

IOWA
GEOLOGY
1996

Iowa Department of Natural Resources

NUMBER 21

IOWA GEOLOGY 1996

Iowa Department of Natural Resources
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COVER:

Clusters of quartz crystals, especially rose, white, smoky and amethyst varieties were used to decorate this wall in the Grotto of the Redemption at West Bend in Palo Alto County. This close-up view also includes blue-green copper minerals, fragments of red jasper, glints of pyrite ("fool's gold"), globular mounds of white chalcedony, rust-colored iron-rich rocks, sea shells, and small geodes. The Grotto was hand-built of an extraordinary array of high-quality specimens brought to the Iowa countryside by Father Paul Dobberstein between 1912 and 1954 (see p. 18).

Cover photo by Paul VanDorpe



Jean Cutler Prior *Editor*
Patricia J. Lohmann *Publication Designer*



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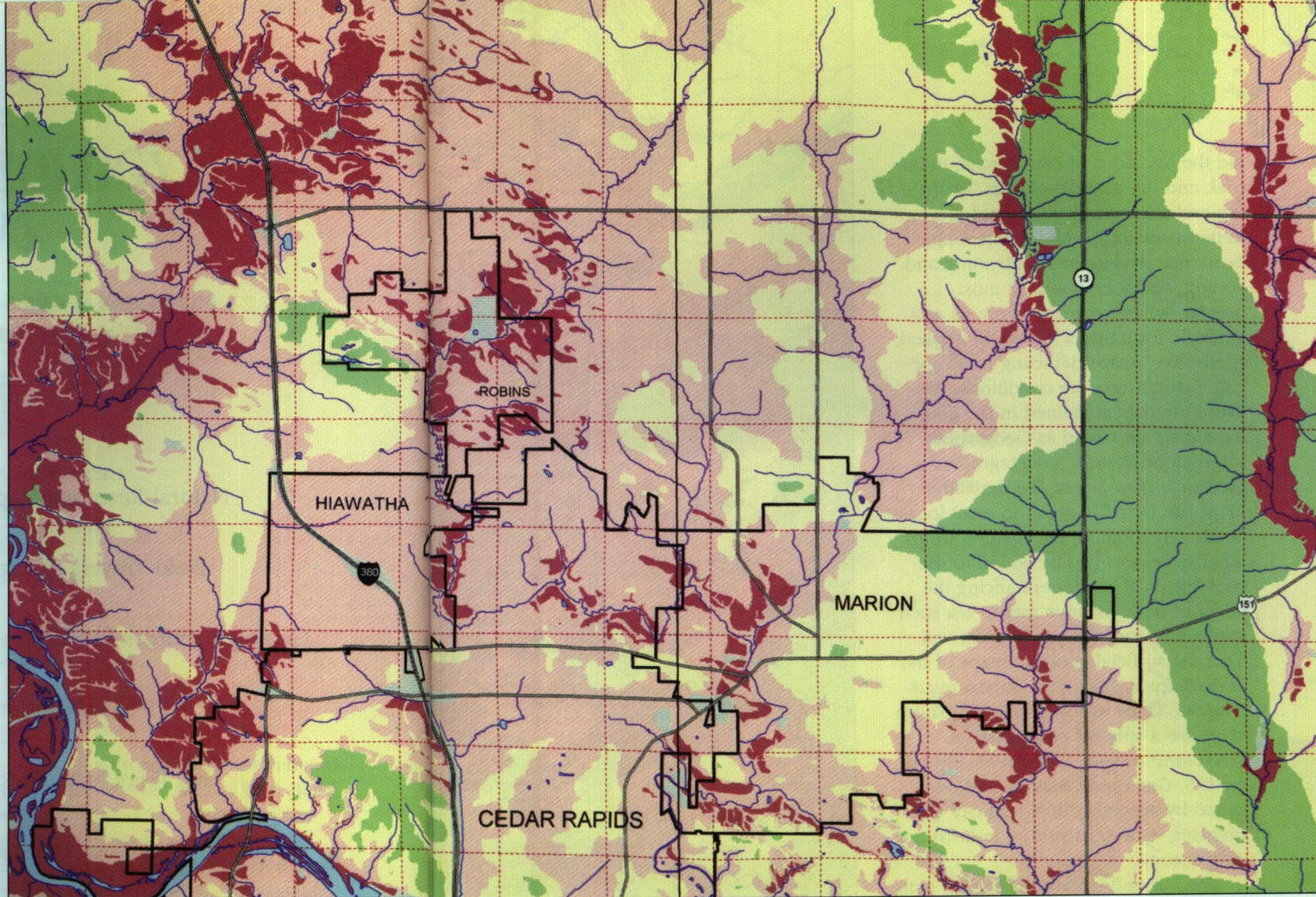
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NATURAL RESOURCE MAPPING OF LINN COUNTY

To help community leaders make informed decisions on economic development, natural resource management, and environmental protection

Robert D. Libra

In 1994, the Geological Survey Bureau (GSB) began producing detailed geologic maps of portions of Linn County. These maps depict the types of geological materials – rock strata, glacial deposits, stream alluvium, and wind-blown sand and silt – that occur within about 18 feet of the land surface. Compiled at a scale familiar to users of U.S. Geological Survey topographic maps, 1:24,000 (1 inch = 2,000 ft), they incorporate a wide array of information, including water well records, observations of rock and soil exposures, borings taken along road and power line rights-of-way, and the Linn County Soil Survey. Existing data



sources are assembled and studied, and then augmented with research borings obtained by GSB staff. Bore holes are targeted to provide needed information about the relationship between the terrain and its underlying materials within local areas. This research-based understanding is the key to constructing a geologic map, as it

allows the mapper to project information beyond the point-specific data provided by individual drill holes.

Geological maps produced at this scale and by this process are quite detailed, and are rich in information about the near-surface environment where society conducts its day-to-day business. This information, which can

