

ERNEST LUTHER MAJER

EDUCATION

Ph.D., June 1978 Geophysics, University of California, Berkeley

M.A., December 1972 Geophysics, University of California, Berkeley

B.S., June 1971 Mining Engineering-Applied Geophysics Option, Columbia University, New York, New York

B.A., June 1971 Math-Physics, Whitman College, Walla Walla, Washington

EXPERIENCE

Staff Scientist, Earth Sciences Division, 1978 - 1986 Lawrence Berkeley Laboratory

Initial work at LBL was directed toward analyzing the seismic waves generated by an impulsive source embedded in a medium, with the goal of specifying the dynamic source characteristics and properties of the material. This involved the analysis of microearthquake data from field studies in geothermal and petroleum regions have to analyze the relationship between reservoir dynamics and seismicity. Techniques were also developed to characterize acoustic emission and microseismic activity associated with geothermal reservoir management, the underground storage of nuclear waste (thermal and radiation effects), determining the path of hydrofractures associated with stimulation and stress measurement activities, and for tracking fluid injection fronts.

Staff Scientist, Group Leader Geophysics/Geomechanics Group Earth Sciences Division, 1986 - 1994 Lawrence Berkeley Laboratory

Efforts during this time were expanded to include wave propagation studies for monitoring and characterizing potential underground nuclear waste sites, toxic waste sites, geothermal, and petroleum reservoir boundaries. These activities focused on utilizing multi-component Vertical Seismic Profiling (VSP) and high resolution tomographic mapping techniques. Initial emphasis was on fractured rock sites and more recently in heterogeneous near surface soils. A principle effort this work has been to link the transport parameters to the geophysical parameters through laboratory studies of rock and soil physics. In conjunction with these projects work was also carried out to develop in-field, seismic data acquisition and processing systems for crosswell and single well systems. Group leader responsibilities were to provide research oversight and direction for a group of seven professionals, five faculty scientists, and ten postdoctoral and student researchers.

Staff Scientist, Department Head/Subsurface Geosciences, Geophysics/ Geomechanics Earth Sciences Division, 1994 - 2002 Lawrence Berkeley Laboratory

Recent and present work has been in the extension of high resolution seismic imaging work for geothermal, petroleum, and gas reservoir monitoring and characterization, integration of geophysical methods for nuclear waste disposal, and the application of geophysical methods for defining physical properties associated with subsurface bacterial transport and heterogeneity. Department Head duties involved oversight and administration of four basic research groups totaling 53 people supporting applied programs in fossil energy, nuclear waste disposal, geothermal energy, and environmental management.

Staff Scientist, Earth Sciences Division Deputy Director, 2002 – present, Acting Division Director 2006 – 2007 Lawrence Berkeley National Laboratory

Focus has been on utilizing geophysical methods for recovery of conventional and alternative energy sources, environmental cleanup, nuclear waste disposal and CO₂ sequestration. This includes work in all aspects of the technology from instrumentation, data acquisition, processing and interpretation. Work has focused on complex geologic environments such as fractured reservoirs, heterogeneous environments and multiphase/multifluid reservoirs. Recent emphasis has been on using geophysical methods to allow improved energy efficiency for extraction of resources from tight gas sands, oil sands, through application of alternative methods such as seismic stimulation, microbial enhanced oil recovery, and high resolution imaging of in-situ processes. Management duties cover working with the Division Director and the Division Council in exploring and developing major new scientific initiatives, opportunities for growth, and participate in shaping the Division's scientific vision as well as serving as the Division's Energy Programs and Fundamental Programs leads.

OTHER EXPERIENCE/SERVICE

In addition to serving on numerous peer review and expert panels, significant positions also include the following:

Panel on Annual Review of U.S. Progress in Rock Mechanics, National Research Council 1987-1989.

Coordinator of Geophysics for Management and Organization Team, USDOE Yucca Mountain Project. 1995 - 1999

Duties include coordinating and advising on all geophysical work among the individual participants of the Project (USGS, LLNL, LANL, SNL, LBNL, SAIC). This covers all well logging, surface and subsurface geophysics.

Co-subprogram Coordinator, (with Dr. F. Brockman PNL)

Subsurface Science Program on Bacterial Heterogeneity, U. S. Dept. of Energy, Office of Health and Environmental Research, 1993 - 1999.

Planning and implementation of a fundamental research program in defining physical and chemical properties controlling natural bacterial heterogeneity. Principle investigators from four national laboratories and five universities are involved.

