

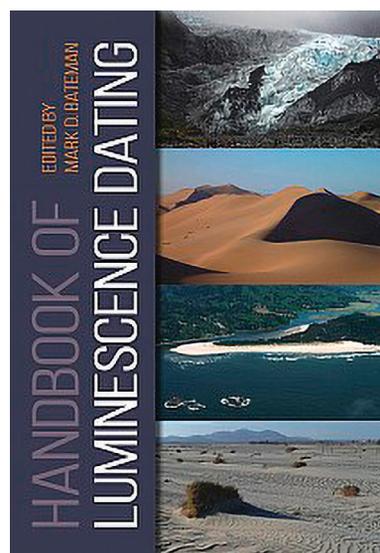
## HANDBOOK OF LUMINESCENCE DATING<sup>1</sup>

Quartz and feldspar are ubiquitous and amazing minerals because they record a stored signal that can be accessed to establish the time that elapsed since that mineral was last exposed to sunlight (or heated from ~100 °C to 400 °C). In the *Handbook of Luminescence Dating*, a cast of expert-practitioners explore the wide range of luminescence dating applications that are employed by Quaternary scientists, archaeologists and geologists. The authorship, well-chosen by Mark Bateman, includes scientists from across their career ranges and from a broad geographical swath of academic institutions. Appropriately for a book published in English, the authors are dominated by native English speakers, but include a handful of European voices. Readers interested in exploring the fascinating literature beyond this book will learn of the rapid growth of luminescence dating within China and of the expertise offered early in the technique's development by research groups in India, amongst other non-western research laboratories. Only four of the twelve chapters are co-authored, which may reflect a deliberate decision to achieve a consistency in written style and tone. Further co-authorships could have brought a wider range of perspectives and practical experiences to each of the methodological or application chapters. Five of the eighteen authors are female, which doesn't fully reflect the wider field of luminescence dating where there is greater gender balance and, perhaps, even a current imbalance towards early career female scientists.

The book includes three very useful opening chapters. Chapter 1 takes the reader through the scientific principles of luminescence dating, including interesting historical insights. Chapter 2 explains the field-based decisions and approaches needed to be taken to successfully apply luminescence dating techniques. Chapter 3 provides an explanation of the statistical procedures that are employed in the analysis of chronological datasets. These three chapters achieve clear and concise treatments of their themes and each is written with a skill that holds the reader's interest. Key figures and illustrations provide effective visual aids to help communicate the scientific underpinnings of the luminescence method. The inclusion of diagrams throughout the book is consistently useful. A minor niggle is that the illustrations do not follow a fully uniform style, either in font style or font size. Navigating the themes within the book has been made easy by using clear chapter structures allied to a well-assembled index.

The scope of the eight application chapters is excellent and comprehensive. This ensures that the book will serve as a valuable reference point. It has been designed for readers who are either learning the luminescence dating technique first-hand or are seeking to have a clear idea of what to expect if they are collaborating with geochronologists. The content and tone of the book conveys the fact that luminescence dating methods are far from a plug-and-play commercial service: producing a chronology requires a detailed understanding of geomorphological processes and of the luminescence characteristics of the sample. The implication of this message is that, at the very least, luminescence ages are "coproduced" by the end user (e.g. archaeologist, Quaternary scientist, geomorphologist) and an expert practitioner within geochronology, and that the context of ages are informed by a comprehensive understanding of sediment transport, burial conditions and any observations during field sampling.

Given the wide applicability of windblown depositional sediments for luminescence dating, it is sensible that this book devotes two chapters to this application. Chapter 4 focusses on the sand-sized materials (which, perhaps, should have been reflected in the chapter title), whilst Chapter 5 explores the finer-grained loessic material. Both chapters draw on a wide range of global applications and case studies to explore oppor-



tunities, challenges and developments. Chapter 6 focusses on glacial and periglacial environments, with an appropriate emphasis on the need to understand geomorphological processes and depositional context. That message is reiterated in Chapter 7 on fluvial and hillslope applications, which are shown to have a very wide and successful range of dating applications. Chapter 8 covers sediment dating in coastal and marine settings, which are environments where an increasing number of successful applications are being made, despite the setting presenting additional methodological challenges (e.g., dose-rate calculations in marine sediments). In Chapter 9, the promise of the contribution of luminescence dating to understanding the behaviour of tectonic faults and the generation of earthquakes is explored, alongside a recognition of methodological challenges in this setting. Archaeological contexts are outlined in Chapter 10: there is great demand for luminescence as a geochronological tool in archaeology but there are challenging research questions and technical methodological issues to be addressed. The relatively new field of rock exposure dating is described in Chapter 11, which includes a comprehensive overview of the equations and models used. The book has a logic to the chapter order, leading from rock exposure dating in Chapter 11 to the final Chapter 12 on future developments in luminescence dating. This detailed, yet concise, final chapter picks up on the themes and challenges explored throughout the book and highlights additional developments relating to technology and equipment, including field-portable luminescence readers, the use of radiography to image spatial variations in dose rate, and charge-coupled devices for use with scientific cameras to spatially resolve luminescence signals within a range of materials.

This book will certainly be a useful resource for undergraduate, masters and doctoral students. Each application chapter gives very clear examples. Importantly, the message that luminescence dating is not (yet) a "plug-and-play" commercial technique is clearly demonstrated. Successful luminescence dating requires a nuanced understanding of sample geology and geomorphology, as well as an appreciation of the suitability of individual samples to the range of laboratory protocols that have been, and continue to be, developed. This important point about methodological development is expanded upon in the final chapter on future developments.

In summary, this book is an extremely valuable addition to the literature on luminescence dating. It offers something unique: in one fun, fascinating and informative volume, it introduces all the key principles while illustrating the practicalities and the potential applications. The book aims to prepare those new to geochronology to the luminescence dating technique in an accessible way. It achieves that aim and more.

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1 Bateman MD (ed) (2019) *Handbook of Luminescence Dating*, Whittles Publishing, Scotland, 416 pages. ISBN 978-184995-395-5. £90.00

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