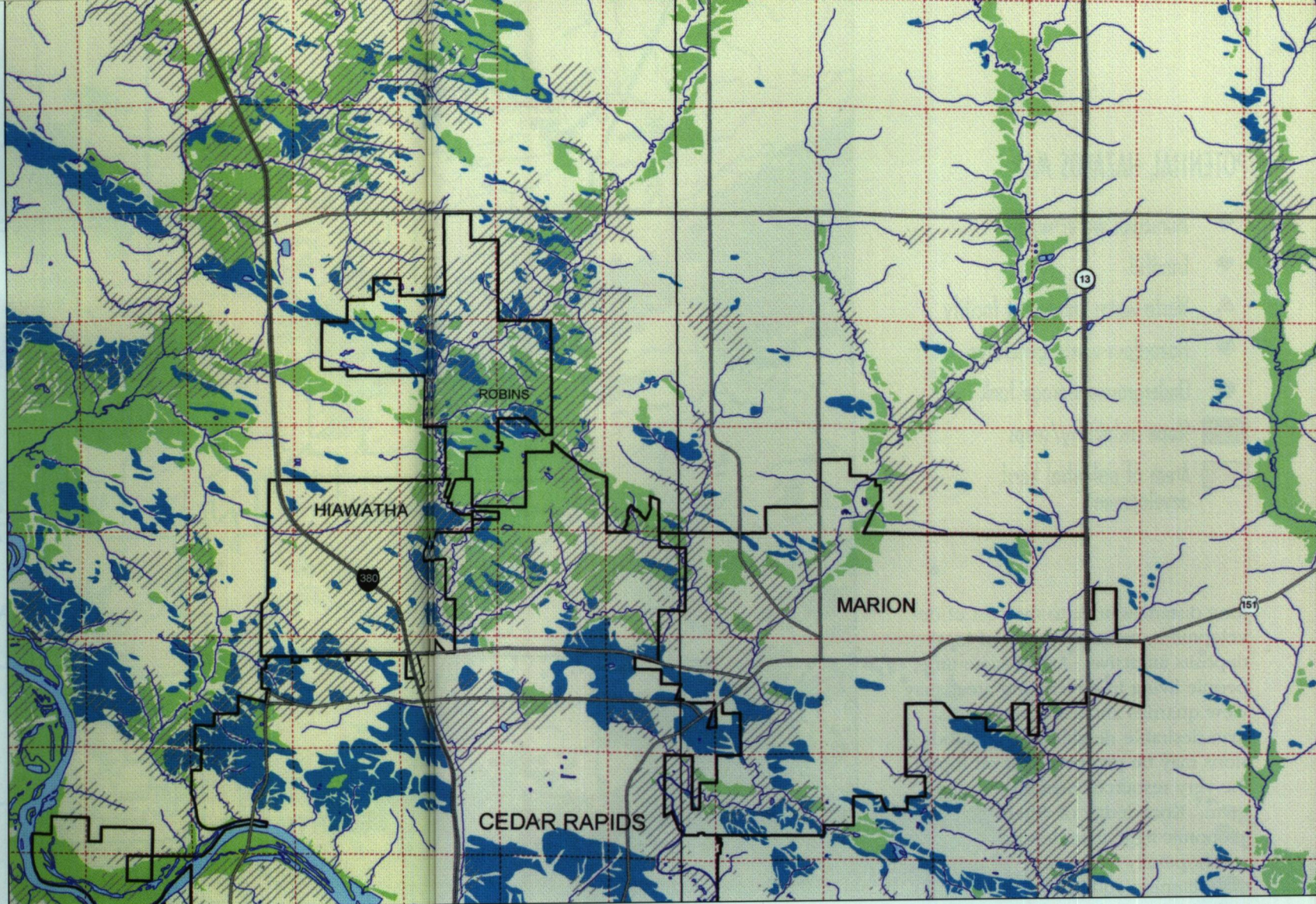
GROUNDWATER VULNERABILITY MAP

- Most vulnerable aquifers
- Vulnerable aquifers
- Less vulnerable aquifers
- Protected aquifers

aid the decisions of commercial, industrial, and housing developers; quarrying and mining industries; and local departments of health, engineering, economic development, planning and zoning, and solid waste, is most useable when processed from its raw geologic form into a variety of applied, "derivative" maps depicting more specific natural resource conditions. Because the data contained in the geologic map are stored as Geographic Information System "coverages," or electronic map layers, the derivative maps can be tailor-made to meet local needs. In addition, information from other coverages can be added to the geologic data, further enhancing the utility of the derivative maps. Six such applied resource maps were derived from the surficial geologic maps of the Cedar Rapids North and Marion quadrangles. Three are shown here. These maps are a spin-off of the federal STATEMAP project, funded initially by the U.S. Geological Survey, and later joined by several county and city agencies, as well as private industry in Linn County.




The Groundwater Vulnerability map (p. 2-3) shows the varying susceptibility of aquifers to contamination from near-surface sources. The most vulnerable areas are shown in red and include areas underlain by sandy alluvial aquifers, areas where bedrock aquifers lie near the land surface, and areas characterized by karst features such as sinkholes. In contrast, aquifers in areas shown in green are overlain by 100 feet or more of slowly permeable glacial deposits, and are largely

protected from surface-related contamination. These areas with greater natural protection are better suited for developments that have the potential to adversely impact groundwater, such as waste-generating industries or agribusinesses, housing developments with a high density of septic systems, or landfills.



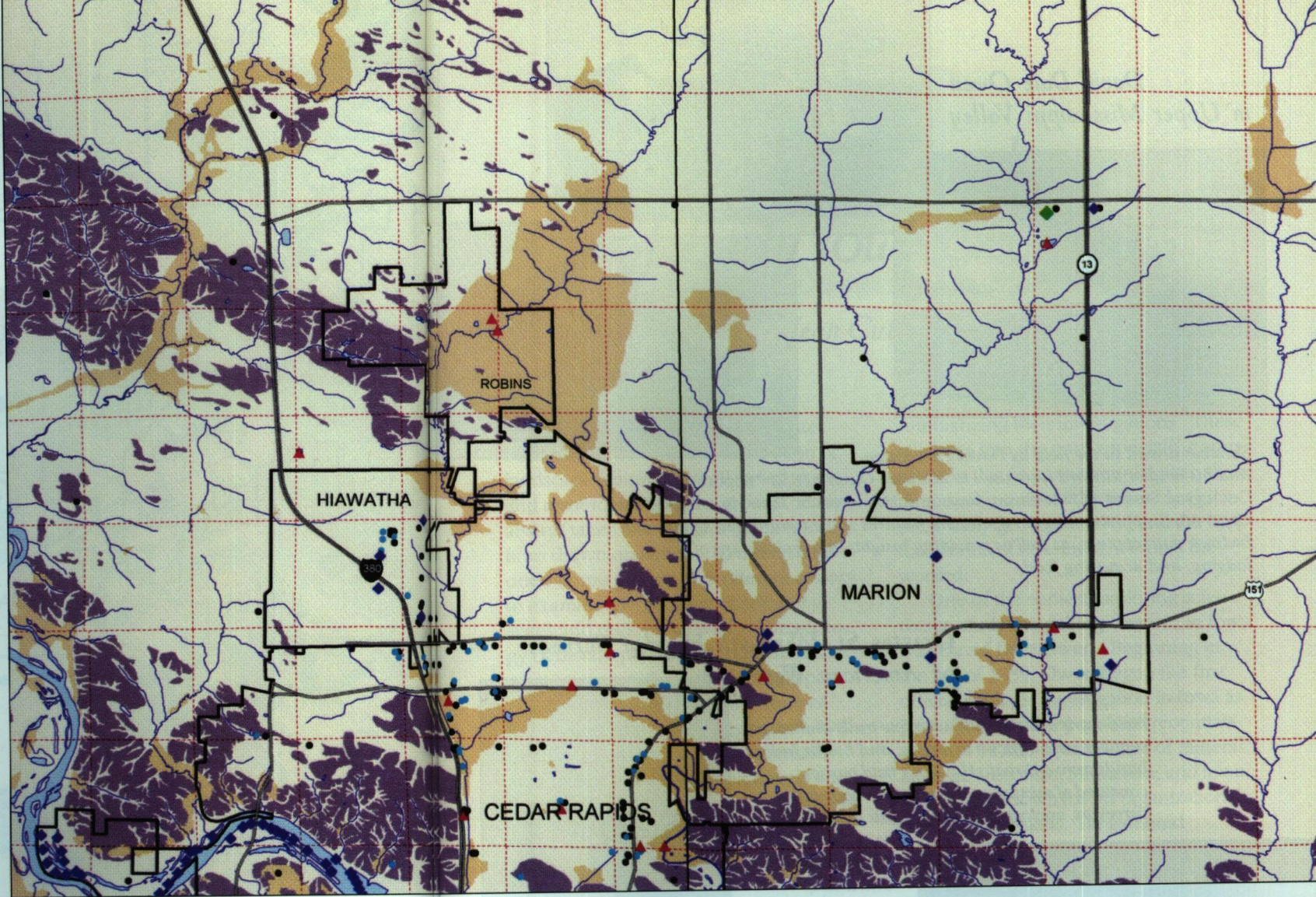
The Aggregate Resources map (above) shows where shallow, readily extractable deposits of sand, sand and gravel, and rock are present and therefore identifies potential locations for sand pits and quarries. These materials are in demand in areas where "suburbanization" of rural areas is occurring. Having to transport aggregate

AGGREGATE RESOURCES MAP

-  Limestone/dolostone
-  Sand and gravel
-  Fine sand

POTENTIAL HAZARDS MAP

- ◆ Municipal water supply
- ◆ Landfill
- ▲ Waste-water treatment facility
- Hazardous-waste generator
- Underground storage tank
- Slope instability/seeps
- Areas of potential karst development



long distances adds to the cost of development, making the use of local deposits attractive. At the same time, people living in developing areas may view quarries and sand pits as less-than-desirable neighbors, and subdivisions may be planned right on top of the very resources needed to build them. Knowledge of where potentially economic aggregate deposits occur will hopefully add to the discussions that planning and zoning officials, pit and quarry operators, developers, and home buyers are having on these issues.

