



# PICK & SHOVEL

INSIDE THIS ISSUE

AGATES

BOOK REVIEW

and MORE

Volume 30, Number 9  
May, 1990

Lincoln Gem and Mineral Club, Inc.

P. O. Box 5342

Lincoln, Nebraska 68505

# 1990 ELECTED OFFICERS

President: <b>Fred B. Holbert</b> , 2822 S. 13th St., Lincoln, NE 68502	423-5639
1st Vice President:	
2nd Vice President: <b>C. David Heffelbower</b> , 1819 Washington St., Lincoln, NE 68502	475-4713
Secretary: <b>Vera Lyman</b> , 420 N. 56th St., Lincoln, NE 68504	464-6089
Treasurer: <b>Phyllis Parks</b> , 2435 So. 19th St., Lincoln, NE 68502	476-6798
Board Member: <b>Francis Belohlavy</b> , 1919 "K" St., No. 4, Lincoln, NE 68510	477-4337
Board Member: <b>Roger Pabian</b> , 315 "D" St., Lincoln, NE 68502	474-2034
Board Member: <b>Sandra McNiff</b> , 2542 Colonial Dr., Lincoln, NE 68502	483-1165
Board Member: <b>Shirley Rockel</b> , 1134 West Avon Lane, Lincoln, NE 68505	464-3059

## NOMINATIONS COMMITTEE

3 Years: Kevin Schwartman, Chair.  
James Null  
Michael Smith  
2 Years: Phyllis Parks, Janet Wright  
1 Year: C. David Heffelbower,  
Bill Rockel

## LONG RANGE PLANNING AND BY-LAWS COMMITTEE

3 Years: To be announced.  
To be announced.  
2 Years: Kevin Schwartman  
Jim Marburger  
1 Year: Bob Wright  
Linda Parks

## STANDING COMMITTEES

Calling: Shirley Rockel  
Education: Roger Pabian  
Field Trips:  
Historian: John & Lillie Lewis  
Hospitality: Wilma (Billie) Heffelbower  
Membership:  
Housing/Property: Jim Parks  
Junior Activities: Janet Wright  
Librarian: Jim Parks

MWF Liaison: Vera Lyman  
Programs: Francis Belohlavy  
Scholarship: Marie Taylor  
Christmas Party: Billie  
Heffelbower  
1990 Rockhound/Year:  
Charles Wooldridge  
1990 Show: Roger Pabian  
1991 Show:

## AUDITING COMMITTEE, 1987-1988

Shirley Rockel  
Don Phillips  
Francis Belohlavy

## YOUR PICK & SHOVEL STAFF

Publisher: Lincoln Gem & Mineral Club, Inc., P. O. Box 5342, Lincoln, Nebraska 68505  
Editor: Roger Pabian  
Business Reporter: Vera Lyman  
Financial Reporter: Phyllis Parks  
Circulation : C. David and Wilma Heffelbower

The Pick & Shovel is the official publication of the Lincoln Gem and Mineral Club, Lincoln, NE. Articles and items appearing within may be reproduced in other club bulletins provided that proper credit is given to the Pick and Shovel and the author, and that a reprint of the bulletin is sent to the editor of the Pick & Shovel.

**CALENDAR OF EVENTS**

**MAY MEETING:** Saturday, May 19, 7:30 PM  
Nebraska Center for Continuing Education, 33rd & Holdrege. Norfolk Room.

**PROGRAM:** From The Midwest Federation Program Library. Should be a good one as usual.

**JUNIOR MEETING:** 7:00 PM. Field trip planning.

**COMING EVENTS:** CLUB PICNIC: June 16,  
Antelope Park Shelter House  
7:00 - 10:00 PM  
Play Rock Bingo  
Win Valuable Prizes

SHOW: Omaha, NE  
Nebraska Mineral & Gem Club  
Holiday Inn, 72nd & Grover  
October 6, 7

SHOW: Topeka, KS, Topeka G & M Society,  
Ag Hall, Expocentre, 17th & Topeka  
October 13, 14

SHOW: Grand Island, NE  
Grand Island Earth Science Society  
Fonner Park  
October 20, 21

SHOW: Tulsa Rock & Mineral Society,  
Tulsa, OK, October 27, 28, County Fairgrounds

**REGIONAL SHOWS:**

1990

CALIFORNIA	EASTERN	MIDWEST	NORTHWEST	ROCKY MOUNTAIN	SOUTH CENTRAL
Ventura, CA June 28-July 1	Landham, MD Aug. 10-12	Evansville, IN July 19-22	Boise, ID June 22-24	Roswell, NM Sept. 28-30	Pasadena, TX Feb. 16-18

1991

San Jose, CA June 14-15-16	Tampa, FL Sept. 19-22	South Bend, IN Aug.30-Sept.1	Seattle, WA July 26-28	Salt Lake, UT June 14-16	Lubbock, TX June 7-9
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**FUTURE MEETING DATES, PLACES:** May, 19, 1990. Nebraska Center for Continuing Education, 33rd & Holdrege.

