

OIL & GAS CONSERVATION COMMISSION

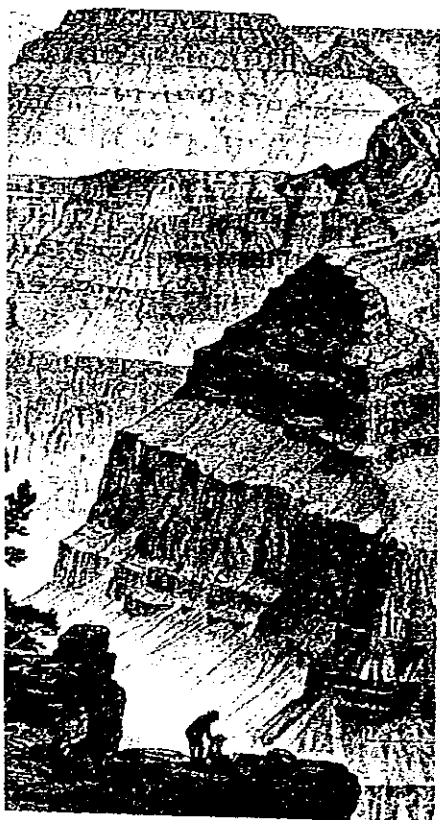
Meeting: August 19, 1974

Mr. John Bannister, Exec. Sec.

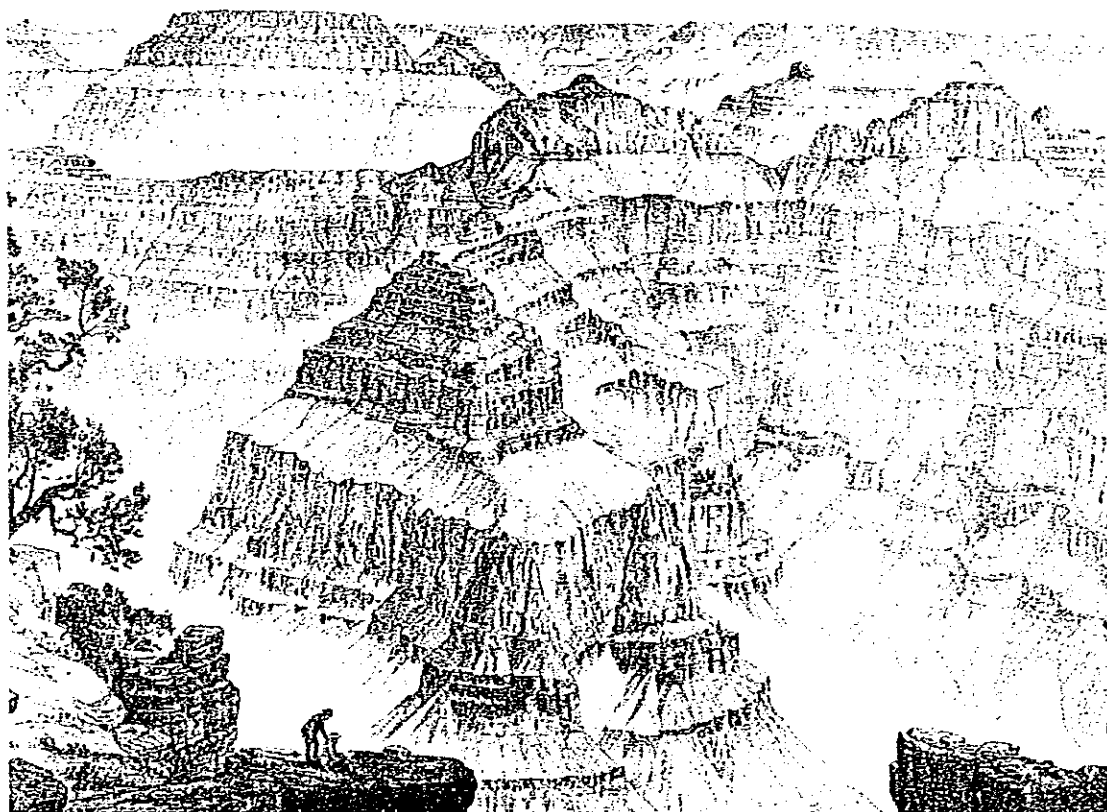


Northern Arizona University

GEOLOGY • BOX 6030
FLAGSTAFF, ARIZONA 86001



GEOLOGY
In The
GRAND CANYON COUNTRY



Northern Arizona University



UNDERGRADUATE AND GRADUATE
PROGRAMS IN GEOLOGY

AT

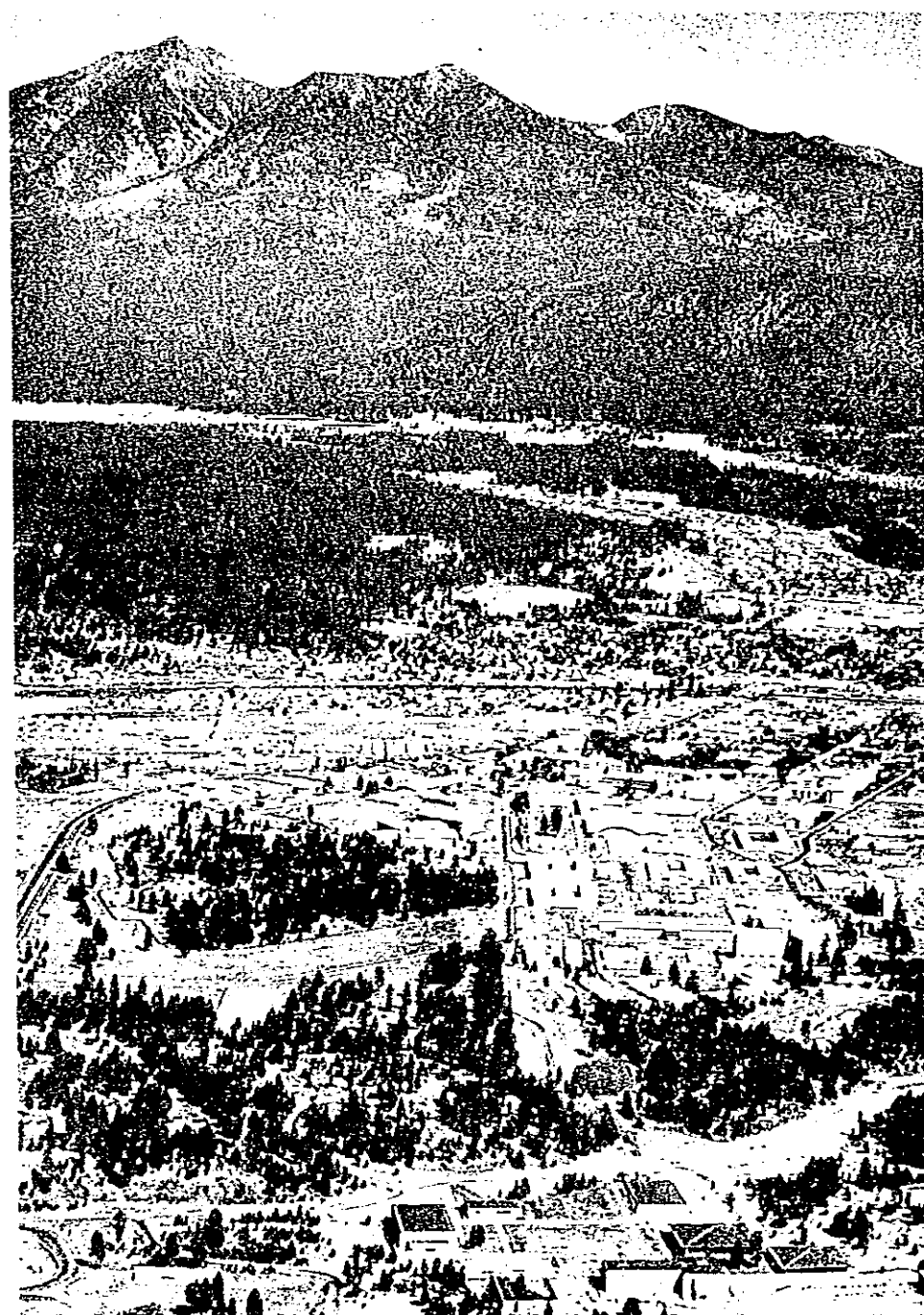
Northern Arizona University

Flagstaff, Arizona



FLAGSTAFF, ARIZONA

Flagstaff, the city of seven wonders, is located in the heart of Coconino National Forest, the largest continuous stand of ponderosa pine in North America. At an elevation of 7,000 feet, sunshine and clear air combine with low humidity to produce a truly delightful climate. North of Flagstaff, the San Francisco Volcanic Peaks, at an elevation of 12,670 feet, are an excellent winter sports and summer hiking area. To the south of Flagstaff is a vast network of canyons and mesas leading to the basin and range province of the Southwest deserts. Within a 100 mile radius of Flagstaff are seven National Parks and Monuments including the incomparable Grand Canyon of the Colorado. Flagstaff is also the home of the Lowell Observatory and the U.S.G.S. Astrogeology Center, deeply involved in Space exploration and the geologic training of scientists-astronauts. Geologically speaking Flagstaff is a truly exciting place to live.