The Potential Hazards map (right) indicates areas where thick deposits of wind-blown silts and sands are piled upon the less permeable underlying glacial deposits. These conditions often result in seeps, where shallow groundwater discharges to the surface near the base of the sand and silt deposits, resulting in slope instability and

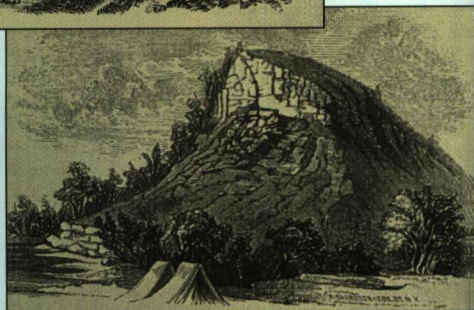
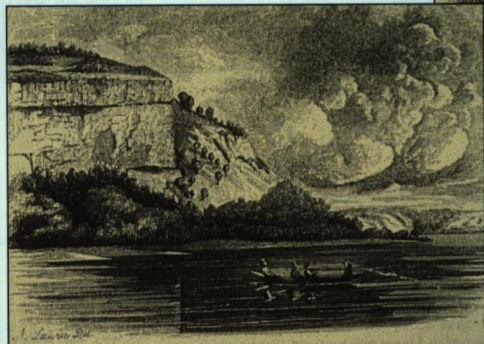
construction difficulties. Also shown are areas where rocks that are susceptible to karst formation lie near the surface. The potential for sinkhole formation in these areas needs to be taken into account when development is planned. The map incorporates other coverages as well, showing the locations of known potential sources

of contamination, such as landfills and underground storage tanks.

Geologic field research – from drilling soil borings to examining outcrops – yields the understanding needed to accurately map geologic materials in the shallow subsurface. Applied resource maps can then be generated to answer questions, from both the pri-

ivate sector and county or city agencies, concerning land use, development, and zoning, and hopefully will form a basic data source for all interested parties as they wrestle with the thorny issues involving economic development, natural resource availability, and environmental protection. ♦

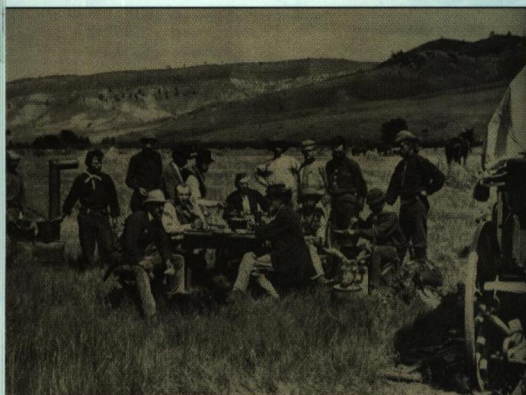
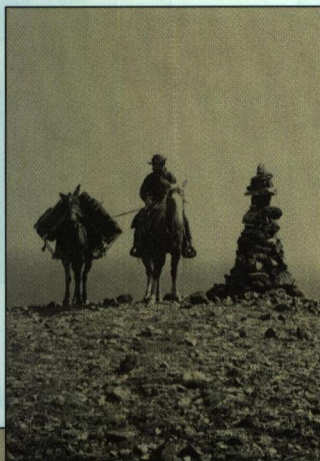
*David Dale Owen
in Upper Mississippi Valley*



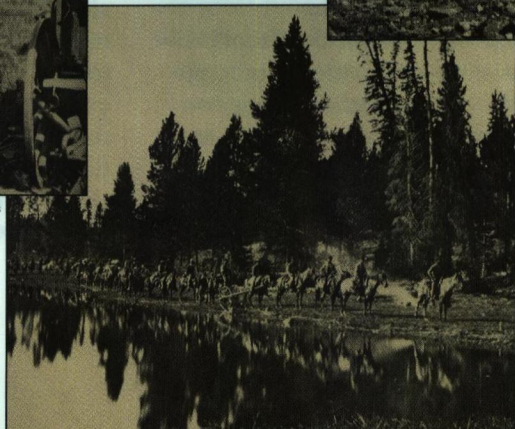
Sketches drawn in the field by David Dale Owen and his brother Richard were used to illustrate Owen's 1852 "Report of a Geological Survey of Wisconsin, Iowa and Minnesota." Their drawings of the Upper Mississippi River region document features of the terrain and significant bedrock outcroppings, as well as providing insights into their means of travel, lodging, and acquiring food.

*Orestes St. John with Hayden Surveys
of American West*

Field work was difficult, with few trails and maps; supplies were difficult to obtain; and hostile Indian bands were a threat. Hayden's field parties consisted of mining engineers, anthropologists, surveyors, zoologists, and geologists in addition to cooks, packers, photographers, and artists.



Photos from National Archives



Field Travels of Early Iowa Geologists

Jean Cutler Prior

Geology is not confined by state boundaries. Tracing the distribution of landscape features as well as soil, rock, and resources below the ground nearly always takes one beyond the political lines drawn on a map. To understand one's home ground, it is often necessary to examine the geology of adjoining states and regions, as well as the geology of distant places that today resemble what Iowa was like in the geologic past.

Assembling our current picture of Iowa's geologic history began with 19th Century geologists who were remarkable for the breadth of their travels and the historic significance of their journeys. There were few geologists, vast distances to cover, and a slow pace of travel. Their perspectives on science were broad-based and encompassed various fields of natural history. Many early geologists who are identified with Iowa are also known for their work in other regions of the country. Wherever they traveled, they always displayed a strong obligation to their science – to observe, collect, and record. The story of their work and how they accomplished it is preserved in a fascinating array of early drawings, historic photographs, personal letters, and publications

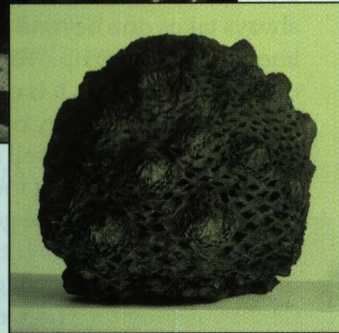
summarizing their investigations. These glimpses into the past, especially appropriate in this Sesquicentennial year, show us something about the times in which these early geologists lived and the historic frame of reference in which they worked.

One of the earliest exploring scientists to study the geologic record in Iowa was David Dale Owen. Beginning in the fall of 1839, Owen began the first official geologic investigation in Iowa as part of a federally sponsored reconnaissance of 11,000 square miles of mineral lands in Wisconsin, Minnesota, and Iowa. Owen was known for his organizational and logistical skills. He gathered provisions, marshaled assistants whom he instructed in the principles of geology, organized field parties and mapped every quarter-section of land in the designated tri-state area. The results of this and later investigations were published in 1852 in a 639-page monograph that is richly illustrated with sketches of landscapes, drawings of fossils, and maps of river valley cross-sections. Rivers were the principal avenues of exploration into the country's interior, and travel was usually by canoe. Owen was a skilled artist, and



Above: Some family members at the Payne and Arnold ranch where Macbride collected and purchased cycad fossils.

Right: This petrified cycad, collected from the ranch, shows well preserved cones and leaf scars. It became the "type specimen" for a new species of these fossil plants, which resembled short, chunky, palm trees.



most of the report's illustrations are from sketches he and his brother Richard drew in the field (sketches, top p. 8). Owen's pioneering work and remarkable personal energy were directed not only toward the Upper Mississippi Valley, but also to later careers as State Geologist of Indiana, Kentucky, and Arkansas.

