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REFLECTANCE STUDY OF SOME OF THE INDIAN COALS

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INTRODUCTION

SINCE reflectance data along the lines described by Ammosov[1] (1957), Schapiro and Gray[2] (1961) are at present not available on Indian coals, it was decided to study the reflectance of some of the coals from Jharia, Raniganj coal fields (Bihar), Vindhya Pradesh coal field, Chirmiri coal field (M.P.), and the results constitute the subject-matter of this paper. It was suggested in one of the earlier publications by the authors[3] (1965), that detailed reflectance work would prove an invaluable criterion in evaluating the coking characteristics of the various Indian coals, as well as for a better industrial exploitation.

METHOD OF STUDY

Small random samples from seams No. 1, (5, 6, 7 combined), 8, 14, 16, 16-*a* from Jharia coal field; Samla seam, Dishegarh seam, and Laikidih seam from Raniganj coal field; seams No. 2 and 4 from Chirmiri coal field; and Nawarazabad seam from Vindhya Pradesh were used for reflectance study. The samples were crushed to pass through 20 mesh, briquetted with an epoxy resin and polished with an automet to get an even and smooth polished surface. Also examined were four screen sizes (10×20 mesh, 20×35 m, 35×65 m, and -65 mesh) prepared of small samples of coal from seams No. 16, 16-*a* of the Jharia coal field; Dishegarh and Samla seams of Raniganj coal field; and the Nawarazabad seam of Vindhya Pradesh. This study was undertaken to examine the variation in reflectance between different size fractions. For the reflectance measurements a Photovolt model 520 M photometer was used, and all readings were made on scratch-free vitrinoids, that were devoid of impurities.

RESULTS OF THE INVESTIGATIONS

According to the classification of Schapiro and Gray[4] (1960) based on reflectance studies, the Indian coals under investigation fall under the category of high volatile to medium volatile coals that are characterized by vitrinoid types V_4 to V_{13}. The high volatile coals, with vitrinoid types V_4 to V_9, are represented by the samples from Vindhya Pradesh, from Chirmiri and by the upper seams of Jharia and Raniganj coal fields; the medium volatile coals, with vitrinoid types V_9 to V_{12}, occur at the middle portion of the section of Jharia and Samla seam of Raniganj coal fields, while the bottom seam of Jharia coal field with V_{13} is nearly a low-volatile coal in rank.

Damodar Valley Coal Fields.—Damodar valley coal fields include the most important fields, chief among them being Raniganj, Jharia, Bokaro, Ramgarh and Karanpura. In this paper some of the seams from Raniganj and Jharia are described. The Raniganj coal field occupies an area of about 600 sq. miles in the province of Bihar and is situated 130 miles north of Calcutta. About 16 miles to the west and a little north of the Raniganj coal field is that of Jharia which encloses an area of 170 sq. miles.

The Damuda series is the coal-bearing series in these coal fields. It is divided into three subdivisions known as (*i*) Barakar measures, (*ii*) Barren measures, (*iii*) Raniganj measures. All the seams studied from Jharia coal fields for reflectance study come from Barakar measures; while Laikidih seam belonging to Barakar measures and Samla and Dishegarh seams belonging to Raniganj measures were studied from Raniganj coal fields.

Figure 1 shows the stratigraphic sequence of the seams in the Jharia coal field. In this