**DISPLAY MATERIALS** Bring items that relate to May (Emeralds) or any other material that suits your fancy. Cases will be furnished.

### PRESIDENT'S MESSAGE

As the summer season approaches, we begin to think of all the fun things that become possible. We remember the feeling of anticipation that occurred many years ago when, as a school boy, we awaited summer vacation. That usually meant going to the old swimming hole, mowing lawns, playing "good guys and bad guys", mowing lawns, reading comic books under a shady tree, mowing lawns, swapping comic books, mowing lawns, riding bikes, and mowing lawns. This year I think that we will go rock hunting instead. Those who attended the April general meeting know that we are attempting to get permission for the club to prospect in a private quarry this summer. If that possibility becomes a reality, all club members will be notified.

Please note that the May meeting will be early this month. It will be held at the Continuing Education Center on May 19 and not the park as we would normally expect during May. Also make note that we will have a summer picnic on June 16 in the shelter at Antelope Park. More information about the picnic will be available later.

If any club member is planning to attend the Midwest Federation meeting and show to be held in Evansville, Indiana, on July 19-22, 1990, would you please make your plans known to any board member. We are looking for someone to represent the club as a delegate.

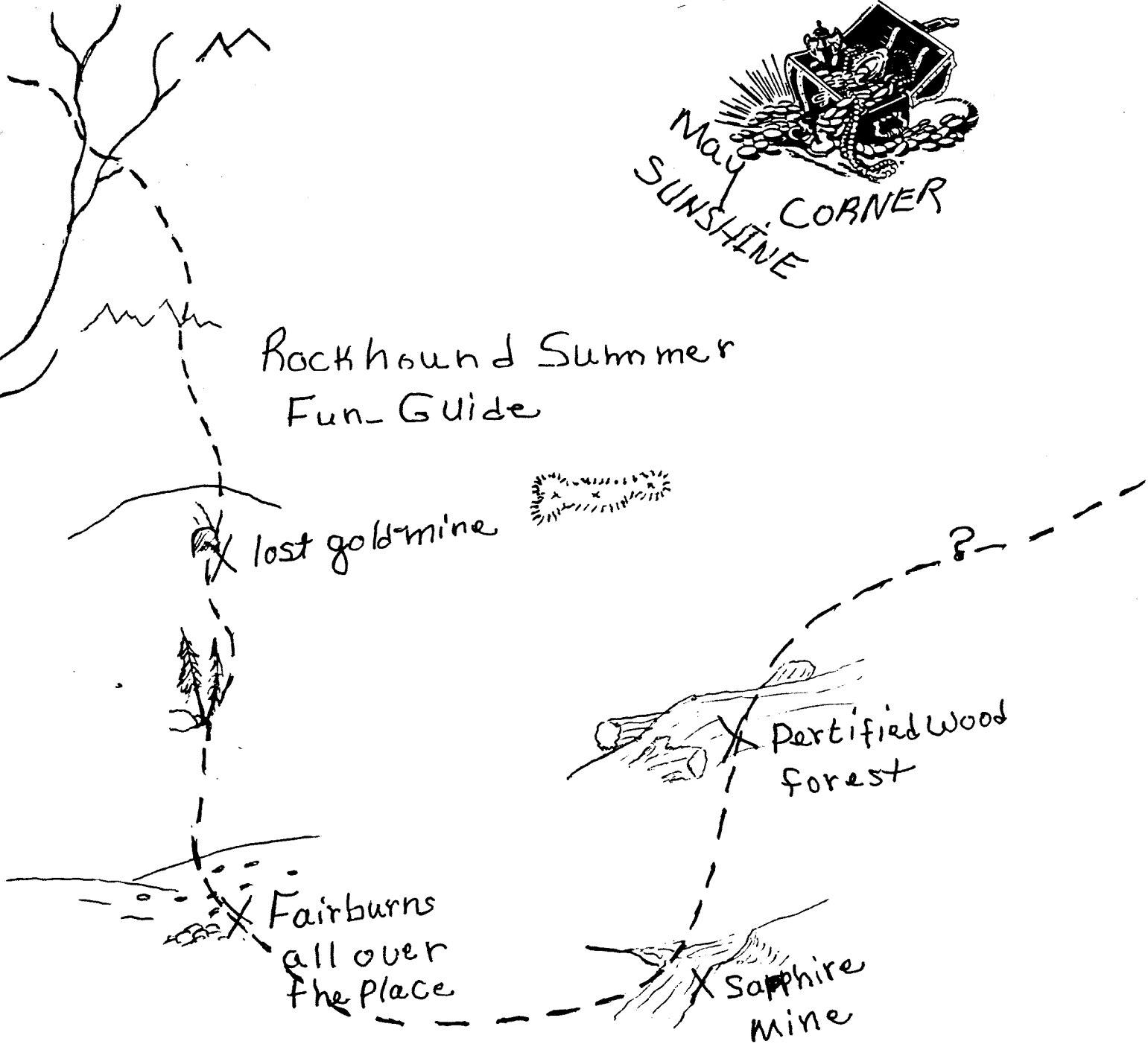
I was amused by a headline in the Sunday Journal-Star. It read, "Mammoth meat plants fact of life in Nebraska". My first thought hinged on the word, "mammoth". At first my pea sized brain thought that the article referred to the mammoth elephant. I suppose that I had been conditioned to think of that ancient mammal after reading about a recent find of the decaying skeletal remains of one in the newspaper. This headline conjured up visions of the discovery in northern Siberia of fleshy frozen carcasses of the giants and "Gorby" and the Russians are entrusting the processing of the meat to Nebraskans.

