty in removing compressions from certain shales. For example, bubbles develop between the nail polish and sheet acetate some 6 to 12 hours after application of the softened acetate. In order to obtain satisfactory transfers, the carbonized plant film and the sheet acetate must be completely bonded together. The precise cause of bubble formation has not been determined to date. However, the sheet acetate manufacturer has converted recently to cellulose triacetate. This may account, in part, for the fact that shrinkage of the sheet acetate during drying has increased materially. This seems to account for concentrations of bubbles centered on minor depressions in the shale and fossil surfaces. But since many bubble areas are not associated with visible surface irregularities, it is probable that some of the bubbles may be due to the entrapment of volatiles given off by the softening agent.

The following modified schedule has yielded a very high percentage of excellent transfers.

SCHEDULE FOR SHALES

1. "Dry fossiliferous rock 24 to 48 hours in usual manner. Be sure surface of fossil is clean and free from extraneous debris" (Abbott, 1950).
2. "Cover fossil and adjacent rock surface with a very thin seal coat of . . ." colorless "nail polish; break all bubbles as they form.
3. "Dry for 30 minutes at room temperature.
4. "Apply a second coat of polish, again breaking bubbles as they form.
5. "Dry at room temperature for at least 30 minutes . . ." (Abbott, 1950).
6. Brush on a heavy coat of a mixture consisting of one part clear spar varnish and twenty parts colorless nail polish. Break all bubbles as they form.
7. Dry at room temperature for at least 36 hours.
8. Apply a second coat of the varnish-polish mixture; dry at room temperature for at least 48 hours.
9. If the carbonized plant film is heavy or if relatively large-leafed species are being treated, apply a third coat of the varnish-polish mixture; dry at room temperature for at least 60 hours.
10. Loosen the peripheral portion of the plastic film not underlain by the fossil with a scapel.
11. Using the side of a scapel blade (dull edge toward fossil) as a support and keeping it as close to the rock surface as possible pull the plastic film and its adhering fossil plant from the rock.
12. If necessary, place the transfer in a dilute (20–25%) hydrofluoric acid bath to loosen the clinging rock matrix.
13. At intervals of approximately five minutes, remove the transfer from the

acid bath; immerse in an excess of luke-warm water to neutralize the acid; brush gently to remove loosened rock matrix; repeat steps 12 and 13 until the rock matrix has been removed.

14. Dry between lens tissues or lintless blotters under a smooth weighted surface for approximately 12 hours.

15. Clear any blushing that may have occurred while the varnish-polish coats were drying or while the transfer was immersed in the acid bath by applying one or two thin coats of colorless nail polish to the shiny side of the transfer; dry free from dust for 12 to 24 hours. The transfer becomes very limp shortly after being coated with polish and must be handled with care; however, the transfer soon regains its original stiffness.

16. Print catalogue number with India ink on the dull side of the transfer and cover the number with polish.

17. Store in glassine envelopes, with plant surface to shiny surface of the transfer to prevent films sticking together or

18. Trim; clear for a few seconds in xylol; and mount, plant side up, in Canada balsam.

DISCUSSION

Approximately 750 carbonized plant compressions have been removed successfully by this technique. Of these, more than 95% exhibit slight to no fragmentation of the carbonized plant film. Specimens collected four years ago have been removed from shale with equal success. Surface dry specimens have been treated within an hour after collecting with satisfactory results.

The principal advantages of this technique are that it is relatively inexpensive, simple, and rapid. If labor costs are disregarded and nail polish is purchased by the gallon, average size specimens can be treated at a cost of approximately one-half cent per specimen. Working as a team, the authors prepare nominial size specimens, steps 1 through 9 of the schedule, at the average rate of 30 specimens per hour.

Four commercial brands of colorless nail polish have been used to coat the fossils and to prepare the varnish-polish mixture. All have proved satisfactory. Five different standard commercial brands of clear spar varnish have been used to prepare the varnish-polish solution.

The varnish-polish mixture is prepared in small quantities by adding the varnish to the polish and then stirring vigorously for 5 to 10 minutes. Frequently, when the relative humidity is high, a white mucous-like mass forms around the end of the stirring rod. This should be removed from the mixture and discarded. When stirring has produced a uniform, bubble-filled mixture, the container is tightly capped and set aside for two or three hours. At the end of that period the bubbles will have broken, and the varnish-polish mixture, which is now ready for application to the pre-treated fossil and adjacent rock surface, is uniformly honey-yellow in color. On prolonged exposure to the air, the varnish-polish mixture becomes viscous. It may be thinned to a workable consistency by adding a small volume of fresh polish.

Minor surface irregularities, such as small pits and grooves, adjacent to and in the fossil present no special difficulty to obtaining satisfactory transfers, provided the depressions are well-filled with polish and the varnish-polish mixture and all bubbles broken. On drying, the depressions are filled with plastic "beads," which adhere strongly to their containing walls. Consequently, the transfer will tend to tear if it is removed too vigorously from the shale. The tendency to tear may be readily prevented by excavating each "bead" with the point of a scapel while the transfer is being pulled from the rock. The plastic "beads" can be flattened without damaging the adjacent plant film by gently pressing them down with the flat side of a scapel blade. For best results, surface irregularities should be reduced or eliminated in so far as practical. However, if care is exercised, specimens may

be removed from very irregular surfaces without special treatment, other than moderately beveling sharp edges and corners.

The varnish-polish mixture frequently blushes during drying. Experience shows that blushing is of two types, only one of which is detrimental to the final transfer. If the relative humidity is moderate, the drying varnish-polish mixture turns slightly white. Except for a slightly thickened transfer film, this type of blushing is not objectionable since it can be cleared later by the application of one or two coats of colorless polish. In fact, better results are obtained when heavily carbonized foliage is being removed if slight blushing does occur. But when the relative humidity reaches 75% or above, the drying mixture not only turns white within a few minutes after application, but also thickens appreciably due to the formation of countless minute bubbles. If the transfer is permitted to cure, it will be opaque and up to one-thirty-second of an inch thick. Critical specimens may be saved by immediately washing off the fluid varnish-polish mixture with beta-methyl-cellusolve (distributed by the Works Laboratory, Carbide and Carbon Chemical Co., South Charleston, West Virginia). The specimen should thoroughly dry before re-coating with nail polish. After the polish has dried, the varnish-polish mixture may be applied in the scheduled manner.

The drying periods proposed in steps 7 through 9 of the schedule are the minimum necessary to obtain consistently satisfactory results. Premature removal of transfers from the rock invariably results in shearing of the carbonized foliage or scaling off of carbon or both. Prolonged drying of the last coat of the varnish-polish yields a brittle transfer which breaks excessively during removal from the shale.

After storage for several months, the transfers become somewhat brittle. To minimumize breakage of specimens in active use, ragged edges of the transfers should be trimmed. Then the transfer may be mounted temporarily between sheets of clear plastic. Small specimens are permanently mounted in balsam on standard slides. A few specimens have been mounted experimentally in a high index media, piccolyte in 50% xylol. Clearing in xylol is unnecessary when this mounting media is employed. This media gives excellent definition to the finer foliage elements and to almost transparent foliage. However, until a satisfactory experience record has been built up, it cannot be recommended for general use.

The authors gratefully express their appreciation to J. H. Hoskins, Department of Botany, University of Cincinnati, for constructive criticism of the manuscript.

LITERATURE CITED

Abbott, M. L. 1950. A paleobotanical transfer method. Jour. Paleo., 24: 619–621.