Another early geologist to work in Iowa was Orestes St. John, Assistant State Geologist of Iowa between 1866 and 1869. His work focused on the coal deposits of south-central Iowa and the

geology and mineral resources of the western half of the state, as well as on paleontology, especially fossil fish. By the mid-1870s, however, he was engaged in similar reconnaissance field work with the historic Hayden Surveys of what were then the "western territories," first in New Mexico and Idaho, then in Wyoming and Colorado. Travel was by pack trains of Army-issue horses and sure-footed but cantankerous mules on whose backs cumbersome loads of photographic and engineering equip-



Photos courtesy of The University of Iowa Calvin Collection

Macbride and Calvin in Cycad Country, 1893. Black Hills of South Dakota

ment were carried. These federally commissioned expeditions of exploration and resource evaluation were led by such geological luminaries as Ferdinand V. Hayden, Clarence King, John Wesley Powell, and George M. Wheeler. The documentary artists and photographers (especially William H. Jackson, photos bottom p. 8) who accompanied these trips brought to the rest of the country some of the first views of the grandeur of the western mountains and thus laid the groundwork for the future establishment of such national parks as Yellowstone, the Grand Tetons, and the Grand Canyon.

In the 1870s, while in the Black Hills of South Dakota, the Hayden Surveys discovered fossil cycads, a prominent group of plants that flourished with the dinosaurs during the Mesozoic Era, about 60 to 250 million years ago. Like stunted palm trees, they had large frond-like leaves crowning a squat, barrel-shaped trunk, usually less than 3 ft in

Left: Thomas Macbride, seated on a petrified log near the cycad fields of the Payne and Arnold ranch (far left), made a substantial contribution to knowledge about ancient plant life in North America. He was one of the first to recognize that peculiar rocks collected by local ranchers were actually fossil plants called cycads.

height. Their trunks were imprinted with the patterned scars of former leaf stalks, and they bore their seeds in cones (photo inset, left). Local ranchers collected the unusual rocks as curios in the early 1890s, referring to them as "petrified pineapples." However, one of the first scientists to actually collect and publish accounts of these cycads was Thomas H. Macbride, noted botanist, educator, and later President of The University of Iowa, as well as a valued scientist with the Iowa Geological Survey. During a visit to the southern Black Hills, he saw a petrified cycad displayed as a curio in a store in Minnekahta and was directed to the Payne and Arnold ranch where he found 40 or 50 other specimens weathering out of a nearby hillside. He explored and collected, accumulating one of the finest collections of these fossils known at the time. His notebook of expenses for a November 1893 trip listed crackers, figs, coffee grounds, candles, lamp oil and chimney, hotel room (\$2.50), meals (\$.25 to \$.75), train tickets, "cycad" (\$10 paid to Arnold) and livery costs, presumably for a horse and buckboard to transport about 25 of the heavy fossils to Hot Springs to be crated and shipped by



Houser writes from Havana, Cuba on May 28, 1893:

"We are much elated this morning over our success on the crinoid grounds; . . . the very first cast of the tangles brought up 25 beautiful specimens of Pentacrinus! What shouting! . . . At about the 200 fathoms line, crinoids are evidently as abundant as they were during the Sub-Carboniferous times [Mississippian] represented at Burlington [Iowa]; . . ."



Photos courtesy of The University of Iowa Calvin Collection



University of Iowa Bahamas Expedition. Modern crinoids collected for research into Iowa's past populations.

rail to Iowa City. On this trip, Macbride was accompanied by Iowa's State Geologist Samuel Calvin (also Chair of the University's Dept. of Geology), who went with him to settle the questions of stratigraphic position and geologic age of the cycad beds. Calvin determined that they were Cretaceous age (Late Mesozoic). Macbride and Calvin's work helped bring scientific attention to what became one of the world's prime localities for cycad fossils.

Samuel Calvin, Thomas Macbride, and Charles Nutting were eminent Iowa naturalists at the turn of the 20th century. They explored the full realm of natural science, including zoology,

botany, and geology. Obtaining specimens for study and museum displays was the purpose of expeditions that were organized by The University of Iowa. A particularly significant trip was to islands of the Bahamas and Dry Tortugas in 1893. Calvin, unable to go along, was kept advised via colorfully written letters from Gilbert L. Houser, an instructor and assistant to the expedition leader Charles Nutting. Houser took numerous photographs of the voyage (photos above). Also on board was Melvin F. Arey, Professor at what later became the University of Northern Iowa and who went on to author several county geologic reports for the Iowa

Geological Survey. The group sailed from Baltimore on the "Emily E. Johnson," a 95-foot, two-masted schooner (photos above). Among other tasks, the expedition examined modern coral reefs in the warm, clear tropical waters. Equipped with primitive, hand-operated dredging equipment, the expedition was noted for its success in accurately locating and collecting the graceful "sea lilies" *Pentacrinus* – the rare, stalked crinoids (photo above, right). Their investigations into the clarity and temperature of seawater, and the myriad of other forms of sea life inhabiting the warm Caribbean waters improved scientists' understanding of the marine environments that

were required for crinoids to thrive in Iowa's geologic past.

Our present understanding of Iowa's geology as well as the broader national geologic picture is built on a body of knowledge first assembled by these and other early geologists with widely different experiences in diverse geographic areas. Today, we are able to import data from satellites, map on computers, and locate ourselves with Global Positioning Systems; yet it remains fundamentally important to travel, observe, collect and record – to examine the geology beyond Iowa's borders in order to better understand the geology within. ♦

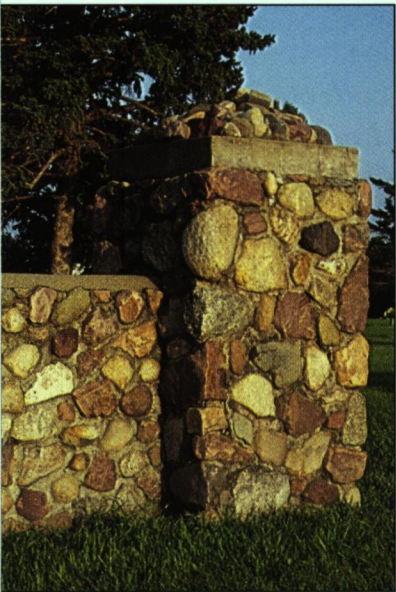
GEOLOGIC SOURCES OF HISTORIC STONE ARCHITECTURE IN IOWA

BRIAN J. WITZKE

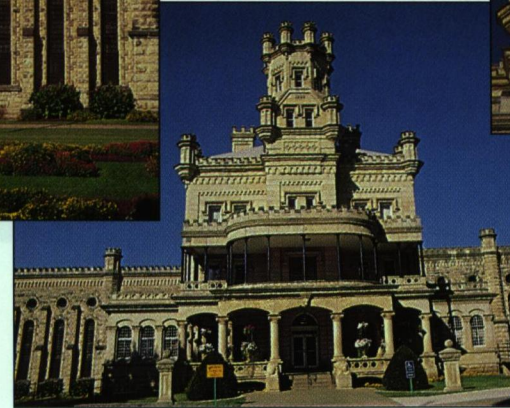
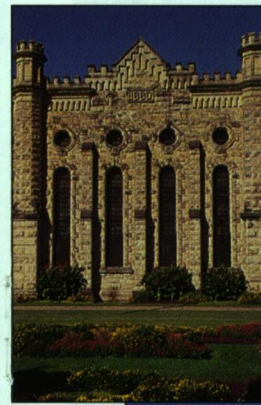
Iowa is richly endowed with a variety of rock resources suitable for building construction, and their utility is particularly well displayed in the early architectural heritage of our state. Although building stone is still actively quarried at a few places in Iowa, notably the quarries at Stone City, quarrying of building stone was more widespread during the 1800s and early 1900s, before the advent of cement block and poured concrete construction. Wherever rock resources were conveniently located near growing communities and farms, quarry workers labored to extract blocks of rock for building purposes, especially for foundation construction. Blocks were often "dimensioned" into desired sizes by the use of hammer and chisel, leaving marks that often are still visible on historic stone buildings across Iowa. Some quarry operations used rock saws and other mechanical devices to make precision block cuts or create stone lintels, trusses, or decorative pieces. Masons used these stone materials to construct houses, churches, stores, public buildings, and other structures, which are lasting monuments to their skills and an appropriate focus of commemoration during this Sesquicentennial year.

