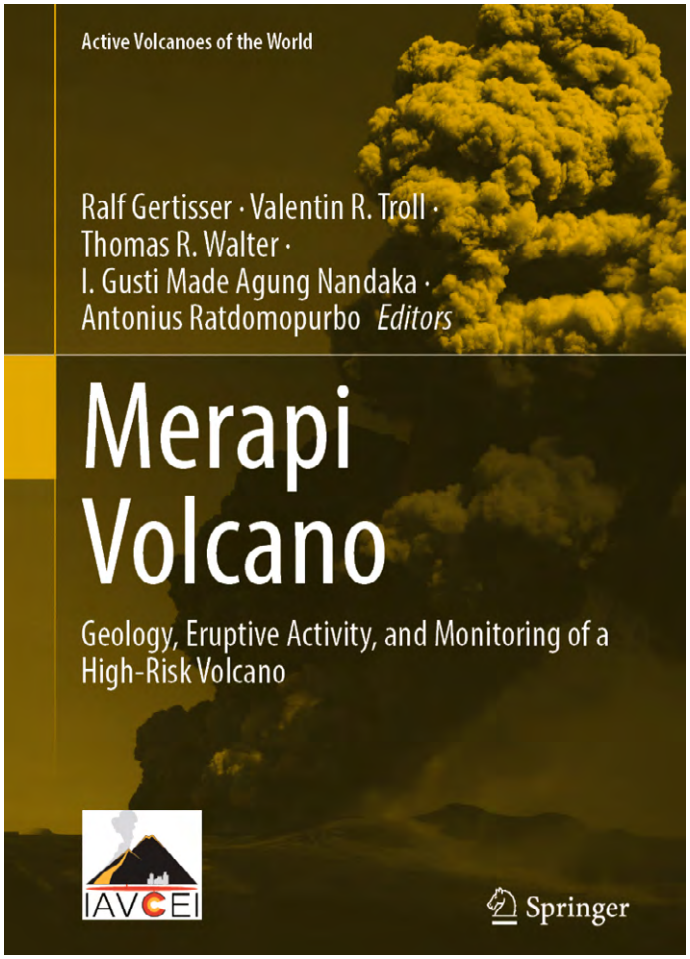
MERAPI VOLCANO, Springer

The latest addition to Springer's Active Volcanoes of the World book series, ***'Merapi Volcano – Geology, Eruptive Activity, and Monitoring of a High-Risk Volcano'*** provides the first comprehensive compilation of cutting-edge research on Merapi volcano on the island of Java, Indonesia. As one of the world's most frequently active and iconic volcanoes, Merapi is perhaps best known for its pyroclastic density currents, which are produced by gravitational or explosive lava dome failures (traditionally referred to as Merapi-type nuées ardentes). Merapi's eruptions have posed a persistent threat to life, property and infrastructure within the densely populated areas on the volcano's flanks, as demonstrated most recently by the catastrophic eruption in 2010.

In a collection of **18 chapters**, authored by **67 scientists** from Indonesia and abroad, and edited by Ralf Gertisser (Keele, UK), Valentin R. Troll (Uppsala University, Sweden), Thomas R. Walter (GFZ Potsdam, Germany), I Gusti Made Agung Nandaka (BPPTKG, Yogyakarta, Indonesia) and Antonius Ratdomopurbo (Geological Agency of Indonesia, Bandung, Indonesia), the book integrates, in 572 pages, the latest results from both the natural (geology, petrology, geochemistry, geophysics, physical volcanology) and social sciences, and provides state-of-the-art information on volcano monitoring, the assessment of volcanic hazards, and risk mitigation measures.



Following an opening letter by John Pallister and Jake Lowenstern (USGS), and a foreword by Andiani, the Head of Indonesia's Center for Volcanology and Geological Hazard Mitigation (CVGHM), the book opens with a review of the scientific exploration and discovery, and the history of volcano monitoring at Merapi by Gertisser and co-authors (**Chapter 1)**.

In **Chapter 2**, Lavigne and co-authors describe the physical environment and human context at Merapi, exploring the complex balance between accessing livelihoods and coping with volcanic hazards, drawing on lessons from the catastrophic eruption in 2010 and its aftermath.

