
Photographs courtesy of R. McKenzie.

# Twelfth Award of the Medal of the Seismological Society of America

*The MEDAL OF THE SEISMOLOGICAL SOCIETY OF AMERICA was established as Article XII of the Constitution and Bylaws in the 1975 annual election. The Medal recognizes outstanding contributions in Seismology and Earthquake Engineering. The twelfth award, in 1989, was made to Dr. Robert E. Wallace.*

## CITATION

The twelfth award of this Medal honors Dr. Robert E. Wallace for his work and leadership in geological research that have linked the disciplines of seismology and geology and have emphasized the simple truth that they are, indeed, one. Bob's studies over the past 25 years have extended the time dimension of seismology from the units of the clock to the counting of the centuries. He has timed earthquakes not with the millimeter scale and the computer cursor but with the map, the rod, and the compass, and in doing so has been a pioneer in opening the field of paleoseismology. While continuing to make significant advances in research, Bob has been a leader in our profession working effectively to bring engineers, geologists, and seismologists together in their efforts to understand and mitigate the effects of earthquakes.

Fifty-one years ago this spring, Bob Wallace graduated from Northwestern University with a Bachelor of Science degree in Geology. He went to Pasadena and spent 4 years from 1938 to 1942 as a graduate student at the California Institute of Technology. With the nation engaged in World Was II, Bob joined the U. S. Geological Survey in May 1942, serving in the Branch of Alaskan Geology. In 1946, he received his Ph.D. degree from Caltech and shortly thereafter published his thesis in the *Bulletin of the Geological Society of America* in the paper entitled "Structure of a portion of the San Andreas rift in southern California." This truly classic paper represents the first detailed geological study of a segment of the San Andreas fault, emphasizing the significance of Holocene faulting decades before such studies became commonplace.

Including his temporary employment status while teaching at Washington State University, Bob has spent over 47 years with the Geological Survey. For two decades following World War II, Bob worked mostly on matters relating to ore deposition and strategic minerals, although his work in the Coeur d'Alene mining district anticipated much of the present interest in seismogenic mechanisms of mesothermal ore deposition. Between 1956 and 1960 as field geologist and 1960 to 1965 as Branch Chief, Bob's work in and around the Humbolt Range, Nevada, developed his long-standing interest in active faults and earthquakes in the Basin and Range Province.

Bob returned to the San Andreas fault in 1965, this time in central California. At a time when earthquake research was virtually the exclusive domain of seismologists—now armed with new worldwide and regional networks, large aperture arrays, and substantial sums of money from the Department of Defense—Bob became the champion of a cause that was then held by only a handful of Earth scientists: that both the cause and effect of crustal earthquakes strongly imprint the geologic record, whether or not systems of inertial seismographs were operating at the time.

Although the origins of paleoseismology date back to G. K. Gilbert in the late 19th century, Gilbert's seminal work on the geologic effects of prehistoric earthquakes had largely been forgotten by the mid-1960's. Bob and a very small number of other geologists breathed new life into this field in the decade of 1965 to 1975, from which time it has expanded to be the virtual cornerstone that it is today for any rational assessment of earthquake hazard and risk. His 1968 paper documenting 9 meters of offset along the San Andreas fault associated with the 1857 earthquake is a classic, and a paper in 1970 set the stage for the now common use of long-term fault-slip rates in quantitative hazard evaluation. And his 1977 paper, "Profiles and ages of young fault scarps, north-central Nevada," literally initiated a whole new discipline, founded on the realization that the detailed morphology of fault scarps could be used to date the earthquakes that caused them.

Perhaps of equal importance, Bob played a significant role in bringing the National Earthquake Hazards Reduction Program (NEHRP) into existence in 1977 and in assuring, against long odds, that it contained and maintained a strong geological component, in both research and application. Bob's commitment to expanded programs in earthquake research is long standing. In summarizing the results of a small conference on earthquake problems held at the Stanford Research Institute in 1960, Bob laid out all of the basic elements of the NEHRP as we know it today.

In the Geological Survey, Bob has served as a Deputy to the Assistant Chief Geologist in Washington, D. C., Assistant Chief Geologist for the Western Region, Project Director of the San Francisco Bay Region Study; Chief of the National Center for Earthquake Research, and between 1974 and the time of his retirement, Chief Scientist of the Office of Earthquake studies, now the Office of Earthquake, Volcanoes, and Engineering. Bob has received the Meritorious and Distinguished Service Awards of the Department of Interior. He "retired" 2 years ago the age of 71, but he is still actively involved in research and national committees convened to guide various disciplines within the Earth sciences.

