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# Seismic Zoning of the U.S.S.R.

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particularly those concerned with the equations of equilibrium and constitutive relations for what are essentially materials exhibiting complex visco-elastic-plastic behavior. This tendency is evident in those sections of the volume in which the stress distribution adjacent to underground openings in salt rocks is related to the corresponding deformations.

Despite the reservations noted above and the inclination of the author to engage in tendentious polemics at the expense of those whose views differ from his, the volume has much to commend it, if only to draw attention to the importance of geological considerations in the mining of salt rocks. The second volume, in which the author intends to discuss the application of stress-relief techniques to the conventional mining of potash, is awaited with interest.

MS received May 26, 1978

## Seismic Zoning of the U.S.S.R.

Edited by S. V. Medvedev
*Izdatelstvo Nauka, Moscow, 1968*
Translated by the Israel Programme for Scientific Translations.
*Jerusalem, 533p., 1976.*
*(Available from Halstead Press).*
$58.50

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The book is a very comprehensive account of the seismic zoning studies in the USSR from 1960 to 1968. In the nine chapters of part I, well-known experts, such as the editor, Medvedev, Bune, Vvedenskaya, Shebalin, and six others describe the fundamentals of seismic zoning. In frequently overlapping detail they cover the various idealised inputs into, and the production of the final zoning maps, such as the use of geological-tectonic data, seismic activity maps, and engineering seismology data. Part II is a collection of 19 papers by some five dozen authors, most of whom are presumably members of the associated institutes of the Academy of Sciences in the various republics. In these chapters they decribe for each region the actual, often less than ideal data that have gone into the new 1:5,000,000 seismic zoning map of the USSR which has now replaced the earlier one of 1957.

In chapter 1, part I, the editor gives a short overview of the whole seismic zoning process, ending with an interesting attempt to show the relevance of seismic zoning for the national economy by a quantitative statistical approach to the expected financial losses, as a function of mixture of building types, construction norms and ground motion intensity recurrence rates.

Chapter 2 is a discussion of the methodological fundamentals of large scale zoning using the well-explored Soviet Central Asia region as an example. Various conceptual schemes of correlating independently drawn maps of seismic data and geological-tectonic maps are described. Each one is then covered in more detail by other authors in chapters 3 to 5. The seismic zoning procedures start from historic and instrumental epicenters intensities, and magnitudes. The territory is divided in quasi-homogeneous zones of earthquake occurrence. Seismic activity maps are prepared which are characterized by the number of events at or above certain energy (or magnitude) and the "constant" slope of the logarithmic recurrence curves.

The third and perhaps most important parameter of regional seismicity is the "maximum potential intensity". Although this cannot yet be determined from seismic criteria alone, it is maintained that it can be predicted within one intensity unit using tectonic criteria. Much stressed criteria are uplift velocity gradients, and mapping of zones of large faults, both deep and shallow ones. For instance, belts of the "first category" are expected to produce intensity IX or more. To qualify, the uplift gradient must be higher than $10^{-9}$ rad/year nearly everywhere, and numerous present day faults must cut through the entire crust, many of them tens of kilometres long, some hundreds. Even without historic earthquakes, such a zone will be rated intensity IX on tectonic grounds. Belts down to category 4 are defined, compared and combined with seismicity maps. Finally, this result of seismo-geological and tectonic correlation is modified to allow for ground motions propagating from potential earthquakes in neighbouring zones. Zones are then simply designated by expected maximum intensity IV to VIII and IX and more, with no explicit annual probability of occurrence, even though an average annual occurrence of 0:001 per 1000 $km^2$ is suggested as a definition for the maximum potential intensity.

Except for a weak attempt to introduce "effective shaking" in chapter 7, intensity is the almost exclusive ground motion parameter used throughout the book; it is clearly defined as the maximum relative displacement of a certain spherical pendulum seismometer (seismoscope!), e.g., intensity V for a displacement of 0.5 to 1mm. The editor devotes a separate chapter (9) to the MSK-64, seismic intensity scale which is named after Medvedev, Sponheuer and Karnik, and is a slightly improved version of the Modified Mercalli scale. Peak ground velocity and acceleration are 1 to 2 cm/sec and 12 to 25 $cm/sec^2$ for intensity V and exact factors of two for each intensity level. (Richter's acceleration-intensity relation $\log a = I/3$ · · · gives 14.7 $cm/sec^2$ at intensity V). However, instrumental strong motion data are scarce and intensities in part II of the book are, as usual, estimated from a descriptive characterization and from various regional magnitude-energy-intensity relations. Most of these are within the usual margins of uncertainty of Richter's formula, but definite regional and also directional differences in intensity attenuation are documented.