Interdisciplinary Committee on Rock Mechanics, (G. Cooper, chair), University of California, Berkeley, 1992-present.

Advising on future research directions in rock mechanics and facilitating interaction between Berkeley Lab and campus.

Co-chair Non-Invasive Monitoring for DOE Site-Wide Vadose Zone Road Mapping
2001-2002

Science Advisory Panel for INEEL Subsurface Science Initiative 2003-2005

AFFILIATIONS/HONORS/AWARDS/PATENTS

American Geophysical Union
American Association for the Advance of Science
Environmental and Engineering Geophysical Society
Seismological Society of America
Society of Exploration Geophysicists
Associate, Seismographic Stations *University of California*
IR100 Award, Development of ASP
Patent for Borehole Shear-wave Source #5131488

Publications

Peer Reviewed Publications:

Majer, E.L., 1978, Seismological Investigations in Geothermal Regions, *Ph.D. Thesis*, LBL-7054, 225 pp.

Majer, E.L. and McEvilly, T.V., 1979, Seismological Investigations at The Geysers Geothermal Field, *Geophysics*, Vol. 44, No. 2, pp. 246-269.

Majer, E.L., McEvilly, T.V., Albores, A. and Diaz, S., 1980, Seismological Studies at the Cerro Prieto Geothermal Field, *Geothermics*, Vol. 9, No. 1-2, pp. 79-89.

Majer, E.L., McEvilly, T.V., and King, M.S., 1981, Monitoring an Underground Repository with Modern Seismological Methods, *International Journal of Rock Mechanics and Mining Engineering*, Vol. 18, pp. 517-527.

Majer, E.L., King, M.S. and McEvilly, T.V. 1982, The Application of Modern Seismological Methods to Acoustic Emission Studies in a Rock Mass Subjected to Heating, *In Proceedings of 3rd conference on Acoustic Emission/Microseismic Activity in Geologic Structures and Materials*, Ed., H.R. Hardy and F.W. Leighton, Trans. Tech. Pub.

McEvilly, T.V., and Majer, E.L., 1982, ASP: An Automated Seismic Processor for Microearthquake Networks, *Bull. Seis. Soc. of Amer.*, Vol. 71, No. 1, pp. 303-325.

Boyce, G.M., Doe T.W. and Majer, E.L., 1984, Laboratory Hydraulic Fracturing Stress Measurements in Salt, *In Proceedings of 25th U.S. Rock Mech. Symp.*, Northwestern University, Evanston, IL, pp. 8.

Majer, E.L. and McEvilly, T.V., 1985, Acoustic Emission and Wave Propagation Monitoring at the Spent Fuel Test - Climax, *International Journal of Rock Mechanics and Mining Engineering*, Vol. 22, no. 4, pp. 215-226.

