Wisconsin Ground Water Association Newsletter

INSIDE THIS ISSUE:

President's Message

First and foremost, I think we really have to put our hands together to thank Boyd Possin and Margy Blanchard who have heroically directed the flow of WGWA the past four years in tag team fashion. Those are shoes that are too big to be filled by one or two persons—which brings me to my next point—this is an organization at a cross roads. Although currently fiscally healthy, our membership has declined in recent years from about 340 (2002) to 300 (2003) to 280 (2004). The job climate in our field and the economy over that span had much to do with that, but apparently it has caused a secondary impact to those who continue to work in the hydrogeology realm. Everyone these days seems to be working long hours, including into weekends, and that can lead us to have tunnel vision where we don't see anything beyond our immediate projects, whether private, public, or academic.

I would argue that in such a time, an organization like WGWA is even more valuable now because it allows you to keep in touch and be aware of things that you often don't have time to keep track of yourself. To that end, we will be making a bigger effort to use the newsletter to report on conferences (that our workloads seem to allow less and less for), helping you to in fact be in two places at once. And I would encourage you to make this a **two-way** street and provide highlights to WGWA for the events **you** are able to attend. Many hands lighten the load—we need to work together.

Speaking of working together, one of the things I have enjoyed over the last several years is hooking up every two months with fellow WGWA members in our geographic "Area." In the Southern Area, this has for the last several years simply been to meet informally for breakfast. It is an invaluable time to find out what others are doing, what issues they are encountering (and answers!), and to build friendships. Two of our areas, Southeast and North Central, have put in extra effort to have speakers—Todd Roush and Scott Brockway are to be commended for their recent work in this realm. You may have noticed several of our positions for WGWA "Area Coordinators" are open. Being a coordinator can be as simple of a task as sending out an e-mail once every two months and getting together for breakfast (we all make time to eat—or at least we should!). I urge someone in each regional area to

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The newsletter is published four times per year. If you have any suggestions or submissions, please contact us at: Wisconsin Ground Water Association, c/o Marilyn Weiss, WGWA Treasurer, P.O. Box 8593, Madison, Wisconsin 53708-8593. Email: wgwainfo@wgwa.org; Web site: http://www.wgwa.org. The deadline for submissions to the 2nd quarter of 2005 newsletter is May 15, 2005.

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make this small effort and I encourage all of us who logistically can to attend—you might be surprised at the results.

Lastly, it's not too early to be thinking about our annual conference, which will be held in April this year. It is definitely a day worth carving out time for as it presents a great opportunity to be intellectually stimulated with new methods, thoughts, people, questions, and solutions. We all need that kind of infusion to keep us sharp and be the creative problem-solvers that our work demands.

Mmmm—when I started to draft this, I didn't think I had much to say! Hopefully it has stirred some thoughts—and prompted some action. Hope to see you soon!

Dave Nemetz, P.G.
WGWA President

FACT

Bacteria, the tiniest free-living cells, are so small that a single drop of liquid contains as many as 50 million of them.

Strange-but-true, Asia Quake Impacts Virginia Well-Water Levels

Asia Quake Impacts Va. Well-Water Levels
January 09, 2005 3:49 PM EST

RICHMOND, Va. - The South Asian earthquake that spawned deadly tsunami waves also shifted water levels by at least 3 feet in a geologically sensitive Virginia well some 9,600 miles away from the epicenter, researchers say.

The well near Christiansburg, which started oscillating about an hour after the magnitude 9 quake near Sumatra on Dec. 26, is particularly sensitive to movements in the Earth and is monitored by the U. S. Geological Survey.

David Nelms, a groundwater specialist with the USGS in Richmond, saw the changes from his computer.

"It just shot up and then it went down below where it originally was," Nelms told the Richmond Times-Dispatch for Saturday's editions, adding that it took about five hours for the water to stop fluctuating.

The USGS tracks water levels around the country, and has monitors at 21 wells across Virginia, primarily for drought.

The Christiansburg well, in the western part of the state, also shows regular, but small, changes caused by tides.

WGWA Board Meeting Minutes
Tuesday, February 1, 2005
Conference Call

Persons present: Dave Nemetz, Becky Caudill, Brian Hahn, Marilyn Weiss, Tom Riewe, and Boyd Possin

I. Call to order about 5:35 pm.

II. Last meeting minutes (August 16, 2004) - Minutes approved. Minutes posted on website.

III. Treasurer's Report (Marilyn Weiss) – Account balance $13,699.33 at the end of year. We've been hovering between $13,000 & $$13,500. We broke even with last year. $3500 spent on scholarships/donations. There is possible decline in the 2005 budget due to memberships declining. Dave asked if we typically set an annual budget. Marilyn stated no. She's placed the spending in an Access database for the last 3 years and she can develop a report to look at how money has been spent. Dave suggests we attach a budget to the Board meeting minutes.

IV. Membership Report –
- Renewals, only 15 people renewed so far this year. As of August 16, 2004, 270 members. Eight student members, 155 corporate members, and 107 individual memberships.
- Dave will inquire into the MGWA membership numbers, what professions participate and at what level, he'll also look into their on-line capabilities
- Boyd will send out corporate renewal notices again this year
- Boyd suggested we set-up for taking a credit cards, NGWA may offer a benefit for this, easy setup

Business

- Boyd will look into NGWA if they will allow multiple state affiliates

- Need to continue the WGWA notes

- Education Committee – Brian Hahn - followed up on organizing the 2005 conference, called universities to find the best time to hold the conference to avoid finals. Last years was held the 1st or 2nd week of May. Suggestions for mid to late April after spring breaks and earlier than finals. No retention of students from the conferences for memberships.

- Newsletter – Lee Trotta not available for call. Current issue (winter, 1st issue) done except for Presidents page and board meeting minutes. Looks good & should go out in February. Do we want a year-end bookkeeping, yes we may include it in minutes or where it fits.

- Fall field trip – Worked well and nice weather (Joint trip with MN). Expenses matched income.

