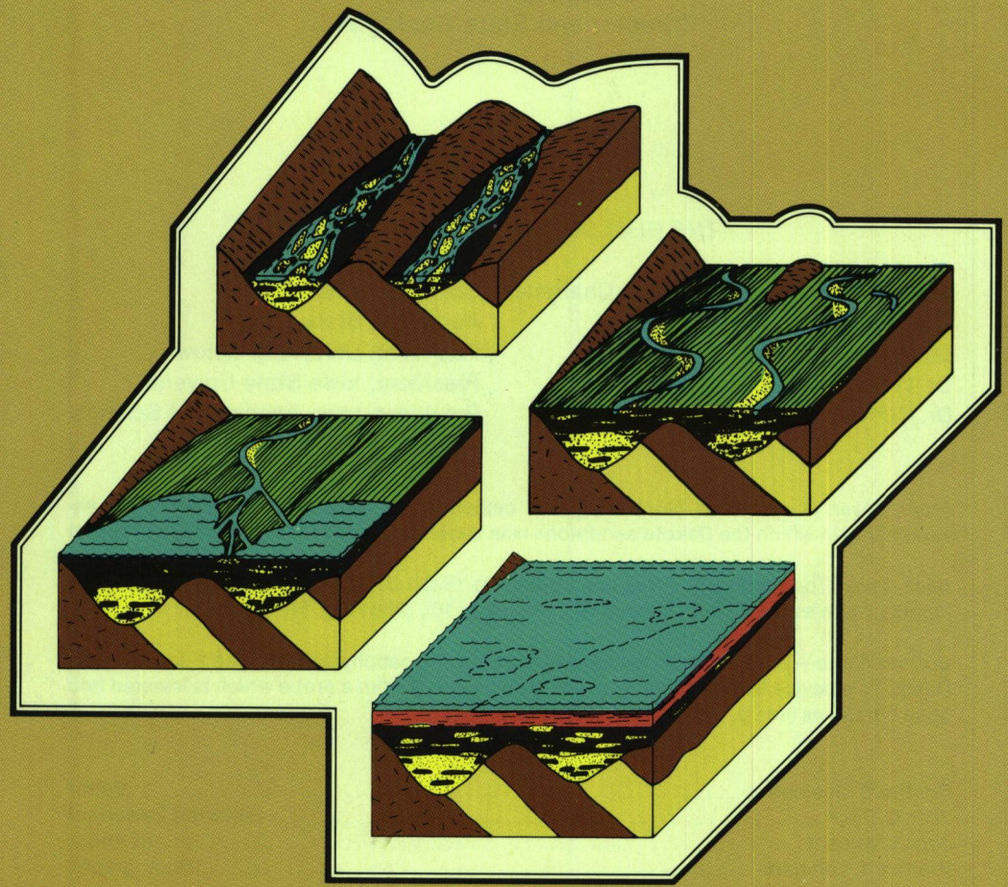
IOWA GEOLOGICAL SURVEY JANUARY 1980

# IOWA Geology

NUMBER 5



IOWA GEOLOGY

JANUARY 1980 NUMBER 5

IOWA GEOLOGICAL SURVEY

123 North Capitol St.
Iowa City, Iowa 52242

Dr. Stanley C. Grant
Director and State Geologist



*Front Cover:* A series of block diagrams depicting the sequence of sedimentary environments in which the Dakota sandstone was deposited. (Drawing by Charmaine Shreve)

*Back Cover: Top Photo*—The IGS test drilling rig "Baby Blue", and the USGS geophysical logging truck at the Camp Quest core site (see p. 10). (Photo by Bill Bunker)

*Bottom Photo*—Bill Bunker at the control panel of the geophysical logging truck at Camp Quest. This device is used to control and record signals from a probe which is lowered into open boreholes (see p. 10). (Photo by Greg Ludvigson)

Charles J. Huelsbeck ..... Editor
Jean C. Prior ..... Editorial Consultant
John L. Knecht ..... Art Editor
Patricia J. Lohmann ..... Photography

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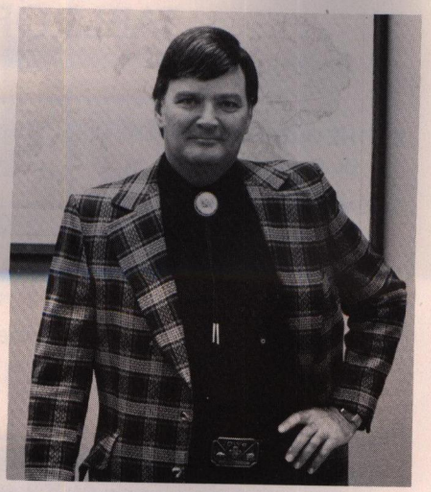


As the Iowa Geological Survey moves into the decade of the 1980's, we reflect on the achievements of the 1970's and examine the goals and challenges ahead. This small agency grew rapidly in the 1970's, as remote sensing, environmental geology, energy resources, and data systems programs were funded to fill state needs and/or federal requirements.

New agencies, such as the Iowa Department of Environmental Quality and older ones, such as the Department of Soil Conservation, the Natural Resources Council, and the Conservation Commission, rely on the Iowa Geological Survey to provide the geotechnical information needed in their regulatory functions. Additional technical advisory services are provided on request to many other state government agencies such as the Commerce Commission, Iowa Development Commission, Department of Transportation, Department of Agriculture, the State Universities, and others. We also provide assistance on request to the Governor's Office, the Attorney General, and the Legislature. Technical service assistance to local governments, citizens, and businesses have also increased by several orders of magnitude during the past 10 years and are expected to continue so.

The second half of the 1970's saw a stabilizing of growth in staff but a continued growth in responsibility to provide technical and scientific data to Iowans. Internal reorganization of the Survey for efficient operations and span of control was essential. Once this was achieved, we were able to shift staff expertise where it could be most valuable while still not severely limiting the scope of personnel responsibilities.

Space needs have been perpetual problems. The remodeling of the old Dental School in 1974-75 for the University of Iowa Geology Department and IGS helped somewhat. In 1979 we opened a new rock library, laboratory, and storage facility at Oakdale. This aided greatly.

Special projects completed or established as on-going state needs during the 1970's include the research capabilities in remote sensing, coal and mineral resources, water-resources data system, engineering geology, soils geology, environmental geology, and comprehensive regional geology. Services established and continuing include project support for other agencies, water resources forecasting and problem solving, environmental technical services, educational services, illustrating, data processing, and remote sensing applications.

Cooperation between IGS and federal agencies has reached new highs. Work with USGS, NASA, NRC, DOE, Soil Conservation, C of E, and EPA has been significant. The last few years of the past decade have seen the geology of Iowa largely rewritten. From the youngest soils and rocks to the oldest, our state is being much more accurately portrayed. Classical Pleistocene geology is being totally rewritten by Dr. George Hallberg, his staff and associates. Bedrock geology is being reworked and/or newly discovered by Bill Bunker, Greg Ludvigson, and others. The 1984 geologic map of Iowa will be very different from the one produced in 1969.



*New IGS facility on the Oakdale Campus, University of Iowa.*

Ray Anderson, his staff, and members of the University geology faculty have made some significant beginnings in geophysical studies in Iowa. Earthquake research has also started under the supervision of Associate State Geologist Orville Van Eck. Numerous other projects of significance have been completed or were begun in the 1970's.

Looking to the 1980's, we see continued major programs and research. Water resources evaluations of most of the State should be completed, new coal reserves will be identified, oil will probably be discovered in Iowa, significant metallic mineral deposits will be identified, and major progress will be made at solving environmental problems, especially soil erosion and hazardous-waste permanent storage. The geology of Iowa will be much better understood, and this will help greatly in management of our Iowa resources.

Potential areas of new responsibility also include management and technical service functions for the mineral extraction industry under contract with the Mines and Minerals Division of the Department of Soil Conservation. Added will be data services for agricultural studies and soil erosion work as well as full operation of a water and mineral resources data system accessible to everyone. Variations of current projects are also expected.

By law the office of the State Geologist is assigned several added responsibilities. These include Administrator of Oil and Gas, Member of the Iowa Energy Policy Council, Member of the Executive Committee of the Department of Environmental Quality, and Member of the Land Rehabilitation Advisory Board. Assignments or appointments made to the State Geologist by Governor Ray include liaison to the Nuclear Regulatory Commission, liaison to the Governor's Science Advisory Council, and state representative to the Governor's Council on Science and Technology. Some of these responsibilities require considerable staff participation and effort. Such activities broaden the base of expertise for the IGS staff and provide an opportunity to have geotechnical input to natural resources agencies.

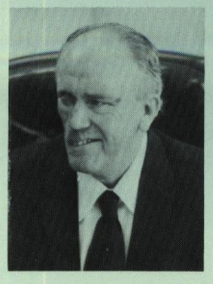
The 1970's have been good years for IGS. We reflect with pride at our accomplishments and services to the citizens of Iowa, and we look ahead with enthusiasm for challenging work in the decade of the 1980's.

Stanley C. Grant

*Dr. Stanley C. Grant*
*Director and State Geologist*

# SEISMICITY IN IOWA

**By Orville J Van Eck**



*Seismicity* is defined as *the phenomenon of Earth movements* and pertains to earthquakes or earth vibrations, including those that are artificially induced. With that definition it is not apparent why anyone living in an area that is so stable in many respects should be concerned about earth vibrations. Nevertheless, the Iowa Geological Survey, supported by a contract with the U.S. Nuclear Regulatory Commission, has begun a study of the seismicity of southwest Iowa.

Even though most of us living in Iowa, or in the Midwest for that matter, have never felt an earthquake, the region is not immune from earthquakes. On the morning of December 16, 1811 in the area of New Madrid, Missouri, there occurred an earthquake so severe that it awakened people in cities as distant as Pittsburgh, Pennsylvania and Norfolk, Virginia. This was the first in a series of strong shocks in the New Madrid area to continue through March, 1812. During that period there were two other principal shocks, one on January 23, 1812 and the other on February 7, 1812. These shocks are considered to be the most severe to have ever occurred in the United States. The affected areas of the three largest earthquakes were widespread, extending south to the Gulf Coast, southeast to the Atlantic Coast, and northeast to Quebec, Canada. The western boundary cannot be established, owing to lack of population at the time.

Fortunately, the loss of life was relatively small because the Midwest was sparsely populated. The devastation of the land, however, was enormous. Reelfoot Lake, in the northwest corner of Tennessee was formed. The heavy damage inflicted on the land led Congress to pass, in 1815, the first disaster-relief act providing owners of ravaged land with equal amounts of land in unaffected regions. All this illustrates that the so-called "stable Midwest" is really not so stable after all. But the real purpose of the Iowa seismicity study is not to record such monstrous shakes; rather, it is to monitor the small, seldom noticed tremors that will provide clues to the deep structures of the earth and possibly predict the potential for larger earthquakes.

