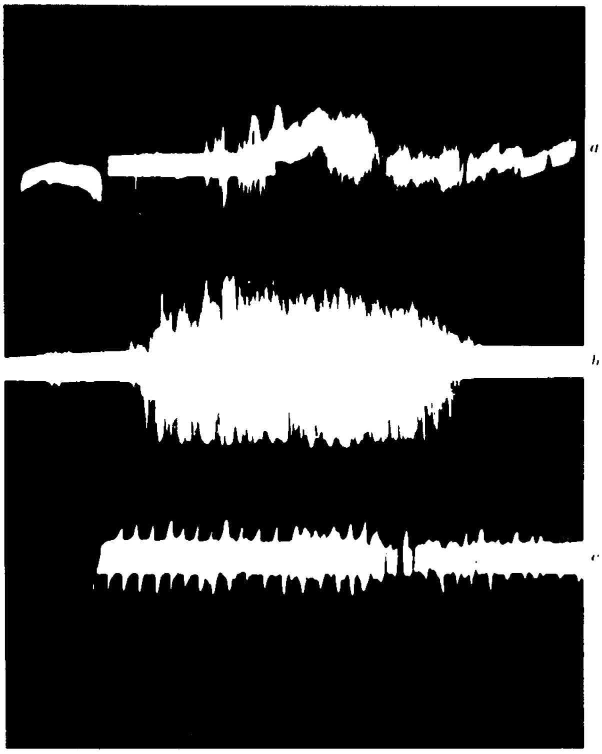

FIG. 2. Cylindrical lens diagrams representing the refractive gradients within a microscopic specimen: *a,* from a colloid-rich goiter; *b,* from skeletal muscle tissue; and *c,* from epithelium tissue of *Allium cepa.*

fiber and likewise of actomyosin obtained in the usual way.

Figure 3 shows the minimal range from which the author was able to take a self-plotting diagram of refractive gradients formed by cylindrical lens optics. The photomicrograph is taken with epithelium cells of

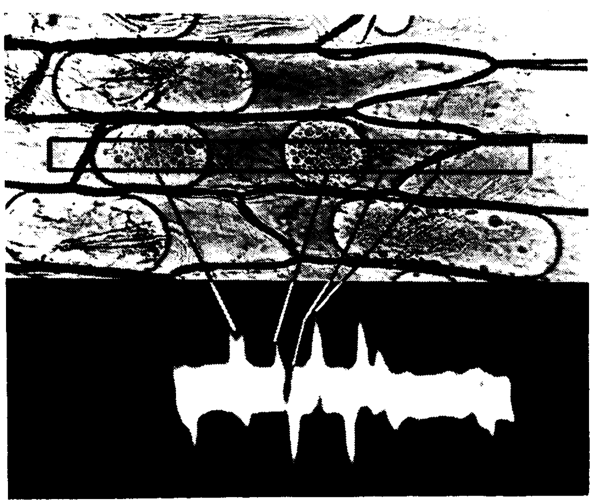

FIG. 3. Photomicrograph from epithelium cells of *Allium cepa* after experimentally induced plasmolysis. A part of one single cell is screened out. Below in the figure is the cylindrical lens diagram corresponding to the inserted rectangular area of the same cell as shown on the photomicrograph above.

Allium cepa after experimentally induced plasmolysis. The plasmolysis was carried out according to Cholodny and Sankewitsch (*6*) by short evacuation of small parts of the upper concave epidermis and by immersion of the epithelium cells into a 0.025 *M* potassium chloride solution for 24 hr. Then the tissue was brought into a 0.75 *M* solution of saccharose in 40 min. The rectangle drawn in the photomicrograph signifies the area from which the cylindrical lens measurement can be made. This area includes a part of only *one cell.* Within the cell two clots of the protoplast and a ghost of the nucleus are to be seen. The corresponding schlieren diagram of refractive gradients is given in the lower half of the photograph. Each detail of the cell structure corresponds to a part of the diagram.

