A STUDY OF THE VARIATION OF REFLECTANCE IN SCREENED SIZE-FRACTIONS OF COAL

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A study has been made of the variations in reflectance of vitrinite in a series of size-fractions of a lower cretaceous coal from Western Canada and several lower Permian coals from India. These variations have been compared with maceral composition of the fractions. The two groups of coal under study are from widely separated geographic areas belonging to different geologic ages, and are of different rank.

METHODS OF STUDY

Because of the nature of the material available for study, the Western Canadian coals and the Indian coals were examined in somewhat different size-fractions. The Canadian coal was available in the form of a 1,000-lb. bulk sample which had been collected underground at a fresh face. This sample was subjected to screen analysis, resulting in the production of 12 size-fractions ranging from -4 in. to -65 mesh. Ten samples of Indian coals were studied consisting of two specimens from each of the five seams from Jharia, Raniganj and Vindhya Pradesh coalfields. The original samples were of the order of 500 grams and due to storage in the laboratory have become slightly oxidized. Each was subjected to screen analysis but the size-fraction series in the case of Indian coals consisted of the following fractions, namely -10 mesh, 10×20, 20×35 and -65 mesh. The Indian coal size-fractions correspond to the finer fractions of the Canadian sample. Insufficient material was available to obtain reliable analysis on the -65 mesh fractions of the Indian coals, so these were not examined petrographically.

Pellets were prepared from these fractions and were polished using a Buehler automet. The photomultiplier set-up was used to obtain reflectance values and 100 readings were taken on each pellet.

RESULTS

The coal from Western Canada is of low volatile rank and characterized by vitrinoid types V_{12} to V_{16}, while the Indian coals cover a range from high volatile to medium volatile bordering on low volatile. The range in vitrinoid types present is from V_4 to V_{13}. The coals from Vindhya Pradesh and those

from top portions of the Jharia series and Raniganj series are distinctly high volatile containing vitrinoids ranging from V_4 to V_9, while coal from the lower portion of the Jharia series and from the eastward extension of the Raniganj, namely Samla, seam are distinctly medium volatile with vitrinoid types ranging from V_9 to V_{13}.

The distribution of the various vitrinoid types observed in different size-fractions for three of the coals examined is presented in Fig. 1. The low

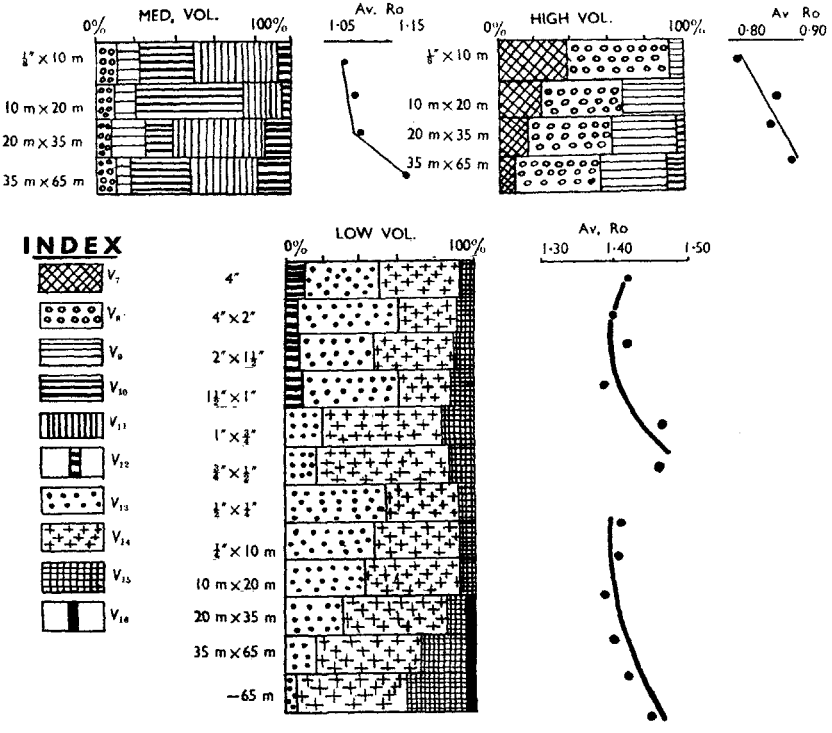

FIG. 1. Reflectance variations in size-fractions.

volatile coal is from Western Canada, the medium volatile coal is from Raniganj field, while the high volatile coal is from Jharia. Fig. 1 shows that there is a tendency for higher reflectance vitrinoid types to concentrate in finer fractions. This is shown both by the bar diagrams in which the actual percentages of the various vitrinoid types are plotted and by the curve which accompanies the bar diagram on the right. The latter portrays the variation in average reflectance calculated for the size-fraction series.

