

UNIVERSITY OF UTAH
RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
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The Earth Science Laboratory (ESL) has been established as part of the University of Utah Research Institute to assist government and industry in energy development, mineral exploration, and basic studies in geology, geophysics, and geochemistry. Director of the new facility is Dr. Stanley H. Ward, Chairman of the Department of Geology and Geophysics at the University of Utah and principal investigator on several Utah geothermal energy projects.

The principal contract for the laboratory is with the U.S. Department of Energy-Division of Geothermal Energy (DOE/DGE). It calls for the new facility to prepare and publish geothermal exploration case histories as part of DOE/DGE's Industry Coupled program, to assist the western states in assessing their low-temperature geothermal resources as part of DOE/DGE's State Coupled program, and to develop new geological, geochemical and geophysical techniques for use by industry in geothermal exploration. The ESL also undertakes industry contracts utilizing the staff's experience in exploration, research, technique development and instrumentation development. For information on how ESL could assist you, contact Phillip M. Wright, Associate Director at the above address.

The ESL staff has a broad range of education and experience in the earth sciences, particularly in exploration for base and precious metals and uranium. Other major strengths include the application of geological, geophysical and geochemical techniques, research and development of new techniques (trace-element geochemistry and three-dimensional geophysical modeling are current examples) and development of new instrumentation. Several of the key posts are filled by exploration and research people from Kennecott Exploration, Inc. and from the Uranium Division of The Anaconda Co.

PRESENT PERSONNEL

Stanley H. Ward, ESL Director, Principal Investigator, and Chairman of the Department of Geology and Geophysics, University of Utah.

Education: Ph.D., 1952, University of Toronto

Specialities: Geoscience research, exploration geophysics, electromagnetic research and exploration, geothermal exploration, research and development, exploration architecture.

Phillip M. Wright, ESL Associate Director, Project Manager

Education: Ph.D., 1966, University of Utah

Formerly: Chief, Geophysics Division Operations, Kennecott Exploration, Inc.

Specialities: Electrical and potential prospecting methods, geophysical data interpretation, mineral exploration, programming, heat flow, geothermal exploration and assessment.

Gerald W. Hohmann, Associate Professor of Geophysics at the University of Utah

Education: Ph.D., 1971, University of California, Berkeley

Formerly: Chief, Geophysics R & D, Kennecott Exploration, Inc.

Specialities: Electrical and potential methods in geophysics, numerical modeling methods, mineral and geothermal exploration.

Robert W. Bamford, Senior Geochemist, Project Manager

Education: Ph.D., 1970, Stanford University

Formerly: Senior Research Geologist and Project Manager for Sulfide Systems Research, Kennecott Exploration, Inc.

Specialities: Geochemical exploration technique development, base and precious metals exploration, geothermal exploration.

Howard P. Ross, Senior Geophysicist, Project Manager

Education: Ph.D., 1965, Pennsylvania State University

Formerly: Senior Geophysicist, Kennecott Exploration, Inc.

Specialities: Electrical and potential methods in geophysics, survey planning and data interpretation for mineral and geothermal exploration.

Joseph N. Moore, Geologist

Education: Ph.D., 1976, Pennsylvania State University

Formerly: Staff Geologist, Uranium Division, The Anaconda Company

Specialities: Metamorphic and igneous petrology, volcanology, uranium and base metal exploration, geothermal exploration.

Dennis L. Nielson, Geologist

Education: Ph.D., 1974, Dartmouth

Formerly: Staff Geologist, Uranium Division, The Anaconda Company

Specialities: Metamorphic and igneous petrology, volcanology, uranium, base metal and geothermal exploration, structural geology.

Odin D. Christensen, Geologist

Education: Ph.D., 1975, Stanford University

Formerly: Assistant Professor of Geology, University of North Dakota

Specialities: Geochemistry of geothermal systems, mineralogy, base metal exploration.