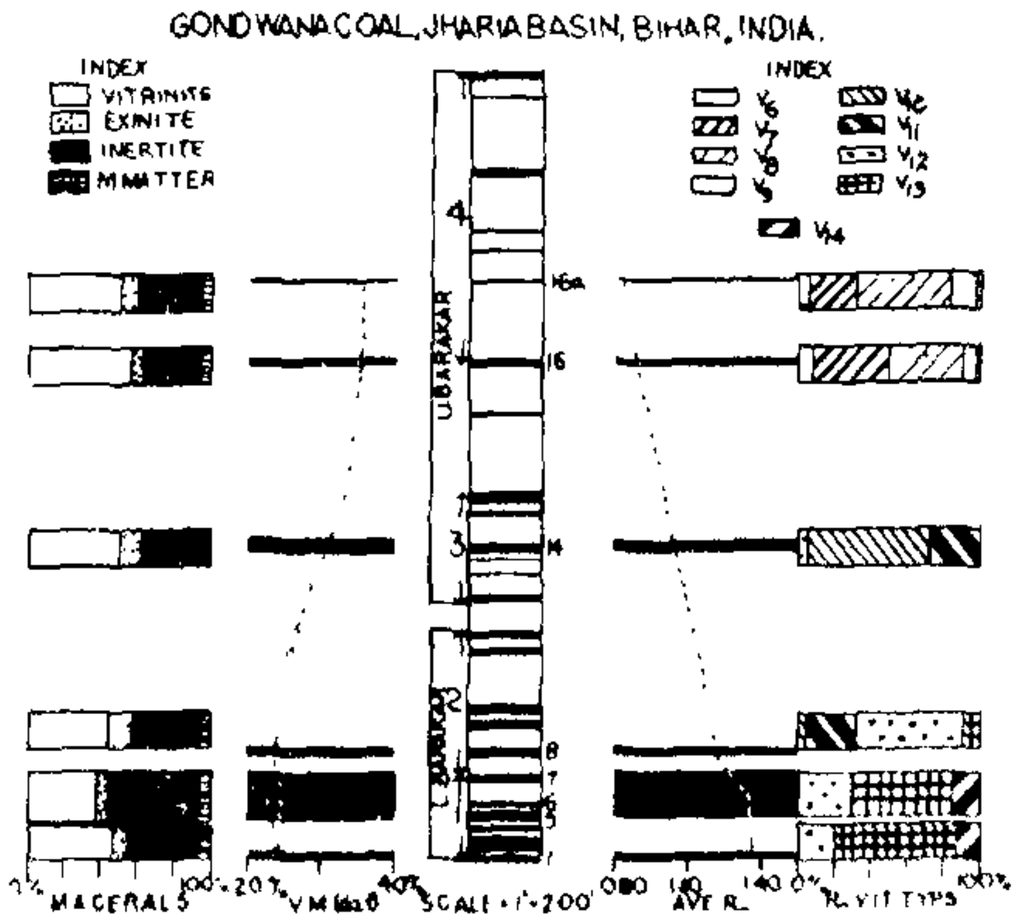


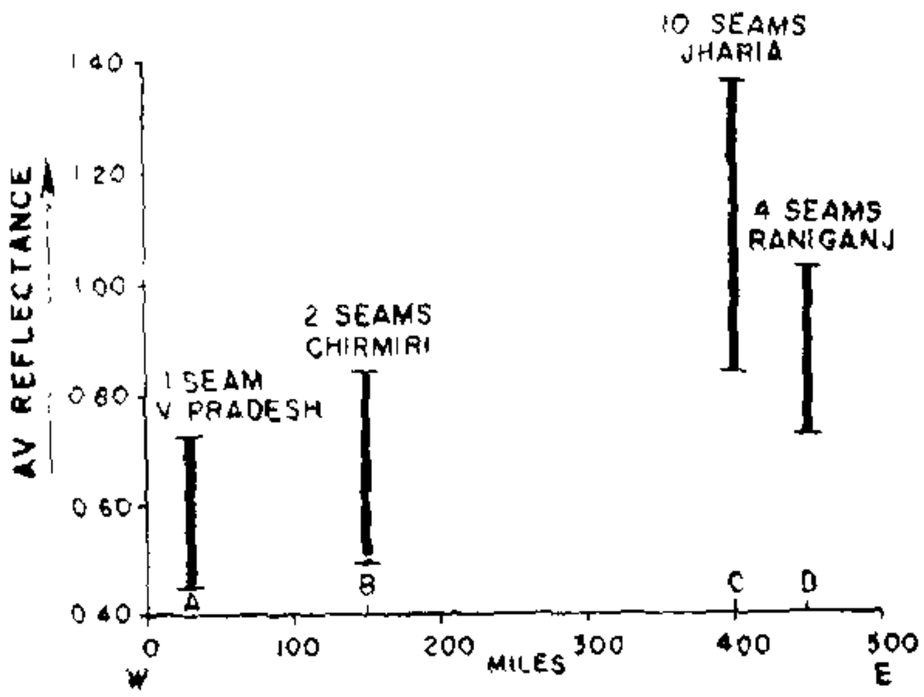
FIG. 1

sequence four stages, marked 1, 2, 3, 4, are recognized. Reflectance measurements were made on samples of each stage. They show a gradual increase in reflectance from the younger

to older seams, which is indicated by a decrease in vitrinoid types V_7, V_8 and V_9 and a corresponding increase of types V_{10}, V_{11}, V_{12} and V_{13}. This is illustrated in the percentage bar diagram on the right of Fig. 1. The average reflectance, also plotted, shows a nearly linear increase with depth. This increase of rank with depth has previously been demonstrated by Ganju[5] (1946) and by Lahiri[6] (1952) from chemical and refractive index studies respectively. Ganju showed the existence of a gradual loss in volatile matter when proceeding downward in the section. Ganju's volatile matter curve is illustrated on the left of the stratigraphic column. The present study indicates that not only chemically but also reflectance-wise the law of Hilt (1873) applies in the Jharia coal field. A similar relationship was observed in the coals of Raniganj coal field, but between these two areas the relationship is not apparent notwithstanding the fact that the coals of the latter are stratigraphically younger than those of Jharia.

The seams of Dishegarh and Samla of Raniganj coal field show lateral variation as noticed by an increase in reflectance from west to east. This lateral variation in the seams of Raniganj coal field has been mentioned by Ganju (1946) based on chemical studies.

Geographically the Bihar coals occupy the N.E. portion, the Chirmiri coals the central portion and the Vindhya Pradesh coals the N.W. portion of the Gondwana coal fields. The variation in average reflectance plotted in Fig. 2



REGIONAL VARIATION OF SOME OF THE COAL FIELDS OF INDIA BASED ON REFLECTANCE STUDY

FIG. 2

