Geological Society of Nevada Southern Nevada Chapter Newsletter

April 2007

PRESIDENT
Bruce Hurley
U.S. Department of Energy
702.295.1284
hurley@nv.doe.gov

VICE PRESIDENT
Jean Cline
UNLV Professor of Geology
702.895.1091
jean.cline@unlv.edu

TREASURER
R. Paul Bowen
R.P. Bowen Engineering, Inc.
702.247.7765
paulbowen@cox.net

SECRETARY/WEBMASTER
Joseph Kula
UNLV Graduate Student
702.895.4751
jkula@unlv.nevada.edu

NEWSLETTER EDITOR
Lora Griffin
UNLV Undergraduate Student
702.419.7661
lora.griffin@unlv.edu

Death Valley Regional Ground-water flow system, Nevada and California—Hydrogeologic Framework and Transient Ground-water Flow Model

SPEAKER: **Wayne Belcher**

DATE: Thursday, April 26, 2007

LOCATION: LFG Rm. 102

TIME: Social half-hour at 6:00 pm
Meeting business at 6:30 pm

SPONSOR: OPEN

Geological Society of Nevada, Southern Nevada Chapter
University of Nevada, Las Vegas
4505 Maryland Parkway, Box 4010, Las Vegas, NV 89154-4010
http://geoscience.unlv.edu/GSN/gsnsc.htm

As we reach the end of the 2006-2007 GSN year, it is a good time to look back, and also ahead. During this year, the Southern Nevada Chapter supported a GSN Field Trip to southern Nevada for the first time in some years. We were also able to put together a very enjoyable chapter trip to the dinosaur sites near St. George, with the presentation by Jim Kirkland providing an unforeseen bonus to the field excursion. As a result of having sponsors for five of our meetings, and the proceeds of our two silent auctions, we were able to cover expenses for the year, and membership attendance is up modestly. All of these are good signs for the future of the Southern Nevada Chapter. However, we still need to get more chapter members actively involved across the range of our activities. A good chance to do this presents itself this Thursday evening, when we elect officers for the 2007-2008 year. I urge each of you to try to attend this meeting and cast your vote, or even better, to consider volunteering for a position for next year. Things have gone well for our chapter this year, but with your help, they can only get better for next year.

-- Bruce Hurley

GSN Spring Field Trip 2007

By Bruce Hurley

The Geological Society of Nevada Spring Field Trip for 2007 departed Las Vegas for the Nevada Test Site (NTS) at 7:20 am on Thursday, April 12, in pleasant, 60-degree weather. The trip reached the NTS at just about the same time as a strong Pacific weather front, and arrived at the Yucca Mountain site in a rain shower. High winds prevented the trip from visiting the top of Yucca Mountain, but attendees were able to visit the north and south portals of the Exploratory Studies Facility, and view the "Yucca Mucker" tunnel boring machine and the Ghost Dance Fault. Brian Dozier of Los Alamos National Laboratory (and the GSN Southern Nevada Chapter) provided a very informative briefing on the repository project and current activities at Yucca.

From Yucca Mountain, the trip headed east and then north across the NTS, to view the Paleozoic carbonate rocks of Syncline Ridge and visit Miocene felsic pyroclastic deposits erupted from the nested calderas of Southwestern Nevada Volcanic Field. The tour reached the crest of Pahute Mesa just in time for a little "Elko weather," but the snow did not stick, and all got a good look at the bedded Miocene tuff units there. From Pahute, it was on to the Rainer Mesa Overlook, to view displacement resulting from the Belted Range Thrust Fault, and the Tunnel Beds sequence, which was used extensively to host underground nuclear tests beneath Rainer Mesa.

Coming down, and warming up, from the Mesas, attendees hiked up to a knob on Radio Tower Hill at the north end of Yucca Flat, where they were able to observe Eleana Formation sandstone and conglomerate units of submarine canyon depositional origin. The tour proceeded on east for a "drive by" of the Climax Mine and Climax stock, first mined for tungsten in the early days of the NTS, and later used for underground nuclear device and nuclear waste storage tests in granite.