Bob has been a member of our Society since 1964 and served on its Board of Directors from 1976 to 1979. He has published a number of papers in the *Bulletin* of the Society. Among his most recent contributions is his editing of the 1986 National Academy of Sciences volume, "Active Tectonics." This remarka-

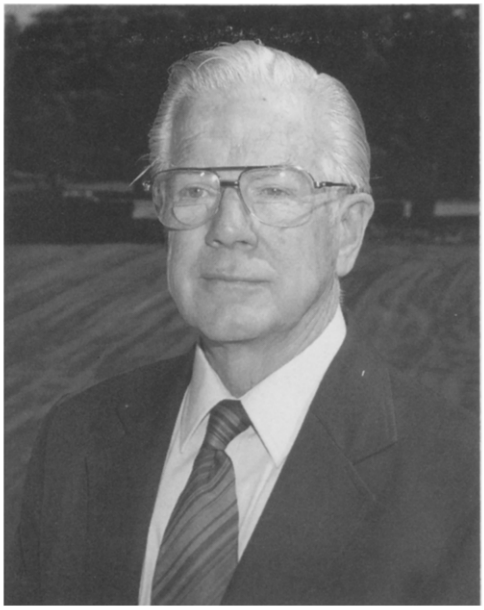
ble compendium could have easily been dedicated to Bob himself, who literally pioneered many of the state-of-the-art studies summarized therein.

Certainly one of Bob's most significant professional contributions has been his statesmanlike leadership in bringing geologists, seismologists, and earthquake engineers together. Both within the Geological Survey and in the broader scientific-engineering community, Bob has worked continuously, vigorously, and unselfishly to help create an environment of mutual respect and mutual purpose among sometimes dissident elements.

Those of us who have had the pleasure to know Bob personally recognize that he is a warm, humble, and, humane person. Perhaps Bob's most outstanding and infectious trait is his optimism. If one ever needs cheering up, a talk or visit with Bob Wallace is recommended. He is an excellent host and many of us have enjoyed lovely evenings at his home, the walls of which are graced with his own paintings, while he and his dear wife Trudy provided sustenance for the body and soul. Bob loves nature and enjoys longs walks looking at the birds, trees, and flowers. Bob also, we believe, loves people. It is hard for anyone to recall Bob speaking ill of another being. Borrowing the words of another, it can be said that Bob has seen ". . . the books in the running brooks, the sermons in the stones, and the good in every thing."

This Society and society in general owe Bob a profound debt of gratitude for his science and his service. In recognition of this debt, the Seismological Society of America humbly and gladly honors Robert E. Wallace as the Twelfth Recipient of its Medal.

John R. Filson
Thomas C. Hanks
Clarence R. Allen



# RESPONSE

Thank you John, Tom, and Clarence.

It was with disbelief that I heard President Sheldon Alexander tell me by phone last summer that I had been selected to be the 1989 Medalist of the Seismological Society of America—and disbelief especially at this moment because so many of you should be standing here instead of me. You have granted me an honor that I shall treasure always.

My disbelief is especially confounding when I consider the circuitous path of science I have followed over the past 50 years. While doing field work in Alaska I discovered one day at lunchtime that I was sitting on pieces of quartz loaded with visible gold. I was sure then that I always would be an economic geologist, and, of course, a rich one. Indeed, I was the former for over 20 years, but never the latter. Another time, the thrill of discovering a column of Plesiosaur vertebrae sticking out of the Panoche Hills in California convinced me that my future lay in paleontology. Similarly, I was sure at one point that I found my true scientific home in the Precambrian Belt Series of Idaho and Montana, a far cry from earthquake studies. After managing the first USGS permafrost program in 1945, I was approached by a Colonel Orr of the Air Force, who offered me an opportunity to head up their new Snow, Ice, and Permafrost program. I signed the papers, and waited. But fate intervened when Colonel Orr was killed while practicing parachute jumps. Except for fate, I would today be an iceman, or perhaps a snowman.

Then came a love affair with the great block faults of the Basin and Range province, as well as the great thrust faults and décollement there. But of course that love affair with faults had its beginning with a thesis on the San Andreas fault while at Cal Tech in the late 1930s and early 1940s. A course under Charles Richter, which included real-life earthquakes during the class, no doubt was the true premonitory signal for to-

day's event. But enough of reminiscing. Let's look ahead. That's the important direction.

