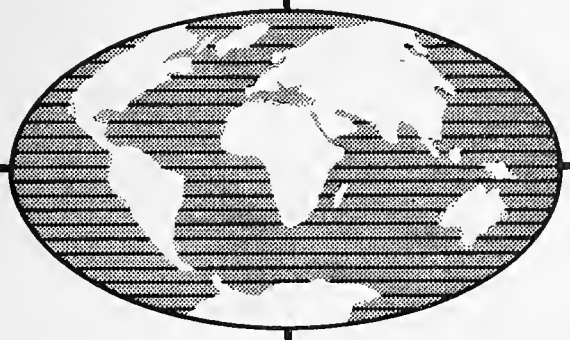
Department of Geology

University of Illinois
Urbana-Champaign



Research Report
1984-1985

1984–1985 RESEARCH REPORT

DEPARTMENT OF GEOLOGY

UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN

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(Compiled and edited by S. Marshak and P. Lane)

Rob Lander, a graduate student studying volcanic sediments with Professor Hay, analyzing the output of the X-ray diffraction unit.

INTRODUCTION

The Department of Geology continues to evolve rapidly with the appointment of six new assistant-professors and the filling of the Ralph E. Grim Chair by Richard L. Hay. One additional appointment in geochemistry/mineralogy will be made during the 1985 academic year.

These new appointments have completed our new research and teaching program in geophysics-seismology as well as reinforcing previous strengths in the areas of groundwater geology, clay mineralogy, geochemistry and the broad study of tectonics, diagenesis, sedimentology, structural geology, and historical geology.

One of the major advantages of the University of Illinois is the easy access to facilities in other Departments. The Department, for example, has access to superb micro-analytical facilities (SEM, high-resolution STEM, SIMS, etc.) in the Center for the Microanalysis of Materials (a National Facility in the Materials Research Laboratory) and the Center for Electron Microscopy and the NMR Center in Chemistry.

The Department is fortunate to share the campus with the Illinois State Geological Survey. Members of the Survey and the Department cooperate in research programs and graduate teaching in areas such as groundwater and environmental geology, clay mineralogy, quaternary geology, coal geology, stratigraphy and paleobiology.

With 60 students, the Department maintains strong programs in graduate research and teaching. The list on the following page outlines some major areas that include a broad coverage of theoretical, experimental and field research. The list is not exhaustive and some cross-disciplinary programs are available.

Geology graduate students, Charles Weiss and Wang-Hong Yang using one of the high-resolution nuclear magnetic resonance spectrometers. These spectrometers are used to examine the structures of a wide variety of crystalline and amorphous materials.

GRADUATE RESEARCH AREAS IN GEOLOGY

Clays and Clastic Diagenesis - S. P. Altaner, T. A. Anderson, C. M. Bethke, R. L. Hay, R. J. Kirkpatrick, G. deV. Klein, R. C. Reynolds, Jr. (adj.)

Carbonate Rocks and Diagenesis - T. A. Anderson, A. V. Carozzi, R. L. Hay, P. A. Sandberg

Engineering Geology and Applied Rock Mechanics - A. S. Nieto

Geochemistry - S. P. Altaner, T. F. Anderson, C. M. Bethke, C-Y. Chen, R. J. Kirkpatrick

Geomorphology and Quaternary Geology - W.H. Johnson, L. R. Follmer (adj.), J. E. King (adj)

Geophysics - J. D. Bass, W-P. Chen, A. T. Hsui, S. Grand (1986)

History of Geology - A. V. Carozzi

Hydrogeology - C. M. Bethke, K. Cartwright (ISGS-adj.)

Igneous/Metamorphic Petrology - D. E. Anderson, C-Y. Chen, R. L. Hay, R.J. Kirkpatrick

Mantle Dynamics - J. D. Bass, C.-Y. Chen, A. T. Hsui

Mineralogy/Mineral Physics - S. P. Altaner, J. D. Bass, C.-Y. Chen, R. L. Hay, D.M. Henderson, R.J. Kirkpatrick

Paleobiology - D.B. Blake, R.L. Langenheim, P.A. Sandberg, J. King (adj)

Sedimentary Basin Analysis - S. P. Altaner, C. M. Bethke, D. B. Blake, A. V. Carozzi, R. L. Hay, A. T. Hsui, G. deV. Klein, R. L. Langenheim, S. Marshak

Seismology - W.-P. Chen, S. Grand

Stratigraphy and Sedimentation - T. F. Anderson, D. B. Blake, A. V. Carozzi, R. L. Hay, G. deV. Klein, R. L. Langenheim, C.J. Mann, P. A. Sandberg

Structural Geology, Rock Physics, Tectonics - D. E. Anderson, J. D. Bass, W-P. Chen, A. T. Hsui, S. Marshak, A. S. Nieto

UNIVERSITY OF ILLINOIS GEOLOGY DEPARTMENT

FACULTY PROFILES

The information given below is generalized and conveys only work done in the last few years. For more specific information about courses or research, please contact the individual faculty member at the Department address.

STEPHEN P. ALTANER, Assist. Professor [1986 Appointment] (B.S., Colgate U. 1979; Ph.D. Univ. of Illinois 1985) - Clays and Diagenesis; Sedimentary Rocks and Stratigraphy

Stephen Altaner will be setting up a program in clay mineralogic and petrologic research. Among his broad range of interests in clay mineralogy, he plans to investigate conditions of clay mineral formation in sedimentary and diagenetic environments, in soils, and in hydrothermal environments associated with epithermal ore deposits, modern geothermal fields, and acid sulfate systems. Specific research topics will include diffusion in argillaceous rocks, kinetics of diagenetic clay mineral reactions, determination of thermal and burial histories of sediments, and occurrence of ammonium in epithermal ore deposits. Results of this type of research will have applications in the fields of petroleum exploration, mineral prospecting, and nuclear waste disposal. Field relations, petrography, chemical analysis, x-ray diffraction, stable and radiogenic isotope analysis, mathematical modeling, and experimental petrology techniques will be used for this research. Mineralogic research will include examination of mixed-layer and non mixed-layer clay minerals by transmission electron microscopy, by near- and mid-infrared spectroscopy, and by nuclear magnetic resonance (to complement the existing program of R.J. Kirkpatrick).

DAVID E. ANDERSON, Professor and Head (BSc-Hons., Univ. of Sydney, Australia, 1961; M.S. & PH.D. 1967, Univ. of Sydney, Australia) - Metamorphic and Theoretical Petrology

Professor Anderson has been department head since 1983. His research involves metamorphic processes and their relationship to the thermal and tectonic history of various metamorphic terraines. Current projects include: 1) Studies (with Stephen Marshak) of the metamorphism of rocks in the Granite Wash and Buckskin Mountains of Western Arizona and the relationship of metamorphism to thrust faults in the region. 2) Compositional and textural zoning in garnets and their relationship to the tectonic history of the Moine Schists of Scotland. 3) Chemical changes associated with shearing and mylonitization of basic igneous rocks in Scotland and Upper Michigan. 4) Theoretical modelling of diffusion processes in aqueous and crystalline electrolytes. Funds are currently being sought jointly by Stephen Marshak and D.E. Anderson for a comprehensive study of the deformation and metamorphism of the Transantartic Mountains. Professor Anderson teaches graduate courses in thermodynamics (including non-equilibrium thermodynamics) and metamorphic petrology.

THOMAS F. ANDERSON, Professor (B.S. 1961, DePauw University, Ph.D. 1967, Columbia University) - Stable Isotope Geochemistry

Professor Anderson's research involves the application of stable isotope variations to investigating the origin and diagenesis of sediments. He collaborates with Dr. John D. Hudson of the University of Leicester on oxygen isotope variations in Phanerozoic carbonates and their implications for diagenesis, paleoclimates, and hydrosphere-lithosphere interactions. Much of the data used is from a continuing joint project with Prof. P. A. Sandberg on textural, chemical, and isotopic characterization of constituents in Phanerozoic limestones. Three Ph.D. students are currently involved in this joint project. Professor

Anderson is also collaborating with Dr. M. A. Arthur (University of Rhode Island) on mass and isotopic balance considerations on the burial of organic carbon and sulfur in marine sediments. The results of this study will improve our general understanding of the role of sedimentary cycles in global redox balancing. One Ph.D. student is conducting research in this area. Professor Anderson also maintains his interests in paleo-oceanographic implications of isotopic variations in Quaternary nannofossils, the origin of ground ice and the sulfur isotope geochemistry of coal. Future plans include the continuation of studies on secular isotope variations (oxygen, carbon, sulfur) in marine sediments, with particular emphasis on mid- and lower-Paleozoic limestones and shales and on oxygen isotope variations in biogenic phosphates. Professor Anderson would also like to resume studies of experimental carbonate diagenesis.

JAY D. BASS, Assistant Professor (Ph.D. 1982, State University of New York at Stony Brook) - Geophysics; Mineral Physics; Elastic Properties of Minerals

Jay D. Bass has been at Illinois since August 1984. His major research efforts are in the area of experimental geophysics and laboratory measurements of the physical properties of minerals. Much of his recent work has focused on measurements of elastic wave velocities in minerals and high-pressure polymorphic phases by Brillouin spectroscopy, and this work is being further pursued at Illinois. Brillouin spectroscopy is a light scattering technique that is particularly well suited for measuring wave velocities in microscopic-sized samples, many of which are synthesized at high pressures and high temperatures. The results of such experiments are used to calculate the wave velocities and density of mineral aggregates under the high-pressure and high-temperature environment of the Earths deep interior. Comparisons with seismological models of velocity versus depth in the Earth provide a powerful constraint upon the chemistry and mineralogy of the Earths mantle, and this is a prime motivation for measuring elastic properties. In addition to measurements under room conditions, a program will be initiated to perform these experiments at high pressure in diamond-window pressure cells, and at high temperatures. Other research pursuits include: 1) X-ray studies of crystal structures at high pressure, 2) The high-pressure equation of state of oxides and metals which bear on the composition of the mantle and core, using shock-wave techniques (in collaboration with the California Institute of Technology), 3) In-situ measurements of stress in the Earths crust by holographic interfermetry (also with Cal Tech).

CRAIG M. BETHKE, Assistant Professor (A.B. 1980, Dartmouth College, Ph.D. 1985, University of Illinois) Hydrogeology

Craig Bethke's primary research interest is study of the groundwater hydrology of sedimentary basins through geologic time, and the effects of groundwater motion on petroleum migration, ore formation, and sediment diagenesis. Recent work includes a theoretical analysis of the role of compaction-driven groundwater flow during subsidence of sedimentary basins, performed on a CRAY supercomputer. He applied this analysis in a study of the relative importance of compaction-driven and gravity-driven groundwater flow over the geologic history of the Illinois Basin, and this work has improved understanding of petroleum migration, as well as the genesis of Mississippi Valley-type ore deposits. Craig also recently completed research on the illitization reaction of smectite, a clay mineral dehydration reaction which is an important contributor of deep fluids and cements in evolving basins. This research was recognized with an award from the Clay Minerals Society. Current work involves construction of a numerical chemical reactor model to study the dynamics of sediment diagenesis, including effects of transport by groundwaters, and study of the origins of geopressured zones in the subsurface. With the support of petroleum and minerals companies and governmental sources, Craig is building a hydrogeology laboratory, complete with supercomputer and interactive computer graphics facilities.

DANIEL B. BLAKE, Professor (B.S. 1960, University of Illinois, M.S. 1962, Michigan State, Ph.D. 1966, University of California) Invertebrate Paleontology; Biostratigraphy

Professor Blake continues to study fossil and modern sea stars, and Paleozoic Bryozoa. In recent years, his work has taken him to numerous museums in North America, Europe and Australia. Professor Blake and Dennis Kolata, a geologist at the Illinois Geological Survey, have begun a paleoecological study of a Middle Ordovician carbonate and shale interval which is bounded by K-bentonite (altered volcanic ashes) isochrones. Individual K-bentonites can be recognized from Minneapolis-St. Paul to south of St. Louis and therefore it is possible to characterize coeval paleoenvironments on a subcontinental scale. Professor Blake teaches Introductory Physical Geology, undergraduate Paleontology, and graduate courses in Paleoecology and Principles of Paleontology. Paleoecology includes field trips to Southern Illinois and Kentucky.

ALBERT V. CAROZZI, Professor (M.S. 1947, University of Geneva;[Geology and Mineralogy] Dr.Sc. 1948, University of Geneva) - Sedimentary Petrography; Petroleum Geology

Professor Carozzi supervises many graduate students in the department and at the request of one of his major research sponsors, PETROBRAS (The National Oil Company of Brazil) has recently worked with them in setting up and implementing a new educational venture which consists of an MS program by PETROBRAS in association with the Federal University of Ouro Preto (Minas Gerais). This program includes reservoir geology, structural geology, engineering geology and basin analysis. Professor Carozzi taught short courses dealing with the sedimentary petrography of carbonate and siliciclastic rocks, followed by their depositional models applied to oil exploration for the first phase of this program in Brazil. He is presently working on the second phase and the planning of a Ph.D. program. In addition to PETROBRAS research support, TEXACO USA is supporting microfacies work and experimental development of secondary porosity in carbonate rocks under simulated deep burial conditions with application to the Atokan of the Midland Basin and the Smackover of the Gulf Coast.

CHU-YUNG CHEN, Assistant Professor (B.S. 1977, National Taiwan University, Ph.D. 1983, MIT) Trace Element Geochemistry; Isotope Geochemistry; Igneous Petrology

Chu-Yung Chen joined the Department in August 1983 and is setting up a neutron activation laboratory and an isotope dilution laboratory for high quality trace-element and isotope analyses. Her research projects include: (1) The geochemical evolution of Haleakala volcano, East Maui. (2) Trace element variations of tholeiites, transitional basalts and alkalaic basalts from Mauna Kea volcano, Hawaii. (3) Rare-earth geochemistry of Hilina formation, Kilauea volcano, Hawaii. (4) Pb isotopic geochemistry of Loihi seamount. (5) Sr and Nd isotopes and trace element geochemistry of ultramafic nodules from Mt. Leura, Victoria, Australia. (6) Trace element studies and factor analyses of coal from Freeport and aerosol from Houston. (7) Petrological and geochemical studies of West Maui volcano. (8) Trace element and isotopic (Nd, Sr and Pd) studies of the transition from tholeiitic to alkalic volcanism on Hawaiian islands. (9) Geochemistry of high-MgO basalts from Hawaiian volcanoes. (10) Mineral chemistry of Hawaiian basalts. (11) Ophiolites from Cyprus. (12) Kimberlites and Carbonatites from Illinois. (13) Oxygen isotopic geochemistry of Hawaiian basalts.

WANG-PING CHEN, Assistant Professor (B.S., National Taiwan University, 1974, Ph.D., MIT, 1979) - Geophysics, Seismology, Tectonics

The research activity of the earthquake seismology group centers around the quantitative understanding of large scale deformation of the lithosphere. The most important constraints are obtained from the precise determination of depth and source mechanism of earthquakes as well as the gravity and geoid anomalies derived from satellite altimetry observations. Dr. Chen's current research efforts include studying the relationship between seismic activity and the thermal-mechanical properties of the lithosphere, source kinematics of large earthquakes, and the role of strike-slip faulting in the evolution of regions of extensional tectonics. As a spin-off, a seismic study of the Azores-Gibraltar plate boundary is also funded by the NSF. The tectonic setting of this plate boundary is unique because of the presence of divergent, transcurrent, and convergent characteristics along a single boundary; the occurrence of ocean-ocean convergence apparently without a Benioff zone; and the transition from such convergence to continental collision. Dr. Chen was recently an invited speaker at the Regional Assembly of the International Association of Seismology and Physics of the Earth's Interior in India (1984) and visited the Himalaya as a part of his study on the quantitative aspects between seismicity and mountain building.

STEPHEN GRAND, Assistant Professor [1986 appointment] (B.Sc. 1978, McGill University; PhD. 1985, Cal Tech) - Geophysics, Seismology

Stephen Grand is interested in the elastic fine structure of the mantle. Using synthetic seismogram techniques to understand wave propagation in the mantle, shear waves from earthquakes can be used to determine structure. Using multiple bounce shear waves increases the resolution and applicability of the technique. Recently, using the synthetic seismogram technique, vertical shear profiles were developed for the Canadian shield, the western United States and the northwest Atlantic ocean, showing large differences to 400 km depth. Current research efforts are to derive fully three-dimensional models of the mantle shear structure beneath North America using the tomography technique, developing computer codes to make synthetic seismograms appropriate for propagation through laterally varying structure and investigating deep mantle structure beneath individual tectonic provinces on a world-wide scale. The ultimate goal of this research is to help answer questions such as how deep do continents extend, is the mantle layered and on what scale does convection occur in the earth.

RICHARD L. HAY, Ralph E. Grim Professor of Geology (B.S. 1947, Northwestern University; M.S. 1949, Northwestern University; Ph.D. 1952, Princeton University) - Stratigraphy; Sedimentary Petrology

Most of Professor Hay's work has been concentrated on the general fields of stratigraphy, paleo-environment of non-marine sediments, pedogenesis, silicate diagenesis, and volcaniclastic sedimentology. His present major research effort is on spring-related carbonate rocks and Mg-silicate clays (sepiolite, smectite and kerolite) that were chemically precipitated in a Pliocene lake basin in the Amargosa Desert of Nevada-California. By field and laboratory work he and his students are working out the distribution and paleoenvironments of the different types of carbonates and clays. A new research interest, developed at Illinois, is the diagenetic alteration of Ordovician Midcontinent tuffs to K-feldspar and K-bentonite. He is trying to determine when and under what conditions the K-feldspar and mixed-layer illite-smectite were formed. This research is in collaboration with Dennis Kolata of the Illinois Geological Survey.

DONALD M. HENDERSON, Professor (A.B. 1943, Brown University; Ph.D. 1950, Harvard) - Mineralogy; Crystallography

Professor Henderson's research interests are in the area of transmission electron microscopic and nuclear magnetic resonance study of the local structures of minerals. He teaches graduate and undergraduate classes in mineralogy, optical mineralogy, structural mineralogy and crystallography.

ALBERT T. HSUI, Associate Professor (B.S. 1968, Lowell Technological Institute; M.S. 1969, Cornell University; Ph.D. 1972, Cornell University) - Geophysics; Mathematical Modelling; Geodynamics; Planetary Evolution and Borehole Seismology

Dr. Hsui's research interests include: (a) Planetary differentiation and its effects on mantle evolution and mantle dynamics; (b) Magma dynamics and its relationship to the structure of igneous rocks; (c) investigations on the geodynamics at convergent plate boundaries and (d) a new project to study wave propagation around a borehole. Dr. Hsui teaches a general geology course for science and geology majors, exploration geophysics and two other graduate courses in Geodynamics and Mathematical Methods in Geology.

W. HILTON JOHNSON, Associate Professor (A.B. 1956, Earlham College, M.S. 1961, University of Illinois; Ph.D. 1962, University of Illinois) - Quaternary Stratigraphy; Glacial Geology

Dr. Johnson is working on a project, supported by NASA through the Jet Propulsion Lab, to evaluate the use of Shuttle Imaging Radar-B data in the delineation and mapping of glacial geology and meltwater drainage landforms from central Illinois to central Ohio. The radar and other remote sensing data will be integrated with ongoing stratigraphic and sedimentologic studies in making interpretations of the dynamics and interactions of some of the major lobes and sublobes along the southern margin of the Laurentide Ice Sheet. Graduate students under Johnson's supervision are working on a variety of projects including: Quaternary geology and glacial sedimentology in the Precambrian shield terraine of south-central Ontario, late Pleistocene and Holocene fluvial geomorphology, stratigraphy and sedimentology of the lower Illinois River valley region, provenance of Illinoian and pre-Illinoian tills in south-central Illinois, and late Quaternary geology of the Napoleon Hollow Archeological site, Illinois River valley. Dr. Johnson teaches Introduction to the Study of the Earth, Glacial Geology, Quaternary Geology and Geomorphology. Field trips taken locally and to central Wisconsin emphasize glacial geology and stratigraphy, to central and southwestern Illinois focus on glacial stratigraphy, paleosols, late Pleistocene and Holocene fluvial geomorphology and alluvial stratigraphy; trips to Indiana emphasize glacial and bedrock geomorphology of the karst plain near Bedford.

R. JAMES KIRKPATRICK, Professor (B.S. 1968, Cornell University; Ph.D. 1972, University of Illinois) - Igneous and Experimental Petrology, NMR Spectroscopy

For several years Professor Kirkpatrick's research has centered on the use of magic-angle sample-spinning nuclear magnetic resonance spectroscopy (MASS NMR) in examining the structures of silicate crystals and glasses (quenched melts). One aim of this work is to better understand the thermodynamic, mechanical, and crystallization behavior of lava and magma and thereby the origin, evolution, and crystallization of igneous rocks. Another major objective is to use MASS NMR to examine the structure of crystalline phases that are too fine grained to be examined by single crystal x-ray or neutron diffraction such as clay minerals. This research program is being conducted in collaboration with Prof. Eric Oldfield of the School of Chemical Sciences, Professor D.M. Henderson and students and post-doctoral fellows in both Geology and Chemistry. Professor Kirkpatrick teaches Igneous and Metamorphic Petrography, Igneous Petrology (Graduate Level) and Geochemical Kinetics.

GEORGE deVRIES KLEIN, Professor (B.A. 1954, Wesleyan University; M.A. 1957, University of Kansas; Ph.D. 1960, Yale University) Sedimentology; Marine Geology; Sandstone Petrology and Diagenesis; Petroleum Geology of Clastic Reservoirs; Basin Analysis

Dr. Klein's research interests are focused on several topics. These include (1) Paleogeographic distribution of depositional systems through time, (2) Analysis of the timing of depositional systems and sandstone diagenetic events to the geodynamic and tectonic evolution of sedimentary basins, (3) Correlation of sedimentological, tectonic and volcanic events in back-arc basins of the western Pacific, and (4) Understanding processes of sedimentation, preservation potential and mass balancing of terrigenous sediments delivered from continents to ocean basins. This last project involves analysis of changing turbidite sedimentation history in submarine fans to changes in continental sediment yield, uplift rate and denudation rate, and comparing such data to petrologic data so as to ascertain the role of weathering history, sea level change and tectonics to preservation potential of marine sediments. Analysis of sedimentary basins has focused on back-arc basins and cratonic basins and devising solutions for recognizing ancient basins of controversial origin. Paleogeographic analysis has focused on storm and tidal sedimentary systems.

RALPH L. LANGENHEIM, JR., Professor (B.S. Geol. Engineering 1943, University of Tulsa; M.S. 1947, University of Colorado; Ph.D. 1951, University of Minnesota) - Stratigraphy, Paleontology, Field Geology, Geology of Energy, Coal

Professor Langenheim's research centers on Pennsylvanian stratigraphy and biostratigraphy in the Illinois Basin and southern Nevada. Presently major effort is being devoted to determining brachiopod ranges in the Arrow Canyon, Nevada section which has been proposed for several regional and/or world stratotypes. Study of latest Chesterian and early Atokan brachiopods is planned for the immediate future as well as regional study of Atokan and Desmoinesian stratigraphy and biostratigraphy in the southern part of the Cordilleran Miogeocline. He teaches History of the Earth, Geology of Energy and Field Geology at the elementary level; Principles of Stratigraphy at the intermediate level and graduate courses in Stratigraphy. He is Director of the Summer Geology Field Camp which is held in Wyoming.

C. JOHN MANN, Professor (B.S. 1953, University of Kansas; M.S. 1957, University of Kansas; Ph.D. 1961, University of Wisconsin) - Stratigraphy; Mathematical Geology; Petroelum Geology

Professor Mann's mathematical geology research work, sponsored by Sandia National Laboratories, attempts to determine probabilities and probability density functions of natural geological events and processes in order to more accurately predict hazards accompanying long-term storage of nuclear waste materials. Dr. Mann is also examining the evolution of stratigraphic sequences in an effort to more accurately determine periodicities and cyclicities which are known to be present as well as to perhaps detect new ones which previously have gone undetected. He teaches Geology for Engineers, General Geology, and Principles of Stratigraphy. These courses include field trips to southern Indiana, Upper Wabash River Valley and San Salvador Island, Bahamas. Studies in the Bahamas are on algal structures in a brackish to hypersaline lake in an attempt to relate structures and lack of structures in the mounds to environmental conditions under which they are growing.

STEPHEN MARSHAK, Assistant Professor (A.B. 1976, Cornell University; M.S. 1979, University of Arizona; Ph.D. 1983, Columbia University) - Structural Geology and Tectonics

Dr. Marshak's current research focuses on field analysis of structural geometry and fabrics in fold-thrust belts and in poly-phase deformed metamorphic terranes.

