



T. rex and the Crater of Doom, by Walter Alvarez, 1997 (2008 edition), Princeton University Press, Princeton, New Jersey, paperback, xxii + 185 p., USD 16.95, ISBN 978-0-691-13103-0.

T. rex and the Crater of Doom by Walter Alvarez is a fast-paced read. With fewer than 150 pages of text, and written at a general science level, it can be devoured rapidly. This has its pros and cons: readers in 2009 with a geoscience background will already be familiar with the terminology and concepts. Those readers, however, will also know how the story turns out, and would probably like more detail than the book is intended to provide. If you pick it up looking for technical details, or personal conflicts, you will not find them. If, however, you are interested in a swift-moving, geological procedural on the Cretaceous-Tertiary bolide theory written by one of the leading figures in its development, you have found it. (Today the Paleogene and Neogene have replaced the Tertiary; the boundary is now known as the Cretaceous-Paleogene). It succeeds within the limitations imposed by its format and choice of tone, and works well as an introduction to the history of the debate and as a personal story. I found myself interested in finding out more about the process and the debate.

Alvarez chooses to follow the story of finding the crater rather than retell a strict chronological history. The protagonist scientists test and reject leads, chase down red herrings, and finally arrive at the evidence that ties everything together. Brief, slice-of-life interludes are interspersed to give the reader a feel for Alvarez's colleagues. These interludes are interwoven with expository and procedural threads. The first few chapters set the scene, leading off with a depiction of the proposed extraterrestrial apocalypse. Back in the story proper, the introductory work may seem slow to those readers already versed in geology, but in a work that is both fast-paced and short, readers skip forward at their own risk. Skimming is also risky because of the interweaving of background material, personal interludes, and work on the boundary, and because of the way Alvarez's work evolved from tangents.

Tangents that eventually pay off, wrong turns, and misleading evidence are the order of the day. In fact, relatively little goes as expected, as illustrated by the path that led to the discovery of the first iridium anomaly. Alvarez's involvement with the boundary begins with fieldwork to collect material for a project on the tectonics of the Italian microplate, which reaches a dead end but then turns into a magnetostratigraphy project, where he becomes familiar with K-T boundary clay. His interest in foraminifera turnover at the boundary leads to a project to de-

termine the duration of boundary clay deposition, where he opts to use iridium (as a proxy for meteoritic dust) after beryllium-10 proves unworkable. Once Alvarez learns of the iridium anomaly, the personal interludes drop out and the structure of the story becomes a more straightforward presentation of the paths he and his colleagues take as they move from hypotheses about mass extinction to, eventually, the discovery of Chicxulub.

This doesn't mean that these paths run any smoother than those that led to finding the iridium anomaly in the first place. The first possibility for the anomaly that Alvarez and colleagues examine is a supernova, and at first plutonium-244 isotope work seems to confirm this origin, only to be shown as an error. This is something of a running theme in the second half of the book: misleading data taking Alvarez and others into promising dead ends. As the first results are published, it's charming to realize the audacity of that first Alvarez et al. proposal of the Cretaceous-Tertiary impact hypothesis. All there was for it at hand were a couple of sites with iridium anomalies associated with near-extinction of planktonic foraminifera, evidence that a supernova wasn't responsible, and a mechanism for extinction via dust-induced darkness.

The book's momentum falters in the following chapter as directions of inquiry scatter during the decade leading up to the (re)discovery and publication of Chicxulub. Part of the scatter is due to the lack of a suitable crater and various lines of evidence coming up with seemingly conflicting results for where to find it. Spherule composition puts the searchers on the track of an oceanic crater, but shocked quartz, while strongly supporting the impact hypothesis, points to a continental location. There is also Deccan volcanism to consider as well as sidetracks such as Nemesis and the Manson crater. The multiplicity of aspects under consideration condenses in the next chapter when Alan Hildebrand follows tsunami deposits around the Gulf of Mexico to the Yucatan. The overlooked line of evidence leads to an overlooked structure, published by oil geologists Glen Penfield and Antonio Camargo Zanoquera as an impact crater in 1981. This, of course, is what is now known as the Chicxulub crater. As before, the momentum of the book slackens a bit in the aftermath as Alvarez seeks to tie up loose ends.

While *T. rex and the Crater of Doom* is ultimately successful in its aims, there are a few factors other than the book's format that hinder it, particularly the use of uniformitarianism as a

strawman. Alvarez chooses to not detail personal conflicts and handles the passions engendered by the debate with scientific detachment; the writing style is polite to a fault. Every named individual who brings up objections to the bolide theory is treated professionally. While this detachment is commendable, the concept of uniformitarianism is substituted in place of personal conflicts as an antagonistic force. It is difficult to use a faceless concept as an antagonist without the concept becoming a strawman, and opposition becoming overly triumphal. In this case, the use of uniformitarianism does not work; attacking a concept is too easy, and the point is made often enough that it draws the reader out of the story. Readers with backgrounds in vertebrate paleontology may be more sensitive to this because it resembles the use of orthodoxy as a target. The presentation of uniformitarianism as such a strong force also makes the depictions of the various scientists less believable; if the prevailing paradigm were so powerful, one would expect its adherents to put up more of a fight. Reviewing with years of hindsight, the lack of passion makes the debate seem less realistic.

The passage of time and changes in geology since the described events may also pull the reader out of the story, though this is not the fault of the book itself. Many people in the geosciences today were born after the publication of the iridium spike and began study long after Chicxulub was published. For these people who grew up with dinosaur-killing impacts dramatized in

television documentaries, a time when bolide impacts and their potential to cause extinctions were not taken seriously is not part of their history. Readers from the recent side of the divide may find themselves having to step back from what they know, unlike those who were active at the time, or readers with little to no geology background at all.

T. rex and the Crater of Doom is an odd case. For a geoscience audience reading it in 2009, it is not as satisfying as it could be because of its brevity and general science reading level. Readers looking for an exhaustive history of Alvarez's work on the Cretaceous-Tertiary extinction will shoot through this book and leave looking for more, whereas those interested in an introduction or a first-hand view of the process will find it more useful. The writing has an engaging conversational tone throughout most of the book, but the uniformitarianism strawman drains some of the life out of the story. Within its chosen limitations, though, it succeeds, becoming more than a historical artifact.

Justin Tweet

Paleontology Research Assistant (Guest Scientist)
National Park Service, Geologic Resources Division
9149 79th St. S.
Cottage Grove, MN 55016
USA
jtweet.nps.paleo@gmail.com