AN AUTORADIOGRAPHIC TECHNIQUE FOR ILLUSTRATION OF STRUCTURES IN SEDIMENTARY ROCKS

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Structures seen on the surface of a rock (e.g. with fossils) are frequently difficult to illustrate photographically due to the low contrast between different rock constituents, particularly when the general colour and texture are uniform. The method described below is based on the chemical properties of the constituent minerals and achieves in many cases a higher degree of contrast between structure and matrix.

ROSENQVIST (1950), investigating the adsorptive properties of clay minerals, quartz, and feldspar, suspended in a diluted radium solution, showed that radium was preferentially adsorbed by the clay minerals. This property is utilized in the technique described below. Radium is usually less readily adsorbed on the surface of a fossil and the contrast with the matrix is accentuated.

Method

The rock surface is wet with a dilute solution (2.5×10^{-6} μg cm^{-3}) of radium. After drying, the surface is washed with water. It is then covered with an autoradiographic stripping film (Kodak AR 10) and exposed for from 3 to 5 days before developing. Mounting and removal of the film should be done with great care in a bath of distilled water, and the detailed procedure of the handling of the film is given by the manufacturer. The stripping film is then mounted on a glass plate and used as a photographic negative. Figs. 4, 5, and 6 (Pl. 1) show three pictures of the fossil arthropod *Marrella splendens* described by WALCOTT (1912, p. 192) from the dark Middle Cambrian Burgess Shale. Photo No. 4 is taken with normal illumination, Photo No. 5 is produced by reflected light, a method used by Störmer (MONSEN 1937), and No. 6 is produced by the method described above. Some details

may be better reproduced by the first two methods, but in Photo 6 the thorax and pygidium have a better contrast.

Figs. 1 and 2 show the same specimen, a crossbedded calcareous siltstone from the Middle Ordovician of the Oslo district (the bronni zone at Huk, Oslo). Fig. 2 is an ordinary photograph. Fig. 1 is produced by the autoradiographic technique. Laminae rich in clay minerals appear more exposed on the negative and therefore lighter on the photograph. Relatively small variations in the clay mineral content yield good contrast on the film and even minor sericitization of feldspar can be distinguished. In some cases better contrast is obtained by etching the specimen with HF or another acid before the radium solution is added.

The resolution of the film is limited by the length of the track produced by the α rays. The tracks of α rays from radium on this film (Kodak AR 10) are up to 30–50 μ and magnification exceeding 20–30 times is therefore not practicable. By combining isotopes with α rays of lower energy (shorter tracks) with various film types, it should theoretically be possible to obtain higher resolution. The degree of adsorption to the minerals may also be varied by using other isotopes.

For further information on autoradiographic techniques the reader is referred to BOYD (1955), where references are also made to autoradiography of radioactive rocks.

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PLATE

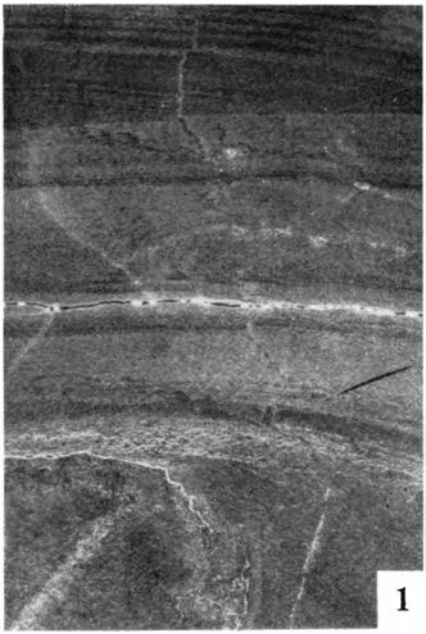
PLATE 1

Fig. 1. Crossbedded calcareous siltstone from the bronni zone (Middle Ordovician) at Huk, Bygdöy, Oslo. × 4. The picture is produced by the method described above. Note the finer laminations in each layer.

Fig. 2. Ordinary photograph with use of filter of the same subject as in Fig. 1. (Photographer: O. Brynildsrud)

Fig. 3. Eocambrian sandstone (Moelv Sparagmite, Rena, Norway) reproduced by the method described. Light grains are feldspar and dark grains are quartz. × 2.

Figs. 4, 5, and 6 are pictures of the same specimen of the fossil arthropod *Marrella splendens* (Walcott, 1912) from the Middle Cambrian Burgess Shale, Canada. Paleontologisk Museum, Oslo, Cat. No. A30974 — Fig. 4: Photo with normal illumination. Fig. 5: Photo with reflected light. Fig. 6: Photo produced by the method described above. × 5. (Figs. 4 and 5 were made by O. Brynildsrud.)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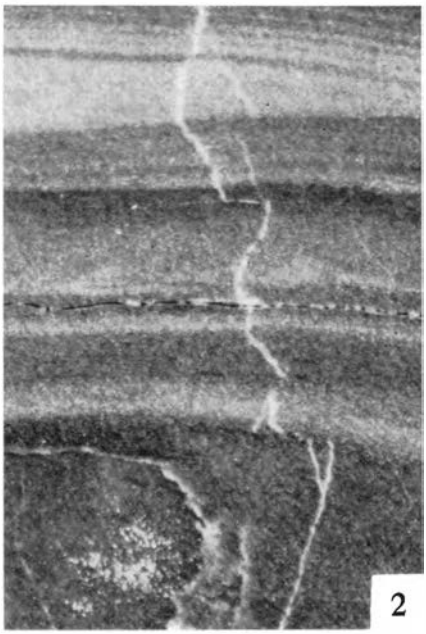
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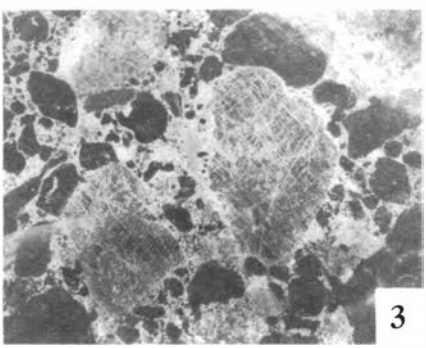
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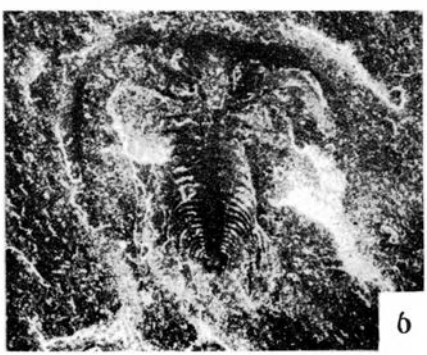
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