- Officer Positions Opening
  - President Elect - Brian unsure of committing due to time constraints (responsibilities for the 1st year typical to organize the technical conference and the Fall field trip) next year serving as president, following year to serve as past-president (like a board member - non-voting) – In the end he agreed to run as long as have significant help with conference
  - Secretary - Janis has agreed to run again
  - At Large Board Members (non-voting board member) - Tom's Membership is up, need replacement for Tom '02-'04, Brian '03-'05, Becky '04-'06

- Conference - Suggestion of Bruce Brown (WGNHS) gave talk at WI Water Well Association on developing maps for arsenic spell well casing depths
  - AWRA unwilling to partner for a conference again, president this year Michael Penn
  - WI Well Water Association already had their winter conference

- Web Site - fix links, put terms on board members, remove members only link, update past events (only listed through 2002).

- WGWA Notes - Becky Caudill to issue e-mails this year, Marilyn is the keeper of e-mail addresses

- Area Coordinators - suggested having the coordinator setup breakfasts with the main focus an informal setting for discussions
  Southeast - OPEN, Scott resigned & Judy previously resigned
  Western - OPEN
  Northeast - OPEN

- Wisconsin Groundwater Festival - $2,500 donation

- Election - Boyd to put together a ballot for a WGWA note for elections

- Groundwater Guardian (GG) – Lee resigned from heading this. Let this go dormant for now.

- WGWA Spring conference – Tentative date of April 29 Dells location likely. Board agreed to provide more of a team effort to plan conference, with Brian Hahn taking

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the overall lead. Will have another phone conference to lay ground work in two weeks.

- Annex 2001 - Is Kathy going and are we willing to support part of the trip. Last year WGWA supported travel up to $500.
- Straddling the Divide - Becky Caudill will write summary for WGWA notes.
- Fall Field Trip - Think about ideas for locations
- Association with NGWA - give members additional access? Will look into questions on benefits
- Boyd moved to commend Tom Riewe for 3-years of valuable service

V. Dave motioned to adjourn meeting at 7:10 p.m., Marilyn seconded motion.

Calendar of Events

What: 'Straddling the Divide'
When: February 15-16, 2005
Where: Holiday Inn – Merchandise Mart, Chicago, Illinois
More info: The Illinois State Water Survey and the Northeastern Illinois Planning Commission, in collaboration with WGWA and the South Eastern Wisconsin Regional Planning Commission, are organizing a conference on water resources planning in the Lake Michigan region. For more information go to http://www.nipc.org/environment/slmrwsc/conferences/

What: Minnesota Air, Water & Waste Conference
When: February 15-17, 2005
Where: the Sheraton Bloomington Hotel
More info: Feb.15, is a pre conference training day with various 1/2 day and full day courses. The two day conference has 8 concurrent tracks covering emergency response, stormwater, air & water quality, remediation, environmental innovation, solid, demolition & hazardous waste. Learn about trends in important environmental issues facing Minnesota, and explore ways to use or change these trends to improve our quality of life. For more information go to http://www.pca.state.mn.us/

What: The Geological Society of America North Central Section meeting
When: May 19-20, 2005
Where: Minneapolis
More info: If you wish to submit an abstract for a talk at one of the sessions, they are due by **February 22nd**. See the following web page for details on the GSA North Central meeting and how to submit an abstract. http://www.geosociety.org/sectdiv/Northc/05ncmtg.htm
The Minnesota Ground Water Association will be holding a Symposium on Ground Water Sustainability as a concurrent session with other GSA NC meeting sessions on May 19th. This will be the MGWA Spring Conference.

What: Environmental Grants Workshop (DNR)
When: February 22, 2005 1:00-4:15 pm
Where: Dept. of Revenue's Event Room at 2135 Rimrock Road, Madison
More info: Sponsored by Rock River Coalition Storm Water Issue Team - for a brochure go to http://dnr.wi.gov/org/water/wm/nps/grants/NPSGrantsBrochure.pdf

What: Stormwater Symposium 2005
When: March 10th & 11th
Where: Schlitz Audubon Nature Center, Milwaukee

What: Culvert Erosion Control Workshop
When: March 15, 2005 8:15 - 3:00 pm
Where: UWEX Jefferson County
More info: Contact Suzanne Wade for more information. Sponsored by the Transportation Information Center

What: GeoBadger Alumni Weekend
When: May 6-7, 2005
Where: On Friday May 6, the new West Wing Addition will be dedicated, there will be four plenary lectures with distinguished speakers, a Weeks Hall open house, and a GeoBadger cookout in Weeks Hall Courtyard. On Saturday May 7, there will be a field trip with Dave Mickelson and others and the Annual Spring Banquet with distinguished alumni and student awards. Weeks Hall is at 1215 West Dayton Street in Madison. More info: www.geology.wisc.edu

Asian Megaquake Strikes Virginia?