About 1.2 billion years ago, a major rift, or spreading apart, of the earth's crust began in the area that is now Lake Superior and extended down across Minnesota, Iowa, the southeast corner of Nebraska, eastern Kansas and possibly into Oklahoma. As the spreading progressed, molten igneous rock was extruded from great depths and intruded upward into the giant fracture that was developing. The results of some of this activity are visible in northern Minnesota. Farther south in Iowa, because of the thick cover of younger rock material, these more dense and more intensely magnetic rocks can be detected only by precise geophysical measurement or by deep drilling.

The geophysical measurements, which include precise determinations of gravity and magnetics, indicate that the ancient rift zone (now called the Keweenawan mafic belt), which is about 30 miles wide, enters north-central Iowa in the Worth County area and in a long arc passes west of Des Moines and exits directly south of Council Bluffs in southwest Iowa. Careful analyses of the geophysical measurements show that the rift zone is bounded on each flank by near-vertical faults with displacements of 18,000 to 20,000 feet. There is evidence that there was some movement on these faults as recently as Pennsylvanian time, about 300 million years ago.

The real question is, has there been movement during historical time or perhaps at present? To determine this, the Iowa Geological Survey, in cooperation with the Geological Surveys of Kansas, Nebraska, and Oklahoma, is establishing a network of very sensitive instruments, called seismometers, to detect any minor tremors or microearthquakes.

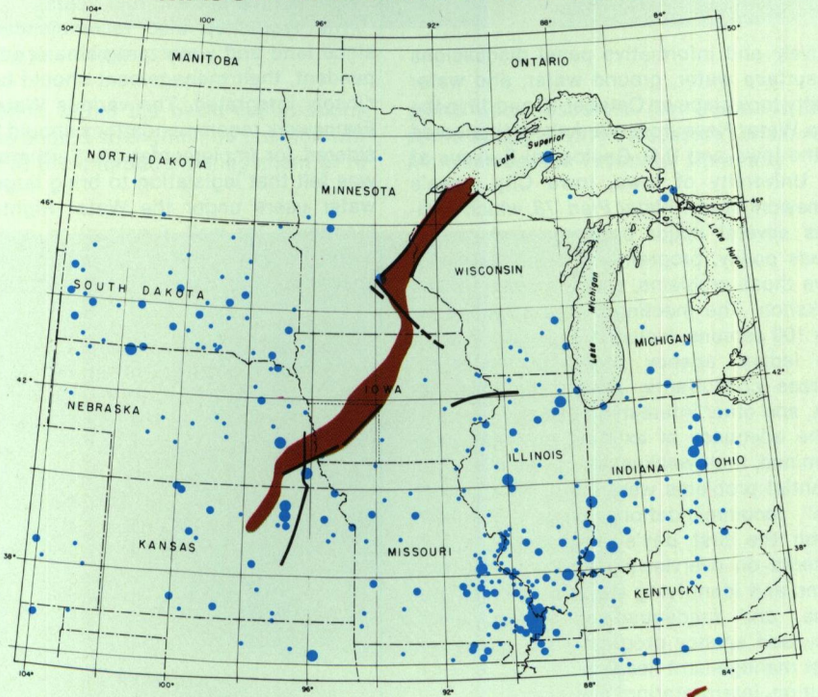
The Iowa network will have seismometers and related equipment located in Adams, Fremont, Harrison, Pottawattamie, and Shelby Counties in southwestern Iowa. The signals from the seismometers will be transmitted to the Geological Survey in Iowa City via telephone line, where they will be recorded for detailed analyses.

Little is known about the sources and causes of earthquakes in the Midwest and eastern United States. As a result, designers of nuclear power plants are required to design the facilities to withstand the shock that would be generated by an earthquake similar to the largest quake known to have occurred in that region. This can lead to costly over-design.

With information gained from this program, we expect to be better able to advise the designers of nuclear generating plants as to the potential for an earthquake in the Midwest and what the intensity of the probable earthquake might be. This information will also be useful to the designers of any large structures, including dams or tall buildings, that can be affected by movement of the earth.

There have not been many earthquakes located in Iowa during historic time, but there have been rather numerous events in neighboring states. We expect that when the Iowa seismic array is fully operational, we shall find that there are events that otherwise would have gone undetected. We also expect that these studies will provide a great deal of new information about the geology of Iowa that may lead to discovery of new mineral resources. *(Mr. Van Eck is Associate State Geologist.)*

## TECTONIC ELEMENTS AND MAJOR REGIONAL EPICENTERS




**Modified Mercalli Intensities***

- I — IV
- V — VI
- VII — XII

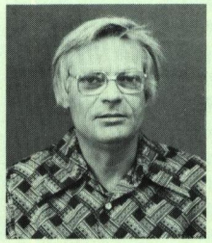
**Keweenawan Mafic Belt**

**Faults**

*Epicenter Information from Dockal, J., 1970.

# IOWA WATER RESOURCES WORKSHOP

**By Donivan L. Gordon and Charles J. Huelsbeck**



*Donivan L. Gordon*

*Charles J. Huelsbeck*

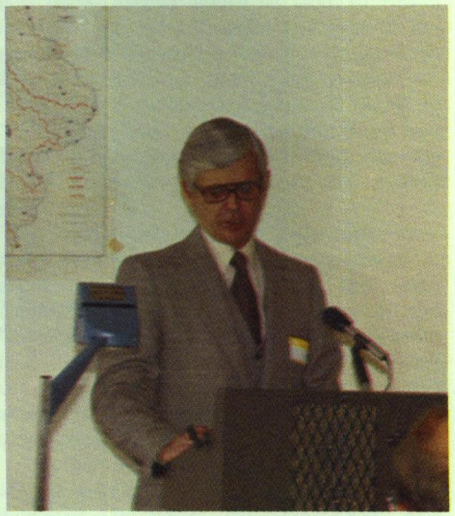
Lively and informative panel discussions on surface water, ground water, and water quality took place on October 18 and 19 in the Iowa Water Resources Workshop sponsored by the Iowa and U.S. Geological Surveys at the University of Iowa, Iowa City. Iowa's framework study, *Water Plan '78,* which identifies several major problems and recommends policy, programs, and legislation to solve those problems, was the basis for the workshop. The meetings were attended by over 100 persons, including legislators, state and federal agency personnel, water resources consultants, private water managers, and other interested parties.

The adequacy of existing programs was examined, their weaknesses pinpointed, and potential problems were cited. "Framework plan" recommendations were highlighted during the first day's discussions, which centered on overviewing existing data programs and identifying major problems, concerns, and inadequacies. The panelists discussed agency programs and goals and water management needs related to data acquisition, interpretation, and use.

At the evening banquet on October 18, Dr. Stanley C. Grant, Director of the Iowa Geological Survey, introduced the guest of honor, State Senator Forrest V. Schwengels (Fairfield) who reminded the group that *Water Plan '78* would be the key reference in future planning, research, legislation, and water management in Iowa. Other legislative participants in the workshop were State Senators Arthur L. Gratias, Nora Springs; Dale L. Tieden, Elkader, and State Representatives Douglas R. Smalley, Des Moines; Sonja Larsen, Ottumwa; Jean Lloyd-Jones, Iowa City; Lester D. Menke, Calumet, and Semor C. Tofte, Decorah. The legislators serve on the Natural Resources Standing Committees.

Among the key needs cited during the two days were improvement of interagency communications within the current state agency framework, co-ordination between interagency programs, emphasis on public education and public participation in water issues, data collection and availability of data concerning water use, stream (low flow) and lake gauging, ground water resources evaluation, potential surface water storage sites, and topographic mapping (at 1:100,000 and 1: 50,000 scales and completion of 7.5′ quadrangles of the state in four years).

The Workshop also recommended that, since land and water programs are interdependent, their management should be more closely integrated. The various Water Plan Framework recommendations should be considered for implementation. Furthermore, it was felt that legislation to bring large scale water users under the Water Rights Law, standards for well construction and abandonment, and a system for licensing drillers should be considered. Finally, in addition to cooperation within the basin commissions, the state should strengthen its position with respect to the interstate management of regional water resources. *(Mr. Gordon is Chief of the Survey's Water Resources Division and Mr. Huelsbeck is Technical Librarian.)*

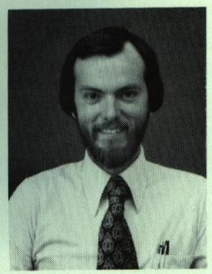


*U.S.G.S. District Chief Donald Leifeste welcomes workshop participants.*

*Workshop panel in session.*

*Dr. Grant introduces banquet guest speaker, Senator Forrest Schwengels.*

# REINVESTIGATION OF GLACIAL DEPOSITS AND VOLCANIC ASHES IN SOUTHWEST IOWA



**By Dr. George R. Hallberg**

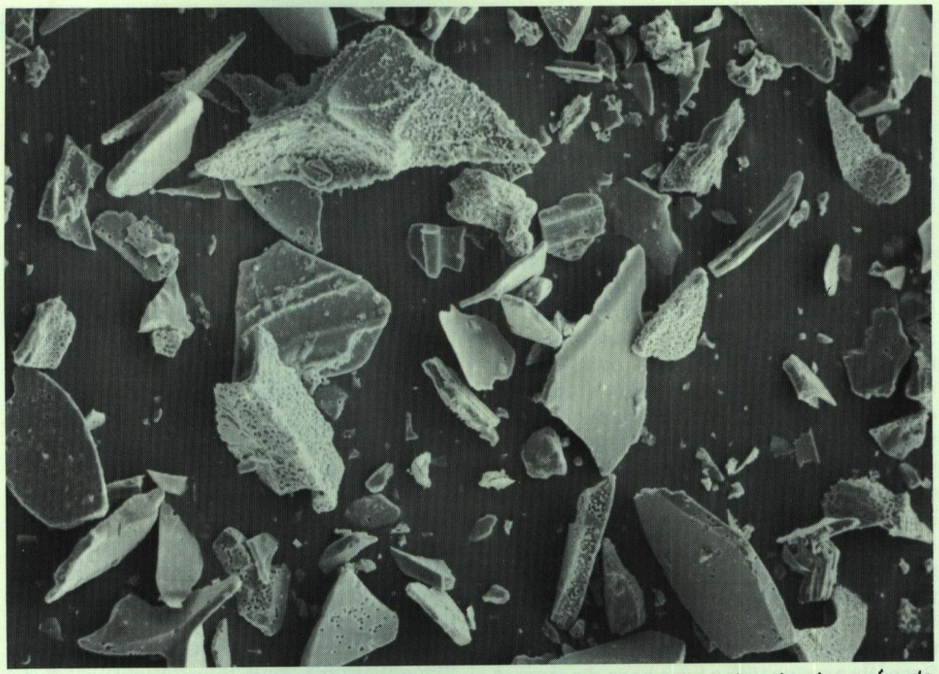
*Yellowstone National Park helps solve geologic problems in Iowa.*

Till, which is the material left by large continental ice sheets during the Pleistocene Epoch or Ice Ages, covers nearly all the bedrock surface in Iowa. In places the glacial till (popularly called "boulder clay" or "blue clay" in well borings) with other interbedded materials attains thicknesses of several hundred feet. Consequently the till deposits play important roles in most uses of Iowa land—from agriculture to foundations for buildings. To understand fully the nature of engineering and hydrologic properties and problems in these deposits, it is important that their stratigraphy be as thoroughly understood as possible. To meet this need, the Iowa Geological Survey, in cooperation with various agencies, has been conducting investigations into the stratigraphy and related applied properties of the till deposits.

