## Recording Crevices in Plane Surfaces by Pigment-fillings Held in Cellulose Acetate Moulds

In extending work on the recording of low relief in etched or abraded plane surfaces of rocks, minerals and metals by means of cellulose acetate moulds[1], it has been found that the forms and distributions of narrow structural crevices and microscopic pits in these and similar surfaces can be accentuated, for detailed study, by filling them with a suitable pigment which is then removed by, and retained in, the thin cellulose acetate moulds made from these prepared surfaces (Fig. 1). For this purpose a dispersion of cellulose acetate in tetrachloroethane is convenient. Addition of an appropriate plasticizer to the dispersion minimizes the development with time of very slight shrinkage and brittleness in the resulting moulds.

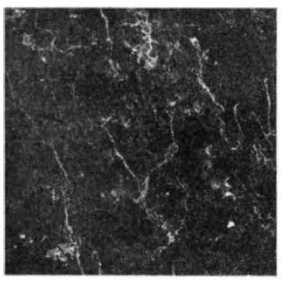

Fig. 1

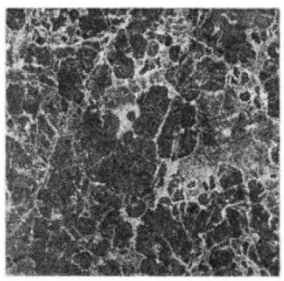

Fig. 2

PHOTOGRAPHIC ENLARGEMENT (× 5/3) OF DYE-LINES ACCENTUATING 'RIFT' IN THE POLISHED SURFACE OF A GRANITE (FIG. 1) AND IRON OXIDE-AREAS EMPHASIZING CREVICES IN THE CRYSTAL FABRIC OF A POLISHED AND ETCHED IRON ORE (FIG. 2). Each print was made from a cellulose acetate mould, thickness 0·08 mm., used in an enlarger as a 'negative' and employing Kodak *B.G.*-4 paper exposed to a 60-watt lamp for 15 sec. at *f* 8 for Fig. 1 and *f* 6·3 for Fig. 2.

This pigmentation method, foreshadowed in a previous communication[2], is distinct from the dyed resin impregnation technique of Dr. B. H. Knight. It is suitable for recording such features as rift and grain in granites, cleat in coals, inter-crystal fissures in well-crystallized rocks or metallic ores, and traces of cleavages, glide-planes, twin-boundaries or small shallow etch-pits in the surfaces of individual mineral crystals. Further, it may prove to be useful in studies of crazing on glazed pottery and the crystal fabrics of certain alloys. Experiments suggest the most satisfactory records obtained by this method are derived from crevices or pits varying in width between 1 $\mu$ and 10 $\mu$.

The pigment can be a solid dye, such as 'Soluble Blue 3*M*' or lampblack, or a liquid such as Indian ink. If a powdered pigment is used, the etched surface is cleaned and sprinkled with either finely divided dye or lampblack, which is then introduced into the crevices with the ball of the thumb, or a pad of soft cloth. If Indian ink is employed, on the other hand, it is washed over the cleaned surface with a camel-hair brush, and the excess removed, after a moment, with a pad of absorbent cloth ; the use of cotton-wool is inadvisable as it tends to sweep cotton fibres into some of the surface crevices. Whether solid or liquid pigment is used initially, a careful rotary polishing movement with a suitable cloth removes it from the surface, while leaving it undisturbed in the crevices. The surface is then ready to receive the necessary thin layer of dispersion from which a pigmented cellulose acetate mould solidifies.

It is noteworthy that no significant spreading of pigment takes place in the dispersion-layer provided (*a*) the pigment used is not soluble in tetrachloroethane and (*b*) the dispersion-layer is thin. In connexion with (*a*), lampblack is a convenient pigment, apart from its relative chemical stability and its opacity in thin layers.

'Automatic' pigmentation of polished and etched surfaces of certain iron ores and iron-bearing meteorites[2] can be developed by exposing them to moist air for such a time that they become covered with thin films of hydrated iron oxides which can then be stripped from these surfaces in cellulose acetate moulds. By this means the forms and distributions of narrow fissures in the surfaces are recorded either as unpigmented bands, or as dark red-brown lines cutting the lighter brown limonite-bearing areas of the moulds (Fig. 2). Equivalent pigmentation can be obtained by developing thin films of copper carbonates on the polished and etched surfaces of some copper ores.

Finally, direct comparisons can be made between any pair of pigment patterns by superposing the necessary cellulose acetate moulds on an illuminated tracing desk, or by projecting them in a lantern or epidiascope, while photographic prints of any of the patterns can be made with ease by using the corresponding mould in the role of a photographic negative.

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[1] Dollar, A. T. J., *Geol. Mag.*, **79**, No. 4, 253 (1942).
[2] Dollar, A. T. J., *Nature*, **152**, 248 (1943).

## Photometric Measurement of Specific Surface

In the course of measurements of the light transmission of dispersions of fine alumina powder in aqueous media, it has been found in these Laboratories that the effective projected area per unit weight of the powder gives a fairly good straight line of negative slope when plotted against the fourth power of the wave-length of the incident light. The projected areas were calculated from the usual formula :

$$A = \frac{\log_e I_0/I}{KCt},$$

where $A$ is effective projected area ; $I_0$ is intensity of incident light ; $I$ is intensity of emergent light ; $K$ is opacity factor of powder ; $C$ is concentration of powder by weight per unit volume ; and $t$ is path-length.

The measurements were made over the visible range with a photo-electric apparatus having a very low angle of acceptance (about 0·0001 ster radian), the opacity factor of the powder being assumed equal to unity. Extrapolation of the graph of $A$ against wave-length to cut the axis of $A$ yields a value of the projected area, $A_0$, for which the wave-length is very small compared with the particle size. In such cases it has been shown by Sinclair[1] that the effective projected area is equal to twice the geometric projected area $A_G$ owing to diffraction and scattering.

The specific surface of particles in random motion is usually considered to be equal to $4A_G$, 4 being the ratio of surface to projected area for a sphere. However, the crystals of calcined alpha-alumina may to a first approximation be considered as flat rectangular plates, and hydrated alumina crystals are roughly