The Intimate Link Between Earthquakes and Groundwater

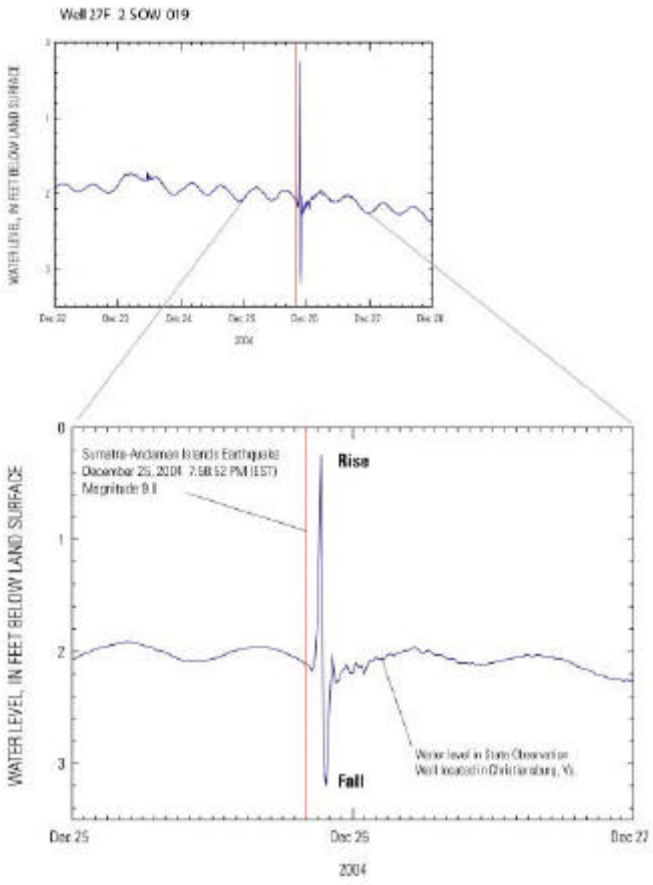
By Troy R. Thompson, PG, CPG

It sounds like another far-fetched story like the claims of some Wisconsin well drillers that groundwater in southeastern Wisconsin comes from Lake Superior. But this one is true. The USGS in Virginia announced that the recent Sumatran earthquake, responsible for the devastating tsunami, had a dramatic effect on the water level of a deep well in Christianburg, Virginia. The well is located approximately 9,600 miles from the epicenter. According to a USGS press release (USGS 2005) the water level in the well suddenly began to oscillate as much as three feet approximately one hour after the earthquake, and continued to oscillate for five hours afterward (see Figure 1).

The well is 450 feet deep and is completed in limestone of the Beekmantown Formation. Apparently fractures that supply water to the well are sensitive to seismic stresses, which cause them to expand and contract. According to USGS water specialist Mr. David Nelms this well has exhibited water level effects related to earthquakes since its construction in 1969. However, "this is the first time that the effect of an earthquake has been recorded and available online in near real-time," he said.

The link between earthquakes and groundwater levels has been well known for a long time (Sneed, et. al., 2003). Earthquake effects on well water levels have been observed at short and great distances from the quake. The 2002, M7.9 Denali earthquake in Alaska instantaneously increased the water level in a well in Wisconsin by 2 feet (see Figure 2). Earthquake responses in water wells are either permanent or long-term changes in the water level, such as in the Wisconsin well, or, less commonly, temporary oscillations such as in the Virginia well. Water level oscillations are more rarely seen in part because the digital water level recording typically performed now samples water levels at frequencies that are too low to catch the effects of an earthquake.

Figure 1—Source: USGS, 2005



Earthquake effects on water wells are of more than simple scientific interest (Sneed, et. al., 2003). Earthquakes can change the ability of wells to produce water. Within three months of the 1998 M5.2 Pymatuning earthquake in northwestern Pennsylvania approximately 120 local household-supply wells went dry. Suggested mechanisms include compaction of the aquifer matrix, opening or closing of fractures or conduits, and creation of new conduits. They may also change the quality of the water produced by increasing turbidity or causing geochemical changes. The 1992 M7.3 Landers, California quake increased carbon-dioxide levels in water supply wells in San Bernardino, California disabling the water filtration system.

Earthquakes have also been observed to induce changes in groundwater causing other problems not

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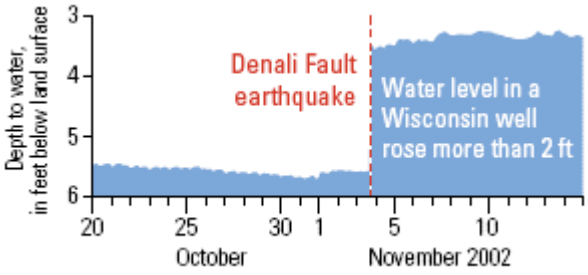
related to wells (Sneed, et. al., 2003). They may change water table or stream base-flow levels resulting in flooding, landslides, erosion, or other problems. The Landers earthquake increased the flow of an oil and gas seep resulting in contamination of the Santa Clara River. They can even threaten sensitive ecosystems and species. Two different earthquakes (one in Mexico in 1978 and the Denali, Alaska quake in 2002) produced significant effects on the Devil's Hole in Death Valley, which is the only home of the endangered Pupfish. It has been observed that an earthquake induced drop in the water level of the Devil's Hole could eliminate the Pupfish.

More controversial, but of increasing interest, are changes in groundwater levels or groundwater chemistry that may presage earthquakes (Sneed, et. al., 2003). While the ability to use such phenomena to predict earthquakes is far from established, there is growing recognition that as conditions build towards an earthquake they may show up in changes in groundwater levels or even groundwater chemistry. Chinese scientists and authorities in Quinglong County used changes in water levels in wells among other observations to anticipate and prepare for the 7.8M Tangshan earthquake of 1976 (UN, 1996). This earthquake killed more than 240,000 people in Tanshan, China. However, even though it damaged or destroyed as many as 180,000 buildings in Quinglong County, it did not directly cause a single death because authorities had warned the people and moved them out of the buildings beforehand. Pre-seismic effects on water levels and water chemistry are increasingly being documented at other places. Post-event studies of dated water bottled prior to the M7.2, 1995 Kobe, Japan earthquake documented changes in sulfate and chloride concentrations in the water.

So if your monitoring wells have not been behaving like you would like them to recently, you might want blame it on the earthquake.

Figure 2—Source: Sneed, et. al., 2003



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Renew your WGWA Membership

Groundwater Guardian

"Water, Water Everywhere…

BUT NOT A DROP TO DRINK, SAYS WAUKESHA, UNLESS IT CAN TAP INTO LAKE MICHIGAN"

This article first appeared in the January issue of Milwaukee Magazine. Copyright, Milwaukee Magazine.

WAUKESHA WANTS IT ALL new industry, wider highways, bigger homes, more people.

To quench its thirst for growth, Waukesha now needs more drinking water. But it's gotten itself into a squeeze. By supplying almost limitless amounts of water to its expanding subdivisions and industrial parks, the city and county have depleted their wells. As the sandstone aquifer is drawn down, the water has become contaminated with high levels of radium, a natural but potentially cancer-causing element.

What to do? Change a few rules, says Waukesha.

In 2001, the city challenged the EPA's radium standards as too stringent. It lost the legal battle two years later. So now, hoping to avoid paying millions of dollars for treatment systems and new wells farther west, it wants to tap into Lake Michigan and pump 20 million gallons per day to accommodate growth. And, as it recently announced, it wants it ASAP.

