fragments which frequently have razor-sharp edges, whereas the Barnsley coal breaks into more regularly shaped pieces with less acute edges. In general, cubes of both coals break explosively when they are compressed between flat platens; but it has been found possible to induce non-explosive breakage in the Barnsley coal provided extremely low rates of straining are used. No matter how slowly the anthracite cubes have been loaded, explosive breakage has always occurred. These differences are probably related to the rheological properties of the coals, and in particular to the presence or absence of creep.

Somewhat analogous to the explosive breakage of cubes are the violent outbursts of coal from the seam which occasionally occur. These outbursts have occurred in many areas, but there is strong evidence that in the United Kingdom they are most prevalent in the anthracite areas. Outbursts have been attributed to many factors, but high in importance among these would seem to be the nature of the coal itself. If the coal can creep, the roof load will be more easily accommodated as the workings advance, so that the stresses in the coal remain below the breaking strength. If the coal cannot creep, there is a greater risk that the breaking strength of the coal will be exceeded, resulting in an explosive outburst. This may offer an explanation of the prevalence of outbursts in anthracite; but it would be unwise to generalize further since other considerations, such as the nature of the floor, the thickness of the seam and the rate of build-up of the overburden stresses all affect the problem.

This communication describes work forming part of the research programme of the Mining Research Establishment of the National Coal Board and is published by permission of Dr. W. Idris Jones, director-general of research. The views expressed are my own and not necessarily those of the Board.

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¹ Griggs, D. T., *J. Geol.*, **47**, 225 (1939).

Photographic Sensitizers in Gelatin

THIRTY years ago, Sheppard¹ isolated allyl isothiocyanate from extracts of photographically active gelatins. It has since been made evident that this sulphur sensitizer is not usually present in gelatins produced by existing methods. Steigmann² has demonstrated by chemical tests the presence in lime-treated hide gelatins of thiosulphate and trithionate ions, and has indicated a mode of formation of these sensitizing substances by alkaline degradation of cystine. Wood^{3,4} has applied paper chromatography and paper electrophoresis to extracts from gelatins, and has detected thiosulphate and polythionates. He has suggested alternative mechanisms of sensitizer formation, including oxidation of sulphides used for depilatory purposes in gelatin precursor treatment, and also oxidation or autoxidation of sulphur dioxide. The purpose of the present communication is to indicate that a quantitative method has been devised for determining sensitizers in gelatin extracts.

Fig. 1. Anodic polarograms of various sulphur sensitizers in 0.2 M potassium nitrate: (1) 0.4 mM Thiosulphate, (2) Gelatin extract, (3) 4 mM Allyl isothiocyanate, (4) 0.5 mM Thiourea, (5) 0.5 mM Thiosinamine

The method of extraction was similar to that used by Wood³, but on a smaller scale; 25 gm. of the gelatin were extracted at 0° C. with a total of about 200 ml. of water, and the extracts were concentrated *in vacuo* to 10 ml. These concentrated extracts have been examined polarographically. Fig. 1 shows the results of anodic polarography in 0.2 M potassium nitrate on the extract from a particular gelatin and on some known sensitizers. In making such comparisons, it is essential to compare at roughly the same wave-height, as the substances shown all have a half-wave potential which varies with concentration.

It will be seen that the sensitizer present closely resembles thiosulphate in its behaviour. Cathodically, in 1 M ammonium dihydrogen phosphate⁵, tetrathionate has been detected in the extract. Apart from their polarographic characteristics, the identification of these constituents is confirmed by the behaviour of the extracts towards anion-exchange resins, and to such reagents as iodine (for the thiosulphate) and sulphite (for the tetrathionate).

This technique is readily applicable to the routine examination of gelatins. In this Laboratory, fifty-two gelatins have been examined in this way, and the conclusions indicated above have been found to be generally valid. Neglecting for the moment the tetrathionate content as of secondary importance⁴, the thiosulphate contents of the gelatins tested range from 34 p.p.m. for a very active hide gelatin to 0 for inert gelatins. In general, the thiosulphate contents correlate well with the photographic activities of the gelatins.

This work will be reported in full elsewhere. Thanks are due to the directors of Ilford Limited for permission to publish this communication.

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¹ Sheppard, S. E., *Phot. J.*, **65**, 380 (1925).

² Steigmann, A., *Sci. et Indust. Phot.*, **22**, 441 (1951).

³ Wood, H. W., *Sci. et Indust. Phot.*, **23**, 209 (1952).

⁴ Wood, H. W., *J. Phot. Sci.*, **2**, 154 (1954).

⁵ Furness, W., and Davies, W. C., *Analyst*, **77**, 697 (1952).