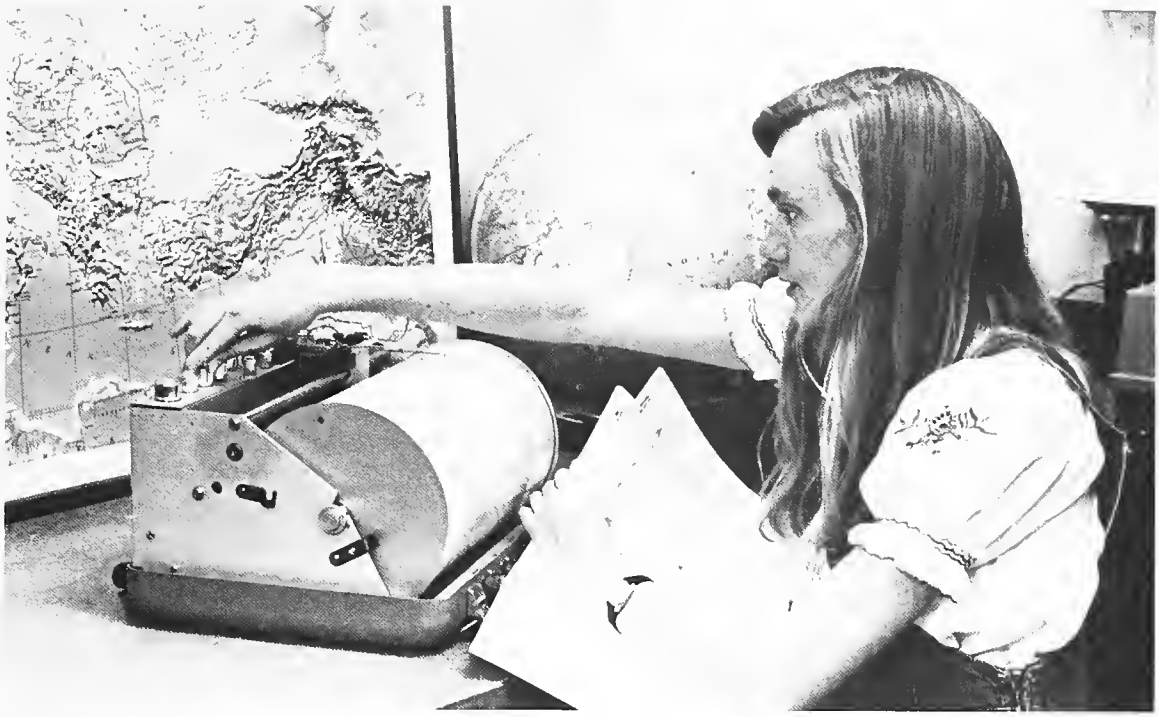
This work presently involves studies in two regions: the Appalachian foreland in New York State and the Sonoran desert of western Arizona. His work on oroclinal bending in the Appalachians is currently being funded by the National Science Foundation. Conditional on funding, Dr. Marshak anticipates beginning a new project (with D.E. Anderson) on basement geology of the Transantarctic Mountains. Student theses in structural geology and tectonics (some of which are shared with D.E. Anderson) at the University of Illinois are on topics such as: structures of the Appalachian fold-thrust belt near Kingston, New York; polyphase deformation of Mesozoic strata in the Granite Wash Mountains, Arizona; mylonite evolution in the Buckskin Mountains, Arizona; petrographic and geochemical changes occuring during deformation of limestone; shear zone development in mafic dikes of northwest Scotland. Dr. Marshak's teaching responsibilities include: introductory structure, advanced structure, and geotectonics. Course field trips have run to northern Michigan, central Wisconsin, and eastern Tennessee. Two new courses are anticipated: Tectonics of the southern Cordillera (with D.E. Anderson), and Rock rheology (with J.D. Bass and W.-P. Chen).

ALBERTO S. NIETO, Associate Professor (B.S. 1961, San Marcos University; M.S. 1963, Washington University; Ph.D. 1974, University of Illinois) - Engineering Geology; Applied Rock Mechanics

Dr. Nieto's main professional interests are applied rock mechanics and the geotechnical characterization of large engineering sites such as hydroelectric projects, underground storage caverns, waste disposal sites, surface and underground mines, major highways, foundations for large structures and others. He is presently supervising Ph.D. theses on shear strength of soil-filled discontinuities in rock masses and the analysis of a new model for slope failures that involves a combination of toppling and sliding. Dr. Nieto teaches Geology for Engineers, Principles of Engineering Geology and Practice of Engineering Geology at undergraduate and graduate levels; he also holds a joint appointment in the Civil Engineering Department.

PHILIP A. SANDBERG, Professor (B.S. cum laude 1960; M.S. 1961, Louisiana State University. Fil. Lic., 1964; Fil. Dr., 1965 University of Stockholm) - Carbonate Sedimentology; Micropaleontology; Historical Geology

Professor Sandberg's current research is in part on the temporal variation in non-skeletal carbonate mineralogy and its relationship to plate-tectonically mediated chemical changes in the ocean, particularly pCO_2. Another major research effort is devoted to the study of microcrystalline limestones, including the role of cementation and compaction in lime mud diagenesis, and temporal and environmental variations in lime mud diagenesis and precursor carbonate mud types. Professor Sandberg teaches Carbonate Sedimentology, the SEM portion of Microbeam Analysis (SEM and electron microprobe), Micropaleontology, and an Intersession field course entitled "Introduction to Modern Marine Carbonate Environments" This field group looks at Florida Cenozoic carbonates in the panhandle area, along the west coast and around Miami, then goes to the Florida Keys region to study modern equivalents of ancient carbonates.

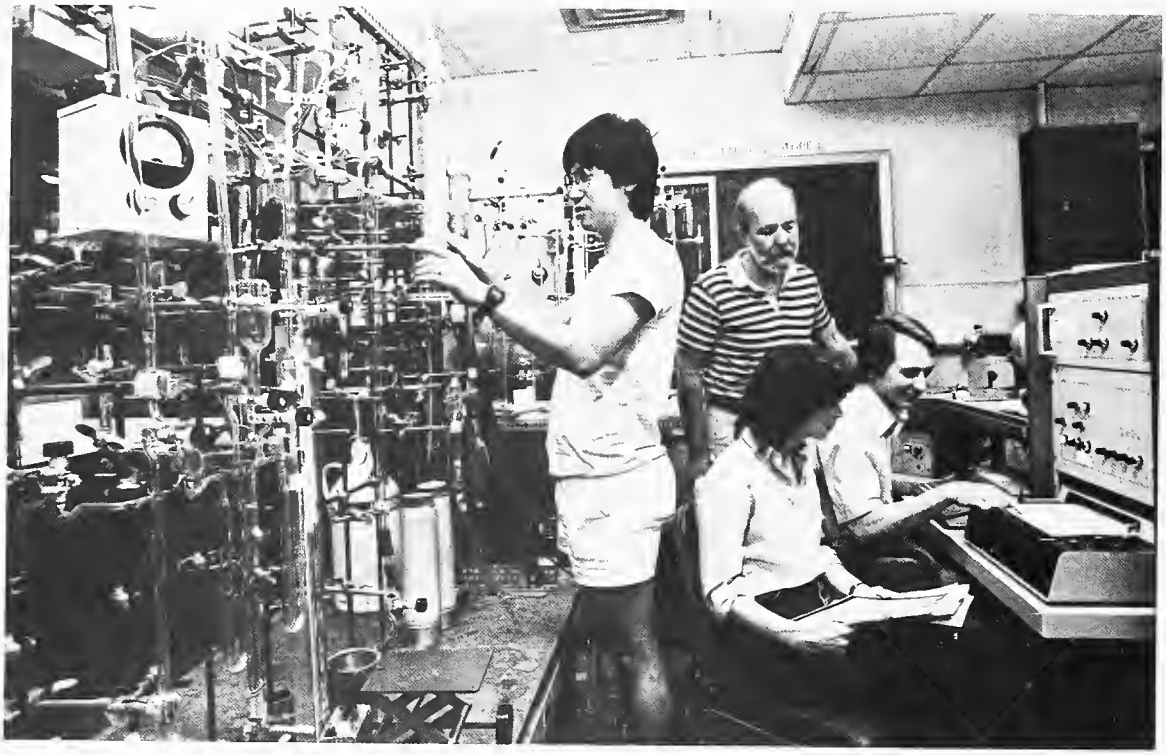


Nina Grimison, a graduate student in geophysics, calibrating a portable seismograph. The globe shows her thesis area in the eastern Atlantic.

RECENTLY FUNDED PROJECTS

Principal Investigator	Title	Agency
Thomas F. Anderson	Burial of Organic Carbon and Sulfur in Cretaceous Marine Sediments: Mass and Isotopic Balances	National Science Foundation
Jay D. Bass	Mineral Elasticity by Brillouin Scattering	National Science Foundation
Craig Bethke	Paleohydrologic Modeling of Sedimentary Basins	ARCO
	Techniques of Hydrologic Modeling	TEXACO
	Chemical Kinetics of Diagenetic Reactions	EXXON Production Research
Chu-Yung Chen	Petrological and Geochemical Study of the Evolution of West Maui Volcano	National Science Foundation
Wang-Ping Chen	A Study of Intracontinental and Intraplate Intermediate Depth (Sub-Crustal) Earthquakes	National Science Foundation
	A Seismic Study of the Azores-Gibralter Plate Boundary	National Science Foundation
W. Hilton Johnson	Interlobate Comparison of Glacial-Depositional Style as Evidenced by Small-Relief Glacial Landscape Features, Illinois, Indiana, and Ohio, Utilizing Shuttle Imaging Radar-B	National Aeronautics & Space Administration
R. James Kirkpatrick	Kinetics of Igneous Processes	National Science Foundation
	High-Resolution NMR Spectroscopy of Geologically Important Crystals and Glasses	"
	Study of Nuclear Magnetic Resonance (NMR) Spectroscopy of Solids	Sandia National Laboratories
	Study of Nuclear Magnetic Resonance (NMR) Spectroscopy of Solids	"

Principal Investigator	Title	Agency
George deV. Klein	Synthesis of Back-Arc Basin Sedimentology Based on DSDP/IPOD Drilling	National Science Foundation
Stephen Marshak	Kingston Arc of Eastern New York: Structural Geometry, Strain and Tectonic Significance of an Oroclinal Bend in the Appalachians	National Science Foundation
Philip A. Sandberg	Original Mineralogy in Micrites: Genetic and Diagenetic Implications	National Science Foundation
	Original Mineralogy in Micrites: Genetic and Diagenetic Implications	American Chemical Society Petroleum Research Fund
	Original Mineralogy in Micrites: Genetic and Diagenetic Implications	AMOCO



The stable Isotope Geochemistry Laboratory. Kyung Sik Woo is working on a vacuum extraction line. Professor Tom Anderson, Linda Bonnell and Brian Popp ponder the output of a mass spectrometer.

LIST OF PUBLICATIONS 1984-1985

Geophysics/Structural Geology/Tectonics/Engineering Geology

Books and Articles

Anderson, D. L. and J. D. Bass, 1984. Mineralogy and Composition of the upper mantle: Geophys. Res. Lett., v. 11, p. 637-640.

Bass, J. D., 1984. Elasticity of single-crystal $SmAlO_3$, $GdAlO_3$ and $ScAlO_3$ perovskites: Phys. Earth. Planet. Interiors, v. 36, p. 145-156.

Bass, J. D. and D. L. Anderson, 1984, Composition of the upper mantle: geophysical tests of two petrological models: Geophys. Res. Lett. , v. 11, p. 237-240.

Bass, J. D., and D. J. Weidner, 1984. Elasticity of single-crystal orthoferrosilite: J. Geophys. Res., v. 89, p. 4359-4372.

Bass, J. D., D. Schmitt and T. J. Ahrens, 1984. Holographic in-situ stress measurements. Geophys. J. R. Astr. Soc., in press.

Sasaki, S., C. T. Prewitt, J. D. Bass and W. A. Schulze, 1984. The space group and crystal structure of orthorhombic perovskites $CaTiO_3$ and $CdTiO_3$. Acta. Cryst. B, Submitted.

Molnar, P., and W.-P. Chen, 1984. S-P wave travel time residuals and lateral inhomogeneity in the mantle beneath Tibet and the Himalaya. J. Geophys. Res., v. 89, p. 6911-6917.

Nabelek, J. L., W.-P. Chen, and H. Ye, 1984. The Tangshan, North China, earthquake sequence of 1976: A complicated multiple rupture and its tectonic implications. Submitted to J. Geophy. Res.

Huang, J., and W.-P. Chen, 1985. Source mechanisms of the Mogod earthquake sequence of 1967 and the event of July 4, 1974 in Mongolia. Submitted to Bull. Seism. Soc. Am.

Grimison, N., and W.-P. Chen, 1985. The Azores-Gibraltar plate boundary: Focal mechanisms, depths of earthquakes, and their tectonic implications. Submitted to J. Geophys. Res.

Grimison, N., G. Karner, W.-P. Chen, and J. Weissel, 1985. A diffuse zone of ocean-ocean convergence: Gravity and geoid signitures of the Horseshoe Seamounts. Submitted to Tectonics.

Hsui, A. T., B. D. Marsh and M. N. Toksoz, 1984. On melting of the subducted oceanic crust. Tectonophysics, v. 99, p. 207-221.

Sawyer, D. S., A. T. Hsui and M. N. Toksoz, 1985. Subsidence and thermal history resulting from middle Miocene extension in the Los Angeles Basin. Submitted to Tectonophysics.

Hsui, A. T. and N. Riahi, 1985. Onset of double-diffusive convection with crystallization. Submitted to Int. J. of Eng. Sci.

Hsui, A. T. and M. N. Toksoz, 1985. A model for tube wave attentuation and its application to the determination of in-situ formation permeability. In preparation.

Marshak, S., 1985. Structure and tectonic setting of the Hudson Valley Fold-Thrust Belt, New York: A buckled thrust system. Geol. Soc. Am. Bull. (in press).

Laubach, S.E., and Marshak, S., Pattern of faulting developed during extension of crystalline basement, northwest Scotland: In preparation for J. Geol. Soc. London.

Marshak, S., and T. Engelder, 1985. The development of cleavage in limestones of a fold-thrust belt in eastern New York. J. Struc. Geol. (in press).

Engelder, T., and S. Marshak, 1985. Disjunctive cleavage formed at shallow depths in sedimentary rocks. J. Struc. Geol. (in press).

Marshak, S., and T. Engelder, 1985. The deformed Lower Devonian strata of the Hudson Valley, west of Catskill, New York. Geol. Soc. Am., DNAG Centennial Field Guide, (in press).

Nieto, A. S., D. Stump and D. G. Russell, 1984. A mechanism for sinkhole development above brine cavities in the Windsor-Detroit area, Procs. 6th Intern. Symp. on Silt, v. II, p. 1063-1092.

Nieto, A. S. and D. C. Russell, 1984. Sinkhole development in Windsor Detroit solution mines and the role of downward mass transfer in subsidence, In Situ, Quarterly, v. 8, p. 293-327.

Nieto, A. S. and P. K. Mathews, 1985. Moment-driven deformation of rock slopes. Procs. 36th Symp. Highway Geology; Purdue University, West Lafayette, IN, 12 p.

Nieto, A. S. and C. Zambak, 1985. Design of rock slopes susceptible to toppling, Sect. 9, Chapter in Handbook of Civil Engineering, Technomics Pull. Co., P. N. Sheremisenoff, N. P. Sheeremisenoff, S. L. Cheng, editors.

Abstracts

Bass, J. D. and D. L. Anderson, 1983. Mantle compositions and mineral elasticity. Trans. Am. Geophys. Union, v. 64, p. 848.

Bass, J. D. and D. L. Anderson, 1984. Geophysical tests of two chemical models for the Earth's upper mantle. Abstracts, Lunar Planet. Sci. Confer. XV, March 12-16, 1984, p. 38-39.

Bass, J. D., C. Chang, B. Svendsen and T. J. Ahrens, 1984. Temperature measurements of shock-compressed iron. Trans. Am. Geophys. Union, v. 65, p. 1090.

Anderson, D. L., and J. D. Bass, 1984. The seismic structure and mineralogy of the upper mantle transition region. Trans. Am. Geophys. Union, v. 65, p. 999.

Schmitt, D. , J. D. Bass and T. J. Ahrens, 1984. Holographic In-situ stress measurements. Trans. Am. Geophys. Union, v. 65, p. 1102.

Huang, J., and W.-P. Chen, 1984. Source mechanism of the Mogod earthquake sequence of January, 1967 in Mongolia. EOS Trans. A.G.U., v. 65, p. 241.

Chen, W.-P. and P. Molnar, 1984. Seismic wave velocity structure beneath the Tibetan plateau: A summary of constraints from regional and teleseismic observations. Abstract, Regional Assembly of the International Association of Seismology and Physics of the Earth's Interior, National Geophysical Research Institute, Hyderabad, India.

Grimison, N., and W.-P. Chen, Source mechanisms of earthquakes and the present-day tectonics along the Azores Gibraltar plate boundary, EOS Trans. A.G.U., 66, 1985.

Karner, G. D., N. L. Grimison, W.-P. Chen, and J. K. Weissel, SEASAT derived gravity and geoid anomalies of the Azores-Gibraltar plate boundary: A diffused zone of ocean-ocean convergence near Gibraltar, ibid, 1985.

Chen, W.-P., Sub-crustal earthquakes beneath the Shillong plateau and their tectonic implications, ibid, 1985.

Hsui, A. T., 1984. A preliminary dynamic model for planetary differentiation. Lunar and Planetary Science Conf. XV, Houston, Texas, p. 383-384.

Hsui, A. T., 1984. Crustal differentiation and mantle evolution. EOS Amer. Geophys. Un. Trans., v. 65, p. 272.

Marshak, S., P. Kwiecinski, D. McEachran, and J. Tabor, 1985. Structural geometry of the "Orocline" in the Appalachian foreland, near Kingston, New York. Geol. Soc. Am. Abst., w. Pgms., v. 17, p. 53.

Marshak, S., 1985. Evidence for a buckled thrust system in the northern Appalachian fold-thrust belt, New York. Geol. Soc. Am. Abst. w. Pgms.

Marshak, S., D.E. Anderson, and S. Laubach, 1985. Modes of fracture propagation and rock-water interaction in extensional terranes: (in) "Conference on extensional tectonics," Durham, England.

Marshak, S., T. Engelder, and S. Bhagat, 1985. Mechanism of cleavage-parallel extension in lime wackestone. "Conference on structures of sedimentary rocks," London, England.

Laubach, S. E., S. J. Reynolds, J. E. Spencer, and S. Marshak, 1984. Polyphase deformation history of Mesozoic metasedimentary rocks in western Arizona: Geol. Soc. Am. Abst. w. Pgms., v. 16, p. 570.

Marshak, S., and T. Engelder, 1984. Development, distribution and evolution of cleavage in a fold-thrust belt in eastern New York State. Int. Conf. on multiple deformation & foliation development, Bermagui, Australia, p. 2.

Petrology/Mineralogy/Geochemistry/Hydrogeology

Books and Articles

Westgate, L. M. and T. F. Anderson, 1984. Isotopic evidence for the origin of sulfur in the Herrin (No. 6) Coal Member of Illinois. Intl. J. Coal Geology, v. 4, p. 1-20.

Steinmetz, J. C. and T. F. Anderson, 1984. The significance of isotopic and paleontologic results on Quaternary calcareous nannofossil assemblages from Caribbean core P6304-4. Mar. Micropaleo., v. 8, p. 403-424.

Bethke, C. M., and R. C. Reynolds, 1985. Recursive method for determining frequency factors in interstratified clay diffraction calculations, Clays and Clay Minerals.

Bethke, C. M., 1985. A numerical model of compaction-driven groundwater flow and heat transfer and its application to the paleohydrology of intracratonic sedimentary basins. J. Geophys. Research.

Bethke, C. M., in review. Hydrologic constraints on genesis of the Upper Mississippi Valley Mineral District from Illinois Basin brines.

Bethke, C. M., N. Vergo, and S. P. Altaner, in review. Pathways of smectite illitization.

Bethke, C. M., and S. P. Altaner, in review. A layer-by-layer mechanism of smectite illitization and application to a new rate law.

Roscoe, B. A., C.-Y. Chen, and P. K. Hopke, 1984. Comparison of the target transformation factor analysis of coal composition data with x-ray diffraction analysis. Analytica Chimica Acta, v. 160, p. 121-134.

Staudigel, H., A. Zindler, S. R. Hart, T. Leslie,C.-Y. Chen and D. Clague, 1984. The isotopic systematics of a juvenile intraplate volcano: Pb, Nd, and Sr isotope ratios of basalts from Loihi Seamount, Hawaii. Earth. Planet. Sci. Lett., v. 69, p. 13-29.

Chen, C.-Y. and F. A. Frey, 1985. Trace element and isotope Geochemistry of Haleakala volcanic series, East Maui: Implications to the origin of Hawaiian basalts, J. Geophys. Res.

Kuo, L.-C., and R. J. Kirkpatrick, 1985. Kinetics of crystal dissolution in the system forsterite-diopside-silica. Am. J. Sci., 285, 51-90.

Kirkpatrick, R. J., R. A. Kinsey, K. A. Smith, D. M. Henderson, and E. Oldfield, 1985. High-resolution solid-state sodium-23, aluminum-27, and silicon-29 nuclear magnetic resonance spectroscopic reconnaissance of alkali and plagioclase feldspars. Am. Min., v. 70.

Kinsey, R. A., R. J. Kirkpatrick, J. Hower, K. A. Smith, and E. Oldfield, 1985. High-resolution aluminum-27 and silicon-29 nuclear magnetic resonance spectroscopic study of layer silicates, including clay minerals. Am. Min., v. 70.

Oldfield, E., and R. J. Kirkpatrick, 1985. High-resolution NMR of inorganic solids. Science, 277, 1537-1544.

Kirkpatrick, R. J., T. Dunn, S. Schramm, K. A. Smith, Oestrike, R., and Turner, G., 1985. Magic-angle sample-spinning nuclear magnetic resonance spectroscopy of silicate glasses: a review. Structure and Bonding in Glass, Walrafen, G., and Revez, A., eds., Nat. Bureau of Stds.

Kirkpatrick, R. J., K. A. Smith, S. Schramm, G. Turner, and W.-H. Yang, 1985. Solid-state nuclear magnetic resonance spectroscopy of minerals. Ann. Rev. of Earth and Planetary Sci., v. 13.

Yang, W.-H., R. J. Kirkpatrick, T. Emilsson, N. Vergo, J. McHone, and E. Oldfield, 1985. Detection of high-pressure silica polymorphs in whole-rock samples from meteor impact sites using solid-state silicon-29 nuclear magnetic resonance spectroscopy. Meteoritics, in press.

Kirkpatrick, R. J., K. A. Smith, E. Oldfield, and R. Oestrike, 1985. High-resolution aluminum-27 and silicon-29 NMR spectroscopy of glasses and crystals along the join $CaMgSi_2O_6$ - $CaAl_2O_6$. Am. Min., in press.

Goodman, B. A., J. D. Russell, B. Montez, E. Oldfield, and R. J. Kirkpatrick, 1985. Structural studies of imogolite and allophanes by aluminum-27 and silicon-29 nuclear magnetic resonance spectroscopy. Phys. Chem. Minerals, in press.

Turner, G., K. A. Smith, R. J. Kirkpatrick, and E. Oldfield, 1985. Boron-11 nuclear magnetic resonance spectroscopic study of borate and borosilicate minerals and a borosilicate glass. J. Mag. Res., submitted

Yang, W.-H., R. J. Kirkpatrick, and D. M. Henderson, 1985. High-resolution silicon-29, aluminum-27, and sodium-23 nuclear magnetic resonance spectroscopic study of aluminum-silicon disordering in annealed albite and oligoclase. Am. Min., submitted.

Kirkpatrick, R. J., R. A. Kinsey, K. A. Smith, D. M. Henderson, and E. Oldfield, 1985. High resolution solid-state sodium-23, aluminum-27, and silicon-29 nuclear magnetic resonance spectroscopic reconnaissance of alkali and plagioclase feldspars. Amer. Mineralogist, v. 70, p. 106-123.

Abstracts

Bonnell, L. M. and T. F. Anderson, 1984. Sulfur isotopic variations in Cretaceous green and black shales. Geol. Soc. Am., 1984 Annual Meetings, p. 449.

Bethke, C. M., J. D. Pruitt, and M. H. Barrows, 1984. Petrographic, geochemical, and paleohydrologic evidence of the nature of petroleum migration in the Illinois Basin. Amer. Assoc. Petrol. Geol. Bulletin, v. 68, p. 454.

Bethke, C. M., S. P. Altaner, and N. Vergo, 1984. A layer-by-layer mechanism of smectite illitization and its application to a new rate law. Clay Minerals Soc. Ann. Mtg., invited paper.