Northern Arizona University, South and North Academic Centers, with the City of Flagstaff in the background and the San Francisco Peaks on the Horizon

Northern Arizona University

N.A.U. is one of three state supported universities in Arizona, with a student enrollment of about 9,800 students. Established in 1899, the University has experienced rapid growth in recent years and has succeeded in combining time-tested traditions with the finest of modern facilities and the highest standards of instruction: At N.A.U., "to become educated is to become more human" and the faculty is dedicated to the highest level of scholarship coupled with a spirit of friendliness which will enhance and preserve the individuality of the student.

The Department Of Geology

Geology is a relatively recent addition to the many disciplines at N.A.U. Although Geology was taught for many years, the first B.S. degree was not conferred until 1966. Since that year, the department has grown to nine full-time professors and three adjunct professors. There are 154 undergraduate majors and 36 graduate majors. It is the intent of the Department to stabilize this growth at present levels in order to insure personalized instruction and supervision. Graduate study is confined to the Masters degree and no further degree plans are contemplated. The growth of Geology at N.A.U. has been an orderly process augmented by federal funding, principally N.S.F., and by substantially increased state budgets and by significant contributions by several petroleum and mining companies. Each additional staff member in Geology has joined N.A.U. because of his primary interest in teaching supplemented by his interest in field oriented research.

Programs Of Study

Programs leading to the B.S. degree.

1. The Geology Extended Major designed for career work in geology as a profession.
2. The Applied Geology Extended Major with concentrations in Geophysics, Hydrology, and Engineering Geology.
3. The Earth Science Major for students interested in environmental and interdisciplinary studies as well as in the teaching of Earth Science at the secondary level.
4. The Recreation Land Management Extended Major for students interested in careers in the Forest and Park Services.

Graduate Degree Programs.

1. The Master of Science in Geology is designed for students intending to pursue careers in the mining and petroleum industries as well as in state and federal surveys.
2. The Master of Arts in the Teaching of Earth Science is designed for students who do not have teaching certification. The program includes 12 hours of course work in Education.
3. The Master of Science in Earth Science is designed for students desiring to expand their background in Earth Science for work as curators and preparators, research assistants, or in the teaching of Earth Science.

Courses In Geology

Undergraduate

101 Man and the Earth (4)	320 Stratigraphy (3)
121 Physical Geology (4)	360 Engineering Geol (3)
122 Historical Geology (4)	370 Structural Geol (4)
250 Paleontology (3-4)	408 Geophys Instrumentation (2)
301 Geol Human Affairs (3)	410 Intro Oceanography (3)
305 Rocks & Minerals (3)	420 Field Methods (2)
310 Mineralogy (5)	421 Summer Field Geology (6)
315 Petrology (5)	430 Geomorphology (3)
319 Sedimentology (3)	485 Undergrad Research (1-6)

Undergraduate and Graduate

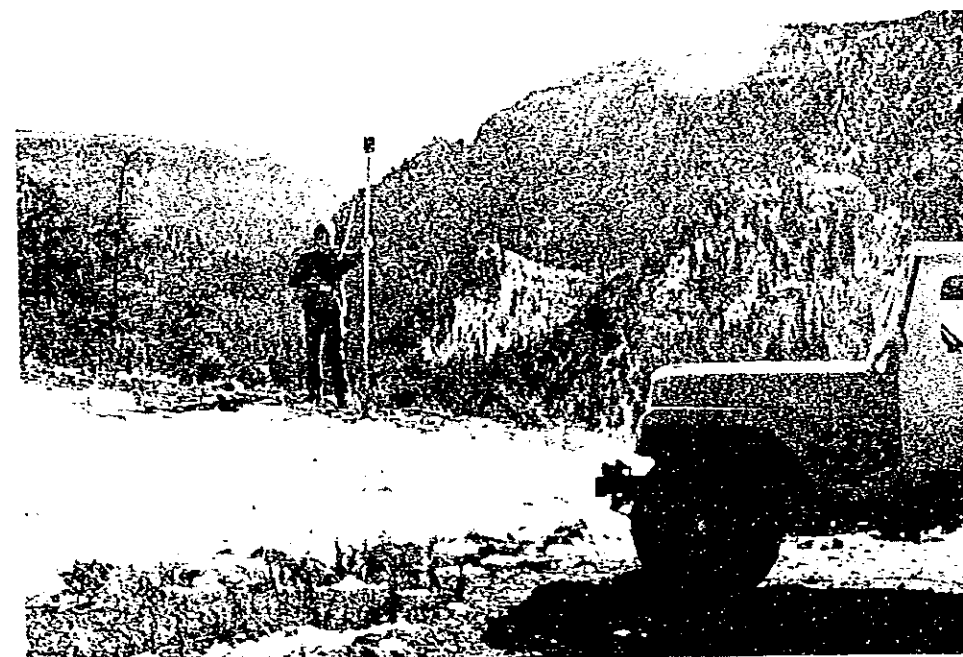
501 Evol of Geol Prov (3)	560 Intro to Geophys (3)
522 Optical Mineralogy (3)	570 Intro to Geochem (3)

Graduate

600 Tech Sess in Geol (½)	630 Micropaleontology (2)
605 Adv. Paleo (2-3)	631 Field Geol for Teach
606 Geol for Teachers (3)	635 Paleogeology (3)
607 Earth History (3)	638 Elements of Geology (2)
608 Landforms of N. Amer (3)	640 Volcanology (2-3)
611 Sed Pet Sandstones (3)	644 Adv. Structural Geol (3)
612 Sed Pet Carbonates (3)	646 Adv. Stratigraphy (3)
615 Founders & Concepts (2)	650 Marine Geology (3)
620 Economic Geology (3)	670 Hydrogeology (3)
621 Igneous Petrology (3)	680 Teach Meth in Earth Sci (2)
622 Metamorphic Petrology (3)	697 Independent Study (1-3)
625 Isotope Geochronology (3)	698 Graduate Seminar (1-2)
626 Topics in Earth Sci (3)	699 Thesis (4-6)



Freshman Geology students in the Inner Gorge of the Grand Canyon of the Colorado



Magnetometer measurements in Oak Creek Canyon at the Mogollon Rim

Facilities and Equipment

Geology occupies two floors of a modern three story building on the North Academic Center, utilizing 5 lecture rooms and 10 laboratories for instruction and research. Two labs are fully equipped for audio-visual tutorial instruction. Standard equipment, including 18 petrographic microscopes, is provided for undergraduate instruction. Research equipment available at the graduate level includes full instrumentation for petrographic and paleontologic micrography, X-ray diffraction and fluorescence, atomic absorption, and colorimetry instrumentation. For quantitative analysis of data, the Department has electronic and rotary calculators and a H-P. 9810A calculator, printer and plotter. In geophysics, a LaCoste and Romberg gravity meter, a proton precession magnetometer, a 13 channel refraction seismic unit, earth resistivity unit, flux-gate magnetometer, provide instrumentation for a wide range of field investigations. For field work, the Department has 2 van-buses, 2 Power Wagon Carryalls, and 9 Jeeps. A rock preparation and thin-section laboratory, drafting, enlarging and map reproduction (Ozalid) room, and a well-equipped photographic dark room provide support for thesis research and preparation of manuscripts.



Field work in the Volcanics of the Hopi Buttes area

Field Studies

Because of the favorable climate in Arizona, field work is done on a year round basis. All undergraduate and most graduate courses include field studies to augment classroom and laboratory work. The Department offers two summer field courses, Geol. 408 and 421, the latter of which is required of all undergraduate majors. In addition, most undergraduates take at least one course involving field problems ranging from forminiferal studies to gravimetric investigations. Brief descriptions of the field courses follows:

Geol. 408 Geophysical Instrumentation: A two semester-hour course in field application of geophysical instruments including gravity meter, magnetometer, refraction seismograph, and resistivity meters. The work will stress a maximum of "hands-on" experience with each instrument. Classwork will be minimized and will consist of instruction regarding operation of various instruments and methods of reducing field measurements to mapable data. Prerequisites: One year Physics, College Algebra-Trig., Physical Geology.

Geol. 421 Summer Field Geology: A six semester-hour course in the application of geologic principles to the solution of detailed and regional problems. The course consists primarily of four problems in two areas. Flagstaff Area: (1) Stratigraphic and structural mapping of Precambrian and Paleozoic Sedimentary and Metamorphic Rocks; (2) Stratigraphic and structural analysis of an Igneous and Metamorphic Complex. Grand Canyon Area: (1) Stratigraphic Facies of Toroweap (Permian) Formation; (2) Geologic Mapping of Big Springs Fault System in the Grand Canyon. Use will be made of the Brunton, plane table, air photos. Written reports which will be based on field and laboratory analysis are required. Prerequisites: Mineralogy & Petrology, Structural Geology & Field Methods. Stratigraphy and Sedimentology are helpful but are not required.