This short circuited thought reminded me of an incident from my college days. One question on a chemistry exam was failed by one half of the class. Those who answered the question properly did so because they had interpreted the question correctly. The simple question was, "Why are so many chlorine producing plants found near Niagra Falls"? Those that answered correctly reasoned that manufacturing facilities could produce chlorine cheaply using hydroelectric power from the river. Those students failing the question, knew that growing plants had cycles that produced oxygen and carbon dioxide but they couldn't think of a single biologic entity which gave off chlorine gas. Ultimately, the professor threw the question out.

FRED B. HOLBERT



Rockhound Summer  
Fun-Guide



Happy Spring Billie  
 Happy Summer Sunbeam  
 Happy Everything

## LGMC JUNIORS

It was great to see so many of you at the April meeting. The May fieldtrip is still up in the air at the writing on this article. I will send out notices of the May 19th fieldtrip if Ed Whyrick can run it. We plan to meet at the Continuing Education Building on 33rd and Holdrege again the evening of the 19th. The Junior Program will be learning about relative hardness of minerals. We can identify many specimens if we know the color and the hardness.

I would like to tell you a little more about the program that I will be running with Dr. Nan Lindsley-Griffin. We call the program W.I.S.E.

We have obtained funding from the National Science Foundation to run a series of Science Institutes this summer for rural girls in Nebraska. The purpose of these institutes is to get 6th and 7th grade girls excited about science, in the hope that many of them will choose careers in science or science education. We hope to enlist your help.

Two separate groups of 5 institutes will be offered. The first group of two institutes at Chadron State College and Kearney State College, will run June 3-15 and June 10-22 respectively. These two institutes, on the Science of the Earth's Environment, are for about 24 girls who have completed the sixth grade. The curriculum will incorporate innovative laboratory experiments and short field trips with computer exercises, and informal discussions about science careers.

The second group of 3 institutes on The Physics of the Earth's Environment, is for 45 girls who have completed the 7th grade. They will begin July 18-20 with laboratory projects at Chadron, Kearney and Wayne State Colleges, continue with a joint field trip July 23-30, and conclude with a visit to the UNL campus July 31-Aug 3. During the field trip we will take the entire group of girls and staff to a number of environmentally critical sites around the state. During the visit to UNL we hope to introduce the girls to a number of women and men who are actively engaged in scientific research,

LINCOLN GEM & MINERAL CLUB, INC. - BOARD OF DIRECTORS - April 5, 1990  
Nebraska Hall Rm 115 7:30 P.M.

President Holbert called the meeting to order. Minutes of the March Meeting were approved as read. Treasurer's report was also approved as read.

BILLS:

Show bills were approved with motion by Dave Heffelbower, 2nd by Gerald Moore. Motion carried. Club bills were approved with motion by Gerald Moore, 2nd by Francis Belohlavy. Motion carried.

SHOW "BITS":

The banner did not appear on 'O' Street, because the wind the week before had broken the hangars.

Scott Wolter, who presented the program "Green River Fossils" at the Show returned his gratuity check for same. Board decided to purchase book/s for Club Library. Bob Feurer, 1140 Locust North Bend, NE 68649 (Science teacher there attended our Show and was very impressed. Would like more information about Club & bulletin. Show Chairman, Roger Pabian thanked all who helped with the Show in any way. All dealers wish to return next year. 1990 Show cards signed by people from 14 states.

MEMBERSHIP:

Motion by Shirley Rockel to accept \$ 10. from Andy Zarins. 2nd by Dave Heffelbower. Carried.

No new members.

OLD BUSINESS:

Charles Wooldridge to place 1/3 page Ad inside back cover of Pick & Shovel @ \$5. per issue.

