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Resource News-January/February 1993

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News

Theory predicts concentration of contaminants in aquifers

A recent theory that allows scientists to predict the concentration of contaminants in aquifers was the topic of an invited paper presented by You-Kuan Zhang at the December 1992 fall meeting of the American Geophysical Union in San Francisco. Zhang is an assistant professor in the Conservation and Survey Division and co-author of the paper.

This new theory is an improvement on previous theories that tried to make similar predictions because it is a truer model of what actually happens to contaminants within an aquifer, Zhang said.

He noted that the theory has practical application in areas vulnerable to groundwater contamination. For example, by using the theory scientists can model nitrate concentrations in an aquifer and make predictions about where the contaminants

will go. "The theory can tell us how long it will take for a domestic well to become contaminated or predict the concentration levels of contaminants that come from specific sources such as landfills and gas storage tanks," he said.

Zhang has developed a computer program for this theory and has applied it to a field experiment in Borden, Canada.

He said the "Eulerian-Lagrangian" theory enables researchers to better predict the concentration levels of groundwater contaminants such as nitrates by reducing the uncertainty of such predictions.

"In general, it is difficult to make accurate predictions because the physical properties of aquifers vary over space. Therefore, predictions of contaminant concentration levels have involved a large degree of uncertainty," Zhang said.

National Geologic Mapping Act of 1992 would aid limited geologic mapping in nation and state

Only 18 percent of the United States and 34 percent of Nebraska have been mapped in detail, less than the percentages for many third world countries, according to Perry B. Wigley, director of the Conservation and Survey Division.

But passage of the National Geological Mapping Act of 1992 could significantly improve those figures, he said, if congressional appropriations are adequate to cover much-needed geologic mapping.

The legislation addresses four mapping categories: federal, state, support and educational. The federal map component is intended to fund geologic mapping conducted by the U.S. Geological Survey, while the support map component provides services needed to support geological mapping such as paleontological, geochemical and geophysical studies.

The state map component directly affects CSD, Wigley said, because it provides federal funds to state surveys for geologic mapping and requires 50 percent matching funds from the state. The educational map component will help finance the training of field geologists at colleges and universities.

Wigley noted that while the federal and support map components are currently funded at nearly 100 percent of authorized levels, the state and educational map components are underfunded. The state map component, authorized for funding at \$18 million, is only funded at \$1.3 million, and the educational map component, authorized for \$500,000, is currently not funded. The Association of American State Geologists will be working very hard to get the maximum authorized funding for

(See *Geologic mapping continued on page 2*)

Leaf fossil bears Roger Pabian's name

A 100 million-year-old fossilized leaf has been christened after invertebrate paleontologist Roger Pabian, a professor and researcher in the Conservation and Survey Division.

The *Pabiana variloba* leaf, found at the Rose Creek Quarry, south of Fairbury and the site of perhaps the world's oldest known flower fossils, was named after Pabian to credit him with the discovery of the Rose Creek locality.

For more than two decades, Pabian and plant

fossil experts Garland Upchurch, Jr. and David Dilcher have made numerous visits to the Rose Creek site since Pabian and two co-workers first found the leaf fossils in 1968. During this time, the scientists have unearthed a wealth of fossilized plants, but have found little evidence of fossil invertebrates, which are Pabian's specialty. Upchurch and Dilcher named the leaf after Pabian in 1990, who also has a crinoid, the *Pabianocrinus*, carrying his name.

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Institute of Agriculture and Natural Resources/University of Nebraska-Lincoln

Resource

Geologic mapping *continued from page 1*

the bill in the coming year, he said.

In addition to a need for more federal funds to support geologic mapping at the state level, Wigley said mapping needs to be more highly regarded by fellow professionals. Contrary to the view among some scientists that mapping is

a low-level scientific activity, Wigley stressed the importance of geologic mapping for geologists.

"A geologic map should be viewed as at least as important as a refereed journal article," he said.

Groundwater levels decline in Nebraska in 1991

Groundwater levels continued to decline in 1991 in most of Nebraska's 93 counties, according to the state and federal report, "Groundwater-level Changes in Nebraska, 1991," recently released by the Conservation and Survey Division at the University of Nebraska-Lincoln.