Next on the agenda was a visit to the rim of Sedan Crater, a massive excavation formed by an underground nuclear detonation during Project Plowshare in 1962. This test was carried out to evaluate the potential for the use of nuclear explosives for large-scale construction projects, such as canals. From Sedan, the bus headed south, to view the ICECAP site. ICECAP was the site of an underground nuclear test being prepared to be carried out when the nuclear test moratorium was announced in September 1992.

Many of the non-nuclear components of this planned test have been left in place to display the test equipment and configuration involved in conducting a nuclear test in an underground shaft. A short distance further south, the tour was able to drive through the collapse sink (sometimes referred to as a subsidence crater) from the Bilby underground-test of 1963.

A brief drive back to the east took the trip to the remaining wooden house from the Apple-2 atmospheric nuclear test of 1955. This house was one of a number of houses constructed to determine the effects of a nuclear explosion on ordinary residential structures for civil defense purposes. From the Apple-2 site, the tour returned to Mercury at the south end of the NTS, where attendees visited the U.S. Geological Survey Core Library. The Core Library contains a large proportion of the core obtained from the approximately 4000 holes drilled at the NTS, in addition to drill logs for many of these holes. Upon leaving the Core Library, the trip departed for Las Vegas, dinner at Cozymel's, and preparation for Day 2 of the trip.

Geologists for a Cure

The **12th Annual Race for the Cure** will take place, Saturday May 5, 2007 at the Fremont Street Experience in downtown Las Vegas. Local geologists will gather together to raise money for the *Susan G. Komen Breast Cancer Foundation*.

There are **6 Ways to Participate:**
5k Run (timed) ~ $20 registration
5k Walk (timed) ~ $20 registration
1 mile walk ~ $20 registration
Sleep in for a Cure ~ $20 registration
Kids for the Cure® (ages 3-12; $10 registration)
Babies for the Cure® (under 3 yrs; $10 registration)

Prizes will be awarded to the top run finishers, largest teams & individuals who raise the most money for the breast cancer foundation.

For more information on how you can join with geologists from the UNLV Geosciences team email **rhowley@unlv.nevada.edu** or visit http://race.komenlasvegas.com/site/TR?team_id=7210&pg=team&fr_id=1020 &/or http://race.komenlasvegas.com.

Start Times:
5K Run – Start Time: 8:15am
5K Walk – Start Time: 8:20am
1 Mile Fun Walk – Start Time: 8:45am
Sleep In for the Cure® - For those individuals or team participants who are unable to attend the Race but wish to support the fight against breast cancer.
Register as a Sleep In for the Cure® participant and receive a special Sleep In for the Cure® T-shirt (vs. the Race T-Shirt).

You must register online by April 26, 2006
Registration is only $20 if part of a team!
Robyn Howley will pick-up all team packets and distribute them before Race Day!

If you don't wish to join the team you can still *Support the cause by donating to a single team participant or by making a team donation!*

UPCOMING EVENTS

April 26:
Meeting – Wayne Belcher,
Death Valley Regional
Groundwater Flow Model
Officer Elections

April 27:
Mackay Seminar
Dr. Peter Megaw, President IMDEX Inc., **"Exploration and Development of Excellon Resources Platosa Bonanza Ag-Pb-Zn Manto Deposit, Durango, Mexico"** Reception immediately following in the Mackay Building, 4:00–5:30 p.m. in the Lilly Brant room. Lecture in the Mackay Science Building – Building 036, Room 215. RSVP shelley@mines.unr.edu by April 23.

May 4:
Mackay Seminar
John Muntean, Nevada Bureau of Mines and Geology, Mackay School of Earth Sciences and Engineering **– "The Turquoise Ridge Gold Deposit"**

MEETING SPONSORS ADVERTISING

Meeting sponsorship has always been important to the goal of keeping operating costs to a minimum to ensure that funds are available for chapter functions and scholarship awards. Don't forget refreshment sponsors receive newsletter advertising on our "Meeting Sponsors" list in the newsletter. Businesses or individuals who would like sponsor a social hour at one of our GSN Southern Nevada Chapter meetings or would like to place a "Paid Advertisement" in our monthly newsletter should contact Bruce Hurley at (702) 295-1284 or hurley@nv.doe.gov .