Motion by Roger Pabian we raise Subscription rate to Pick & Shovel to \$10. per year effective with May issue. 2nd by Vera Lyman. Carried.

May General Meeting will be held in regular Meeting room in NE Center. Park not available.

NEW BUSINESS:

Tentative: June picnic - dessert supper in park. (June 16-Bethany Park Shelter House)  
Rock Bingo Hot Dogs w/dessert.

Show Manual - Fred Holbert & Gerald Moore planning on compiling Show Manual. Need several meetings with people who have held positions. Protocol on ribbons. Also manual for Board Members.

Show: Re-need for cash drawer. Pershing- new contract negotiations?

Meetings: 4-20,21 NAS Meeting; anyone interested. Study Group - 4/10 Rm 115

Respectfully submitted,

*Vera Lyman*  
Vera Lyman, Secretary

LGMC Treasurer's Report April 1990

NBC Checking Acct. Bal 4/1/90 \$ 1054.71

Receipts:

New Mambership Family 27.00

Paid out:

New checks debit memo 16.10  
Antelope Shelter June 25.00  
April P & S Prtg. 100.22  
'90 Show Expenses 127.88  
269.20

NBC Checking Account April 30, 1990

\$ 812.51

**BOOK REVIEW**

By Andy Zarins

The Origins of Agates, Thundereggs, and Other Nodular Structures, by Benjamin M. Shaub. Published in 1989 by The Agate Publishing Co. Orders should be sent to: 159 Elm Street, Northampton, MA 01060. 105 pp. Hardbound. \$19.95 postpaid.

How agates and related phenomena, such as geodes, chert nodules, and thundereggs, form has long been subject to debate. Despite numerous theories, the mechanics of their formation remain a mystery. But the clue to a better understanding of the creative process lies in geochemistry, namely, silica diagenesis. Benjamin Shaub's book, The Origins of Agates, Thundereggs and Other Nodular Structures touches on agate formation, with his all inclusive "syngenetic agglutinated colloidal silica theory," which he claims, "replaces the 200-year old epigenetic infilled cavity theory."

Unfortunately, Mr. Shaub's loudly repeated assertions that his theory is the only correct one and that everybody else is wrong represent the book's major fault. So much for personalities in science. If the author had restricted himself to one subject, say thundereggs (which is what this book set out to do), and been more detailed in his analysis, Origins would have been a fairly enjoyable study. Instead, the reader travels haphazardly from topic to topic, touching on the thundereggs of Oregon, reviewing the Bruneau Jasper of Utah (Idaho?, Ed.), hopping from the butterfly agates of Mexico to the Amethyst Geodes of Brazil to the septarian nodules of New Zealand.

Mr. Shaub's theory of thunderegg formation is basically sound: that silica gels form from rhyolitic material while the magma is hot. But his argument loses credibility when he claims that agates form from siliceous gels derived from basaltic magma--a silica-poor rock. It becomes even less credible in the discussions about the insolubility of silica in water. Origins does not even mention volcanic ash and opal--important considerations in the formation of silica gels and the development of agates.

The book is short (just over 100 pages) and is printed in large type, which may explain, but not justify, its cursory treatment of the topic. Sharp readers may wince at a few minor typos, but the color plates are good. So, what is it about this book that makes it a chore to read? Mr. Shaub should have stuck to Oregon thundereggs. ++

**EDITOR'S NOTE** The above publication is now in the club's library and may be checked out. I recommend that people in the quartz study group read it to get another point of view on this subject. RKP

**BEST STUDENT PAPER**

At the recent meeting of the Earth Science Section of the 100th Annual Meeting of the Nebraska Academy of Sciences at Olin Hall on the Campus of Nebraska Wesleyan University, the \$100 prize, donated by T. Mylan and Eunice Stout, was won by Hannan LaGarry, Department of Geology and Division of Vertebrate Paleontology, UN-L and Carl Wellstead, Department of Biology, Doane College, Crete.

Their paper was titled New Permian Vertebrate Localities in the Eskridge Formation, Richardson County, Nebraska. They recorded several kinds of fossil fish including lungfish and some amphibian remains. +++

**QUARTZ STUDY GROUP: how agates form.**

By Charles Wooldridge

The Lincoln Gem and Mineral Club's Quartz Study Group met Tuesday, February, 13th. The evening's topic was "How Agates Form." Roger Pabian sketched on the blackboard "Bowen's Reaction Series" which is a map of the order that minerals take as they crystallize out of a magma. There is a specific order in this process, beginning with olivene, pyroxene, amphibole, and biotite one one side of the series and calcium feldspars and sodium feldspars on the other side of the series. These are followed by quartz, hydrothermal minerals such as topaz and tourmaline, and finally, the sulfide minerals, the constituent mineral of many plumes found in geologically young agates such as from the Big Bend area of Texas.