There is a chapter on long-term seismic forecasting of earthquakes which considers the cyclic occurrence of great earthquakes and filling of gaps along the U.S.S.R. Pacific coast, but earthquake prediction in the current usage of the word is not treated.

Although the zoning procedure is described in rather authoritative, sometimes dogmatic terms, the details of part II of the book give evidence of considerable leeway and arbitrariness, inevitable with insufficient data. In several cases a footnote acknowledges reclassification of regions after the book went to press due to a new earthquake. This comes as a bit of relief to western readers who may feel overwhelmed by the truly massive

effort that has obviously gone into the seismic zoning of the USSR.

Despite its length, frequent repetitiveness and sometimes difficult reading the book must be recommended to those involved in any aspect of seismic risk analysis.

MS received April 21, 1978

## Geology in the Urban Environment

By R. O. Utgard, G. D. McKenzie, and D. Foley
*Burgess Publishing Company, Minneapolis, Minnesota, 355p., 1978*
$9.95

Reviewed by P. F. Karrow
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This book is an exception to my general distaste for collections of papers. Although my first reaction was "Oh, not another one!", on looking through it I found I was excited and fascinated by the papers it contained.

The authors state that the book "is designed as a basic text for courses in geology of the urban environment. It might also be used as a supplementary text in environmental geology courses." I suspect courses in urban geology constitute a very small market, as desirable as such courses may be in theory, and I would expect the use as supplementary reading in environmental geology would predominate. It is not a textbook according to my conception, which involves synthesis and generalization of knowledge on a particular subject. Instead it is a collection of readings and case histories which can serve as useful illustrations of geological problems affecting urban areas. Most papers date from the 70s, some papers have been reduced substantially in length by the authors of the book.

After a short foreward by Robert F. Legget, a recognized authority in the field of urban geology, and a short preface by the authors acknowledging U.S. Geological Survey publications as a major source, the book is divided into seven topical parts. Each part begins with a brief summary by the compilers of the collection.

Part one, introduction, contains four papers by McGill, Legget, Withington, and Loudermilk describing the role and need for urban geology, urban geological and engineering maps, the Washington experience, and some examples from the Old World.

Part two, geologic hazards in the urban environment, contains nine papers dealing with such topics as hydrology and floods, sediment problems, landslides and subsidence, and earthquakes.

Part three, engineering aspects of land use, comprises five papers on swelling clays, the urban water table, landslides, Chicago flood control, and permafrost problems.

Part four, resource availability in the urban environment, contains four papers on water resources, mineral resources, and use of mines for underground space, this last being one of my favourites in the book.

Part five, environmental considerations of urban resource development, contains three papers on waste disposal, lake management, and strip mine reclamation.

Part six deals with interpretation and presentation of geologic data on the urban environment, and contains four papers on San Fransisco, engineering geology maps, carbonate terrain problems, and data systems.

The last part, on utilization of geologic information in regional planning, comprises two papers on general recommendations and the California master plan.

The book concludes with a glossary and four appendices, geologic time chart, conversion factors, surface water criteria for public water supplies, and a listing of state and provincial sources of information (mainly geological surveys).

As can be inferred from the above summary of contents, some overlap in topics is present, both because topics interrelate and because the original papers were not written for the context in which they have been placed.

While I would not agree with its designation as a text book, I believe this book should provide interesting and instructive reading for students of a wide variety, but particularly those in geography, planning, geology, and civil engineering. I should also interest professionals in those fields as a good sampling of the recent experience in urban geology. I have ordered several copies for the supplementary reading shelves in our university book store.

MS received March 23, 1978

## Photographic Atlas of the Mid-Atlantic Ridge Rift Valley

By Robert D. Ballard and James G. Moore
*Springer-Verlag, New York, 114 p., 1977.*
US $19.80

Reviewed by James M. Hall and William A. Kay
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By the end of the 1960s study of deep ocean geology and geophysics from surface ships had given rise to the attractive plate tectonic model for the lithosphere. However, testing and refining the model by direct examination of critical areas, such as the median valleys of spreading ridges, was held up by the poor resolution of surface ship techniques. For example, attempts to map the topography of rift valleys produced a series of interfering hyperbolae, while dredge-haul rock samples could neither be located in space with much confidence, nor be related to known detailed topography.

Various means of overcoming this problem of lack of resolution came into use in the early 1970s. These include observation and sampling of the ocean floor from submersibles or by deep-tow devices, and sampling of ocean crust by drilling rather than dredging.

The book being reviewed gives some of the first results of observation from submersibles, with supporting photography from towed camera systems. The area covered is the rift valley of the Mid-Atlantic Ridge at 37°N, the FAMOUS (Franco-American Mid-Ocean Undersea Study) area. The book is essentially a collection of photographs which comprise most of the 183 illustrations. Most were taken from within the submersible ALVIN.