Fall 1991 groundwater measurements showed that water levels continued to decline in the eastern half of Nebraska due to prolonged drought, said the report's authors, Gregory V. Steele, U.S. Geological Survey, and Perry B. Wigley, director of the division.

The report, based on the latest data, said that in the fall of 1991, 77 percent of observation wells in the state had groundwater levels lower than the previous fall.

"Water-level declines were most prominent in the south-central and southeastern parts of Nebraska, where precipitation continued to be below normal, and groundwater irrigation was needed to supplement supplies," according to the report.

Most counties had water-level declines of 1 to 5 feet from the previous year, with the largest area of decline extending from Phelps County in the west to Gage County in the east. The largest water-level decline was measured in Fillmore County, where one well showed a one-year decline of 23 feet. The largest area of one-year declines greater than 5 feet also occurred in Fillmore County.

By contrast, the report noted that above-average precipitation in the western half of Nebraska resulted in large areas of water-level rises in Box Butte, Dawson and Perkins counties. The largest water-level rise from fall 1990 to fall 1991 was recorded in Custer County, where one well had a water-level rise of 20.92 feet.

Many areas also continued to have declining water levels from estimated predevelopment levels (from about the

mid-1930s to the mid-1950s, depending on the part of the state) to fall 1991. Exceptions to this trend include large areas of water-level rises south of the Platte River--as great as 113 feet--and around large reservoirs.

Intensive irrigation and below-normal precipitation continued to lower water levels from predevelopment throughout much of the Upper Big Blue and Little Blue groundwater control areas.

"Groundwater withdrawals for irrigation during the past 41 years have caused water levels to decline at least 5 feet below estimated predevelopment ... levels in an area of about 1.41 million acres" in the groundwater control areas, the report showed.

Box Butte County, in spite of a one-year water-level rise from 1990 to 1991, continued to show water-level declines from predevelopment to fall 1991 of 5 to 70 feet over 420,000 acres.

More than 70 percent of the water used for irrigation in Nebraska is pumped from wells. During 1991, the report noted, 708 new irrigation wells were drilled--39 fewer than were drilled and registered during 1990.

The report estimates that 5 million acre-feet of water were pumped from irrigation wells in 1991. That volume is 16 times greater than the amount used for domestic, livestock, municipal, industrial and other purposes.

Data used in the 38th annual report on Nebraska's groundwater levels were provided by 38 federal, state and local agencies and municipalities. Copies of the report can be purchased from the Conservation and Survey Division, 113 Nebraska Hall, University of Nebraska-Lincoln, Lincoln, NE 68588-0517 for \$10 plus a \$1.50 handling charge. Nebraska residents should add sales tax.

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Resource News is a bimonthly publication of the Conservation and Survey Division, 113 Nebraska Hall. Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, 68588-0517. It is distributed free to all interested in earth science in the state. To receive it, write to the address above. In addition, the Resource News audience will receive Resource Notes, the annual report of the division. The Conservation and Survey Division is the agency designated by statute to investigate and interpret the geologically related natural resources of the state, to make available to the public results of these investigations and assist in the development and conservation of these resources. The Conservation and Survey Division provides information and educational programs to all people without regard to race, color, national origin, sex or handicap. Background of nameplate on page one depicts the layered rock column from the Geologic Bedrock Map of Nebraska. Layers shown are (from the bottom) Precambrian, Cambrian, Ordovician, Silurian and Devonian rocks.