At the graduate level, all thesis research to date has been field oriented and the staff is actively engaged in a variety of field investigations. Masters thesis completed during the last two years include the following:

Petrology of the Tapeats Sandstone, Grand Canyon
Geology of Shinarump Lake Area
Campanian-Deonian Stratigraphy in Northern
Lavasapi Canyon
Petrology of Toroweap Formation, Walnut Canyon
Geology of Tuckup Canyon, Grand Canyon

Structural Analysis of Coconino Forest
Gravity Climbing at Gray Mountain
Petrology of Younger Precambrian Basaltic Rocks,
Grand Canyon
Structure and Petrology of Older Precambrian
Crystalline Rocks, Grand Canyon
Stratigraphy of Bass Formation, Grand Canyon

Current research at the M.S. level which is in various stages of completion include the following:

Geology of Precambrian Rocks in
Sholl Valley
Basalt Stratigraphy of the Apache
Mud Mountain
Petrology and Geochemistry of Sulfide-bearing
Precambrian Sulfide Complex
Metasupracrustal Petrology and Structure of Final
Schist in Mineral Mountains
Geology of Woodly Mountain Volcanic Field
Petrology and Geochemistry of Carbonate
and Plutonic Deposits, Volcanic Peak
Geology of Shadow Mountain
Carbonate Facies and Petrology, Mississippian of
Four Corners Area

Engineering Geology of Flagstaff
Stratigraphy and Depositional Environment of
Precambrian Dwy Formation, Grand Canyon
Geology of Copper Creek Area
High Channel Loaves and Geology in the
Beaver Creek Watershed
Toroweap Facies, Marble Canyon
Petrology of Redwall Limestone,
Southwestern Arizona
Hydrogeology of Fort Valley
Petrology of Shinarump Formation, Northern
Arizona
Seismic Velocity and Deep Seismic Potential
in the Beaver Creek Watershed

Geology Staff

Charles W. Barnes, Ph.D., University of Wisconsin, has interests in structural analysis, rock mechanics, and metamorphic petrology. Currently he is studying the history of a complexly deformed area near Flagstaff where monoclinical axes of varying age form interference patterns on an enormous scale, and promote superbly developed gravity-gliding features on every scale. Additionally, the structural and petrologic puzzles exhibited by the older Precambrian rocks exposed in the Inner Gorge of the Grand Canyon and along the Mogollon Rim provided a challenge in polyphase interpretation.



Stanley S. Beus, Ph.D., University of California in Los Angeles, specializes in biostratigraphy and invertebrate paleontology. He is interested in the ecology of Paleozoic invertebrates, particularly brachiopods, biostratigraphy in the Cordilleran region, and the application of statistics to paleontological problems. Current research activities include Precambrian stratigraphy in the Grand Canyon, Devonian biostratigraphy, megafossils of the Pennsylvanian and paleoecology of a Carboniferous limestone in South Wales.



David S. Brumbaugh, Ph.D., Indiana University, specializes in structural geology and geophysics. Primary interests include the application of geophysical techniques to structural problems, and the kinematics and sequence of deformation of structures. Current research activities include a geophysical study of the Big Hole River basin of southwestern Montana to determine basin configuration and structural relations; analysis of regional fracture patterns in the Cherokee basin of Kansas and Oklahoma; and chronological study of a portion of the southwest Montana thrust belt.



Augustus S. Cotera, Ph.D., University of Texas, is a sedimentologist and sedimentary petrologist. Current research interests include the petrology of late Precambrian and early Paleozoic sandstones exposed in the Grand Canyon and fabric analysis of Triassic conglomerates and sandstones. His general interests include paleogeographic interpretations using sedimentary structures and paleocurrent analysis, and the application of statistical analysis to problems involving sedimentary models and depositional environments.



Raymond L. Eastwood, Ph.D., University of Arizona, is a geochemist with strong interests in volcanology, isotope geochronology, mineralogy and petrology. Current research concerns the post-Miocene volcanism in the southern Colorado Plateau - Basin and Range area specifically in the San Francisco volcanic field, which involves establishing a chronology of volcanic and structural events and a definition of petrologic events via field and laboratory studies. On the level of theory, his interests involve relating mechanisms of geologic processes and principles of chemistry and physics.



Richard F. Holm, Ph.D., University of Washington, is a petrologist with interests in the petrology and structural geology of igneous and metamorphic rocks; his interests also include mineralogy and the geology of mineral deposits. A research program now in progress combines field and laboratory studies of the structure, stratigraphy and petrology of the San Francisco Peaks volcano in northern Arizona. Current research activities also include petrologic studies of alkalic and mafic gneisses, and mafic and ultramafic intrusions of the Precambrian Dahomeyan basement complex of southeastern Ghana, West Africa.

Monty
Errol L. Montgomery, Ph.D., University of Arizona, is a hydrogeologist with particular interests in applying geophysical techniques to hydrologic investigations. His research has included hydrologic analysis of alluvial aquifers using the gravimeter, refraction seismograph and the proton precession magnetometer. Studies of volcanic and sedimentary rocks and experimental techniques relating changes in seismic velocity to degree of weathering and unsaturated permeability. Current research also includes urban geology and evaluations of geologic hazards by quantification of relationships between slope rock type, soil type and historical costs of damage due to surficial earth movements.



Dale Nations, Ph.D., University of California at Berkeley, is a paleontologist with primary interests in Cenozoic paleoecology and micropaleontology. He emphasizes the interpretation of age and environment of deposition of stratigraphic units based upon coordinated analysis of sedimentary structures, invertebrate and vertebrate fossils and fossil floras wherever they occur together. Main research efforts are in non-marine sedimentary basins in the Verde Valley and Tsegi Canyon, Arizona. On a worldwide basis, he is also interested in fossil decapod crustacean faunas.

*side of Cal
 Pan Am
 (Comoco)*

Dick
Richard R. Rawson, Ph.D., University of Wisconsin, is interested in carbonate petrology and stratigraphy. His research is focused on depositional environments of ancient sedimentary rocks including textural analysis of carbonates and analysis of sedimentary structures. Current research includes analysis of depositional environments of carbonate rocks found in the Toroweap Formation of the Grand Canyon and northern Arizona. The Toroweap Formation represents a transgressive-regressive cycle and displays very well all sedimentary facies from open marine to aeolian sand dunes.



(Cont. of 6)

*optimistic as to
 our oil*

Adjunct Professors

Thor N. V. Karlstrom, Ph.D., Univ. of Chicago, is a geologist with the USGS Branch of Astrogeologic Studies in Flagstaff. He was instrumental in the preparation of the preliminary landing site geologic maps used in the Apollo Lunar exploration program. More recently, he has begun work on environmental surficial geologic studies in conjunction with the ERTS mapping program. Because of his extensive early work in glacial sediments in Alaska, he has taught graduate courses in Glaciology in his position as Adjunct Professor at N.A.U.



John F. McCauley, Ph.D., Columbia University, is a Branch Chief of the USGS Branch of Astrogeologic Studies in Flagstaff. He has had major responsibilities in Lunar exploration programs since their inception but especially in the Ranger and Apollo programs. He is presently involved in the direction of exploration of Mars in the Mariner and Viking programs. Prior to his extensive work in Space Geology, he was Associate Professor of Geology at the University of South Carolina. As Adjunct Professor at N.A.U., he has been involved in teaching graduate level courses in Lunar Geology and NSF sponsored short courses in Astrogeology for college teachers.



Edward W. Wolfe, Ph.D., Ohio State University, is a geologist with the USGS Branch of Astrogeologic Studies in Flagstaff. He has been engaged in Mapping of the Merriam Crater complex in the San Francisco Volcanic Field in conjunction with field testing of equipment and techniques for Lunar exploration and in Astronaut training. He is co-investigator in the geologic equipment program and site mapping of Lunar landings of the Apollo 16 & 17 missions. In addition, as Adjunct Professor, he has taught graduate courses in Volcanology and also courses in General Geology at N.A.U.