But it's a contentious proposition, with a whole new set of complicated rules. Waukesha sits just beyond the Great Lakes watershed and is prohibited from "diverting" water from Lake Michigan without approval by the Council of Great Lakes Governors – the eight U. S. governors and two Canadian premiers whose states or provinces border the five lakes.

They're enormous lakes, of course, the largest source of fresh water in the world. Lake Michigan alone contains 1,180 cubic miles of water. So why not share?

The concern is that Waukesha's plan, if approved, could open the floodgates for other communities with depleted or contaminated water supplies – even beyond Wisconsin's borders. If Waukesha is permitted to pipe water, what will stop Oconomowoc from asking? Or Johnson Creek? Las Vegas? Phoenix?

Despite their vast size, the Great Lakes are extraordinarily fragile, as demonstrated by past years of drought. Just 1 percent of the lakes' volume is replenished each year through precipitation, surface runoff and groundwater flow.

Last summer, the governors' council drafted new standards for water consumption and diversion. Gov. Jim Doyle is the council's co-chairman. And Waukesha is at ground zero. It has asked Doyle to make it the first test case for water diversion under the revised standards.

One key provision requires that an equal measure of water taken from the lake be returned to its watershed in the form of treated wastewater. Also, methods of conserving water and preserving wetlands would need to be put into practice.

Waukesha, so far, has resisted all of the above.

In an October letter to the Great Lakes governors, the mayors of Waukesha, Brookfield, Muskego, New Berlin and Pewaukee say returning the water is unnecessary. By pumping 20 million gallons to Waukesha County from Lake Michigan instead of from the ground, the aquifer will replenish itself and flow east, as it has in years past, say the mayors.

Their claim is based on soft science. The hydrogeologic properties of the aquifer are not yet fully understood, says Chuck Ledin, who leads the DNR Office of the Great Lakes, which regulates water diversion plans. "Trying to apply the [diversion] system to Waukesha will be very complicated."

Meanwhile, Waukesha's conservation measures have been inconsistent. The 1,500-acre Pabst Farms in Oconomowoc, once a major groundwater recharge area, is the site of massive development. And only now, as it

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builds its case for diversion, has the City of Waukesha proposed serious methods of conservation.

Still, Waukesha has received backing by the American Water Works Association and the Municipal Environmental Group. Doyle has indicated he would consider the plan. And Mayor Tom Barrett, in an olive-branch offering to Waukesha County last fall, said he would take it into account.

Weeks earlier, Waukesha quietly won support from Milwaukee County. Without public hearings or public action by the County Board or County Executive Scott Walker, the county agreed to kick in $261,787 to help fund a regional drinking water supply study by the Southeastern Wisconsin Regional Planning Commission, seen by some as a nemesis to urban planning. Long sought by Waukesha County, the study was regarded by former Mayor John Norquist and several Common Council members as an artful way for Waukesha to gather ammunition for the emerging water wars.

But in a looming crisis of Waukesha's own making, seldom is there a discussion of the S word – sprawl. Instead, as it has in the past on transportation and housing, Waukesha barrels ahead with its self-centered approach, setting up the possibility of confrontation and, as the city's water utility manager has hinted, the potential for another lawsuit.

To see the future of Waukesha as a beneficiary of Lake Michigan's riches, you only need to look south to Kenosha County. Plagued with radium in its drinking water, the village of Pleasant Prairie in 1989 was granted approval by the governors' council to pump water from Lake Michigan, one of only two communities in the country permitted to divert water from the Great Lakes.

Today, Pleasant Prairie is a boomtown, with new subdivisions, wide streets, an industrial park and an outlet mall. And alongside its $11 million community center, the village has a lake of its own, Lake Andrea, once an empty gravel pit and now overflowing with spring water.

The Earthquake and Resulting Tsunami

The earthquake and resulting tsunami are certainly the biggest news to hit the hydrogeology world in our lifetime. By now you've seen countless photos of demolished homes and devastated victims of the event (death tolls are still being revised upwards). Harder to find are descriptions of the geologic event itself and what science could have done or could still do to prevent the disastrous aftereffects. As your editor, here are pertinent excerpts that I've been able to compile from recent accounts.

Asian disaster toll surges past 55,000 as relief operations stall

Tue Dec 28, 3:47 PM ET

BANDA ACEH, Indonesia (AFP)
The quake Sunday, the biggest in 40 years at 9.0 on the Richter scale, ruptured the Indian Ocean seabed off Indonesia's Sumatra island, sending huge waves thousands of kilometres (miles) to kill and destroy in countries around southern and southeast Asia and even in Africa.

The waves triggered by the quake were so powerful that the destruction reached the shores of Africa about 7,000 kilometres (4,000 miles) away, killing more than 100 Somali fishermen.

The tragedy has sparked a growing chorus of calls for a tsunami alert system, as many victims were swept from coastlines hours after the quake which triggered the giant waves was recorded.

"The people should be buried and the animals should be destroyed and disposed of before they infect the drinking water. It's a massive operation," said UN disaster relief coordinator Jan Egeland.

In Sri Lanka, drinking water wells were already badly contaminated with sea water, government minister Susil Premajayantha said, but the biggest fear is of water contamination by decomposing bodies which could spark epidemics of cholera and typhoid, experts warned.

"The biggest health challenges we are facing are the spread of waterborne diseases," said International Federation of Red Cross and Red Crescent Societies health official Hakan Sandbladh.

Millions at risk of waterborne disease in South Asia--UNICEF

Posted 01:56am (Mla time) Dec 30, 2004 By Agence France-Presse (condensed version)

GENEVA, Switzerland -- Millions of people will be at risk of disease unless there is immediate action to provide clean water in communities hit by tidal waves in South Asia, the UN Children's Fund (UNICEF) warned.

In many places around the disaster-ravaged coastline of the Indian Ocean, the water and sewage systems will have been wrecked by the quake-driven waves, and groundwater supplies may be contaminated by seawater.

In such conditions, it will be essential to have non-contaminated water supplies -- brought in by truck or isolated in a concrete-walled reservoir -- and for latrines to be dug to take care of human waste.

