Limnogeology Division Newsletter Volume 3. Number 1. June 2005.

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Baker Lake, Nevada - May all your lakes be this beautiful to core! (see article below)

Welcome: Welcome to the first issue of the third volume of the Limnogeology Division of the Geological Society of America (GSA). It is hard to believe we are now into our third year as a Division and as a newsletter.

In this issue we have the message from the Chair Tom Johnson (promised in the last issue but delayed due to field work), an article about limnogeology in Nevada, written by "yours truly", and the usual meeting information. No new books on limnogeology have come to our attention in the last 6 months, but if you look in previous newsletters, there are plenty of options out there. It is a relatively short newsletter this month, but there are some interesting meetings and workshops to take note of, particularly the Lake Tahoe coring workshop (see meetings section), and GSA, of course. Our next newsletter will have an article on the lakes of Mars, so that should definitely be interesting. We are eager to receive more articles from our Division members, especially any of you who may feel that your favorite aspect of limnogeology is not being covered sufficiently. So please give some thought to a submission. But enough of this! Enjoy the newsletter and see you in Salt Lake City I hope!

Michael Rosen, *Carson City*

Message from the Chair - Tom Johnson, Chair (2004-2006)

Greetings from the Presidential Suite of the Limnogeology Division! My view of Central Park is superb, and the room service is quite elegant. Ah, fantasy, fantasy. Fear not, for your dues paid to the Limnogeology Division do not support the life style to which we division officers aspire, darn it. In 2004, 95% of our total income (dues and contributions) was expended on the Kerry Kelts Research Awards provided to three graduate students to further their thesis research in limnogeology. (For details on awardees, see our January 2005 newsletter.) The remaining 5% of our 2004 expenditures was used for postage associated with election ballots and newsletters. The official recognition of student talent in limnogeology is an important activity for our division, for it encourages our young colleagues to excel in their science, and it enhances their abilities to develop new and important professional contacts for their future endeavors in the field.

Unfortunately the size of the Kelts awards is limited presently to $300 each, due to our relatively small membership. For this reason, I encourage you to expand the membership of the Limnogeology Division, by personally contacting your colleagues and asking if they have yet joined. I also ask you to consider making a donation to the Limnogeology Division above and beyond the level or our modest annual dues. I can assure you that the funds will go almost entirely to the student research award fund. Our auditors in green eye shades are highly motivated – I don't see the Presidential Suite becoming a reality anytime soon.

I just returned from the DOSECC (Drilling Observation and Sampling of Earth's Continental Crust) Annual meeting in Austin, Texas, where we heard reports on a number of continental scientific drilling programs. Among these were preliminary reports of drilling projects completed during the past year on Lake Bosumtwi , West Africa (see article by Jon Peck in the January 2005 Newsletter); Lake Malawi, East Africa; three lakes in Iceland; Hvítárvatn: "White Stream Lake", Haukadalsvatn: "Hawk Valley Lake", Hestvatn: "Horse Lake", and a Pleistocene lake bed underlying Valles Caldera in New Mexico. Lake drilling projects are becoming more frequent and more ambitious in scope, a sign that Limnogeology is gaining prominence in the field of Earth Sciences. Our challenge is to demonstrate that the investment in these drilling projects is warranted. Are we breaking new frontiers in such fields as paleoclimatology, continental dynamics, and petroleum geology, or are we only confirming what already has been discovered? Among our more immediate challenges are to improve our ability to date lake deposits accurately, and to generate more sophisticated means of detecting and interpreting the signals in lake sediments of various age and setting. As daunting as these tasks may seem, consider the parallel challenges that faced investigators of polar ice cores just three decades ago.

The Limnogeology Division was established to promote: (1) research on both ancient and modern lakes around the world, (2) collaboration of scientists from all disciplines on lake research, (3) presentation and publication of lake research, and (4) students in performing research or wishing a career in lake studies. The Division is doing a pretty good job through its sponsorship of sessions and field trips at various professional meetings and through its student research awards program. We are sponsoring (or co-sponsoring) the following sessions at the upcoming annual meeting of the GSA (as well as several field trips), and I urge you to consider submitting abstracts to help insure that they fill up with a stimulating collection of presentations:

T-10: Chemistry, Ecology and Groundwater Hydrology of Lakes, Streams, Playas and Springs: Observations at the Interface - Alison Smith, Donald Rosenberry, Emi Ito, co-conveners.