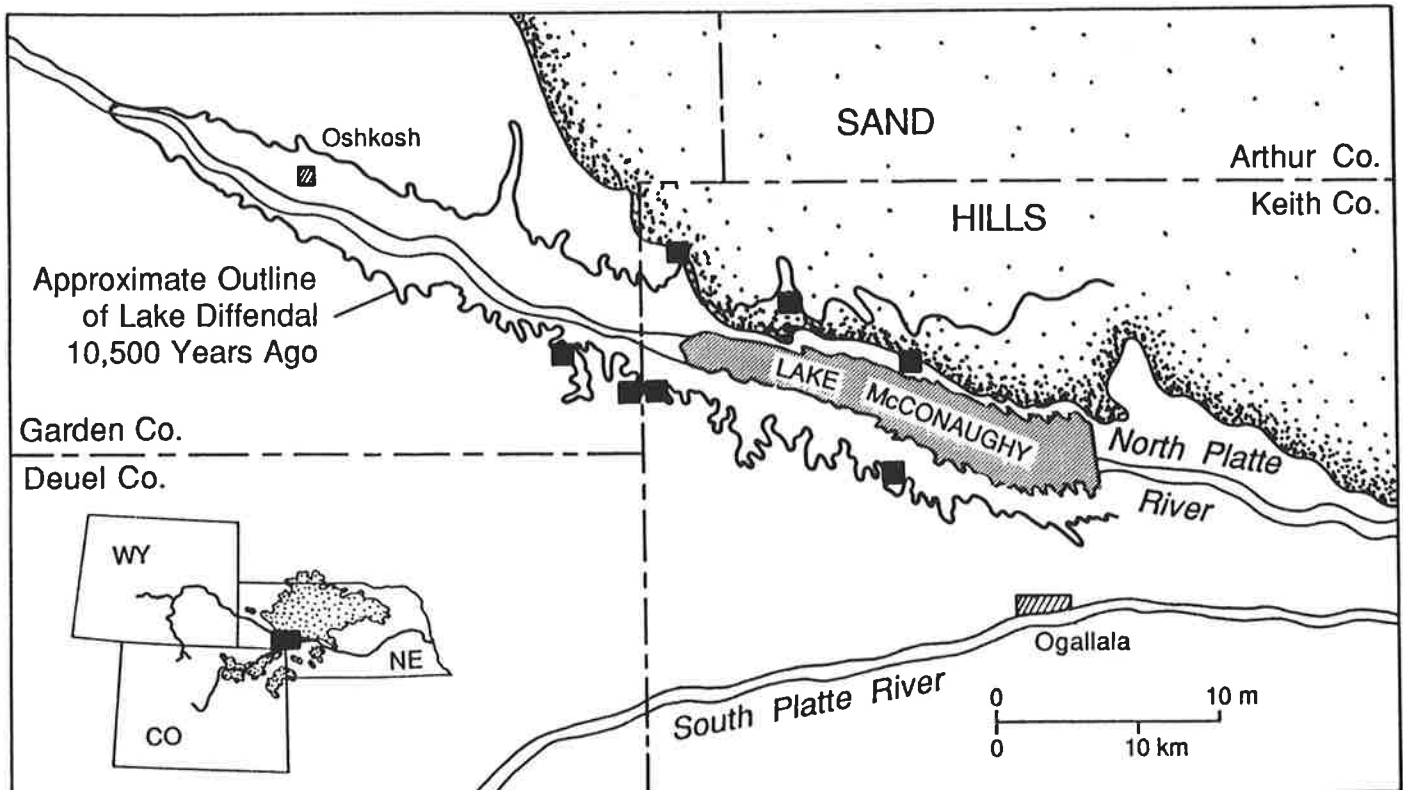
Ancient Lake Diffendal Created by Dune Dam on North Platte

During a long dry interval in Nebraska's recent geologic past, sand dunes moved across the dwindling North Platte River, dammed it and created Lake Diffendal, an ancient lake twice the size of human-made Lake McConaughy, which now occupies nearly the same position.

That's the "dune-dam" hypothesis put forth by Jim Swinehart and David Loope, University of Nebraska-Lincoln geologists, to explain the origin and formation of this giant lake on the North Platte River and other smaller lakes throughout the Nebraska Sand Hills. They presented their findings at the 1992 annual meeting of the Geological Society of America on October 26 in Cincinnati.

Swinehart, a research geologist in the Conservation and Survey Division and Loope, UNL associate professor of geology, named the lake after CSD research geologist Robert Diffendal, Jr. Diffendal first discovered lake sediments dated at 8,000 to 10,000 years old in the valley around Lake McConaughy, Nebraska's largest reservoir, during the late 1970s.