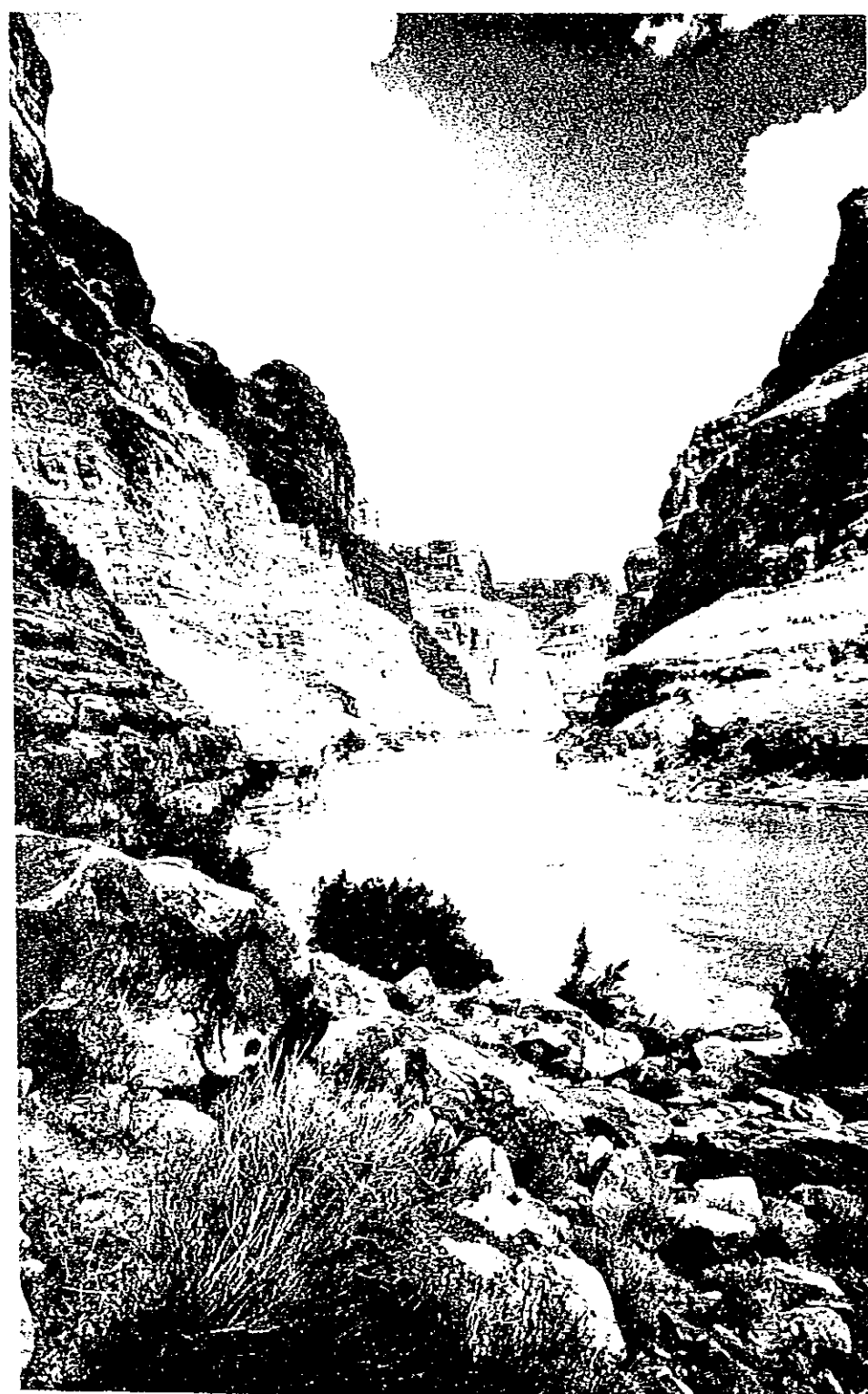




Fresh Snowfall on the San Francisco Volcanic Peaks

FINANCIAL ASSISTANCE

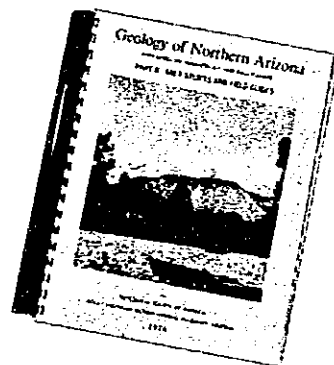
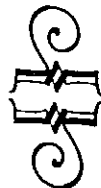
In addition to the financial assistance provided to students by the Financial Aids office of the University, the Department of Geology awards assistance to both undergraduate and graduate geology majors. Upperclass undergraduate students work as departmental assistants and laboratory assistants on an hourly basis, not to exceed 15 hours per week. Stipends range from \$800 to \$1,000 per academic year. At the graduate level, the Department awards 9 graduate teaching assistantships at a stipend of \$2,000 per academic year plus out-of-state tuition waivers. Also, 3 research assistantships at \$2,000 each and 3 technicianships at \$2,500 each are awarded, neither of which, however, have out-of-state tuition waivers. Application forms for either undergraduate or graduate assistantships are available upon request. The closing date for all applications is February 15 and awards are announced on March 1 of each year.



PLANNING A TRIP TO THE GRAND CANYON COUNTRY ?

ORDER YOUR COPY OF

Geology of Northern Arizona



THE MOST COMPLETE WORK EVER PUBLISHED

A limited number of sets, used for the Rocky Mountain Section Meeting of the Geological Society of America, are available.

Part 1 - Regional Studies

Topic	Number of Papers	Pages
1. Precambrian Geology	5	1 - 97
2. Paleozoic Geology	2	119 - 192
3. Mesozoic Geology	2	193 - 220
4. Cenozoic Geology	4	221 - 316
5. Structural Geology	3	317 - 392
6. Economic Geology	1	393 - 406

Part 2 - Area Studies & Field Guides

1. Grand Canyon - River Guide & Kaibab Trail Guide 409 - 422
2. North Central Arizona - Field Trip Guide & 2 Papers 423 - 464
3. San Francisco Volcanic Field - Field Trip Guide & 3 Papers 465 - 546
4. San Francisco Mountain - Field Trip Guide & 4 Papers 547 - 601
5. Verde Valley - Field Trip Guide & 2 Papers 602 - 646
6. Hopi Buttes - Field Trip Guide & 2 Papers 647 - 728
7. Black Mesa Area - Field Trip Guide & 2 Papers 729 - 793
8. Jerome Area - Field Trip Guide & 1 Paper 794 - 804

This two volume set was specifically prepared for the Rocky Mountain Section Meeting, held in Flagstaff in April, 1974. Sixty Five scientists from the U.S.G.S., Northern Arizona University, University of Arizona, Arizona State University and several other institutions contributed papers and field guides, most of which are in print for the first time. The two volume set represents the most complete and up-to-date work ever published on the Geology of Northern Arizona.

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(includes shipping & postage)

GEOLOGY FOR TEACHERS *in the* GRAND CANYON COUNTRY



THREE - OR - FIVE HOURS OF GEOLOGY AT NORTHERN ARIZONA UNIVERSITY

GEOLOGY 606 GEOLOGY FOR TEACHERS (3)
JULY 15 - AUGUST 17, 1974

GEOLOGY 538 ELEMENTS OF GEOLOGY (2)
(GEOLOGY OF THE GRAND CANYON)
JUNE 10 - JUNE 21, 1974
OR JULY 15 - JULY 26, 1974

PURPOSE: A series of two courses in Geology have been selected for the purpose of providing teachers at the secondary and elementary level with an understanding of the principles of Earth Science. Students may elect to take one, or two courses in the series. One course includes A RAFT TRIP DOWN THE COLORADO RIVER IN THE GRAND CANYON.

LOCATION: Classwork will be done on the campus and field studies will be done in areas within an hour drive of the University. Flagstaff is located in the pine forests of the Colorado Plateau at an elevation of 7,000 feet, and within one hour driving radius of the San Francisco Volcanics, Precambrian metamorphics, acid igneous intrusions, and several canyons in which are exposed stratigraphic sections of rocks ranging in age from Precambrian through Cretaceous. The Grand Canyon is within two hours driving distance.

GEOLOGY 606 GEOLOGY FOR TEACHERS (3)

Earth materials and processes on the Earth surface. A beginning course in the physical aspects of the Earth including minerals and rocks, erosion of the land surface by water, wind and ice, earthquakes and volcanic activity. Three lectures and two labs and/or field trips per week.

GEOLOGY 538 GEOLOGY OF THE GRAND CANYON (2)

Origin, structure, and entrenchment of the Grand Canyon with emphasis on the physical principles and historical aspects of the earth which are so superbly exhibited in the Grand Canyon. Five lectures, two films, one day field trip and a four day raft trip down the Colorado from Lees Ferry to Phantom Ranch and hike out to South Rim.

COST: Tuition \$14 per credit hour; Activity Fee \$3 per course. Geology 638 \$50 field trip fee plus \$170 River Trip Fee (includes food and transportation).
Optional Fees: University Dorm - Two to a room \$9 per week; University Cafeteria - Twenty Meal Ticket \$15. Private rooms and apartments are also available.

INFORMATION and APPLICATION: Chairman, Department of Geology,
Box 6030 - Northern Arizona University, Flagstaff, Arizona 86001

GEOLOGY IN THE GRAND CANYON COUNTRY



NORTHERN ARIZONA UNIVERSITY

The Northern Arizona University is one of three state-supported universities in Arizona, with a current enrollment of more than 9,000 students. The University is located in Flagstaff in the north-central part of the state at an elevation of 7,000 feet. The City is entirely surrounded by the Coconino National Forest in the high pine forest Colorado Plateau country. Flagstaff is on the southern edge of the San Francisco Volcanic Field, with the major cone rising to more than 12,000 feet. Within a 100-mile radius of Flagstaff are seven National Parks and Monuments, including the incomparable Grand Canyon of the Colorado. Flagstaff is the home of the U.S.G.S. Astrogeology Center, deeply involved in lunar exploration and the geologic training of scientist-astronauts.

The Department of Geology offers major programs leading to the BS and MS degrees in Geology, BS degree in Geophysics, BS and MA degrees in the Teaching of Earth Science, and the MS degree in Earth Science. The Department of Geology shares a modern building with Physics and has available the normal equipment facilities in support of advanced research work in the geological sciences, including x-ray diffraction, atomic absorption, mass spectrometry and a computer terminal for quantitative research.

