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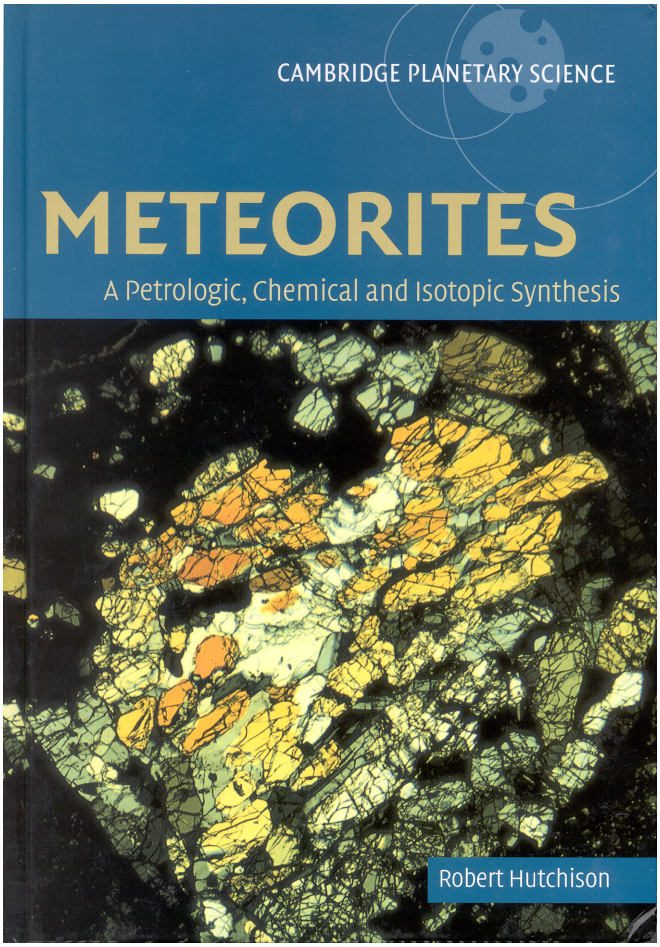
Book Review

Meteorites: A petrologic, chemical and isotopic synthesis, by Robert Hutchinson. Cambridge University Press, 2004, 520 pp., $140.00, hardcover. (ISBN 0-521-47010-2)



If nothing else, reading Robert Hutchison's *Meteorites: A petrologic, chemical and isotopic synthesis* can give a professional meteorite researcher an idea of how broad the multidisciplinary science related to meteorites has become. The book's goals include making the science "intelligible and enjoyable to professional scientists whose training lies in a variety of fields" and serving as an introduction for graduate students and advanced undergraduates. I suspect it will fall short of its goals for those without a background in mineralogy or petrology. However, simply noting the amount of material covered in the 442 pages of text and adding to it the topics close to one's heart that are given brief or no mention leads to the conclusion that a book that tried to be a scientific introduction might inevitably have be as long as the multi-authored *Meteorites and the early solar system* (Kerridge and Matthews 1988) or *Planetary materials* (Papike 1998).

The book's strength is the seven chapters (out of 12 total) that primarily describe meteorites and their components. These comprise four chapters about chondrites (including one about chemistry and classification, one about components, and one each about carbonaceous and non-carbonaceous chondrites) and three about "differentiated meteorites" (really everything non-chondritic, including primitive achondrites, ureilites, and lunar and martian meteorites, as well as the obvious aubrites, HEDs, and irons). Can't remember the difference between a winonaite and a brachinite or between a CR and a CH? Here's the place to look it up. Although they are not always in prominent places, there are several useful tables and figures comparing the petrography, chemistry, and oxygen isotopes of the types.

Another of the book's best features is that Hutchison typically cites the two or three best reviews about each topic introduced. Coupled with a 28 page bibliography, that makes this an excellent reference volume.

