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Edited by Robert G. Coleman and Xiaomin Wang
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Recent discoveries of diamond and coesite in the upper crustal rocks of the Earth have drastically changed scientists' ideas concerning the limits of crustal metamorphism. Previously, it was thought that such ultrahigh pressure minerals could form only in the Earth's deep mantle or as a result of high energy impacts of extraterrestrial objects on the Earth's surface.

In examining the geological aspects of diamond and coesite in the Earth's crust, this book attempts to define an entirely new field of metamorphism. In doing so, it provides unique insights into the formation of diamond and coesite at very high pressures and explores new ideas regarding the tectonic setting of this style of metamorphism. After presenting a general overview of the geology and tectonics of UHPM, the text relates experimental and petrogenetic studies of UHPM minerals to *P-T* stability fields. Then the principal mineralogical indicators of UHPM are discussed, and details relating them to possible new, yet undiscovered areas are outlined. Several chapters discuss the structural style of the deformation of these UHPM rocks, relating them to subduction and continental collision. Estimated thermal and kinetic parameters are modeled to produce constraints on the conditions leading to UHPM. Separate chapters provide petrologic and tectonic accounts of UHPM occurrences in the Western Alps, Norway, China and Russia, as well as of the UHPM peridotites in Ronda, Spain and Beni Bouchera, Morocco.

This book will be of particular interest to researchers and graduate students of metamorphic petrology and global tectonics.

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ULTRAHIGH PRESSURE METAMORPHISM

Edited by

ROBERT G. COLEMAN XIAOMIN WANG

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Preface

The new discoveries of diamond and coesite previously thought to form only in the mantle or under cataclysmic conditions have mobilized the petrologic community into an intense search throughout the world for new occurrences of these minerals in crustal rocks. The advancement in petrologic knowledge has taken shape in three separate and interconnected spheres that have allowed us to explore further into the depths of our planet. Continued high temperature and pressure laboratory experimental synthesis produced heretofore unrecognized naturally occurring species that initiated a search for these minerals in nature. Identification and chemical analysis of micron-size mineral inclusions in resistant minerals by the electron and ion probe have provided the ground truth for verifying the presence of such ultrahigh pressure minerals (UHPM) occurring naturally. At a much different scale, geophysical seismic profiles across young orogenic zones containing UHP minerals, such as the Alps, reveal that fragments of subducted crust indeed penetrate into the mantle and that plate movements are capable of moving crustal materials to such great depths. In all new discoveries, such as this one, there has been an enthusiasm developed for discovering yet another occurrence of diamond or coesite. Nearly a decade ago these discoveries were not predicted, and so the reality of these new finds is only now being considered by the earth science community; therefore, we can look forward to new paradigms explaining the origin of UHP minerals.

Our efforts to recruit experts in this field so as to collate the rapidly expanding field of UHPM into a book started three years ago. Since that time new discoveries have been made, and amazing progress in explaining the tectonic setting of such occurrences is developing. This book is designed to bring together our knowledge and to provide a forum to describe carefully certain occurrences. We have no illusions that at least some of the data given in this book will become anachronistic before it is published, but these col-

lected chapters provide a starting point for anyone interested in this exciting new development in earth science.

Our chapter authors have done an excellent job in summarizing the data up to this time, and we would like to thank them for their contributions and insights. We would also like to acknowledge the efforts of reviewers who have given us insights and materially improved the expression and content of the chapters. The enthusiasm and counseling of Catherine Flack, our Cambridge editor, has been of great help to us during the preparation of this book.

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