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Dates support hypothesis of very recent dune formation

Sand Hills study yields first data from laser dating

Preliminary data from a new, laser-activated technique to date sand grains show agreement with the hypothesis that existing dunes in the Nebraska Sand Hills were formed less than 10,000 years ago, according to a University of Nebraska-Lincoln research geologist.

James B. Swinehart, with UNL's Conservation and Survey Division, said the early test results from the laser dating technique, called optically stimulated luminescence (OSL), correspond to previously gathered radiocarbon dates, but that these and future OSL dates should give scientists a higher degree of confidence about the age of the dunes. The OSL results, he said, will be used to substantiate the relatively few radiocarbon dates taken from the Sand Hills dunes.

The findings are the first in the two-year study of the sand dunes and the ancient climate of the Sand Hills, supported by a $90,000 grant from the National Science Foundation. Swinehart and UNL colleague David Loope, associate professor of geology, hope to determine past climate changes by studying the history of dune movement in the Sand Hills. Large dunes can only form in a climate more arid than at present.

The OSL technique, developed at the Research Laboratory for Archaeology and the History of Art at Oxford University and applied by researcher Steven Stokes, represents an advance because organic material is not needed for the tests. Organic material, necessary for radiocarbon dating, is rarely found in Sand Hills dunes. But this new technique uses a laser to release electrons trapped within ''defects'' in the crystal structure of quartz grains, which are the major component of Sand Hills sand, Swinehart said. The electrons build up naturally during radioactive decay in buried sand grains.

(See **Sand Hills** *continued on page 3)*

Airborne thermal-infrared data to aid study of alkali lakes

The surface-water temperatures of several Sand Hills lakes were recently measured from high in the sky.

The measurements weren't made with your average thermometer, obviously. Instead, researchers from the University of Nebraska used a thermal-infrared scanner carried aloft in an airplane.

The scanner detected and recorded varying levels of heat emitted by the surface waters of Island Lake, Krause Lake and several others in western Nebraska, said Donald C. Rundquist, director of the Conservation and Survey Division's Center for Advanced Land Management Information Technologies (CALMIT).

Data gathered during the three late-August flights over Krause Lake and several nearby will be used to support research on Nebraska's alkali lakes. The data gathered during the flights over Island Lake, located in the Crescent Lake National Wildlife Refuge, will be used to evaluate a model developed

(See **Alkali lakes** *continued on page 2)*

Quake shakes north-central Nebraska

Not everyone noticed it, but it shook some things up.

A minor earthquake shook parts of north-central Nebraska in August, causing no physical damage but rattling doors, windows, plates and hanging pictures. Some people reported hearing a low, rumbling noise, like that produced by large trucks or heavy machinery, said a University of Nebraska-Lincoln geologist.

Raymond R. Burchett, research geologist with UNL's Conservation and Survey Division, said the minute-long quake occurred Aug. 26 at about 7:50 a.m. CDT and had a magnitude of 3.4 on the Richter scale.

Centered in southeastern Cherry County, the quake was also felt in parts of Blaine, Brown, Rock and Thomas counties, Burchett said.

The cause of earthquakes in north-central Nebraska is unknown, he said, because of a lack of subsurface data. However, most earthquakes are the result of faulting in subsurface rock layers.

According to Burchett's publication, ''Earthquakes in Nebraska,'' quakes with magnitudes of 2.9 to 3.5 are felt indoors by many and outdoors by few during the day. Some are awakened at night. Dishes, windows and doors are disturbed and walls make a cracking sound. The sensation may be like a heavy truck striking a building.

Magnitude 2 quakes, Burchett said, are generally considered the smallest people can feel. Magnitude 7 quakes and greater are considered major and can cause massive destruction.

''Earthquakes in Nebraska'' is available from the UNL Conservation and Survey Division, 113 Nebraska Hall, Lincoln, Neb., 68588-0517, for $4.50 plus $1.50 postage and appropriate city and state sales tax.

The bimonthly newsletter of the Conservation and Survey Division

Regular reporting of resource issues reaffirmed

Editor's note: This is the first issue of Resource News. With it, the Conservation and Survey Division reaffirms a commitment to timely reporting of CSD activities, as well as other natural-resource stories from the University of Nebraska-Lincoln, that began with the publication of Resource Notes as a quarterly in 1986. It was published regularly until 1988. With the separation of the UNL Water Center from the division in 1988, Resource Notes lost half of the writing team that compiled the quarterly, Water Center communications specialist Pat Larsen, and was cut back to one annual edition.

The recent addition of a part-time editorial assistant has made it possible to resume more regular public-information activities. The name, Resource News, was chosen to evoke a connection with Resource Notes, which still will be published once a year in a magazine format near the beginning of September. Resource News will be published bimonthly five times a year, and Resource Notes will serve as a kind of special edition for the September-October issue.