A diversity of rock types have been used in Iowa for stone construction. Limestone and dolomite have been extensively quarried for building stone.

Although most sandstones are not very durable, some that are cemented by iron minerals provide a lasting and attractive building stone, as seen in the Amana colonies. Additional materials are locally important, including field stones derived from glacial drift (photo, left). Even quartzite, coal (inside back cover), and geodes (see cover) have been used. The Geological Survey Bureau has played an important historic role in locating and describing the varieties of stone available for building and other uses in Iowa.



Robert McKay



Paul VanDorpe



IOWA MEN'S REFORMATORY, ANAMOSA. *The Men's Reformatory, constructed in several stages between 1872 and 1936, is one of the most imposing stone buildings in Iowa. It is composed of carefully dimensioned blocks of "Anamosa stone" quarried by convict labor at the neighboring "penitentiary quarries." This stone, with its distinctive finely laminated appearance, is an attractive and durable Silurian-age dolomite still actively quarried for building stone at nearby Stone City.*



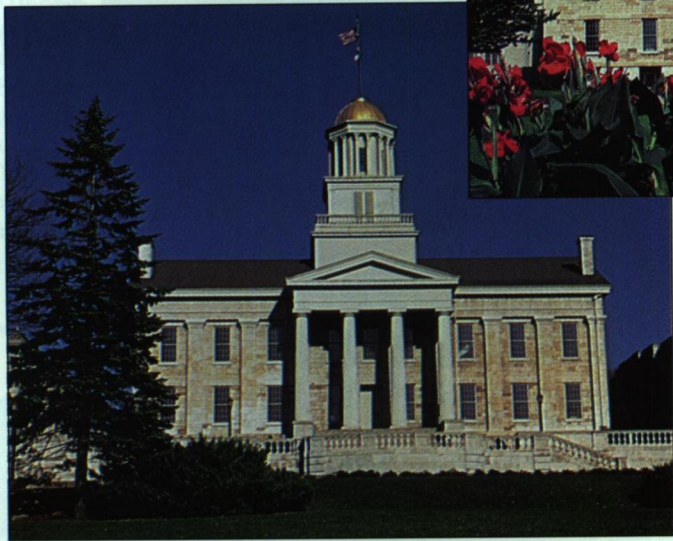
SIoux CITY

PUBLIC MUSEUM. *The Sioux City museum is housed in the Romanesque-style Peirce mansion built in the early 1890s. It is constructed of distinctive and durable pink-to purple-colored Sioux Quartzite of Precambrian age, the oldest rock unit exposed at the land surface in Iowa. Quartzite quarries are located near Sioux Falls and nearby areas of Minnesota and northwesternmost Iowa. Many outstanding buildings are constructed from this enduring stone in the tri-state region and elsewhere.*

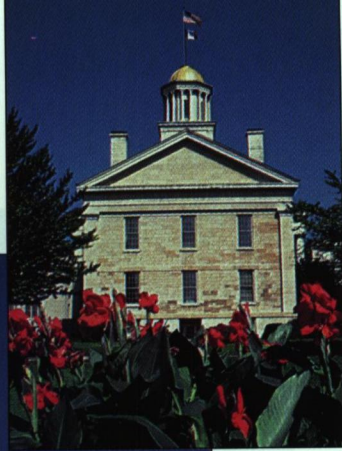


Photo courtesy of Sioux City Public Museum

OLD CAPITOL, IOWA CITY. *Stately limestone block construction characterizes Iowa's former territorial capitol and first state capitol, whose cornerstone dates to 1840. The imposing blocks of Devonian-age limestone were hand-quarried at Iowa City and along present-day Coralville Lake in Johnson County. Occurrences of natural building stone in the area were important in deciding the site of Iowa's capital city.*



Photographic Services, The University of Iowa

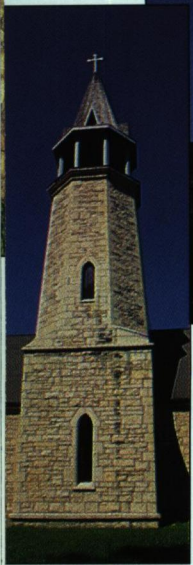


Steve Hall



NEW MELLERAY ABBEY, DUBUQUE CO. *Many beautiful stone churches can be seen across Iowa, and the New Melleray Abbey near Dubuque is illustrated as an example of the rich heritage of religious construction found in our state. This Trappist monastery was constructed by monks in several construction phases beginning in 1868 and*

continuing into the 1950s. It is composed principally of Silurian-age dolomite blocks from the monastery's quarry, with edge-blocks and windows of Anamosa stone. Some intermediate construction is of Indiana limestone, a common building stone used throughout the Midwest.



Ken Formanek

HISTORIC MONTAUK, CLERMONT. *This beautiful Italianate mansion of brick and native limestone was built in 1874 for William Larrabee, Iowa's 12th governor. Montauk serves as an example of the use of building stone for the foundation, lintels, and cornices in an otherwise brick construction. Many buildings from the 1800s and early 1900s possess building stone foundations, but later constructions are primarily characterized by foundations of cement block or concrete.*



Lynette Seigley

STATE CAPITOL, DES MOINES.

The state capitol building in Des Moines, constructed from 1872-1884 from a variety of building stones, is a spectacular example of late 19th-century stone construction. The granite base was secured from Buchanan County boulders and quarries in Minnesota. Limestone blocks comprising the foundation and lower levels were quarried in Iowa at locations in Johnson and Madison counties. The bulk of the exterior was constructed from sandstone blocks derived from quarries in Missouri. Additional stone, both local and imported, was used in the interior construction, including a number of decorative marbles.



Ken Formanek

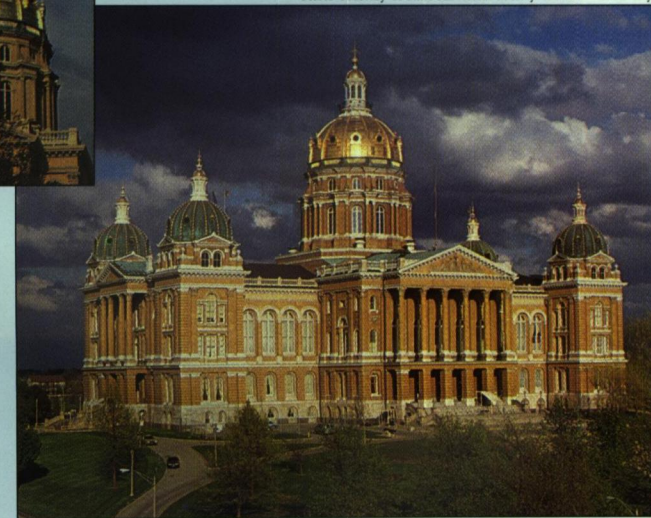
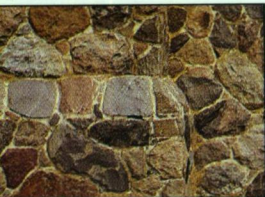