T-57: Paleoenvironmental Records in and Around the Bonneville Basin: From Glacial/Interglacial Cycles to Anthropogenic Impacts – Joseph F. Rosenbaum and Katrina Moser, co-conveners.

T-61: Glacial Geology and Lake Sedimentology: In Memory of Geoffrey O. Seltzer – Donald T. Rodbell and Jacqueline A. Smith, co-conveners.

T-77: Advances and Applications with the Fossil Record of Non-Marine Arthropods (Paleogeoarthropods: Insecta, Chelicerata, Myriapoda, some Crustacea), for Geoscientists and Biologists – Cary R. Easterday and Sarah H. Lubkin, co-conveners.

T-115: Holocene Climate Change in Western North America: Spatial-Temporal Phasing of Climate Modes, Events, and Transitions – Matthew E. Kirby, Steve P. Lund, Larry V. Benson, Rob Negrini, co-conveners.

T-116: Causes and Effects of the Paleocene-Eocene Thermal Maximum and Other Paleogene Hyperthermal Events – Scott L. Wing, convener

(see “meetings” below for email addresses of conveners)

However there is more that the Division can do, for example, through sponsorship of thematic workshops in Limnogeology, or perhaps by encouraging improved dialog between program managers in the funding agencies and our community. If you have ideas for making the Limnogeology Division more effective, please contact me at tcj@d.umn.edu. I will pass your suggestions on to the other officers and we will consider them for discussion at our Business Meeting at the GSA Annual Meeting in Salt Lake City, scheduled for Tuesday, October 18, from 5:45 to 6:30 pm. I hope to see you there!

Tom Johnson

Feature Article

Limnogeology of some Nevada lakes

Michael R. Rosen, U.S. Geological Survey, Carson City Nevada

This article is intended as an introduction to a few lake coring studies that I have been involved in while I have worked for the US Geological Survey in Nevada. Specifically I will discuss cores and sediments studied from Big Soda Lake, Pyramid Lake and Baker Lake (Figure 1). Limnogeology has a relatively rich history in Nevada and important studies by other researchers on Moderen Nevada lakes such as Pyramid Lake, Walker Lake, and Lake Mead have contributed to our understanding of Holocene and Pleistocene climate and anthropogenic contaminants entering the environment. There have also been extensive studies of Pleistocene (Lake Lahontan) and older lakes by numerous research over the years. What I will discuss is a relatively short period of time; mostly over the last couple hundred years, but extending back perhaps 1500 years at Baker Lake. The three lakes have very different geologic, limnologic and anthropogenic influences. Pyramid Lake, which is probably the best known, is currently the terminal lake of the Truckee River Basin. The Truckee River passes through the cities of Reno and Sparks and is influenced by a population of more than 350,000 people. Pyramid Lake is a large deep lake that is a remnant of Pleistocene Lake Lahontan. Extensive studies by Larry Benson and his colleagues(Benson, 1994; Benson et al., 2002; Benson et al., 1996), and other studies by Lebo et al. (1994), Meyers et al. (1998), Yang et al. (2003), and others have documented the paleoclimate and inorganic contaminants caused by anthropogenic influences on the basin to a large extent. Our study extends these studies by including organic contaminants

Figure 1. Approximate locations of Pyramid, Big Soda, and Baker Lakes

and looking more closely at some organic isotopic measurements of carbon and nitrogen. Pyramid Lake is a hyposaline lake that supports an important game fish population (trout). Big Soda Lake on the other hand is a small ground water-fed lake that is over 60 m deep. It is a volcanic explosion crater from an eruption that occurred in the last 10,000 years. It is currently meromictic with a mixolimnion that is about 35 m deep and has a total dissolved solids (TDS) concentration of about 25,000 mg/L. The monimolimnion has a TDS of over 85,000 mg/L. Big Soda Lake has been studied since the King survey went through Nevada in the 1860s (King 1877). It has been studied by Russell (1885), Hutchinson (1937), Kharaka et al. (1984) and many others due to its unique chemistry and the fact that it has only been meromictic for the past 100 years due to the construction of the Newland's Irrigation Project in 1907. Baker Lake is an even smaller alpine lake that is about 3 m deep and is located in Great Basin National Park at an elevation of over 3,000 m. As far as I am aware, there have been no limnolgeological studies of this lake and no detailed limnological studies. Baker Lake was cored as a "reference" lake for other studies that are being done as part of the National Water Quality Assessment Program of the US Geological Survey (see the article by Pete Van Metre in Volume 2 Number 1 of the Limnogeology Division Newsletter). The purpose of this article is to show what has been done in these lakes and what is ongoing. The Big Soda Lake study tufa study is completed and has been published (Rosen et al., 2004) but the core has not been analyzed yet. The Pyramid and Baker Lake cores have been analyzed and we are in the process of writing up the results, what is presented below is a preliminary assessment of the data collected.