The glacial deposits of Iowa are also of significant scientific interest. The sequence of these deposits was first analyzed nearly a century ago. A great deal of the classical work, which unraveled the geologic evidence showing that the Midwest has been glaciated repeatedly, was done in Iowa. In fact the classical stages of the early Pleistocene—the Kansan glacial stage, the Aftonian interglacial stage, and the Nebraskan glacial stage— were defined from evidence in southwest Iowa and eastern Nebraska, and particularly in the Afton-Thayer region

*Steve Sayre and Nyle Wollenhaupt, of Midwestern Consulting Labs., Inc., Storm Lake, sampling a new ash site in Cherokee County. The white colored zones are very pure ash deposits, interbedded within other stream-laid sediments. Photo by George Hallberg*



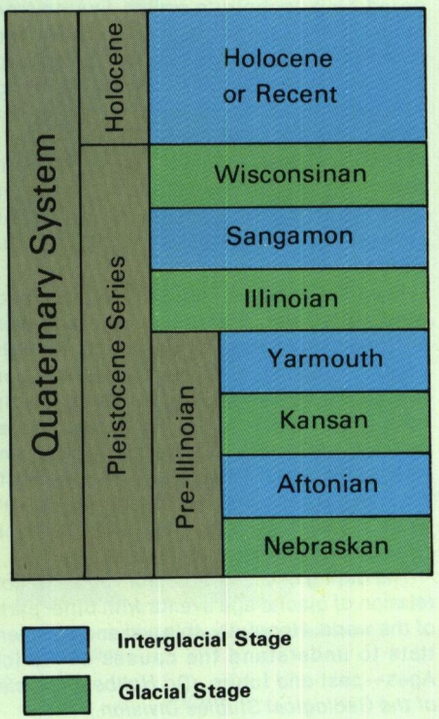


*SEM photomicrograph (200X) of ash particles showing very angular volcanic glass shards (smooth fragments) and pumice fragments ("pitted particles"). Photo by Robert McKay*

of Union County (thus, the name AFTONian). The work in these areas defined the concepts and terminology used in much of North America. It was generally thought that there was one till unit which represented the Kansan glaciation and one till representing the Nebraskan, which were separated by the Aftonian "gumbotil". (The gumbotil we now know to be a buried soil, or paleosol.)

However in recent years, in other states and other parts of Iowa, the sequence of glacial deposits has been found to be much more complex than simply one till per glacial period. The staff of the Iowa Geological Survey has been collaborating with Dr. John Boellstorff, research geologist with the Nebraska Conservation and Survey Division, on a project to reevaluate these early Pleistocene deposits. Dr. Boellstorff's project, which was in part funded by the National Science Foundation (Grant No.: DES-74-23535), has involved continuous-core drilling at many of the classical outcrop localities and at known volcanic-ash sites.

The core drilling has provided a much more thorough look at the stratigraphy of these glacial-age materials. For example, many of the classic outcrop descriptions showed the



entire Kansan and Nebraskan sequence in 30 to 40 feet of exposure. The recent core drilling has in many instances shown 100 to 200 feet more of glacial deposits below these sections, with as many as three more distinct till deposits below the Nebraskan in a single core hole. This obviously complicates the rather simplistic view of single Kansan and Nebraskan tills.

The volcanic ash sites, previously mentioned are adding another exciting dimension to the modern understanding of these deposits. These ash deposits are wind-blown materials consisting of volcanic glass and minerals derived from volcanic eruptions, and now buried within the glacial deposits. Detailed chemical and mineralogical analyses by several scientists with the U.S. Geological Survey have shown that these ash deposits were formed during the eruptions of now-extinct volcanoes in Yellowstone National Park in Wyoming, roughly 850 air-miles to the west. Ash deposits occur in Woodbury, Guthrie, Adair, Union and Ringgold Counties, and near the Harrison-Monona County line. Recently new localities have been discovered in Audubon and Cherokee Counties.

These ash deposits can be radiometrically dated by a technique called fission-track dating. Four separate-age ashes have been dated from Iowa and Nebraska. The ages are approximately 0.6, 0.7, 1.2 and 2.2 million years before present. The 2.2 million-year date occurs on top of the oldest glacial deposit we have recognized. This places the beginning of glaciation in Iowa somewhat older than 2.2 million years ago—considerably older than many previous estimates.

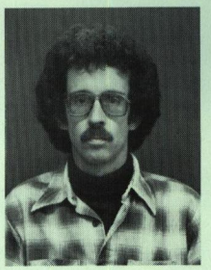
In earlier geologic studies, these ash beds were called the "Pearlette Ash" and were all considered to be the same age. Now the separation of the ash beds by dating, coupled with the recognition of more glacial episodes than previously recognized, has effectively rendered the classical Kansan and Nebraskan terms obsolete. These deposits are now being referred to as "Pre-Illinoian", while the work is completed and new rock-stratigraphic terminology is developed.

The dating of these deposits will allow correlation of glacial-age events with other parts of the world. Hopefully, this will enable scientists to understand the causes of the Ice Ages—past and future. *(Dr. Hallberg is Chief of the Geological Studies Division.)*

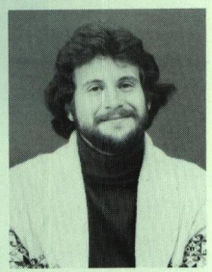


# NORTHWEST IOWA WATER RESOURCES PROJECT

**By Bill Bunker, Greg Ludvigson and Brian Witzke**



*Bill Bunker*

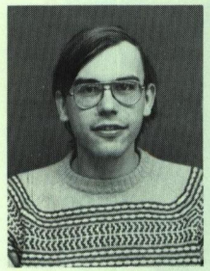


*Greg Ludvigson*

In the summer of 1977, a comprehensive investigation of the water resources of a 16-county, 6,600 square-mile area in northwest Iowa was initiated by the Iowa Geological Survey and the U.S. Geological Survey. Since that time, more than 30 test wells with a cumulative thickness of over 15,000 feet have been drilled. Among the significant early discoveries in the study is the likelihood that water moving upward from deeply buried Paleozoic aquifers is supplying some of the water in the Cretaceous Dakota aquifer, the major source of water in the region. This strengthened the previously held suspicion that the rocks beneath the Dakota aquifer exert a profound influence on the overall water availability in northwest Iowa.

## Dakota Aquifer

The water-producing sandstones of the Dakota aquifer were deposited by ancient rivers of the Cretaceous Period about 100 million years ago. These rivers flowed in a southwesterly direction through an old hilly land surface which had over 500 feet of relief. The location of the valleys and hills was controlled by the distribution and differing rates of erosion of underlying Paleozoic and Precambrian rock units (fig. 1a). The ancient buried river valleys are filled with thick deposits of relatively clean sandstone that can be expected to sustain yields of over 500 gallons per minute. Parts of the upland areas of the old land surface, however, are covered by thin clayey sandstones (figure 1b) that cannot sustain yields of more than 100 gallons per minute. Eventually, as the ancient sea into which the rivers flowed continued to rise from the west, the area was covered by the marine deposits of the Graneros Shale and the Greenhorn Limestone (fig. 1c, d). The old sea has long since receded; the Cretaceous rocks have been deeply eroded in many places and are now covered with younger, Pleistocene-age glacial deposits.

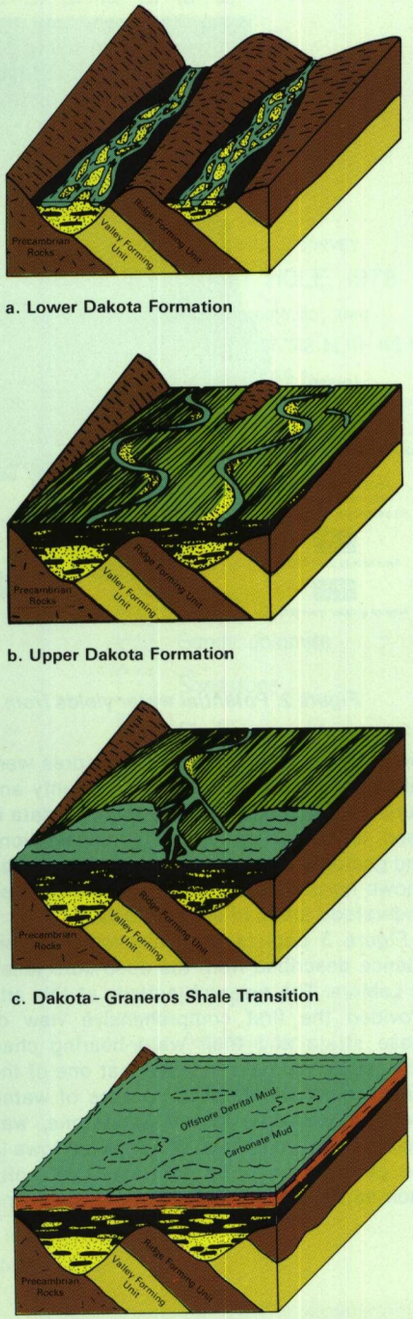


*Brian Witzke*

Based on data from the test wells and this model of the changing Cretaceous environments, maps showing the distribution of water-availability can be prepared. The Dakota covers 84 percent of the study area, but it can be expected to sustain yields of more than 500 gallons per minute over only 69 percent of the study area. Figure 2 summarizes the predicted water-availability from the Dakota aquifer in northwest Iowa.