Photo courtesy of State Historical Society of Iowa - Iowa City



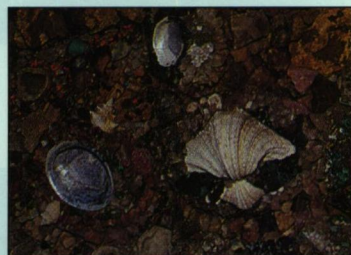
Robert McKay



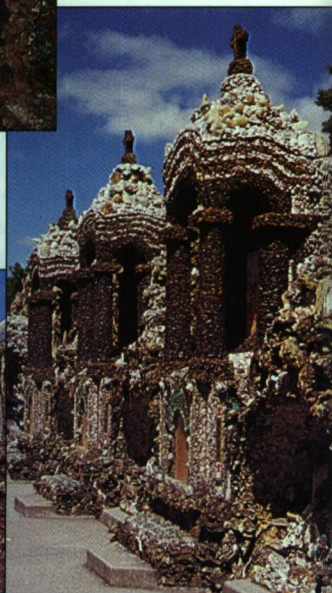
IOWA LAKESIDE LABORATORY, W. OKOBOJI LAKE. Glacial deposits across Iowa contain an abundance of boulders and cobbles of igneous and metamorphic rocks transported via glaciers from Minnesota. In areas where the bed-

rock is deeply buried, these easily accessible field stones have been utilized for building, principally house and barn foundations. The fine example of boulder construction shown here (Shimek Lab) is found at Iowa Lakeside Laboratory, a state university field station for natural history classes and research.

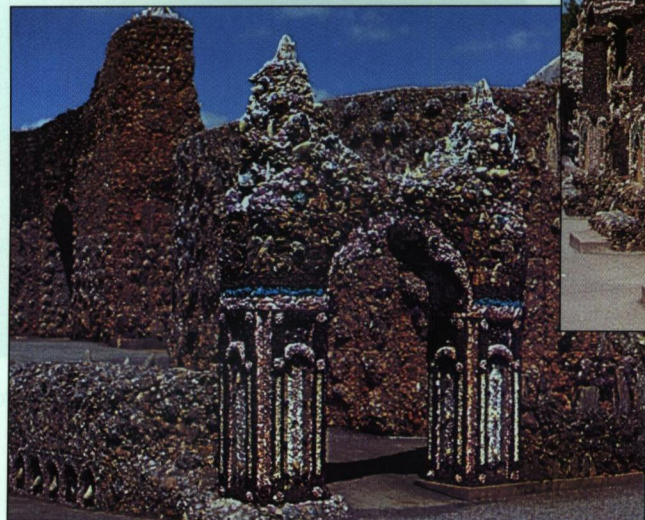
GROTTO OF THE REDEMPTION, WEST BEND. The famous West Bend grotto provides an example of the varied styles of stone construction found in Iowa. It incorporates an incredible diversity of rock types extravagantly encrusted over a concrete framework. Striking rocks, minerals, crystals, ores, semiprecious stones, shells, and fossils came from many localities around the United States and elsewhere. Construction was initiated in 1912 under the direction of Father Paul Dobberstein, whose vision and lifelong dedication resulted in this remarkable labyrinth of grotto structures.



Paul VanDorpe



Lynette Seigley



Jean Prior

FORT ATKINSON STATE PRESERVE. Fort Atkinson was constructed between 1840 and 1842 as a frontier military post in northeast Iowa to enforce a treaty to protect the area's Winnebagos from other Indians. Limestone slabs derived from the fort's quarry were used to construct foundations for the barracks and other buildings. The main buildings were limestone-walled constructions. Restored buildings as well as stone ruins are included today within this state preserve.



Ken Formanek



Paul VanDorpe



SANDSTONE HOUSE, AMANA. This sandstone house (Olde World Lace Shoppe), built in 1857, is characteristic of the simple and pleasing architectural style found throughout the Amana colonies. Residential and community buildings in several of the

Amana villages are built from this distinctive locally quarried reddish-brown sandstone of Pennsylvanian age. Amana's sandstone buildings largely date from the 1850s through 1870s.



PALEOKARST IN IOWA

Robert M. McKay

Following heavy rain, a muddy torrent of water laden with dislodged soil, twigs and leaves rushes down a gully and spills over a lip of rock, disappearing into a dark echoing hole. Crashing to the bottom of the pit, the flow continues outward and downward along narrow passageways until some of it slows to a standstill in a large subterranean room rapidly filling with turbid water and debris.

This description characterizes a geologic process that takes place in “karst” landscapes. Such landscapes are typically underlain by shallow limestone, and surface drainage is con-

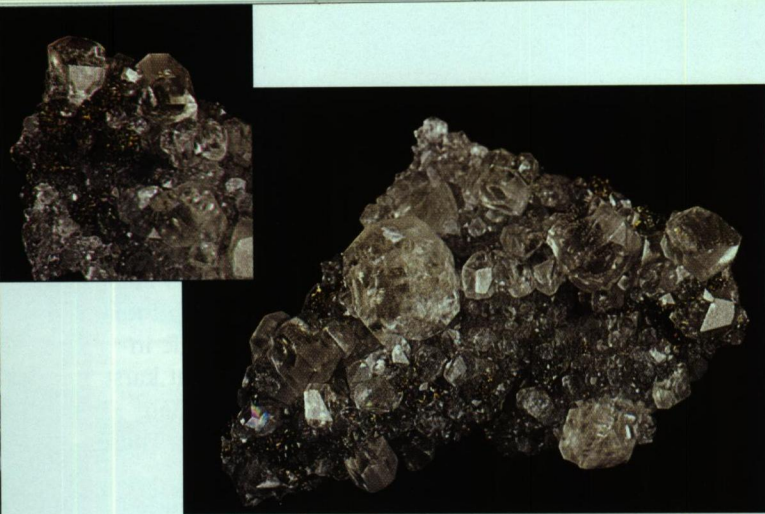
nected to subterranean cavern systems via sinkholes and vertical openings in the rock. Today, karst processes are active in the limestone-dominated terrain of northeast Iowa. Geologic investigations, however, show that karst conditions also occurred elsewhere during the state’s geologic past. These ancient karst conditions, or “paleokarst” as it is known, include similar features that developed in much older limestone landscapes, then were buried and preserved beneath

Left: The recessed opening in this old quarry face at the Linwood Stone Company property in Scott County was excavated for access to additional limestone resources underground. Subsurface features encountered here during mining include open paleokarst caverns lined with beautiful mineral crystals (p. 22-23).

Right: A shale-filled chamber is exposed in the River Products Company limestone mine in Louisa County. Weak shale in these pockets of paleokarst causes safety hazards for mine workers and adds impurities that must be removed to maintain product quality.

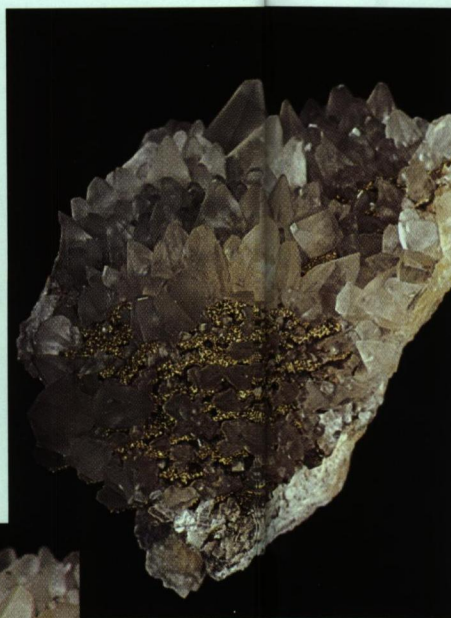
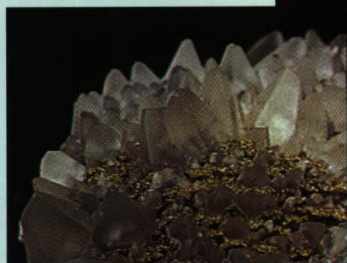


Michael Bounk



Museum-quality varieties of the mineral calcite edge the paleokarst chambers encountered underground at the Linwood Stone Co. mine in Scott County.