These sediments are tell-tale clues that the waters of the river were blocked and a lake was created about 40 miles long. The most compelling interpretation the researchers have for this blockage is that dunes migrated across the North Platte drainage about 10,000 to 12,000 years ago.



Approximate outline of Ancient Lake Diffendal and present-day Lake McConaughy near Ogallala along southwestern edge of Nebraska Sand Hills. Black squares indicate sites where samples of lake-bed sediments were taken.

CSD's Earth Science Information Center state affiliate for USGS, clearinghouse for earth-science data

The Conservation and Survey Division, the Nebraska State Affiliate for the U.S. Geological Survey's Earth Science Information Center (ESIC) since 1979, serves as a clearinghouse for earth science data. ESIC provides access to a wide variety of maps and related products including topographic and historical maps, current and historical aerial photography, satellite imagery, geologic and water data and brochures. The center can provide information on both paper and mylar products, as well as digital spatial data suited for geographic information systems (GIS).

Those seeking information need to identify the types of information needed, the location, approximate scales and periods of interest. ESIC staff will locate appropriate products and provide information on ordering. Maps and data for Nebraska can usually be obtained directly from CSD.

For assistance, write, call or visit the ESIC office in room 104 Nebraska Hall at the University of Nebraska-Lincoln, or call 1-800-USA-MAPS to reach one of the national ESIC offices.

1993 Nebraska Water Conference celebrates water history

"A Centennial Observance of Irrigation in Nebraska" is the focus of the 1993 Nebraska Water Conference March 15-17 at the Holiday Inn Convention Center in North Platte. The challenges and changes in the state's water use through history are the conference themes. And a multi-author encyclopedia of the state's water history, *Flat Water: A History of Nebraska and Its Water*, published by the Conservation and Survey Division, also will be unveiled.

Two keynote addresses kick things off, one from Nebraska historian Bob Manley on water issues in 1893 and another from Duane Acker of the U.S. Department of Agriculture on water issues in the year 2093. Session one involves "Reflections on the Past," featuring talks from the book's chapters on: Climate and Hydrology--Ann Bleed (Department of Water Resources); Technology and Industry--Les Sheffield (UNL Water Center); Economics and Finance--Steve Schafer (Nebraska Department of Administrative Services); Changes in Ecosystems--Charles Flower-

day (Conservation and Survey Division); Politics and Policy--Steve Gaul (Nebraska Natural Resources Commission); and Farm Family--Don McCabe (Nebraska Farmer).

Session two examines the "Challenges of Today," looking at these challenges: Socio-economic--Charles Lamphear (UNL Bureau of Business Research); Environmental--Mike Hayden (US Fish and Wildlife Service); Limitations of the Resource--Mike Jess (DWR); and Legal and Institutional--Jim Cook (NRC); followed by a panel discussion by former Nebraska governors.

Session three will take a look at the "Challenges of the Future." It begins with a panel discussion by agricultural producers and then moves to examinations of: Financial Institutions--C.G. Kelly Holthus (York banker); Government--Joe Hall (US Bureau of Reclamation); and Citizens' Groups--Marty Strange (Center for Rural Affairs).

Coming up: National, state and regional meetings and workshops

--Nebraska Well Drillers and Pump Installers Short Course, January 14-15, Kearney.

--American Geophysical Union, Front Range Meeting, February 8-10, Lincoln.

--Nebraska Well Drillers Association, annual conference, February 17-18, Lincoln.

--Shallow Exploration Drillers Clinic, February 24-25, Sioux Falls, S.D.

--Children's Groundwater Festival, Nebraska Groundwater Foundation, March 9, Grand Island.

--CALMIT workshop--Fundamentals of ARC/INFO, March 15-18, Lincoln; contact Chris Keithley for more information: (402) 472-2565.

--Nebraska Water Conference, March 15-17, North Platte.

--Geological Society of America, North Central Section, March 29-30, Rolla, Missouri.

--Nebraska Academy of Sciences, annual meeting, April 16-17, Lincoln.

--American Association of Petroleum Geologists, annual meeting, April 25-28, New Orleans.

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