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APPLIED MINERALOGY IN SCIENCE AND TECHNOLOGY

PREFACE

This issue of *The Canadian Mineralogist* contains papers read at the GAC–MAC annual meeting in Fredericton in May 1985, at which time four special sessions were held under the title "Applied Mineralogy in Science and Technology". These sessions were the first ever held that the Association devoted to the applied aspects of the science. This emphasis reflects a world-wide trend to an increased appreciation of the importance of knowing the "mineralogy" of substances. Mineralogy is an old science, with its roots in the arts of the ancient alchemists. For long, its industrial use was recognized by only a few. Substances were all too frequently characterized by their elemental chemical composition only, and little attention was paid to their mineral constituents, real or synthetic. Now, the importance of information on their physical and chemical characteristics and of their relationship to other phases is recognized in order to adequately characterize a substance. This is, in part, crystal chemistry, which is a splendid term now rarely used.

The differences in the practice of applied mineralogy as opposed to mineralogy as a pure science are sometimes tenuous. "Commercial" and "practical" are usually associated with the applied. Both depend on performing good science and the rigorous pursuit of technical answers. At its best, applied mineralogy starts with an industrial problem and purposely uses mineralogy to solve it. At the other end of the scale, it is the fortuitous practical application of a mineralogical result from an exercise in basic science.

The growing appreciation of the usefulness of applied mineralogy reflects the push/pull relationship between technological supply and industrial demand. Without the tools with which to provide information, the uses of applied mineralogy are limited. No matter how skilled the manipulation of the polarizing microscope, it took a long time to obtain information, and even then the information was incomplete. The advances in instrumental analysis that have allowed accurate determination of chemical composition of smaller and smaller grains and thinner and thinner surface-layers provide a wealth of information that can be applied to solve industrial and scientific problems. The development of electron-microprobe analysis, automatic image-analysis, ion implantation and other techniques, together with the computerized refinement of results, yield important mineralogical information. Not only can chemical composition be measured, but information also is obtained on ionic species, together with surface characteristics, grain size and shape and the relationship between adjacent entities. There are now both quality and quantity of information not previously available.

Undoubtedly, economic factors have been important in popularizing applied mineralogy. The mining industry as an example, hard pressed to remain financially viable, has had to use all means possible to increase earnings. Mineralogical studies of ores and concentrate products have proved their worth in understanding the behavior of the valuable ore-minerals in the grinding and processing circuit, thereby leading to additional recoveries. Improved recovery of some elements, as in the case of silver formerly lost to tailings, has led to significant increases in revenue. In other cases, the refinements in the process circuit have turned a losing operation into a profitable one.

Applied mineralogy has come into its own, and demands for this type of information are becoming increasingly routine. Phrases such as the following are becoming common in work orders: "Profitable extraction of valuable minerals demands an understanding of the process mineralogy . . . An applied mineralogical study can provide a quantitative basis for evaluation and recommendations on process schemes and recovery predictions . . ."

Thirty papers were read at the Fredericton meeting. Topics covered coal utilization, mineral processing and smelting, industrial minerals, occupational health and technology in general. The papers on coal mineralogy dealt with the problem of removing pyrite in order to reduce the sulfur content, the role of microscopy in coke production and the use of microscopy in examining the residues left from the conversion of coal to liquid petroleum products. Most papers, as could be expected, focused on ore mineralogy for beneficiation and smelting purposes. These dealt with techniques such as analysis of trace silver by SIMS and with the use of mineralogy to improve gold recovery from refractory ores and the reduction of chemical corrosion in transfer ladles. Equally important was the application of mineral investigations to solve industrial problems of concrete deterioration, the opacity of paper, rock cutting with water-jet drills and architectural conservation. The uses of biomineralogy were applied to pneumoconiosis and nephrology. That the subject has come into its own is shown by the papers read at the GAC–MAC meeting. Only a small number are presented here for the readers of the journal.

As convenor of the special sessions, I take this opportunity to thank the GAC–MAC meeting organizers for having this special session. In addition, Dr. Jeffrey Levine, of the School of Mines and Energy Development, University of Alabama, accepted to act as associate editor covering the field of coal petrology; Dr. Robert F. Martin, editor, shepherded the manuscripts submitted through the review process. Finally, I acknowledge the award of a special grant in aid of publication of this special collection of papers from the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources Canada.

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