Above: Brilliant prisms of flat-topped or "nailhead" calcite are accented with pyrite ("fool's gold") and bronze-colored chalcopyrite.



Left: Sharply pointed crystals of "dog-tooth" calcite are laced with the gold luster of pyrite. **Above:** Gray, fine-grained limestone grades to a band of white crystalline calcite, then to tiny points of "dog-tooth" calcite tipped with iron, giving the crystals their brownish color.

Photos by T. Scott Krenz

younger geologic formations.

Karst conditions result when water and carbon-dioxide from the atmosphere and soil combine to form mild carbonic acid which then mixes with groundwater. As the water descends along fracture openings and through thin separations between rock layers, the weakly acidic groundwater slowly dissolves portions of the limestone, eventually forming subterranean cavern systems that can have complex links back to the land surface. Karst development eventually ceases as climate, vegetation, groundwater infiltration and local relief change, and the subsurface openings gradually fill with various earth materials.

In Iowa and other parts of North America, conditions conducive to karst formation recurred periodically between 470 and 315 million years ago,

during the Ordovician, Devonian, Mississippian and Pennsylvanian periods of geologic time. These ancient episodes of karst development are known to Iowa geologists from the paleokarst settings seen in the state's mines and quarries. Natural outcroppings of paleokarst are rare, though a fine example is found below Bridal Veil Falls at Pikes Peak State Park in Clayton County, where Ordovician sandstone fills a paleokarst basin in the underlying dolomite. More frequently, paleokarst is exposed during road construction or the quarrying and underground mining of limestone for road and concrete aggregate. Typically, the

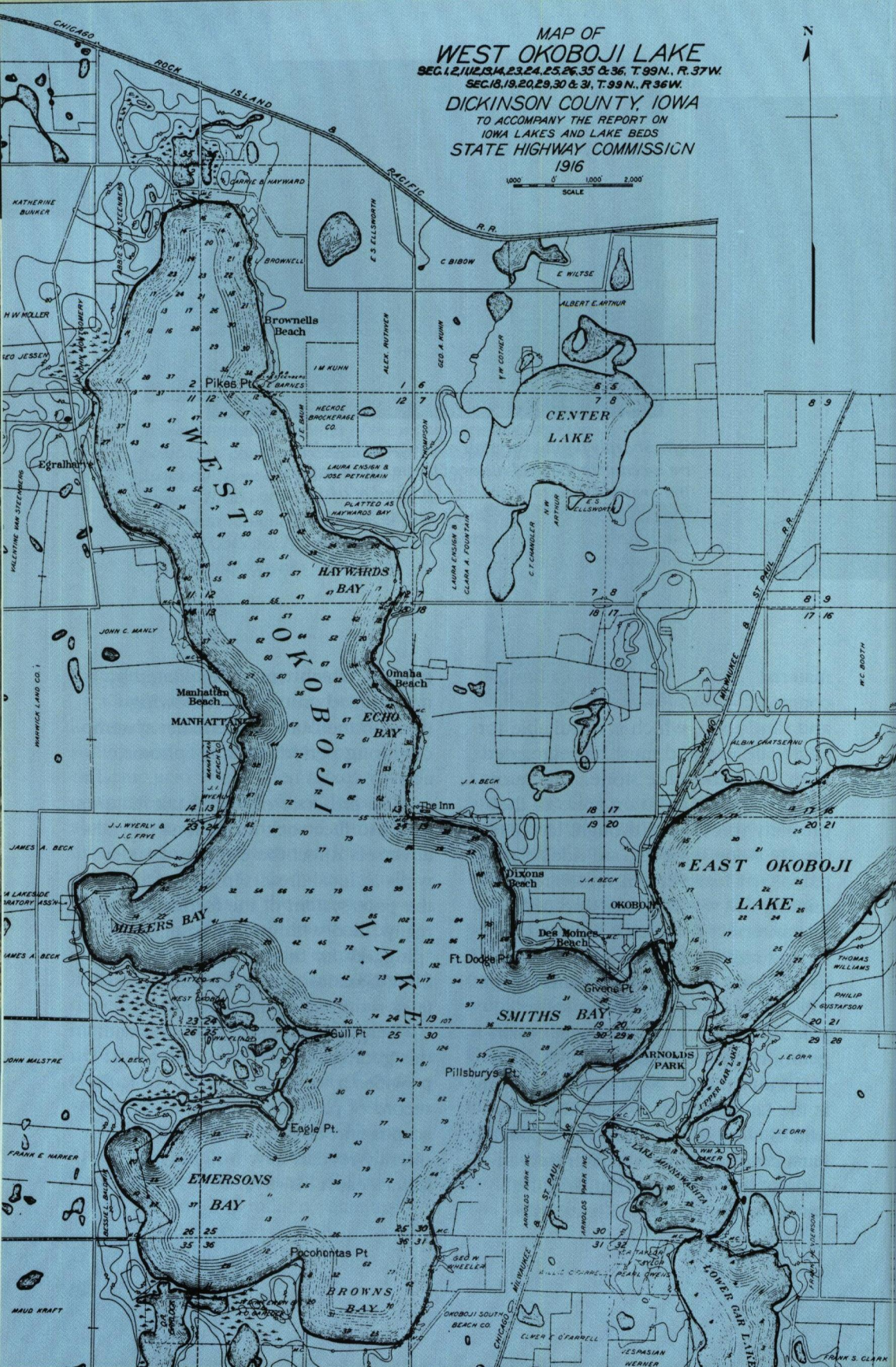
material filling the paleokarst basin is composed of soft, interbedded shale and sandstone, which is unsuitable for aggregate use and must be segregated from the marketable stone. Operators may find that significant areas of their property, previously thought to contain quality stone reserves, are riddled with paleokarst features. In underground mining, the working-face and ceiling may intersect paleokarst fillings, thus mixing impurities with the limestone. In addition, these weaker materials can cause safety hazards, as the softer paleokarst filling can collapse, endangering mine workers.

In an unusual geologic setting seen at the Linwood Stone Company mine near Davenport, a portion of a paleokarst cavern complex was preserved without a sediment filling, and the cavern openings contain exquisite

crystals, which were precipitated by mineralized groundwater flowing through the buried paleokarst system over long periods of time (photos, above).

The presence of paleokarst features in subsurface rock formations may also adversely affect the drilling of water wells in local areas. In some cases, the pore system of the formation, normally filled with groundwater, is "plugged" by fine-grained paleokarst fill, a situation which usually necessitates redrilling of the well nearby.

