BIOPETROLOGY OF THE KARGALI COAL SEAM, EAST BOKARO COALFIELD

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ABSTRACT

The Kargali seam is the thickest and the most important coal seam in East Bokaro Coalfield. Anthraxylous constituents derived from fragments of wood (mostly gymnospermous) and bark are abundant in a state of fine division. Lenticular bodies of fusain are quite common in which cell cavities commonly contain clay material and carbonates. Spores, cuticle and resin-like bodies are generally present in small proportion but locally become abundant. Sedimentary mineral matter occurs more or less homogeneously disseminated in the coal types. Biopetrological evaluation of Kargali seam indicates coking constituents of the coals. However, common presence of clastic grains in the coal hinder suitable preparation of the coals for coking purposes. Potentially, the coking characteristics of the coal seam could be affected by degree and method of preparation.

INTRODUCTION

During the past two or three decades, coal industry in India in common with rest of the world has faced with problems of depletion of good quality coals along with more and more development of inferior seams which has resulted in deterioration of quality product. This problem has led to adopt ways and means to improve the quality of coals by artificial methods as practised elsewhere in the world. It has been well established that significant improvement in quality of coals may be evolved by mechanical methods by benificiation. It is necessary, therefore, to have basic data on the composition of Permian coal seams of India to evaluate the practicability of coal seams for the above purpose. The present study is oriented to know the economic potentiality of the Kargali seam which lies in East Bokaro Coalfield. Several coal seams occur in Bokaro Coalfield. The coalfield is divided into two separate coalfields, e.g. the East and West Bokaro Coalfields according to the position of Lugu Hills of Panchet rocks which separate them. The Kargali seam lies in East Bokaro Coalfield along with other important coal seams of Bermo and Karoo (DUTT, 1961). The downward succession is as follows:

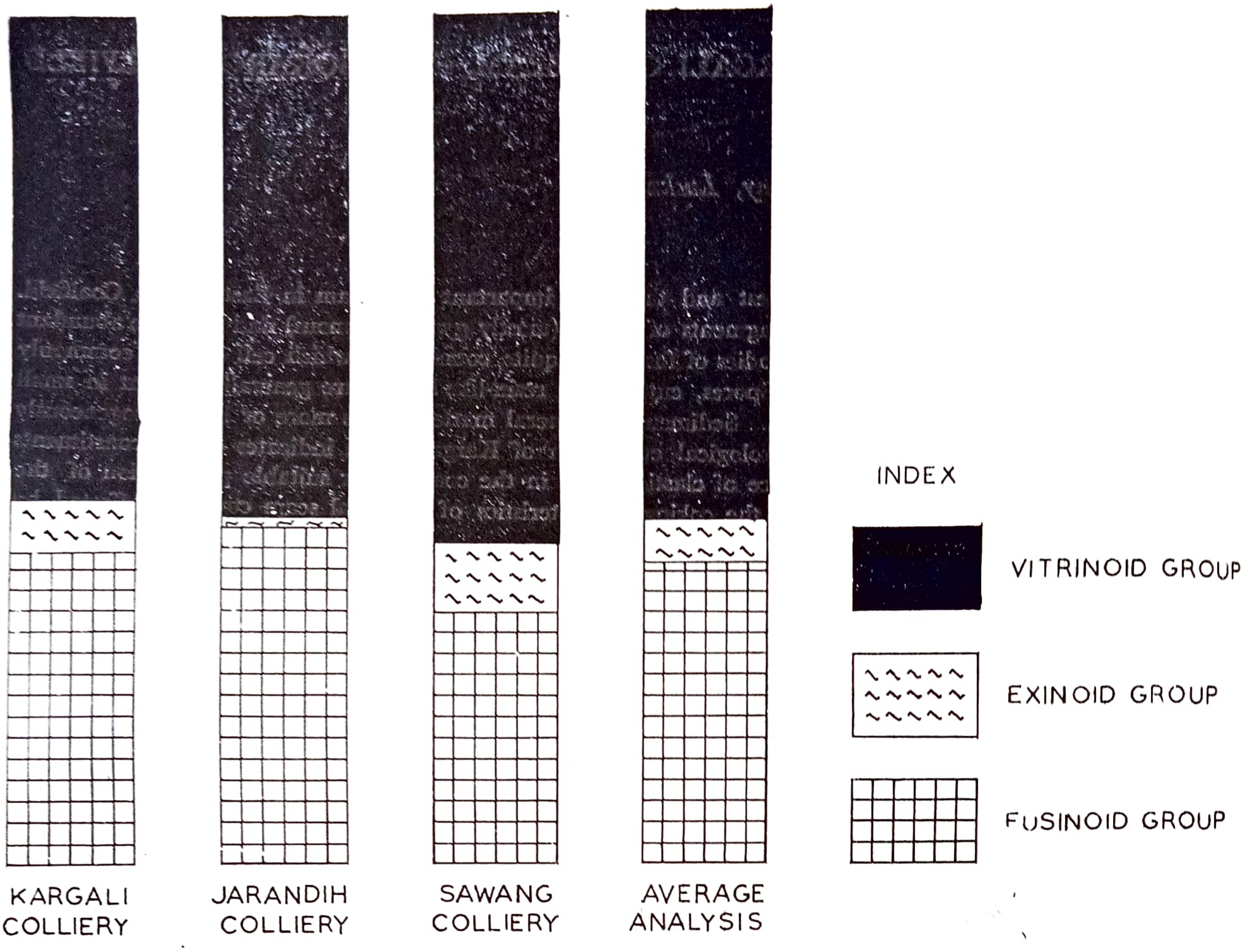
(i) Karoo seam
(ii) Bermo seam
(iii) Kargali seam
(iv) Kathara seam