Pyramid and Baker Lakes

The cores from Pyramid and Baker Lakes were taken during the same week near the end of August 2003 (Figures 2 & 3). For family reasons I could not actually be there when the cores were taken, but I have been the principal researcher analyzing the material we obtained. A box core about 0.5 m in length and a gravity core about 1 m long were obtained from both lakes (Figures 4). Lead-210 and Cs-137 age dating has been done on the box cores and we are now trying to match up sequences to the gravity cores to extend the record back as far as we can. Other historical markers, such as the use of mercury for gold extraction during the Comstock era in Virginia City in the 1860s, provide additional markers, and the use of historical lake stage data from Pyramid Lake are also useful for constraining trace metal concentrations in the cores (Figure 5). The mercury profiles in both the box and gravity cores from Pyramid Lake have almost identical profiles and show that the gravity core has compacted approximately 30 percent relative to the box core. This information will be used for constraining age profiles in the cores. Preliminary analysis of the gravity and box cores indicate that trace metal concentrations and carbon, oxygen and nitrogen isotopic signatures correlate with lake stage height, some decreasing and other increasing. Box core and gravity core data agree relatively well. For example a plot of calcium concentrations in both cores compared to Pyramid Lake stage height shows that calcium decreases in both cores when lake stage falls (Figure 6). Carbonate content in the core also decreases, which explains the lower Ca concentrations. Organic contaminants have never been analyzed in cores from Pyramid Lake. Concentrations are relatively low, but increases of up to four times the background concentrations for PAHs are found in samples from the past 10 years and around 1970 (Figure 7). Assuming our age dating is accurate, these periods correspond to small lake level increases indicating that increased runoff may entrain more organic contaminants into Truckee River water. Although lake level rose in the early 1980s, we have not sediment sample that corresponds to that period of time.

The information given above is simply a short preview of the work we are conducting on these cores. Additional information on stable isotopes, trace element chemistry, mass accumulation rates, and sedimentology is still in progress. Hopefully we will have a manuscript completed in

Figure 2. Pyramid Lake coring expedition with pontoon boat used for coring. Pyramid tufa is in the background.

Figure 3. Baker Lake from above.

the next 3 to 4 months. Our data is complimentary to the data collected by Yang et al (2003), because these authors did not collect organic contaminant data, they did not analyze whole sediment samples (they used acid extractable concentrations), and they compared their concentration profiles to Truckee River discharge data near Pyramid Lake, rather than to Pyramid Lake stage height data. Hopefully, a further detailed study will shed more light on anthropogenic effects on Pyramid Lake in the last 200 years.

The dating of the cores from Baker Lake indicates slow depositional rates of approximately 0.25 mm per year, which is identical to depositional rates calculated for Big Soda Lake by Oremland et al. (1988) from a longer record. The settings of these two lakes are somewhat different. Baker Lake is an alpine lake with a small catchment and Big Soda Lake is a lowland lake that is ground water-fed. However, both lakes have small catchments and little deposition from surface runoff, except from catastrophic landslides. In contrast, Pyramid Lake has a somewhat variable

Figure 4. Box core from Baker Lake. No visible lamination is present in the core.

depositional rate, depending on where the core is taken in the lake, but in our box core it appears to be about 2 mm per year. Because of the lower deposition rate in Baker Lake, our record can be extrapolated back almost two thousand years. If this extrapolation is correct, we can see increases in trace metal and major element concentrations between 1300 and 1900 calendar years before present (Figure 8). This period corresponds to the Little Ice Age (LIA) that occurred between approximately AD1350 (or 1450) to AD1900. Transport and/or sources of dust (e.g., particles, calcium, magnesium, potassium) and species of marine origin (e.g., sodium, chloride and others) to central Greenland increased during the LIA. (Taylor et al., 1992; Whitlow et al., 1994), indicating that this could be a possible explanation for increases in this alpine lake. However, more work needs to be done on the sediments to verify this hypothesis. Analysis of pollen and diatoms are planned to see if similar sorts of changes occur over this period for these types of indicators.