- Majer, E.L., Doe, T., 1986, Studying Hydrofractures with High Frequency Seismic Monitoring, *International Journal of Rock Mechanics and Mining Engineering*, Vol. 23, no. 3, pp. 185-199.
- Majer, E. L., and Patrick, W.C., 1986, Acoustic Emission and Wave Propagation Monitoring, in: *Spent Fuel Test-Climax: An Evaluation of the Technical Feasibility of Geologic Storage of Spent Nuclear Fuel in Granite*, Ed. W.C. Patrick, UCRL-53702, pp. 265-277.
- P.A. Witherspoon, Long, J.C.S., Majer, E.L., and Myer, L.R., 1987, Combined Seismic and Hydraulic Method of Modeling Flow in Fractured Low Permeability Rocks, presented at the NATO Workshop on Advances in Analytical and Numerical Groundwater Flow and Quality Modeling, *Groundwater Flow and Quality Modeling*, E. Custodio et al.(eds.) pp. 299-329.
- Daley, T. M., McEvelly, T. V. and Majer, E. L., 1988, Analysis of P- and S-Wave Vertical Seismic Profile Data from the Salton Sea Scientific Drilling Project, *J. Geophys. Res.*, Vol. 93, No. B11, pp. 13,025-13,036.
- Daley, T. M., McEvelly, T. V., and Majer, E. L., 1988, Multiply-Polarized Shear Wave VSPs from the Cajon Pass Drillhole, *Geophys. Res. Lett.*, Vol. 15, No. 9, pp. 1001-1004.
- Majer, E.L., McEvelly, T.V., Eastwood, F.W., and Myer, L.R., 1988, Fracture Detection Using P- and S-Wave Vertical Seismic Profiling at The Geysers. *Geophysics*, Vol. 53, No. 1, pp 76-84.
- Campden, D.A., Crampin, S., Majer, E.L. and McEvelly, T.V., 1989, Modeling Shear-Wave Particle Displacements to Obtain Fracture Geometrics in a Geothermal Reservoir (A-46), *European Association of Exploration Geophysicists*, West Berlin, Germany, pp. 41.
- Majer, E.L., 1989, The Application of High Frequency Seismic Monitoring Methods for the Mapping of Grout Injections, *International Journal of Rock Mechanics and Mineral Sci.*, Vol. 26, No. 3/4, pp. 249-256.
- Campden, D.A., Crampin, S., Majer, E.L. and McEvelly, T.V., 1990, Modeling the Geysers VSP: a progress report, *The Leading Edge*, Vol. 9 No. 8, pp. 36-39.
- Karasaki, K., Majer, E.L., Peterson, J.E. and Myer, L.R., 1990, Fractured Rock Characterization Investigations at Lawrence Berkeley Laboratory, *Geophysical Exploration*, Vol. 42 No. 6, pp. 411-420.
- Majer, E.L., Myer, L.R., Peterson, J.E., Karasaki, K., Long, J.D.S., Martel, S.J., Blumling, P., and Vomvoris, S., 1990, Joint Seismic, Hydrologic and Geomechanical Investigations of a Fracture Zone in The Grimsel Rock Laboratory, Switzerland, NAGRA-DOE Technical Report NDC-14, Berkeley, CA, pp. 173. LBL-27913
- Tura, M.A.C.; Johnson, L.R.; Majer, E.L., and Peterson, J.E., Jr. (1990) Application of Diffraction Tomography to Fracture Detection. *Geophysics*, **57**(2), pp 245-257. LBL-28466.
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- Majer, E. L., Chapman, R. H., Stanley, W. D., and Rodriguez, B. D., 1992, Geophysics at The Geysers, GRC Special Report 17, *Monograph on The Geysers Geothermal Field*, Geothermal Resources Council; Davis, California, pp 97 -111.
- Romero, A.E., Jr.; McEvelly, T.V.; Majer, E.L., and Michelini, A. (1992) Velocity Structure of the Long Valley Caldera from the Inversion of Local Earthquake P and S Travel Times. *Journal of Geophysical Research*, **98**(B11), pp. 19,869-819,879, LBL-33234. (Publication date: November 10, 1993)
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- Vasco, D.W. and Majer, E.L., 1993, Wavepath Traveltime Tomography, *Geophysical Journal International*, **115**(3), pp. 1055-1069, LBL-32519. (Publication date: December 1993)
- Romero, A.E., Jr.; McEvelly, T.V.; Majer, E.L., and Vasco, D.W. (1994) Characterization of the Geothermal System Beneath the Northwest Geysers Steam Field, California, from Seismicity and Velocity Patterns. *Geothermics*, **24**(4), pp. 471-487, LBL-36142. (Publication date: August 1995)
- Vasco, D.W.; Peterson, J.E., Jr., and Majer, E.L. (1994) Beyond Ray Tomography: Wave Paths and Fresnel Volumes. *Geophysics*, **60**(6), pp. 1790-1804, LBL-36679. (Publication date: November-December 1995)
- Vasco, D. W., Peterson, J. E., Jr., and Majer, E. L., 1995, Nonuniqueness in Travel Time Tomography: Ensemble Inference and Cluster Analysis, *Geophysics*, **61**(4), pp. 1209-1227, LBL-37644. (Publication date: July-August 1996)
- Vasco, D.W.; Peterson, J.E., Jr., and Majer, E.L. (1995) A Simultaneous Inversion of Seismic Travel Times and Amplitudes for Velocity and Attenuation. *Geophysics*, **61**(6), pp. 1738-1757, LBL-38081. (Publication date: November-December 1996)
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- Majer, E.L., Datta-Gupta, A., Peterson, J.E., Vasco, D.W., Myer, L.R., Daley, T., Kaelen, B., Queen, J., D'Onfro, P., Rizer, W., Cox, D., and Sinton, J., 1996, Utilizing Crosswell Single