## Paleozoic Aquifers

The Paleozoic Era includes a vast stretch of geologic time between 225 and 600 million years ago. During the Paleozoic, warm shallow seas periodically covered nearly all of Iowa at a time when Iowa and much of North America straddled tropical and subtropical latitudes. Nowhere in northwest Iowa can the Paleozoic-aged rocks, deposited in these ancient seas, be seen at the surface. Information about their hydrology and stratigraphy must be acquired exclusively through a study of information retrieved from drill holes. The IGS has drilled a series of rock cores in an effort to provide the first detailed look at the Paleozoic rocks of northwest




a. Lower Dakota Formation

b. Upper Dakota Formation

c. Dakota-Graneros Shale Transition

d. Graneros Shale–Greenhorn Limestone Transition

*Figure 1.*

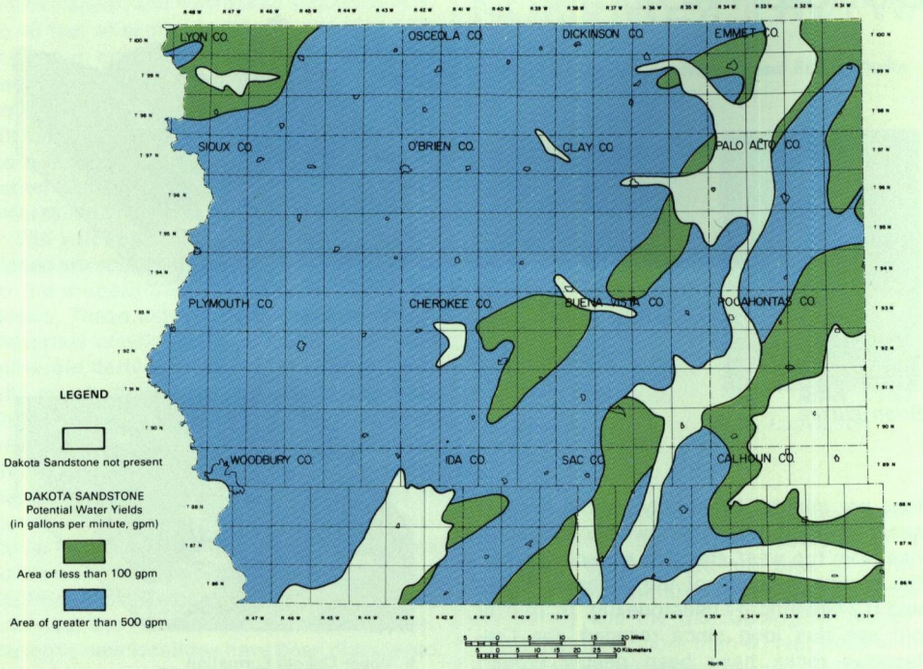



*Figure 2. Potential water yields from the Dakota sandstone in Northwest Iowa.*

Iowa. The most nearly complete cores were taken near LeMars in Plymouth County and Aurelia in Cherokee County. The core data is used to construct regional cross-sections and geologic maps which help tie the lesser-known northwest Iowa strata in with better-understood areas in eastern Iowa.

Figure 3 depicts the Paleozoic rock sequence described from the deep core taken at LeMars. The research activity at this site provided the first comprehensive view of these strata and their water-bearing characteristics. We have learned that one of the state's most widely used sources of water, the Cambrian-age Jordan Sandstone, was eroded away from much of northwest Iowa in the geologic past. By contrast, rock units such as the Galena Dolomite and the Elvins Group-B appear to be better sources of water here than elsewhere in the state. Preliminary results of this deep drilling thus suggest greater water availability at depth in this area than previously believed.

With good stratigraphy and geologic control in hand, the complex hydrologic relationships within the Paleozoic rock sequence and between the Paleozoic, Cretaceous, and Pleistocene aquifers can begin to be defined. An Open-File Report, titled *Status of Hydrogeologic Studies in Northwest Iowa* by G. A. Ludvigson and B. J. Bunker, is available on request from the IGS. *(Messrs. Bunker and Witzke are Research Geologists in the Stratigaphy and Economic Geology Division, and Mr. Ludvigson is a Research Geologist in the Research Division.)*



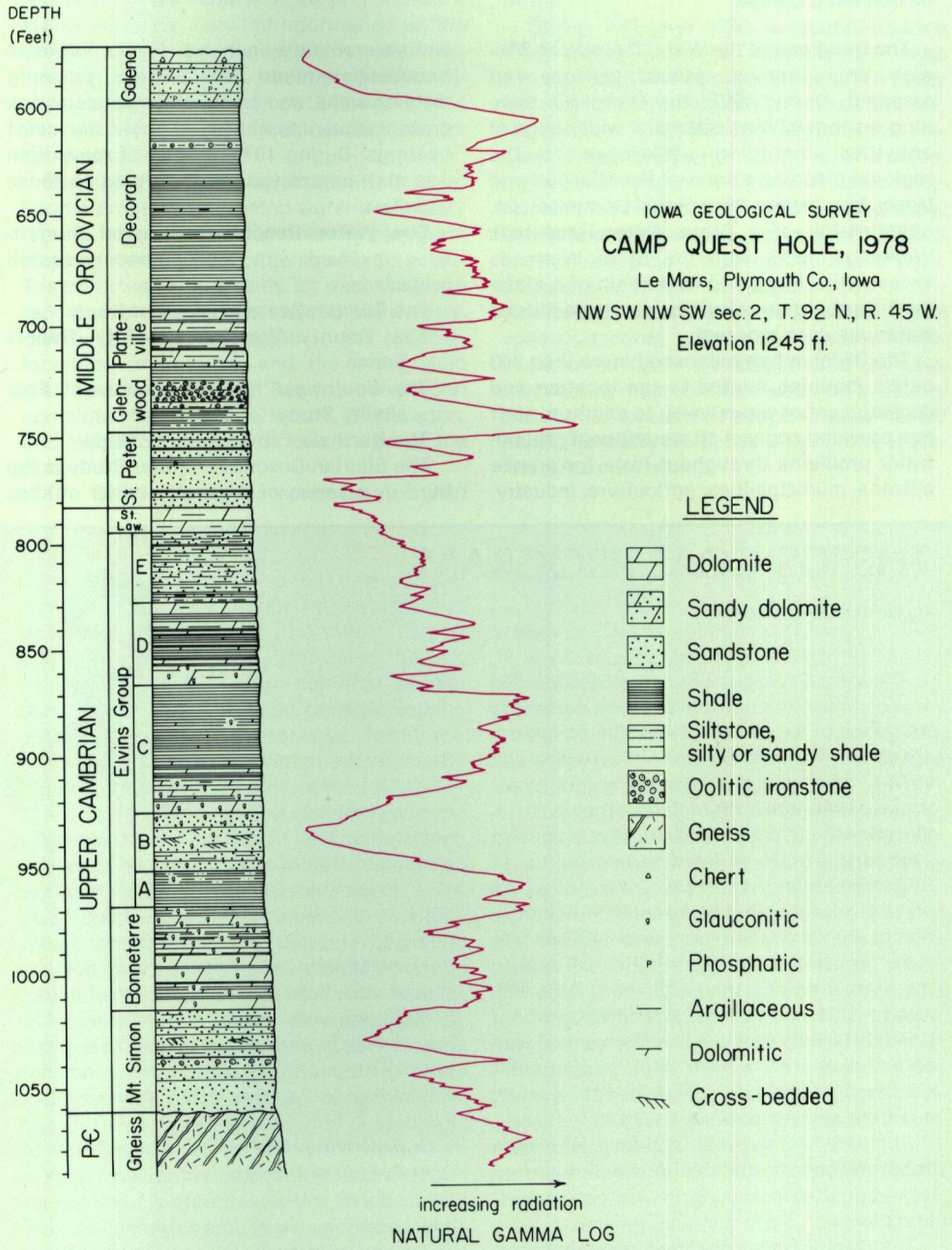



*Figure 3.*

# WATER RESOURCES DIVISION

**By Donivan L. Gordon**

The functions of the Water Resources Division are planning, public service, and research. During 1978, the Division's planning responsibilities covered a wide range of activities, including assistance to the regional planning efforts of the Missouri and Upper Mississippi River Basin Commissions, coordination of a State Water Resources Workshop, work with the State Wetlands Preservation Plan, and leadership of a state-level task force studying a state-federal water-use data program.

The Division has processed more than 300 public inquiries related to the location and development of water wells. In addition, staff has provided counsel on a number of groundwater problems throughout Iowa for private citizens, municipalities, agriculture, industry, and several state agencies. These problems frequently required field surveys, pumping tests on wells, and on several occasions, the presentation of testimony at public and court hearings. During 1978, a total of more than one staff-person-year was devoted to these activities.

The Water Resources Division currently is involved with four primary research projects:

The Silurian-Devonian Aquifer Study
The County Water-Availability Report Series
The Southwest Iowa Impoundment Feasibility Study
The Northwest Iowa Aquifer Study.

The Silurian-Devonian Aquifer Study is the third in a series of regional aquifer studies and was preceded by the Mississippian and Jordan regional aquifer publications. The objective of these reports is to present, on a statewide basis, detailed information on the extent of the aquifer systems, their hydrologic relationships, their productive capacities, and the quality of their water. The Silurian-Devonian study is scheduled for completion in 1981.

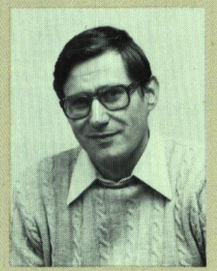
Beginning in 1979, the Division embarked upon a program to develop water-availability reports for all 99 Iowa counties. This program is scheduled to be accomplished in six years. The objective is to provide for each county a report which details sources of ground water, quality of water, the depth to the sources, locations of sources, and the water yield that can be expected. Reports have been completed for Dallas, Jefferson, Washington, and Wapello Counties at this stage of the program.

The Division provides administrative and logistical support for the research drilling operation required for the Northwest Aquifer Study.

During 1979 and 1980, a reconnaissance study of surfacewater impoundment sites will be undertaken and completed. The study will look at potential sites in Pottawattamie, Cass, Adair, Mills, Montgomery, Adams, Fremont, Page, and Taylor Counties. The objective of this program is to model basic information on soils, runoff, rainfall, topography, and evaporation and to use this information for evaluating potential impoundment sites. The study will look at feasible sites in two size categories: (a) sites suitable for reservoirs that could sustain the needs of communities of 2,000 population and (b) sites that would meet similar needs of a county distribution system of approximately 13,000 population. *(Mr. Gordon is Chief of the Water Resources Division.)*

# THE IGS COAL PROGRAM

**By Dr. Matthew Avcin, Jr.**



The Iowa Geological Survey (IGS) Coal Resource Program and Coal Division came into existence in September, 1973. The fuel shortages experienced during the winter of 1972-73 and the major energy disruptions associated with the birth of OPEC, the rise in international oil prices and the Arab boycott caused the State of Iowa to re-examine its fuel alternatives and take a closer look at the state's coal-producing potential. Revitalization of Iowa's coal industry was necessary in order to expand the contribution of coal to the state's energy mix. The role of the IGS was to work out the coal stratigraphy, about which little was previously known, and develop a sedimentary model which would permit a better understanding of Iowa coal quality, quantity, and occurrence.

Ancillary to these research functions were important responsibilities in the areas of information distribution and environmental assessment.

