PREFACE

Most of the North American continent is underlain by long-cratonized crust. However, the geologists', geochemists' and geophysicists' attention is mainly focused on the surrounding mobile megabelts. Only few publications consider the North American craton as a whole and attempt to review its entire history from the Late Archean to the present. Even in the last, as yet unfinished synopsis, created under the label *Decade of North American Geology (DNAG)*, the geology of the craton is divided between volumes separately considering the Canadian Shield and cratonic platforms, platformal cover and basement, in the U. S. and Canada.

This separateness reflects a real disconnection between professionals in different countries, provinces or states (consider the well-known border "faults"), industries and branches of geology - hard-rock and soft-rock. Hard-rock geologists are trained in igneous and metamorphic petrology and related disciplines. Soft-rock geologists specialize in sedimentology and disciplines related to it. Geologists in these two groups concentrate on different practical tasks, use different data, read different journals. The gap between them is great, and the links weak.

Tectonics in these two fields of knowledge usually focuses on different rocks: crystalline shields and platformal basement, or unmetamorphosed sedimentary cover. Their interrelationship is often reduced to just so-called basement influences on the distribution of provenance areas and structure of sedimentary basins. Worse, tectonics is commonly equated with just the structure of the crust or its parts, ignoring other manifestations of tectonism. The dynamic causes of tectonic events are often presumed to be located away from cratons and even away from continents.

In such a partition, tectonics often loses its identity as a specific geological discipline, and regional tectonics misses the principal focus of its exploratory effort. Tectonics relies on systematic knowledge of a endogenic geodynamical processes, which are expressed in their four principal aspects: tectono-sedimentological, tectono-magmatic, tectono-metamorphic (including all kinds of alteration), and tectono-deformational. These aspects of tectonism are observable through geologic mapping of the crust. Geo-

logic mapping is more than just compilation of geologic maps (which are the usual final product). It includes direct observation and description of rock types and their areal distribution, as well as observation, measurement and description of rock bodies and their spatial and temporal relationships. This information is supplemented with the results of drilling in many areas of soft and hard rocks.

Tectonics synthesizes the findings from field mapping and from many related specialized disciplines - petrology, paleontology, etc. A tectonist's job is to combine into an internally consistent concept a broad range of facts and data from different fields of industrial, academic and scientific activity. From a huge volume of diverse information, he/she must select that which permits to evaluate the observed phenomena induced by endogenic processes in the lithosphere. Tectonic analysis is carried out in the four aspects: tectono-sedimentary, tectono-magmatic, tectono-metamorphic, and tectono-deformational.

In this book, we use this integrated approach in some detail, primarily with examples from the Northern Hemisphere, the North American craton, and particularly the Alberta Platform in it. This approach is rock-based and fact-driven, and that gives it realistic predictive power. This book is thus not about plate tectonics, nor terrane tectonics, nor tectonic modeling, but rather it is about non-speculative tectonics of cratons, which are the largest parts of continents. Cratonic regions are the most suitable areas for human habitation, agriculture, and industry. They contain enormous natural resources - oil and gas, coal and salt, bauxite, titanite sands, and various construction materials. These regions provide clues to the understanding of the entire continental and global tectonics.

This book is intended for those whose job is to manage the existing resources and find new ones, maintain and develop the urban and rural infrastructure, transportation, and environment. It is also intended as a tutorial for young geologists interested in studying regional tectonics and practical applications of tectonic knowledge. Of course, proper understanding of the tectonic fundamentals would enhance their use for prognostic purposes. To help the practitioners and students inspired by practical societal needs is the main purpose of this book.

A crucial point is that *geologic field mapping was, is and will remain the principal source of regional tectonic information*. Deep drilling has added a lot of information to what is known from surface studies. Deep continental drilling through crystalline rocks

provides invaluable information about the endogenic regimes, putting unshakable constraints on speculations about the crust. We are now also blessed with many auxiliary techniques - geochemical, isotopic, radiometric, geophysical, remote-sensing, experimental - as well as with a strong mathematical apparatus and computer capability for data processing and modeling useful for some tectonic tasks. These techniques and tools put a new burden on the modern tectonists - to be familiar not only with a wide variety of relevant factual geologic data and analytic results, but also with the potential and limitations of a great variety of methods, techniques and procedures used in obtaining geochemical and geophysical information.

Tectonics is in fashion these days. Paleontologists and volcanologists, hydrogeologists and stratigraphers, geophysicists and geochemists try to leave their mark by applying their findings to tectonics. The pursuit of tectonic applications may, however, distract the specialists from their work, causing them instead to enter the realm of uncertainty and speculation. Only deep knowledge of all four aspects of tectonics, and skills to apply them properly to particular areas, provide the antidote against groundless speculation conferred by healthy skepticism.

Tectonics, like geology itself, embraces practice and theory, local descriptions and regional generalizations. Tectonics, like all of geology, is the practice of mineral and petroleum exploration, as well as a science dealing with the evolution of geologic systems. Like geology, tectonics, as a science, is descriptive and restricted to rock-made bodies (the largest of which is the lithosphere). Tectonics, like all of geology, is a science of principles, i.e. empirical generalizations no less meaningful than the principles which are mathematically described and physically modeled. In this book, the reader will find little speculation, and lots of skepticism about one-sided physical and chemical solutions to the problems of regional tectonics. The reader will find examples of careful use of these principles in some of the best-studied areas of the North American craton: parts of southern Canadian Shield and western Interior Platform.

Not least, this book is aimed at readers who would stay with our logical development from the beginning to the end. It would require time and patience. But we will try to make the readers' efforts worthwhile.

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