The notion expressed is that the plumes in plume agates form first and the agate forms around them later. This is because the sulfides crystallize where they can, namely, in voids and fractures in the rock. H. C. Dake, founder of "The Mineralogist", once published a picture of gas vesicles in Oregon with just plumes and no agate in the hollow cavity. Because plumes form a zone of weakness in the agate nodule, they are most common in geologically young agates such as those from West Texas and from the ash beds of central Oregon, both kinds of which are less than 30 million years old. Plumes are rare in geologically old agates such as Lake Superiors because they eroded off of the nodule and were destroyed through the greater time span.

**Diagenesis** is the sum of the effects of physical and chemical processes that act upon a particle after it forms or is deposited. The silica that forms the agate is freed up by devitrification of rhyolitic glass or by devitrification of glassy volcanic ash shards that overlie quartz deficient basaltic rocks. The gel precipitates into the hollows and may sit unchanged for, possibly, long time spans. Until the introduction of some catalyst such as iron sulfate or calcium carbonate, the gel remains unbanded. When these impurities are introduced into the gel, the gel begins to form spherulitic crystals and the impurities are deposited in the troughs between their tips, forming the bands. (These structures have been duplicated in the laboratory in time periods ranging from 12 hours to 180 days. Eds. note) The foreign materials are possibly isolated from the silica gel because of the differences in their ionic radii.

The agate has a lower specific gravity than the silica gel from which it forms. Thus, when the agate forms, there will be a greater volume of material in the vesicle than there was before the agate formed. This creates "escape tubes" that show where excess silica was forced out of the nodule. These are the duct-like patterns seen in many agates, especially Brazilians.

When the silica gel is highly saturated, banded agate will form, but when the gel becomes undersaturated, euhedral quartz will form. The saturation of the gel can be effected by changes of temperature, pressure, or increased concentration or dilution of the gel. Zones of agate and quartz show where gels went from saturated to undersaturated conditions as the nodule formed.

Roger discussed some of the work done by Russian geologist, Lev Lebedev, in his research in metacolloids. Lebedev had reported seeing silica gels in the southern Ural Mountains over a 30 year time span of his research there and he further saw some of the features we see in agates actually forming in place in the field.

The oldest known agates are about 1.2 billion years. This may be a relic of the Earth's early Precambrian atmosphere which is thought to have been mostly ammonia and methane gases. The crystalline structure of the agate would have been unstable in this mixture. (Agates are soluble in strong bases such as ammonia. Eds. Note) In the late Precambrian, the earth developed an oxygen-nitrogen atmosphere in which agates would have been chemically stable.

Roger then spent some time discussing where the silicon dioxide comes from that comprise the seminal silica gel of several of the more commonly known agates. These were agates from the Lake Superior region and West Texas, that form in a basaltic terrane, and agates from Oregon, which form in a rhyolitic terrane. Following the lecture, we saw a number of informative slides showing supporting evidence for the features described in the lecture. +++

### **CONGRATULATIONS !**

To Anne R. Crawford, former LGMC Junior Member, as she graduates from Lincoln High School this month with many academic honors including a National Merit Scholarship of \$2,000.00. You will remember the Computer Rock Quizzes which Anne prepared for several of our annual swaps, shows, and geology days. We're all proud of the many accomplishments and wish Anne the very best of success as she continues her education and her career. +++

### **REDUCING YOUR SHOW EXPENSES**

Cloth for lining your display cases can be a major expense in preparing show displays. Thrift stores and rummage sales often have many remnants of excellent fabric at a fraction of the cost that these materials might cost at a fabric shop. The above outlets also have many other items that can help to prepare your display. +++

### **NEBRASKA ACADEMY OF SCIENCES**

The One Hundredth Annual Meeting of the Nebraska Academy of Sciences was held Friday and Saturday, April 20 and 21, at Olin Hall on the Nebraska Wesleyan University Campus. Thirteen papers were presented in the Earth Science section and most reflected new discoveries or new interpretations of geological evidence found in Nebraska. +++

### **TRIVIA DEPARTMENT**

The following bit came from Garrison Keillor's "American Radio Company of the Air" show that is on KUCV-FM from 5:00 to 7:00 Saturday afternoon. Boyd Senter was born in Lyons, Nebraska, in 1892. He had the ability to learn almost any musical instrument and by 1915 had a jazz band that went on to great fame. With the beginning of the animated cartoon era, Boyd Senter's band provided the music for Mickey Mouse features. By the mid-1930's, the style of music had become the swing of Glenn Miller and Benny Goodman, and Mr. Senter retired from show business and moved to northern Michigan where he opened a sports shop featuring hand tied fishing flies. He later opened a rock shop and then invented the vibrating rock tumbler. Mr. Senter died in 1980. +++

**OTHERS WRITE**

Reprinted from Osage Hills Gems, Bartlesville, OK, December, 1989.

