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PAUL F. KERR'S ROLE IN THE DEVELOPMENT OF CLAY MINERALOGY[1]

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Reminiscences of cooperation with Paul Kerr hark back to a period of joint studies of the clay minerals, and since this also represents the modern study of these minerals, it may have more than casual interest. It would be fitting for Paul to be a co-author of such a paper.

The bibliography of Professor Kerr will indicate his essential part in the developmental stage of modern clay mineral studies. There will be occasion to refer to the contributions of others in this outline of the development of clay mineralogy, but only a few selected references will be included.

Clay minerals had interested early mineralogists, and by the early eighteen hundreds several had been described, but with few exceptions clay mineral studies had been in eclipse for nearly a hundred years. Mineralogists had been aware of microcrystallinity, but among soil scientists there had been a very general assumption that clay materials, being "colloids" and "non-crystalline," were not amenable to direct observation. Dr. Kelley (1942) stated " . . . practically all soil scientists had held until about ten years ago that clay is an amorphous substance . . . ".

About this time, however, significant methods for mineral study were developing. The Larsen tables (1st edition, 1921; 2nd edition, 1934) gave a new impetus to mineral identification by means of the petrographic microscope, and about the same time there were refinements in the technique for such determinations. Another trend was that of *x*-ray application to crystal structure. Thus the stage was set for a renewal of interest in the minerals of soils. This paper can consider only the initial stage of this clay mineral renaissance, the most significant period extending from around 1925 to 1935 and even on to 1940. This development of interest in clays led to the appointment of a Committee for the Investigation of Clay Minerals under the National Research Council, 1931 to 1935, with especial encouragment from Dr. Waldemar Lindgren.

Ross and Shannon (1925, 1926) presented papers on the origin of bentonite of which the characteristic mineral was identified as montmorillonite, and its properties and composition were discussed. Pictures taken under crossed nicols indicated its crystallinity. In 1927, Ross (1928) presented a paper before the First International Soil Congress in which the crystallinity of soil-forming materials was stressed, along with the fact that kaolinite and montmorillonite were identifiable under

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the microscope. The cooperation of Foshag and Shannon of the National Museum, and the interest of Paul Kerr in the application of *x*-ray methods, were mentioned.

The evidence of the crystallinity and the means for its recognition appealed to Dr. W. P. Kelley of the University of California and he became the agent of a new alliance between mineralogists and soil scientists. In discussing the 1928 paper of Ross and a confirmatory paper by Hendricks and Fry (1930), Kelley in 1942 remarked "Perhaps the greatest importance of these researches lies in the fact that they made possible the determination of the specific components of soil colloids and a better understanding of the properties of soils" and "The essentials of the conclusions drawn in 1927 by Ross and more specifically applied to soil colloids in 1929 have been fully confirmed by many workers both at home and abroad."

Thus the mission of Professor Kelley to soil scientists stemming from the First International Soil Congress (1927) serves to date the initiation of the modern study of soil materials, and in the same way the work of Professor Kerr from 1928 through 1940 serves to date the alliance of *x*-ray studies to soil science. This was followed by joint papers on the relations of groups of minerals, on dickite, on the kaolin minerals, and on halloysite and allophane; eight papers in all in which petrographic and *x*-ray methods were correlated. The appropriateness of the name dickite, in honor of Professor Dick, for a material which had long been correlated with kaolinite was pleasing to both of us. Thus Kerr was a pioneer in introducing *x*-ray methods into clay mineral research, and very effectively served to unite these with petrographic and chemical methods.

The aforementioned papers of 1925, 1926, and 1928 appeared about the same time that Grim published a number of petrographic studies of clays. Earlier, Wherry had reported on the origin of bentonite (1917) and in another paper (1925) had discussed that material as a "one-dimensional colloid." The early studies were based on petrographic methods and chemical analyses, but from the early twenties Kerr had investigated *x*-ray methods. In December 1927 Ross and Kerr's joint paper "Optical and *x*-ray research on clay minerals" was presented at the annual meeting of the Mineralogical Society of America.

After 1930 the study of clay minerals expanded rapidly. In this country Kelley and his associates made detailed studies of "base exchange" and published a paper in 1931 introducing *x*-ray methods. Gruner also did pioneer work on *x*-ray methods and reported on nontronite (1935). At this time, too, Bray, Grim, and Kerr (1935) published a paper on clay mineral technique. Foshag (1936) described a magnesian bentonite, hectorite. Bradley (1937) began his contributions to clay

mineralogy. Ewell and Insley (1935) reported on the synthesis of clay minerals. Here also should be mentioned the long service of W. H. Fry on soil problems and his rare skill with microscope technique. Sterling B. Hendricks and also A. E. Alexander began their contributions to soil problems. The joint papers with Shannon have been mentioned, but he and Foshag of the National Museum were also valuable as advisors and in making Museum material available for study.

In Germany, F. Rinne (1924) using x-ray methods recognized the difference between kaolinite and nacrite. F. Heide in 1928 presented a petrographic study of montmorillonite. By the mid-thirties, German workers had begun their valuable chemical, petrographic, and x-ray contributions to clay mineralogy in the study of the less obviously crystalline materials. This includes C. W. Correns (1938–39), K. Endell and associates (1933–37), M. Mehmel (1935–39), W. Noll (1930–40), and U. Hofmann (1930–39). In Holland there was J. C. L. Favejee (1939) and C. H. Edelman (1935–39). In England there was C. E. Marshall, whose work continued in this country, A. Brammall (1939–40) and G. Nagelschmidt (1934–39). In Russia, L. B. Strutinskii (1926), I. N. Antipov-Karataev (1936), D. P. Serdyuchenko (1929–33), and I. S. Sedletskii (1938–39) published valuable papers.

This sketch, with its reminiscences of associations with Paul Kerr, has been a renewal of pleasant memories and a reminder of the rewards of cooperative effort. There was the efficiency of the petrographic microscope, even with difficult materials; Paul's correlation of that with x-ray methods; the mission of Dr. Kelley to the soil specialists; and the integration of these studies into a distinct event in mineralogical history. Here are memories to be prized!

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