The Coal Division provides information on coal deposits and mining activity to private citizens, government agencies, coal mining companies, coal consuming companies, and researchers. The Coal Division also provides advice and information on potential and existing pollution associated with all phases of coal utilization. Some of the important contributions made by the Division are assistance with modification of the existing surface-mining law which led to enactment of a revised state law in 1975, the development of rules under the new law, the ongoing development of rules under the federal Surface Mining Act of 1977, the ongoing research into underground mine subsidence in conjunction with the Office of Surface Mining, research into the chemical makeup of Iowa coal, and participation in the Advisory Committee to the Iowa State University Coal Project.

Concurrently, the staff assigned to the Coal Resource Project continues to work on their primary mission of data acquisition and interpretation. As of Oct. 1, 1979, 84 holes had been drilled with a cumulative total of 24,930 feet, of which 16,186 had been cored.

In each hole drilled, the Pleistocene, or glacial-age, materials are rock-bitted and logged in the field by a geologist, with additional information provided by the driller. Samples are bagged in five-foot intervals and are stored for later detailed analysis. Once bedrock is encountered, the hole is cased and the rock is continuously cored through the Pennsylvanian into the top of the Mississippian. A complete description of the core is prepared in the field and then is forwarded to the main office for typing, reproduction, and release to the public.

All coal units encountered during coring are immediately removed from the core and are wrapped in plastic, boxed, and forwarded to the main office for additional study. Each coal unit is sampled, processed, and analyzed for spore and pollen content. This study of the spore and pollen (palynology) has proved to be the best available technique for the identification and correlation of individual coal seams. Chemical analyses are routinely run on coal units over 18 inches thick, as well as on samples collected from the active coal mines.

A similar study is being conducted on selected rock units which occur between the coals. This study is based on conodonts (microscopic fossils), and is being used as an indepedent check on the palynology study. The distribution of conodonts is providing additional information on the origin of the rock units between the coals; in turn, this information is facilitating the development of a depositional model for the Pennsylvanian rocks.

Termination of state funding for coal research was announced for June 30, 1980. Plans are being made to publish the results of the studies and reposit all data and samples in a systematic manner. Drilling was terminated in December. All equipment and samples will be transferred from the Blakesburg field station to Iowa City.

Current plans include publications in each of the major research areas. In palynology, two major papers are planned to document the correlation techniques and catalog the coal correlations for approximately 75 to 80 holes. Additional identifications and correlations made after publication will be placed on open file. The primary advances achieved in conodont research will be summarized in two papers, the first of which will deal with the paleoecology of conodonts and their usefulness in understanding environments of deposition of Pennsylvanian rock units. The second paper will document the stratigraphic ranges of various conodonts through time. A final paper will be prepared for summarizing the chemistry of Iowa coals, based on the hundred-plus samples analysed so far.

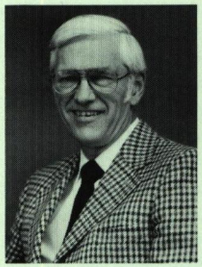
Though the Survey's program of active coal research is ending, the agency will do its best to continue meeting requests for advice and information on the coal resources of the state. *(Dr. Avcin is Chief of the Coal Division.)*

# EVALUATION OF COMPLEX WATER-RIGHTS PROBLEMS

**By Paul J. Horick**

*We are currently in the process of locating and studying a new well field for the city of Jefferson. We have drilled two test holes northeast of Jefferson—and there appears to be an adequate sand and gravel formation in the area to support a well field for the city.*

*We would like to know the extent of this formation so we can more accurately determine the extent of influence that the new well field will have on the people that now use that formation for their own water supply.*



So began a letter addressed to the Iowa Geological Survey (IGS) by the city's consultant concerning a water shortage at Jefferson and the recent attempt at a solution. Our reply pointed out a lack of good hydrogeologic data in the area and advised that a controlled production test, including measurement of water levels in several observation wells, would be needed to obtain reliable information.

Subsequently, the IGS, in conjunction with the city consultant and the well drilling contractor, conducted an aquifer test to determine the coefficients of transmissivity and storage. These parameters provide a measure of the permeability and porosity of the aquifer or its capability to transmit and store water. The potential radius of influence of the new city well also was investigated.

The aquifer being tested is a sand and gravel body filling a bedrock channel within the Hardin Creek Basin. This aquifer supports numerous naturally flowing wells in the area. The city's test well was 178 feet deep, with a static water level of six feet below the surface. The well was test pumped at a rate of slightly over 1000 gpm for 24 hours, resulting in a drawdown of 43 feet. After the pump was turned off, measurements showed that in three hours the water level returned to within two feet of the original static water level. Five observation wells, completed in the same aquifer, were utilized to monitor changes (drawdown) in water levels during the pumping test. By plotting the drawdown curves and using Jacobs modified non-equilibrium formula, the transmissivity and storage coefficients for the aquifer were calculated to be $T = 50{,}000$ to 70,000 gpd/ft, and $S = 3.8 \times 10^{-4}$ to $4.4 \times 10^{-4}$.

The sides or walls of the buried channel, against which the aquifer thins or wedges out, create barrier conditions which have an effect on the drawdown and on the radius of influence of the city well. The drawdown curves for the observation well steepened in the latter stages of the test, indicating the beginning of the barrier effects. When the system reaches equilibrium, the curves will flatten out. The drawdown and radius of influence of the city well are also dependent upon the rate that water can move downward through the overlying till deposit. This might range from .0001 to .001 ft./day. With this range, calculations indicate that drawdowns of from 10 to 16 feet are anticipated at a radius of 2000 feet from the pumped well and 6.5 to 11.5 feet at a radius of 5000 feet.

Although the net effect of the new city well could cause some wells in Hardin Creek to cease flowing, the aquifer would not be depleted, *i.e.,* water could be obtained from the wells, but they would have to be pumped.

The IGS staff testified at a public hearing conducted by the Iowa Natural Resources Council. The testimony given greatly aided in understanding the problem and assisted the Water Commissioner's staff in its determination on this water permit application.

This case study is an example of the increasing number of water-use conflicts in the state and illustrates how the IGS can serve other government agencies and the public sector by conducting pumping tests for aquifer evaluation and assessment of potential interference problems. *(Mr. Horick is Senior Ground Water Geologist in the Water Resources Division.)*



# EDUCATIONAL ENCOUNTERS OF A GEOLOGIC KIND

**By Jean C. Prior**

*Points of geologic interest in the western Iowa landscape are pointed out at Hillview Park in Plymouth County. Photo by Carolyn Benne*

## . . . With the teachers

No doubt we can all remember our first encounters with the subject that would one day become the substance of our careers. Many geologists can recall influential introductions made in the course of polishing prized agates, collecting fossil shells mysteriously remote from the nearest sea, or emptying the local library of its books on dinosaurs. Somewhere along the way, these kindling interests caught fire, in many instances sparked by the knowledge and encouragement of a well-remembered teacher. Today, Iowa's teachers as well as scout leaders, 4-H counselors, nature-center naturalists, and interested citizens are participating in increasing numbers in outdoor education programs designed to offer introductions to geology in the field.

The Iowa Geological Survey, usually seen in the role of technical advisor to the public on matters related to the state's geological resources, also recognizes that education at all levels serves to increase understanding of natural resource occurrence, geologic processes, and the sense of geologic time that are so important in dealing with pressing environmental problems and landuse issues. Added benefits certainly include the special insights and perspectives which geological understanding can bring to one's personal enjoyment of the natural landscape.

Though demand outweighs our personnel capacity to respond, the Survey tries to accommodate the numerous field-season requests for agency participation, considering diversity of both geographic area and program sponsors. The organizers of these programs come from many sources: the Iowa Department of Public Instruction, regional Area Education Agencies, the Iowa Conservation Education Council, County Conservation Boards, the Iowa Teachers Conservation Camp (University of Northern Iowa), the University of Iowa Environmental Studies Program, and the Isaac Walton League, to mention those we have worked with in 1979. Workshops and field seminars are held in state parks, county parks, scout camps, church camps, and conservation-education centers, all featuring scenic surroundings, rustic accommodations, and shared learning with kindred spirits.

The geology of an area provides a natural framework within which the association of soils, wildlife, forest and prairie, and archaeological and historic resources can be viewed and understood. Continued Survey participation in these programs will insure placement of that important keystone of geology in the understanding and appreciation of Iowa's natural environment.

## . . . With the public

Five original field sketches of Iowa landscapes drawn in 1868 formed the basis of a

public exhibition which toured three Iowa cities during the past summer. The pencil sketches, found in California, were drawn by Orestes H. St. John, Assistant Geologist with the Iowa Geological Survey from 1866 to 1869. Return of the sketches for our archives revealed that each drawing corresponded to one of the lithographs which illustrate the two-volume 1870 *Report of the Geological Survey of the State of Iowa.* Each sketch was meticulously drawn, dated and signed, and included detailed landmark notations. Their precise nature enabled Iowa City artist Carolyn Milligan and I to relocate and redraw the sites as they appear today. The comparative drawings, which document 110 years of change, were exhibited at Old Brick Auditorium in Iowa City, the Blanden Gallery in Fort Dodge, and the Sioux City Public Museum. Sponsoring agencies were the Iowa Geological Survey, the Iowa Board for Public Programs in the Humanities, the Iowa Division of Historic Preservation, and the Iowa Advisory Board for Preserves.

The exhibition and its unique multidisciplinary focus on geology, art, and history has put geology before the public eye in an unusual context, allowing the viewer to observe and reflect on changing patterns of landuse, to examine St. John within the 19th Century tradition of the documentary artist, and to understand the effects of bedrock geology, glacial history, stream erosion, and geologic time in shaping the Iowa landscape.

