

students and final year undergraduates specializing in low-temperature chemistry.

Oxford University Press have produced this book to a very high standard and for a volume in hardback, the price is fair. For some, however, the purchase of this book is but the beginning and the price of a license for the software is in a different league.

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The Manson Impact Structure, Iowa: Anatomy of an Impact Crater. Geological Society of America Special Paper 302. Paperback, vi + 468 pp. Price US\$99.50, ISBN 0-8137-2302-7. Edited by Christian Koeberl and Raymond R. Anderson.

The Manson impact structure (north-central Iowa, USA), at ~38 km in diameter is one of the largest impact structures in the United States. The crater is filled with a thick layer of sediments and breccias, and for many years following its recognition as an impact structure, its age was put at between 60 and 90 Myr., (i.e., spanning the Cretaceous-Tertiary (K-T) boundary), on the basis of sediment stratigraphy, fission track- and argon age-dating. After the proposal by Alvarez *et al.* (*Science*, 1980) that the extinction at the end of the Cretaceous was a consequence of a giant impact, the search commenced for the site of the impact. The apparent age of the Manson structure indicated that it was a possible candidate for the K-T impact site. On this basis, in 1991 the Iowa Geological Survey Bureau, with the US Geological Survey, conducted an intensive drilling programme across the structure, resulting in the production of over 1000 m of well-characterized drill core from a dozen locations across the feature. The cores were made available for study, and it is the results from these materials that are collected in this Geological Society of America Special Paper.

The book consists of a series of 22 papers, covering all aspects of the Manson impact structure, including historical, stratigraphic, structural, geochemical, isotopic, mineralogical and petrographic descriptions and interpretations. The occurrence and distribution of shock-produced mineral polymorphs and impact melt breccias receive due

recognition. There is discussion of the dynamics of crater formation, and comparisons with craters on the moon and Venus. An introductory chapter contains an overview of other impact craters in the US, for comparison, along with a valuable discussion of the characteristics by which a crater and associated shock features might be recognized, on both macro and micro levels. A major irony of the study has been the precise dating of the Manson structure, at 74 Myr., too old to be implicated as the site of the K-T event. Notwithstanding this disappointment, the comprehensive nature of the investigation has ensured that the Manson structure is now one of the best understood features in the US. The publication is riddled with maps of the Manson structure: geological, geophysical, cross-sections, location, diagrammatic, schematic etc., etc. However (and this is a very minor carp on an otherwise excellent book), I couldn't find a single picture of what the Manson feature actually looks like from the ground (or air) today. I know that the crater is buried in glacial drift and has a town built on it – but surely there must be some giveaway that it is there?

There is an increasing perception of the role impacts have played in shaping the Earth's history. The relatively low number of well-studied craters has hampered interpretation of the cratering record. This publication, co-ordinated, logically organised and comprehensively indexed by the editors Koeberl and Anderson, provides a valuable insight into just one feature on the Earth's surface. The only other craters studied in similar detail are at Chicxulub (Mexico), now known to be the K-T impact site, and at Sudbury (Canada), where major mineral deposits are located. It is too much to hope that other craters not associated with 'newsworthy' features such as extinctions or precious mineral deposits can be studied in such detail, but this exercise on Manson has certainly provided a wealth of detail of immense use to impact and cratering specialists.

As usual, the GSA Special Paper Series has produced a scholarly body of work which will be the baseline reference material in this field for many years to come. It is an excellent publication, for which the editors must be congratulated.

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