These are the main threats, experts say:
- CHOLERA, an intestinal infection caused by a bacterium, Vibrio cholerae. It causes severe dehydration through diarrhoea and is dangerous to babies and the elderly, but in most cases can be successfully fought by intravenous fluids and antibiotics.
The bug lives naturally in brackish water and estuaries and is passed on from human to human by faeces.

"(...) What happens in any tsunami... is the sewer and water systems get combined," Andrew Natsios, head of the US Agency for International Development (USAID) said on Tuesday.

"As a result of that, the only water people drink is basically mixed with sewage, and that means a high risk of cholera and other communicable disease that can begin epidemics."

- TYPHOID, a fever caused by the germ Salmonella typhi, blamed for some 600,000 deaths per year. The bug is carried in the blood and intestinal tract and is passed on through tainted water or through eating food prepared by someone who carries the germs on his hands and fails to wash them off after going to the toilet. Like cholera, typhoid proliferates in conditions of poor sanitation. It can be treated with antibiotics, although drug-resistant strains of the bug are a growing concern, and vaccines are available.

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- MALARIA, a mosquito-borne disease in tropical countries that claims around a million lives a year. The disease cycle depends on mosquitoes living and breeding in proximity to humans. The insect lays its eggs in water and feeds on humans for a blood meal, transferring a parasite that proliferates in the liver and attacks red-blood cells, causing fever and anaemia. Another mosquito-transmitted danger is dengue fever.

An early task for relief workers will be to drain stagnant pools left by the tsunamis, which will be ideal breeding grounds for mosquitoes.

Membership in tsunami warning system might have saved thousands

Mon. Dec. 27, 2004 By JOSEPH B.VERRENGIA Associated Press

The catastrophic death toll in Asia caused by a massive tsunami might have been reduced had India and Sri Lanka been part of an international warning system designed to warn coastal communities about potentially deadly waves, scientists say.

The warning system is designed to alert nations that potentially destructive waves may hit their coastlines within three to 14 hours. Scientists said seismic networks recorded Sunday's massive earthquake but without wave sensors in the region, there was no way to determine the direction that a tsunami would travel.

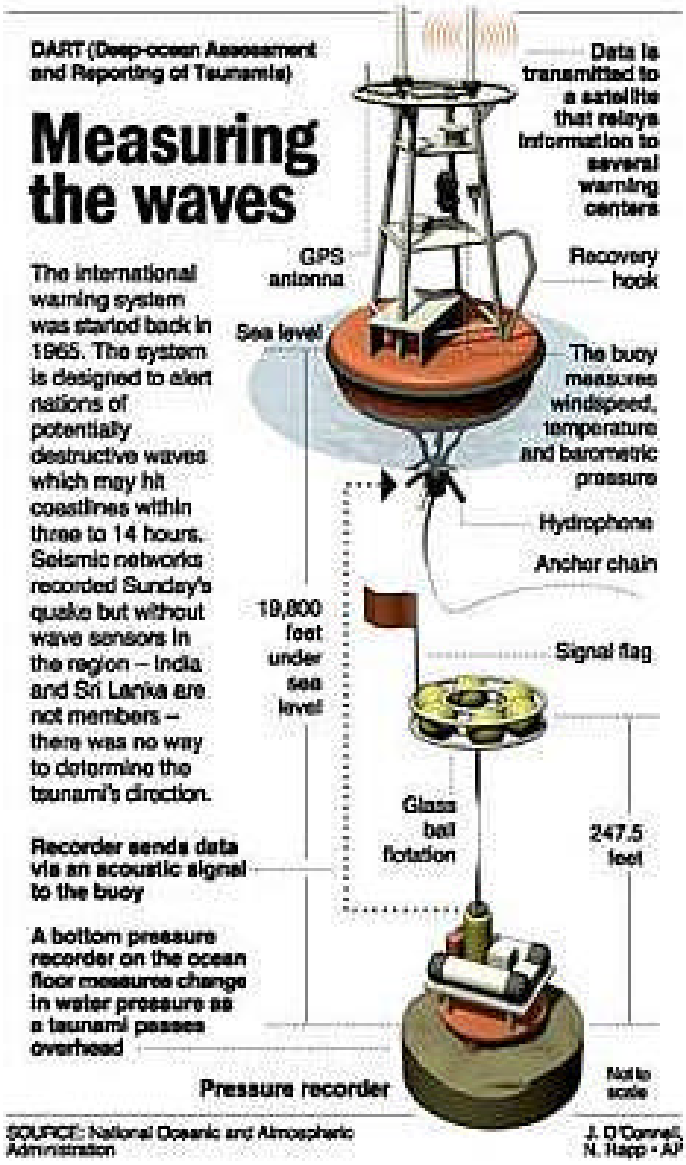
A single wave station south of the earthquake's epicenter registered tsunami activity less than 2 feet high heading south toward Australia, researchers said.

The waves also struck resort beaches on the west coast of the Thailand's south peninsula. Although Thailand belongs to the international tsunami warning network, its west coast does not have the system's wave sensors mounted on ocean bouys.

"They had no tidal gauges and they had no warning," said Waverly Person, a geophysicist at the National Earthquake Information Center in Golden, Colo., which monitors seismic activity worldwide. "There are no bouys in the Indian Ocean, and that's where this tsunami occurred."

"It's a huge rupture," said Charles McCreary, director of the Pacific Tsunami Warning Center near Honolulu. "It's conceivable that the sea floor deformed all the way along that rupture, and that's what initiates tsunamis."

