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Principles of seismology

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like a compendium of well thought-out research projects. This time, and as opposed to the previous volume in the series, I would give this one a "strong buy" recommendation for anyone interested in the regional geology of the Mesozoic platforms that surround the Tethys. Those who don't have a direct interest in the area should still look for the book in the library if only to satisfy their curiosity about this interesting and complex area.

Roadside Geology of Maine

By D.W. Caldwell
Mountain Press Publishing Co.
Missoula, Montana
1998, 318 p., US$18.00 paperback

Roadside Geology of Indiana

By Mark J. Camp and Graham J. Richardson
Mountain Press Publishing Co.
Missoula, Montana
1999, 316 p., US$18.00 paperback

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All geologists who can tear themselves away from computer screens and geophysical logs to look at actual rocks — and, alas, I fear we are a dwindling number! — have cause to be grateful to Mountain Press for the two excellent series of guidebooks to geology at outcrop. The two latest in their Roadside Geology series are both well up to the high standard set by earlier volumes.

D.W. Caldwell grew up in Maine and worked awhile with the Maine Geological Survey, as well as with the United States Geological Survey. He is nowadays a consultant in the fields of construction and hydrology, while also serving on the faculty of Boston University, Massachusetts. His account, of a state whose earlier topography was virtually oblitereated by the Wisconsin glaciation, necessarily stresses the erosional and depositional effects of the episode in earth history. However, as he shows, there is plenty to be seen in roadsides that will excite the structural and metamorphic geologist, and a sufficiency of interest also for the igneous geologist and mineralogist. Only the paleontologist is likely to be disappointed.

Paleontologists and soft-rock stratigraphers should have a happier time in Indiana, where the strata laid down on the flanks of the Kankakee and Cincinnati arches of the Middle to Late Paleozoic are rich in invertebrate fossils. Here also, the landscape was shaped in the Pleistocene; glacial deposits blanket much of the northern part of the states, with windborne sands forming an extensive dune complex, and loess providing the fertile soils that are Indiana's richest natural resource. However, the earlier strata have added economic materials to the state's income, and the geological itineraries include coal mines (functioning or abandoned), clay and marl pits, limestone and ironstone quarries, and monuments to the search for petroleum. The authors — a stratigrapher and a glacial geologist, respectively — are well qualified to expound Indiana's geology and do so in lively fashion.

Both books feature clearly drawn and informative maps and sections, most often in two colours, along with a plethora of photographs, historic or modern. (The second book also includes effective sketches of the biological communities of past times.) The little red roadbadges at the top corners of pages attractively facilitate their consultation. Both books, like their predecessors in this excellent and innovative series, can be recommended without reservation to geologists visiting these states, and the prices are remarkably moderate, an important factor in this age of wallet-emptying book prices!

Principles of seismology

By Augustin Udias
Cambridge University Press
Cambridge, UK CB2 2RU
2000, 475 p.
US$39.95 paperback, US$90 hardcover

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The topics covered in *Priniciples of Seismology* by Udias are also covered in a combination of other seismology books including those authored by Aki and Richards, Bullen and Pilant. However, this book has its own unique blend of seismic theory and observations. It should prove to be a very useful publication for seismologists at a wide range of expertise levels.

Several chapters cover the fundamental seismic theory of elasticity and wave propagation. Basic concepts and characteristics of elastic solids, such as Poisson's ratio, are well explained. The book also discusses more esoteric topics such as the effects of gravity and temperature on seismic wave propagation.

Normal mode theory, reflections, refractions, surfaces waves, and ray tracing are all lucidly explained. Many of the concepts are relevant for global, engineering and exploration seismology. It is interesting that finite-difference and finite-element solutions to the wave equation are not discussed, even though they are used in engineering and exploration applications. This is probably due to the fact that these methods are prohibitively expensive for most global seismology problems and this book tends to emphasize global seismology.

Principles of Seismology has much to offer those studying natural earthquakes since it contains a number of famous earthquake seismogram examples. There are complete discussions of earthquake sources, magnitudes, fracture models, and methods for locating earthquake epicenters. Useful geometrical and physical explanations are given for earthquake source mechanisms and resulting fractures. The discussions of seismometers and earthquake recordings were relegated to the last chapter, which is

somewhat unusual since these topics are normally discussed earlier in most seismic textbooks. Nevertheless, explanations of seismic instrumentation, theory and observations are all generally very clear and systematic in this book.