STAFF

- Charles W. Barnes, Ph.D., Wisconsin, Associate Professor
Structural Analysis and Metamorphic Petrology
- Stanley S. Beus, Ph.D., UCLA, Professor
Paleontology and Stratigraphy
- David S. Brumbaugh, Ph.D., Indiana University, Assistant Professor
Structural Geology and Geophysics
- Augustus S. Cotter Jr., Ph.D., University of Texas, Professor, Chairman
Sedimentary Petrology of Sandstones
- Raymond L. Eastwood, Ph.D., University of Arizona, Assistant Professor
Geochemistry, Geochronology and Volcanology
- Richard F. Holm, Ph.D., University of Washington, Assistant Professor
Mineralogy and Igneous Petrology
- Errol L. Montgomery, Ph.D., University of Arizona, Assistant Professor
Hydrogeology and Geophysics
- J. Dale Nations, Ph.D., University of California-Berkeley, Assistant Professor
Micropaleontology and Paleoecology
- Richard R. Rawson, Ph.D., University of Wisconsin, Associate Professor
Stratigraphy and Carbonate Petrology

RESEARCH OPPORTUNITIES

Within 50 miles of Flagstaff, rocks ranging in age from Precambrian to Recent are superbly exposed; research problems in all three rock types are abundant. Faculty and student research in the past few years has included the following generalized areas: Precambrian Grand Canyon - petrographic and structural analysis; Paleozoic - Biostratigraphy, Sedimentary environmental studies; Mesozoic - Geologic mapping, petrologic and heavy mineral analyses; Cenozoic - Petrology of extrusive rocks in the San Francisco Volcanic Field, Geomorphologic studies, Surface and subsurface hydrologic investigation.

FINANCIAL ASSISTANCE

- Teaching assistants: \$2,000 a year plus Tuition Waiver
Research assistants: \$2,400 a year plus Tuition Waiver

Appointments are also available to qualified students with an interest in Astrogeology in cooperation with the Astrogeology Branch of the USGS located in Flagstaff.

Applications for assistantships should be filed prior to March 1. Application forms and information may be obtained by writing to:

Chairman, Department of Geology - Northern Arizona University - Flagstaff, Arizona 86001

FIELD GEOLOGY *in the* GRAND CANYON COUNTRY



LOCATION: The field work is based on the University campus and at temporary field stations of the North Rim of the Grand Canyon. Flagstaff is located in the pine forests of the Colorado Plateau at an elevation of 7,000 feet, and within one hour driving radius of the San Francisco Volcanics, Precambrian metamorphics, acid igneous intrusions, and several canyons in which are exposed stratigraphic sections of rocks ranging in age from Precambrian through Cretaceous. The Grand Canyon is within two hours driving distance.

GEOLOGY 408 GEOPHYSICAL INSTRUMENTATION (2) MAY 27 – JUNE 10, 1974

PROGRAM: A two semester-hour course in field application of geophysical instruments including gravity meter, magnetometer, refraction seismograph, and resistivity meters. The work will stress a maximum of "hands-on" experience with each instrument. Classwork will be minimized and will consist of instruction regarding operation of various instruments and methods of reducing field measurements to mappable data.

PREREQUISITES: One year Physics, College Algebra-Trig., Physical Geology.

STAFF: Dr. David S. Brumbaugh

GEOLOGY 421 SUMMER FIELD GEOLOGY (6) JUNE 10 – JULY 13, 1974

PROGRAM: A six semester-hour course in the application of geologic principles to the solution of detailed and regional problems. The course consists primarily of four problems in two areas. **FLAGSTAFF AREA:** (1) Stratigraphic and structural mapping of Precambrian and Paleozoic Sedimentary and Metamorphic Rocks; (2) Stratigraphic and structural analysis of an Igneous and Metamorphic Complex. **GRAND CANYON AREA:** (1) Stratigraphic Facies of Toroweap (Permian) Formation; (2) Geologic Mapping of Big Springs Fault System in the Grand Canyon. Use will be made of the Brunton, plane table, air photos. Written reports which will be based on field and laboratory analysis are required.

PREREQUISITES: Mineralogy & Petrology, Structural Geology & Field Methods. Stratigraphy & Sedimentology are helpful but are not required.

STAFF: Dr. David S. Brumbaugh and Dr. Richard R. Rawson. Two graduate student assistants.

FACILITIES: Transportation in Department Vans, Carryalls and Jeeps. The Department facilities include petrographic, sedimentation, and thin-section preparation laboratories, and drafting room. The library contains complete runs of standard journals and periodicals. The University Student Union, Activities Center, Summer Fine Arts and Film Classics Series are available to all students.

GEOLOGY 538 - GEOLOGY OF THE GRAND CANYON (2) JULY 15-26, 1974

Origin, structure and entrenchment of the Grand Canyon of the Colorado with emphasis on the physical principles and historical aspects of the Earth which are so superbly exhibited in the Grand Canyon. Five lectures, two films, one day field trip and **FOUR DAY RAFT TRIP** from Lees Ferry to Phantom Ranch and hike out to South Rim.

PREREQUISITES: No previous course work in geology is required.

STAFF: Dr. Charles W. Barnes

COST: Tuition \$14 per credit hour; Activity Fee \$3 per course; Class Fees: Geol. 408 \$25, Geol. 421 \$50, Geol. 638: \$50; Geol. 638 River Trip Fee \$170 (includes food and transportation).

Optional Fees: University Dorm – Two to a room \$9 per week (private rooms and apartments are also available); University Cafeteria – Twenty meal ticket \$15.

Enrollment Limited to 32 students in each course. Application deadline March 1, 1974

INFORMATION and APPLICATION: Chairman, Department of Geology, Box 6030
Northern Arizona University, Flagstaff, Arizona 86001



OFFICE OF
Oil and Gas Conservation Commission
STATE OF ARIZONA
4515 NORTH 7TH AVE.
PHOENIX, ARIZONA 85013
PHONE: (602) 271-5161

A G E N D A

Meeting
Little America Motel
Flagstaff, Arizona
August 19, 1974

10:00 a.m.

Call to order

1. ✓ Approval of minutes of meeting of June 21, 1974
1. ✓ Report of Executive Secretary
3. Report of Enforcement Section
4. Report of Geology Section
5. Old Business
6. New Business BUDGET TRIPS
7. Adjourn

IF YOU ARE UNABLE TO ATTEND THIS MEETING, PLEASE NOTIFY THIS OFFICE AS SOON AS POSSIBLE.

TEXAS Rules
to Ballard

NEXT Meeting FRI 9-20
BUFFET HOME 6:30 THUR 19

1974 FOR BUFFET
DP-INK 6:30 PM

TRIPS
JACK-ME PASADENA

SANTA FE

BUDGET

TRIPS Jack-me
Pasadena 9-23-25

Bill - Boise Idaho
10-10-18

Santa Fe 28 or 29
me Aug

OIL AND GAS CONSERVATION COMMISSION
4515 N. 7th Avenue
Phoenix, Arizona 85013

The regularly scheduled meeting for July 19, 1974 was not held because a quorum would not be present.

By _____
Ralph W. Bilby, Chairman



OFFICE OF

Oil and Gas Conservation Commission

STATE OF ARIZONA

4515 NORTH 7TH AVE.
PHOENIX, ARIZONA 85013

PHONE: (602) 271-5161

August 7, 1974

Memo: Commissioners
From: John Bannister

I would remind you that our meeting in August will be held in Flagstaff at the Little America Motel at 10:00 a.m. on August 19, 1974. The University of Northern Arizona will present a short program at 11 a.m.

I will arrange accommodations at Little America for each of us for the evening of August 18th. Unless I hear from you to the contrary, I will order accommodations for you and your wife. Should you or your wife be unable to attend this meeting, please advise us at your earliest convenience. As usual, we will have our Dutch treat dinner and Little America has agreed to set aside a room for that purpose. Drinks can be ordered from 7 p.m. to 7:30, with dinner beginning at 7:30 - price \$6.75 per person.

The Governor's Office has advised us that Dr. Geoffrey E. H. Ballard has been invited to accept appointment to this Commission. I am sure each of us extends a most sincere welcome to Dr. Ballard and I know we will look forward to his joining us in Flagstaff.

As you are aware, the Interstate Oil Compact Commission is meeting in Phoenix December 8, 9 and 10, 1974. The office has been called on to make a few arrangements at this time and I am sure as the time of the meeting approaches our services will be called on more and more by the IOCC staff. We will lend every effort to comply with their wishes and to make the Phoenix meeting a memorable one for the IOCC members.

I attended the meeting of the Rocky Mountain Mineral Law Foundation in San Francisco on July 10 to 12th. This meeting concerned itself with both mining and oil and gas problems. The first day's program was a joint session and was addressed by Mr. E. M. Benson, Jr., Executive Vice President of Atlantic Richfield. He spoke of the urgent need of a national energy

Memo: Commissioners
August 7, 1974
Page Two

pool and, surprising enough, as his company has done in the past, called for a phase-out of the depletion allowance while phasing-in of free market pricing of the petroleum production. This, of course, engendered much comment.

Another most interesting paper presented was by William K. Tell, Jr., Vice President of Texaco, who made a most interesting presentation for the petroleum industry in a rebuttal to many of the criticisms being made against it at this time.

A most interesting paper was presented by David Wynne, attorney of San Francisco, concerning some of the lasting problems of geothermal energies. The Friday and Saturday sessions of the meeting were broken up into oil and gas sections and mining section. Due to the number of papers being given in both sections, many of which I was desirous to hear, I attended both sections as faithfully as possible. It is my feeling that the time spent in San Francisco at this meeting was both worthwhile and beneficial.