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- Cox, B.L., Sweet, A., and Majer, E.L., 2007, Application of electrical methods to measure microbial activity in soils: Preliminary microcosm results *Journal of Industrial Microbiology and Biotechnology*, In Press.
- D'Onfro, P.S.; Rizer, W.D.; Queen, J.H.; Majer, E.L.; Peterson, J.E.; Daley, T.M.; Vasco, D.W.; Datta-Gupta, A., and Long, J.C.S. 1998. An integrated approach for characterizing fractured reservoirs. In Jones, G., Fisher, Q.J., and Knipe, R.J., Ed. *Faulting, Fault Sealing, and Fluid Flow in Hydrocarbon Reservoirs*. Geological Society, (147), pp. 193-208, LBNL-43915. (Publication date: 1998.)
- Hubbard, S., Rubin, Y., and Majer, E., 1998, Estimation of hydrogeological parameters and their spatial correlation structure using geophysical methods, *Water Resources Journal*, June 1999
- Hubbard, S.S., Y. Rubin, and E. Majer, 1999, Spatial correlation structure estimation using geophysical and hydrogeological data, *Water Resources Research*, **35**(6), pp. 1809-1825. LBNL-42962.
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- Hubbard, S., Chen, J., Peterson, J., Majer, E., Williams, K., Swift, D., Marlleux, B., and Rubin, Y., 2000, Hydrological Characterization of the DOE Bacterial Transport Site in Oyster, Virginia Using Geophysical Data, *Water Resources Research*, **37**(10), pp. 2431-2436, LBNL-46224.
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- Gritto, R., Daley, T. and Majer, E., 2002. *Estimating subsurface topography from surface-to-borehole seismic studies at the Rye Patch Geothermal Reservoir*. *Geothermics*, **32**(3), pp. 275-295, LBNL-50490. (Publication date: June 2003)
- Gritto, R., Korneev, V., Daley, T., Feighner, M., Majer, E. and Peterson Jr., J.E., 2002. Surface-to-tunnel seismic tomography studies at Yucca Mountain, Nevada. *Journal of Geophysical Research - Solid Earth*; v 109-B3, March 2004, LBNL-50470.
- Hubbard, S., Majer, E., and Rubin, Y., *Geophysical Characterization in Vadose Zone, Science and Technology Solutions*, Chapter 10, eds. Brian Looney, Battelle Press, 2000.
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- Methods: A Case Study at the South Oyster Bacterial Transport Site in Virginia. *Water Resources Research*, v. 40-12, 2004, LBNL-54059.
- Lu, Guoping, and Majer, Ernest L. (2003) Coiled tubing deployment makes crosswell seismic surveying successful in horizontal wells. *The Leading Edge*, **22**(5), pp. 454-458, LBNL-53005.
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- Majer, Ernest L., (2006) *Barrier Systems for Environmental Contaminant Containment and Treatment* in Airborne and Surface Geophysical Method Verification, edited by C. C. Chein, H. I. Inyang, and L. G. Everett, Taylor & Francis Group, Boca Raton, FL.
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- Lo, W.C., Sposito, G., and Majer E.L. 2007. Low frequency dilatational wave propagation through unsaturated porous media containing two immiscible fluids, *Trans Porous Media* 68, 91-105
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- Cox, B.L., Sweet, A., and Majer, E.L., 2009, Application of electrical methods to measure microbial activity in soils: Preliminary microcosm results *Journal of Industrial Microbiology and Biotechnology*, In Press.

Selected Papers presented at Technical Conferences, Technical Reports, and Abstracts:

- Beyer, H., Key, A., Liaw, A., Majer, E.L., McEvelly, T.V., Morrison, H.F., and Wollenberg, H., 1976, *Preliminary Open File Report, Geological and Geophysical Studies in Grass Valley, Nevada*, LBL-5262.
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Majer, E.L. and McEvelly, T.V., 1983, The Stripa Acoustic Emission Experiment, *In National Academy of Sciences Special Report on Hydraulic Stress Measurement Techniques*, U.S.G.S Open File Report 82-1075 pp. 215-220.

Patrick, W.C., Ballou, L.B., Butkovich, T.R., Carlson, R.C., Durham, W.B., Hase, G.L., Majer, E.L., Morten, D.N., Nyholm, R.A., Reche, N.L., Wolder, D.G., Yow, J. L., 1983, Spent Fuel Test Climax: Technical Measurements, *UCRL-53294-83*.

Green, M.A., Majer, E.L., More, V.D., O'Connell, R.D. and Shilling, R.C., 1986, Ground Motion Measurements at the LBL Light Source Site, the Bevatron and at SLAC, pp. 1-88, *LBL-21519*.

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Majer, E.L., 1989, GTO–DOE/ Industry Cost Shared Research; Microseismic Characterization and Monitoring, *Presented at the DOE Geothermal Program review VII*, San Francisco, CA, pp. 1-4, LBL-26899.

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