In **Chapter 3**, Holmberg shows how an understanding of culture, ancient Javanese traditions and long-held beliefs, which remain prevalent today, is crucial for hazard communication, crisis response and risk reduction. The geological and tectonic setting, and the stratigraphy of the surrounding area and likely basement of Merapi is introduced by Harijoko and co-authors in **Chapter 4**. In **Chapter 5**, Lühr and co-authors review the large number of geophysical investigations at Merapi that have provided a detailed image of the magma-plumbing system, synthesizing information from large active and passive seismic experiments, gravity, tilt, GPS, electrical resistivity and ambient noise tomography data, and earthquake locations. A review of the geological history, chronology, and magmatic evolution of Merapi, and how the knowledge of the structure and stratigraphy of the volcano evolved, is given by Gertisser and co-authors in **Chapter 6**. An important contribution by Bronto and co-authors (**Chapter 7**) describes the discovery of a large debris avalanche deposit of Merapi and discusses the implications for the volcanoes structural evolution and potential future sector collapses. **Chapters 8-10** cover various petrological aspects of Merapi's magma plumbing system. In **Chapter 8**, Troll and Deegan characterize the petrology of Merapi lavas and the suite of inclusions found at the volcano and explore their petrogenetic significance. In **Chapter 9**, Preece and co-authors look carefully at the textural characteristics of phenocrysts and microlites, with a goal of understanding the timescales of crystallization, the interplay between crystallization and ascent rate, and the implications for eruption mechanisms and explosivity at Merapi. Deegan and co-authors (**Chapter 10**) summarize evidence for assimilation, metasomatism, and metamorphism of limestone in the Merapi magmas and show that gas production through metamorphism is an important process that increases the explosivity and consequently the hazards of Merapi's eruptions. The history and evolution of volcanic gas studies at Merapi are detailed in **Chapter 11** by Nadeau and co-authors. The authors demonstrate that studies of gases provide critical additional insights into recent eruptions and have improved understanding of magma ascent and evolution. **Chapter 12** by Subandriyo and co-authors covers the large-magnitude VEI 4 eruption of Merapi in 2010, the worst volcanic disaster at the volcano in 80 years, describing comprehensively eruption chronology, monitoring data, volcanic deposits, petrology, eruption impact, emergency response activities, and civil protection measures. Budi-Santoso and co-authors (**Chapter 13**) thoroughly document the history and current implementation of the monitoring system at Merapi, which is now the most modern and elaborate in Indonesia. In **Chapter 14**, Walter provides a review of synthetic aperture radar (SAR) and interferometric SAR (InSAR) methods, explaining how Merapi has served as a laboratory volcano, where these remotely

sensed radar data have helped track deformation, estimate rates of lava dome extrusion, map and estimate volumes of pyroclastic deposits, detect eruption plumes, evaluate damage, and assess risk. In **Chapter 15**, Darmawan and co-authors review the use of unoccupied aircraft systems (UAS) at Merapi, describing how high-resolution imagery and photogrammetric structure-from-motion (SfM) analyses have been used to interpret dome growth and explosions in the summit crater. Charbonnier and co-authors (**Chapter 16**) consider the hazards of pyroclastic density currents – the deadliest volcanic phenomenon at Merapi – explaining how these and other hazardous phenomena are represented in hazard maps used to reduce risk. In **Chapter 17**, Thouret and co-authors give a comprehensive review of lahars, another common phenomenon at Merapi, describing their physical characteristics and deposits, spatial and temporal distributions and flow regimes, as well as impacts, geophysical signals, and warning systems. The chapter also presents the first use of FLO-2D computational lahar simulations at Merapi. The book closes with **Chapter 18** by Nandaka and co-authors, who describe how Merapi has served as a laboratory volcano for Indonesia and the world, and how it may help to address fundamental scientific questions in volcanology and risk mitigation in the future. In addition to summarizing post-2010 activity and the unusual present growth of two lava domes at the summit, they explore longer term trends and examine what is needed to prepare for future eruptions, some of which could be stronger and longer lasting than that of 2010.

This comprehensive collection of the latest research summarized in a single, 18-chapter book has been termed 'monumental' (Corado Cimarelli) and a must read for any student of Merapi volcano (John Pallister).