In a sense, the future is synonymous with prediction, whether by the name of forecasting, probabilistic seismic hazard assessment, mitigation, preparation, or response—the fundamental thing is looking forward, or predicting. Despite enormous advances in our understanding of the earthquake process over the past 20 years, I believe that in 200 years we will look back on 1989 as near the very beginning of prediction and risk assessment.

As scientists of the Earth, our understanding may be not much better than that of the physicians in George Washington's day, who, with the best of intentions, treated George during his terminal illness by bleeding him again and again. We earth scientists, knowing so little about how the Earth works, very possibly are bleeding our patients, if only figuratively. For example, by not having a precise forecast of risk and probabilities, yet talking tens of billions of dollars in potential damage and thousands of casualties in a great earthquake, we have frightened the populace and increased the demand for earthquake insurance. The industry has responded by increasing the deductible to a point where the insurance is of questionable value to a homeowner.

Currently, our first line of defense against great earthquakes is the design and construction of earthquake-resistant structures. I heartily endorse that approach. But what if the new revelation just now emerging from paleoseismology proves to be significant for most intracontinental regions? I refer to the discovery that large earthquakes tend to cluster in time at a given site and that individual clusters are interspaced by thousands, even tens of thousands, of years of quiescence. During 10,000 years of quiescence, which represents 100 or more construction cycles, would it make economic sense to add from two to six percent cost to each cycle, 200 to 600 percent all told, to protect against an earthquake that would not occur, could not occur, during the period? If only we could know! Perhaps in our ignorance, with our inability to predict either the likelihood of, or the future absence of large earthquakes, we will be bleeding resources that could be better used for other needs of society. Ignorance is costly!

Similarly, let us consider California's Special Studies Zone Act. In my opinion, the act is an inspired and important legislative step toward hazard mitigation. The act is intended to reduce the hazard represented by potential fault shearing. But is it appropriate to require the same exploration and evaluation efforts along an active fault where the potential fault offset is likely to be measured in millimeters (if only we could be sure) as at sites where it is likely to be meters? I believe that it is now time to consider modification and refinement of the act and to consider better definitions of "active faults." Our current legal definitions of an "active fault" (and there are several) are woefully inappropriate, because we were unprepared scientifically to provide intelligent guidance at the time those definitions were fixed in legal precedences. Now we can look forward to extended, costly, years of argument to rectify those mistakes.

But you, seismologists, engineers, geologists, sociologists, and economists, have developed a process and demonstrated that by working together on a global basis very complex problems can be tackled successfully. That process starts from a scientific and technical base, which drives administrative policy and implementation. As important is that we have learned these elements must evolve and develop concurrently. If the science is adequate, effective mitigation and response techniques have a reasonable chance of being found and

developed. To the degree that the science of the Earth is blind, response procedures cannot even be conceived, or may be entirely counter-productive.

Earthquake prediction, or forecasting, is not just an exciting academic exercise. In my opinion, it is the most fundamental ingredient of any rational approach to earthquake-hazard mitigation. We aren't very far along. For ultimate success, we must consciously adopt a predictive frame of mind. Ben Franklin knew that weather moved from west to east. We aren't even at that elementary stage in earthquake prediction, let alone to a point, as in weather forecasting, where every citizen can view the movement of fronts and cyclones in beautiful detail on the evening TV screen. I envision being able to watch a strain front move across a region, just as we do weather fronts, and from that, knowing with a high degree of certainty that a flurry of seismic activity will occur tomorrow in a certain area that has reached a critical threshold of preparation. Our detailed measurements of strain, as advanced as they seem today with two-color lasers and space techniques are perhaps equivalent only to Ben Franklin's getting a spark off the key on his kite string during a lightning storm.

Perhaps I have overly belittled our accomplishments, because we have accomplished so much during the past 20 years. I have used a circumspect tone only to place those many accomplishments in proper pespective. For I sincerely say, you haven't seen anything yet! Successful and useful predictions of earthquakes are inevitable, and effective earthquake-hazard mitigation throughout the world is achievable.

I have prevailed upon your politeness and patience for too many minutes now. Before I close, I want to express my gratitude and thanks to those who have helped me over the decades. First, for the opportunity to do science, my thanks to the U.S. Geological Survey, an orpanization without comparison for the freedom and opportunities to carry out research. May it survive as an organization of high accomplishments, integrity, and credibility through these difficult times. On the home front, my dear wife, Trudy, has patiently and graciously put up with the obsessions and activities of an earthquake nut. To you of the Seismological Society of America, thank you for succumbing to the creative writing of the nominating committee, thus selecting me as an honored—yet disbelieving—medalist. Thank you all; thank you very much.

Robert E. Wallace