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LOW MAGNIFICATION THIN SECTION PHOTOGRAPHY*

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Following the recent useful article by F. W. Atchley (1958) a few additional comments may be of use to persons taking photomicrographs at low magnification.

The "trial negative" or step test is by far the best method of determining the correct exposure, but a step test in a geometrical progression rather than an arithmetical progression is more likely to contain the correct exposure. The suggested steps of 3, 6, 9, 12, 15 seconds will give an exposure ratio of only 1:5 but if a progression of 2, 4, 8, 16, 32 seconds is used this will give an exposure ratio of 1:16. Such a step test is made by commencing exposure with the dark slide sheath fully withdrawn, giving an exposure of 2 seconds and then progressively closing the sheath at intervals of 2, 4, 8 and 16 seconds. The last step is thus exposed for $2+2+4+8+16=32$ seconds.

Since for the linear part of the characteristic curve of the emulsion, contrast is a function of development and not exposure, the exposure chosen should be that which produces the correct *density*.

Uneven field illumination is obtained when using a microscope at low magnification and attempting to cover a larger field than that for which the objective was designed. It may easily be compensated for by using a positive printing mask in which the denser parts correspond to the duller parts of the field, normally around the edges. The photomicrographic negative should have sufficient exposure to give satisfactory gradation in the less dense parts but not so much that the central portion is overexposed. This will not be possible if the illumination varies considerably between the center and margin of the field. In such a case the negative should be given the maximum exposure permissible without overexposing the central portion.

The mask is made by exposing a plate in the photomicrographic camera without a subject being present. This plate should be of the same type as that used for the photomicrographic negative and it should have identical processing to obtain the same degree of density variation. A print of this negative on process film is used as the mask, which should have a density of 0.1 or less at the centre and a density range the same as that of the negative from which it was printed. This density range may be controlled by development. If this mask is now placed in contact,

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back-to-back with the photomicrographic negatives it will compensate for the density variations and make printing or enlarging a matter of comparative ease. It will not significantly affect definition.

REFERENCE

ATCHLEY, F. W. 1958. Low Magnification Thin Section Photography. *Am. Mineral.*, **43**, 997–1000.

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MAGNETIC SUSCEPTIBILITY OF NATURAL RUTILE, ANATASE, AND BROOKITE

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Precision measurements of the magnetic susceptibility of synthetic rutile and anatase have recently been made by Senftle and others (in press). On these specially purified forms of TiO_2, magnetic susceptibilities of $(0.067 \pm 0.0015) \times 10^{-6}$ and $(0.040 \pm 0.0003) \times 10^{-6}$ electromagnetic units per gram were obtained for rutile and anatase, respectively. Because of technical difficulties in preparation, it was not possible to prepare magnetically pure brookite; and, hence, no measurements were reported on this crystallographic form of TiO_2.

To compare the susceptibilities of natural crystals with the above data on synthetic crystals and to obtain approximate susceptibility data for brookite, the magnetic susceptibility of natural crystals of these minerals was measured at room temperature. The method of analysis has been described in detail by Senftle and others (1958). In each measurement corrections were made for ferromagnetic impurity by making a $1/H$ plot previously described. The results are shown in Table 1.

The per cent variation for rutile is significantly less than for anatase, whereas that for brookite is very large. This variation is a function of the purity of the crystals. It is relatively easy to prepare magnetically pure rutile, anatase is considerably more difficult, and as far as is known, no magnetically pure brookite has ever been made. M. D. Beals (National Lead Company, oral communication, 1958) finds that to a large extent the impurity in anatase consists of volatile compounds that are removed above 650° C. when rutile is formed. The higher purity would account for the smaller range in susceptibility of rutile. The higher temperatures, however, convert the impurities to compounds with somewhat higher