I would like to mention that probably the most important piece of business at our meeting in Flagstaff will be the tentative approval of our 1975-76 budget, the main summary sheets of which are enclosed for your perusal.

Confidential: El Paso Natural Gas has indicated a great interest in creating underground storage of natural gas in the Casa Grande area. I have but little information concerning this at present but do know extensive studies are being continued. I will keep you apprised of this as information is available.



OFFICE OF

Oil and Gas Conservation Commission

STATE OF ARIZONA

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PHOENIX, ARIZONA 85013

PHONE: (602) 271-5161

ACTIVITY REPORT

August 7, 1974

Memo from W. E. Allen, Director
Enforcement Section

From various sources I have heard that a fair size lease play is in progress in the Strip Country of Arizona. Estimates of leases taken run as high as one million acres. Apparently this acreage is being taken by various lease brokers. I was told recently by Ed Heylmun, a consulting geologist, that his group is definitely going to drill at least one well in the Strip Country within a year. Mr. Heylmun is a frequent visitor to the office seeking well information in various areas of the State.

It would seem that Morton Bros., independent operators from Casper, Wyoming, are making preparations to drill a well in Navajo County, the Sitgreaves Forest area. Morton Bros. have contacted the Forest Service in regards to making the location and drilling the hole. The Forest Service in turn contacted this office for information regarding the amount of acreage that would be involved and the noise factor to be considered in the drilling of the well.

As of this date we have had no response from Eastern Petroleum Company regarding our letter to them dated June 21, 1974. The Commission had instructed them that their wells in the Navajo Springs area be plugged within 60 days. Registered letters were sent to Mr. Henry Fullop, the principal of Eastern; Jess Edwards, an associate; and the bonding company. Mr. Edwards and the bonding company accepted their letters. Mr. Fullop's letter was returned marked "unclaimed". We have since sent a copy of the letter by registered mail to Eastern's statutory agent in Arizona with a copy by regular mail to Fullop. The statutory agent accepted delivery.

Activity Report
August 7, 1974
Page 2

The week of July 22 was spent in the field, all areas were covered. In general our operations are in pretty good shape. I only noticed one minor violation of our rules and it has since been corrected.

We have been informed that Consolidated Oil & Gas of Denver were selling their interest in the East Boundary Butte Field to Merrion and Bayless of Farmington, New Mexico. The transfer of this property was tentatively set for August 1, 1974. Consolidated presently has two producing wells in the field and one water injection well. Production from these two wells in May was 239 barrels of oil and 6,504 MCF gas. Merrion and Bayless have three wells in this field.

Geothermal Kinetics-Amax, Inc., Pima Farms No. 1 has set 9 5/8" casing at 5361' and at last report the total depth of this geothermal prospect was 5861'.

Duval Corporation is drilling their mineral state test in the SE/SW, Section 9-T19N-R27E, Apache County. At the last report they were drilling below 1350'. The projected total depth is 1850'.

Reed Nix of Nix Drilling Company has not renewed drilling on his geothermal test in Graham County. In a recent conversation with Nix he told me that he was attempting to mortgage some property in order to raise more funds.

We previously reported that California Liquid Gas Corporation have started storing propane in their reservoir located in the SW/NW, Section 2-T2N-R1W. A loading terminal is being constructed on a railway spur some three miles northwest of the storage reservoir and a 7" pipeline has been laid from the reservoir site to the loading terminal. The Company plans on drilling at least two more wells for additional storage.

I believe Mr. Bannister has mentioned in his report that El Paso Natural Gas is studying the feasibility of constructing underground storage for natural gas in the Casa Grande area.

The grapevine informs us that someone is running some seismograph crews out of Gila Bend. We have heard that it was either Shell or Texaco, but again it could be Fugro, Inc., an engineering firm that is making a detailed study of the area for the Army Air Force.



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August 7, 1974

J. N. Conley
Director, Geology Section

PUBLICATIONS

Requests for our publications and copies of well record data were about normal this past month. Most of the requests for our newest publications have apparently resulted from word-of-mouth information as to their availability, as no announcements have been noted in industry trade journals. We will complete and distribute in the near future our new price list and description of currently available and in-preparation publications.

The Pinta Dome-Navajo Springs-East Navajo Springs pool map will be printed this month. Unforeseen extra work, drafting, reproduction, and assembly problems have delayed preparation of copy-ready material for our revised and expanded Sources of Information Directory and two special publications.

INVESTIGATIVE PROJECTS

Structure Mapping, Northern Arizona. Dr. George Davis, Geosciences Department, University of Arizona, reports favorable progress for the surface structure mapping project in Northern Arizona, which is being funded by a grant to the Office of Arid Lands Studies by NASA. Because of the large number of folds noted on the ERTS imagery needing to be checked on the ground, the project completion date has been extended to September 30. Davis plans on visiting our office soon to see what input we may have for the surface phase of the overall project.

Holbrook Area, and Regional Structure Map of Northern Arizona. As these are both long-range projects, I will no longer report on them monthly.

Water Inventory Project, Navajo Reservation. I have previously reported that we have furnished Morrison-Maierle, Inc., some well and other data in northeastern Arizona. This firm is making a complete inventory of the water resources of the reservation under a Bureau of Indian Affairs contract. The last inventory was made in 1966 by the U. S. Geological Survey in cooperation with the Bureau of Indian Affairs (BIA) and the Navajo Tribe. The results were published in 1969 by the Survey (Professional Paper 521-A).

Activity Report
August 7, 1974
Page 2

The surface mapping phase of the current project will be completed soon. A representative of the BIA has assured me that we will eventually get copies of the maps. Integration of the information revealed by these maps, those of Professional Paper 521-A, and those to be made by Dr. George Davis will produce an excellent map showing surface structural features. This map will be very useful to us in our subsurface investigations.

Photogeologic Map - Papago Indian Reservation. The firm of Amuedo & Ivey, Inc., has completed a photogeologic map of the Papago Indian Reservation for the Bureau of Indian Affairs. Arthur Woll, BIA, Washington, D. C., informs me that this is an excellent map and that he will send us a copy.

EXPLORATION & LEASING

Holbrook area. Bill Maddox, a lease broker in Denver, Colorado, has been filing oil and gas leases on Arizona State Lands on the Nine Mile anticline in T18N-R24E-25 in Apache County for an unknown client.

Whitlock Valley. The Arizona State Land Department reports that it still plans to put up for competitive bidding approximately 23,000 acres of state lands for geothermal leasing. This almost solid block of acreage is in T9S-R30E near the southeast corner of Graham County.

Relative to geothermal resources, A. K. Doss, State Land Department, reports that several major company representatives told him at a recent geothermal meeting attended by 19 state land commissions in Austin, Texas, they had considerable interest in Arizona's potential for energy from this resource.

GENERAL

Computer Graphics Conference. I recently attended this conference at Arizona State University as the representative of this Commission. The purpose was to provide an up-to-date description and demonstration of a number of computer graphics systems and thus provide a state-of-the-art up-date for attendees. Several of the systems demonstrated are currently being evaluated by the ARIS Computer Graphics Committee. Our recommendation will be requested regarding the system to be used in the ARIS program.

My recommendation will be for the Interactive Graphic Systems and Mapping Application Procedure on the AGS/700 available from Applicon, Inc. The mapping procedures offered by this company are very accurate, versatile, and permit fast and economical up-dating of maps. In the preparation of maps a draftsman's output is increased about eight times. Texaco Inc. is currently installing this system in its Midland, Texas, division office.

If some State agency acquires this system, possibly an arrangement could be made for our Commission to use it for the production of certain kinds of maps. Arizona State University's Geography Department has a much less sophisticated computer system for the production of maps. It is adequate, however, for the production of some types of maps we prepare. I believe that an arrangement can be made with the Geology Department of Arizona State University for the joint authorship and production of some maps in the future.

Activity Report
August 7, 1974
Page 3

National Referral Center. This center assists those who have questions in science and technology by referring them to organizations that can answer those questions. It is operated by the Science and Technology Division, Library of Congress. The data base for this free service is a subject-indexed inventory that contains some 9,000 organizations (called "information sources"). The Center directs those who have a question concerning a particular subject to organizations with specialized knowledge of that subject. As this Commission has specialized knowledge concerning energy and other subsurface resources in Arizona, I have submitted an application to the Center for inclusion in its data bank.

Oil and Gas Field Data Bank and Map Project of North America. The American Association of Petroleum Geologists is sponsoring this project. The data for Arizona's fields has been gathered by a Chevron Oil Company geologist and sent to Norman, Oklahoma, for incorporation with the data bank. I have requested that when printouts are available we be furnished copies for checking and making possible additions.

Sample Library. In my report of July 10 I mentioned that I was trying to "find a home" for our dead-storage samples and cores which we do not need to preserve in our library. The Chief of the Core Laboratory Project, U. S. Geological Survey, has informed me the Survey may be interested in acquiring the 38 tons of Supai salt cores we have stored in an Arizona State University facility.

Visitors. We have had only a few visitors this past month seeking information. One of them was a representative of Fugro, Inc., a firm of consulting engineers and geologists, which in the past has purchased some of our maps and copies of logs and other material in southwestern Arizona. The firm now has a contract with the U. S. Defense Department to search for potential missile sites.