Duncan Foley, Associate Geologist

Education: Ph.D., 1978, Ohio State University

Specialities: Volcanology, petrology, environmental geology, isotopic geology, regional geothermal resource assessment.

William E. Glenn, Senior Geophysicist

Education: Ph.D., 1973, University of Utah

Formerly: Senior Research Geophysicist, Kennecott Exploration, Inc.

Specialities: Well log analysis, reservoir engineering, electromagnetic methods, geophysical exploration.

Dale J. Green, Senior Electronics Engineer

Education: B.S., 1956, University of Utah; Graduate work, E.E., Geophysics

Formerly: Chief Electronics Engineer, Kennecott Exploration, Inc.

Specialities: Design and development of electronic instrumentation for surface surveys and borehole logging.

Richard C. Fox, Geophysicist

Education: M.S., 1968, University of Utah

Formerly: Geophysicist, Geophysics Operations, Kennecott Exploration, Inc.

Specialities: IP-Resistivity, potential methods, mineral and geothermal exploration.

Regina M. Capuano, Associate Geologist

Education: M.S., 1977, University of Arizona

Specialities: Economic geology, geochemistry, uranium research.

Bruce S. Sibbett, Associate Geologist

Education: M.S., 1976, University of Idaho

Formerly: Exploration geologist, Lucky Mc Uranium Corp.

Specialities: Geologic mapping, uranium exploration, volcanology, mineral patents and mining claims.

Christian Smith, Associate Geologist

Education: M.S., 1977, University of New Mexico

Formerly: Hydrologist, Water Resources Division, USGS.

Specialities: Geophysics, geothermal research and exploration, ground water hydrology.

Ross W. Whipple, Geophysicist

Education: M.S., 1949, University of Utah

Formerly: Consulting geophysicist, Salt Lake City, UT.

Specialities: Sub-surface temperature research, electrical and potential methods in mining exploration.

Jeffrey B. Hulen, Associate Geologist

Education: B.S., 1969, University of Utah

Formerly: Geologist, Bear Creek Mining Company and Kennecott Exploration, Inc.

Specialities: Geologic mapping, base and precious metal exploration, geothermal exploration.

Terry J. Killpack, Associate Geophysicist

Education: M.S., 1975, University of Utah

Formerly: Systems Engineer, Jet Propulsion Laboratory

Specialities: Digital signal processing, geophysical modeling, computer programming.

Carol A. Withrow, Computer Programmer
Education: M.S., 1970, University of Utah
Formerly: Programmer/Analyst, University of Utah
Specialities: Systems and statistical programming, mass spectrometric applications, numerical analysis, graphics.

Michael J. Bullett, Assistant Geologist, Geothermal Sample Library Curator
Education: B.S., 1971, Westminster College, Salt Lake City
Formerly: Geologist/Information Specialist, Kennecott Exploration, Inc.
Specialities: Field geologic mapping, geochemical sampling, sample preparation.

Susan M. Samberg, Assistant Geologist
Education: B.S., 1977, York College (CUNY)
Specialities: Mineralogy, structural geology, geochemistry, fission track dating.

Ruth Kroneman, Research Chemist
Education: B.A., 1956, Carleton College, Northfield, MN.
Formerly: Ames Laboratory (AEC), Kennecott Exploration, Inc.
Specialities: Inorganic analytical chemistry and procedure development, AA, spectroscopy, ICP.

Support Personnel

Susan R. Moore, Executive Secretary, M.A., 1971, Pennsylvania State University
Susan M. Keller, Secretary
Sharif Dajany, Administrative Assistant, B.S., 1973, Utah State University
Doris D. Cullen, Drafting Supervisor, B.S., 1969, University of Nevada
Dorothy Yu, Librarian, M.S.L.S., 1964, George Peabody College for Teachers
Jim Stringfellow, Technical Editor, M.A., 1975, University of Utah
John Lopez, Drafting Assistant
Connie Pixton, Drafting Assistant

FACILITIES

The ESL is housed in a modern, 5,000 sq. ft. building with office and laboratory space located in University Research Park overlooking Salt Lake Valley (see accompanying map). Additional space will be available in early 1979 in a nearby building now under construction.