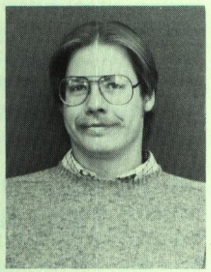
### . . . With the National Geographic Society

The National Geographic Society has published a new book in its Special Publications Series titled, *America's Majestic Canyons.* Featured in the chapter on the Midwest is a beautifully illustrated and interestingly written segment on the "Gorge of the Upper Iowa." The Iowa Geological Survey provided geological assistance to National Geographic author Ed Welles and photographer Matt Bradley as they canoed the Upper Iowa through Winneshiek and Allamakee Counties in search of their story. Their visual and written impressions can be seen in *America's Majestic Canyons* (Book Code 00271), National Geographic Society, 17th and M Streets NW., Washington, D.C. 20036. *(Mrs. Prior is a Senior Research Geologist in the Water Resources Division.)*

# RESULTS OF THE LANDSAT DEMONSTRATION PROJECT

**By M. Patrick McAdams and Ross Black**

*M. Patrick McAdams*



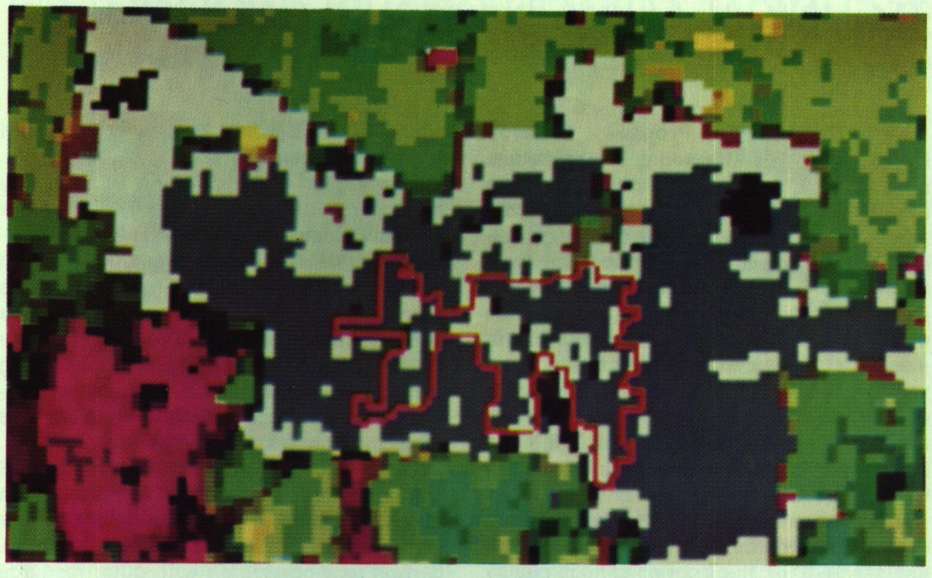
*Ross Black*

Since 1978 a Landsat demonstration project has been developed and carried out by representatives of Iowa agencies and the National Aeronautics and Space Administration's Earth Resource Laboratory (ERL). The project was designed to test and evaluate the ability of Landsat satellite data to provide information for the management of Iowa's soils resources when used in combination with other natural resources information in a computer data base. As part of the demonstration project, ERL constructed a digital natural resources data base for the North Branch basin in Madison County, Iowa. Each cell in the data base contained identifiers for the soil mapping unit, slope (S), slope length (L), soil erodibility (K), rainfall (R), and 1973 and 1978 land cover (C). The soils mapping units were entered into the data base by digitizing the *Modern Soil Survey* maps of the basin. The S, L, K, and R factors were entered by assigning the appropriate values to each mapping unit. The 1973 and 1978 land-cover data were derived from digitally processed Landsat imagery.

By converting all of the information to a common digital format referenced to a common map projection, one can analyze the data in a variety of combinations. The S, L, K, R, and 1973 and 1978 C factors were used in the universal-soil-loss equation (USLE) to calculate potential soil erosion for each cell in the data base. The data base also was used to: 1) document the rotation of land into and out of row crops, 2) determine the slope classes of areas that were converted to row crop between 1973 and 1978, and 3) determine the number of acres of a certain soil type converted to row crop during this period.

A second data base was constructed for a five-square-mile area centered on Ankeny, Iowa. This data base contained 1950 land use (digitized from aerial photography), 1973 and 1977 land use (from Landsat), and soils information (digitized from the *Modern Soil Survey).* By overlaying the land use and soils information in the data base, we could map the urban growth of Ankeny and document the number of acres of prime agricultural land (PAL) converted to urban land use. The table below summarizes the results of this analysis.

IGS is presently in the process of acquiring the computer equipment and programs necessary to establish a Landsat image processing capability in Iowa. It is anticipated that the facility will be completely operational by mid-to-late 1980. It is felt that this system will provide the state's resource agencies with a powerful tool for assessment and management of natural resources. *(Mr. McAdams is Supervisor and Mr. Black is an Analyst in the Remote Sensing Laboratory.)*



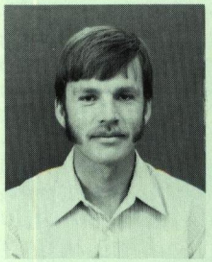
*Area of Urban development for the City of Ankeny: Red Outline—1950; Blue-Grey area—1973; White area—1977*

| Year | Ankeny Urban Area (acres) | Growth (acres) | Acres of PAL Converted to Urban Land Use |
|---|---|---|---|
| 1950 | 204 | | |
| 1950-1973 | | 797 | 772 |
| 1973 | 1001 | | |
| 1973-1977 | | 711 | 681 |
| 1977 | 1712 | | |

*Conversion of Prime Agricultural Land to Urban Use 1950-1977*

# TECHNICAL SERVICES GROUP

**By Bernard E. Hoyer**



Progress towards meeting Iowa Geological Survey service needs may be measured in part by growth in staff and development of new capabilities resulting from new equipment and new methods. During the past year, Technical Services has significantly increased its capabilities to serve. The Illustrating Services, which in recent years has increased its capabilities with new equipment, made progress when a second full-time graphic artist position was permanently established. This assures IGS of the continued high-quality artistic talent that is so important to Survey communication of its resource information.

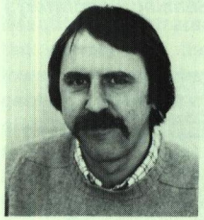
Likewise, Data Processing has benefited from another programmer, Sue Vossoughi, and a data-entry operator, Pat Ring. These positions, funded by a contract from the Environmental Protection Agency, will help analyze possible associations of water sources and incidence of cancer. Continued IWARDS data-base programming and the development of digitizing and graphics techniques are also aimed at developing useful resource-analysis systems.

The largest single advance in capability results from the requisition of a computer system designed to analyze resource information from the Landsat satellite system within the Remote Sensing Laboratory. This purchase, a direct outgrowth of the Iowa Landsat Demonstation Project, provides new potential for using remote sensing technology for the acquisition of environmental information. It also complements other data-processing system development. Much of the planned development for IGS computer-assisted analysis will be put on this computer. The system should allow for significant integration of current satellite-derived land-cover data with other resource data. Installation of the system will begin in the spring of 1980, and processing capabilities should be available during the summer.

Looking back at the past year reveals that Technical Services has come a long way in developing capabilities; the plans ahead for using these capabilities to answer resource questions are both challenging and exciting. *(Mr. Hoyer is Chief of the Technical Services Group.)*

# IOWA WATER RESOURCES DATA SYSTEM (IWARDS)

**By Richard L. Talcott**



The IWARDS staff has helped agencies and researchers locate and retrieve water-related data and also has helped with management of data by providing computer programs and technical assistance. Over 100 information and data processing requests were met during the past year. These ranged from brief telephoned referrals to a data processing subcontract involving the addition of several full- and part-time staff members.

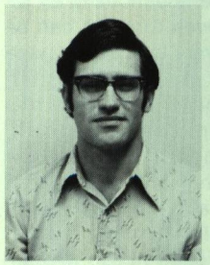
Most of the routine data retrievals were for geological and water quality data. Several requests involved production of computer-generated maps showing such features as depth to specific rock formations and concentrations of nitrates in drinking-water supplies.

IWARDS assisted a precipitation study undertaken by the IGS Water Resources Division by providing a series of maps depicting deviations from normal rainfall amounts across Iowa for various study periods. IWARDS staff also computed the probable frequencies for dry periods of various lengths, to be used in a report that will characterize the patterns of precipitation throughout Iowa.



# EASTERN IOWA SILURIAN KARST STUDY

**By Michael J. Bounk**



The bedrock underlying much of eastern Iowa consists of dolostones and limestones of Silurian age (about 400-440 million years old). These strata, which range up to 500 feet in thickness, are subject to development of solutional openings (karst) by groundwater movement. These openings vary from less than an inch to several feet in width and can transmit large volumes of water, often providing high yields to wells which intersect them. Development of solution cavities near the land surface can occasionally result in surface collapse and the appearance of a "sinkhole". Areas of active sinkhole development present hazards to livestock and buildings. Also the open nature of the karst system makes the ground-water resource highly susceptible to chemical or biological contamination. Rapid movement of water through the system also allows little opportunity for natural removal or diminution of these contaminants. Thus an understanding of karst phenomena is especially important to groundwater studies as well as to landuse concerns.

I am presently studying geologic controls on karst development in eastern Iowa in order to understand its variation throughout the Silurian section. To date, it has been determined that in its area of occurrence, one particular stratum, the *Cyclocrinites* beds (a zone marked by fossil algal forms), has been dissolved to a greater extent than have most other Silurian strata. This is demonstrated both in rock core studies and by geophysical probes lowered into wells. This characteristic is also demonstrated by the abundance of caves developed throughout this zone in its area of outcrop. The majority of these caves and presumably smaller solutional openings are developed along factures or joints in the rocks, as is true elsewhere in carbonate rocks. Regional studies are being conducted to predict the directional trends of these fractures.

When this study is concluded, the results will add to our knowledge of the occurrence and extent of karst development in the Silurian of northeast and east-central Iowa and to our understanding of the direction and speed of ground-water movement in this area. *(Mr. Bounk is a Research Geologist in the Stratigraphy and Economic Geology Division.)*

A federally funded (Environmental Protection Agency) study of cancer incidence and drinking water quality is being supported with IWARDS data. All water quality data available in computerized form is being provided to the University of Iowa Department of Preventive Medicine and Environmental Health. Directed by Dr. Peter Isacson, University statisticians will look for relationships between cancer rates and high concentrations of water constituents throughout the state. This two-year project began in April 1979 and may be extended to four or more years. The IGS and USGS are receiving about $60,000 per year to accelerate the computerization of data in order to provide additional locational information and to produce computerized map displays.

Development of a computer cartography system at IGS is proceeding on a timely basis. Currently, programs are being written so that maps may be created as computer files and displayed on a video screen for editing and updating. A major portion of the data held by IGS is map-related; thus computerization will represent a major improvement in efficiency and accessibility for management of our files. *(Mr. Talcott is IWARDS Manager and Data Processing Supervisor.)*

# THE IOWA GEOLOGICAL SURVEY'S WELL-LOGGING PROGRAM

**By Michael Bounk and Brian Witzke**

Presently, the Survey maintains a library of about 20,000 well logs based on drill cuttings and cores taken by drillers throughout the state and submitted to the IGS for description and analysis. Well cuttings include pieces of rock or surficial materials broken up by the drill bit and brought to the surface by circulating drilling fluids. Cores are long cylinders of rock or other materials that provide more extensive information about subsurface strata than well cuttings because they are intact rather than broken into small pieces.

When we receive a set of cuttings from a well, they are first dried. Part of each rock sample then is washed to remove drilling muds, and the samples are placed in envelopes and stored in boxes. These sample sets form part of an extensive library of well cuttings available for examination by interested geologists and hydrologists. The samples are logged at a depth scale of 1 inch to 50 feet by Survey geologists using binocular microscopes and simple chemical tests. Normally, a sample interval of five feet is used on these logs. Each log contains a graphic column, with different colors and patterns used to describe various rock types, minerals, fossils, and rock porosity. To the right of this column is a detailed written lithologic description. To the left of the column, the names of rock formations and other stratigraphic units are noted. Information concerning water yields and well construction are also noted on the log. After we log a well, the information is entered into a computer system that provides rapid access to the broad range of recorded information on subsurface stratigraphy and hydrology in Iowa. The log is then filed in the strip-log library.