The number and wide range of seismology topics in the book are excellent. This book is useful and highly affordable; it sells for only US$39.95 in paperback edition. It should be a useful addition to the library of any seismologist.

Guns, germs, and steel The fates of human societies

By Jared Diamond
W.W. Norton Ltd., New York, London
1999, 480 p.
US$14.95, C$19.99, paperback
(hardcover edition published 1997)

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Why is this non-geological Pulitzer Prize-winning book reviewed here? Simple answer: this fascinating book, which in the author's opening words "attempts to provide a short history of everybody for the last 13,000 years," uses the methods of the historical sciences — astronomy, geology, and paleontology — to examine recent human history globally. This is amazingly successful, providing explanations and insights into human history so convincing that many must be correct!

Jared Diamond is professor of physiology at the University of California (UCLA) School of Medicine, with interests in evolutionary biology. It is clear that he has an enormous grasp of multitudes of facts and inferences bearing on human history globally. He asks and answers several interrelated questions, including "Why did human development proceed at such different rates on different continents?"; and " Why were Europeans, rather than Africans or Native Americans, the ones to end up with guns, the nastiest germs, and steel?". We of European origin tend to think that human history's pattern reflects innate differences among people themselves: we were the inventors of guns and steel, because of our innate intellectual superiority. Diamond identifies this as "the racist biological explanation," and is for him the strongest argument for writing the book. He offers one sentence to describe the book's theme: "History followed different courses for different peoples because of differences in people's environments, not because of biological differences among peoples themselves" (p. 25).

Following a Prologue developing the idea of regionally differing courses of history, the book has four parts. Part One looks at early history up to the clash between the Incas and Spaniards in Peru in 1532; Part Two, the rise and spread of food production; Part Three, the course from food to guns, germs, and steel; and Part Four, "around the world in five chapters," such questions as how China became Chinese and how Africa became black.

Diamond takes great care to identify what happened, where, and particularly when, using calibrated radiocarbon dates for events/artifacts of the last 15,000 years, significant in tracing the course of human history. As he states, the historical science approach makes it clear that history is "not just one damn fact after another... There really are broad patterns to history, and the search for their explanation is as productive as it is fascinating" (p. 32).

Diamond makes a compelling case that early peoples developed as a consequence of the environment in which they lived, including the biological and geological resources available to them. Food production was critical to human development, because the domestication of animal and plant species permitted specialization of human societies from hunter-gatherers to leaders and builders of organized societies, as well as much greater human population densities. A key point is that domestication of animal and plant species did not occur at the same time everywhere, and one of the reasons for this was that there were major differences in what was locally available to be domesticated. Of the ~200,000 wild plant species on earth, only a dozen account for 80%+ of modern crops. There are about 148 species of large wild terrestrial mammals over ~100 pounds in weight that are candidates for domestication, yet only five — sheep, goats, cows, pigs, and horses — are the main domesticates, with another nine minor contributors. So it makes sense that early humans living in places containing the most species of animals and plants that could be domesticated would have a significant advantage over those humans living elsewhere.

Diamond shows that there were major differences in the distribution of animals and plans that could be domesticated, with the cradle of early civilization, the Fertile Crescent of the Mediterranean, an area rich in such species, an early and clear advantage. Early humans who harnessed food production went on to develop guns and steel: in the resulting high-density populations the nastiest germs developed, that killed on contact those societies with no resistance to such germs. Human history depended on what biological and physical resources were available to our ancestors, and not on how smart they were! Other geographic/geologic factors were involved too: rates of diffusion and migration of human societies, most rapid in Eurasia because of its east-west axis and limited barriers; ease of diffusion between continents; and continental differences in area or total population size. A key message is that long-term comparison of regions — the application of the approaches geologists use regularly in research and exploration — yields insights that cannot be won from short-term studies of single societies.

An Epilogue presents the case for the study of human history as a science, further fascinating reading. People's image of science is usually based on physics, in which experimentation is the essence of the scientific method. Yet the historical sciences have made much progress from observation, comparison, and natural experiments, approaches which are as essential to geology as they are to understand living systems in general and human activities in particular. The book offers a stunning demonstration of the success of the historical science approach to human history, offering a new framework which, hopefully, historians will be quick to adopt. It's also a great read!