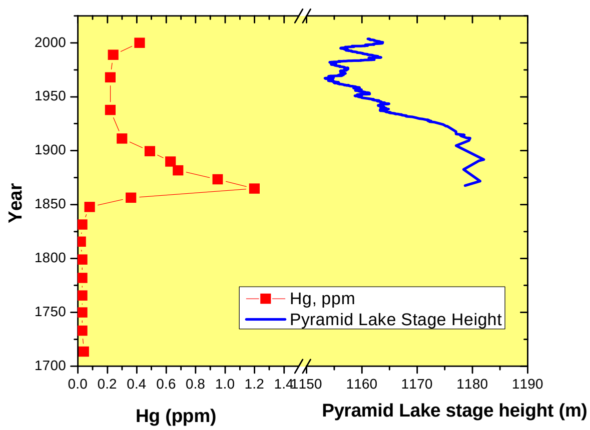

Figure 5. Mercury concentrations in Pyramid Lake core compared to lake stage height. Note the Hg peak around 1865.

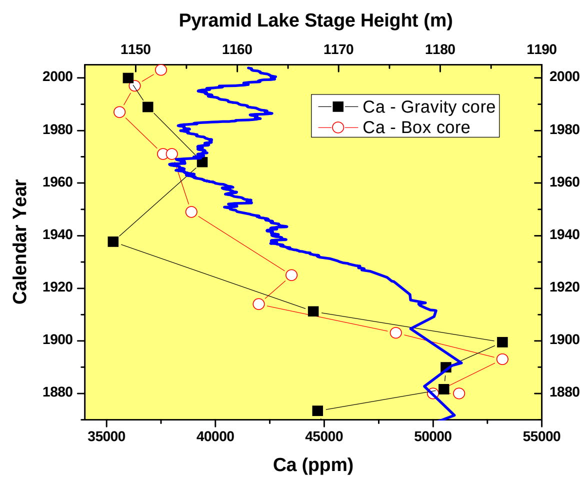

Figure 6. Calcium concentrations in both the box and gravity cores compared to lake stage height. Both have similar trends and decrease as lake level decreases.

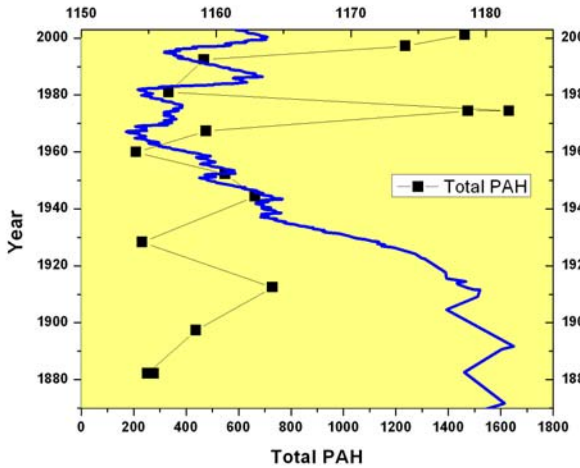

Figure 7. PAH concentrations in the box core compared to Pyramid Lake stage height. Note PAH increases correspond to level increases.

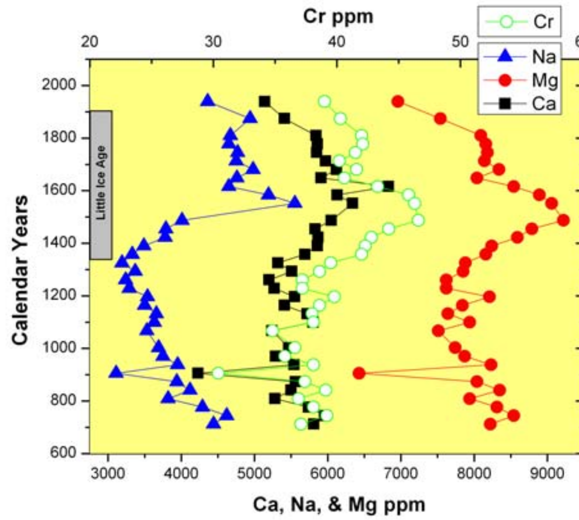

Figure 8. Concentrations of Na, Ca, Mg and Cr in the Baker Lake gravity core. Higher concentrations appear to correlate with the timing of the Little Ice Age period (grey rectangle).