The purpose of this undertaking is to keep both lay and technical audiences abreast of the ongoing research, service and information activities performed by the division, as well as to shed light on resource issues generally throughout the state. We hope these journalistic efforts serve to stimulate interdisciplinary research, appropriate citizen involvement in resource concerns and quality management by natural-resource organizations in Nebraska.—CF

Alkali lakes *continued from page 1*

to determine the energy budget of lakes and marshes based on surface-water temperature measurements, Rundquist said.

David C. Gosselin, a member of the Alkali Lakes Working Group (ALWG) and CSD hydrogeologist, said the airborne thermal scans were made to identify groundwater seepage in individual lakes and to search for evidence of regional flow patterns. Other ALWG members include Anne Matherne, CSD hydrologist, Jerry Ayers, CSD research hydrogeologist, and Steve Sibray, CSD research hydrogeologist in Scottsbluff.

The thermal scanner is able to distinguish relative temperature differences of lake water and since groundwater is generally much cooler than lake water, it is relatively easy to identify areas of groundwater seepage into the lakes, Gosselin said.

He said the data will help identify lakes with different amounts of groundwater seepage, a number of which will be studied in greater detail. In addition, a unique feature of alkali lakes, which occur between sand dunes in an area with negligible runoff and outflow, is their high potassium concentrations. Incoming groundwater may be the potassium source, he said, and the high concentrations may be due to evaporation.

Understanding the origin of the alkali lakes and their relationship to the groundwater flow system is important for a number of reasons. They serve as excellent natural laboratories for understanding chemical reactions between water and sediment; they may provide fundamental information necessary for understanding wetland systems; and they may prove important in understanding the origin of non-marine potash deposits, the primary ingredient in some fertilizers, he said. The lakes also may provide information about the origin of sand-dune related oil fields.

Doug Goodin, a UNL geography doctoral student who is conducting research on the energy budget over small bodies of water for his dissertation, said the energy budget refers to net radiation—the balance of short- and long-wave solar radiation not reflected back by the earth's surface or atmosphere. Goodin explained that net radiation is either consumed to heat the air or evaporate water or is absorbed by the earth's surface. The behavior of each consumption factor varies with temperature, which makes it possible to calculate each factor using surface-temperature measurements, he said.

Goodin said the purpose of the airborne missions over his research site on Island Lake is to compare calculations made using airborne temperature measurements with actual energy-budget measurements made on the lake. Such comparisons have not yet been made as the infrared data must first be digitized and entered into a computer.

Determining energy balance, especially evaporation rates, over a wetland or marsh is an important part of understanding an area's hydrological balance, Goodin said. He said he will also use the data to identify how evaporation over a wetland or marsh modifies the climate of the immediate region.

Resource News is a bi-monthly publication of the Conservation and Survey Division of the Institute of Agriculture and Natural Resources, 113 Nebraska Hall, University of Nebraska–Lincoln, 68588-0517. It is distributed free to all interested in earth science. To receive it, write to the address above. 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 the results of these investigations, and to 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.

On-site wetlands inspection: One of many jobs for field soil scientists

Even though the Bush administration has issued less stringent standards for determining wetlands, countless appeals of wetlands designations are still being processed. And nearly every appeal requires an on-site inspection by an expert.

That job falls, in part, to the field soil scientists with the University of Nebraska-Lincoln's Conservation and Survey Division. In addition to helping with the wetlands appeals process, CSD field soil scientists inspect sites for tax evaluation appeals, as well as handling the ongoing update of county soil surveys, said Mark Kuzila, CSD head soil scientist.

With a wetlands determination, the soil, vegetation and hydrology are reviewed before an area is designated a wetland. In the case of tax evaluation appeals, the soil map is reviewed, and, depending on the characteristics of the site, the evaluation is either upheld or changed, Kuzila said.

But the major reason for soils faculty in the field is that after nearly 70 years of completing a soil survey for every county in Nebraska, now it's time to update.

Steve Hartung, one of CSD's five field soil scientists, explained that certain data in the original surveys may be in error because the properties of some soils have changed over time. For that reason, he said, it's important to go back over certain areas.

For example, the Wahoo-based soils specialist said, during his present work with the USDA Soil Conservation Service on the update of the Saunders County soil survey, researchers have found that most of the soils are more eroded by water than previously noted. Some of them are so eroded, he said, that they no longer have the same properties as when they were first mapped and have, therefore, been renamed.

In addition to helping with the determinations already mentioned, soil survey data is important to farmers and ranchers, resource managers, construction engineers, community planners, sanitarians, realtors and land developers, to name a few. When we interpret all the data, Hartung said, we can help farmers manage their soil and estimate what kind of crop yields they can expect. Such data are also important to people who want to install septic tanks, dig farm ponds or put in roads, he said.

While making soil surveys is Hartung's major responsibility, he said, he also helps organize high school and college soil-judging contests, makes presentations at natural resources district and county meetings and locates potential research sites for the SCS National Soil Survey Laboratory, located in Lincoln.