The Geothermal Document Library contains pertinent geothermal publications and open file data, as well as basic geoscience publications and periodicals. It is open for public use.

The Geothermal Sample Library (GSL) is housed in a separate 4,000 sq. ft. building. It provides open file accessibility and archival storage for field and drill hole samples (chips, cores, chip boards, and remainders from analysis) as well as cross-referencing to all work done on the samples. At present, the GSL contains samples from thirty shallow thermal gradient holes and seven deep holes from geothermal areas of current interest. Samples may be examined by appointment. Private industry has also submitted samples which are presently not available for public perusal. Complete sample preparation facilities permit proper initial preparation of samples for storage and subsequent division into representative subsamples for distribution to laboratories engaged in geothermal and other research.

The Geochemical Laboratory has facilities for preparation of special samples (e.g., specific gravity and magnetic fractions) and for multi-element analysis of a spectrum of solid and fluid samples. Principal instrumentation includes an ARL Inductively Coupled Plasma (ICP) Spectrophotometer with dedicated computer operating system, scanning primary slit, and auto sampler. The ICP is capable of quantitative analysis for 37 major and trace elements (Na, K, Ca, Mg, Fe, Al, Si, Ti, P, Sr, Ba, V, Cr, Mn, Co, Ni, Cu, Mo, Pb, Zn, Cd, Ag, Au, As, Sb, Bi, Se, Te, Sn, W, Li, Be, B, Zr, La, Ce and Th) at a rate of 15 to 20 samples per hour. Limits of accurate quantitative determination are commonly in the low ppb range for liquids and low ppm range for solids. A wide variety of matrices are readily accommodated by the ICP through software correction of spectral interferences and background correction using the computer controlled scanning primary slit. An IL Atomic Absorption Spectrophotometer with graphite furnace and automatic background correction is available as back-up for the ICP. X-ray diffraction equipment for identification of mineral phases is available at the nearby Utah Biomedical Test Laboratories, another division of the University of Utah Research Institute.

The Electronics Laboratory has modern equipment for support of projects and for development of new electronic instrumentation.

Computer facilities at ESL include a Tektronix 4014-1 graphics terminal, a Varian Stratos 42 electrostatic plotter, and several Texas Instruments Silent 700 data terminals. At present, this equipment is linked to a Univac 1108 system at the University of Utah. There are plans to install a mini computer system at ESL to interface with the Univac 1108 as well as to other large computer systems.

PRINCIPAL CONTRACTS

The Earth Science Laboratory of the University of Utah Research Institute serves as the principal subcontractor to the University of Utah on three current government contracts for work in geothermal energy.

1. Name of Contract: Reservoir Exploration and Assessment Technology
Sponsoring Agency: Department of Energy
Contract Number: EG-78-C-07-1701
Cognizant DOE Person: John W. Salisbury
2. Name of Contract: Geothermal Research Roosevelt Hot Springs KGRA
Sponsoring Agency: Department of Energy
Contract Number: EY-76-S-07-1601
Cognizant DOE Person: John W. Salisbury
3. Name of Contract: Induced Seismicity and Seismic Baseline Studies at
Roosevelt Hot Springs and Cove Fort/Sulphurdale, Utah.
Sponsoring Agency: Department of Energy
Contract Number: EW-78-S-07-1823
Cognizant DOE Person: Allan Jelacic

In addition, ESL has a proprietary contract with a private company for design and development of new geophysical instrumentation for use in electrical prospecting.

Other prime contracts currently active involve geophysical data interpretation for geothermal exploration and waste disposal for several clients.

PUBLICATIONS

The most recent publications performed under DOE contract are listed below. Certain of these publications are available upon request.