Tue Dec 28,11:56 AM ET **Associated Press** Graphic shows how quake warning system works. (AP Graphic)



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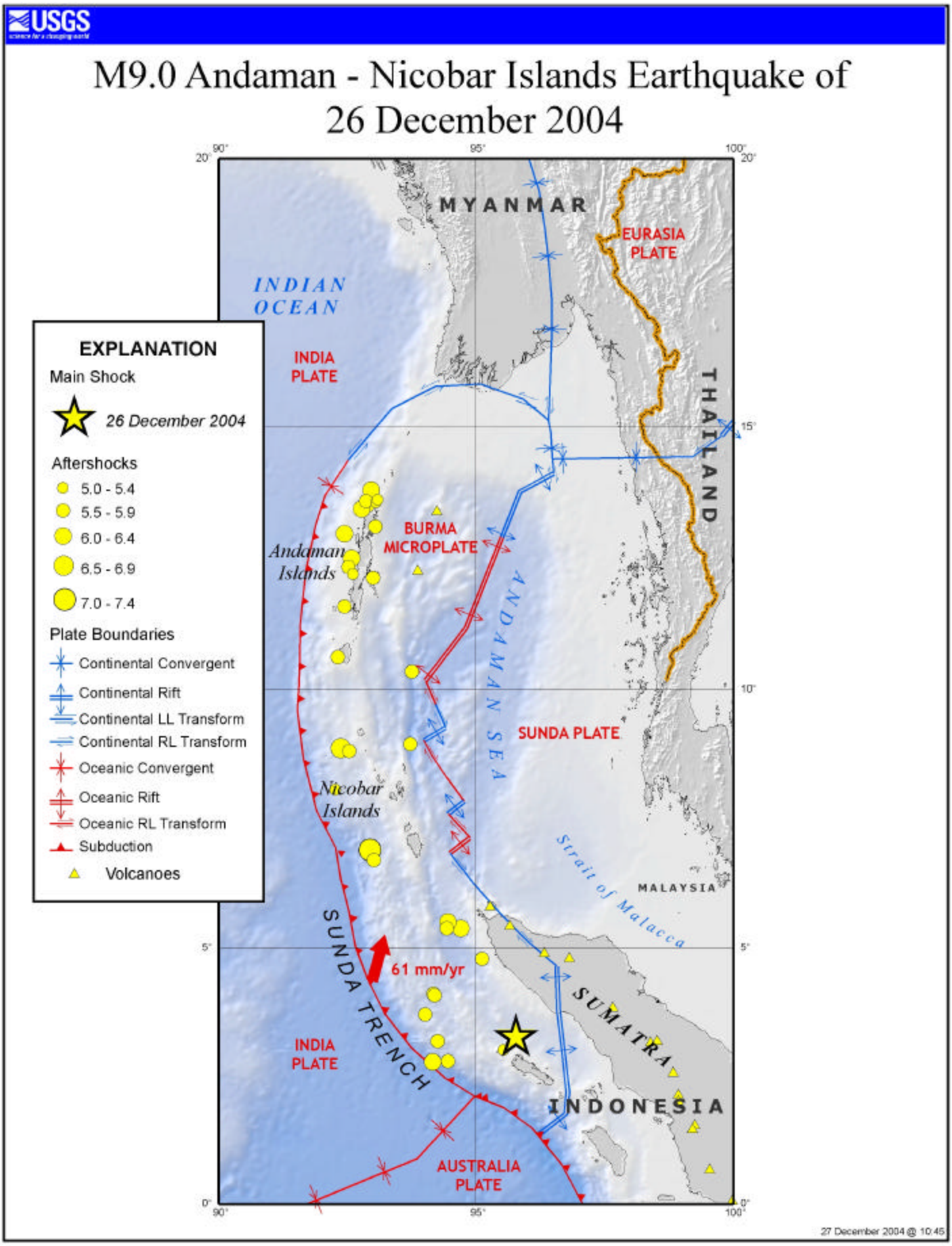

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U.S. Scientists Say Quake Movement Shifted Islands

Tue Dec 28, 4:21 PM ET

LOS ANGELES (Reuters) - The massive earthquake that devastated parts of Asia permanently moved the tectonic plates beneath the Indian Ocean as much as 98 feet, slightly shifting islands near Sumatra an unknown distance, U.S. scientists said on Tuesday.

A tsunami spawned by the 9.0-magnitude quake off the northern tip of Sumatra killed an estimated 60,000 on Sunday in Indonesia, Thailand, India, Malaysia, Sri Lanka and East Africa.

Satellite images showed that the movement of undersea plates off the northern tip of Sumatra moved the Nicobar Islands and Simeulue Island out to sea by an unknown distance, U.S. Geological Survey (news - web sites) geophysicist Ken Hudnut said.

Although the data showed that plates more than 12 miles beneath the ocean's surface moved dramatically, scientists will have to use handheld satellite positioning systems at the sites to learn precisely how much the land masses on the surface shifted, Hudnut said.

The USGS (news - web sites) team in Pasadena, California, also was studying more detailed satellite images on Tuesday to determine if the scraping of one plate over another plowed up enough debris on the ocean floor to block the port of Banda Aceh in Sumatra where international aid was headed.

Large earthquakes in the last decade in Kobe, Japan, and Golcuk, Turkey, deformed the coastlines and rendered their ports inoperable after the crises, Hudnut said.

The scientists have asked for cooperation from operators of commercial satellites that can provide high-resolution images to show the extent of damage to coastlines, he said.

USGS Earthquake Hazards Program website

http://earthquake.usgs.gov/eqinthenews/2004/usslav/neic_slav_faq.html

Question: What was the size of the fault that produced the earthquake?
Answer: An initial estimate of the size of the rupture that caused the earthquake is obtained from the length of the aftershock zone, the dimensions of historical earthquakes, and a study of the elastic waves generated by the earthquake. The aftershocks suggest that the earthquake rupture had a maximum length of 1200 -- 1300 km parallel to the Sunda trench and a width of over 100 km perpendicular to the earthquake source. An early estimate from the study of elastic waves show the majority of slip was concentrated in the southernmost 400 km of the rupture.

Question: What was the maximum displacement on the rupture surface between the plates ?
Answer: The maximum displacement estimated from a preliminary study of the seismic body waves is 20 meters.

Question: What was the maximum displacement of the sea bottom above the earthquake source?
Answer: The displacement of the ground surface will be related to, but somewhat less than, the displacement on the earthquake fault at depth. In places, the block of crust beneath the sea floor and overlying the causative fault is likely to have moved on the order of 10 meters to the west-southwest and to have been uplifted by several meters.