**ABOUT OUR HOBBY****GEOLOGIC FIELD NOTES - STRATIGRAPHIC TERMS**

by David (The Fossil Fisherman) Brumbaugh  
 STRATIGRAPHY is the branch of geologic science which deals with the description, organization, and classification of stratified rocks. In addition, aspects of this branch also include paleontologic studies beyond systematic and descriptive structure. Various classification schemes are used in stratigraphy. These are split into those based upon observation and those based on inference. FACIES indicate variations within a stratified formation (unit), usually observed as composition or faunal differences.

Two major schemes are used for observable outcrops or faces. LITHOSTRATIGRAPHIC (rock arrangement in layers or strata) units are based on rock characteristics. The FORMATION is the fundamental unit of lithostratigraphy, with a definite rock composition or a distinctive assembly of units, definite separation from adjacent units above and below, and traceable from outcrop to outcrop. MEMBERS are subdivisions of formations. BEDS are sometimes informally used as further subdivisions of members. GROUPS are two or more successive formations related by lithology (mineral constituents and stratigraphic arrangement) or position with reference to unusual or unexpected zones (genetic similarity). (i.e. Dewey limestone formation of the Skiatook Group) SOIL-STRATIGRAPHIC units, related to lithostratigraphic units, are distinct, being based on soil composition rather than rocks. BIOSTRATAGRAPHIC units, the other scheme, are based on fossils. ASSEMBLAGE ZONES are characterized by groups of fossil genera (families). RANGE ZONES are defined by the time range of the fossil. CONCURRENT-RANGE ZONES are defined by groups of overlapping range zones.

Two major schemes are also used for inferential units. CHRONOSTRATIGRAPHIC (time-stratigraphic) units are strata deposited during a finite portion of geologic time. SYSTEM corresponds to the geologic time unit, PERIOD; SERIES to EPOCH; and STAGE to AGE. (i. e. Missourian Series of the Pennsylvanian System) There are no corresponding chronostratigraphic units to the geologic time units of EON and ERA. ECOSTRATIGRAPHIC units, based on environmental conditions, form the second major scheme. EXOZONES are based on ecological conditions, such as water depth zones. GEOLOGIC-CLIMATE units include separate glacial and interglacial episodes and also include individual pulses of glaciation (STADE) and retreats (INTERSTADE) during a major glacial episode.

**NEW PUBLICATION**

"Earthquakes in Nebraska" by R. R. Burchett. Conservation and Survey Division, IANR, University of Nebraska-Lincoln, Educational Circular 4a. \$4.50

This is an updated, much sprightlier version of the same title issued as Educational Circular 4 that was published in 1979. Color graphics and recent earthquake data make this edition current and easy to use. All earthquake buffs should own this neat little volume. +++

## QUARTZ STUDY GROUP

By Don Phillips

The Quartz Study Group met again on Tuesday, April 10, at 7:30 PM in Room 115 Nebraska Hall. Present were: Roger Pabian, Fred Holbert, Kevin Schwartzman, Dwight and Dorothy Miller, Phyllis Parks, Charles Wooldridge, and Don Phillips.

Before starting into the evenings planned program, Roger Pabian back-tracked somewhat, and showed the group some specimens that related to a previous session. Shown were scepter and phantom quartz crystals. It was explained that the scepter is formed when the middle part of a double terminated quartz crystal either does not form or is partially dissolved away, leaving the ends of the crystal expanded. The phantom crystal forms when a new crystal growth forms over an already existing crystal, the effect being more pronounced if the first crystal becomes coated with dirt or some other mineral. Both were very nice specimens showing some of the different physical properties of quartz.

Roger arranged for a guest lecturer for the evening program. Andy Zarins talked on the subject of agates. He put together a slide presentation which aided his talk.

Andy covered many areas, and gave an informative talk. He explained what geological settings are needed for agates to form, such as those found in basaltic (igneous) rocks, and those found in carbonate (sedimentary) rocks.

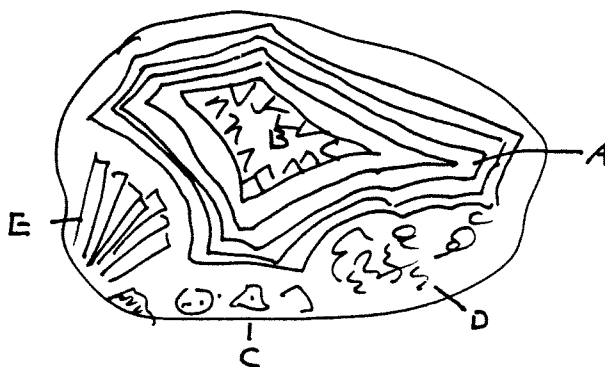
He explained how silica-rich gel permeates into gas vesicles in rock and later solidifies. The banding found in agates occurs when impurities are introduced into the gel.