Big Soda Lake

Two pieces of work have been undertaken at Big Soda Lake. The first was the study of Modern tufa mounds that have formed in the last 100 years. The results of this work were published last year (Rosen et al., 2004). However, in preparing the figure for the isotopes for the paper, I used some information that came from Kharaka et al. (1984) and I included isotope data for water from below the chemocline in the graph. I have corrected the graph below (Figure 9) and it now shows that the lake water that could have formed the tufa mounds is heavier than all the measurements from the tufa carbonate. The new figure reinforces the interpretation in the paper, but I just wanted to show the correct figure somewhere. It isn't worth sending a correction to *Geology* for this.

The second piece of work was to take a gravity core from the central part of the lake. A core was taken by Oremland et al. (1988) and some work was done on the organic chemistry of the core and the upper part was age dated. However, no geochemistry or sedimentology was published on this core, so we decided it was a good opportunity to try out our new gravity coring gear and our new GPS system for our boat. Figure 10 shows six photos of the coring experience. It was a beautiful day with little wind when we did the coring last year (2004). On our first try (photos 1 and 2) we got a very nice meter-long core. I got an end-cap on the bottom of the core and was trying to get some tape around the end-cap when it was suggested that I stand it up to get the weights off the top. Well, that was a mistake! Photo 3 shows the result of the pressure of 2 meters of water and sediment on the end-cap once the suction had been removed. Even with my hand on the bottom, the core went all over the bottom of the boat! Yuck, did it smell! After cleaning out the boat as best we could, we tried again. Photos 4-6 show the second attempt and the beautiful 1 meter length core that shows many internal millimeter scale lamination in the core. We weren't exactly in the middle of the basin, but the core was taken in about 50 m of water (The lake is 61 meters deep). The core is now stored in a freezer at the University of Nevada at Reno and we are waiting on some funding to actually analyze the core. If someone is interested in looking at the core or wants to do some collaborative work on the core, just let me know and we can see what we can do. I believe there is a complete Holocene climate record in the lake although the core may not get to the beginning of the Holocene. The Oremland et al (1988) core was about 2 meters long, so our core is obviously not the entire sequence of sediments in the lake. However, it is not clear how much sediment is in the lake. It has been estimated that the lake is about 10,000 years old (see Kharaka et al.1984), but I don't know how precisely that age is known.