Chen, C.-Y., M. O. Garcia, and F. A. Frey, 1984. The Role of crystal fractionation in the Haleakala Volcanic Series - Major and Trace Element Constraints. E.O.S. Trans. AGU, v. 65, p. 1131.

Frey, F. A., C.-Y. Chen, M. Roden, and A. Kennedy, 1985. Utilization of geochemistry to understand the origin of the Hawaiian islands. The Am. Nuclear. Soc., Annual Meeting, Boston.

Schramm, S., E. Oldfield, and R. J. Kirkpatrick, 1984. High-Resolution Solid-State Oxygen-17 NMR Spectroscopy of Oxides and Silicates. Am. Geophys. Union, Spring 1984 Meeting.

Smith, K. A., E. Oldfield, R. J. Kirkpatrick, D. M. Henderson, and R. Oestrike, 1984. Correlation of Silicon-29 NMR Chemical Shift and Crystal Structure Parameters for Crystalline Silicates. Am. Geophys. Union, Spring 1984 Meeting.

Kirkpatrick, R. J., D. M. Henderson, R. Oestrike, L. Rowan, R. A. Kinsey, K. A. Smith, B. Montez, and E. Oldfield, 1984. High-Resolution ^{27}Al NMR Spectroscopy of Crystalline Aluminosilicates. Am. Geophys. Union, Spring 1984 Meeting.

Turner, G. L., K.A. Smith, E. Oldfield and R. J. Kirkpatrick, 1984. High resolution solid state Boron-11 nuclear magnetic resonance spectroscopy of crystalline Borate and Borosilicate minerals and model compounds. Am. Geophys. Union, Spring 1984 Meeting.

Oestrike, R., R. J. Kirkpatrick, 1984. Silicate glass structure in the system Anorthite-Diopside-Forsterite: A high resolution solid state NMR study. Am. Geophys. Union, Spring 1984 Meeting.

Yang, W.-H., R. J. Kirkpatrick and E. Oldfield. High-resolution ^{23}Na, ^{27}Al, and ^{29}Si NMR spectroscopy of Al/Si disordering in annealed albite. Am. Geophys. Union, Spring 1984 Meeting.

McHone, J., T. Emilsson, W.-H. Yang, R.J. Kirkpatrick, N. Vergo, and E. Oldfield, 1984. Coesite and Stishovite detected in natural concentrations by solid-state silicon-29 nuclear magnetic resonance. 1984 Meteorites Society Ann. Meeting, Albequerque, NM.

Oestrike, R., W.-H. Yang, R. J. Kirkpatrick, E. Oldfield, B. Montez, A. Navrotsky, and R. Hervig, 1985. Investigation of framework-stoichiometry aluminosilicate glasses using silicon-29 and aluminum-27 MASS NMR spectroscopy. Am. Geophys. Union, Spring 1985 Meeting.

Weiss, C. A., Jr., R. J. Kirkpatrick, and T. Dunn, 1985. Aluminum-27 and silicon-29 NMR spectroscopy of peraluminous gels. Am. Geophys. Union, Spring 1985 Meeting.

Turner, G. L., K. A. Smith, E. Oldfield and R. J. Kirkpatrick, 1985. Structure and cation effect on phosphorus-31 NMR chemical shift and anisotropy of model and mineral orthophosphates. Am. Geophys. Union, Spring 1985 Meeting.

Yang, W.-H., R. J. Kirkpatrick, G. L. Turner, and E. Oldfield, 1985. Phosphorus-31 and aluminum-27 NMR spectroscopy of alumino-silicate glasses. Am. Geophys. Union, Spring 1985 Meeting.

Sedimentary Geology/Stratigraphy/Paleontology/Geomorphology

Books and Articles

Blake, D. B., 1985. The Benthopectinidae (Asteroidea: Echinodermata) of the Jurassic of Switzerland. Ecl. Geol. Helv. v. 77(3) p. 631-647.

Blake, D. B., 1985. Some post-Paleozoic sea stars (Asteroidea: Echinodermata) suggesting slow rates of evolution. J. Paleont. (in press).

Blake, D. B., 1984. Constructional morphology and life habits of the Jurassic sea star Sphaeraster Quenstedt. N. Jb. Geol. Palaont. abh., v. 169(1) p. 74-101.

Carozzi, A. V., 1984. Glaciology and the Ice Age. Jour. Geol. Education, v. 32 (3), p. 158-170.

Carozzi, A. V. and B. Wolff, 1984. Microfacies, depositional environments, and diagenesis of the Amapa carbonates (Paleocene-Middle Miocene), Foz do Amazonas Basin, offshore N.E. Brazil. Petrobras-Cenpes, Ciencia, Tecnica, Petroleo, v. 13, 103 p., 17 plates.

Carozzi, A. V. and R. T. Bertani, 1984. Microfacies, depositional models and diagenesis of Lagoa Feia Formation (Lower Cretaceous), Campos Basin, offshore Brazil: Petrobras-Cenpes, Ciencia, Tecnica Petroleo, v. 14, 104 p., 25 plates.

Carozzi, A. V. and D.C. Ward, 1984. Geology Emerging, a catalog illustrating the history of geology (1500-1850) from a collection in the Library of the University of Illinois at Urbana-Champaign. Robert B. Downs Publication Fund No. 8, U of I Library and the Graduate School of Library and Information Science, 565 p., 106 figures.

Carozzi, A. V. and I. Diaby, 1984. The St. Louis Limestone (Middle Mississippian) of Illinois Basin, U.S.A. - A carbonate ramp-bar-platform model. Archieves Sciences Geneve, v. 37 (2), p. 123-169.

Carozzi, A. V. and Jila Banaee, 1984. Bailey Limestone (Lower Devonian) of Southwestern Illinois: a carbonate turbidite. Trans. Illinois Acad. Sciences, v. 77 (3-4), p. 271-282.

Carozzi, A. V. and R. T. Bertani, 1985. Lagoa Feia Formation (Lower Cretaceous), Campos Basin, offshore Brazil: rift stage lacustrine carbonate reservoirs. Part I. Jour. Pet. Geol., v. 8(1), p. 37-58.

Bowman, H., F. H. Stross, F. Asaro, R. L. Hay, R. F. Heizer, and H. V. Michel, 1984. The northern Colossus of Memnon: new slants. Archaeometry, v. 26, p. 218-229.

Hay, R. L., and R. K. Stoessell, 1984. Sepiolite in the Amboseli Basin of Kenya: a new interpretation. In Singer, A., and Galan, E. (eds.) Palygorskite--sepiolite occurrences, genesis and uses. Elsevier Developments in Sedimentology No. 37., p. 125-136.

Johnson, W. H. Stratigraphy and correlation of the glacial deposits of the Lake Michigan Lobe prior to 14,000 B.P. Submitted as chapter in IGCP Project 24, Quaternary glaciations in the northern heimisphere.

Johnson, W. H., A. K. Hansel, L. R. Follmer, 1985. Wedron Section, Wedron, Illinois - Concepts of Woodfordian glaciation in Illinois in Decade of North American Geology - Centennial Field Guides, GSA (in press).

Johnson, W. H., A. K. Hansel, B. A. Socha, L. R. Follmer and J. M. Masters, 1985, Depositional environments and correlation problems of the Wedron Formation (Wisconsinnan), northeastern Illinois: North-central Section, GSA Field Trip, Illinois State Geological Survey Guidebook, 16, 91 p.

Klein, G. deV., 1984. Relative rates of tectonic uplift as determined from episodic turbidite deposition in marine basins. Geology., v. 12, p. 48-50.

Klein, G. deV. and Y.I. Lee, 1984. A preliminary assessment of geodynamic controls on depositional systems and sandstone diagenesis in back-arc basins, western Pacific Ocean. Tectonophysics, v. 102, p. 119-152.

Klein, G. deV., 1984. Sedimentary structures, in Heath, G. R., editor, 1984, Sedimentology, physical properties and geochemistry in the Initial Reports of the Deep Sea Drilling Project, v. 1-44: an Overview: World Data Center A for Marine Geology and Geophysics Rept. MCG-1, p. 27-61.

Klein, G. deV., 1984. Vertical sequences and log shapes of major sandstone reservoir systems (Chart): Boston, MA, IHRDC Pub. Co. (Wall Chart).

Klein, G. deV., 1985. The control of depositional depth, tectonic uplift and volcanism on sedimentation processes in the back-arc basins of the western Pacific Ocean. Jour. Geol., v. 93, p. 1-25.

Marsaglia, K. M. and Klein, G. deV., 1985. The paleogeography of Paleozoic and Mesozoic storm depositional systems: A Reply. Jour. Geol., v. 93, p. 91-94.

Klein, G. deV., 1985. Intertidal flats and intertidal sand bodies: in Davis, R. A., Jr., editor, 1985. Coastal sedimentary environments, 2nd ed. New York, Springer-Verlag, p. 187-224.

Klein, G. deV., 1985. Sedimentation patterns in relation to rifting, arc volcanism, and tectonic uplift in back-arc basins of the western Pacific Ocean: in Kobayashi, K., and Uyeda, S., editors, Proceedings of the OJI Conference on continental margins. Tokyo, Terra Sci. Pub. Co. (in press).

Klein, G. deV., 1985. Sandstone depositional models for exploration for fossil fuels, 3rd ed. Boston, IHRDC Publishing Co., 209 p.

Klein, G. deV. The frequency and periodicity of preserved turbidites in submarine fans as a quantitative record of tectonic uplift in collision zones. Tectonophysics (in press, 1985).

Haslett, J. M., Johnston, J. M. and Langenheim, R. L., Jr., Geology of the Wamp Spring Area, Hayford Peak Quadrangle, Clark County, Nevada, Earth Sci. Bull., v. 13, no. 3-4 and v. 14, nos. 1-4, p. 19-23.

Webster, G. D. and R. L. Langenheim, Jr. Atokan stratigraphy of the southern Cordilleran Miogeosyncline and adjacent shelf platform, southeastern California to northwestern Nevada, p. 123-131 in Sutherland, P. K. and Manger, W. L. (eds.), The Atokan Series (Pennsylvanian) and its boundaries -- a symposium, Okla. Geol. Survey Bull., v. 136, 198 p.

Langenheim, R. L., Jr., Webster, G. D. and Weibel, C. P., Atokan rocks of the Bird Spring Group Arrow Canyon, Clark County, Nevada, p. 133-156 in Sutherland, P. K. and Manger, W. L. (eds.), Atokan Series (Pennsylvanian) and its boundaries -- a symposium, Okla. Geol. Survey Bull. v. 136, 198 p.

Webster, G. D., Gordon, Mackenzie, Langenheim, R. L., Jr. and henry, T. W., Road logs for the Mississippian-Pennsylvanian boundary in the Eastern Great Basin: Salt Lake City, Utah to Las Vegas, Nevada, p. 1-74 in Lintz, Joseph, Jr. (ed), Western Geological Excursions, v. 1, Geol. Soc. Amer., 1984 Ann'l Mtg., Reno, Nev., Dept. Geol. Sci., Mackay School of Mines, Univ., Nev. Reno., 281 p.

Webster, G. D., P. Brenckle, M. Gordon, H. R. Lane, R. L. Langenheim, Jr., G. A. Sanderson and W. D. Tidwell, 1984. The Mississippian-Pennsylvanian boundary in the Eastern Great Basin, p. 406-418 in Sutherland, P. K. and Manger, W. L. (eds), Compte Rendu, v. 2, Neuvieme Cong. Internat. Strat. et Geol. Carbonif., Wah., D.C. and Champaign-Urbana, IL, 530 p.

Petersen, D. W. and R. L. Langenheim, Jr., 1985. Spiriferellina lata Lane in the Uppermost Chesterian in the Bird Spring Group at Arrow Canyon, Clark County, Nevada, Trans. Ill. State Acad. Sci., v. 77, no. 3-4, p. 207-218.

Mann, C. J. and L. R. Hoffman, 1984. Algal Mounds in Storr's Lake, San Salvador Island, Bahamas. Proc. Second Symposium on Geology of the Bahamas, CCFL Bahamas Field Station, San Salvador.

Mann, C. J., 1985. Changing Faces. Math. Geol., v. 17, p. 219-220.

Lasemi, Z., and P. A. Sandberg, 1984. Transformation of aragonite-dominated lime muds to microcrystalline limestones, Geology, v. 14, p. 420-423.

Sandberg, P. A., 1985. Non-skeletal aragonite and pCO_2 in the Proterozoic and Phanerozoic, in The Carbon Cycle and Atmospheric CO_2: Natural Variations Archean to Present. Amer. Geophys. Union, Geophys. Mon. Ser., v. 32 (in press).

Sandberg, P. A., 1985. Recognition criteria for calcitized skeletal and non-skeletal aragonite. Palaeontographica Americana, no. 54, p. 272-281.

Sandberg, P. A., 1985. Ancient aragonite cements and their occurrence in ancient limestones, in Harris, P. M. and Schneidermann (eds.) "Carbonate Cements", Soc. Econ. Paleont. Mineral., Spec. Publ. 36, 27 pp., 3 pls.

Bailey, J. B. and P. A. Sandberg, 1985. Preserved Mineralogy and Ultrastructure in Two New Pennsylvanian Bivalves. Proc. Ninth Int. Cong. of Carboniferous Strat. and Geol., v. 4 (in press).

Abstracts

Blake, D. B., 1984. Stability and Change in the History of Sea Stars. Abs. for 5th Internat. Conf. on Echinoderms, Galway, Ireland.

Carozzi, A. V. and W. C. Dawson, 1985. Experimental fabric-selective porosity in phylloid algal limestones. A.A.P.G. Bull., v. 69 (2), p. 248.

Carozzi, A. V. and R. T. Bertani, 1985. Lagoa Feia Formation (Lower Cretaceous), Campos Basin, offshore Brazil - rift-valley-stage lacustrine carbonate reservoirs. A.A.P.G. Bull., v. 69 (2), p. 237-238.

Hay, R. L., D. R. Kolata, M. Lee and W. D. Huff, 1984. Age of potassium metasomatism in an Ordovician tuff of the Mississippi Valley. GSA Abst. with Prog. v. 16, p. 533.

Socha, B. J., W. H. Johnson and A. K. Hansel, 1985. Glacigenic diamictons of late Wisconsinan age at Wedron, Illinois. GSA Abst. with Prog., v. 17, no. 5, p. 327.

Klein G. deV., 1984. Role of depositional depth and source terrain uplift rates on sedimentation patterns in back-arc basins of Western Pacific. A.A.P.G. Bull., v. 68, p. 495.

Klein, G. deV., 1984. Linear sand bodies in the Yellow Sea of Korea. Korea-US Seminar and Workshop on Marine Geology and Physical Processes of the Yellow Sea, p. 53-55.

Klein, G. deV., 1984. Determination of relative tectonic uplift rates in sediment source terrains from analysis of preserved turbidite frequencies occurring in submarine fans. Soc. Econ. Paleont. and Min. Annual Midyear Mtg. Abstracts, p. 43-44.

Klein, G. deV., 1984. Continental drilling targets sedimentary systems, and deep-hole diagenesis. EOS, v. 65, p. 1102.

Fritz, J. L., C. P. Weibel and R. L. Langenheim, Jr., 1984. Biostratigraphy of Pennsylvanian syringoporoid corals, Bird Spring Group, Arrow Canyon Range, Clark County, Nevada. GSA Abstr. with Prog., v. 16, no. 3, p. 139.

Huff, B. G. and R. L. Langenheim, Jr., 1984. Late Atokan brachiopod biostratrigraphy, Bird Spring Group, Arrow Canyon, Clark County, Nevada, Bull. AAPG, v. 68, no. 4, p. 489.

Langenheim, R. L., Jr., General geology and natural history of the Galapagos Islands, Earth Sci. Bull., v. 15 (1982), p. 145.

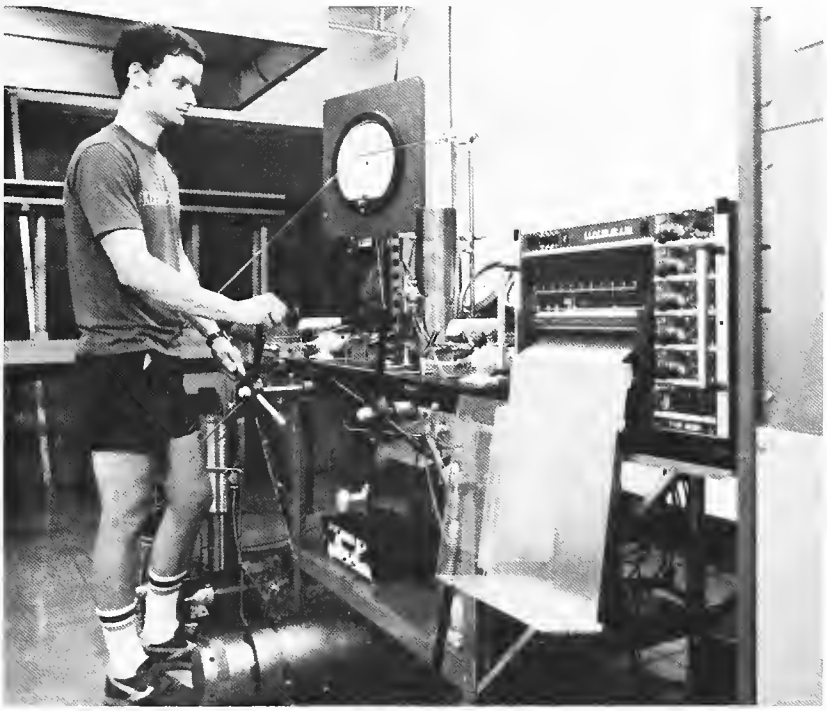
Vaiden, R. C. and R. L. Langenheim, Jr., 1985. Biostratigraphy and paleoenvironment of Morrowan (Zone 2) brachiopoda, Bird Spring Group, Arrow Canyon, Clark County, Nevada. Bull. AAPG, v. 69, no. 2, p. 313.

Mann, C. J., 1984. Quantitative Stratigraphic Correlation. Edited by J. M. Cubitt and R. A. Reyment: A Review. Math. Geology, v. 16, p. 213-215.

Mann, C. J., 1984. When Regressing with linear models, beware! GSA Abstr. with Progr., v. 16, no. 6, p. 584.

Sandberg, P. A., 1984. Phanerozoic cyclicity in non-skeletal carbonate mineralogy. Invited paper AGU Chapman Conference on Natural Variation in Carbon Dioxide and the Carbon Cycle, Tarpon Springs, Florida.

Sandberg, P. A., 1984. Ancient aragonites: their recognition and temporal distribution. 7th Meeting of Carbonate Sedimentologists, University of Liverpool, U.K.



Graduate student Don Von Bergen, who works with Prof. Carozzi, operating a unique high-pressure triaxial compression apparatus, which allows the circulation of CO_2-charged water under controlled conditions of temperature and pressure. This apparatus, which simulates burial conditions, is used to study development of secondary porosity in carbonate rocks.

DEPARTMENT OF GEOLOGY: COURSE OFFERINGS, 1982-1985, & ANTICIPATED

Geophysics - Structural Geology - Tectonics
Engineering Geology

Introduction to Geophysics	350	Bass/Chen/Chen
Geophysical Prospecting	351	Hsui
Physics of Earthquakes	397	W.-P. Chen
Mathematical Methods in Geology	480	Hsui
Geodynamics	493	Hsui
Numerical Methods in Geomechanics	493	Hsui
Introduction to Seismology	493	W.-P. Chen
Advanced Topics in Seismology	493	W.-P. Chen
Geophysical Inverse Theory	493	W.-P. Chen
Deformation of the Upper Mantle	493	W.-P. Chen/Bass/Marshak
Mineral Physics	493	Bass
Rheology of Earth Materials	493	Bass/Marshak
Introduction to Structural Geology	311	Marshak
Advanced Structural Geology	488	Marshak
Geotectonics	489	Marshak
Southern Cordilleran Geology	493	D. Anderson/Marshak
Practice of Engineering Geology	451	Nieto
Principles of Engineering Geology	450	Nieto
Geology for Engineers	250	Nieto

Sedimentary Geology - Stratigraphy - Paleobiology
Quaternary Geology - Geomorphology

Principles of Stratigraphy	321	Langenheim/Mann
Advanced Stratigraphic Geology	422	Langenheim
Selected Topics in Stratigraphy	493	Langenheim
Introduction to Paleontology	320	Blake
Paleoecology	420	Blake
Seminar in Paleontology	493	Blake
Micropaleontology	493	Sandberg
Sedimentology and Arkoma Basin	309	Klein
Field & Lab Procedures in Sedimentology	310	Klein
Sedimentary Petrography	338	Carozzi
Sedimentary Processes	437	Klein
Analysis of Sedimentary Basins	493	Klein
Sedimentology of Non-Marine Rocks	493	Hay
Sedimentology of Volcanoclastic Rocks	493	Hay
Recent Sedimentary Environments	477	Klein
Introduction to Modern Marine Carbonate Environments	315F	Sandberg
Carbonate Sedimentology	438	Carozzi
Carbonate Sedimentology	439	Sandberg
Depositional Models for Petroleum Exploration	444	Carozzi
Carbonate Ultrastructure and Diagenesis	493	Sandberg
Marine Geology of the Bahamas	315M	Mann
Geochemistry of Sediments and Natural Waters	432	T. Anderson
Oceanography	370	T. Anderson

Electron Beam Microanalysis	493	D. Anderson/Sandberg
X-ray Mineralogy	493	Altaner
Mineralogy of Clays	462	Altaner
Mineralogy of Clays II	463	Altaner
Coal Geology	493	Damburger
Paleobotany	350	Phillips
Geomorphology	301	Johnson
Quaternary Geology	457	Johnson
Glacial Geology	357	Johnson
Introduction to Palynology	493	King

Mineralogy - Igneous & Metamorphic Petrology - Geochemistry, Hydrogeology

Mineralogy	333	Henderson
Petrology	334	Henderson/ Kirkpatrick/C.-Y. Chen
Optical Mineralogy	335	Henderson
Petrography & Petrogenesis	336	Kirkpatrick
Advanced Igneous Petrology	435	Kirkpatrick/C.-Y. Chen
Advanced Metamorphic Petrology	493	D. Anderson
Theoretical Petrology & Non-equilibrium Thermodynamics	434	D. Anderson
Kinetics of Geological Processes	493	Kirkpatrick
Seminar on Melt Structure	493	Kirkpatrick
Structural Mineralogy	431	Henderson
X-Ray Mineralogy	493	Henderson/Altaner
Crystallography	493	Henderson
Mineralogy of Clays	462	Altaner
Mineralogy of Clays II	463	Altaner
Electron-beam Microanalysis	493	D. Anderson/Sandberg
Introduction to SEM & TEM	469	T. Kriven(Ceramics)
Neutron Activation Analysis	493	C.-Y. Chen
Chemistry of the Earth	360	T. Anderson/C.-Y. Chen
Geochemistry of Sediments and Natural Waters	493	T. Anderson
Trace-element Geochemistry	493	C.-Y. Chen
Isotope Geology	433	T. Anderson/C.-Y. Chen
Advanced Isotope Geochemistry	493	C.-Y. Chen
Introductory Hydrogeology	397	Bethke
Groundwater Hydrology	455	Bethke

Introductory Courses

Introduction to Study of the Earth	101
History of the Earth	102
General Geology I & II	107, 108
Regional Field Study (Grand Canyon)	115
Physical Sciences in Modern Science	142
Geology for Engineers	250
Geology of Energy	105
Field Geology in Rocky Mountains (Field Camp)	317

See also listings from depts. of Theoretical and Applied Mechanics, Metallurgy, Civil Engineering, Materials Research, and Geography.

FIELD-BASED RESEARCH AND INSTRUCTION

The Department of Geology has traditionally maintained a strong emphasis on field-related studies. This tradition has continued through both field-based instruction and field-based research. In many instances, this work is closely tied to state-of-the-art laboratory or theoretical studies. Below, we highlight some of the field areas in which members of our faculty are currently undertaking or recently completed field research or teaching.