Thailand toll tops 1,800, regional deaths now 82,000. Churned up sediment threatening coral reefs. Health officials warn disease the next menace
Bangkok Post News
December 30, 2004
http://www.bangkokpost.com/News/30Dec2004_news01.php

KULTIDA SAMABUDDHI RANJANA WANGVIPULA
Natural Resources and Environment Ministry permanent secretary Petipong Pungbun na Ayutthaya said staff were inspecting damage caused by Sunday's tidal waves and trying to quickly repair vital water systems.

In Thailand, a rehabilitation effort for marine national parks devastated by the tidal waves is underway, focusing on the recovery of surface and groundwater sources and collection of hazardous waste scattered by the sea surge.

Mr Petipong said volunteer divers would also be sent to retrieve debris covering coral reefs. All told, 12 marine national parks had been severely damaged.

``It will take anywhere from three to 15 years for these ruined marine national parks, which have attracted more than 40% of foreign tourists visiting the country each year, to recover," he said.

GOING DEEP AT THE BOTTOM OF NORTH AMERICA

Or AN OVERVIEW OF THE INYO COUNTY'S 2003 DEATH VALLEY CALIFORNIA AREA GEOPHYSICAL PROGRAM

John R. Jansen; Aquifer Science and Technology, Waukesha, WI

Michael J. King; The Hydrodynamics Group, Edmonds, WA

Joy Loughry; Aquifer Science and Technology, Waukesha, WI

Ted Powell; Aquifer Science and Technology, Waukesha, WI

Death Valley National Park, at 282 feet below sea level, is the terminal discharge point for the Death Valley Regional Groundwater Flow System. It receives groundwater flow from much of Southern Nevada. Inyo County is concerned that it could be the ultimate destination for contamination leaving the Yucca Mountain site.

Yucca Mountain, Nevada is the site of the only proposed high-level nuclear waste repository in the United States. The site is approximately 50 km (30 miles) east of Death Valley. Death Valley, well known for having the lowest elevations in North America, is located in Inyo County, California. The repository was designed using the philosophy of multiple barriers, both engineered and natural, each of which impedes the potential movement of contaminants. The proposed repository would be constructed in the unsaturated zone above the water table in Tertiary tuffaceous rocks. The principal potential transporting mechanism for contaminants is moving groundwater. Underlying the repository, at a depth of approximately 2 km (6,000 feet), is the extensive Lower Carbonate Aquifer (LCA) that is known to be highly permeable. Various investigators suggest that the points of ultimate discharge from the Lower Carbonate Aquifer are the springs on the eastside of Death Valley, within Inyo County.

Inyo County has participated in oversight activities associated with the Yucca Mountain Nuclear Waste Repository since 1987. The purpose of Inyo County's oversight is to ensure that repository siting and subsequent repository activities do not adversely impact the public health, safety, or welfare of County residents, including Death Valley National Park. A primary concern of Inyo County is groundwater flow between the alluvial and carbonate aquifers at Yucca Mountain and in Inyo County.

The hydrogeology of the Death Valley Drainage Basin is important to the understanding of the movement of ground water from Yucca Mountain

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High-resolution magnetic surveys were used to provide independent verification on the depth and geologic style of faulting in the Carbonate Aquifer detected by the gravity survey. Weak magnetic signatures were seen on the faults, indicating the large offsets in the Carbonate Aquifer did not displace the underlying igneous basement rock

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and the spring discharge in Death Valley National Park (DVNP). In an idealized basin and range setting, ground water generally moves downward from mountainous recharge regions, then laterally toward discharge areas, and then upward into the discharge areas.

The United States Department of Energy (DOE) has hypothesized that water moving under Yucca Mountain flows through unconsolidated valley fill deposits and discharges in the Ash Meadows area of the Armagosa Valley. Bredehoeft and Winograd hypothesized that the large volume of water discharging from the springs in the Furnace Creek area of Death Valley requires drainage from a larger regional flow system, including the Yucca Mountain area. To document this connection, King and Bredehoeft (1999) studied the geochemical signature of springs in Death Valley and found them to be similar to the geochemical signature of the lower carbonate aquifer, suggesting connection to a regional flow system.

The U.S. Department of Energy has awarded Inyo County grant funds for a geophysical and drilling program to evaluate the connection between the LCA in the Armagosa Valley and the Southern Funeral Moun-