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Contact Lora Griffin at lora.griffin@unlv.edu

Death Valley Regional Ground-water flow system, Nevada and California—Hydrogeologic Framework and Transient Ground-water Flow Model

Speaker: **Wayne Belcher**

ABSTRACT

A numerical three-dimensional (3-D) transient ground-water flow model of the Death Valley (DV) region was developed by the U.S. Geological Survey for the U.S. Department of Energy programs at the Nevada Test Site and at Yucca Mountain, Nevada. Decades of study of aspects of the ground-water flow system and previous less extensive ground-water flow models were incorporated and reevaluated together with new data to provide greater detail for the complex, digital model.

A 3-D digital hydrogeologic framework model (HFM) was developed from digital elevation models, geologic maps, borehole data, geologic and hydrogeologic cross sections, and other 3-D models to represent the geometry of the hydrogeologic units (HGU's), as well as structural features, such as faults and fractures that affect ground-water flow. The HFM represents Precambrian and Paleozoic crystalline and sedimentary rocks, Mesozoic sedimentary rocks, Mesozoic to Cenozoic intrusive rocks, Cenozoic volcanic tuffs and lavas, and late Cenozoic sedimentary deposits of the DV regional ground-water flow system (DVRFS) region in 27 HGU's.

Information from a series of investigations was compiled to conceptualize and quantify hydrologic components of the ground-water flow system within the DVRFS model domain and to provide hydraulic-property and head-observation data used in the calibration of the transient-flow model. These studies reevaluated natural ground-water discharge occurring through evapotranspiration (ET) and spring flow; the history of ground-water pumping from 1913 through 1998; ground-water recharge simulated as net infiltration; model boundary inflows and outflows based on regional hydraulic gradients and water budgets of surrounding areas; hydraulic conductivity and its relation to depth; and water levels appropriate for regional simulation of prepumped and pumped conditions within the DVRFS model domain. Simulation results appropriate for the regional extent and scale of the model were provided by acquiring additional data, by reevaluating existing data using current technology and concepts, and by refining earlier interpretations to reflect the current understanding of the regional ground-water flow system.

Ground-water flow in the DV region is composed of several interconnected, complex ground-water flow systems. Ground-water flow occurs in three subregions in relatively shallow and localized flow paths that are superimposed on deeper, regional flow paths. Regional ground-water flow is predominantly through a thick Paleozoic carbonate rock sequence affected by complex geologic structures from regional faulting and fracturing that can enhance or impede flow. Spring flow and ET are the dominant natural ground-water discharge processes. Ground water also is withdrawn for agricultural, commercial, and domestic uses.

Ground-water flow in the DVRFS was simulated using MODFLOW-2000, a 3-D finite-difference modular ground-water flow modeling code that incorporates a nonlinear least-squares regression technique to estimate aquifer parameters. The model uses annual stress periods with discrete recharge and discharge components. Recharge occurs mostly from infiltration of precipitation and runoff on high mountain ranges and from a small amount of underflow from adjacent basins. Discharge occurs primarily through ET and spring discharge and water withdrawal by pumping and, to a lesser amount, by underflow to adjacent basins. All parameter values estimated by the regression are reasonable and within the range of expected values. The simulated hydraulic heads of the final calibrated transient model generally fit observed heads except in areas of either nearly flat, or very steep hydraulic gradient.

The model represents the large and complex ground-water flow system of the DV region at a greater degree of refinement and accuracy than has been possible previously. The representation of detail provided by the 3-D digital hydrogeologic framework model and the numerical ground-water flow model enabled greater spatial accuracy in every model parameter. The lithostratigraphy and structural effects of the hydrogeologic framework; recharge estimates from simulated net infiltration; discharge estimates from ET, spring flow, and pumping; and boundary inflow and outflow estimates all were reevaluated, some additional data were collected, and accuracy was improved.

More information about the DVRFS, edited by Wayne Belcher, is available in the U.S. G. S. Scientific Investigations Report 2004-5205, page 408, or on-line at: http://water.usgs.gov/pubs/sir/2004/5205/.