Book Review

“Disaster Deferred: How New Science is Changing Our View of Earthquake Hazards in the Midwest”,
by Seth Stein, Columbia University Press, 2010; ISBN: 978-0-231-151138-2 (cloth)

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The book discusses the seismicity of the US Midwest. This is one of the most intriguing phenomena of North American seismicity. There is recently much concern about seismic hazard in the US Midwest. It is difficult to say to what extent this concern is true and to what extent it may result from interest from the general public (and mass media), in which the upcoming 200th anniversary of the famous New Madrid earthquakes may play an important role. Several eccentric forecasters and fortune tellers have recently spread rumors about upcoming new large quakes in the areas. Those rumors have proven false; however, it was the time itself that has proven them false, as seismology did not take a clear stand. The book discusses what we really know about the New Madrid earthquakes and seismicity of the region.

The historical information on the New Madrid earthquakes is very well weighed out between what is generally known and famous about those quakes and what is scientifically proven. The author discusses the historical data comparing it with modern data of the instrumental era from the Mississippi Valley, including precise GPS measurements—in part performed by the author himself. Also discussed are other places of known intraplate seismic activity in North America, such as Charlevoix, Quebec (1663), Charleston, S.C. (1886) or Grand Banks off Labrador (1929), in an attempt to find common features of this type of seismic activity, and provide possible explanations of the cause of these earthquakes.

The book also brings out the ever-returning problem of conformism in science. A fresh example of such conformism in seismology is the March 11, 2011 $M = 9.0$ earthquake in Japan, which was not unexpected but hardly anybody had thought this earthquake to be so big. Estimates in this case were up to about $M = 8.6$, for two reasons: nobody has seriously considered drawing isoseismal lines out to far sea and nobody had thought of a quake so big because seismic hazard studies were done many years ago based on the MS magnitude scale, which is known to saturate at about $M = 8.5$: in other words, one cannot get an earthquake of MS much greater. Seismic hazard studies once performed were considered valid and nobody has thought of repeating them. Here, in the case of New Madrid, conformism seems to work the opposite way. The issue is that—in general opinion, as well the common one as the scientific—all earthquakes in America are in some way compared with what is going on in California, where earthquakes are most common, and their mechanisms are best known.

The author clearly and strongly points out that California and the Midwest have so much different geological structures and simple—mechanical—transfer of Californian findings to the Midwest reality leads to false results in terms of seismic hazard that is generally overestimated. In particular, attenuation of seismic waves in California is much greater than in the Midwest, so in the Mississippi Valley it does not take an earthquake so big as in California to cause similar shaking or damage. In particular, the 1811–1812 New Madrid earthquakes were widely felt—as far away as Charleston, S.C., Niagara, N.Y. and northern Wisconsin. An earthquake in California

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which would have been felt on a such large area, would have been so big that it would cause complete total damage in its epicenter area. The damage in New Madrid in 1811–1812 was extensive only very close to New Madrid and, therefore, can be possibly attributed to ground liquefaction and not to the actual earthquake shaking. Recent estimates of the earthquakes' size render much lower magnitudes than previous results. Studying "Disaster Deferred" one other possibility comes to my mind: earthquakes so widely felt with relatively small damage at the epicenter—could it be that their foci were deeper than expected? Because of lack of reliable data, the author does not discuss the source depth issue, focusing on local crustal structures such as the New Madrid, Reelfoot and Cottonwood Grove faults as the apparent sources of the earthquakes. Such reasoning seems to be in accord with the instrumentally observed patterns of seismicity in the Mississippi Valley, but whether this is right—or perhaps the author, escaping from one conformism trap, falls right into another—may be only shown by future studies. That is, hopefully; if not, the big New Madrid earthquakes can happen again.

The book also brings out the issues of seismic hazard, seismic construction codes and earthquake preparedness. The costs of enforcement of

Californian-based seismic construction codes in the Midwest, in fact, may prove much higher than the damages that could be caused by the earthquake, while the chance of the earthquake's taking place during the lifetime of a specific construction can be termed only moderate. Needless to say, this is a very courageous statement on behalf of a seismologist and perhaps the best evidence of the author's reliability and credibility.

"Disaster Deferred" offers a very interesting reading not necessarily only to seismologists but to the general public at college level. In fact, it does not contain a single mathematical formula. Instead it has a descriptive form that makes it interesting to everyone and not only those who are interested in pure science. To scientists, the book presents interesting and often unknown or neglected facts. It is also a masterpiece when considering how to present often complicated and complex scientific findings to the general public in a way easy to understand.

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