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.

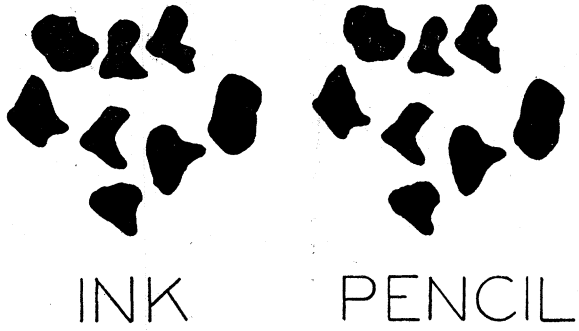

Fig. 1 (left). Drawing and lettering executed in ink. Fig. 2 (right). Drawing and lettering executed in pencil with no inking.

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

comments (*10–13*) and seem to imply that I claim as original certain concepts supposedly introduced by them. As will subsequently appear, my views are markedly different from theirs in at least one fundamental respect. Thus their interpretation of my reason for omitting references to their papers does not seem reasonable, particularly in view of the fact that references to two of their papers (*10, 12*) are cited by McConnell and Gruner (*14*) in a paper which B.-S. and B. (*1*) do not cite but which was cited in my paper (*2*). In this same connection, they seem to attach some significance to omission of references to my own comments in the Russian literature (*15, 16*). Equal significance presumably could be attached to my omission of some of my other papers (*8, 17, 18*) on the same subject, but this sort of reasoning leads to an obvious absurdity.

Rather than being concerned with some obscure concepts presented during the interval 1938–40 by these Russians, I was concerned primarily with the results of Geiger (*19*) and of Brasseur and Dallemagne (*20*). Elsewhere (*8, 18*) the hypothesis of Hendricks and Hill (*21*) is discussed.

Although the views of Hendricks (*22*) stand in sharp contrast to my own in certain details, Hendricks agrees with me on one fundamental point: *the complete absence of any justification for assuming admixture of calcite* in pure samples of francolite. This is the fundamental point of divergence of B.-S. and B., who not only assume a specific and unjustifiable composition for carbonate apatite but also assume the necessity of calculating an admixture of calcite. Thus B.-S. and B. (*1*) reduce their own argument to an absurdity by calculating the chemical compositions to include a mineral phase that several authors have shown cannot be present. This point was adequately discussed in my paper (*2*), and references bearing on this subject were presented. Nevertheless, B.-S. and B. confine their attention to an attack on my hypothesis, without reference to that proposed by Hendricks and Hill (*21*) and, at the same time, completely disregard a fundamental premise of my hypothesis.

It becomes unnecessary, then, to reply in considerable detail to their remarks on the validity of such questions as interatomic distances, inasmuch as their assumptions include fundamental errors that completely invalidate their entire thesis.

For translations of Russian papers, I am indebted to Mrs. Justina D. Epp, Peter O. Krumin, and George S. Mitchell.

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12. N. V. Belov, *ibid.* **22**, 89 (1939).
13. I. D. Borneman-Starinkevitch and N. V. Belov, *ibid.* **26**, 804 (1940).
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15. D. McConnell, *Compt. rend. acad. Sci. U.R.S.S.* **22**, 87 (1938).
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21. S. B. Hendricks and W. L. Hill, *Proc. Nat. Acad. Sci. U.S.* **36**, 731 (1950).
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Variation of Susceptibility to Polio

For 6 years I have been gathering data on a peculiar phenomenon that may be of interest to some readers. The data were gathered with the aid of numerous individual pediatricians and pediatric clinics. They pertain to an unexpected correlation between susceptibility to poliomyelitis and genetic traits indicated by pigmentation of skin, hair, and eyes.

The observations may be summarized thus: cases of polio investigated, 1183; polio patients with blond hair, blue eyes, and fair skin, 1; polio patients with blond hair, brown eyes, 17; polio patients with brown or black hair and eyes, 1165.

Obviously, these observed ratios differ significantly from the occurrence of light pigmentation in the general population. It is also noteworthy that the patients with light pigmentation had relatively light cases of the disease, and only two of them suffered any permanent impairment therefrom.

These observations pertain only to the members of the Caucasian race, since it was also noted that patients from other racial groups were in marked disproportion to their ratios in the general population.

It is felt that this variation of susceptibility to poliomyelitis should be taken into account in any statistical study of the value of prophylactic measures, since it is obvious that misleading results may be obtained unless there is an equal distribution of light- and dark-haired individuals in the control and experimental groups.

In the course of my investigations, I have met several pediatricians who had independently made the same observations, but I have not learned of any other attempt to gather objective data on this point. Any summary of pertinent data from readers or hypotheses of mode of influence would be greatly appreciated.

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