In order to investigate this increase in reflectance in the finer mesh sizes, a maceral analysis was made on each fraction. In this analysis a distinction was made between the larger masses of pure vitrinoid material and smaller stringers and lenses of vitrinoid material associated with other macerals,

that is to say, the vitrinoids which might fall into the category of the microlithotype vitrite were distinguished from vitrinoid material which might fall into other microlithotypes. The result of this textural grouping of the vitrinoids is shown in Fig. 2. The bar diagrams illustrate the actual percentage values of these two vitrinitic varieties in the size-fractions of the three coals under discussion. The linear plots show the relationship between average reflectance and the two textural vitrinoid varieties. These plots show clearly that with an increase in the percentage of pure unassociated

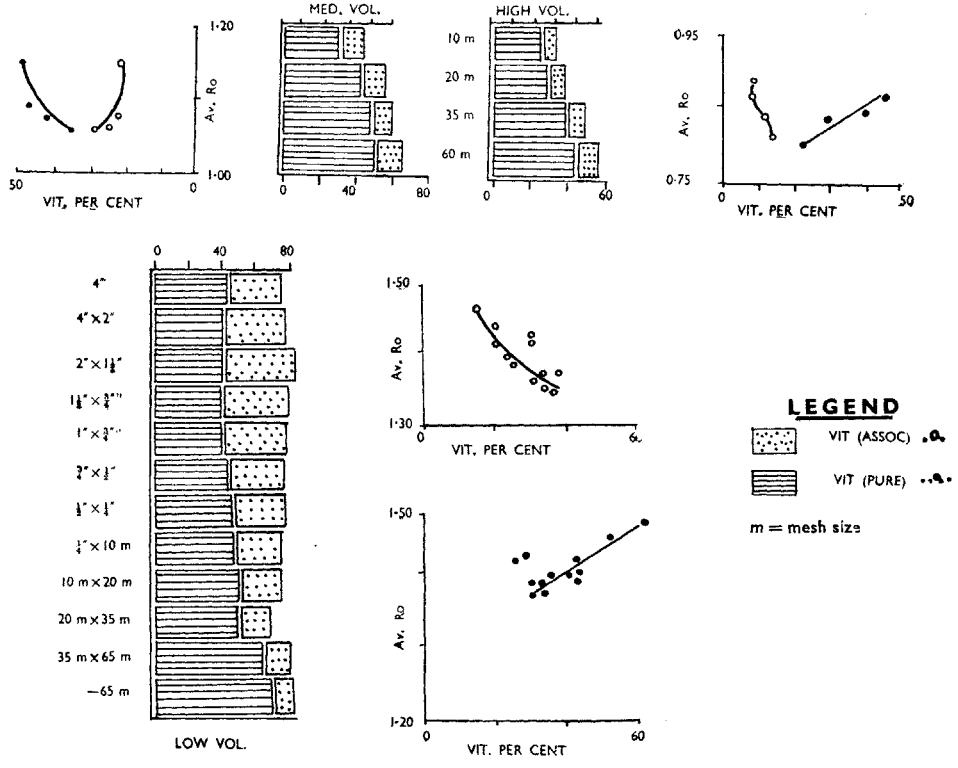

FIG. 2. Relation of vitrinite occurrence to reflectance and size.

vitrinoids there is an increase in average reflectance, while an increase in vitrinoids with associations is accompanied by a decrease in average reflectance.

It has been shown by a number of workers (McCabe 1936; Hacquebard and Lahiri 1954; Harrison 1963) that vitrinitic material tends to concentrate in finer mesh sizes because of its brittle nature. Presumably the vitrinoids found in the more pure and thicker vitrain bands would be more amenable to such concentration than vitrinoid material which may be more intimately associated with more durable components such as exinoids and mineral matter. Recent work conducted at the CSIRO by Brown *et al.* (1964) in Australia has

shown that the reflectance observed on vitrinite from a vitrain band is higher than that observed on the ground-mass vitrinite in more dull varieties of coal such as durain or even clarain.

If we relate these observations to the present study, it can be surmised that the pure unassociated vitrinoids are probably derived from the thicker vitrinitic bands. According to the Australian assessment of reflectance variation, therefore, it is not surprising to find the more highly reflecting vitrinoids concentrated in the finer meshes.

The conclusion drawn above, if substantiated by further work, may have a practical significance. It appears that not only can vitrinoids as a whole be concentrated by simple size-fractionation, but in addition certain types of vitrinoids can be preferentially enriched in certain fractions. Thus, for example, it might be possible to select for a particular use screen fractions enriched in a certain vitrinoid such as V_9.

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