Field Research

D. E. Anderson: Metamorphic reactions in rocks of northwest Scotland

J. Bass: In Situ stress measurements in Colorado

A. V. Carozzi: Minifacies of Mid-Continent Carbonates

C.-Y. Chen: Geochemical studies in Hawaii basalts and in Cyprus ophiolite

W.-P. Chen: Central Himalayas, India

R. L. Hay: Diagenetic studies in California; stratigraphy, diagenesis and early man studies in east Africa

W.H. Johnson: Quaternary stratigraphy, glacial geology, and geomorphology in Illinois

R. J. Kirkpatrick: Study of the Cyprus ophiolite

G. deV. Klein: Submarine sedimentology in the Sea of Japan and the Yellow Sea, Korea

R. L. Langenheim, Jr.: Stratigraphy and paleontology, Nevada

C.J. Mann: Stratigraphy of Illinois basin; Bahamas

S. Marshak: Structural analysis in eastern New York, western Arizona, and the Transantarctic Mountains

A. S. Nieto: Engineering geology problems in western Canada and Peru

P. A. Sandberg: Diagenesis in Pennsylvanian carbonates, S. E. Kansas

Field Teaching

Carbonate Geology: Florida Keys

Engineering Geology: Pennsylvania; central Wisconsin

Field Methods: Bighorn Mountains, Wyoming; western Arizona and southern California; Bahamas; central Wisconsin

Hydrogeology; Viburnian-trend mineral district; St. Francois Mountains

Introductory Geology: Ozark Mountains, Missouri; Colorado and Northern Arizona; central Wisconsin; east-central Illinois; Colorado, Utah, S. Nevada

Mineralogy/Petrology: Northern Michigan; western Arizona and southern California

Paleontology: Southern Illinois; Kentucky; Indiana; Wisconsin; Iowa; Minnesota; Missouri

Quaternary Geology/Geomorphology: Northern Illinois, southern and eastern Wisconsin; south-central Indiana; east-central Illinois/central, western and southern Illinois

Sedimentology: Ouachita Mountains

Stratigraphy: Wabash Valley; western Illinois

Structural Geology: Northern Michigan; eastern Tennessee; central Wisconsin; western Arizona and southern California

John Tabor, a graduate student in structural geology, about to descend into a quarry to map fold-thrust structures in eastern New York

Jack Pullen, the department's thin-section technician, preparing specimens using the automated Logitech polisher.

LABORATORY FACILITIES

Applied Rock Mechanics: direct shear devices, uniaxial compression column, slaking durability unit, soil testing equipment, base-friction table, and rock-wedge simulator.

Computer: University computer services provide: CDC Cuber 175 and 174, IBM 4341, DEC Vax II, Pyramid 90X, and on order, Cray MPX, along with necessary peripherals.

Electron-Microbeam: JEOL microprobe, Cambridge SEM, High-resolution SEM/EDAX systems (at the Center for Electron Microscopy), TEM and STEM systems and Argon Mill (at the Center for Materials Research).

Experimental Petrology: TemPress cold-seal pressure vessels, Deltech and Lindburg high-temperature furnaces (for synthesis, kinetics, and phase-equilibrium experiments).

Geochemistry: Siemens X-Ray Fluorescence and Perkin-Elmer Atomic Absorption Spectrophotometer for bulk-chemical (major, minor, and trace elements) analysis; MAT 250 isotope-ratio mass spectrometer (set up for carbon, oxygen, and sulfur); trace-element Neutron-Activation system (Germanium co-axial detector and multi-channel analyzer) (on order).

Hydrogeology: Equipment for accessing campus and remote cray supercomputers; computer colorgraphics and digitizing equipment.

Mineral Physics: (On order) Brillouin spectrometer (laser-light scattering for measuring elastic properties). Diamond-Anvil Pressure Cell (for optical and x-ray measurements on samples at pressures up to 300 kbar.

NMR Spectroscopy: High-resolution nuclear-magnetic resonance spectrometers and associated equipment for solution and solid spectroscopy (in Chemistry Building).

Seismology: Microfilm library of post-1960 WWSSN seismograms; computer file of post-1980 GDSN seismograms; digital seismic signal processing facilities including dedicated computer, interactive graphics, and record digitizer; portable short-period seismograph.

Soft-Rock Studies: Cathode luminescence; microscopes, settling tanks; isodynamic magnetic separator, acid preparation equipment, X-ray radiography.

Support: Logitech Automated thin-section preparation equipment; Numerous research-quality petrographic microscopes; photographic darkrooms.

Triaxial Loading: Hydraulic equipment for burial simulation and fluid circulation

X-Ray: Seimens X-ray powder diffractometer system, X-ray fluorescence analyzer, Philips X-ray diffractometer, Single-crystand and powder cameras, preparation equipment for clay minerals.

UNIVERSITY OF ILLINOIS GEOLOGY LIBRARY

The Library of the University of Illinois at Urbana-Champaign is the third largest university library in the country; our collection is surpassed in size only by the collections of Harvard and Yale. At present, we have over 6 million books and printed serials, and over 3 million non-book items including microfilms, videotapes, and maps. In 1985 the University of Illinois Library switched to a computer catalog system, which permits the identification of items by authors, titles, or keywords. The new system will also search the collections of affiliated libraries in addition to our own, and will automatically request books for delivery via campus mail. A terminal in the Geology Library permits direct access to **GeoRef** and other online sci/tech databases.

The **Geology Library** is housed in the Natural History Building along with the Department, thereby permitting easy access to books, journals, and maps. The total geology collection of the University includes over 160,000 volumes (of which half are in the Geology Library and the remainder are in the Main Library) and 55,000 catalogued sheet maps. Our holdings are notable for complete sets of all primary and most secondary American and foreign geological journals. The collection also includes a substantial selection of Soviet geological literature.

The University Library's **Rare Books Room** is repository for one of the world's outstanding collections of rare and early geological literature. Included in the collection are, among others, first editions of classic works by Agricola, Steno, Gesner, Biringucci, Smith, Maclure, Hutton, Werner, and Agassiz. We also possess a substantial selection of early American geological works. An annotated 565 page catalog to this collection by D. Ward and A. Carozzi was published in 1984 by the University of Illinois Library.

The Geology Library is managed by full-time staff, headed by Dederick Ward. Mr. Ward is active in national and international geoscience information efforts. He currently serves on the GeoRef advisory committee of the American Geological Institute.

Library Staff member Suzanne Hayes, Librarian Dederick C. Ward and staff member Diana Walter in Geology Library Map Room. The Geology Library houses over 80,000 volumes and 55,000 sheet maps in the Natural History Building.

COLLOQUIUM PROGRAMS

Students and faculty of the Department of Geology have a broad range of professional specialties, therefore, Colloquium programs are sought to provide topics of interest to all. Colloquia are held on Friday afternoons and begin with informal conversation, coffee and cookies in the lounge with the formal presentation following in the lecture hall. Recent speakers have included:

FALL 1983

Dr. GEORGE deVRIES KLEIN (Dept. of Geology, UIUC) "Tectonics and Sedimentation of the Back-arc Basins of the Western Pacific Ocean."

MR. RICK SCHULT Dept. of Geophysics, Stanford Univ.) "On the Speed of Continents over Hot Spots Since the Jurassic." (special colloq.).

DR. RICHARD L. HAY (Dept. of Geology, UIUC) "Fossil Footprints of Laetoli in Tanzania, East Africa."

DR. HARLAN P. BANKS (Div. of Biological Science, Cornell Univ.) "Intriguing Aspects of Early Land Plants (Silvrian - Devonian)."

DR. DEREK E. G. BRIGGS (Geology Dept., Univ. of London, England) "The Soft-bodied Organisms of the Burgess Shale."

DR. CHU-YUNG CHEN (Dept. of Geology, UIUC) "Geochemical and Petrologic Systematics in Lavas from Haleakala Volcano, East Maui, Hawaii: Implications for the Origin of Hot-spot Volcanism."

DR. DONALD J. LEVERENZ (Construction Eng. Res. Lab., Champaign) "Engineering Problems in the Exploitation of Non-fossil Fuels."

DR. HAROLD A. ILLICH (Sun Expl. and Production Co. of Texas) "Significance of Petroleum in Biochemical Evolutionary Studies."

DR. JOHANNES SCHROEDER (Geologisch - Palaontologisches Institut, Kiel Univ. at Berlin, Germany) "Multiple Choice in Carbonate Diagenesis." (special colloquium)

DR. MORRIS W. LEIGHTON (Chief, Illinois State Geological Survey) "Keys to Recent Significant Hydrocarbon Discoveries in Latin America."

DR. JOHN M. HAYES (Dept. of Geology, Indiana Univ.) "Redox Balances in Early Cycles."

DR. PETER A RONA (Sr. Res. Geophysicist, AAPG Distinguished Lecturer) "Hydrothermal Mineralization at Sea Floor Spreading Centers."

DR. MICHAEL A. ARTHUR (Grad. Schl. of Oceanography, Univ. of Rhode Island) "Biotic Extinction at the Cretaceous-tertiary Boundary: Terrestrial Versus Extraterrestrial Explanations."

DR. ALEXANDRA NAVROTSKY (Dept. of Chemistry, Arizona St. Univ.) "Structure of Glasses."

MS. ANNEMARIE MEIKE (Univ. of California, Berkeley) "TEM Studies of the Microstructure of Stylolites in Limestone." (special seminar)

DR. CARL E. JACOBSON (Dept. of Earth Sci., Iowa St. Univ.) "Structure, Metamorphism, and Tectonic Significance of the Pelona Schist and Vincent Thrust, Southern California."

DR. RICHARD J. REEDER (SUNY-Stony Brook, NY) "Carbonate Mineralogy."

DR. PATRICK BROWNE (Geothermal Inst., Univ. of Auckland, New Zealand) "Active Geothermal Systems and Ore Deposition."

DR. MICHAEL J. DeNIRO (Dept. of Earth and Space Sci., Univ. of California) "Developing Geochemical Methods to Study Anthropologic Problems." (special lecture)

DR. CARL WOESE (Microbiology Dept., UIUC) "Early Life: Recent Advances in Knowledge."

SPRING 1984

DR. STEPHEN MARSHAK (Dept. of Geology, UIUC) "The Development and Evolution of Tectonic Cleavage in Limestone."

DR. HUAN-YEN LOO (Inst. of Geology, St. Seismological Bur., Beijing, P.R.C.) "Three Dimensional Numerical Modeling of Formation Mechanism of the Shangxi Graben."

DR. YONG AHN PARK (Seoul National Univ.) "Late Quaternary Sedimentation on the Continental Shelf Off the Southeast Coasts of Korea."

DR. CHARLES W. COLLINSON (Head, Stratigraphy and Areal Geol. Sect., Illinois State Geological Survey) "Littoral Sediment Systems and Lake Level Dynamics in Southern Lake Michigan."

DR. PAUL McMILLAN (Dept. of Chemistry, Arizona St. Univ.) "Structural Studies of Silicate Melts by RAMAN Spectroscopy."

DR. JAMES E. KING (Head, Scientific Sections; Curator of Paleontology, Illinois State Museum) "Comparison of Terrestrial and Marine Quaternary Paleoenvironmental Records."

DR. NICHOLAS WOODWARD (Dept. of Geology, Univ. of Tennessee, Knoxville) "Thrust Deformation Geometries and Structural Lithic Units in Wyoming and Tennessee."

DR. R. JAMES KIRKPATRICK (Dept. of Geology, UIUC) "NMR Spectroscopy of Silicate Crystals and Glasses."

DR. J. BRUNO RISATTI (Illinois State Geological Survey) "Deep Sea Natural Gas and Origins of Sedimentary Methane."

DR. JAMES L. WILSON (Dept. of Geol. Sci., Univ. of Michigan) "Tectonic Positions and Stratigraphy of Basinal and Shelf Evaporites: A World-wide View."

DR. OTTO W. NUTTLI (Dept. of Earth and Atmos. Sci., St. Louis Univ.) "Seismicity and Source Mechanics in Midplate Earthquakes."

DR. WARREN HAMILTON (Res. Geologist, AAPG Distinguished Lecturer) "Mode of Extension of Continental Crust."

DR. ALFRED M. ZIEGLER (Dept. of Geophysical Sci., Univ. of Chicago) "Climates of the Mesozoic and Cenozoic."

DR. MICHAEL A DUNGAN (Dept. of Geol. Sci., Southern Methodist Univ.) "The Petrologic Evolution of the Taos Plateau Volcanic Field, Northern New Mexico."

DR. NORBERT MORGENSTERN (Dept. of Civil Engineering, University of Alberta, Canada) "Terror of Engineering in the Pleistocene."

FALL 1984

DR. RICHARD G. GORDEN (Dept. of Geol. Sciences, Northwestern Univ.) "Paleomagnetism and Absolute Plate Motions."

DR. ROBERT RAISWELL (Univ. of Leeds) "Carbon and Sulfer Variations in Different Depositional Environments through Phanerozoic Time."

DR. PAUL GUION (Oxford Polytechnic, Headlington, Oxford, U.K.) "Crevasse Splays in the East Midlands Coalfield."

DR. EDWARD M. STOLPER (Div. Geol. & Planetary Science, Cal Tech) 12:00 - "Densities of Silicate Melts at High Pressures by Shock Wave Measurements"; 4:00 - "Volatiles in Magmas."

DR. GRANT GARVEN (Dept. of Earth & Planetary Sciences and Dept. of Geography & Environmental Engineering, Johns Hopkins Univ.) "Regional Groundwater Flow and Ore Genesis in Sedimentary Basins."

DR. PAUL NADEAU (The Macaulay Institute for Soil Research, Craigiebuckler, Aberdeen, Scotland, U.K.) "Aspects of Interstratified Clays and Clastic Diagenesis."

DR. NEIL A. CHAPMAN (British Geol. Survey) "Geological Disposal of Radioactive Waste."

DR. ROBERT NEWTON (Dept. of Geophysical Sciences, Univ. of Chicago) "Geobarometry & Geothermometry and their Applications to Tectonic Processes."

DR. ROBERT NOWACK (Dept. of Earth, Atmospheric & Planetary Sciences, MIT) "The Two-Dimensional Gaussian Beam Synthetic Method: Testing and Applications."

DR. THOMAS H. ANDERSON (Dept. of Geology & Planetary Science, Univ. of Pittsburgh) "Evolution of the Continental Margin, Northwest Mexico."

MR. STEPHEN ALTANER (UlUC) "Formation of K-Bentonites by Potassium Metasomatism: Applications to Nuclear Waste Disposal."

DR. JUNG HOO LEE (University of Michigan) "Transitions in Clay Minerals during Slaty Cleavage Development: Stem STEM Study of the Martinsburgh Formation Near Lehigh Gap, Pennsylvania."

DR. R. L. LANGENHEIM, JR. (Dept. of Geology, UIUC) "Definition of Mid-Carboniferous Boundary."

MARK R. BAKER (Exxon Production Research Co., Houston, TX) "Well Log Interpretation for Geotechnical and Coal Quality Assessment."

DR. DAVID R. JANECKY (Dept. of Geology & Geophysics, Univ. of Minnesota) "High-Temperature Oceanic Geothermal Systems -- Experimental and Theoretical Considerations with Respect to the Formation of Massive Sulfide Deposits."

DR. HSIN YI LING (Dept. of Geology, Northern Illinois University) "Radiolarian Occurrence and its Implication to Plate Tectonics and Paleoceanography."

DR. LYNN WALTER (Dept. of Earth & Planetary Sciences, Washington Univ.) "Controls on Relative Rates of Carbonate Dissolution and Precipitation: Insights from Laboratory Experiments."

DR. DENNIS R. KOLATA (Illinois State Geol. Survey) "K-Bentonite of the Ordovician Decorah Subgroup, Mississippi Valley: Correlation by Chemical Fingerprinting."

DR. KEITH RIGBY (Dept. of Earth Sciences, Univ. of Notre Dame) "Evolutionary Effects of an Asteroid Impact at the End of the Cretaceous."

SPRING 1985

DR. JAMES TYBURCZY (Div. of Geol. & Planetary Science, Cal Tech) "Electrical Conductivity of Melts and the Earth's Low Velocity Zone."

DR. PETER DAVIS (Princeton Univ.) "Upper Mantel Structure Inferred from Normal Mode Measurements."

DR. GERARD BOND (Lamont-Doherty Geol. Observatory of Columbia Univ.) "New Evidence for a Breakup Chronology of a Late Precambrian Supercontinent, from Subsidence Analysis of Sedimentary Sequences."

DR. STEPHEN GRAND (Cal Tech) "Shear Velocity Structure Beneath North America."

DR. GEORGE ZANDT (State Univ. of New York, Binghamton) "Lithosphere Structure Determined from Teleseismic Waveforms."

DR. WALTRAUD KRIVEN (Ceramic Eng., UIUC) "Transmission Electron Microscopy on Ceramics and Minerals."

DR. THURE CERLING (Dept. of Geology & Geophysics, Univ. of Utah) "Soils, Climate and Geochemistry."

DR. PHILIP C. ENGLAND (Dept. of Geol. Sciences, Harvard University) "The Tertiary Deformation of Asia."

DR. LAURA CROSSEY (Univ. of Wyoming) "Organic Acids and Porosity Enhancement."

DR. DAVID JANECKY (Los Alamos Nat. Lab.) "Peridotite-Water Interactions at 200° and 300°C: Experimental and Theoretical REsults."

DR. CHRISTOPHER PAOLA (Dept. of Geology & Geophysics, Univ. of Minnesota, MN) "Transport of Sand in Suspension."

DR. DENNIS PREZBINDOWSKI (Amoco Prod. Co. Research Center) "Evolution of Formation Water."

DR. ARTHUR L. BLOOM (Dept. of Geol. Sciences, Cornell Univ.) "Tectonic Geomorphology and Coral Reefs."

DR. S. KIRBY (U.S. Geol. Survey, Menlo Park, Calif.) "Rheology of the Lithosphere from Experimental Rock Mechanics."

DR. MARK REED (Univ. of Oregon) "Boiling and Oxidation in Epithermal Systems."

DR. RONALD H. VERNON (Dept. of Geology, Univ. of New Mexico) 12:00 - "K-Feldspar Megacrysts in Granites - Phenocrysts, not Porphyroblasts." 4:00 - "Metamorphic/Deformational Relationships around the Sandia Granite, New Mexico."

DR. PHILIP BETHKE (U.S. Geol. Survey, Reston, VA) "Geothermal Systems and Epithermal Ores: Lessons from Creede, Colorado."

DR. DAVID DINGLEY (University of Bristol, England) "Crystal Symmetry Determination in the Scanning Microscope and Applications to Minerals."

DR. LANIER ROWAN (U.S. Geol Survey, Denver, CO) "Genesis of Mississippi Valley-Type Ore Deposits."

DR. ROBERT DIETZ (Dept. of Geology, Arizona State Univ.) "Creation/Evolution: Did the Devil Make Darwin Do It?"

DR. G. MUYZER (Dept. of Biochemistry, University of Leiden, The Netherlands) "Immunology of Macromolecules from Fossil and Recent Shells."

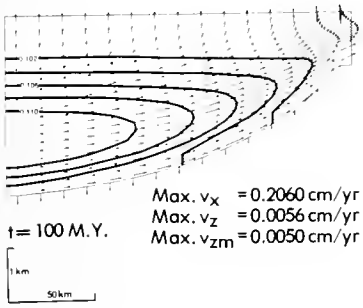
DR. NOBU SHIMIZU (Dept. of Earth, Atmospheric & Planetary Science, MIT) "Applications of the Ion Microprobe to Geochemistry and Cosmochemistry."

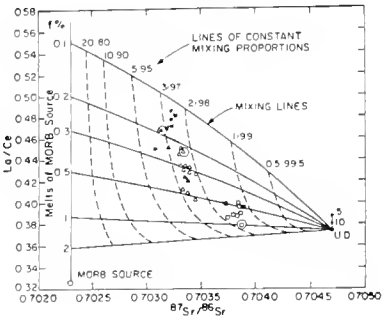
DR. FREDERICK FREY (Dept. of Earth, Atmospheric & Planetary Science, MIT) "Trace Element Geochemistry of Igneous Rocks."

DR. MIRIAM KASTNER (Scripps Institution of Oceanography) "Origin of Dolomite and its Spatial and Chronological Distribution - a New Insight."

RECENT CONTRIBUTIONS OF NEW FACULTY MEMBERS

a





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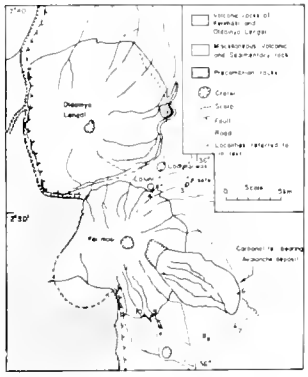

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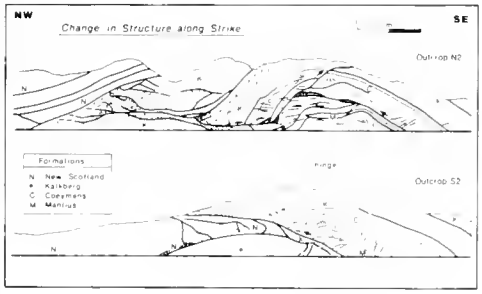

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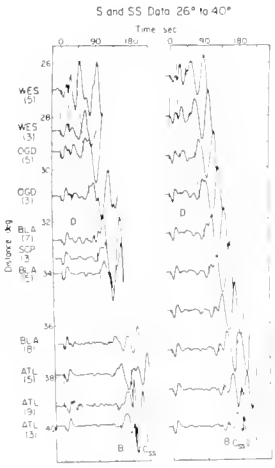

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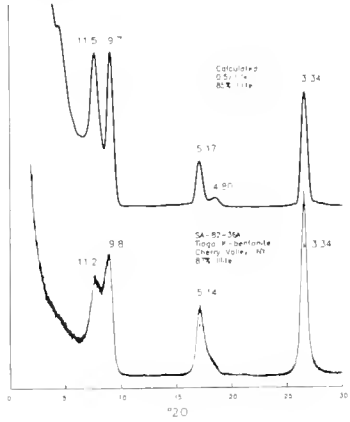

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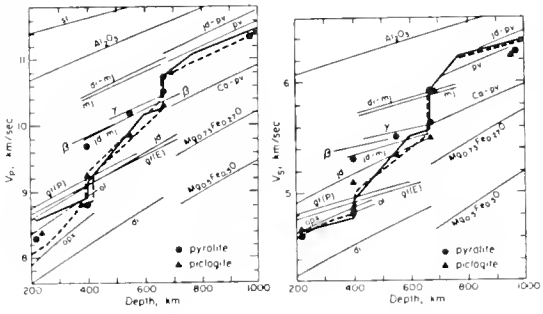

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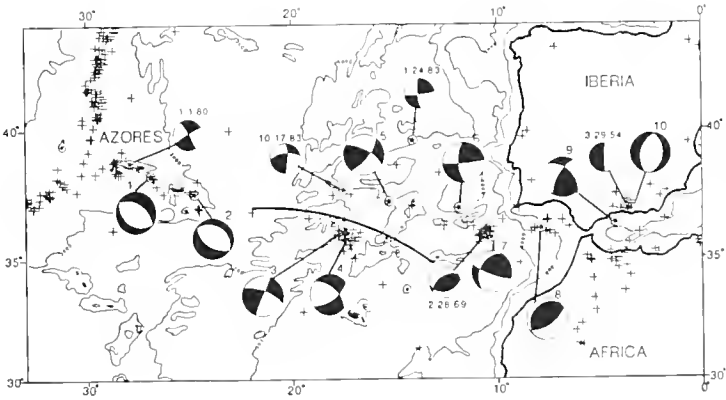

h

(Captions are on the reverse side)

a) Figure 5, from: **Bethke, C. M.,** 1985, A numerical model of compaction-driven groundwater flow and heat transfer and its application to the paleohydrology of intracratonic sedimentary basins: J. Geophys. Res., v. 90, p. 6817-6828. A cross-sectional illustration of fluid velocities relative to the subsiding medium. The solid lines show equipotentials.

b) Figure 9, from: **Chen, C.-Y.,** 1985, Trace element and isotopic geochemistry of lavas from Haleakala Volcano, East Maui Hawaii - Implications for the origin of Hawaiian basalts: J. Geophys. Res., in press. An illustration of a two-reservoir but multi-component mixing model for the origin of Hawaiian basalts.

c) Figure 1, from: **Hay, R. L.,** 1983, Natrocarbonatite tephra of Kerimasi volcano, Tanzania: Geology, v. 11, p. 599-602. A map of Kerimasi volcano and vicinity showing sample localities of modern carbonatite eruptive rocks.

d) Figure 8, from: **Marshak, S.,** 1986, Structure and tectonics of the Hudson Valley fold-thrust belt, New York: Geological Society of America Bulletin, in prep. Cross-sectional sketches showing the rapid variation in structural geometry that can result from lateral ramping in a fold-thrust belt.

e) Figure 12, from: **Grand, S. P.,** and Helmberger, D. V., 1984, Upper mantle structure beneath the northwest Atlantic Ocean: J. Geophys. Res., v. 89, p. 11,465-11,475. A comparison of recorded synthetic seismograms for earthquakes in the distance range of 26° to 40°, indicating a small amount of upper mantle heterogeneity.

f) Figure 12, from: Bethke, C. M., and **Altaner, S.,** 1985, A layer-by-layer mechanism of smectite illitization and application to a new rate law: Clays and Clay Minerals, in press. Diffracation pattern resulting from a removed-neighbor model of illitization, at 85% illite layers.

g) Figure 1, from: **Bass, J.D.,** and Anderson, D.L., 1984, Composition of the upper mantle: Geophysical tests of two petrological models: Geophys. Res. Letters, v. 11, p. 237-240. Velocity profiles and denisty for various minerals based on laboratory measurements. Earth model PREM is shown (heavy solid line) along with a range of velocities from other studies.

h) Figure 2, from: Grimison, N.L., and **Chen, W.-P.,** 1985, The Azores-Gibraltar plate boundary: Focal mechanisms, depths of earthquakes, and their tectonic implications: J. Geophys. Res., in press. The bathymetric map also shows epicenters of all earthquakes of magnitude > 4.0 in the region of the Azores Islands to Gibraltar in the eastern Atlantic Ocean. Focal mechanisms for fifteen large events are also shown, indicating the complexity of plate interactions in the region.