The completed strip logs are used either individually or in groups for a variety of uses. The most common, and one of the most practical applications, is to assist well drillers and the general public in planning for water wells. Data on one or more existing wells near a proposed site are reviewed with the requirements of the new well in mind. A prediction of well depth, quantity and quality of water encountered, rock units penetrated at various depths, and estimates of casing necessary to line the well hole can be made. This is done either informally over the telephone or by office visit, or a detailed well forecast can be mailed. Such forecasts vary in accuracy with the quantity and quality of subsurface information available for a particular region and with the amount of structural and stratigraphic variation in the immediate area. However, when used with these limitations in mind, the forecasts can eliminate much guesswork and assist drillers and engineers in estimating costs and in determining well design.

After a well is in use for some time, rock debris can leak into the hole because of a deteriorating casing. In these instances, a log of the well has proved valuable in determining where the debris is coming from and how to repair the well. The same is true for wells which have gone dry or where the production has dropped off.

Other important uses of well logs include determination of hydrologic conditions in local areas; for example, estimating whether large withdrawals of water can be made without serious impact on the production of adjacent wells. Variations in aquifers and rock units on a state-wide basis also can be examined. Regional cross-sections are constructed to gain better understanding of stratigraphic relationships and geological history in Iowa and adjacent states. These studies also help us gain better knowledge of the distribution of economic deposits such as coal, limestone, dolomite, and gypsum. The strip-log files have been utilized by oil and mining companies to aid in prospecting for possible economic mineral resources in the state.

As seen from the above discussion, strip logs are invaluable to our growing understanding of Iowa geology. The drill cuttings from which these logs are made come from municipal and industrial wells, oil and gas test wells, and private domestic wells. Well owners and drillers stand to benefit in the long run by submitting samples of drill cuttings from new wells. With more extensive subsurface information available in a particular region, the Survey can better assist drillers and well owners in the future. *(Messers. Bounk and Witzke are Research Geologists in the Stratigraphy and Economic Geology Division.)*



# STRATIGRAPHY AND ECONOMIC GEOLOGY

**By Raymond R. Anderson**

With the addition of Robert McKay in January 1979, the Division of Stratigraphy and Economic Geology (STRECOG) is at full strength. Bob comes to us from the University of Iowa and will be working primarily on projects related to economic geology, sedimentology, and stratigraphy.

STRECOG has been working on a number of projects in the past year.

## Hazardous Waste Disposal

As a prelude to pending legislation, STRECOG has been studying various geologic units in the state as possible repositories for hazardous wastes (exclusive of nuclear wastes). The three geologic containers presently being evaluated are Upper Devonian shales, Pennsylvanian shales, and Pleistocene tills. The study of the Upper Devonian shales (including the Juniper Hill Member of the Lime Creek Formation, the Maple Mill Formation, and the Sheffield Formation) is nearing completion. Because no design standards exist at present, the following guidelines are being applied to the preliminary evaluation of sites for trench or bored storage: 1) less than 50 feet of unconsolidated overburden, or less than 20 feet of bedrock cover for economic access to the shale unit and 2) a thickness of at least 50 feet of low-permeability clays or shales for the protective storage unit. Work has not yet commenced on potential areas within Pennsylvanian-age shales or the Pleistocene units. For more information on this study, contact Ray Anderson or Robert McKay at the Iowa Geological Survey, 123 N. Capitol St., Iowa City, Iowa 52242.

## Carbonate Hydrology Study

This project, conducted in cooperation with the U.S. Geological Survey Surface Water Division, and soon to be completed, is a detailed study of the hydrology of the shallow, carbonate bedrock aquifers in the Benton-Linn County area. A preliminary report on this study is scheduled for late 1980. Contact Bill Bunker at IGS for more details.

## Bouguer Gravity Map

The IGS will soon publish a Bouguer gravity map of Iowa based on a compilation of numerous gravity stations, generally on six-mile centers, and with a contour interval of five milligals. Contact Ray Anderson for more details.

## Stratigraphic Study

STRECOG has begun a review of the entire stratigraphic column in Iowa. This long-term study will include review of existing literature and examination of many drill cuttings, cores and outcrops. The goal of the study is to update Iowa's stratigraphic nomenclature with new developments in surrounding states to ascertain depositional environments and to identify economic potential. Initial areas of emphasis and researchers involved include Middle Devonian (Bill Bunker), Silurian through Middle Ordovician (Brian Witzke), Lower Ordovician through Cambrian (Robert McKay and Brian Witzke), and Precambrian (Ray Anderson).

## STRECOG Notes

In the last year two oil tests were drilled in Iowa. The Linn County test well was 1,085 feet deep and proved to be a dry hole. The second, in Montgomery County, was temporarily abandoned at 2,063 feet because of loss of circulation.

Brian Witzke and Bob McKay provided geologic assistance during the drilling of a series of 12 test wells in the area of the La Bounty chemical disposal site at Charles City. Bill Bunker obtained geophysical logs for nine of the wells.

The IGS completed another deep stratigraphic test core in eastern Cherokee County. Called the Larson Lake test, a total of 1,545 feet of section was drilled into the Cambrian Elvins Group, including 1072 feet of Paleozoic rocks (nearly 100% recovered) and about 220 feet of Cretaceous (about 50% recovered) (Bill Bunker and Brian Witzke). *(Mr. Anderson is Chief of the Stratigraphy and Economic Geology Division).*

# Topographic Mapping in Iowa

**By Raymond R. Anderson**

Completion of the U.S. Geological Survey (USGS) 7½ minute topographic mapping program in Iowa is now within sight, thanks to a cooperative agreement signed by the USGS, the Iowa Geological Survey (IGS), and the Iowa Department of Transportation (IDOT). Under the terms of the agreement, the IGS will continue at its present level of contributions, $100,000 per year, through fiscal year 1982, then provide $78,000 in 1983. The IDOT has agreed to contribute $40,000 this year and each of the next 2 years through 1982. The USGS will provide funding to match that contributed by both the IGS and IDOT. With the addition of IDOT and USGS matching funds, the mapping program will be completed by June 1983 with all maps published no later than 6 months thereafter.

As of November of 1979, over 68% of Iowa's 1,092 7½ minute quadrangles had published topographic map coverage. Additional quadrangles have not yet been published, but advance copies are available, bringing the number of topographic quadrangles available to 91% of the state. Six percent of the remaining area has been mapped at the slightly larger 15 minute scale. This means that topographic mapping of either the 7½ or 15 minute scale for 97% of Iowa is available. Mapping has yet to be initiated on only 1.5% of the state's 7½ minute quadrangles, and all of these areas have completed 15 minute topographic coverage. In summary: 1,092 total 7½ minute quadrangles in Iowa, 744 printed 7½ min. topographic maps, 249 advance copies of 7½ min. topographic maps available, 52 7½ min. topographic maps in progress in areas with completed 15 minute coverage, 31 7½ min. topographic maps in progress in areas with no completed 15 minute coverage, 16 7½ min. quadrangles with topographic mapping yet to begin.

## STAFF PROMOTIONS IN '79

*Sheila A. Coughlin* from Accounting Clerk II to Accounting Technican I.

*Barbara A. Miller* from Confidential Secretary II to Confidential Secretary III.

*Christine M. Crowley* from Clerk Typist III to Secretary I.

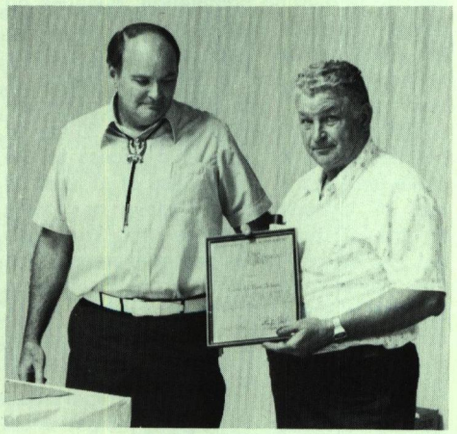
# SALUTE TO THE SUPPORT SERVICES CREW

**By Martha B. Kafer**

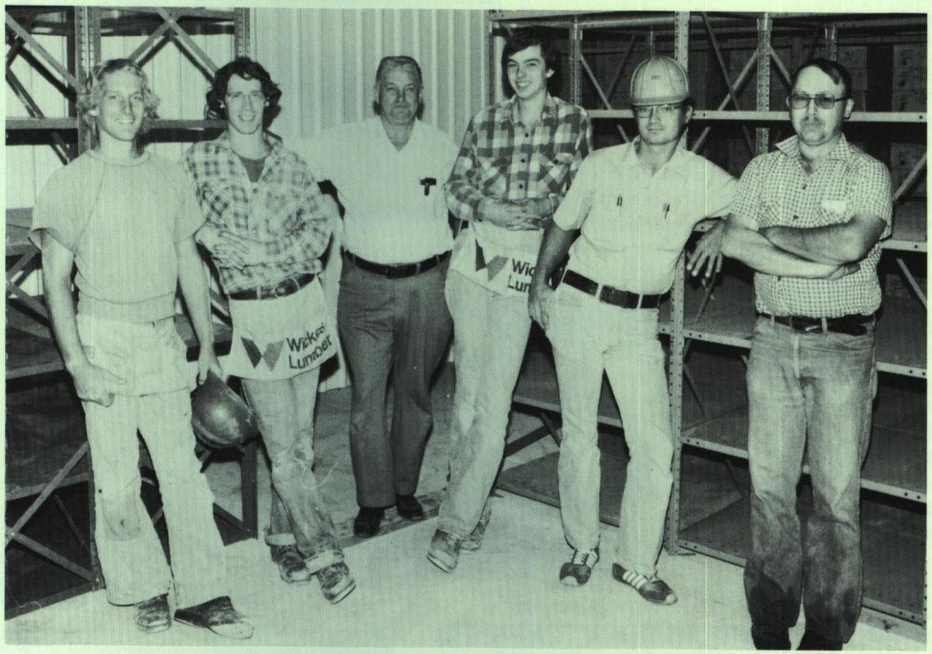
(This is the second in a series featuring the skills of staff members to the Survey, to other agencies cooperating with us on joint projects, and to the people of Iowa.)

This year we want to acknowledge our Support Services staff of Earle "Bud" Scheetz, Mike Farmer, and Charles Kithcart and their special skills. We particularly commend them for their tremendous efforts this past summer in the move of our well sample and core library and warehouse operations to our new Oakdale facility.

The monumental task was accomplished under Bud's organization and direction, with the capable assistance of Mike, Charles, and a summer crew composed of Ed Wahl, Arlin DeJong, and Kirk Hatfield. They efficiently and economically moved hundreds of tons of core, samples, equipment, supplies and publications to the new facility, a move which had to take place while the new building was still under construction. The rest of the Survey suffered very little inconvenience. This was truly an "extra effort" job.