One weakness of the descriptive chapters is the production. Although the cover contains a large, attractive, color photomicrograph, the book itself contains no color images. The book contains many images of meteorites. But whether it is a photo of a hand sample, a photomicrograph, or a backscattered electron image, the images of meteorites are typically a few centimeters in largest dimension (frequently having eight and occasionally 10 images to the page). For example, the figure illustrating the different types of chondrules consists of 10 images, each one 3 × 5 cm.

Another weakness as an introductory book is the terminology. While terms like "euhedral," "eutectic," "undulatory extinction," "Fo_{88}," and many others that appear undefined will be understood by most meteoriticists, I suspect they would be daunting to the unsuspecting chemist, physicist, or astronomer trying to break into the field and particularly so for students in these areas. In the obligatory table giving the names and formulas of meteoritic minerals (Table 3.2), the minerals are listed by type, which makes perfect sense to someone who basically knows their minerals, but there isn't an alphabetical cross-listing or index for use by someone looking for an introduction. Even something as basic as a petrologic thin section is never described, nor are

the distinctions between reflected and transmitted light or the significance of crossed polarizers explained. Hence, I suspect this should not be used as an introductory text outside of an earth sciences department. On the other hand, these will not be problems for geologists or for scientists from any discipline who already have a meteorite background and are simply looking to add a good compact reference volume.

As well as these descriptive chapters, there is a good introductory chapter that would be particularly valuable to a newcomer to the field, a chapter about chondrite chronology that includes introductions to various dating schemes, and three chapters about origins: one on the origin of chondrites and their components, one on "parent body processes and petrogenetic associations" (primarily discussing chondrite metamorphism and the relationship, or lack thereof, of HEDs, IIAB irons, main-group pallasites and mesosiderites), and one on the origin of the planets.

Although they are intriguing reading, the "origins" chapters are flavored by the author's "predilections," as promised in the preface. Thus, we find that chondrules formed from disruption of molten planetesimals, CAIs formed via an X-wind process, and Jupiter was a captured body unrelated to the protosolar nebula. While any or all of these views may ultimately turn out to be correct, none is currently close to being a consensus, and the text gives no sense of how close to, or distant from, the mainstream any of these are.

In the contentious case of chondrule formation, 16 different chondrule-forming mechanisms are presented, but shock waves, central to many of the currently popular theories, are mentioned last, and only in relation to material falling onto the protosolar disk. The book concludes with a one-page discussion of life in the Universe that is only peripherally related to meteorites.

As mentioned earlier, there were also a number of topics I was disappointed to see omitted, though of course including everything that any random sample of five meteoriticists have come up with would lead to a larger book than envisioned by the author or the series editors. Such omissions include spectroscopy of meteorites and asteroids, orbital dynamics work of the last two decades, impact production of lunar or martian meteorites, and spacecraft missions to asteroids (either the results so far or the promise for the near future). "Fossil" chondrites and organic materials in meteorites receive only cursory mentions. In addition, some concepts central to long-running arguments, such as the rubble-pile model of chondrite parent bodies or the cooling rates calculated by use of fission tracks, are not mentioned at all.

Besides all of the images, there are also various plots of data. A very welcome feature is the recurring appearance of a standardized oxygen three-isotope plot when discussing different meteorite types or components. The other data plots are also often good, in part because many of them are simply the most appropriate figure from the literature. Although this usually works, a few didn't reproduce well, and there were at least three or four with features not explained in their captions.

I found several typographical errors and a couple of factual ones, but not enough of either to be a distraction. Most readers familiar with the field will probably be more bothered by interpretations that are or are not included.

In summary, how valuable this book is depends on who the buyer is. Professors teaching a course would not probably not want this as a textbook, either because of the amount of mineralogy and petrology assumed or because of the nonstandard theories espoused. It would be a good purchase for a geologist coming into the field; less so for a scientist from any other field. For someone wanting to classify some of the myriad desert meteorites found every year, it would definitely be valuable for the tables and description of how certain types of meteorites are differentiated. Finally, for the rest of us working meteoriticists, it is probably worthwhile as a reference volume.

Timothy D. Swindle
Lunar and Planetary Laboratory
University of Arizona
Tucson, Arizona, 85721-0092, USA

REFERENCES

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