GEOLOGY RESEARCH REPORT
UNIVERSITY OF ILLINOIS - URBANA-CHAMPAIGN
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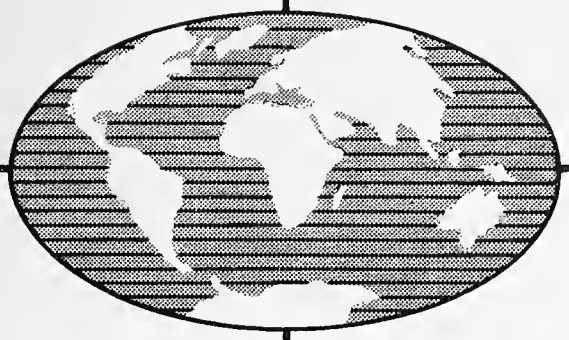
Department of Geology

University of Illinois
Urbana-Champaign



Research Report
1986 - 1987

1986-1987 RESEARCH REPORT

DEPARTMENT OF GEOLOGY

UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN

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Compiled and edited by D. E. Anderson and P. Lane

Fall 1986

INTRODUCTION

Recent appointments in the Geology Department have completed our new research and teaching program in geophysics-seismology and mineral physics as well as reinforcing previous strengths in the areas of groundwater geology, clay mineralogy, geochemistry and the broad study of tectonics, diagenesis, sedimentology, structural geology, and historical geology.

A diverse range of research instrumentation is housed within the Geology department including: an automated electron microprobe; gas source mass spectrometer, SEM; 11.7T NMR spectrometer, X-ray diffractometers, XRF and AA units; neutron activation analysis system; seismological laboratory and library; hydrology laboratory with high-speed link to a supercomputer ; Brillouin spectrometer; cold seal and diamond-anvil high-pressure equipment; laboratories for sedimentological and mineralogical studies. Departmental computing facilities include an Alliant FX-8 Supercomputer with a high speed link to CRAY-XMP in the National Center for Supercomputing Applications. An outstanding geology library is located in the Geology building.

The Department of Geology encourages cooperative research with the departments of Physics, Chemistry, Plant Biology, and Mathematics, the School of Engineering, and the Centers for Materials Research and Electron Microscopy. The extensive facilities in these and other units on campus are readily available and commonly used by Geology faculty and students. Examples include transmission and scanning electron microscopes, ion probes and diffractometers in the Materials Research Laboratory and Center for Electron Microscopy; facilities for NMR, ESR, and IR spectroscopy in the School of Chemical Sciences.

The Department is fortunate to share the campus with the Illinois State Geological Survey, an organization with a rich tradition of research. Members of the Survey and the Department cooperate in research programs and graduate teaching in areas such as groundwater and environmental geology, clay mineralogy, quaternary geology, coal geology, stratigraphy and paleobiology.

With approximately 60 graduate students, the Department maintains strong programs in research and teaching. The list on the following page outlines some major areas that include a broad coverage of theoretical, experimental and field research. The list is not exhaustive and cross-disciplinary programs are available.

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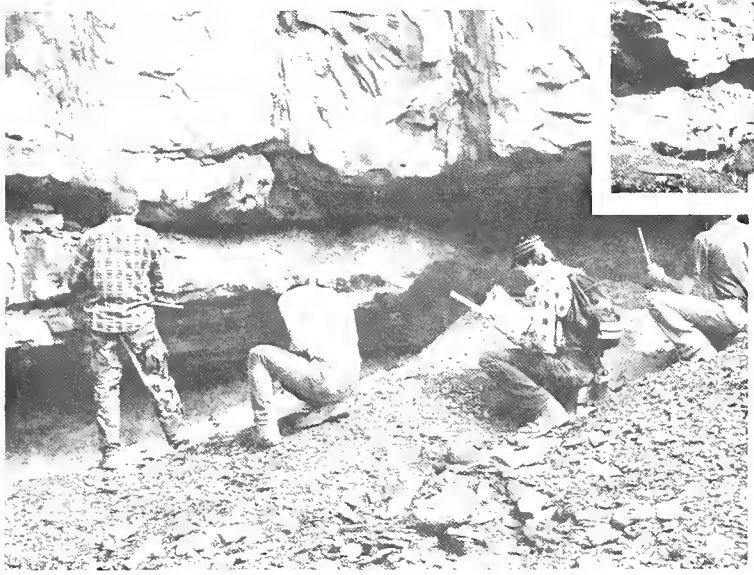

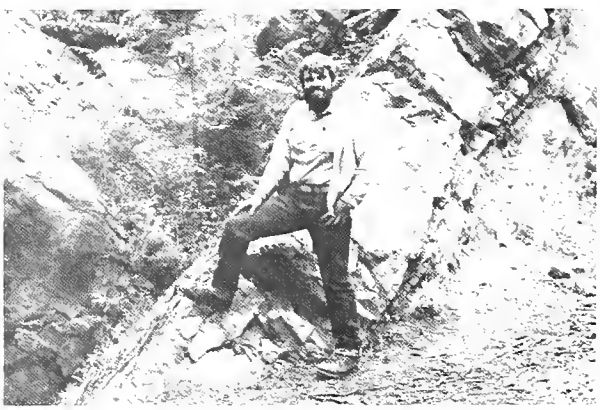

GRADUATE RESEARCH AREAS IN GEOLOGY

Clays and Clastic Diagenesis - S. P. Altaner, T. A. Anderson, C. M. Bethke, R. L. Hay, R. J. Kirkpatrick, G. deV. Klein, R. C. Reynolds, Jr. (adj.)

Carbonate Rocks and Diagenesis - T. A. Anderson, A. V. Carozzi, R. L. Hay, P. A. Sandberg

Engineering Geology and Applied Rock Mechanics - A. S. Nieto

Geochemistry - S. P. Altaner, T. F. Anderson, C. M. Bethke, C-Y. Chen, R. Cygan, R. J. Kirkpatrick

Geomorphology and Quaternary Geology - W.H. Johnson, L. R. Follmer (adj.), J. E. King (adj)

Geophysics - J. D. Bass, W-P. Chen, A. T. Hsui, S. Grand (1986)

History of Geology - A. V. Carozzi

Hydrogeology - C. M. Bethke, K. Cartwright (ISGS-adj.), A. T. Hsui

Igneous/Metamorphic Petrology - D. E. Anderson, C-Y. Chen, R. L. Hay, R.J. Kirkpatrick

Mantle Dynamics - J. D. Bass, C.-Y. Chen, A. T. Hsui

Mineralogy/Mineral Physics - S. P. Altaner, J. D. Bass, C.-Y. Chen, R. Cygan R. L. Hay, D.M. Henderson, R.J. Kirkpatrick

Paleobiology - D.B. Blake, R.L. Langenheim, P.A. Sandberg, J. King (adj)

Sedimentary Basin Analysis - S. P. Altaner, C. M. Bethke, D. B. Blake, A. V. Carozzi, R. L. Hay, A. T. Hsui, G. deV. Klein, R. L. Langenheim, M. W. Leighton (ISGS-adj.), S. Marshak

Seismology - W.-P. Chen, S. Grand

Stratigraphy and Sedimentation - T. F. Anderson, D. B. Blake, A. V. Carozzi, R. L. Hay, G. deV. Klein, R. L. Langenheim, C.J. Mann, P. A. Sandberg

Structural Geology, Rock Physics, Tectonics - D. E. Anderson, J. D. Bass, W-P. Chen, A. T. Hsui, S. Marshak, A. S. Nieto

SUPERCOMPUTING

AND

FIELD TRAINING

UNIVERSITY OF ILLINOIS GEOLOGY DEPARTMENT

FACULTY PROFILES

STEPHEN P. ALTANER, Assist. Professor [1986 Appointment] (B.S., Colgate U. 1979; Ph.D. Univ. of Illinois 1985) - Clays and Diagenesis; Sedimentary Petrology

Professor Altaner's main research interests are in the fields of clay mineralogy and clay petrology. He investigates conditions of clay mineral formation in sedimentary and diagenetic environments, in soils, and in hydrothermal environments. Specific research topics in clay petrology include diffusion in argillaceous rocks, kinetics of diagenetic clay mineral reactions, determination of thermal and burial histories of sediments, occurrence of ammonium in rocks and minerals, and clay mineral formation in saline, alkaline lakes. Results of this type of research will have applications in the fields of petroleum exploration, mineral prospecting, and nuclear waste disposal. Field relations, petrography, chemical analysis, scanning electron microscopy, x-ray diffraction, stable and radiogenic isotope analysis, mathematical modeling, and experimental petrology techniques will be used for this research. Mineralogical research will include the structural analysis of mixed-layer and non mixed-layer clay minerals using transmission electron microscopy, near- and mid-infrared spectroscopy, and nuclear magnetic resonance (to complement the program of R.J. Kirkpatrick).

DAVID E. ANDERSON, Professor and Head (BSc-Hons., Univ. of Sydney, Australia, 1961; M.S. & PH.D. 1967, Univ. of Sydney, Australia) - Metamorphic and Theoretical Petrology

Professor Anderson has been department head since 1983. His research involves metamorphic processes and their relationship to the thermal and tectonic history of various metamorphic terraines. Current projects include: 1) Studies (with Stephen Marshak) of the metamorphism of rocks in the Granite Wash and Buckskin Mountains of Western Arizona and the relationship of metamorphism to thrust faults in the region. 2) Compositional and textural zoning in garnets and their relationship to the tectonic history of the Moine Schists of Scotland. 3) Chemical changes associated with shearing and mylonitization of basic igneous rocks in Scotland and Upper Michigan. 4) Theoretical modelling of diffusion processes in aqueous and crystalline electrolytes. Funds are currently being sought jointly by Stephen Marshak and D.E. Anderson for a comprehensive study of the deformation and metamorphism of the Transantartic Mountains. Professor Anderson teaches graduate courses in thermodynamics (including non-equilibrium thermodynamics) and metamorphic petrology.

THOMAS F. ANDERSON, Professor (B.S. 1961, DePauw University, Ph.D. 1967, Columbia University) - Stable Isotope Geochemistry

Professor Anderson's principal research interests are in the stable isotope geochemistry of sediments and natural waters. The focus of his current activities is on the significance of stable isotope variations in marine sediments during the Phanerozoic. Investigations in progress in this area include the following: (1) The oxygen isotope record of Paleozoic calcite fossils as implications of the history of oceanic temperatures and hydrosphere - lithosphere interactions. (2) Mass and isotopic burial fluxes of reduced sulfur and organic carbon during the Cretaceous. (3) Chemical and isotopic studies (including oxygen isotopes in biogenic phosphates) on rocks and fossils along a Middle Ordovician depth gradient in the Taconic Fouland Basin. (4) The petrology, Chemistry, and isotopic

composition of sulfides from hydrothermally altered oceanic rocks, with emphasis on the role of sea water - crust interaction in controlling the mass and isotopic cycle of marine sulfate. Professor Anderson is also involved in experimental and theoretical studies of the partitioning of isotopes and trace elements during the dissolution and precipitation of carbonates. Professor Anderson teaches chemistry of the Earth, Oceanography, Isotope Geochemistry, and Sedimentary Geochemistry.

JAY D. BASS, Assistant Professor (Ph.D. 1982, State University of New York at Stony Brook) - Geophysics; Mineral Physics; Elastic Properties of Minerals

Jay D. Bass has been at Illinois since August 1984. His major research efforts are in the area of experimental geophysics and laboratory measurements of the physical properties of minerals. Much of his recent work has focused on measurements of elastic wave velocities in minerals and high-pressure polymorphic phases by Brillouin spectroscopy, and this work is being further pursued at Illinois. Brillouin spectroscopy is a light scattering technique that is particularly well suited for measuring wave velocities in microscopic-sized samples, many of which are synthesized at high pressures and high temperatures. The results of such experiments are used to calculate the wave velocities and density of mineral aggregates under the high-pressure and high-temperature environment of the Earths deep interior. Comparisons with seismological models of velocity versus depth in the Earth provide a powerful constraint upon the chemistry and mineralogy of the Earths mantle, and this is a prime motivation for measuring elastic properties. In addition to measurements under room conditions, a program will be initiated to perform these experiments at high pressure in diamond-window pressure cells, and at high temperatures. Other research pursuits include: 1) X-ray studies of crystal structures at high pressure, 2) The high-pressure equation of state of oxides and metals which bear on the composition of the mantle and core, using shock-wave techniques (in collaboration with the California Institute of Technology), 3) In-situ measurements of stress in the Earths crust by holographic interfermetry (also with Cal Tech).

CRAIG M. BETHKE, Assistant Professor (A.B. 1980, Dartmouth College, Ph.D. 1985, University of Illinois) Hydrogeology

Craig Bethke's primary research interest is study of the groundwater hydrology of sedimentary basins through geologic time, and the effects of groundwater motion on petroleum migration, ore formation, and sediment diagenesis. Craig received a 1986 Presidential Young Investigator Award for this research. Recent work includes a theoretical analysis of the role of compaction-driven groundwater flow during subsidence of sedimentary basins, performed on a CRAY supercomputer. He applied this analysis in a study of the relative importance of compaction-driven and gravity-driven groundwater flow over the geologic history of the Illinois Basin, and this work has improved understanding of petroleum migration, as well as the genesis of Mississippi Valley-type ore deposits. Craig also recently completed research on the illitization reaction of smectite, a clay mineral dehydration reaction which is an important contributor of deep fluids and cements in evolving basins. Current work involves construction of a numerical chemical reactor model to study the dynamics of sediment diagenesis, including effects of transport by groundwaters, and study of the origins of geopressured zones in the subsurface, and investigation of the fluid pressure regimes within fold-thrust belts during orogenies. With the support of petroleum and minerals companies and governmental sources, Craig is building a hydrogeology laboratory, complete with an Alliant FX/8 supercomputer, one of the world's most powerful computers.

DANIEL B. BLAKE, Professor (B.S. 1960, University of Illinois, M.S. 1962, Michigan State, Ph.D. 1966, University of California) Invertebrate Paleontology; Biostratigraphy

Professor Blake has recently completed a phylogenetic analysis of all post-Paleozoic asteroids, and a review of asteroid classification and functional morphology. With Thomas E. Guensburg, a former graduate student, he is now studying the water vascular system and functional morphology of Paleozoic asteroids, and with Edward M. Snyder, another former student, he is studying phylogeny of Paleozoic bryozoans. He and his graduate students are working on field and laboratory studies of the paleoecology and biogeography of Carboniferous bryozoans, and a paleoecological analysis of a widely distributed Ordovician interval bounded by two K-bentonite (altered volcanic ash) isochrones. Professor Blake teaches Introductory Physical Geology, undergraduate Paleontology, and graduate courses in Paleoecology and Principles of Paleontology. Paleoecology includes field trips to Southern Illinois and Kentucky.

ALBERT V. CAROZZI, Professor (M.S. 1947, University of Geneva;[Geology and Mineralogy] Dr.Sc. 1948, University of Geneva) - Sedimentary Petrography; Petroleum Geology

Professor Carozzi is continuing carbonate microfacies studies in the Paleozoic of the Mid-Continent and with support from TEXACO USA is undertaking experimental studies on the development of stylolitic secondary porosity under simulated deep burial conditions with application to the Atokan of the Midland Basin and the Smackover of the Gulf Coast. He has just completed two books. The first one entitled "Carbonate Rock Depositional Models: a Microfacies Approach" is a worldwide synthesis of his own studies and that of his graduate students over a period of more than 35 years. The volume which has 500 illustrations is scheduled to be published by I.H.R.D.C. Press in Boston in late fall 1986. The second volume was prepared in collaboration with Dr. Chengyun Yang of the Department of Geology, Peking University who was a research associate with Professor Carozzi in this Department in 1982. The book is entitled "Practical Classification and Microfacies Analysis of Carbonate Rocks" and illustrated by 200 plates of photomicrographs. This bilingual (Chinese-English) volume has a preface by Dr. Shicung Guan of Academia Sinica. It will be released late this year by the Printing House of Peking University. It will be the first book on carbonate rocks ever published in the People's Republic of China.

CHU-YUNG CHEN, Assistant Professor (B.S. 1977, National Taiwan University, Ph.D. 1983, MIT) Trace Element Geochemistry; Isotope Geochemistry; Igneous Petrology

Chu-Yung Chen joined the Department in August 1983 and is setting up a neutron activation laboratory and an isotope dilution laboratory for high quality trace-element and isotope analyses. Her research projects include: (1) The geochemical evolution of Haleakala volcano, East Maui. (2) Trace element variations of tholeiites, transitional basalts and alkalaic basalts from Mauna Kea volcano, Hawaii. (3) Rare-earth geochemistry of Hilina formation, Kilauea volcano, Hawaii. (4) Pb isotopic geochemistry of Loihi seamount. (5) Sr and Nd isotopes and trace element geochemistry of ultramafic nodules from Mt. Leura, Victoria, Australia. (6) Trace element studies and factor analyses of coal from Freeport and aerosol from Houston. (7) Petrological and geochemical studies of West Maui volcano. (8) Trace element and isotopic (Nd, Sr and Pd) studies of the transition from tholeiitic to alkalic volcanism on Hawaiian islands. (9) Geochemistry of high-MgO basalts from Hawaiian volcanoes. (10) Mineral chemistry of Hawaiian basalts. (11) Ophiolites from Cyprus. (12) Kimberlites and Carbonatites from Illinois. (13) Oxygen isotopic geochemistry of Hawaiian basalts.

WANG-PING CHEN, Associate Professor (B.S., National Taiwan Univ., 1974, Ph.D., MIT, 1979) - Geophysics, Seismology, Tectonics

The research activity of the earthquake seismology group is focusing on the quantitative understanding of large scale deformation of the lithosphere. We constrain the thermo-mechanical properties of the lithosphere by precisely determining the depth and focal mechanism of earthquakes, and by analyzing the gravity and geoid anomalies derived from satellite altimetry. Our current research projects include: plate coupling and the unbending of the subducted lithosphere, the relationship between earthquake generation and rheology, source kinematics of large earthquake sequences, the nature of strike-slip faulting in regions of extensional tectonics, and the high resolution reflection imaging of a fold-and-thrust belt in the Hudson valley.

RANDALL T. CYGAN, Assistant Professor (1987) (B.S. 1977, University of Illinois at Chicago, M.S. 1980 and Ph.D. 1983, Pennsylvania State University) - Geochemistry, Mineral Physics

Randall Cygan is active in research dealing with the mineral equilibria and chemical kenetics of geochemical processes. Of primary interest in his research is the examination of chemical diffusion processes in silicate minerals as a means of extracting the thermal histories of mineral assemblages in crystalline rocks. Experimental research includes the examination of cation diffusion rates in high temperature phases, such as garnet and olivine, using electron and ion microprobe analytical techniques. High temperature measurements of electrical behavior involving the conductivity and dielectric response of silicate minerals are being performed to elucidate the point defect structure of the phase. The type and number of defects will dictate the energies and, ultimately, the rates of ionic transport. Theoretical approaches, including the ionic modeling of silicate mineral structures and physical properties, complement the experimental work and provide insight into the nature of chemical bonding in silicates. His other research interests include the examination of rock-water interactions and the kinetics and mechanisms of mineral dissolution, chemical fractionation and transport processes in magmatic systems, and the nucleation kinetics of silicate minerals.

STEPHEN GRAND, Assistant Professor [1986 appointment] (B.Sc. 1978, McGill University; PhD. 1986, Cal Tech) - Geophysics, Seismology

Stephen Grand is interested in the elastic fine structure of the mantle. Using synthetic seismogram techniques to understand wave propagation in the mantle, shear waves from earthquakes can be used to determine structure. Using multiple bounce shear waves increases the resolution and applicability of the technique. Recently, using the synthetic seismogram technique, vertical shear profiles were developed for the Canadian shield, the western United States and the northwest Atlantic ocean, showing large differences to 400 km depth. Current research efforts are to derive fully three-dimensional models of the mantle shear structure beneath North America using the tomography technique, developing computer codes to make synthetic seismograms appropriate for propagation through laterally varying structure and investigating deep mantle structure beneath individual tectonic provinces on a world-wide scale. The ultimate goal of this research is to help answer questions such as how deep do continents extend, is the mantle layered and on what scale does convection occur in the earth.

RICHARD L. HAY, Ralph E. Grim Professor of Geology (B.S. 1947, Northwestern University; M.S. 1949, Northwestern University; Ph.D. 1952, Princeton University) - Stratigraphy; Sedimentary Petrology

Professor Hay's work has been concentrated on the general fields of stratigraphy, paleoenvironments of semiarid basins, pedogenesis, silicate diagenesis, and volcaniclastic sedimentology. His present major research effort is on spring-related carbonate rocks and Mg-silicate clays (sepiolite, smectite and kerolite) that were chemically precipitated in a Pliocene lake basin in the Amargosa Desert of Nevada-California. He and his students have worked out the distribution, paleoenvironment, and origin of the different types of carbonates and clays. Other research interests are diagenetic alteration of Ordovician tuffs in the Midcontinent to K-feldspar and K-bentonite (with Dennis Kolata of the ISGS and Mingchou Lee of Case Western University), silicate diagenesis in Searles Lake, California (with Sandra Guldman), and carbonatite eruptive rocks.

DONALD M. HENDERSON, Professor (A.B. 1943, Brown University; Ph.D. 1950, Harvard) - Mineralogy; Crystallography

Professor Henderson's principal research interests are concerned with local structures in minerals and with their study via such approaches as nuclear magnetic resonance, electron diffraction and transmission electron microscopy. Currently, he is studying ordering and local structures in feldspars. He is interested also in the educational uses of microcomputers. He teaches undergraduate and graduate courses in mineralogy, optical mineralogy, x-ray diffraction, structural mineralogy and crystallography.

ALBERT T. HSUI, Associate Professor (B.S. 1968, Lowell Technological Institute; M.S. 1969, Cornell University; Ph.D. 1972, Cornell University) - Geophysics; Mathematical Modelling; Geodynamics; Planetary Evolution and Borehole Seismology

Dr. Hsui's research interests are basically in the pursue of fundamental understanding of the working principles of various geological and tectonic processes. Some of his past and continuing research topics include: (a) investigations of geodynamic processes at convergent plate boundaries; (b) planetary differentiation and its effects on mantle evolution and mantle dynamics; (c) fluid dynamics within magma bodies and their relationships to the formation of igneous rocks. More recently, a few new projects have been formulated. One of the new topics is to study wave propagation around a borehole. This is to improve our present understanding of vertical seismic profiling and to provide improved interpretation of acoustic logging results. Another project is to carry out a comparative analysis of the SEASAT altimetry data and the MAGSAT data to gain better understanding of the crustal and the upper mantle structure of the Earth. Additionally, a new project has been developed jointly with Professor G. deV. Klein to study sedimentation, subsidence, thermal and tectonic evolution of sedimentary basins. Dr. Hsui teaches a general geology course for science and geology majors, exploration geophysics and other graduate courses in Geodynamics and Mathematical Methods in Geology.

W. HILTON JOHNSON, Associate Professor (A.B. 1956, Earlham College, M.S. 1961, University of Illinois; Ph.D. 1962, University of Illinois) - Quaternary Stratigraphy; Glacial Geology

Dr. Johnson's research interests are in the areas of geomorphology, glacial geology and stratigraphy. His work is concentrated on the surficial deposits in Illinois in cooperation with colleagues at the State Geological Survey. Currently he is working on relict periglacial features dating from the last glaciation, Wisconsinan stratigraphic correlations and drainage events in northeastern Illinois (with A. K. Hansel), on geomorphic mapping of the Woodfordian drift plain using remote sensing and related methods, and on interactions between the Lake Michigan and Huron-Erie glacial lobes in eastern Illinois and western Indiana (with N. K. Bleuer). Graduate students under Johnson's supervision are working on a variety of projects including: Quaternary geology and glacial sedimentology in the Precambrian shield terraine of south-central Ontario, late Pleistocene and Holocene fluvial geomorphology, stratigraphy and sedimentology of the lower Illinois River valley region, provenance of Illinoian and pre-Illinoian tills in south-central Illinois, and late Quaternary geology of the Middle Fork Vermilion River valley. Dr. Johnson teaches Introduction to the Study of the Earth, Glacial Geology, Quaternary Geology and Geomorphology. Field trips taken locally and to central Wisconsin emphasize glacial geology and stratigraphy; trips to central and southwestern Illinois focus on glacial stratigraphy, paleosols, late Pleistocene and Holocene fluvial geomorphology and alluvial stratigraphy; trips to Indiana emphasize glacial geology and bedrock and Karst geomorphology of the unglaciated area of south-central Indiana.