The Kargali seam occurs in Barakar Stage, striking in general east-west direction. The dip varies 10° to 20°. The seam extends for several miles covering Dhori, Bokaro, Jarandih, Gobindapur and Sawang areas in East Bokaro Coalfield either in entire thickness or in splits. The thickness of the seam varies from 40-120 feet. The proximate analysis of an average sample varies as follows :

Moisture 0.96%—1.06%
Ash 15.23%—18.54%
Volatiles 26.76%—29.68%
Fixed carbon 50%—57%

BIOPETROLOGICAL CHARACTERISTICS OF THE KARGALI SEAM (Fig. 1)

The characteristic aspect of the ultimate coal constitutes of various organic entities may by grouped under durain, duroclarain, clarain and vitrain coal types.



DISTRIBUTION OF MICROCONSTITUENTS IN KARGALI SEAM EAST BOKARO COALFIELD

Fig. 1

Durain

Many samples studied are entirely of durain coal type. Average thickness of the durain layer range between 10-20 mm. Sometimes durain is intimately associated with clarain and form duroclarains. Vitrinite constituent in durain occurs in finely irregular sheets having 0.025-0.041 mm thickness. It forms 20 to 40 per cent of the coal type. Some microlayers of vitrinite show structures of wood and bark tissues as source material. Fusinite constituent in durain occurs in coarse or lenticular bodies. Some lenticular bodies are filled with carbonate or clay mineral. Average thickness range from 0.020 to 0.055 mm. It forms 60 to 80 per cent of the durain coal type. Spores, cuticles and resin body like substances occur in very negligible proportion in the composition. Hardly it makes upto 1 per cent of the total composition. Micrinite and similar finely divided organic material derived from disintegration of fossil fragments is quite conspicuous in coal type. Together with fusain and fusinite, it forms 50 to 80 per cent of the composition. Apart from these typical macerals, considerable proportion of plant fragments exhibit transition and intermediate types between vitrinite and fusinite. Sedimentary mineral matter occurs homogeneously disseminated throughout in durain. Increase in clastic mineral content may transform the coal into carbonaceous shale. It has been noted that mineral matter, increases with increase of inertinite. As the ash in coal is directly related to clastic minerals, higher mineral content suggests more ash in coal samples.

Duroclarain

Macroscopically for coals having constituent proportion between clarain and durain are regarded as duroclarain. Such intermediate types form some proportions in the coal seam. Microscopically the coals exhibit alternate layers of clarain and durain, each revealing diagnostic characteristics of microclarain and microdurain. Thin sheets of vitrinite alternate with either fusinite or exinite more or less in regular fashion. Sometimes more massive vitrinite is associated with larger fusain. Vitrinite sheets range between 0.02 mm to 0.06 mm. It forms about 65 per cent of the total maceral composition. Microvitrinites are mostly collinitic without having any structural details of organic fossils. Fusinite constituent in duroclarain occurs as lenticular structures, more often filled with micrinite and mineral matter. It is often associated with vitrinite or exinite. Average thickness range from 0.005 to 0.09 mm. It forms 34 per cent of the maceral composition of durain coals. Sometimes transition between fusinite to semifusinite and vitrinite has been recognised. Vitrinite and fusinite form more than 90 per cent of the duroclarain coal type. Spores, cuticles and clastic minerals are less and form hardly 1 per cent of the coal constitution. Sedimentary matter is closely associated with the coal type often masking the purity of the type. It is common to find changes from duroclarain to durain, as coal constituents exhibit transition and intermediate conditions.

