X-ray diffraction using rock chips

X-RAY diffraction studies of clay minerals in rocks usually involves powdering the rock and mounting the powder in the camera or goniometer. The mounting may be in the form of a cellulose spindle, capillary tube or, in the case of a recording diffractometer, as a pressed powder held in the slot of a metal plate.

The pressed powder method, while providing a certain amount of preferred orientation and a resulting improvement in the intensity of the basal reflections, is not exactly reproducible from sample to sample. Some improvement may be obtained by 'sedimenting' the powder on to a glass slide, which is then mounted in the goniometer.

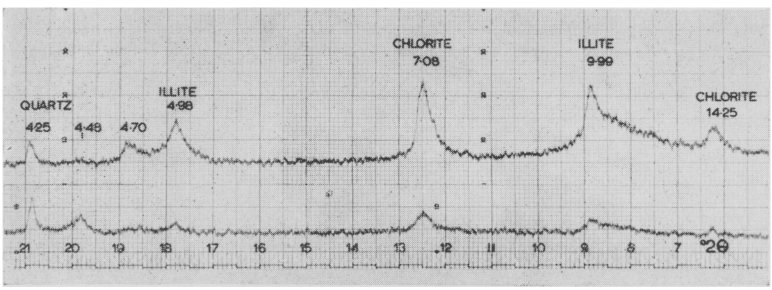

FIG. 1. Diffractometer pattern from a chip of shale, parallel to the bedding plane (above), compared with a pattern from a pressed powder sample of the same rock (below).

Natural sedimentation processes generally produce better preferred-orientation of clay minerals than can subsequently be achieved with the powder. Since the basal plane reflections of clay minerals are the most useful, direct mounting of a shale chip with its bedding plane incident to the X-ray beam was investigated.

The samples examined were Carboniferous shales from the South Wales coalfield. These rocks part readily along the bedding, but the surfaces exposed are rather uneven. Chips about 2 inches square were ground on the bedding surface with fine carborundum to produce a flat plane that is still essentially parallel to the bedding surface; the thickness of the chips was about $\frac{1}{8}$ in. enabling them to be held by the spring clip on the goniometer.

A Philips' PW 1010/25 X-ray generator was used with filtered Cu-$K\alpha$

radiation (36 kV, 20 mA), a PW 1050 goniometer ($\frac{1}{2}°$ 2θ per minute) and a Geiger counter (1650 V).

The results are shown in fig. 1. The lower pattern was obtained from a pressed powder and the upper pattern, under identical instrumental conditions, from the same rock in the form of a ground chip. The improvement in intensity using the chip is evident, particularly for the basal reflections in the region 14 to 10 Å. A 'sedimented' powder of the rock was run but gave negligible improvement in intensity over the pressed powder method.

Examination of several rocks with the present method has shown that many 'degraded' peaks represented in the powdered samples are not evident when the rock chip is used as sample. Powdering and crushing processes must be largely the reason for these differences.

The method appears to be a useful one for obtaining rapid qualitative mineralogical data and to problems of orientation. Work is in progress for the application of the technique to quantitative clay mineral analyses.

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BOOK REVIEWS

DYBEK (J.). *Zur Geochemie und Lagerstättenkunde des Urans.* Clausthaler Heft zur Lagerstättenkunde und Geochemie der mineralische Rohstoffe (ed. H. Borchert), vol. I. Berlin (Borntraeger), 1962. xi+163 pp., 24 figs, 33 tables. Price (paper bound) DM 50.

The Clausthal periodicals on the economic geology and geochemistry of mineral raw materials, Professor Borchert states in a foreword, will discuss ore deposits particularly from the genetic point of view. It is intended that each volume will concentrate on one element or on a type of deposit of that element. In this first volume, Dr. Dybek presents a broad review of the geochemistry and economic geology of uranium without dealing in detail with individual deposits or becoming embroiled in controversy. The main chapters are on the following topics: (1) The physical and chemical properties of uranium, particular attention being paid to the solubility of uranium in water and to its precipitation and adsorption from aqueous solution (28 pp.). (2) Uranium minerals (8 pp.). (3) The distribution of uranium in meteorites and tektites, and in the