PREFACE

The energy scenario of India is such that, in that absence of commercially exploitable source of energy, coal and lignite will continue to be the dominant source of energy for the coming several decades. With the limited reserves of our precious coking coals, and the availability of inferior grade, high-ash-content coals, we will have to be largely dependent on very high mineral matter content, semi or non-coking coals. The combustion of such low grade coals on a megascopic scale during Thermal Power generation is prone to pose alarming threats to our environment by way of causing environmental pollution which arises primarily due to the mineral matter (ash forming components) and other inorganic impurities present in our coals, which are essentially of 'drift' origin. Not only a knowledge of the mineral matter content of the coals but also their chemical, fuel, carbonization, and mineralogical characteristics are significantly important to evaluate their quality and also their various end uses in different industries. Since the reserves of coals of Jharia, Wardha Valley, and J & K constitute a sizeable portion of total coal reserves of the country and because the coals of these regions are the principal source of feed coal for the industries of central India, which is undergoing rapid industrialization, the coals being obtained from these coalfields need to be necessarily characterized in terms of their chemical, fuel, carbonization and mineralogical systematics, in order to properly asses their utilization potential. It was from this viewpoint that the present research work on the mineralogy of coals of Jharia (Dhanbad district in Jharkhand), Wardha Valley (Maharashtra) and Jammu and Kashmir (J & K) region, was undertaken in some detail.

The present dissertation embodies the results obtained by the author in the course of studies carried out by him on the mineralogy characteristics of some typical coals of the above-mentioned regions of the country, viz. Lodna and Bhowrah coals (Jharia Coalfields, BCCL) ; Kamptee, Tandsi, and Pathkhera Coals (Wardha Valley Nagpur, Western Coalfields of Coal India Ltd.) and Metka, Tata Pani and Chakker coals as well as Kashmir Lignite (from J & K, coalmines s under Northern Coalfields of Coal India Limited). The investigations comprise essentially the chemical, and mineralogical characterization of these coals which primarily

belong to of Gondwana and Tertiary coal formation. The chemical analysis comprised of proximate and ultimate analysis, determination of calorific values of these coals, analysis of coal ashes and evaluating their fusion characteristics, while the mineralogical characteristics of the coals included the identification of different mineral species present in the raw coal and their corresponding low temperature ashes, for which such instrumental techniques as X-ray diffraction Spectroscopy, Infra-red Spectroscopy and Scanning Electron Microscopy techniques were exploited. The entire thesis has been divided into three chapters. A curtain raiser and Chapter-wise analysis of the entire thesis are briefly presented in the following paragraph.

Chapter – I, the general introduction, includes the introductory aspects of the subject mater and gives an exhaustive description of the role of coal is total energy scenario. Origin of coal, which covers formation of coal, rank of coal (peat, lignite, sub-bituminous, bituminous, semi and anthracite coal), chemical constitution of coal including structure of coal, classification of coal, the mineral matter and inorganic impurities present in coal (inherent mineral matter and extraneous mineral matter), which includes a full catalogue of minerals generally found in coal, and also the trace elements. Other major impurities viz. sulphur present in coal are also described in some details. Next the general aspects of analysis and characteristics of coal are dealt with in some detail, followed by a general treatment of the identification and characterization of minerals in coal by different instrumental techniques, which also includes the theory and principles of instrumental techniques used in the present work namely XRD, IR and Thermal analysis. Describing the role of inorganic impurities (sulphur) Minerals and trace elements in the coal conversion processes, combustion in particular, a global survey of literature has subsequently been presented, followed by the Indian Scenario, covering the work done on Indian coals on these aspects. This chapter has been concluded by pinpointaing the aims, objectives and scope of the present work.

Chapter II, the general experimental, deals with the experimental methods / procedures followed for the chemical analysis of the coals and the characterization of minerals present therein. After describing the coals selected for this work and the

coalfields from where they were obtained, the methods of preparation of sample for the analysis including proximate and ultimate analysis, determination of calorific value, etc are briefly described, Furthermore,the procedure for the determination of chemical composition of coal ash as also the experimental procedures for each of the instrumental analysis techniques (XRD, IR and SEM) used for the identification and characterization of different mineral species present in the coals of the present study and their respective ashes are also described in this chapter.

Chapter III is exclusively devoted to the experimental results of the chemical, and the mineralogical characteristics of all the afore-mentioned coals of Jharia, Wardha Valley, and Jammu & Kashmir coalfields.used in the present work. For clarity and better understasnding, this chapter has been divided into two parts : part-I dealing with Jharia and Wardha Valley coals (Gondwana formation) and the Part-II dealing with Jammu coals and Kashmir lignite (Tertiary formation). In various sub-sections of both the parts of this chapter, results on the mineralogical characterization by XRD, IR , Thermal Analysis (DTA/TGA)and Scanning Eloectron Microscopy are separately reported. Followed by this is a general discussion of the results, followed by correlation of mineralogy with geological formation of the coals. The variations in the mineralogy of these coals have been explained in terms of the allochthonous or drift mode of Gondwana and Tertiary coal formation, to which they belong.. Finally, in the light of all the chemical, fuel and mineralogical parameters taken cumulatively, the utilization potentials of these coals for different industrial end uses have been examined.

The Thesis has been concluded in a separate chapter, "Summary and Conclusions", in which important findings and conclusions arising from this work have been summarized and highlighted.