JNC:os

JNC
J.N.C.

MONTHLY FINANCIAL REPORT

1 RECEIPTS MONTH OF	2 CLASSIFICATION	3 RECEIPTS	4 APPROPRIATED RECEIPTS	5 UNAPPROPRIATED RECEIPTS	6 TOTAL ALL RECEIPTS YEAR TO DATE
July 1974	1 Permits to Drill				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
-0-	TOTAL CURRENT MONTH RECEIPTS				XXXXXX
XXXXXX	TRANSFERS IN				
-0-	BALANCES BROUGHT FORWARD			3,276 83	XXXXXX
	TOTALS - MONTH AND YEAR TO DATE			3,276 83	3,276 83
7 CLAIMS PAID MONTH OF	8 EXPENDITURES FUND TITLES	9 TOTAL AMOUNT AVAILABLE YEAR TO DATE	10 CLAIMS PAID YEAR TO DATE	11 OUTSTANDING ENCUMBRANCES	12 UNENCUMBERED BALANCE
July 1974	1 Personal Services	31,348 00	6,388 31		24,959 69
6,388 31	2 Emp. Related Exp.	4,090 00	800 43		3,289 57
800 43	3 Professional Serv	1,109 00			1,109 00
	4 Travel-State	2,475 00		1,924 02	550 98
586 81	5 Travel-Out of State	3,200 00	586 81		2,613 19
6,223 13	6 Other Operating Exp.	25,305 50	6,223 13	17,431 51	1,450 86
	7 Capital Outlay-Equip.	4,100 00		3,499 86	600 14
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
13,998 68	TOTALS	71,627 50	13,998 68	23,055 39	34,573 43

1	2	3	4
CLAIMS PAID YEAR TO DATE	OBJECT CODE NO.	DISTRIBUTION OF EXPENDITURES CLASSIFICATION	CLAIMS PAID MONTH OF <i>July 1974</i>
	7111	1 Per Diem: Commission Members	1
	7112	2 Salaries: Employees	2 6,388 31
	7151	3 Industrial Insurance	3
	7153	4 F.I.C.A.	4 373 73
	7155	5 Retirement	5 366 70
	7156	6 Health Insurance	6 60 00
	7159	7 Personnel Commission	7
		8	8
	7215	9 Professional Services: Engineer	9
	7219	10 Professional Services: Other	10
		11	11
	7221	12 Travel - State: Mileage	12
	7222	13 Subsistence	13
	7223	14 Public Transp.	14
	7224	15 Vehicle Expense	15
	7225	16 Reg. Fees; Parking; etc.	16
		17	17
	7232	18 Travel - Out of State: Subsistence	18 215 00
	7233	19 Public Transp.	19 246 61
	7234	20 Airport Parking	20
	7235	21 Reg. Fees; Telephone; etc.	21 125 20
		22	22
	7251	23 Occupancy: Office Rent	23 5,548 38
	7261	24 Warehouse Rent	24
	7263	25 Warehouse Mtn. & Repair	25
	7272	26 Mtn. & Repairs: Furn. & Equip.	26
	7280	27 Office Supplies	27 67 39
	7300	28 Field Supplies; Film; Am.Strat; P.I., etc.	28 97 21
	7331	29 Printing: Reports; Large Maps; etc.	29
	7332	30 Legal Advertisement	30
	7333	31 Court Reporter	31
	7334	32 Postage	32
	7335	33 Telephone	33 198 35
	7337	34 Drayage; Express; etc.	34 61 80
	7349	35 Rental, Misc.	35
	7360	36 Dues & Subscriptions	36
		37	37
	7431	38 Capital Outlay: Office Equip; Ipr; etc.	38
	7434	39 Spec. Equip. (Geol.)	39
	7436	40 Automobile	40
		41	41
	7913	42 Revolving Fund	42 250 00
		43	43
		44	44
		45	45
		46	46
		47	47
		48	48
		49	49
		50	50
		51	51
		52	52
		53	53
		54	54
		55	55
		TOTAL	



OFFICE OF

Oil and Gas Conservation Commission

STATE OF ARIZONA
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July 10, 1974

THE REGULARLY SCHEDULED MEETING FOR
JULY 19, 1974 WILL NOT BE HELD BECAUSE
A QUORUM WILL NOT BE PRESENT.

OIL AND GAS CONSERVATION COMMISSION
4515 N. 7th Avenue
Phoenix, Arizona 85013

Minutes of Meeting
June 21, 1974

Present:

Mr. Ralph W. Bilby, Chairman
Mr. W. Roger Hafford,
Vice Chairman
Mr. Robert A. Bledsoe, Member

Absent:

Mr. F. Keith Benton, Member

The regular Commission meeting for the month of June, 1974 was called to order by Chairman Ralph Bilby at 10:00 a.m.

Minutes of meeting of April 19, 1974 were approved as written.

Reports of Executive Secretary, Enforcement Section and Geology Section were accepted.

Executive Secretary advised that the Commission anticipates reverting approximately \$7,000 to the General Fund, in keeping with the Governor's economy request that all agencies attempt to cut costs by at least 5% for the fiscal year 1973-74.

Executive Secretary advised that the Commission budget request for fiscal year 1974-75 was allowed as requested, plus adjustments for increased personal services and related costs.

Director of Geology Section advised that the \$14,000 technical assistance grant from the Four Corners Regional Commission for geophysical and geological exploration to be conducted by the University of Arizona under the direction of the Commission has now been concluded and the expanded report of southeastern Arizona, based on the report submitted by Drs. Aiken and Sumner of the University of Arizona, is now being completed by the printer.

Commission authorized out of state travel for the Executive Secretary to attend the 20th Annual Rocky Mountain Mineral Law Institute to be held in San Francisco, California July 11 to 13, 1974.

It was directed that copies of sheets from the guest register be supplied the members of the Commission with the regular monthly mailing.

Director of the Enforcement Section advised that Eastern

Minutes of Meeting
June 21, 1974
Page 2

Petroleum Company has drilled 85 holes in the Navajo Springs area of northern Arizona for helium exploration. Some 30 of the holes are still open, although only 10 holes are capable of production or have produced commercially. Repeated efforts to have the holes plugged and abandoned by Eastern Petroleum Company have failed. After discussion, Executive Secretary was instructed to notify Eastern Petroleum Company that the wells be plugged within sixty days from this date or show cause to the Commission why they have not done so, with a copy of the notification sent to the bonding company.

Since a quorum will not be present during the month of July due to vacation schedules, the next regular Commission meeting will be held at Little America in Flagstaff, Arizona on August 19, 1974 at 10:00 a.m.

Meeting adjourned at 11:30 a.m.

APPROVED

Ralph W. Bilby, Chairman

Also present at meeting:

Mr. Bill King
The Arizona Republic

OIL AND GAS CONSERVATION COMMISSION
4515 N. 7th Avenue
Phoenix, Arizona 85013

The regularly scheduled meeting for May 17, 1974 was not held
because a quorum would not be present.

By _____
Ralph W. Bilby, Chairman



OFFICE OF

Oil and Gas Conservation Commission

STATE OF ARIZONA

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July 9, 1974

Memo: Commissioners
From: John Bannister

I would invite your attention to the fact that the Commission will not meet in July due to conflicts in vacation schedules, however the Commission will meet in August on MONDAY, the 19th, at the Little America Motel in Flagstaff. I will make initial reservations for all out of town Commissioners and request that you advise me at your earliest convenience should you not be able to attend this Monday meeting.

Mr. Conley is in the process of securing a speaker from Northern Arizona University and we will keep you advised as our plans progress. As usual, we will have a dutch treat dinner and I will initially plan to set this up at Little America, also.

On June 28 and 29 the State held a meeting in Carefree, Arizona concerning Arizona's energy future and its impact on the environmental and growth patterns of the State. This meeting was sponsored by the Governor and was well attended. In addition to Governor Williams, Senator Paul Fannin and Mr. Hugh Downs were some of the principal speakers.

The meeting later split into various committees concerning themselves with specific problems. I was assigned to the committee on natural resources. Our committee felt that Arizona could become self sufficient in energy but this self sufficiency would depend on the development of such things as geothermal and solar energies. I pointed out that the development of these forms of energy were somewhere down the road and that Arizona's concern, as well as that of the Nation, should initially be directed toward satisfying our short term demands and only the development of oil and gas sources could accomplish this.

On June 30 through July 3 I attended the IOCC meeting in Vail, Colorado. This was a well attended meeting and again the

Memo: Commissioners
7-9-74
Page 2

theme of the Nation's self sufficiency in energy was taken up. The IOCC reflected the stand I took in Carefree, i.e. that the most immediate concern to this Nation is short term demand which can only be met by oil and natural gas sources. The availability of coal and the possibility of converting this into natural gas was considered at length.

You are aware I am the Chairman of the Environmental Protection Committee of the IOCC. I had arranged a speaker from Exxon, who urged that the states in no way abandon their environmental controls to the Federal Government, but that all state agencies concerned with environmental protection keep their rules updated at all times in view of current technology and that the aim of the rules be reasonable protection, but in such manner as not to make prohibitive and unreasonable demands on industry.