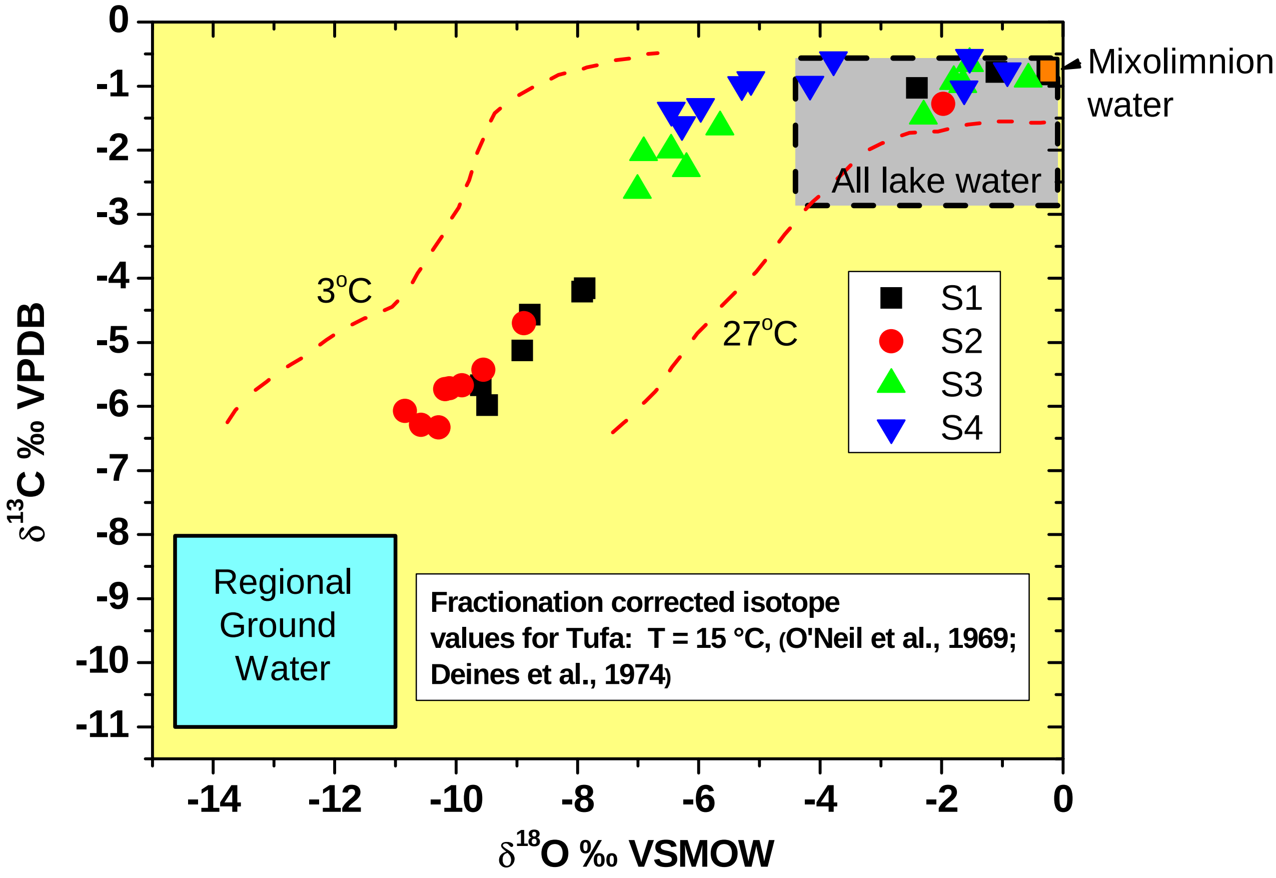

Figure 9. Stable isotope plot of tufa carbonates compared to the water from which they could have formed. The figure is a corrected version of the one in Rosen et al. (2004). Note that the current lake water composition is heavier than all the values from the carbonate.

