

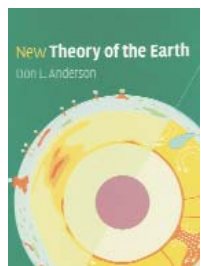
Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and to stop nuclear terrorism. One issue concerns the Comprehensive Nuclear Test Ban Treaty (CTBT) for which the US Senate declined to give its advice and consent in 1999. Since then, the UN General Assembly has elected five times to support the CTBT, with a cumulative vote of 870 to 7 (5 negative votes for the US, 1 for Palau, and 1 for North Korea). The September 2007 conference intended to encourage the CTBT into force had 106 nations in attendance, including Iraq, Iran, Pakistan, China, and Russia—but the US, India, and North Korea were absent. I believe the viability of the CTBT affects the viability of the NPT.

Bernstein's complex book is well crafted, and his descriptions are insightful; I caught only a couple of minor errors. For example, does the photo on page 22 depict Enrico Fermi joking about the fine structure constant? I was glued to *Nuclear Weapons*, even after having read Rhodes and other authors. It is sobering to realize that without the existence of a rare isotope (uranium-235) of a moderately rare element or the use of many particle accelerators, we would not be confronted by a global nuclear threat. Nuclear physics is less studied today than it was between 1930 and 1980. Today's new PhD-holders do not know about spontaneous fission of plutonium-240 and obtaining tritium from lithium deuteride. *Nuclear Weapons* should be required reading for any physics undergraduate, as it can educate the next generation on such matters. Those who want to extend their study can then move on to Rhodes's magnum opus.

New Theory of the Earth

Don L. Anderson
Cambridge U. Press, New York,
2007. \$70.00 (384 pp.).
ISBN 978-0-521-84959-3

Don L. Anderson's *New Theory of the Earth* is the much-anticipated, second edition of his monograph on the internal structure, composition, and dynamics of our home planet. The release of



of the first version, *Theory of the Earth* (Blackwell, 1989) roughly coincided with the 200th anniversary of the classic, similarly titled treatise by James Hutton, the founder of modern

geology. In the new version, Anderson updates the important factual material that earned his first edition its stellar reputation, and he adds his own perspectives on the enduring controversies that make debates about Earth's interior so lively.

What sets *New Theory of the Earth* apart from other books on this subject is its broad scope, drawn from the vast storehouse of information the author assembled from every branch of solid-Earth science. Anderson, a professor emeritus of geophysics in the division of geological and planetary sciences at Caltech, asserts, quite rightly, that the traditional disciplines have fostered overly narrow views of Earth's interior. Geochemists, seismologists, petrologists, and geodynamicists often see Earth so differently that it is easy to forget we are all looking at the same planet. Anderson succeeds in counteracting this tendency by offering a genuinely interdisciplinary perspective of Earth, delivered in his engaging yet authoritative style.

The focus of the book is Earth's mantle, the mostly solid silicate and oxide shell between the crust and the core, that makes up about two-thirds of our planet's mass. The mantle largely controls Earth's internal dynamics and its long-term evolution. Anderson approaches the twin problems of interpreting mantle structure and inferring its dynamics by synthesis rather than by analysis. His skill for combining widely diverse observations into a coherent picture is on full display in the book. It must be said that not all of his interpretations reflect the community's consensus. For example, he infers that compositionally derived buoyancy forces are on a par with thermally derived buoyancy forces in the geodynamic engine; by contrast, the conventional interpretation is that thermal effects dominate the process, at least in the present-day mantle. Conventional or not, he is nevertheless careful to provide the data that underlie his interpretations; he thus empowers the readers to come to their own conclusions.

The sequencing of topics is one of the book's best qualities. Instead of describing structures in Earth in chronological order of their discovery, which is too often the approach in older monographs, Anderson begins with a brief comparison of the terrestrial planets and then offers a critique of the current ideas on mantle dynamics; that critique quickly establishes the theme for the rest of the book. The introduction is followed by the "meat and potatoes" of

the book: a review of Earth's structure and composition, from the crust to the core; an interpretation of mantle-derived isotopes and magmatic products; and a survey of the physical properties of mantle minerals and their assemblages. I found those parts to be the best in the book; they are insightfully written and replete with informative tables, diagrams, and figures. The final two parts include the author's interpretation of the mantle heterogeneity as imaged by seismic tomography, followed by a nice account of the flow of thermal energy through the mantle system in space and in time, all without recourse to a single formula.

One aspect of the new edition that readers might find problematic is the reliance on "Googlets," key words inserted into the text for directing web searches. Those entries are used in place of ordinary text citations in referring to the recent literature on a given topic. However, Anderson has retained many of the older text citations from the first edition, and that practice has given his referencing scheme a discernible bimodal quality. Interactive referencing may eventually supersede traditional citation methods as search-engine capabilities increase, although my own experiments with several of his Googlets met with mixed success.

Like its predecessor, *New Theory of the Earth* offers an insightful, insider's view of what our planet is made of and how it works. Because it is so well written and well conceived, it is suitable either as a graduate-level textbook or as supplemental reading in an advanced undergraduate course. And because it is so comprehensive, it deserves to be within arm's length of every serious student of Earth.

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Von Braun Dreamer of Space, Engineer of War

Michael J. Neufeld
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The development of spaceflight and the success of harnessing of the atom are the great stories of 20th-century technological and scientific achievement. However, both challenge historians to explain how scientists and engineers could willingly, even fervently, apply their talents to projects of great moral ambiguity. Wernher von Braun