R. JAMES KIRKPATRICK, Professor (B.S. 1968, Cornell University; Ph.D. 1972, University of Illinois) - Igneous and Experimental Petrology, NMR Spectroscopy

For several years Professor Kirkpatrick's research has centered on the use of magic-angle sample-spinning nuclear magnetic resonance spectroscopy (MASS NMR) in examining the structures of silicate crystals and glasses (quenched melts). One major objective of this work is to better understand the thermodynamic, mechanical, and crystallization behavior of lava and magma and thereby the origin, evolution, and crystallization of igneous rocks. Another major objective is to use MASS NMR to examine the structure of crystalline phases that are too fine grained to be examined by single crystal x-ray or neutron diffraction, such as clay minerals. A third major objective is to develop advanced NMR spectroscopic methods to examine solid materials. This research program is being conducted in collaboration with Professor Eric Oldfield of the School of Chemical Sciences, Professor D.M. Henderson, Professor S. P. Altaner, and students and post-doctoral fellows in both Geology and Chemistry. Professor Kirkpatrick teaches Igneous and Metamorphic Petrography, Igneous Petrology (Graduate Level) and Geochemical Kinetics.

GEORGE deVRIES KLEIN, Professor (B.A. 1954, Wesleyan University; M.A. 1957, University of Kansas; Ph.D. 1960, Yale University) Basin Analysis; Clastic Sedimentology Geology and Sedimentology; Sandstone Petrology and Diagenesis

Dr. Klein's research activities deal with several aspects of basin analysis and Clastic sedimentary systems. These include (1) Analysis of the timing of depositional systems, diagenetic events, sea level history, global sedimentary cycling and paleoclimatic events to the geodynamic and tectonic subsidence history of sedimentary basins. Research in this area has focused on the Illinois Basin in cooperation with Dr. A. T. Hsui and with the Illinois State Geological Survey, and on back-arc basins of the western Pacific. Analysis of sedimentary basins involving the transition from an active margin into continental crust

is in the planning stage in the Yellow Sea of Korea. (2) Paleogeographic distribution of depositional systems through time. Research in this area has focused on storm depositional systems, tidal sedimentary systems and deep water submarine fans and turbidites. (3) clastic diagenesis. Research in this area has focused on downhole diagenetic changes in response to thermally-driven fluid circulation in back-arc basins, and a current project in the Illinois Basin. (4) Understanding the controls and processes of correlating bedload sediment yield from continents to oceans. This program has focused on bedload sediment yield in active continental margins tying sediment yield and turbidite periodicity in ocean basins to rate of tectonic uplift. Dr. Klein teaches Geology 309 (Sedimentology and Sedimentary Geology), Geology 310 (Field and Laboratory Procedures in Sedimentology; this is a laboratory course which accompanies Geology 309, Geology 477 (Recent Sedimentary Environments). Course field trips are run to the Vermillion River of Illinois (to study point bar evolution), central Indiana (to examine clastic and carbonate facies), and the Arkoma Basin and Ouachita Mountains of Arkansas and Oklahoma to examine Carboniferous clastic depositional systems.

RALPH L. LANGENHEIM, JR., Professor (B.S. Geol. Engineering 1943, University of Tulsa; M.S. 1947, University of Colorado; Ph.D. 1951, University of Minnesota) - Stratigraphy, Paleontology, Field Geology, Geology of Energy, Coal

Professor Langenheim's research centers on Pennsylvanian stratigraphy and biostratigraphy in the Illinois Basin and southern Nevada. Presently major effort is being devoted to determining brachiopod ranges in the Arrow Canyon, Nevada section which has been proposed for several regional and/or world stratotypes. Study of Latest Chesterian through Late Morrowan faunas is currently under way as well as a regional study of Atokan and Desmoinesian stratigraphy and biostratigraphy in the southern part of the Cordilleran Miogeocline. He also is involved in the work of the various IUGS subcommittees seeking to define Late Carboniferous stratotypes. He teaches History of the Earth, Geology of Energy and Field Geology at the elementary level; Principles of Stratigraphy at the intermediate level and graduate courses in Stratigraphy. He is Director of the Summer Geology Field Camp which is held in Wyoming.

C. JOHN MANN, Professor (B.S. 1953, University of Kansas; M.S. 1957, University of Kansas; Ph.D. 1961, University of Wisconsin) - Stratigraphy; Mathematical Geology; Petroelum Geology

Professor Mann's mathematical geology research work, sponsored by Sandia National Laboratories, attempts to determine probabilities and probability density functions of natural geological events and processes in order to more accurately predict hazards accompanying long-term storage of nuclear waste materials. Dr. Mann is also examining the evolution of stratigraphic sequences in an effort to more accurately determine periodicities and cyclicities which are known to be present as well as to perhaps detect new ones which previously have gone undetected. He teaches Geology for Engineers, General Geology, and Principles of Stratigraphy. These courses include field trips to southern Indiana, Upper Wabash River Valley and San Salvador Island, Bahamas. Studies in the Bahamas are on algal structures in a brackish to hypersaline lake in an attempt to relate structures and lack of structures in the mounds to environmental conditions under which they are growing.

STEPHEN MARSHAK, Assistant Professor (A.B. 1976, Cornell University; M.S. 1979, University of Arizona; Ph.D. 1983, Columbia University) - Structural Geology and Tectonics

Dr. Marshak's current research interests are in the area of field structural geology. Along with several graduate students, he has been focusing efforts on two field areas during the past three years. One group has been studying the mechanism of orocline formation in the Appalachian fold-thrust belt near Kingston, New York (the work was supported by NSF). As a result of this work, they have been able to demonstrate that oroclines in thin-skinned domains can develop by reactivation of detachment faults during non-coaxial shear; second-generation movement on such faults results in rotation of hanging-wall folds and in development of complex accommodation structures. One student in the group has also looked in detail at the nature of grain-scale extensional fabrics in cleaved limestone of the fold-thrust belt. He has discovered, by application of Fry strain analysis, that the microlithons between cleavage domains are locally stretched by as much as 80% parallel to cleavage, and thus are not passive during cleavage formation. A second group has been working in the Sonoran desert region of western Arizona. One of the students has just completed a study of poly-phase contractional Mesozoic structures in the Granite Wash Mountains. A second student has been working on the nature of basement/cover relations and on fold evolution and metamorphic history in the mylonite of the Buckskin Mountains "core complex." Another of the structure students is currently working on the relationship between basement structure and seismicity in the central Adirondack Mountains of New York. Contingent on funding, Dr. Marshak anticipates initiating two new projects; the first concerns chronology of tectonism in the mid-continent, and the second concerns the basement tectonics of a portion of the Transantarctic Mountains.

ALBERTO S. NIETO, Associate Professor (B.S. 1961, San Marcos University; M.S. 1963, Washington University; Ph.D. 1974, University of Illinois) - Engineering Geology; Applied Rock Mechanics

Dr. Nieto's main professional interests are applied rock mechanics and the geotechnical characterization of large engineering sites such as hydroelectric projects, underground storage caverns, waste disposal sites, surface and underground mines, major highways, foundations for large structures and others. In the last two years he has investigated the precursory, moment-driven deformation of some very large rockslides in Peru, Italy and Canada. He is also studying the role of water (apart from its effect on effective stresses) in the triggering of slope movements in mountainous, semiarid regions. He is presently supervising Ph.D. theses on shear strength of soil-filled discontinuities in rock masses and the analysis of a new model for slope failures that involves a combination of toppling and sliding. Dr. Nieto teaches Geology for Engineers, Principles of Engineering Geology and Practice of Engineering Geology at undergraduate and graduate levels; he also holds a joint appointment in the Civil Engineering Department where he collaborates in research projects in geotechnical engineering.

PHILIP A. SANDBERG, Professor (B.S. cum laude 1960; M.S. 1961, Louisiana State University. Fil. Lic., 1964; Fil. Dr., 1965 University of Stockholm) - Carbonate Sedimentology; Micropaleontology; Historical Geology

Dr. Sandberg has begun a new research program on appliation of immunology to carbonate sedimentology and paleontology. This NSF-funded study is a joint effort with Peter Westbroek (a Visiting Professor, in our department, from the Dept. of Biochemistry, Univ. of Leiden, Netherlands). This study will investigate the use of antibodies raised against the matrix of modern carbonate skeletons for determination of source organisms for carbonate sediments and taxonomic affinity of uncertain fossil taxa. In connection with this new research program, Dr. Sandberg has taken coursework in immunochemistry and has been awarded an Associateship in the Center for Advanced Studies (Spring 1987), and a Fellowship in the LAS program of Study in a Second Discipline (Fall 1986). During part of that time, he will be engaged in training and research in Leiden, where an international Center for Geoimmunology is developing. Research on carbonate mud sources and micrite diagenesis is continuing, including textural-compositional studies of ancient micrites, experimental diagenesis (hydrothermal bombs) of carbonate muds, and investigation of trace element-isotopic signatures as indicators of most probable modern carbonate mud contributors. Dr. Sandberg's teaching responsibilities include: Carbonate Sedimentology, the SEM portion of Microbeam Analysis (SEM and electron microprobe), Micropaleontology, and an Intersession field course in the Florida Keys entitled "Introduction to Modern Marine Carbonate Environments".

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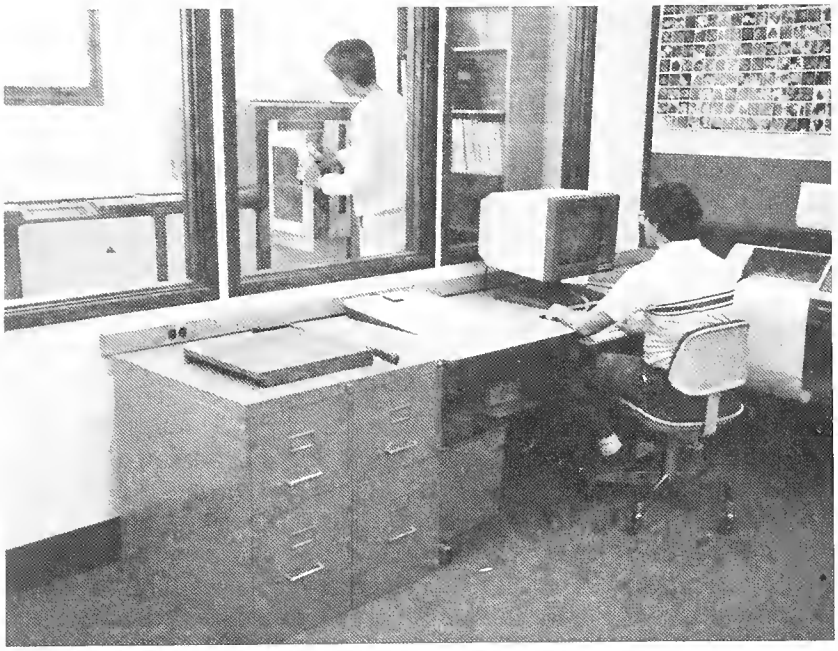
PLEASE NOTE: The faculty profile information given above is generalized and conveys only work done in the last few years. For more specific information about courses or research, please contact the individual faculty member at the Department address.



Tom Corbet and Ming-Ku Lee model deep groundwater flow on the Alliant FX-8 in the department's Center for Supercomputing in Hydrogeology. The revolutionary architecture of the FX-8 uses eight parallel computing heads simultaneously to perform at speeds rivaling the world's fastest computer. A fiber optic link connects the FX-8 to other campus computers including a Cray XMP-48.

Wang-Hong Yang using one of the high-resolution nuclear magnetic resonance spectrometers. These spectrometers are used to examine the structures of a wide variety of crystalline and amorphous materials

RECENTLY FUNDED PROJECTS

Principal Investigator	Title	Agency
Thomas F. Anderson	Integrated Paleontological, Geochemical and Paleo-Oceanographic Studies on the Taconic Foreland Basin	NSF
	The Petrology of Sulfides and the Geochemistry of Sulfur in Hydrothermally Metamorphosed Ocean Rocks	NSF
Jay D. Bass	Mineral Elasticity by Brillouin Scattering	NSF
Craig Bethke	Paleohydrologic Modeling of Sedimentary Basins	ARCO
	Techniques of Hydrologic Modeling	TEXACO
	Simultaneous Chemical Transport and Reaction	AMOCO
	Faculty Research Initiation Grant	SHELL
	Research Initiation Grant	EXXON
	Theoretical Modeling of Simultaneous Mass Transport and Chemical Reaction during Diagenetic Alteration of Sedimentary Rocks	NSF
	Presidential Young Investigator Award	NSF
	Sponsored Research Grant Program	ALLIANT Computer Systems
Albert Carozzi	Stylolitization Processes, Natural Stylolitic Porosity, and Experimental Development of Stylolitic Porosity in Carbonate Rocks Under Simulated Deep Burial	TEXACO
Chu-Yung Chen	Petrological and Geochemical Study of the Evolution of West Maui Volcano	NSF
Wang-Ping Chen	A Study of Intracontinental and Intraplate Earthquakes	NSF
	Shallow Seismic Profiling of a Fold-and-Thrust Belt in New York	AMOCO/ TEXACO

Principal Investigator	Title	Agency
Stephen P. Grand	Tomographic Inversion for Mantle Shear Structure	NSF
	Determination of Q as a Function of Depth and Tectonic Province	DARPA
Albert T. Hsui	SEASAT Altimetry Interpretation and Geoid Modelling	U.S. AIR FORCE
	Numerical Modelling of Sedimentary Basin Evolution	CHEVRON
W. Hilton Johnson	Interlobate Comparison of Glacial-Depositional Style as Evidenced by Small-Relief Glacial Landscape Features, Illinois, Indiana, and Ohio, Utilizing Shuttle Imaging Radar-B	NASA
R. James Kirkpatrick	Kinetics of Igneous Processes	NSF
	High-Resolution NMR Spectroscopy of Geologically Important Crystals and Glasses	NSF
	Study of Nuclear Magnetic Resonance (NMR) Spectroscopy of Solids	SANDIA Nat. Lab.
	Study of Nuclear Magnetic Resonance (NMR) Spectroscopy of Solids	SANDIA Nat. Lab.
George deV. Klein	Synthesis of Back-Arc Basin Sedimentology Based on DSDP/IPOD Drilling	NSF
Stephen Marshak	Kingston Arc of Eastern New York: Structural Geometry, Strain and Tectonic Significance of an Oroclinal Bend in the Appalachians	NSF
Philip A. Sandberg	Original Mineralogy in Micrites: Genetic and Diagenetic Implications	NSF
	Original Mineralogy in Micrites: Genetic and Diagenetic Implications	ACS Pet. Research Fund
	Original Mineralogy in Micrites: Genetic and Diagenetic Implications	AMOCO
	Application of Immunology to Carbonate Sedimentology and Paleontology	NSF

LIST OF PUBLICATIONS 1985-1986

Geophysics/Structural Geology/Tectonics/Engineering Geology

Books and Articles

Huang, J., and W.-P. Chen, 1985, Source mechanisms of the Mogod earthquake sequence of 1967 and the event of July 4, 1974 in Mongolia, Geophys. J. R. Astr. Soc.

Grimison, N., and W.-P. Chen, 1985, The Azores-Gibraltar plate boundary: Focal mechanisms, depths of earthquakes, and their tectonic implications, J. Geophys. Res., v. 91, p. 2029-2047.

Grand, S. P. and D. V. Helmberger, 1985, Uppermantle shear structure beneath Asia from multi-bounce S waves, Phys. Earth Planet. Int., v. 41, p. 154-169.

Grand, S. P., D. V. Helmberger and L. J. Burdick, 1985, Attenuation bias measurements of the semipalatinsk and North African test sites, Woodward-Clyde Consultants Technical Report, WCCP-R-85-01.

Helmberger, D. V., G. R. Engen and S. P. Grand, 1985, Long period wave propagation in laterally varying structure, J. Geophys., v. 58, p. 82-91.

Helmberger, D. V., G. R. Engen and S. P. Grand, 1985, Upper-mantle cross section from California to Greenland, J. Geophys., v. 58, p. 92-100.

S. P. Grand, Shear velocity structure of the mantle beneath the North American plate, Ph.D. thesis, Caltech, Pasadena, 228 pp.

Hsui, A. T., J. Zhang, C. H. Cheng and M. N. Toksoz, 1985, Tube wave attenuation and in-situ permeability, MIT Full Wave Form Acoustic Logging Consortium Report, p. 193-204.

Hsui, A. T. and S. Youngquist, 1985, A dynamic model of the curvature of the Mariana Trench, Nature, v. 318, n. 6045, p. 455-457.

Riahi, N. and A. T. Hsui, 1986, Non-linear double diffusive convection with local heat and solute sources, Int. J. of Engineering Sci., v. 24, p. 529-544.

Sawyer, D. S., A. T. Hsui and M. N. Toksoz, 1986, Subsidence and thermal history resulting from middle Miocene extension in the Los Angeles Basin. Tectonophysics, in press.

Hsui, A. T. and M. N. Toksoz, 1986, Application of an acoustic model to determine in-situ permeability of a borehole, J. of the Acoustical Society of America., in press.

Heidlauf, D. T., A. T. Hsui and G. deV. Klein, 1986, Tectonic subsidence analysis of the Illinois Basin, J. of Geology, in press.

Marshak, S., and Engelder T., 1985, Development of cleavage in limestones of a fold-thrust belt in eastern New York, J. Struc. Geol., v. 7, p. 345-359.

Engelder, T., and Marshak, S., 1985, Disjunctive cleavage formed at shallow depths in sedimentary rocks, J. Struc. Geol., v. 7, p. 327-343.

Laubach, S. E., and Marshak, S., 1986, Geometry of fault arrays generated during extension of fractured crystalline basement, J. Geol. Soc. London, Special issue on extensional Tectonics, in press.

Marshak, S., and Engelder, T., 1986, The deformed Lower Devonian strata of the Hudson Valley, west of Catskill, New York, Geol. Soc. Am., DNAG Centennial Field Guide to the Northeast, in press.

McEachran, D. B., and Marshak, S., 1986, Teaching strain theory in structural geology using graphics programs for the Apple Macintosh computer, J. of National Assoc. of Geology Teachers, in press.

Marshak, S., 1986, Structure of the Hudson Valley fold-thrust belt between Catskill and Kingston, New York: A field guide, Geol. Soc. Am. NE-section 1986 Field Trip Guidebook, 70 p.

Marshak, S., 1986, Structure and tectonics of the Hudson Valley fold-thrust belt, New York, Geol. Soc. Am. Bull., v. 97, p. 354-368.

Nieto, A. S. and P. K. Mathews, 1985, Moment-driven deformation of rock slopes, Procs. 36th Symp. Highway Geology; Purdue University, West Lafayette, IN, 12 p.

Nieto, A. S. and C. Zambak, 1985, Design of rock slopes susceptible to toppling, Sect. 9, Chapter in Handbook of Civil Engineering, Technomics Pull. Co., P. N. Sheremisenoff, N. P. Sheeremisenoff, S. L. Cheng, editors.

Abstracts

Grimison, N., and W.-P. Chen, 1985, Source mechanisms of earthquakes and the present-day tectonics along the Azores Gibraltar plate boundary, EOS Trans. A.G.U., v. 66, p. 298.

Karner, G. D., N. L. Grimison, W.-P. Chen, and J. K. Weissel, 1985, SEASAT derived gravity and geoid anomalies of the Azores-Gibraltar plate boundary: A diffused zone of ocean-ocean convergence near Gibraltar, ibid, p. 361.

Chen, W.-P., 1985, Sub-crustal earthquakes beneath the Shillong plateau and their tectonic implications, ibid, p. 306.

Chen, W.-P., and J. L. Nabelek, 1985, Strike-slip earthquakes and the development of the North China basin, ibid, v. 66, p. 1067.

Nabelek, J. L., and W.-P. Chen, 1985, The Tangshan earthquake sequence of 1976 and its implications for the evolution of the North China basin, ibid, v. 66, p. 961.

Graves, R., S. P. Grand and D. V. Helmberger, 1985, Upper mantle cross-section from Tonga to California, EOS trans. AGU, v. 66, p. 975.

Hsui, A. T., 1985, On the curvature of the Mariana Trench, EOS, Trans. Am. Geophys. Un., v. 66, n. 18, p. 369.

Hsui, A. T., J. Zhang, C. H. Cheng and M. N. Toksoz, 1985, Tube wave attenuation and in-situ permeability, Proceedings of the Soc. of Professional Well Log Analysts 26th Annual Logging Symposium, June 17-20, Dallas Texas.

Hutasoit, L. M. and A. T. Hsui, 1985, Finite amplitude double diffusive convection in porous media, Proceedings of the North Central Regional Meeting of the Geological Society of America, DeKalb, Illinois.

Heidlauf, D. T., A. T. Hsui and G. deV. Klein, 1985, Tectonic and subsidence history of Illinois Basin, EOS Trans. Am. Geophys. Un., v. 66, n. 46, p. 1059.

Youngquist, S. and A. T. Hsui, 1985, Geometric evolution of the Mariana Trench and associated back-arc system, EOS, Trans. Am., Geophys. Un., v. 66, n. 46, p. 1077.

Hsui, A. T. and M. N. Toksoz, 1985, Attenuation of Stoneley Wave and the determination of in-situ permeability, EOS, Trans. Am. Geophys. Un., v. 66, n. 46, p. 977.

Hsui, A. T., 1986, Evolution of the Mariana Trench and its implication to plate reconstruction at convergent plate boundaries, Proceedings of the 1986 Texas A & M University Geodynamic Symposium on Mesozoic and Cenozoic plate reconstructions, p. 49-101.

Laubach, S. E. and Marshak, S., 1985, Fault patterns generated during extension of crystalline basement, Geol. Soc. Am. Absts. v. 17, p. 460.

Marshak, S., Kwiecinski, P., McEachran, D., and Tabor, J., 1985, Structural geometry of the "orocline" in the Appalachian foreland, near Kingston New York, Geol. Soc. Am. Abst. w/pgms., v. 17, p. 53.

Marshak, S., 1985, Evidence for a buckled thrust system in the northern Appalachian fold-thrust belt, New York, Geol. Soc. Am. Abst. w/pgms., v. 17.

Marshak, S., Anderson, D.E., and Laubach, S., 1985, Modes of fracture propagation and rock-water interaction in extensional terranes: in "Conference on extensional tectonics," Durham, England.

Marshak, S., Engelder, T., and Bhagat, S., 1985, Mechanism of cleavage-parallel extension in lime wackestone, "Conference on structures of sedimentary rocks," London, England.

Dawers, N., Marshak, S., Seeber, N., et al., 1986, Geologic controls on seismicity in the central Adirondacks, Geol. Soc. Am. Abst. w/pgms., v. 18, p. 12.

Tabor, J., and Marshak, S., 1986, Along-strike variations in structural geometry of the Appalachian fold-thrust belt south of Kingston, New York, Geol. Soc. Am. Abst. w/pgms, v. 18, p. 70.

Petrology/Mineralogy/Geochemistry/Hydrogeology

Books and Articles

Bethke, C. M., 1985, A numerical model of compaction-driven groundwater flow and heat transfer and its application to the paleohydrology of intracratonic sedimentary basins, Jour. of Geophys. Research, v. 90, p. 6817-6828.

Bethke, C. M., and R. C. Reynolds, 1986, Recursive method for determining frequency factors in interstratified clay diffraction calculations, Clays and Clay Minerals, v. 34, p. 224-226.

Bethke, C. M., 1986, Hydrologic constraints on genesis of the Upper Mississippi Valley Mineral District from Illinois Basin brines, Economic Geology, v. 81, p. 233-249.

Bethke, C. M., N. Vergo, and S. P. Altaner, 1986, Pathways of smectite illitization, Clays and Clay Minerals, v. 34, p. 125-135.

Bethke, C. M., and S. P. Altaner, 1986, Layer-by-layer mechanism of smectite illitization and application to a new rate law, Clays and Clay Minerals, v. 34, p. 136-145.

Bethke, C. M., 1986, Inverse hydrologic analysis of the distribution and origin of gulf coast-type geopressured zones, Jour. of Geophys. Research, v. 91, p. 6535-6545.

Chen, C.-Y. and F. A. Frey, 1985, Trace element and isotope Geochemistry of Haleakala volcanic series, East Maui: Implications to the origin of Hawaiian basalts, J. Geophys. Res. v. 90, p. 8743-8768.