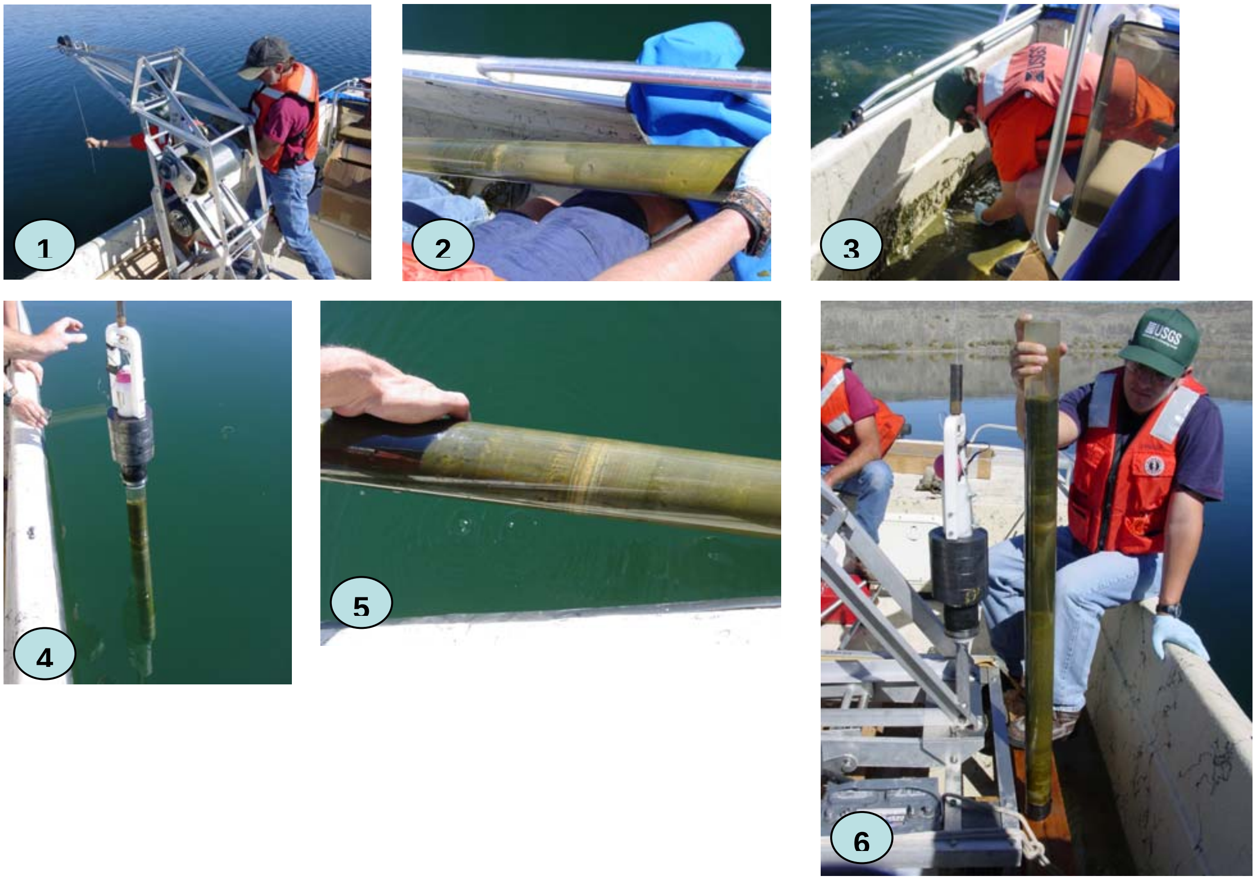

Figure 10. Photos of the coring expedition on Big Soda Lake. See text for explanation of the photos.

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Meetings

Below is an announcement on workshop to discuss planning and research on coring at Lake Tahoe, taken from their web page: http://tahoeworkshop.ucdavis.edu

Workshop on Coring in the Lake Tahoe Basin

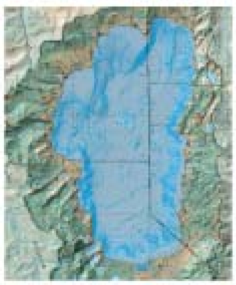
September 15-18, 2005
Granlibakken Lodge, Tahoe City, California

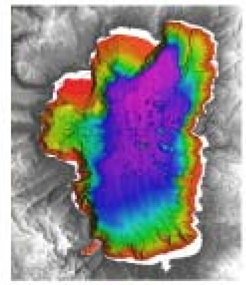
[Objectives] [Application] [Funding] [Organizing Commitee] [Contact]

Objectives

Recent studies suggest that off-shore and on-shore sedimentary sequences in the Lake Tahoe Basin contain a continuous record of geologic processes, extending back two-million years. Such a record would represent one of the longest and most continuous records in North America, and one that is recoverable with existing coring technology. The purpose of this workshop is to develop a comprehensive plan for scientific coring in the Lake Tahoe basin. The workshop will build on an earlier workshop that identified key questions that could be addressed by coring. These questions deal with the paleoclimate record of the region, the role of earthquakes, landslides and volcanic activity in shaping the basin, the history of glaciation in the region, and the subsurface movement of water in the basin. The answers to these questions will give planners and policymakers a firmer basis on which to make decisions about restoration and preservation of Tahoe's unique environment, about mitigation of geologic hazards that threaten Tahoe's inhabitants and structures, and about control and remediation of groundwater contamination.

Participants in the workshop will be expected to work in teams to develop a detailed science plan. This plan will serve as the basis for multi-institutional and multidisciplinary proposals that can be submitted to NSF, EPA, USGS and other funding agencies. Participants will also address technical, logistical and political issues that will arise from a large and complex coring program.





Application

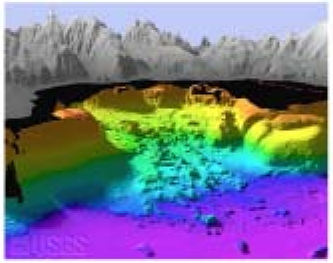
The workshop will be held at Granlibakken Lodge in Tahoe City, California. The organizing committee expects to be able to cover lodging and per diem for all participants as well as travel expenses up to $200.