This is the smallest area that, at present, can be screened for cylindrical lens measurements and analyzed for self-plotting one-dimensional refractometric studies by the usual Philpot-Svensson optics. The described method gives a more quantitative but less obvious result about local refractive gradients within a biological structure than colored phase contrast or schlieren methods, as published by Sailor-Brice-Zernike (*7*) and by the author (*8*).

References

1. PHILPOT, J. ST. L. *Nature,* **141,** 283 (1938); In: J. A. V. Butler and J. T. Randall, *Progress in Biophysics,* Vol. II. London: Butterworth-Springer. (1950).
2. SVENSSON, H. *Kolloid-Z.,* **87,** 181 (1939); **90,** 141 (1940).
3. WIEDEMANN, E. *Chimia* (Switz.), **2,** 25 (1948).
4. MEYER-ARENDT, J., and MEYER-ARENDT, E. *Z. wiss. Mikroskop.,* **67,** 354 (1953).
5. KECK, E. *Virchow's Arch. pathol. Anat. u. Physiol.,* **324,** 116 (1953).
6. CHOLODNY, N., and SANKEWITSCH, E. *Protoplasma,* **20,** 57 (1933).
7. SAILOR, C. P., BRICE, A. T. and ZERNIKE, F. *J. Opt. Soc. Am.,* **40,** 329 (1950).
8. MEYER-ARENDT, J. *Photographie u. Forsch.,* **5,** 121 (1952).

Manuscript received March 9, 1953.

A Technique for Collecting, Mounting, and Sectioning Airborne Particulate Material

R. D. Cadle, A. G. Wilder, and C. F. Schadt

Stanford Research Institute, Stanford, California

The collection and identification of airborne particulate material is an important part of many studies of the earth's atmosphere. One of the most convenient and efficient methods for collecting such material is by filtration. However, if filtration is employed, it has usually been necessary to remove the particles from the filters in order to identify the material collected. Such removal is tedious and is usually not quantitative.

Recently a technique has been developed in these laboratories for mounting and sectioning such particles without removing them from the filters. The filters are rendered transparent in the process, which greatly aids in determining the optical properties of the sectioned particles. The filters used are the cellulose acetate-cellulose nitrate filters developed by Goetz

(*1*) and now sold commercially under the trade name Millipore filters.[1] They filter mainly by a screening action whereby the particles are deposited on the filter surface. These filters become transparent when mounted in a medium having approximately the same refractive index as the filters (about 1.50).[2] Advantage is taken of this property by mounting the filters in methyl methacrylate. A filter on which particles have been collected is placed, collecting surface up, at the bottom of a hollow steel cylinder. Powdered methyl methacrylate is added and heated to about 150° C in a metallographic mounting press. A pressure of about 6000 psi is then applied and the plastic is allowed to cool to at least 80° C. The transparent cylinder of methyl methacrylate is then removed from the press.

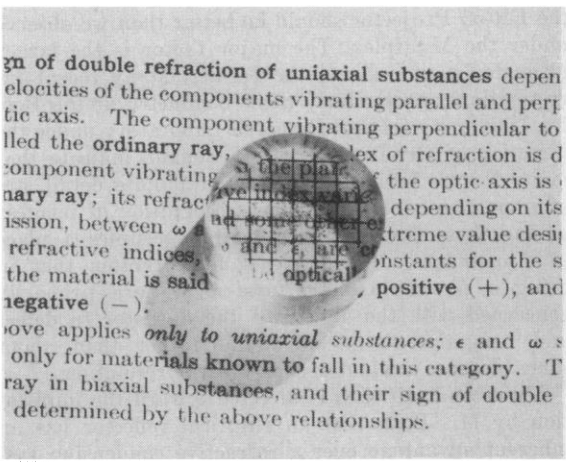

FIG. 1. Dust particles on a Millipore filter mounted at the surface of a cylinder of methyl methacrylate. Note that printing can be read on the page beneath the cylinder. The lines on the surface had been printed on the filter by the manufacturer. Original diameter of cylinder was 2.5 cm.

