A Simple Method for the Photographic Reproduction of Pencil Drawings

Because pencil illustrations are difficult to photograph, line drawings and graphs are commonly inked. Inking is time-consuming and, frequently, not without hazard! Illustration by pencil has advantages as pointed out by Clark (*1*) in his paper describing a pencil found to be suitable for photography.

The present paper describes a method whereby line drawings for photographic reproduction may be executed in ordinary pencil without regard to the reflectance properties of the lines (*2*). This is made possible by the use of transmitted light and photographic paper of extreme contrast.

Although the process involves no more than contact printing, coupled with the use of high-contrast photosensitive material, I present it here since inking is the generally accepted method of preparing illustrations and since a search of the literature since 1926 has brought to light only two papers (*3, 4*) that bear on the subject, both of which might readily escape scientific workers. Moreover, they do not deal with copy for publication. Other papers may have appeared in the commercial literature.

The pencil illustration should be made on drawing paper or other nonopaque material. It is placed in a contact printer or frame so that the side bearing the illustration is away from the light source and in contact with the emulsion side of a piece of high-contrast photographic paper, such as Kodagraph Contact Extra Thin. After exposure through the original, a paper negative is produced upon development. The negative need be immersed only briefly in the fixer, rinsed for a moment, and blotted free of excess water before use.

If a transparency is wanted, the paper negative is photographed directly; if a copy for publication, it is printed by contact.

Figure 1 shows a camera lucida drawing of chromosomes and the word *Ink* prepared for reproduction by inking. Figure 2 was prepared in pencil only and copied by the present method of reproduction.

Once exposure times are determined, a negative and positive can both be produced in no more time than required for inking even simple illustrations. Autopositive paper, which yields a positive image directly, is also available, but the image is reversed laterally.

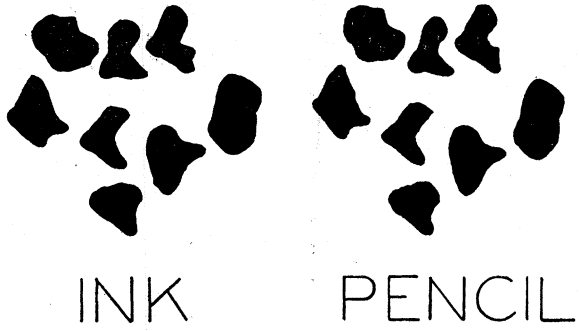

Fig. 1 (left). Drawing and lettering executed in ink. Fig. 2 (right). Drawing and lettering executed in pencil with no inking.

Advantages of the method are saving of time in inking; ability to prepare copies more readily and inexpensively than with camera copy; retention of the original and the ease of correction, alteration, or addition of parts at the paper-negative or positive-print stages.

Paper negative and positive must be thoroughly fixed and washed before storage. Blotters used for absorbing moisture from the paper negative while still charged with fixer must not be used for blotting fixer-free prints.

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References and Notes

1. E. W. Clark, *Science* **117**, 665 (1953).
2. This work was conducted while I was a member of the Department of Botany, University of Hawaii. I wish to thank the Research Committee of the University for material assistance and James K. K. Park for aid in illustration.
3. Anon., *How To Use Kodagraph Reproduction Materials* (Eastman Kodak, Rochester, N.Y., 1950).
4. E. H. Markley, *Product Eng.* **21**, 135 (1950).

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The Problem of the Carbonate Apatites

By completely ignoring one of the most fundamental principles, two Russian scientists, Borneman-Starinkevitch and Belov (*1*), have attempted to attack a recent paper of mine (*2*) that modified certain details of the structural hypothesis of Gruner and McConnell (*3*). It is regrettable that it is not possible to reply to their adverse discussion in the journal where it appeared—that is, *Comptes Rendus (Doklady) de l'Académie des Sciences de l'U.R.S.S.* Rather than attempting a detailed reply involving some of the minor complexities of the problem, which have been discussed in detail by numerous persons, these comments will be confined to some of the general questions raised by B.-S. and B. Nevertheless it will be necessary to reiterate the fundamental errors on which their claims are predicated.

B.-S. and B. (*1*) state that they find it necessary to indicate the "absurdity" of my hypothesis because of the "careless" quotation of these conclusions by Russian geologists. They do not cite specific references, but one may suppose that they refer to the results of Bushinsky (*4, 5*), Chukhrov (*6*), and possibly others. However, these general comments by B.-S. and B. seem somewhat pointless in view of the fact that Bushinsky and Chukhrov do not claim to have confirmed my results but merely call attention to their possible applicability to the enigma of the chemical composition of rock phosphates. Although I have commented on the petrography (*7*), as well as the chemical composition (*8, 9*) of rock phosphates, B.-S. and B. restrict their criticisms essentially to results bearing on the crystal structure of francolite.

The Russian authors (*1*) take pains to point out the omission of references to some of their earlier