Other CSD field soil scientists are Monte Babcock in Imperial, soon to be in Grand Island; Chuck Markley in Valentine; Phil Young in Crawford; and Josh Lear in Omaha.

Sand Hills *continued from page 1*

Every time the grains are exposed to sunlight, all of the stored energy is released. Then, when the grains are reburied during dune movement, electrons begin to collect in the defects once again.

The OSL studies are conducted almost exclusively by Stokes, a New Zealander who is a doctoral candidate at Oxford. During the studies, Swinehart said, samples of buried sand are taken and kept in the dark. Later, in a laboratory, the sand grains are separated and struck by a laser. The amount of light energy released from the defects is measured. Other measurements, such as radioactive content of the grains, are made before an OSL age can be calculated. By knowing how long a sand grain has been buried, he said, it is possible to determine how long ago a sand dune was active.

Previous arguments held that the large dunes have not been active for at least 10,000 years, Swinehart said, and they were originally thought to be between 10,000 and 100,000 years old. However, he said, recent work has shown evidence of two major dune-building periods, one about 3,500 years ago and another about 6,000 to 8,000 years ago. Swinehart said he and Loope also suspect that there has been considerable activity in the dunes during the last 1,000 years. Future studies will test this hypothesis.

Recently, the researchers traveled to the Sand Hills to select future study sites. They also collected core samples from some of the sites to be used in later OSL tests. Many samples are ready to be sent off for radiocarbon dating as well, Swinehart said.

Interest in the Sand Hills has grown recently because of concern about ''greenhouse'' gases contributing to global warming. Some scientists contend that increased temperature and decreased precipitation in the region could reactivate the dunes.

The findings so far on the area's history make it apparent that things change rapidly, Swinehart said. If the study can produce an accurate record of dune building over the last 20,000 years, he said, it will add to the understanding of the impact of possible future climate changes in the Great Plains.

Coming up: CALMIT workshops and Nebraska GIS forums

—**Nebraska GIS forums** include presentations of research, activities in the state and software and hardware demonstrations. Upcoming forums are on Nov. 20, 1991, Jan. 22, Feb. 26, March 18, and April 22, 1992. All forums are held in the University of Nebraska–Lincoln East Campus Union from 11:30 a.m. to 1:30 p.m. For more information contact James W. Merchant, (402) 472-7531.

—**CALMIT workshops** are designed to provide hands-on training to those interested in geographic information systems (GIS) and remote sensing. Upcoming workshops are on: Introduction to GIS (Jan. 20-24; March 9-13); Fundamentals of ARC/INFO (Jan. 27-31; March 16-20); and Image Processing and Digital Analysis (March 23-27). For more information, contact Chris Keithley, (402) 472-2565.

Division moves map and publication sales offices

The Conservation and Survey Division's map and publication sales areas were recently combined and moved into another room on the first floor of Nebraska Hall, which has housed CSD's main office and most of the rest of its office space for 30 years.

Duane A. Eversoll, CSD associate director and chair of the division's space committee, said the move from the front office to room 104 was made to reduce traffic through the front office and to provide room for the expansion of the sales areas. The consolidation of the units provides easier access to information, as all maps and publications are located in one area and handled by one person, he said.

The new map and publications sales office is the former site of the CSD library, just past the second hallway west of the main office. The library now occupies room 11 in the basement of Nebraska Hall. Room 113-I, the previous location of the map sales office, now contains a formal conference room and adjoining faculty office space.

Researcher puts vegetative growth patterns in motion

Animation provides dynamic option

A computer program recently developed by a University of Nebraska-Lincoln researcher puts in motion still satellite images of vegetative growth patterns.

The program, developed by Liping Di, a doctoral student in geography working with the Center for Advanced Land Management Information Technologies (CALMIT), animates patterns of vegetative growth across the state through the growing season, allowing researchers to view those patterns in a movie-like format.

Donald C. Rundquist, director of the Conservation and Survey Division's CALMIT facility, said the software helps researchers more easily see the dynamics of vegetation growth during the year. The annual spring green-up and fall die-off of vegetation in eastern Nebraska are most apparent. The program can also be used to compare vegetative growth patterns in drought years with those in wet years, he added.

Di said he used 10 actual advanced very high resolution radiometer (AVHRR) greenness images, taken at evenly spaced intervals throughout the 1988 growing season, to develop the program. AVHRR is a sensor carried aboard the National Oceanic and Atmospheric Administration (NOAA) polar-orbiting satellite.

Di then entered data from these images into a program that mathematically interpolates between the images, predicting the pattern of vegetative growth or decline from one image to the next. What resulted was a series of images, some actual and some mathematically generated, that, when displayed in rapid succession, produce a smooth animation of vegetative patterns. The program allows the user to adjust the animation speed up to 10 scenes per second.

Di has also used the program to animate NOAA annual growth patterns for the continental United States, Rundquist said. Single satellite images remain the best scientific approach to analyze vegetative growth patterns, but previously it was the only way. Now, he said, this animation tool gives scientists a dynamic, graphic option when conducting research.

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