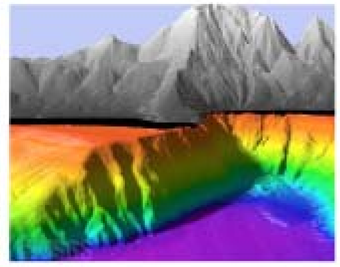
Any researcher interested in the Tahoe basin is invited to apply to the workshop by sending an e-mail to tahoeworkshop@geology.ucdavis.edu. The e-mail should include the following: name, position, contact information, a brief statement of the reasons for wanting to attend the workshop, and if appropriate, a second brief statement about prior work in the Tahoe basin. The deadline for applications is July 31st. Participants will be notified by August 15th.

Information about the workshop is only being disseminated electronically. Visitors to this site are encouraged to bring it to the attention of others who might be interested.

Funding

The workshop is funded by a grant from DOSECC. Additional support for the workshop is provided from the John Muir Institute for the Environment and the Tahoe Environmental Research Center at the University of California-Davis, the Desert Research Institute, the Academy for the Environment at the University of Nevada-Reno, the Institute for Geophysics and Planetary Physics at University of California-San Diego, and the United States Geological Survey.





Organizing Committee

The members of the organizing committee for the Workshop on Coring the Lake Tahoe Basin are Gary Acton (UC Davis), Ken Adams (Desert Research Institute), Irina Delusina (UC Davis), Alan Heyvaert (UC Davis), Graham Kent (UC San Diego), Victor Mossotti (USGS), Dave Osleger (UC Davis), André Sarna-Wojcicki (USGS), Geoff Schladow (UC Davis), Rich Schweickert (University of Nevada, Reno), Gordon Seitz (San Diego State University), Scott Starratt (USGS) and Ken Verosub (UC Davis).

Contact

Questions about the workshop should be directed to Ken Verosub, chair of the organizing committee (verosub@geology.ucdavis.edu).

September 26-30 2005, International Society for Salt Lake Research, 9th Conference, Perth, Western Australia

See http://www.isslr.org for details

Registration deadline is April 30 2005
Abstract submission deadline is May 30 2005
Final circular and program August 15, 2005

Contact (head of local organizing committee) Dr Jacob John, Curtin University of Technology, j.john@curtin.edu.au

Registration is $600 AUD
Student registration is $350 AUD

Conference brochure: http://muresk.curtin.edu.au/conference/ISSLRBrochure.pdf

October 16 – 19, 2005; Proposed Sessions sponsored by the Limnogeology Division for the Geological Society of America Annual Meeting in Salt Lake City.

Holocene Climate Change in Western North America: Spatial-Temporal Phasing of Climate Modes, Events, and Transitions – Contacts: Matthew E. Kirby, mkirby@fullerton.edu, Steve P. Lund, slund@earth.usc.edu, Larry V. Benson, lbenson@usgs.gov, and Rob Negrini, rnegrini@csub.edu

Paleoenvironmental Records in and Around the Bonneville Basin: From Glacial/Interglacial Cycles to Anthropogenic Impacts – Contacts: Joseph G. Rosenbaum, jrosenbaum@usgs.gov and Katrina A. Moser, katrina.moser@geog.utah.edu

Advances and Applications with the Fossil Record of Non-Marine Arthropods (Paleogeoarthropods: Insecta, Chelicerata, Myriapoda, some Crustacea), for Geoscientists and Biologists: Contacts: Cary R. Easterday, ceaste2@uic.edu and Sara H. Lubkin, shl24@cornell.edu

Causes and Effects of the Paleocene-Eocene Thermal Maximum and Other Paleogene Hyperthermal Events. Contact: Scott L. Wing, wings@si.edu

Glacial Geology and Lake Sedimentology: In Memory of Geoffrey O. Seltzer. Donald T. Rodbell, rodbelld@union.edu and Jacqueline A. Smith, jasmit10@syr.edu

Chemistry, Ecology and Groundwater Hydrology of Lakes, Streams, Playas and Springs: Observations at the Interface. Contacts: Alison J. Smith, alisonjs@kent.edu, Emi Ito, eito@umn.edu, and Donald Rosenberry, rosenber@usgs.gov

Please submit abstracts to these sessions so that we will have a good representation of limnogeology at the meeting.

Also sign up for all the Limnogeology Division field trips!!! There are both before and post meeting field trips planned. See *GSA Today* or http://www.geosociety.org/meetings/2005 for details.