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Foreword

High-Pressure Mineral Physics Seminar, 9th Edition



Mineral physics studies provide unique information on the physical, chemical, thermodynamic, and transport properties of the rocks, minerals, and melts that constitute planetary interiors. This information, combined with geophysical, geodynamical, and geochemical observation and modelling, provides a unique tool to constrain the structure, composition, and dynamics of the Earth. As the exploration of pressure and temperature domains now reach terapascal pressures and tens of thousands of kelvins, mineral physics is also open to the study of Earth-like exoplanets. Mineral physics also bridges the gaps between many other disciplines, including solid-earth geophysics, geochemistry, crystallography, experimental petrology, and crystal chemistry.

A consensus places Francis Birch's landmark paper (F. Birch, *Journal of Geophysical Research*, 57, 227–286, 1952) as the article that marked the birth of mineral physics, the science of materials composing the interior of planets, particularly the Earth. Mineral physics will soon reach the canonical and respectable age of 70 years, during which this research area has undergone mutations and revolutions, and benefited from a series of devoted international conferences: the High-Pressure Mineral Physics Seminars. These seminars were initiated in 1976 by scientists from the United States and Japan and were first called the “US–Japan seminar”. The first US–Japan seminar was convened by Murli Manghnani and Syun-iti Akimoto at the University of Hawaii in Honolulu (United States) in 1976. Since then, meetings have been organized every five years and their name morphed into “High Pressure Mineral Physics Seminar” when one was first held outside of the United States or Japan: HPMP5-6 was organized for the first time in Europe in Verbania (Italy) in 2002 and co-sponsored by COMPRES (Consortium for Materials research in Earth Sciences, USA) and attended by numerous European scientists. HPMP5-7 was later on organized by our Japanese colleagues in Matsushima (Japan) in 2007, one of Japan's most idyllic and gorgeous scenic venues. An important aspect of this meeting series is the publication of

proceedings that, akin to a snapshot in time, highlight the scientific and technical progress in our field, thanks to a wide scope of high-level contributions. Previous volumes were published by the American Geophysical Union, in 1987, 1992, and 1998, as *Geophysical Monographs* (volumes 39, 67 and 101, respectively) and in 2003 as a special issue of *Physics of the Earth and Planetary Interiors*. The special volume issued after the 7th High Pressure Mineral Physics Seminar (HPMP5-7) held in 2007 in Matsushima (again published by *Physics of the Earth and Planetary Interiors*) consisted in a collection of experimental, computational, and theoretical research and review papers relating to recent “Advances in Mineral Physics: from Deep Mantle to the Core”. With the Joint 2012 COMPRES Annual Meeting and 8th High-Pressure Mineral Physics Seminar organized in Tahoe City, California, Y. Wang and J.A. Tyburczy described a *new era* in Mineral Physics with new advances in high-pressure science and experimental techniques and announcing a more concerted commitment to mineral physics in the years to come.

We are delighted to introduce and share the results of this commitment; the 9th edition of the High-Pressure Mineral Physics Seminar took place in Saint-Malo, France, in September 2017. It was the first time the meeting was hosted in France, and it was also the first time it opened to and welcomed a delegation of Chinese attendees, with promises of extension of our mineral physics community to China in the years to come. For this 9th edition, we had the opportunity and pleasure to gather mineral physics pioneers such as Jean-Paul Poirier, Bob Liebermann, Takehiko Yagi, Murli Manghnani, Eiji Ohtani, and Tetsuo Irifune.

This special volume includes 28 original articles covering a large number of fields such as equations of state and elastic properties, phase relations, phase transitions and kinetics, rheological and transport properties, vibrational properties, and the study of melts and partial melting, all of which address questions relevant to Earth, planetary mantles and cores, including those of Super-Earths. A special session was also held on experimental

techniques and computational mineral physics. We are convinced that mineral physics is promised to a brilliant future, as it will take advantage of new technological capabilities while further diversifying the researchers and fields of investigation.

We would like to thank here the French laboratories, research programs, and the CNRS (see logos below), for their financial support and precious help in organizing the program and the conference. We are grateful to Ms. Nalini Loret and Ms. Hortense Apan from IMPMC (CNRS and Sorbonne Université) for their exceptional organizational and logistical skills, without which the meeting would not have been possible.

We would like to thank our distinguished international guest editors Bob Liebermann, Eiji Ohtani, and Yanbin

Wang, whose countless efforts and seemingly infinite energy made this volume possible.

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