The now transparent filter and the particles collected on the filter are embedded in one end of the cylinder.

The filter portion is now ground away to the plane of the particles and grinding and polishing continued, using standard metallurgical techniques, until the particles are flat on one side. The plastic cylinder is then returned to the press, particle side up. A thick layer of powdered methyl methacrylate is placed on top of the particles, and the heating and pressing are repeated. Instead of reheating the plastic cylinder in the press, as described above, a second, particle-free, plastic cylinder can be prepared and cemented in place over the polished surfaces of the half-sectioned particles. The cement used is a solution of methyl methacrylate in chloroform. The particles now lie in a plane bisecting a cylinder which is about twice its original length. Most of the plastic is cut away[3] from the unpolished side of the particles. The particles are then ground and polished into thin sections. Most of the remaining plastic is sawed and ground away, leaving the particles mounted in a thin disk of methyl methacrylate. This disk is cemented to a microscope slide to complete the preparation. The particles are now in a form convenient to study with a petrographic microscope or with chemical micrurgic techniques (*2, 3*).

Figure 1 shows dust particles on a Millipore filter mounted in the surface of a cylinder of methyl methacrylate. Printing can be read on the page beneath the cylinder. Figure 2 is a photomicrograph of dust particles collected on a Millipore filter and sectioned in plastic. A petrographic microscope was used and the anisotropic nature of several of the particles is apparent.

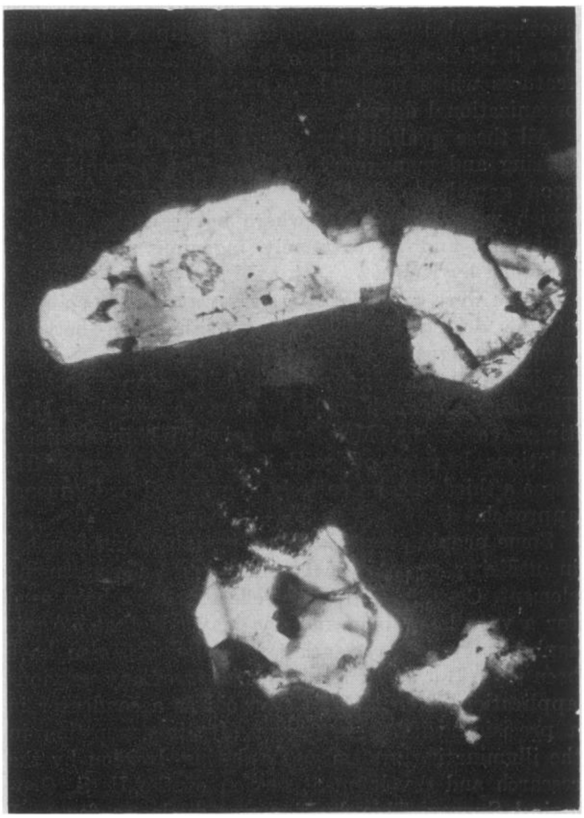

FIG. 2. Dust particles collected on a Millipore filter and sectioned in plastic. Transmitted illumination, crossed nicol prisms. 150 ×.

Various modifications of this technique are undoubtedly possible. Filters containing particles which would be altered by the heat and pressure of the molding process could probably be mounted by covering them with liquid monomers, or polymers, of the self-curing type.

[1] Lovell Chemical Co., Watertown, Mass.

[2] Daylight, room temperature.

[3] This can be done easily and accurately by means of a lathe.

References

1. GOETZ, A. Paper presented at the Seventeenth Ann. Chem. Eng. Symp., J. Hopkins Univ., Baltimore, Md., Dec. 28–29, 1950.
2. CADLE, R. D. *Anal. Chem.*, **23**, 196 (1951).
3. CADLE, R. D., *et al. Arch. Ind. Hyg. and Occupation Med.*, **2**, 698 (1950).

Manuscript received August 20, 1953.