Bamford, Robert W., 1978, Geochemistry of Solid Materials From Two U.S. Geothermal Systems and Its Application to Exploration: Salt Lake City, Earth Science Laboratory, 196 p.

Capuano, R. M., Initial Investigation of Soil Mercury Geochemistry as an Aid to Drill Site Selection in Geothermal Systems: Salt Lake City, Earth Science Laboratory, in preparation.

Fox, Richard C., 1978, Dipole-Dipole Resistivity Survey of a Portion of the Coso Hot Springs KGRA, Inyo County, California: Salt Lake City, Earth Science Laboratory, 21 p.

Fox, Richard C., 1978, Low-Altitude Aeromagnetic Survey of a Portion of the Coso Hot Springs KGRA, Inyo County, California: Salt Lake City, Earth Science Laboratory, 19 p.

Fox, R. C., Hohmann, G. W., and Rijo, L., 1978, Topographic Effects in Resistivity Surveys: Salt Lake City, Earth Science Laboratory, 33 p.

Galbraith, Robert M., 1978, Geological and Geophysical Analysis of Coso Geothermal Exploration Hole No. 1 (CGEH-1), Coso Hot Springs KGRA, California: Salt Lake City, Earth Science Laboratory, 39 p.

Hohmann, Gerald W., and Ting, Sam C., 1978, Three Dimensional Magnetotelluric Modeling: Salt Lake City, Earth Science Laboratory, 48 p.

Hulen, Jeffrey B., 1978, Geology and Alteration of the Coso Geothermal Area, Inyo County, California: Salt Lake City, Earth Science Laboratory, 28 p.

Hulen, Jeffrey, B., 1978, Stratigraphy and Alteration, 15 Shallow Thermal Gradient Holes, Roosevelt Hot Springs KGRA and Vicinity, Millard and Beaver Counties, Utah: Salt Lake City, Earth Science Laboratory, 15 p.

McKinney, D. Brooks, 1978, Annotated Bibliography of the Geology of the Roosevelt Hot Springs Known Geothermal Resource Area and the Adjacent Mineral Mountains, March 1978: Salt Lake City, Earth Science Laboratory, 15 p.

Nielson, D. L., Sibbett, B. S., McKinney, D. B., Hulen, J. B., Moore, J. N., and Samberg, S. M., Geology of Roosevelt Hot Springs KGRA, Beaver County, Utah: Salt Lake City, Earth Science Laboratory, in preparation.

Nielson, D.L., Radon Emanometry as a Geothermal Exploration Technique; Theory and an Example from Roosevelt Hot Springs KGRA, Utah: Salt Lake City, Earth Science Laboratory, in preparation.

Ross, H. P., and Lunbeck, J., 1978, Interpretation of resistivity and induced polarization profiles, Calico Hills and Yucca Mountain Areas, Nevada Test Site: Salt Lake City, Earth Science Laboratory, ESL/UURI report no. 8, 16 p.

The Earth Science Laboratory is responsible for the open file data release of geologic, geophysical, and geochemical drilling and reservoir information generated through the Department of Energy, Division of Geothermal Energy (DOE/DGE) Industry Coupled Programs. In response to RFP No. EY-R-03-0007 issued March 25, 1977, six contracts were let by DOE for exploration and reservoir assessment activities in southwestern Utah. Geologic, geophysical, reservoir and drilling data for the Roosevelt Hot Springs and Cove Fort-Sulphurdale KGRA's have been received by ESL. These private industry data have been released through public notices and open file periods. Those who wish to receive notice of future data releases should contact Howard P. Ross.

Several studies are presently in progress that will be reported in the near future. These include:

Cove Fort-Sulphurdale KGRA, Utah: Geologic, Geophysical and Geochemical Studies.

Computer Programs for the Interpretation of Geophysical Data.

A world map showing location of geothermal areas relative to structural boundaries and Cenozoic volcanism.