Despite problems associated with this geological condition, paleokarst provides a valuable and unique rock record of past earth processes, landscapes and environments, and frequently reveals new insights into Iowa's earth history. ♦



MAP OF
WEST OKOBOJI LAKE
 SEC. 1, 2, 11, 13, 14, 23, 24, 25, 26, 35 & 36; T. 99 N., R. 37 W.
 SEC. 18, 19, 20, 29, 30 & 31; T. 99 N., R. 36 W.
 DICKINSON COUNTY, IOWA
 TO ACCOMPANY THE REPORT ON
 IOWA LAKES AND LAKE BEDS
 STATE HIGHWAY COMMISSION
 1916

GULL POINT STATE PARK: A GLACIAL LEGACY

Lynette S. Scigley
 Deborah J. Quade

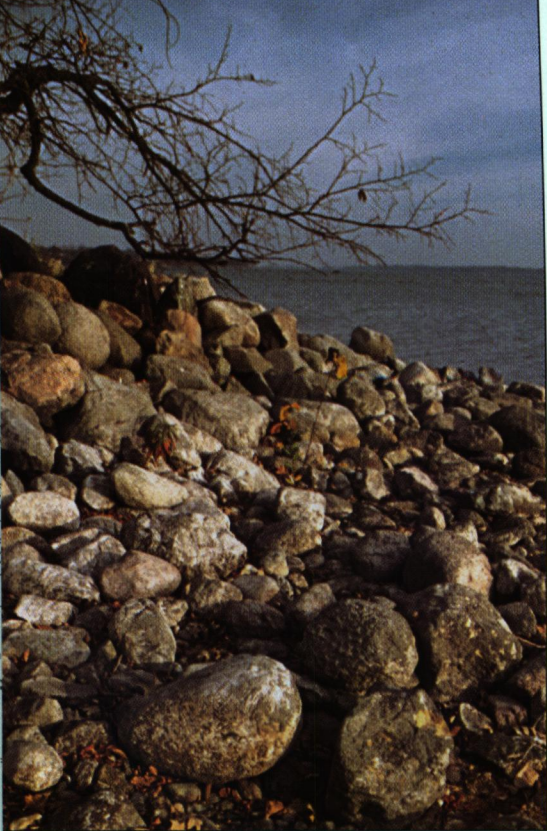
Nestled in northwestern Iowa is an area known as the "Iowa Great Lakes." Historically, this region has been a popular vacation destination, yet few people realize it is also a showplace of geologic features that reflect the state's most recent contact with glaciers. In Dickinson County, the curved, boulder-strewn shores of Gull Point State Park jut outward between Miller's Bay and Emerson's Bay into the deep waters of West Okoboji Lake (map left). The park itself is surrounded by clusters of knobby hills, smaller lakes and bogs, and abundant sand and gravel deposits – all reflecting the last advance of glacial ice into Iowa.

Gull Point State Park and the Iowa lakes region occur along the southwest edge of an ice sheet that surged southward about 13,500 years ago, halting at what is now the city of Des Moines. This ice stagnated across the landscape and was followed by several smaller readvances over the next 1,500 years. The resulting topography in the lakes area is especially eye-catching because the younger glacial advances overlapped the older ice and merged to create widespread areas of high-

relief, hummocky, "knob-and-kettle terrain." The irregular hills of glacial debris associated with these compressed ice margins are laced with sloughs, bogs, and wetland "potholes" that formed in direct contact with the slowly disintegrating ice.

The Iowa lakes region also served as an important drainage outlet along the western edge of the melting ice sheet. One persistent route channeled meltwater southward past the Gull Point area, through the Okoboji Lake Outlet at its southern end, and into the Little Sioux River. Extensive sand and gravel deposits along this route are ample evidence of the huge volumes of water and sediment discharged by the melting ice.

Many other features in the vicinity of Gull Point State Park are products of the wasting ice. For example, Spring Run and Swan Lake-Christopherson Slough wildlife areas developed as a maze of tunnels within the disintegrating ice that funneled meltwater to the Okoboji Lake Outlet. Today, this drainage network is still intact, functioning as subtly linked sloughs and potholes connecting the hummocky



Ron Johnson

135 feet – the deepest of Iowa’s natural lakes. It is thought to have formed along an already existing lowland which became occupied by an enormous block of the decaying glacier.

Coring of sediment accumulated in the western portion of Miller’s Bay reveals information about the region’s past climate. Fossil pollen grains and siliceous diatoms from these deposits show that a spruce and larch forest occupied the area as the ice melted. Over several thousand years, gradual warming occurred and a deciduous forest of oak and elm spread over northwest Iowa. Prairie plants then expanded into the uplands as the climate became still warmer and drier, approximately 3,000 to 7,000 years ago. Lake levels were much lower than they are today. This extremely warm, dry period was followed by more modern climatic conditions; lake levels rose and deciduous woodlands reinhabited the lake margins.

Large boulders are concentrated along the shoreline at Gull Point State Park (photo, upper left). These travel-worn “erratics,” carried into Iowa by

Jean Prior

uplands with the lower lying stream valleys.

Most lakes in this region are rounded, flat-bottomed and shallow, generally less than 20 feet deep. They likely formed as the glacial ice disintegrated and collapsed. West Okoboji Lake, on the other hand, is long and narrow in outline with numerous rounded embayments (Gull Point seen at right) and a maximum depth of approximately



Jean Prior

glacial ice, are usually igneous or metamorphic rock types, which are not native to Iowa. Reddish quartzite, granite and other crystalline rocks are common, and they reflect the massive power of glaciers and the northerly direction from which they came. These boulders are an impediment to agriculture, and in the Gull Point vicinity, field stones removed from crop ground often are seen piled in unused corners or along fence rows. Field stones are also used in building construction, and the beautiful rustic lodge and shore patrol station (photo above) at Gull Point were built of glacial erratics having various shapes and mineral compositions by the Civilian Conservation Corps after the

park was established in 1934.

Gull Point State Park and its surroundings highlight an important chapter of Iowa’s geologic history. Visitors are treated to the scenic beauty of natural lakes and wetlands, valuable wildlife habitat, and excellent examples of landscapes that reflect Iowa’s glacial heritage. ❖

Additional information on this area and its glacial history is available in the free brochure “*Glacial Landmarks Trail: Iowa’s Heritage of Ice*,” available from the Iowa Dept. of Natural Resources in Des Moines or the Geological Survey Bureau in Iowa City.

Building with the Geologic Past

When rock materials are quarried from the earth and raised stone by stone to become a building, the substances of geology take on a new dimension in our daily lives. The ornate Ottumwa Coal Palace (right) highlighted an Iowa geologic resource in a very public way. With the close of Iowa's Sesqui-centennial year, *Iowa Geology* focuses on the state's historic structures as a way of seeing and appreciating Iowa's subsurface resources from a different, and quite visible, perspective. The architectural use of native stone in so many of Iowa's public buildings has a cultural importance to us. These distinctive, sturdy structures attest to the permanence intended by our forebearers; their beauty and utility enhance our lives today; and they remind us of the useful resources beneath our soil.

The initial exploration and documentation of such rock resources is also an interesting part of our state's history and part of a broader national history that was unfolding in the 19th century. The contributions of Iowa's early geologists often made scientific history, yet how they lived and conducted this work is a fascinating story in itself and a mirror on the times – a part of our cultural history. Scientific advancement grew out of personal initiative and perspective, as well as historic scientific tradition and interdisciplinary application – just as it does today. The Geological Survey Bureau builds in a scientific sense on the work these earlier geologists began. We continue to acquire knowledge through traditional field work. With more data and new technologies, we are able to refine the accuracy of earlier geologic studies and to present information in forms that can be understood and used by Iowans today to make informed decisions about the future use of Iowa's natural resources.

Jean Cutler Prior
Editor



Photo courtesy of State Historical Society of Iowa – Iowa City

Coal Palace, Ottumwa

The Coal Palace, constructed in 1890, was a unique and imaginative example of geologic materials used as building stone in Iowa. Completely veneered with blocks of coal, it was built to honor the work of area miners and to publicize the coal resources of southern Iowa. These coal deposits are the carbonized remains of plants that flourished in tropical coastal lowlands present here about 300 million years ago (Pennsylvanian age).

The lavish palace-like building displayed a lofty 200-foot tower, with a dance floor near the top. In contrast to its dark exterior, the interior was bright, with vast rooms decorated with colorful displays made of wheat, oats, corn, sorghum and cattails, including a wall-sized portrait of Chief Wapello. There was a large auditorium for concerts, plays and speeches, and even a 30-foot tall waterfall. A reconstructed coal mine was featured beneath the structure. The Coal Palace was dismantled following the 1891 exposition season.