Frey, F. A., C.-Y. Chen, A. Kennedy and M. F. Roden, 1985, Utilization of Geochemistry to understand the origin of the Hawaiian Islands, Trans. Amer. Nuclear. Soc., v. 49, p. 175-178.

Henderson, D. M., W.-H. Yang and R. J. Kirkpatrick, 1986, High-resolution ^{29}Si; ^{27}Al, and ^{23}Na NMR spectroscopic study of Al-Si disordering in annealed albite and oligoclase, Amer. Min., v. 71, p. 712-726.

Kuo, L.-C., and R. J. Kirkpatrick, 1985, Kinetics of crystal dissolution in the system forsterite-diopside-silica, Am. J. Sci., v. 285, p. 51-90.

Kirkpatrick, R. J., R. A. Kinsey, K. A. Smith, D. M. Henderson, and E. Oldfield, 1985. High-resolution solid-state sodium-23, aluminum-27, and silicon-29 nuclear magnetic resonance spectroscopic reconnaissance of alkali and plagioclase feldspars, Am. Min., v. 70, p. 106-123.

Kinsey, R. A., R. J. Kirkpatrick, J. Hower, K. A. Smith, and E. Oldfield, 1985, High-resolution aluminum-27 and silicon-29 nuclear magnetic resonance spectroscopic study of layer silicates, including clay minerals, Am. Min., v. 70, p. 537-548.

Kuo, L.-C., and R. J. Kirkpatrick, 1985, Dissolution of mafic minerals and its implications for the ascent velocities of perdotite-bearing basalts magmas, J. Geol., v. 93, p. 691-700.

Oldfield, E., and R. J. Kirkpatrick, 1985, High-resolution NMR of inorganic solids, Science, v. 277, p. 1537-1544.

Kirkpatrick, R. J., T. Dunn, S. Schramm, K. A. Smith, Oestrike, R., and Turner, G., 1985, Magic-angle sample-spinning nuclear magnetic resonance spectroscopy of silicate glasses: a review, Structure and Bonding in Glass, Walrafen, G., and Revez, A., eds., Nat. Bureau of Stds.

Kirkpatrick, R. J., K. A. Smith, S. Schramm, G. Turner, and W.-H. Yang, 1985, Solid-state nuclear magnetic resonance spectroscopy of minerals. Ann. Rev. of Earth and Planetary Sci., v. 13, p. 29-47.

Yang, W.-H., R. J. Kirkpatrick, T. Emilsson, N. Vergo, J. McHone, and E. Oldfield, 1985. Detection of high-pressure silica polymorphs in whole-rock samples from meteor impact sites using solid-state silicon-29 nuclear magnetic resonance spectroscopy, Meteoritics, v. 21, p. 117-124.

Kirkpatrick, R. J., K. A. Smith, E. Oldfield, and R. Oestrike, 1985, High-resolution aluminum-27 and silicon-29 NMR spectroscopy of glasses and crystals along the join $CaMgSi_2O_6$ - $CaAl_2O_6$. Am. Min., v. 71, p. 705-711.

Goodman, B. A., J. D. Russell, B. Montez, E. Oldfield, and R. J. Kirkpatrick, 1985, Structural studies of imogolite and allophanes by aluminum-27 and silicon-29 nuclear magnetic resonance spectroscopy, Phys. Chem. Minerals, v. 12, p. 342-346.

Turner, G., K. A. Smith, R. J. Kirkpatrick, and E. Oldfield, 1986, Boron-11 nuclear magnetic resonance spectroscopic study of borate and borosilicate minerals and a borosilicate glass, J. Mag. Res., v. 67, p. 544-550.

Kirkpatrick, R. J., R. A. Kinsey, K. A. Smith, D. M. Henderson, and E. Oldfield, 1986. High resolution solid-state sodium-23, aluminum-27, and silicon-29 nuclear magnetic resonance spectroscopic reconnaissance of alkali and plagioclase feldspars. Amer. Mineralogist, v. 70, p. 106-123.

Knight, C.T.G., R. J. Kirkpatrick, and E. Oldfield, 1986, The unexpectedly slow approach to thermodynamic equilibrium of the silicate anions in aqueous tetramethylammonium silicate solutions, J. Chem. Soc. Chem. Comm., p. 66-67.

Oestrike, R. W., and R. J. Kirkpatrick, 1986, ^{27}Al and ^{29}Si MASS NMR spectroscopy of glasses in the system anorthite-diopside-forsterite, Am. Min.

Turner, G. L., R. J. Kirkpatrick, S. H. Risbud, and E. Oldfield, submitted, Multi-nuclear magic-angle sample-spinning nuclear magnetic resonance spectroscopic studies of crystalline and amorphous ceramic materials, J. Am. Cer. Soc.

Ramachandran, R., C.T.G. Knight, R. J. Kirkpatrick, and E. Oldfield, 1986, A two-dimensional NMR approach to the study of intermolecular scrambling reactions, J. Mag. Res., in press.

Kirkpatrick, R. J., and C. A. Weiss, Jr., 1986, Magic-angle sample-spinning NMR spectroscopy of clay minerals, in Advanced Chemical Methods for

Soil and Clay Minerals Research, Stucki, J. W., ed., D. Reidel Co., New York, in press.

Wood, B. J., R. J. Kirkpatrick, and B. Montez, 1986, Order-disorder phenomena in $MgAl_2O_4$ Spinels, Am. Min., v. 71, in press.

Yang, W.-H., R. J. Kirkpatrick and G. Turner, 1986, ^{31}P and ^{29}Si MASS NMR investigation of the structural environment of phosphorus in alkaline-earth silicate glasses, J. Am. Cr. Soc., in press.

Risbud, S. H., R. J. Kirkpatrick, A. P. Taglialavore, and B. Montez, 1986, Solid-state NMR evidence of 4-5, and 6-fold Al sites in roller-quenched SiO_2-Al_2O_3 glasses, J. Am. Cer. Soc., in press.

Knight, C. T. G., G. L. Turner, R. J. Kirkpatrick, and E. Oldfield, 1986, Solid-state tangsten-183 nuclear magnetic resonance spectroscopy, J. Am. Chem. Soc., Chem. Comm.

Abstracts

Bethke, C. M., 1985, Hydrologic analysis of Gulf Coast-type geopressured zones: 98th Ann. Geol. Soc. Amer. Mtg.

Altaner, S. P., and C. M. Bethke, 1986, Layer ordering in interstratified illite/smectite: Inter. Mineral. Soc. Ann. Mtg.

Bethke, C. M., 1986, Roles of sediment compaction, tectonic compression, and topographic relief in driving deep groundwater migration: 99th Ann. Geol. Soc. Amer. Mtg. (invited paper).

Harrison, W. J., and C. M. Bethke, 1986, Paleohydrologic analysis of interacting meteoric and compactional flow regimes in the U.S. Gulf Coast, 99th Ann. Geol. Soc. Amer. Mtg.

Bethke, C. M., and W. J. Harrison, 1986, Dynamics of geopressured zones during compaction of the U.S. Gulf Coast basin, 99th Ann. Geol. Soc. Amer. Mtg.

Engelder, T., and C. M. Bethke, 1986, Reexamination of the Gulf Coast model used by the Rubey-Hubbert hypothesis for thrust belt tectonics, 99th Ann. Geol. Soc. Amer. Mtg.

Frey, C.-Y. Chen, M. Roden, and A. Kennedy, 1985, Utilization of geochemistry to understand the origin of the Hawaiian islands. The Am. Nuclear. Soc., Annual Meeting, Boston.

Chen, C.-Y., F. A. Frey, S. R. Hart and M. O. Garcia, 1985, Isotopic and rare-earth element geochemistry of the transition from tholeiitic to alkalic volcanism in the Haleakala volcano, East Maui, E.O.S. Trans. AGU Fall Meeting.

Henderson, D. M., 1986, Some mineralogic and petrographic programs for the Apple Macintosh microcomputer, 1986 General Meeting of the International Mineralogical Association, Stanford, CA. Abstracts w/pgms, p. 123.

Oestrike, R., W.-H. Yang, R. J. Kirkpatrick, E. Oldfield, B. Montez, A. Navrotsky, and R. Hervig, 1985, Investigation of framework-stoichiometry aluminosilicate glasses using silicon-29 and aluminum-27 MASS NMR spectroscopy. Am. Geophys. Union, Spring 1985 Meeting.

Weiss, C. A., Jr., R. J. Kirkpatrick, and T. Dunn, 1985, Aluminum-27 and silicon-29 NMR spectroscopy of peraluminous gels, Am. Geophys. Union, Spring 1985 Meeting.

Turner, G. L., K. A. Smith, E. Oldfield and R. J. Kirkpatrick, 1985, Structure and cation effect on phosphorus-31 NMR chemical shift and anisotropy of model and mineral orthophosphates, Am. Geophys. Union, Spring 1985 Meeting.

Yang, W.-H., R. J. Kirkpatrick, G. L. Turner, and E. Oldfield, 1985, Phosphorus-31 and aluminum-27 NMR spectroscopy of alumino-silicate glasses, Am. Geophys. Union, Spring 1985 Meeting.

Turner, G. L., C. Nelson, R. J. Kirkpatrick and R. Oestrike, 1986, ^{11}B and ^{27}Al Mass-NMR spectroscopy of $CaO-B_2O_3-Al_2O_3$ glasses. Amer. Cer. Soc., Fall 1986 Meeting.

Kirkpatrick, R. J., 1986, High-resolution NMR spectroscopy of amorphous solids. 1986 Quantum Geochemistry Conference.

Phillips, Brian and R. J. Kirkpatrick, 1986, A new method for increasing resolution of ^{27}Al mass NMR spectra, A.G.U., 1986 Spring Meeting.

Kirkpatrick, R. J., W.-H. Yang and M. Carpenter, 1986, ^{29}Si mass NMR spectroscopy of plagioclase feldspars, A.G.U., 1986 Spring Meeting.

Oestrike, R., K. Geisinger, A. Navrotsky, G. L. Turner, and R. J. Kirkpatrick, 1986, Structure and thermochemistry of glasses along the join $NaAlSi_3O_8$-$NaBSi_3O_8$: the effect of boron, GSA.

Kirkpatrick, R. J., 1986, IMA 86 crystal growth symposium - introduction, Int. Min. Assoc., 1986 Meeting.

Kirkpatrick, R. J., W.-H. Yang, and M. Carpenter, 1986, ^{29}Si NMR spectroscopy of plagioclase feldspars, Int. Min. Assoc., 1986 Meeting.

Weiss, C. A., Jr., and R. J. Kirkpatrick, 1986, Aluminum-27 and silicon-29 NMR spectroscopy of mixed-layered illite/smectites, Int. Min. Assoc..1986 Meeting.

Phillips, B. and R. J. Kirkpatrick, 1986, Increased resolution for solid-state ^{27}Al NMR, Int. Min. Assoc., 1986 Meeting.

Yang, W.-H. and R. J. Kirkpatrick, 1986, ^{29}Si, ^{27}Al, ^{23}Na mass and ^{29}Si CP/mass NMR spectroscopic studies of the reaction of rock-forming silicate minerals and glasses with aqueous solution, Int. Min. Assoc., 1986 Meeting.

Sedimentary Geology/Stratigraphy/Paleontology/Geomorphology

Books and Articles

Altaner, S. P., Comparison of rates of smectite illitization to rates of K-feldspar dissolution: Clays and Clay Minerals, v. 34 in press.

Whitney G. and S. P. Altaner, 1985, The low-grade metamorphic transformation of clay minerals in sedimentary rocks within the Montana disturbed belt: Guidebook of field trip for 1985 International Clay Conference, 32 pp.

Bethke, C. M. and S. P. Altaner, 1986, Layer-by layer mechanism of smectite illitization and application to a new rate law: Clays and Clay Minerals, v. 34, p. 136-145.

Bethke, C. M., N. Vergo, and S. P. Altaner, 1986, Pathways of smectite illitization: Clays and Clay Minerals, v. 34, p. 125-135.

Blake, D. B., 1985, The Benthopectinidae (Asteroidea: Echinodermata) of the Jurassic of Switzerland. Ecl. Geol. Helv., v. 77, n. 3, p. 631-647.

Blake, D. B., 1985, Some post-Paleozoic sea stars (Asteroidea: Echinodermata) suggesting slow rates of evolution, J. Paleont.

Blake, D. B., 1986, A classification and phylogeny of post-Paleozoic sea stars, Jour. Natural History.

Carozzi, A. V. and R. T. Bertani, 1985, Lagoa Feia Formation (Lower Cretaceous), Campos Basin, offshore Brazil: rift stage lacustrine carbonate reservoirs, Part I, Jour. Pet. Geol., v. 8, n. 1, p. 37-58, Part II, v. 8, n. 2, p. 199-220.

Carozzi, A. V. and Frank U. H. Falkenhein, 1985, Depositional and diagenetic evolution of Cretaceous oncolitic packstone reservoirs, Macae Formation, Campos Basin, offshore Brazil: in P.O. Roehl and P. W. Choquette (eds.), Carbonate Petroleum Reservoirs, Springer Verlag, p. 473-484.

Carozzi, A. V., 1985, The reaction of continental Europe to Wegener's theory of continental drift: Earth Sciences History, v. 4, n. 2, p. 122-137.

Carozzi, A. V. and M. R. Owen, 1986, Southern provenance of Upper Jackfork Sandstone, southern Ouachita Mountains: Cathodoluminescence petrology, Geol. Soc. America Bull., v. 97, n. 1, p. 110-115.

Carozzi, A. V. and Wm. C. Dawson, 1986, Anatomy of a phylloid algal buildup, Raytown Limestone, Iola Formation, Pennsylvanian, Southeast Kansas, U.S.A.: Sedimentary Geology, v. 47, n. 3/4, p. 221-261.

Carozzi, A. V., 1986, Carbonate Rock Depositional Models: A Microfacies Approach, 425 p., 560 figs., I.H.R.D.C. Press, (Book). Carozzi, A. V. and Sadeg H. Bakush, Subtidal storm-influenced carbonate ramp model: Galena Group (Middle Ordovician) along Mississippi River (Iowa, Wisconsin, Illinois and Missouri), U.S.A., Archives des Sciences, Geneve, in press.

Carozzi, A. V., 1986, New eustatic model for the origin of carbonate cyclic sedimentation: Archives des Sciences, Geneve, in press.

Cerling, T. E., and R. L. Hay, 1986, An isotopic study of paleosol carbonates from Oldurai Gorge. Quat. Res., v. 25, p. 63-78.

Johnson, W. H., A. K. Hansel, L. R. Follmer, 1985. Wedron Section, Wedron, Illinois - Concepts of Woodfordian glaciation in Illinois in Decade of North American Geology - Centennial Field Guides, GSA.

Johnson, W. H., A. K. Hansel, B. A. Socha, L. R. Follmer and J. M. Masters, 1985, Depositional environments and correlation problems of the Wedron Formation (Wisconsinnan), northeastern Illinois: North-central Section, GSA Field Trip, Illinois State Geological Survey Guidebook, v. 16, 91 p.

Klein, G. deV., 1985, The control of depositional depth, tectonic uplift and volcanism on sedimentation processes in the back-arc basins of the western Pacific Ocean, Jour. Geol., v. 93, p. 1-25.

Marsaglia, K. M. and Klein, G. deV., 1985, The paleogeography of Paleozoic and Mesozoic storm depositional systems: A Reply. Jour. Geol., v. 93, p. 91-94.

Klein, G. deV., 1985, Intertidal flats and intertidal sand bodies: in R. A. Davis, Jr., editor, 1985, Coastal sedimentary environments, 2nd ed. New York, Springer-Verlag, p. 187-224.

Klein, G. deV., 1985, Sandstone depositional models for exploration for fossil fuels, 3rd ed. Boston, IHRDC Publishing Co., 209 p. (Book).

Klein, G. deV., 1985, The frequency and periodicity of preserved turbidites in submarine fans as a quantitative record of tectonic uplift in collision zones, Tectonophysics, v. 119, p. 181-193.

Klein, G. deV., 1986, Sedimentation patterns in relation to rifting, arc volcanism, and tectonic uplift in back-arc basins of the western Pacific Ocean: in Kobayashi, K., and Uyeda, S., editors, Proceedings of the OJI Conference on continental margins. Tokyo, Terra Sci. Pub. Co., in press.

Lee, Y. I., and G. deV. Klein, 1986, Diagenesis of sandstones in the back-arc basins of the Western Pacific Ocean: Sedimentology, in press.

Heidlauf, D. T., A. T. Hsui and G. deV. Klein, 1986, Tectonic subsidence analysis of the Illinois Basin: Jour. Geology, in press.

Klein, G. deV., 1987, Current aspects of Basin Analysis, Sed. Geol., in press.

Langenheim, R. L., Jr., B. G. Huff, E.W. Lipman and R.C. Vaiden, 1985, Preliminary report of the brachiopod fauna, Arrow Canyon section, Southern Nevada, U.S.A., Compte Rendu, 10eme, Cong. Internat., Sratigraphie et Geologie Carbonifere, Madrid, Spain, v. 2, p. 425-433.

Petersen, D. W. and R. L. Langenheim, Jr., 1985, Spiriferellina lata Lane in the Uppermost Chesterian in the Bird Spring Group at Arrow Canyon,

Clark County, Nevada, Trans. Ill. State Acad. Sci., v. 77 (1984), n. 3-4, p. 207-218 (issued Feb. 1985).

Scheihing, M. H. and R. L. Langenheim, Jr., 1985, Depositional history of an Upper Pennsylvanian Cyclothem in the Illinois Basin and comparison to Kansas in cyclothemic sequences, p. 373-382 in J. T. Dutro, Jr and H. W. Pfefferkorn (eds), Compte Rendu, v. 5, Neuvieme Cong. Internat. Strat. et Geol. Carbonif., Wash. D.C. and Champaign-Urbana, IL, 549 p.

Mann, C. J., 1985, Changing Faces, Math. Geol., v. 17, p. 219-220.

Hunter, R. L., C. J. Mann and R. M. Cranwell, 1985, Determining probabilities of geologic events and processes, Proc. Intern. Topical Meeting on High-Level Nuclear Waste Disposal, Sept. 24-26, 1985, Pasco, Washington.

Mann, C. John, 1985, Changing our name officially, Math. Geology, v. 17, n. 8, p. 783-784.

Mann, C. John, 1985, Revised classification of meteoritic impact sites on Earth, Meteoritics, v. 20, n. 3, p. 591-592.

Mann, C. John, 1986, Composition and origin of material in Pre-Columbian pottery, San Salvador Island, Bahamas, Geoarchaeology, v. 1, p. 183-194.

Mann, C. John, 1986, Mathematical Geology, Geotimes, v. 31, n. 2, p. 36-37.

Mann, C. John, 1986, Misuses of linear regression in Earth sciences in William E. Size, editor, Mathematical Geology Memoir, n. 1.

Hunter, Regina L. and C. John Mann, 1986, Techniques for determining probabilities of geologic processes and events, v. I, Sandia National Laboratories SAND86-0196.

Hunter, Regina L. and C. John Mann (editors), 1986, Techniques for determining probabilities of geologic processes and events, v. II, Sandia National Laboratories, SAND86-0196.

Hunter, Regina L., C. John Mann, W. J. Conover and Robert Budnitz, 1986, Introduction: Chapter 1 in Hunter, Regina L. and C. John Mann (editors), Techniques for determining probabilities of geologic processes and events, v. II, Sandia National Laboratories, SAND86-0196.

Mann, C. John, 1986, The elements of graphing data by William S. Cleveland, Book Review, Math. Geology, v. 18, n. 8, p. 707-710.

Lee, Yong Il, Bernie Lindsey, T. May and C. John Mann, 1986, Grain size distribution of calcareous sands, San Salvador Island, Bahamas, CCFL Marine Studies, Occasional Paper 1986, n. 1, 10 p.

Sandberg, P. A., 1985, Non-skeletal aragonite and pCO_2 in the Proterozoic and Phanerozoic, in The Carbon Cycle and Atmospheric CO_2: Natural Variations Archean to Present. Amer. Geophys. Union, Geophys. Mon. Ser., v. 32.

Sandberg, P. A., 1985, Recognition criteria for calcitized skeletal and non-skeletal aragonite. Palaeontographica Americana, n. 54, p. 272-281.

Sandberg, P. A., 1985, Ancient aragonite cements and their occurrence in ancient limestones, in P. M. Harris, and Schneidermann (eds.) "Carbonate Cements", Soc. Econ. Paleont. Mineral., Spec. Publ. 36, 27 pp., 3 pls.

Bailey, J. B. and P. A. Sandberg, 1985, Preserved mineralogy and ultrastructure in two new Pennsylvanian bivalves, in J. T. Dutro and H. W. Pfefferkorn (eds) Paleontology, Paleoecology & Paleogeography, v. 5, Comptes Rendu, 9e Congr. Int. du Strat. et Geol. Carbonif, p. 271-281.

Popp, B. N., T. F. Anderson, and P. A. Sandberg, 1986, Textural, elemental and isotopic variations among constituents in middle Devonian limestones, North America, Jour. Sed. Petrol., v. 56, n. 5, 13 p.

Turner, J. V., T. F. Anderson, P. A. Sandberg and S. J. Goldstein, 1986, Isotopic, chemical and textural relations during the experimental alteration of biogenic high-magnesian calcite, Geochim. Cosmochim. Acta, v. 50, p. 495-506.

Popp, B. N., T. F. Anderson and P. A. Sandberg, 1986, Brachiopods as indicators of original oxygen and carbon isotope compositions in some Paleozoic limestones, Geol. Soc. Amer. Bull., v. 97, 9 p.

Abstracts

Altaner, S. P., 1985, X-ray diffraction analysis of mixed-layer illite/smectite: Applications to geologic problems (invited speaker): 34th Ann. Denver Conf. on Applic. of X-ray Analysis, Snowmass, CO, p. 48

Altaner, S. P., 1985, Ion exchange experiments in the system (NH_4,K) Cl-H_2O-silicate at temperatures between 200 and 400°C, 8th Internat. Clay Conf., Denver, CO, p. 6.

Altaner, S. P., M. D. Krohn and P. R. Klock, 1985, Analytical techniques for determining bound ammonium, 98th Ann. Geol. Soc. Amer. Mtg., Orlando, FL, p. 512.

Altaner, S. P. and C. M. Bethke, 1986, Layer ordering in interstratified illite/smectite, Internat. Min. Assoc. Mtg., Stanford, CA.

Blake, D. B., 1986, New Eocene sea stars from Seymour Island, Antarctic Penninsula, and comments on preservation of fossil sea stars. GSA Ab. Prog. v. 18(4).

Blake, D. B. and E. M. Snyder, 1986, Tason limits and phylogeny in Paleozoic stenolaemates: computerized analyses of the Rhabdomesina and some possible close allies. Internat. Bryozoological Assoc. Abs. and Prog. for 1986.

Carozzi, A. V. and W. C. Dawson, 1985, Experimental fabric-selective porosity in phylloid algal limestones. A.A.P.G. Bull., v. 69 (2), p. 248.

Carozzi, A. V. and R. T. Bertani, 1985, Lagoa Feia Formation (Lower Cretaceous), Campos Basin, offshore Brazil - rift-valley-stage lacustrine carbonate

reservoirs. A.A.P.G. Bull., v. 69 (2), p. 237-238.

Socha, B. J., W. H. Johnson and A. K. Hansel, 1985, Glacigenic diamictons of late Wisconsinan age at Wedron, Illinois. GSA Abst. with Prog., v. 17, n. 5, p. 327.

Klein, G. deV., 1985, Tidal friction and the earth's rotation II, edited by P. Brosche and J. Sundermann (Rev) Sedimentology, v. 32, p. 309.

Klein, G. deV., 1985, Sediment diagenesis, edited by A. Parker and B. W. Sellwood (Rev), Am. Scientist, v. 73, p. 290-291.

Heidlauf, D. T., A. T. Hsui and G. deV. Klein, 1985, Tectonic and subsidence history of Illinois Basin, Am. Geophys. Union Trans. (EOS), v. 66, p. 1059.

Lee, Mingchou, R. L. Hay and D. R. Kolata, 1985, Episodic potassic alteration of Ordovician tuffs in the upper Mississippi valley, Geol. Soc. Amer. Abs. w/prog. v. 17, p. 641.

Langenheim, R. L., Jr., 1985, Brachiopod paleoecology on the Pennsylvanian shelf margin, southern Nevada, U.S.A., Resumes Abstracts, 1er Cong. Internat. Brachiopodes, Univ. Bretagne Occidentale, Brest, France, p. 56.

Langenheim, R. L., Jr., 1985, Extensional tectonics in the Great Basin: Bristol Range Thrust, Pioche District, Nevada, an example? Wyo. Geol. Assoc., v. 31, n. 6, p. 3.