*"Leadership": Dr. Stanley C. Grant, left, presents Earle Scheetz with a Certificate of Achievement for his dedicated efforts in the move to Oakdale.*



*"Brains & Brawn of Support Services" pictured from left to right, Arlin De Jong, Kirk Hatfield, both summer employees, Earle "Bud" Scheetz, Supervisor, Ed Wahl, summer employee, and Mike Farmer and Charles Kithcart, permanent staff.*

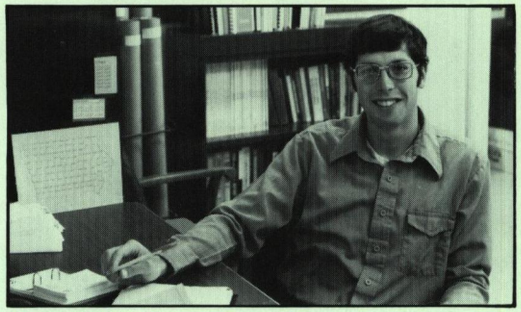
The activities of the Support Services staff range from the collection of basic data to maintenance of the Survey's vehicle fleet. Major responsibilities include personal contacts with drilling contractors to provide agency services and collecting samples of drill cuttings as well as the laboratory preparation of these sample sets for microscopic study.

Bud Scheetz, who has been with the Survey since 1963, is primarily responsible for the development of our cooperative program with the Iowa well drillers. He has enlisted the aid of more than 240 drillers to obtain sets of drill cuttings from new wells. The drillers save samples voluntarily and, in return, we furnish them with the results of our geologic analysis. We also provide log books and sample bags as well as any information needed by them or their customers. This is no small task and has required that Bud, now ably assisted by Mike Farmer, drive many miles (approximately 50,000 a year) to visit the drillers on a regular basis. Charles Kithcart's dedicated efforts for the last 9 years are devoted to the laboratory preparation of these well samples so they can be studied and logged by Survey geologists. There has been a significant increase in data collected as a result of the increased number of wells drilled in recent years. We now have over 25,000 completed sample sets in our rock library.

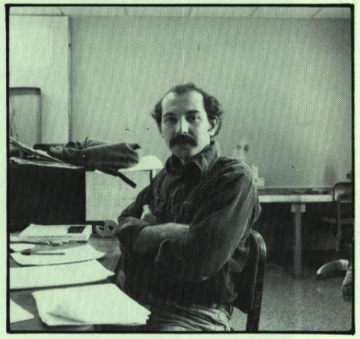
Other functions performed by the Support Services staff include cataloging and shelving of additions to both the drill cuttings and core library, publications inventory maintenance, and a variety of agency program services. These services support nearly all Survey programs, and we recognize their valuable addition to the overall effectiveness of our organization. *(Mrs. Kafer is Chief of Administrative and Support Services.)*

# NEW STAFF IN '79

Patricia M. Witinok



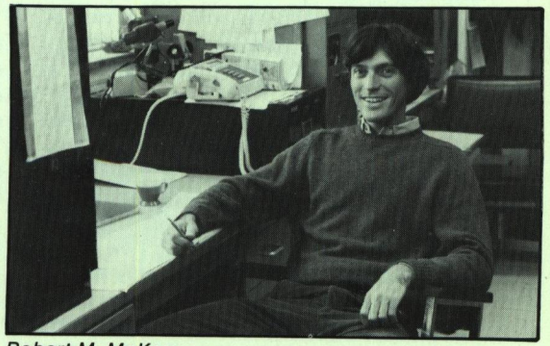
James A. Munter



James E. Gonyier

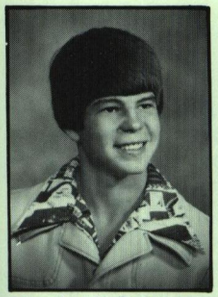
Susan R. Vossoughi

Patricia Lyle Ring

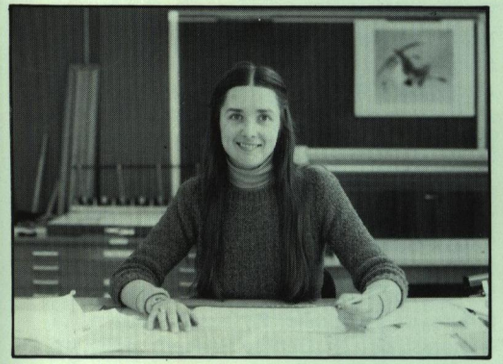


Robert M. McKay

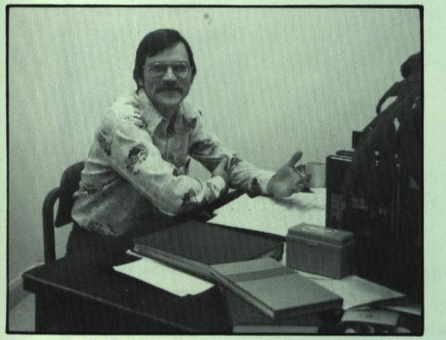




Douglas L. Batten



Patricia J. Lohmann



Steven W. Daut

Christine M. Crowley

*Douglas L. Batten,* from Aurelia, Iowa, came to the Survey in October 1978 on an emergency basis and was appointed permanently in January '79. He previously was a park maintenance man for the Cherokee County Conservation office.

*Christine M. Crowley,* formerly of Dubuque, Iowa began as a Clerk-Typist for the Survey in July. She earned the Secretarial Certificate from Area I Vocational Technical College in Dubuque (1972) and the Bachelor of Arts in General Science with emphasis in Geology from the University of Dubuque (1979). While there, she performed secretarial duties in the Financial Aid Office.

*Steven W. Daut,* born in Davenport, Iowa, joined the Survey in January as a Research Geologist/Geophysicist for the Southwest Iowa Seismicity Study under grant from the Nuclear Regulatory Commission. He has a Bachelor of Science degree in Geology (1978) from the University of Iowa, where he plans to complete his Master of Science in May 1980. He previously did fossil cataloging and was a teaching assistant in Petrology and Mineralogy and Research Assistant for Exploration Geophysics at Iowa.

*James E. Gonyier,* born in Buffalo, Iowa, became a full-time Geologist at IGS in February after serving as a part-time Technican since June 1978. He received the Associate's degree in Mechanical Drawing from Scott Community College (1970) and the Bachelor of Science in Physical Geography (1978) from the University of Iowa, where he began part-time study in August 1979 for the Master of Science in Geography.

*Patricia J. Lohmann,* a native of Scranton, Pa., joined the Survey in July as a Graphic Artist. With a Bachelor of Fine Arts degree from Wittenberg University in Ohio (1972), a Master of Arts (1973), and Master of Fine Arts (1974) from the University of Iowa, Pat has been an Art Instructor at Augustana College in Illinois, an Art Consultant for Westinghouse Learning Corporation in Iowa City, and a free lance artist for the Iowa City division of the Houghton Mifflin Publishing Company.

*Robert M. McKay,* from St. Charles, Illinois, began as a Research Geologist in the Stratigraphy and Economic Geology Division in March. He received a Bachelor of Science degree in Geology from Tulane University (1974) and is completing his Master of Science in Geology at the University of Iowa. He has worked as a mudlogging engineer, as a sum-

mer geologist at IGS, and as a teaching assistant in Geology at the University of Iowa.

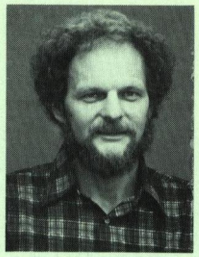
*Jim Munter,* of Duluth, Minn., joined the Staff in September as a Hydrogeologist in the Geological Studies Division. He has a Bachelor of Science degree in Mathematics and Geology from the University of Minnesota-Duluth (1977) and a Master's degree in Hydrogeology from the University of Wisconsin-Madison (1979), where he was a teaching and research assistant. His thesis was on the applicability of groundwater flow models to groundwater-lake interactions in Wisconsin.

*Patricia Lyle Ring,* from Waterloo, Iowa, came to the Survey in August as a Data Entry Operator. She studied Music and Education at Cornell College, Mt. Vernon, Iowa and Anthropology at Northwestern, and is working toward a Bachelor of Liberal Studies degree at the University of Iowa. She has worked as a secretary, private music teacher, and a Research and Development and Test Development specialist with the American College Testing Program, where she also has been a Publications Compositor.

*Suzan R. Vossoughi,* born in Davenport, Iowa, joined the Survey in September as a Computer Programmer after receiving the Associate's degree in Computer Programming at Scott Community College in Bettendorf, Iowa. She has previous computer experience with the Bandag Corporation in Muscatine, Iowa.

*Patricia M. Witinok,* of Rockville, Connecticut became a Research Geologist in the Water Resources Division in August. She received the Bachelor of Science degree in General Science from the University of Iowa (1974), where she received the Master of Science in Geology (1979). Her thesis, *Distributed Watershed and Sedimentation Model,* was produced in conjunction with the Iowa Institute of Hydraulic Research. She has previously worked as a geologic field instructor for the University of Iowa Secondary Science Training Programs at Yellowstone Park and the Rocky Mountains, as a science teacher at Washington, Iowa, Junior High School, as a research assistant for the Institute of Hydraulic Research, and as a geologist with Dr. George Hallberg of IGS on the Missouri River Project.

# IGS REPORTS AND PUBLICATIONS IN '79



**Compiled by Donald L. Koch**

Ground water resources of Dallas County: Open File Report 79-25 WRD, 25 p. $1.00 plus .35 p/h.

Ground water resources of Jefferson County: Open File Report 79-51 WRD, 27 p. $1.00 plus .35 p/h.

Ground water resources of Wapello County: Open File Report 79-90 WRD, 27 p. $1.00 plus .35 p/h.

Anderson, R. R., 1979, Matlock Taconite Body: Open File Report, 7 p. $0.50 plus .35 p/h.

Avcin, M. J., *et. al.,* 1979, Coal resource program report: 13 p. Free.

Hallberg, G. R., Harbaugh, J. R., and Witinok, P. M., 1979, Changes in the channel area of the Missouri River in Iowa, 1879-1976: Special Report Series 1, 32 p. .60 p/h.

Ludvigson, G. A., and Bunker, B. J., 1979, Status of hydrogeologic studies in northwest Iowa: Open File Report, 37 p. $2.00 plus .35 p/h.

Lutenegger, A. J., Hallberg, G. R., and Handy, R. L., 1979, Review of geotechnical investigations of loess in North America: Open File Report, 15 p. $0.50 plus .35 p/h.

Ravn, R. L., 1978, An introduction to the stratigraphic palynology of the Cherokee Group (Pennsylvanian) coals of Iowa: Technical Paper No. 6, 117 p., 22 pls. $6.00 plus .35 p/h.

*(Mr. Koch is Assistant State Geologist.)*