Also, I had previously appointed a sub-committee to consider and report upon the most pressing environmental problems of the various member states. We identified some eighteen problems and discussed five of these problems in depth at this meeting. We plan to discuss the remainder at later meetings.

I am pleased to report that the Federal Department of Justice monitored my committee and reported they felt this was the most important meeting conducted by the IOCC in the past ten years.

The 1974-75 budget for this Commission is now in force. You will recall that I reported at our June meeting that we had received all monies requested. We are starting out the year in excellent shape. I do anticipate that the major part of our budget will be expended. For the 1973-74 fiscal year we are able to revert approximately \$7,150 to the General Fund. This represents slightly less than 5½% of our budget. It is my feeling that the personnel of this Commission should be congratulated for their economical efforts to comply with the Governor's request to reduce spending by at least 5%. These problems have been discussed with the Commission before.

There are indications that we will have increased drilling activity this summer. The indications are coming from several sources and will be discussed in depth by Bill Allen and Jack Conley.



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ACTIVITY REPORT

July 10, 1974

Memo from W. E. Allen, Director
Enforcement Section

Once again it is the Independents that are leading the way in exploratory drilling and new discoveries. In 1973, the Independents drilled 1,686 (76.4%) of the 2,208 new field discoveries, new pay openers and extension wells. Their successes were up 8.9% from 1972. The Majors dropped 3.6% to a total of 21.9% for new discoveries. The drilling funds accounted for the remainder 1.7%. Let us hope for an invasion of independent operators into Arizona very shortly.

At a recent American Association of Petroleum Geologists convention, the president of the Association in his speech remarked that "it bordered on a major disgrace that our level of domestic exploration is only at about what it was 30 years ago." He also stated that the industry is now equipped with new scientific knowledge and technical instruments for finding oil and gas and the problem now is to coordinate the new techniques to take full advantage of them. "We have a substantial and challenging domestic petroleum potential in this country in deeper parts of onshore basins," Mr. Wilson stated. Since Wilson is a consulting geologists, maybe in time he will point some of his clients in the direction of Arizona's deeper basins.

Activity Report
July 10, 1974
Page 2

Duval Corporation has not as yet started their stratigraphic drilling program. Evidently they are experiencing some difficulties in finalizing some of their leasing arrangements.

Geothermal Kinetics-Amax Exploration Pima Farms No. 1 geothermal prospect in Pinal County is drilling below 3340'. They have set and cemented 13 3/8" surface casing.

The Nix Drilling Company State No. 1 geothermal well in Graham County is still shut down due to mechanical difficulties.

Permit No. 621 issued to American Fuels for the drilling of a Pennsylvanian test at the SW/SW Section 10-T40N-R29E, Apache County has expired. They were notified of the expiration date, however did not request an extension.

California Liquid Gas Corporation has started storing propane in their storage reservoir located in the SW/NW Sec 2-T2N-R1W, Maricopa County. This is just north and east of Luke Field. The Company has also started erecting the loading facilities at a railroad spur some 4 miles northwest of the storage project. It is expected that they will start laying the pipeline for transporting the propane in the very near future. Presently all gas brought in for storage is hauled by trucks.

We are in the process of completing a production summary by years on all wells that have produced gas, oil or helium within the State. This summary covers the period from 1954 (year of first recorded production) through 1973.

Eastern Petroleum has been notified of the action taken by the Commission at the June 21 meeting pertaining to the plugging of their nonproducing wells. The letter advising them of this action was mailed June 21, 1974. As of this date we have had no response from Eastern.



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ACTIVITY REPORT

July 10, 1974

J. N. Conley
Director, Geology Section

PUBLICATIONS

The following publications were printed this past month:

Report of Investigation 3 -- A geophysical and geological investigation of potentially favorable areas for petroleum exploration in southeastern Arizona.

Special Publication 1 -- Review of the Development of Oil and Gas Resources of Northern Arizona.

County Well Location Maps: Graham-Greenlee
Pima-Santa Cruz

Distribution to State and Federal agencies, libraries, and schools has been made. These publications, with a note of their availability and price, have also been sent to:

The Oil & Gas Journal
World Oil
Petroleum Information

These industry news media sometimes publicize free of charge the availability of our publications.

A new price list of our publications will be prepared and mailed to persons and companies that have purchased some of our previous publications.

* * *

Currently we are preparing two special publications for printing later this summer. Our Sources of Information booklet is being revised and expanded. This little publication has been very well received by the oil industry and, surprisingly, by several State and Federal agencies.

Activity Report
July 10, 1974
Page Two

INVESTIGATIVE PROJECTS

I. Subsurface Structures

The field check of anomalous structural features mapped on ERTS imagery of the northeast part of the State should be completed sometime this month. Dr. George Davis, University of Arizona, is the principal investigator of this project, which is being funded by a grant from NASA to the Office of Arid Lands Studies (OALS), University of Arizona. We requested that this project be undertaken by OALS.

Completion of the first phase of this project is scheduled sometime after August. No grant monies are currently available for the second and third phases of the project. However, we anticipate that results of the first phase will be useful to us in some of our in-house investigations.

II. Holbrook Area, Apache and Navajo Counties

This is an in-house detailed investigation of the subsurface structure and stratigraphy of the area. It is a long-range project, requiring the preparation of numerous maps, such as structure, isopachous, paleogeographic, oil and gas shows; cross sections, and allied material. The objective is to define or semi-define those areas appearing to have the best potential for petroleum accumulations.

III. Regional Structure Map -- Northern Arizona

The Permian Coconino Sandstone offers the most control for a subsurface structure map in Northern Arizona. Numerous wells have penetrated this sandstone, as it is a good and widespread aquifer. Prior to initiation of detailed subsurface studies of older and potentially oil-bearing reservoir rocks north and northwest of the Holbrook area, we are preparing a structure contour map on the top of this sandstone. This project is progressing slowly.

For both Projects, to the degree possible, we will utilize available geophysical and surface geology in the preparation of subsurface structural interpretations.

GENERAL

Sample Library. Several years ago we obtained a large volume of drill-bit cuttings of wells drilled in southeastern Utah, southwestern Colorado, and northwestern New Mexico. Since then we have contributed some sets of samples to repositories maintained by Shell Oil Company and American Stratigraphic Company, and quite a few sets to the geology department of a small college in Ohio. All of these out-of-state samples are stored in a large Quonset hut owned by the State Highway Department. As this building is on land acquired for the Papago Freeway right-of-way, which will not be built, we will eventually lose this storage space.

We also have approximately 38 tons of cores acquired from Arkla Exploration Company. This company did extensive coring in its exploration program for potash in the Holbrook area. These cores are stored in the basement of the old stadium at Arizona State University.

Activity Report
July 10, 1974
Page Three

A note in an American Association of Petroleum Geologists' newsletter stated that the United States Geological Survey is actively pursuing a plan to establish and maintain repositories for cores and samples in key locations around the United States. I am currently attempting to get more information on this matter. Perhaps we can contribute our dead-storage samples and cores to one of these repositories.

Mineral Exploration. As reported previously, Exxon Company, U.S.A., is exploring for uranium on lands owned by Arizona and New Mexico Land and Cattle Company in northeastern Arizona. This company also paid the Navajo Tribe \$6 million for a uranium exploration option on Tribal lands in northwestern New Mexico.

Mr. Allen has reported on Duval Corporation's proposed potash exploration program in the Holbrook area. Two Duval geologists, incidentally, recently obtained some representative samples of some of the Arkla cores stored at Arizona State University. The exploratory holes to be drilled by Duval will furnish us some more subsurface control.

Duval's current interest in again exploring for potash focuses attention on the importance of preserving cores and records of exploratory programs. Arkla would have destroyed their cores and records stored in Holbrook if we had not made arrangements to acquire them. Duval copied practically all of the Arkla core-hole records we have in our files.

* * *

Warren Carr, in turn, has copied most of our records of Duval's previous potash exploratory program in the Holbrook area. Carr has not divulged the name of his client. My guess is that it is Saint Joe American Exploration Corporation.

Petroleum Exploration. As reported by Mr. Allen, Webb Resources, Inc., has probably consummated a deal to explore for petroleum on lands owned by Arizona and New Mexico Land and Cattle Company. As reported previously, a Webb Resource geologist visited our office this past January to get our ideas on the petroleum potentialities of the Holbrook area. On the subsurface geologic maps he showed me there were seven local prospects which he believed might warrant test holes. He mentioned that his company was actively engaged in exploration in frontier areas. Last year, according to Petroleum Information, Webb Resources drilled 72 wildcat wells in the Rocky Mountain province, most of which were in remote and unexplored portions of northern Montana.

Proposal for a State Land Use Information System. The Arizona Environmental Planning Commission and Office of Environmental Planning are seeking the aid of 22 State agencies (including the three principal universities and this Commission) in the immediate implementation of a program with the two following objectives:

1. To complete a general annotated bibliography for an inventory of land, natural resources, and social, economic, and environmental information related.
2. To agree upon common state procedures and a common information format to assure compatibility of information in a future on-going inventory of land, natural resources, social, economic, and environmental information.

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Our participation would be in furnishing information pertaining to subsurface resources, such as petroleum, helium, salt, and earth heat.

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