Also discussed were all of the different kinds of agates and how their color, skins, and inclusions act like a thumb print in identifying them. Andy had many color slides showing Laguna, Thunder Eggs, Lake Superior, and Brazilian agates. One slide showed the structural components of an agate nodule (See fig. 1) and another showed a map of world wide historic and commercial localities.

The meeting adjourned at 9:30. The last topic discussed was the possibility of taking a club field trip to collect agates this summer.

On behalf of the study group and myself, I would like to thank Andy for taking time out to give an excellent and informative presentation.

Figure 1. Structural elements of an agate nodule.  
 A. Spherulitic chalcedony forming bands. B. Euhedral quartz. C. Decomposed host rock. D. Membranous cristobalite. E. Foreign crystals such as barite, calcite.



## NOMADS AND GEOLOGY

By Roger K. Pabian

Eurasian nomads were by no means theoretical geologists who pondered such problems as plate tectonics or organic evolution of groups of animals. That they had a working knowledge of applied geology is historically documented. Several areas in which the nomads had very explicit laws were mining, water resources, soil resources, and the development of early geological surveys.

Mining of gems and minerals was restricted to surface collecting of stones to be used in jewelry as well as collecting ingots of metallic ores such as hematite or limonite, sources of iron. To dig a hole in the ground for mineral extraction was a capital crime. Two good reasons exist for this. First, the nomads were horsemen; the horse was their means of travel, defense, and livelihood. Any hazard to the horse was a hazard to the nomads and their way of life. Secondly, nomads viewed the earth as a living organism (not to be confused with GAIA of the present day) and to desecrate her in any fashion was considered unpardonable.

That nomads were gold miners, however, is well documented by the abundant gold in the possession of nomad tribes. Scythian gold forms some of the world's most unique artwork, and Huns, Turks, and Mongols made excellent use of this metal. The Golden Horde of Batu Khan derived its name from the abundant gold that decorated the tents of the warriors and their families, and not from the color of their skin. Dredgins, sluicing, and panning operations were set up in many streams and the fleece of a sheep was often used to catch gold particles; hence, the "golden fleece" of Jason and the Argonauts who would have come in contact with the Scythians and their forbears. The most recent gold mining activity by nomads is perhaps that of the Yakuts who work in the Lena River in eastern Siberia. The nomads did not appear averse to digging in gravel bars as they were averse to digging on land. It may be that the bars were quickly replenished by stream transported gravel.

Water policy was perhaps the most rigidly policed area during the reign of Genghis Khan and his immediate successors. The "Yasa", an unwritten code of law of the Mongols was very explicit about the most serious crime a citizen could commit, befouling a waterway. This included casting any waste into a flowing body of water, or bathing or swimming in a flowing body of water. This goes back to the nomads notion of the earth being a living body. The Yasa even stipulated that water was to be taken from the stream to the livestock and it was forbidden to take livestock to the stream to drink. Violation of any of the above water regulations was punishable by death. Sound reason again was the basis for the above law. If people and livestock were not allowed to defoul the waterways, ample, clean drinking water would always be available in a land where it was always in short supply. It was these water laws which led to the severe treatment of conquered Moslem nations in which ritual cleansing was a religious practice.

Nomad laws were much less explicit about standing bodies of water such as lakes or ponds and such activities as bathing in them was not generally looked upon as a severe crime.

Groundwater surveys were conducted during the reign of Ogodai Khan (ca. 1229 - ca. 1240) and in The secret history of the Mongols he considered the drilling of 40 test wells as one of the major achievements of his reign. Although rotary drilling technology was unknown at the time, cable tool technology existed at about the beginning of the Christian Era. Although it can not be proven, the possibility that the Mongols were able to traverse great deserts because they could drill for their own water should be entertained. Ogodai Khan also ordered a survey of natural resources during his reign; thus, we have the beginnings of governmental geological surveys in nomad political organizations.

Cultivation of soils was looked upon in disdain by the nomadic peoples. After the Mongols had conquered northern China, some of the khans wanted to destroy the native populations and put tilled soils back into steppe grasses. Only after a Chinese statesman, Yel-Yu Chut Sai, convinced the nomads that there was a greater profit to be made in the cultivated soils did the nomad generals withdraw their wish. In Mongolia, however, soil tillage, except by the most destitute citizens, was strictly prohibited. Only the highest ranking khan could give permission for soil to be put into garden space.