indicate that there is a decrease in rank of these coals from N.E. to N.W. Accordingly coals of high rank occur in N.E. portion, while coals of low rank are found in the N.W. part.

The average petrographic composition of the coals studied for reflectance from Jharia coal field are plotted by percentage bar diagrams as shown in Fig. 1. There is no apparent relationship indicated between the macerals with depth. However, it is clear from Table I, that

TABLE I

Name of the seam		Vitrinite content	Inertinite content
Raniganj (Average of 4 seams)	..	63·43	23·96
Jharia (Average of 10 seams)	..	48·16	35·60
Chirmiri (Average of 2 seams)	..	40·00	41·00
Vindhya Pradesh (Average of 2 samples)		45·10	40·00

there is a corresponding decrease in the proportion of vitrinite and increase of inertinite from Raniganj to Vindhya Pradesh coals (N.E. to N.W.).

The reflectance study reveals that the seams from the middle portion of the Jharia coal fields (Seams No. 8, 14) are likely better coking than those of the top and bottom portions, because they are characterized by those vitrinoid types which can impart fluidity during coking. The coals from Raniganj particularly those from the western part of the field, are regarded as coking coals, but they will not produce coke of good strength or stability. They are more suitable for blending purposes with other coking coals. Similarly coals from Chirmiri, although possessing enough vitrinoids, do not contain the required type to induce fluidity during carbonization. These coals also are more suited for controlled and proportional blending with other coals in order to produce a satisfactory coke produce.

In conclusion, it can be mentioned that a detailed programme of reflectance studies on the various coals of India, in co-ordination with chemical studies, will prove not only an invaluable tool in industrial application, but also will be useful in the academic understanding of the nature of various coals in time and space.

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