Clarain

Coal type containing 70 per cent or more of vitrinite is regarded as clarain. However, the samples of the seam did not show any prominence of clarain. When present occasionally clarain may be differentiated into "cuticular clarain" and "spore clarain". The vitrinite which forms dominant constituent is either derived from fragments of wood or bark, sometimes showing cell structures. It occurs in thin sheets having mean thickness of 0.04 to 0.15 mm. By volume, it forms 75 to 80 per cent of the coal substance. Fusinite content in clarain is comparatively less when compared to other coal types. Finely divided fusinite, micrinite and clastic grains are disseminated in the clarain. Micrinite is rarely conspicuous. It occurs as fine particles intermixed interstitially with other constituents. Rapid increase in micrinite and inertinite constituent decrease vitrinitic entities of clarain changing the type from clarain to duroclarain and other intermediate types. Although salient features of various coaltypes recognised in the seam are described separately, it must be emphasized that coaltypes exhibit systematic progressive variation in constituent proportion and sizes and the coal seams commonly reveal every possible gradation and intermediate condition in coal types.

Vitrain and Fusain

These types are common in all the coal types described above. Mostly, they occur as microlayers, sometimes in broad bands also. Vitrain is constituted both by telinitic and collinitic macerals. Fusain forms an important constituent in inertinite group of the coal composition.

EVALUATION OF THE COALS

The coal type durain characterized by composite characters and marked proportion of sedimentary mineral matter is prominent in the coal seam. Significantly thin bands of contrasted coal types alternate which are often referred to as microtypes. Even coal blocks that superficially appeared to be uniform, the microbands are commonly developed. The proportion and distribution of vitrinite, fusinite, micrinite and sedimentary mineral matter in micro-and macro-types is of importance in utilization properties of coal. Coal types are intimately associated and every possible gradation and intermediate conditions exist in the combination of types. The seam is characterized by vitrinite entities which has active coking properties. It appears that vitrinitic and fusinitic ratios control the utilization properties. The relationship varies in degree with each sample but the trends are definite and comparable, with decrease in vitrinitic content of the coal, the coke may become much less swollen. Cokes formed from vitrain is relatively strong. But invariable increase in fusinite, micrinite and mineral matter affect the coking properties of the coals. Because of progressive increase in 'inerts' the coal would yield less coking properties. Hence, the general occurrence of mineral matter associated with 'inerts' are of significance in preparation of coals. The volumetric proportions of the seam constituents have a general relationship with swelling characteristics. Changes in coal types from clarain to duroclarain and durain are generally accompanied by increased proportion of mineral matter and overall ash content. In durain, the diagnostic coal type of Kargali seam, overall increase in the clastic grains are common. From the study of distribution of coal constituents, it is evident that cleaning methods are largely conditioned by reducing the petrological constituents which result in high ash durains. Because of high inert and mineral concentrations in the coals, it would appear that elimination of clastics is of primary requisite in cleaning of the coals which ultimately become coking type. Comparative studies with other Indian Permian coal seam constituents (NAVALE, 1974 (in press) ; PAREEK, 1967; SEN *et al.*, 1967; SEN & SEN, 1969) have indicated affinities in physical constitution and related characteristics. However, the Kargali seam coals are more matured and possess certain distinguishing features described above which are not commonly seen in other Barakar (particularly western-southwestern coalfields), Raniganj and Karharbari coals.

CONCLUSIONS

Petrological study of the Kargali seam reveals certain characteristics, which are helpful in evaluating utilization properties of coals. The coals possess coking constituents but invariably contain high proportion of inerts and mineral content. The intimate association between 'inerts' and 'non-inerts' of the coal composition hinder good preparation of coals for utilization. Suitable methods to reduce clastics naturally lowers inert composition and thereby increase coking properties of the coal. The mechanical methods of "cleaning processes" of the seam samples are justified as evident from this study.

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