Mansholt, M. S., J. E. Utgaard and R. L. Langenheim, Jr., Paleoecology and depositional environments of Wolfcampian carbonates in Arrow Canyon, Clark County, Nevada, Soc. Econ. Paleont. Mineral., Midyear Meeting, Abstracts, v. 2, p. 59.

Vaiden, R. C. and R. L. Langenheim, Jr., 1985, Biostratigraphy and paleoenvironment of Morrowan (Zone 2) brachiopoda, Bird Spring Group, Arrow Canyon, Clark County, Nevada. Bull. AAPG, v. 69, no. 2, p. 313. (Typographical error in published title - should read 'Zone 20').

DEPARTMENT OF GEOLOGY: COURSE OFFERINGS, 1982-1986

Geophysics - Structural Geology - Tectonics
Engineering Geology

Introduction to Geophysics	350	Bass/Chen/Chen
Geophysical Prospecting	351	Hsui
Physics of Earthquakes	397	W.-P. Chen
Mathematical Methods in Geology	480	Hsui
Geodynamics	493	Hsui
Numerical Methods in Geomechanics	493	Hsui
Introduction to Seismology	493	W.-P. Chen
Advanced Topics in Seismology	493	W.-P. Chen
Geophysical Inverse Theory	493	W.-P. Chen
Deformation of the Upper Mantle	493	W.-P. Chen/Bass/Marshak
Mineral Physics	493	Bass
Rheology of Earth Materials	493	Bass/Marshak
Introduction to Structural Geology	311	Marshak
Advanced Structural Geology	488	Marshak
Geotectonics	489	Marshak
Southern Cordilleran Geology	493	D. Anderson/Marshak
Practice of Engineering Geology	451	Nieto
Principles of Engineering Geology	450	Nieto
Geology for Engineers	250	Nieto

Sedimentary Geology - Stratigraphy - Paleobiology
Quaternary Geology - Geomorphology

Principles of Stratigraphy	321	Langenheim/Mann
Advanced Stratigraphic Geology	422	Langenheim
Selected Topics in Stratigraphy	493	Langenheim
Introduction to Paleontology	320	Blake
Paleoecology	420	Blake
Seminar in Paleontology	493	Blake
Micropaleontology	493	Sandberg
Sedimentology and Sedimentary Geology	309	Klein
Field & Lab Procedures in Sedimentology	310	Klein
Sedimentary Petrography	338	Carozzi
Basin Analysis and Sedimentary Geology	437	Klein
Analysis of Sedimentary Basins	493	Klein
Sedimentology of Non-Marine Rocks	493	Hay
Sedimentology of Volcaniclastic Rocks	493	Hay
Recent Sedimentary Environments	477	Klein
Introduction to Modern Marine Carbonate Environments	315F	Sandberg
Carbonate Sedimentology	438	Carozzi
Carbonate Sedimentology	439	Sandberg
Depositional Models for Petroleum Exploration	444	Carozzi
Carbonate Ultrastructure and Diagenesis	493	Sandberg
Marine Geology of the Bahamas	315M	Mann
Geochemistry of Sediments and Natural Waters	432	T. Anderson

Oceanography	370	T. Anderson
Electron Beam Microanalysis	493	D. Anderson/Sandberg
Mineralogy of Clays	462	Altaner
Mineralogy of Clays II	463	Altaner
Coal Geology	493	Damburger
Paleobotany	350	Phillips
Geomorphology	301	Johnson
Quaternary Geology	457	Johnson
Glacial Geology	357	Johnson
Introduction to Palynology	493	King

Mineralogy - Igneous & Metamorphic Petrology - Geochemistry, Hydrogeology

Mineralogy	333	Henderson
Petrology	334	Kirkpatrick/C.-Y. Chen
Optical Mineralogy	335	Henderson
Petrography & Petrogenesis	336	Kirkpatrick
Advanced Igneous Petrology	435	Kirkpatrick/C.-Y. Chen
Advanced Metamorphic Petrology	493	D. Anderson
Theoretical Petrology & Non-equilibrium Thermodynamics	434	D. Anderson
Kinetics of Geological Processes	493	Kirkpatrick
Seminar on Melt Structure	493	Kirkpatrick
Structural Mineralogy	431	Henderson
X-Ray Mineralogy	493	Henderson/Altaner
Crystallography	493	Henderson
Mineralogy of Clays	462	Altaner
Mineralogy of Clays II	463	Altaner
Electron-beam Microanalysis	493	D. Anderson/Sandberg
Introduction to SEM & TEM	469	T. Kriven(Ceramics)
Neutron Activation Analysis	493	C.-Y. Chen
Chemistry of the Earth	360	T. Anderson/C.-Y. Chen
Geochemistry of Sediments and Natural Waters	493	T. Anderson
Trace-element Geochemistry	493	C.-Y. Chen
Isotope Geology	433	T. Anderson/C.-Y. Chen
Advanced Isotope Geochemistry	493	C.-Y. Chen
Introductory Hydrogeology	355	Bethke
Groundwater Hydrology	455	Bethke

Introductory Courses

Introduction to Study of the Earth	101
History of the Earth	102
General Geology I & II	107, 108
Regional Field Study (Grand Canyon)	115
Physical Sciences in Modern Science	142
Geology for Engineers	250
Geology of Energy	105
Field Geology in Rocky Mountains (Field Camp)	317

See also listings from depts. of Theoretical and Applied Mechanics, Metallurgy, Civil Engineering, Materials Research, and Geography.

FIELD-BASED RESEARCH AND INSTRUCTION

The Department of Geology has traditionally maintained a strong emphasis on field-related studies. This tradition has continued through both field-based instruction and field-based research. In many instances, this work is closely tied to state-of-the-art laboratory or theoretical studies. Below, we highlight some of the field areas in which members of our faculty are currently undertaking or recently completed field research or teaching.

Field Research

S. P. Altaner: Diagenisis in coal-rich shale, Pennsylvania

D. E. Anderson: Metamorphic reactions in rocks of northwest Scotland

J. Bass: In Situ stress measurements in Colorado

D. B. Blake: Paleoecology of the Ordovician of the Upper Mississippi Valley; Bryozoa of the Carboniferous of the Illinois Basin

A. V. Carozzi: Microfacies of Mid-Continent Carbonates

C.-Y. Chen: Geochemical studies in Hawaii basalts and in Cyprus ophiolite

W.-P. Chen: Central Himalayas, India

R. L. Hay: Diagenetic studies in California; stratigraphy, diagenesis and early man studies in east Africa

W.H. Johnson: Quaternary stratigraphy, glacial geology, and geomorphology in Illinois

R. J. Kirkpatrick: Study of the Cyprus ophiolite

G. deV. Klein: Submarine sediments off Japan and Korea; Illinois Basin

R. L. Langenheim, Jr.: Stratigraphy and paleontology, Nevada

C.J. Mann: Stratigraphy of Illinois Basin; Bahamas

S. Marshak: Structural analysis in eastern New York, western Arizona, and the Transantarctic Mountains

A. S. Nieto: Engineering geology problems in western Canada, Peru, and Columbia

P. A. Sandberg: Carbonate sedimentology & diagenesis, Florida Keys and Diagenesis in Pennsylvanian carbonates, S. E. Kansas

Field Teaching

Basin Analysis and Sedimentary Geology: Basin Analysis Symposium, Minneapolis, MN

Carbonate Geology: Florida Keys

Engineering Geology: Pennsylvania; central Wisconsin

Exploration Geophysics: Basement structure of the Illinois Basin, Central Illinois

Hydrogeology: Viburnian-trend mineral district; St. Francois Mountains

Introductory Geology: Ozark Mountains, Missouri; Colorado and Northern Arizona; central Wisconsin; east-central Illinois; Colorado, Utah, S. Nevada

Mineralogy/Petrology: Northern Michigan; western Arizona and southern California

Field Teaching - Cont.

Paleontology: Southern Illinois; Kentucky; Indiana; Wisconsin; Iowa; Minnesota; Missouri

Quaternary Geology/Geomorphology: Northern Illinois, southern and eastern Wisconsin; south-central Indiana; east-central Illinois/central, western and southern Illinois

Recent Sedimentary Environments: Arkoma Basin and Ouachita Mountains, AK and OK

Sedimentology and Sedimentary Geology: East central Illinois and central Indiana

Stratigraphy: Wabash Valley; western Illinois

Structural Geology: Northern Michigan; eastern Tennessee; central Wisconsin; western Arizona and southern California

WYOMING FIELD WORK

WYOMING FIELD CAMP

The Summer Geology Field Camp presents a comprehensive instructional program; beginning with teaching the principal techniques of field geology, continuing through semi-independent mapping and problem solving, and culminating in reconnaissance of regional relationships between the Central Stable Region, the Rocky Mountain Foreland, the Paleozoic Continental Margin, the Sevier and Laramide thrust belts and the Yellowstone volcanic province. Students map on topographic base, with aerial photographs and, briefly, with plane table. Stratigraphic sections are measured by several techniques. Mapping ranges from detailed study of intensely deformed rocks, through large scale studies of small areas to reconnaissance mapping of areas in excess of twenty square miles. The program is designed to accommodate students of moderate to little formal geologic background and essentially no knowledge of field geology. It is intended to enable them to begin independent work in the field and to qualify them for entry-level professional work as field geologists.

Field mapping is conducted on the northeastern flack of the Big Horn Mountains which exposes a Cambrian through Paleocene sedimentary sequence resting on a Precambrian crystalline complex. Structural relationships are moderately challenging and exposures range from very good to poor. Regional study involves field trips through the High Black Hills, Yellowstone, Tetons, Beartooth Mtns., Hoback Canyon, Wind River Range, Owl Creek Mtns., and the Big Horn Mountains.

We try to maintain a student staff ratio of 6:1. Our staff is diverse in interests with most of the main branches of field-oriented geology represented. Currently we have operated with three to four senior staff aided by a similar number of graduate teaching assistants.

In addition to its instructional program, the field camp staff maintains a continuing research effort in the field area. Currently the staff is engaged in compiling geologic maps on newly published 7 1/2' quadrangles and in special projects on the Precambrian, the Bighorn Dolomite, the Devono-Silurian interval, the Tensleep Sandstone, and the uppermost Cretaceous. Six quadrangles with supporting structure sections have been published and another is in press. A paper on Late Ordovician paleontology and stratigraphy is in press. Several presentations have been made at national and local GSA or AAPG meetings. Staff personnel have been active in Penrose Conferences on foreland structure and have made many presentations at meetings of the Wyoming Geological Association. Seven graduate and/or senior theses have been completed since 1980 and one is currently in progress. Investigators from Urbana, as well as from other institutions, frequently seek our aid in gathering data and/or ideas on many aspects of local geology.

Library Staff member Suzanne Hayes, Librarian Dederick C. Ward and staff member Diana Walter in Geology Library Map Room. The Geology Library houses over 80,000 volumes and 55,000 sheet maps in the Natural History Building.

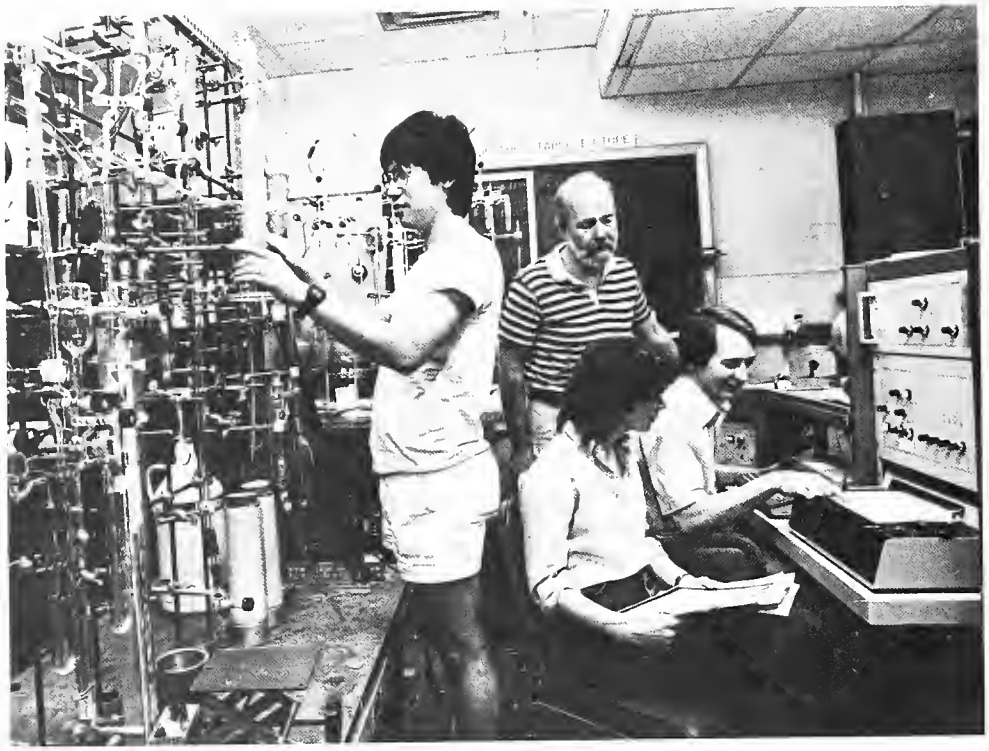
UNIVERSITY OF ILLINOIS GEOLOGY LIBRARY

The Library of the University of Illinois at Urbana-Champaign is the third largest university library in the country; our collection is surpassed in size only by the collections of Harvard and Yale. At present, we have over 6 million books and printed serials, and over 3 million non-book items including microfilms, videotapes, and maps. In 1985 the University of Illinois Library switched to a computer catalog system, which permits the identification of items by authors, titles, or keywords. The new system will also search the collections of affiliated libraries in addition to our own, and will automatically request books for delivery via campus mail. A terminal in the Geology Library permits direct access to **GeoRef** and other online sci/tech databases.

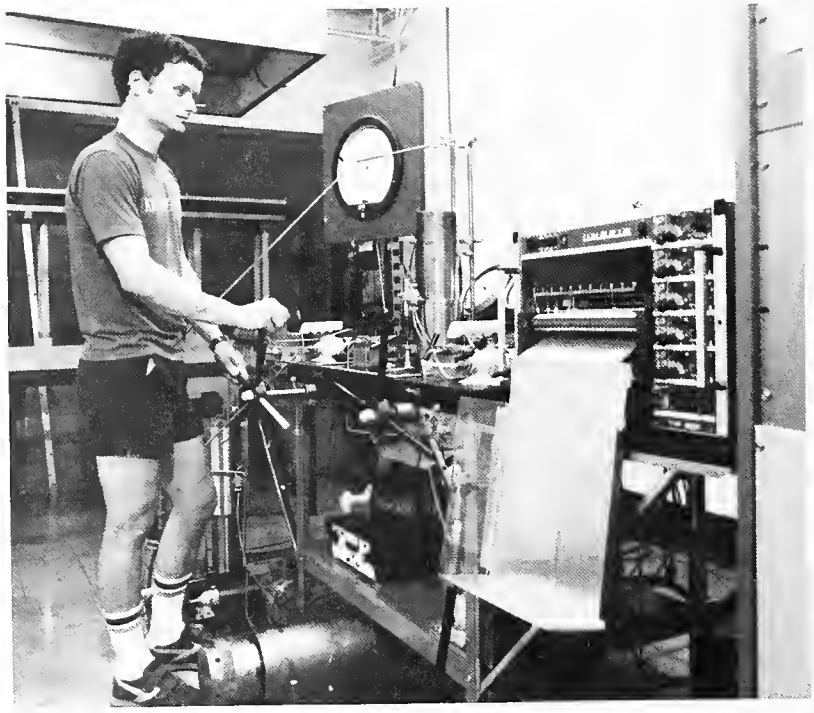
The **Geology Library** is housed in the Natural History Building along with the Department, thereby permitting easy access to books, journals, and maps. The total geology collection of the University includes over 160,000 volumes (of which half are in the Geology Library and the remainder are in the Main Library) and 55,000 catalogued sheet maps. Our holdings are notable for complete sets of all primary and most secondary American and foreign geological journals. The collection also includes a substantial selection of Soviet geological literature.

The University Library's **Rare Books Room** is repository for one of the world's outstanding collections of rare and early geological literature. Included in the collection are, among others, first editions of classic works by Agricola, Steno, Gesner, Biringucci, Smith, Maclure, Hutton, Werner, and Agassiz. We also possess a substantial selection of early American geological works. An annotated 565 page catalog to this collection by D. Ward and A. Carozzi was published in 1984 by the University of Illinois Library.

The Geology Library is managed by full-time staff, headed by Dederick Ward. Mr. Ward is active in national and international geoscience information efforts. He currently serves on the GeoRef advisory committee of the American Geological Institute.



The Stable Isotope Geochemistry Laboratory. K-S. Woo is working on a vacuum extraction line. Professor T.F. Anderson, Linda Bonnell and Brian Popp ponder the output of a mass spectrometer



Graduate student Don Von Bergen, who works for Prof. Carozzi, operating a unique high-pressure triaxial compression apparatus, which allows the circulation of CO_2-charged water under controlled conditions of temperature and pressure. This apparatus, which simulates burial conditions, is used to study development of secondary porosity in carbonate rocks

LABORATORY FACILITIES

Applied Rock Mechanics: direct shear devices, uniaxial compression column, slaking durability unit, soil testing equipment, base-friction table, and rock-wedge simulator.

Computer: An Alliant FX/8, a state-of-the-art processor with parallel-vector architecture, has been installed in the hydrogeology laboratory. The geophysics group will have a SUN 3-160 work station. In addition, a CRAY-XMP48 is available on campus at the National Center for Supercomputing Applications. Other University computers available to the Department include: CDC Cyber 175 and 174, IBM 4341, DEC Vax II, Pyramid 90X, along with necessary peripherals.

Electron-Microbeam: JEOL microprobe, Cambridge SEM, High-resolution JEOL SEM (JSM-840A) with Kevex microanalyzer, TEM and STEM systems and Argon Mill (at the Center for Materials Research).

Experimental Petrology: TemPress cold-seal pressure vessels, Deltech and Lindburg high-temperature furnaces (for synthesis, kinetics, and phase-equilibrium experiments).

Geochemistry: Siemens X-Ray Fluorescence and Perkin-Elmer Atomic Absorption Spectrophotometer for bulk-chemical (major, minor, and trace elements) analysis; MAT 250 isotope-ratio mass spectrometer (set up for carbon, oxygen, and sulfur); trace-element Neutron-Activation system (Germanium co-axial detector and multi-channel analyzer) (on order).

Hydrogeology: Alliant FX/8 supercomputer; equipment for accessing campus and remote Cray supercomputers; computer colorgraphics and digitizing equipment.

Mineral Physics: Brillouin spectrometer (laser-light scattering for measuring elastic properties). Diamond-Anvil Pressure Cell (for optical and x-ray measurements on samples at pressures up to 300 kbar.

NMR Spectroscopy: High-resolution nuclear-magnetic resonance spectrometers and associated equipment for solution and solid spectroscopy (in Chemistry Building).

Seismology: Microfilm library of post-1960 WWSSN seismograms; computer file of post-1980 GDSN seismograms; digital seismic signal processing facilities including dedicated computer, interactive graphics, and record digitizer; portable short-period seismograph.

Soft-Rock Studies: Cathode luminescence; microscopes, settling tanks; isodynamic magnetic separator, acid preparation equipment, X-ray radiography.

Support: Logitech Automated thin-section preparation equipment; Numerous research-quality petrographic microscopes; photographic darkrooms.

Triaxial Loading: Hydraulic equipment for burial simulation and fluid circulation.

X-Ray: Seimens X-ray powder diffractometer system, X-ray fluorescence analyzer, Philips X-ray diffractometer, Single-crystal and powder cameras, preparation equipment for clay minerals.

Rob Lander, a graduate student studying volcanic sediments with Professor Hay, analyzing the output of the X-ray diffraction unit

Jack Pullen, the department's thin-section technician, preparing specimens using the automated Logitech polisher

COLLOQUIUM PROGRAMS

Students and faculty of the Department of Geology have a broad range of professional specialties, therefore, Colloquium programs are sought to provide topics of interest to all. Colloquia are held on Friday afternoons and begin with informal conversation, coffee and cookies in the lounge with the formal presentation following in the lecture hall. Recent speakers have included:

FALL 1985

Dr. J. James Eidel (Illinois State Geological Survey) "The Illinois Superdeep Drillhole."

Dr. Albert T. Hsui (Dept. of Geology, UIUC) "The Origin of Trench Curvatures—A New Dynamic Model."

Dr. Jay D. Bass (Dept. of Geology, UIUC) "Elasticity of Micro-Crystals and the Chemical Composition of the Earth."

Dr. Paul Enos (University of Kansas) "Diagenesis in Mid-Cretaceous Reefs, El Abra Limestone, Mexico."

Dr. Lewis E. Snyder (Dept. of Astronomy, UIUC) "Radio Observations of Comets."

Dr. Sandra J. Lindquist (AAPG Distinguished Lecturer) "Practical Characterization of Eolian Reservoirs for Development: Nugget Sandstone, Utah-Wyoming Thrust Belt."

Dr. David W. Houseknecht (University of Missouri, Columbia) "Tectonic and Sedimentary Evolution of the Arkoma Basin."

Dr. S. N. Casshyap (Visiting Professor, University of Chicago) "Changing Patterns of Alluvial Systems Through Time and Coal-Forming Models: Examples from Gondwana Basins of India."

Dr. Keene Swett (Dept. of Geology, University of Iowa) "Later Proterozoic Sedimentary Successions in E. Greenland and Spitzbergen: Some Sedimentological and Diagenetic Insights and Some Paleontological Surprises."

Dr. John Horner (Montana State University) "Dinosaur Social Behavior."

Dr. Donald Oltz (Illinois State Geological Survey) "Petroleum Geology of the Gulf of Suez."

Dr. Robert R. Loucks (Dept. of Geosciences, Purdue University) "Zoning and Origin of Epithermal Silver-Gold-Lead-Zinc Veins, Topia, Durango, Mexico."

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Dr. George W. Viele (Dept. of Geology, University of Missouri-Columbia) "Collision Effects of the Ouachita Orogeny on the Midcontinent."

Dr. James W. Truran (Dept. of Astronomy, UIUC) "Element Synthesis in Stars and Supernovae."

Dr. Stephen P. Altaner (Dept. of Geology, UIUC) "Geochemistry of Ammonium in Hot Springs Deposits, Western U.S. and Remote Sensing Applications."

Professor Nikolas I. Christensen (Dept. of Geosciences, Purdue University) "Samail Ophiolite, Oman: A Model for the Oceanic Crust and Upper Mantle."

Professor Adolf Seilacher (Geologisch-Palaontologisches Institut) "The Precambrian Ediacaran Fauna: Alien Beings Here on Earth."

Dr. Terry Engelder (Dept. of Geosciences, Pennsylvania State University) "The Effect of a Paleozoic Abnormal Pore-Pressure Event on Present-Day Hydrofracture Measurements of Lithospheric Stress."

Dr. David M. Sherman (U.S. Geological Survey, Reston, Virginia) "Electronic Structures of Minerals: Applications to the Physics and Chemistry of the Earth."

Dr. Arthur Bettis (Iowa State Geological Survey) "Late Wisconsinan and Holocene Landscape Evolution in the Central Des Moines River Valley, Iowa."

Dr. Charles Kreitler (Bureau of Economic Geology, University of Texas at Austin) "Hydrogeology of Sedimentary Basins: Palo Duro Basin as an Example."

Dr. Paul K. Sims (U.S. Geological Survey, Denver, CO) "Anatomy of the Early Proterozoic Penokean Orogeny."

Dr. Hugh Hay-Roe (Murray Assoc. Int., Houston, TX) "Scientific Writing."

Professor Paul Ribbe (Virginia Polytechnic Institute, Blacksburg, VA) "Structure and Characterization of Alkali Feldspars."

Dr. David R. Kingston (AAPG Distinguished Lecturer) "Worldwide Basin Classification and Oil Play Prediction."

Dr. Charles Meyers (Sedona, AZ) "Mineral Deposits Over Geologic Time: 1. Petrologic, Tectonic & Temporal Patterns. 2. Tectonic & Chemical History."

Dr. Frank A. Podosek (Dept. of Earth & Planetary Sciences, Washington University) "Application of SR Isotopes to Studies of Carbonate Diagenesis."

Dr. Daniel Nahon (Dept. of Geology, University of Marseille-St. Jerome) "Tropical Weathering and Landscape Evolution."

Dr. Heikki Ignatius (Geological Survey of Finland) "Geochemical Prospecting in Finland."

Dr. Jerry Jameson (Exxon Production Research Company) "Carbonate Facies Models in the Petershill Formation, Mississippian, Midland Valley of Scotland."

Dr. John V. Walther (Dept. of Geological Sciences, Northwestern University) "The Role of Fluids in Progressive Metamorphism."

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