It is also interesting that the myths of dragons were very popular in nomadic, especially Mongolian, cultures. Cretaceous rocks in Mongolia have provided the world with exceptional dinosaur fossils and large expeditions from American museums collected there in the years before World War II. The possibility that the dragon myths originated in the Gobi Desert is always open to debate.

A cursory glance of the mineral, water, and land policies of the Eurasian nomads could lead one to carelessly deduce that these peoples were very environmentally oriented. The nomads greatest fear was in disturbing a Mother Earth that they considered to be a living being who might strike back at being injured by extravagant and insolent use of her resources or befouling what she had given. +++

## MWF NEWSLETTER

Because of our early publication date this month, the Midwest Federation Newsletter excerpts will appear in the September Pick & Shovel. A copy of the newsletter will be available for your perusal at the May meeting. +++

## CAREERS IN GEOSCIENCES

A colorful, new pamphlet with the above title has been jointly issued by The American Geological Institute, The American Association of Petroleum Geologists, and the Geological Society of America. Descriptions of what geoscientists do as well as trends and outlooks in jobs and salaries are covered. Junior club leaders should probably have one of these at their disposal. For further information, write: American Geological Institute, 4220 King Street, Alexandria, VA 22302-1507. +++

**1990 LG&MC SCHOLARSHIP RECIPIENTS**

Carrie Herbel and Chris Rudnick, our club's 1990 scholarship recipients both presented papers at the 1990 Nebraska Academy of Sciences meeting. Abstracts of their presentations are printed below. The club can take great pride in the work of its 1990 honorees.

**TAPHONOMY OF THE "FRAGMENTAL LAYER": ANALYSIS OF A VERTEBRATE FOSSIL ACCUMULATION IN THE CAP ROCK MEMBER, ASH HOLLOW FORMATION, OGALLALA GROUP (MIOCENE) IN NORTHEASTERN NEBRASKA**

Carrie L. Herbel, Division of Vertebrate Paleontology, University of Nebraska State Museum, Lincoln, Nebraska 68588-0514

"Fragmental layer" is a descriptive field term referring to a widespread occurrence of broken vertebrate fossils within the Cap Rock Member of the Ash Hollow Formation, Ogallala Group (Miocene), along the Niobrara River and its tributaries in northern Nebraska and southern South Dakota. Mammalian fossils from the Cap Rock provide one of the bases for recognition of the Clarendonian Mammal Age in the North American continental record. However, the origin of the "fragmental layer" has never been studied in detail. In 1989, a taphonomic investigation of a representative example of the "fragmental layer" was conducted at the Ashfall site in Antelope County, Nebraska. Test pits excavated in sandstone underlying a thick volcanic ash at the site show that the pre-ashfall depositional environment was primarily fluvial, as indicated by cross bedding, but abundant silicified vegetation indicates extended periods of subaerial exposure. Most of the (3500+) fossils excavated are fragments of mammals of horse to elephant size but remains of small rodents, insectivores, turtles, birds, and amphibians were also recovered by screen washing several tons of sediment. The fossils display a wide variety of post-mortem effects such as trampling, weathering, and carnivore damage. Abrasion levels, however, are low, indicating that most fragmentation occurred in situ and did not result from fluvial transport. The fossils probably accumulated in an attritional manner over many years and may accurately reflect the composition of the local community of larger vertebrates.

Reprinted from Proceedings, Nebraska Academy of Sciences, 100th Annual Meeting, April 20, 21, 1990, P. 60.

**A CLARENDONIAN MICROFOSSIL MAMMAL ASSEMBLAGE IN NORTH-CENTRAL NEBRASKA**

Chris E. Rudnick, Division of Vertebrate Paleontology, University of Nebraska State Museum, Lincoln, Nebraska 68588-0514

Small mammal diversity (26% of the total mammalian fauna) during the Clarendonian land mammal age (8.5 to 11.5 mybp) is lower than the preceding Barstovian age (16 to 11.5 mybp) where small mammals represent 46% of total mammals, and the later Hemphillian age (8.5 to 4.3 mybp) where small mammals represent 48% of total mammals. Is this an actual representation of lower species diversity or is it the result of some other factor?

A recent study involving prolonged screen sampling of a late Miocene fluvial deposit in north-central Nebraska yielded the following results: Clarendonian small mammal diversity and abundance varied within the deposit depending upon grain size and sorting. Diatomaceous silts and fine sands and very coarse sand and gravel produced a smaller number of small mammal fossils than did intermediate grain sizes. Small mammal diversity in proportion to the entire mammal fauna was found to be 48%. This suggests that the paucity of small mammal fossils does not reflect an actual scarcity but rather the application of inefficient collecting techniques in unfavorable lithofacies.

Reprinted from Proceedings, Nebraska Academy of Sciences, 100th Annual Meeting, April 20, 21, 1990, P. 63.

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