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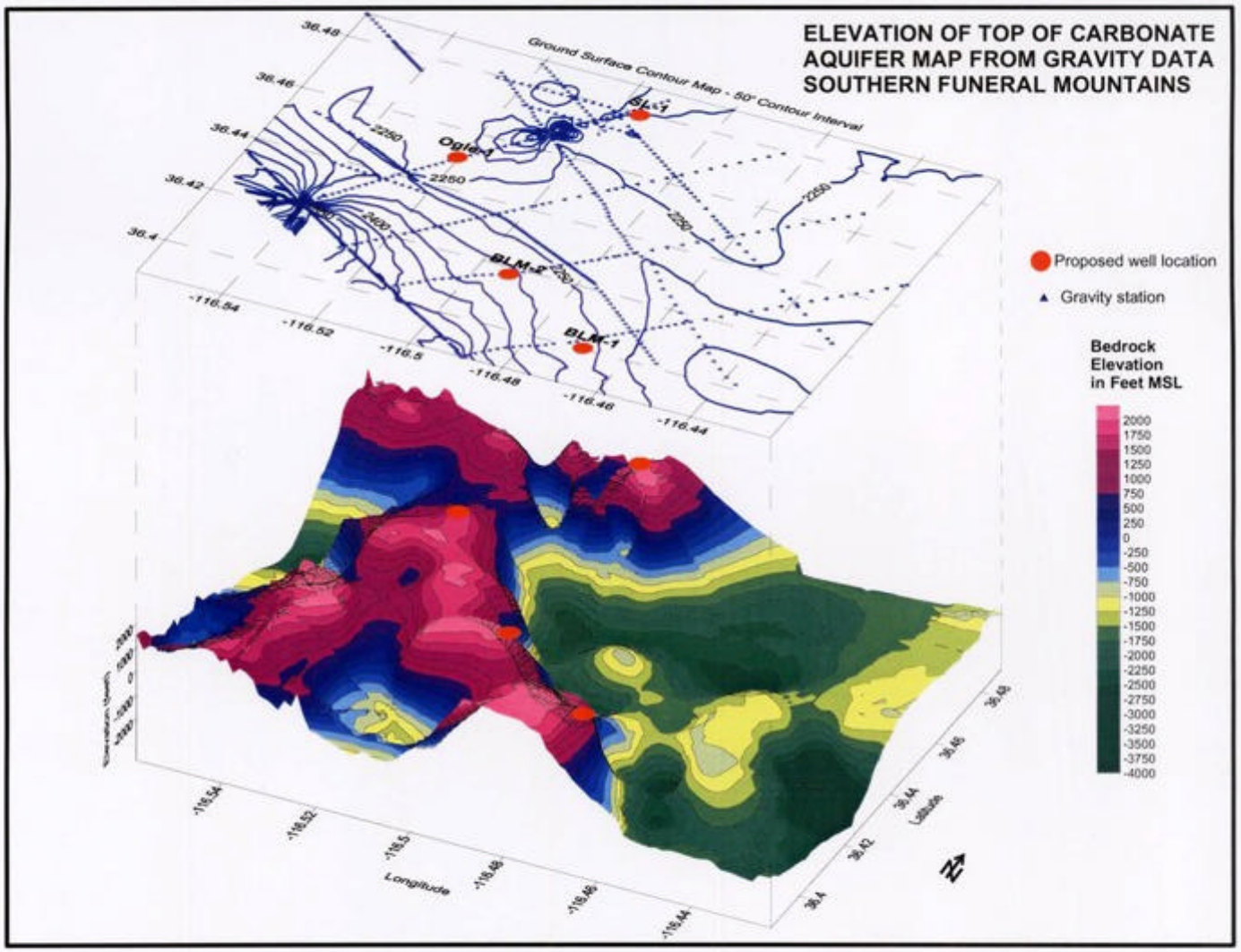

The complexity of the geologic structures is illustrated in this elevation view from the top of the Lower Carbonate Aquifer in the Bat Mountain area of the southern Funeral Mountains.

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tain Range. The program consists of a series of geophysical surveys to characterize the geological structure of the LCA in the Southern Funeral Mountain range, and the drilling of up to five monitoring wells into the LCA.

In FY2002 and FY2003, Aquifer Science and Technology collected a total of 59 miles of gravity data in the Armagosa Valley near Bat Mountain in the Southern Funeral Mountains. The interpreted bedrock surface shows a complex topography, with steep dips and several probable faults. The data was used to select drilling locations for four monitoring wells to be drilled at depths of 1,000 to 4,000 feet. Two monitoring wells were drilled on the eastern Side of the Funeral Mountains in the fall of 2004 based on the geophysical work. Both wells encountered bedrock at the expected depth. One well was drilled to a depth of about 3,000 feet and will be completed in the LCA at a depth of 2,750. The second well was drilled to about 2,700 feet. It will be drilled about another 500 feet in 2005 and completed in the LCA. The location of future wells will be chosen on the basis of additional geophysical surveys we plan to conduct this spring.

We also collected approximately 9 miles of continuous magnetic data and 8 TEM soundings in the Scotty's Junction area of Sarcobatus Flats to map the Sarcobatus Fault as part of a water resources investigation being conducted by the USGS on behalf of the National Park Service. Previous mapping had indicated several possible locations of the fault. The magnetic data indicated the presence of a fault system of at least three faults. The TEM soundings indicated that the faults were steeply dipping normal faults.

This work is a continuation of surveys we conducted in previous years in and around DVNP. The previous surveys included TEM soundings at the Travertine, Texas, Nevares, and Grapevine Springs to determine the hydrogeologic controls influencing the location of these springs, and a TEM and seismic refraction survey in Gold Valley to determine the capture zone for Willow Spring. Future geophysical efforts will concentrate on providing additional subsurface control to help determine the stratigraphy of the bedrock in the floor of the Armagosa Valley and quantify the groundwater discharge to the saltpan of Death Valley on the west side of the Funeral Mountains.

Only 1 percent of the earth's water is available for drinking water.

"OUT-OF-BOUNDARIES"

Death at Devil's Hole

by Kate Silver

Urban legend has it that two boys were lost forever when they dove into a massive underground lake in the desert. It's no myth; for the first time, what really happened 40 years ago.

Illustration by Christopher Smith (Reprinted with permission from Las Vegas Life, January 2005)

Along some of the country's most extreme terrain, right before the Nevada desert turns seamlessly into California, there's a deep, dark gash in the earth. Surrounded by gray and more gray against craggy mountains and fenced off from curiosity seekers, this gash is so deep that no one has ever measured it. It's so far-reaching it hasn't even been mapped. This enormous water-filled cavity in the earth is like an upside-down lake, with water on the bottom and the sand lying on top, and it rises and falls with the tides. It also provides a constant 93-degree home to pupfish, a species of fish found nowhere else in the world.

But there's something else out there, in that place known as Devil's Hole. This is a place that spawned Native American legends of a maiden falling into the hole, where she vanished until days later, when her body turned up in a Death Valley spring miles away. This is a place that called out to Charles Manson; he promised his followers they could disappear down Devil's Hole when the "helter skelter" went down, and escape to a city of gold. This is even a place that has purported UFO activity, and cyber lore circulates of reptilians dwelling within its unknown depths, among raging rivers and endless lakes in the deep underground.

There's something out there. You can sense it as you walk over what feels like a normal stretch of desert, directly above one of the naturally eeriest places on earth. And 40 years ago, four boys from Las Vegas were drawn to it.

Only two returned.

* * *

Las Vegas was still a small town back in the 1960s, fueled by gambling, run by the mob and an easy place for four young men, ages 19 and 20, to get into trouble. Bill Alter remembers those times clearly. "We did whatever we could find to do," the Las Vegas High School graduate says, with a slight Southern twang. "There was nothing interesting to do around here, let's face it. If you wasn't drinkin', hoin' or gamblin', well that was it. You had to make up your own get-go around here."

Alter speaks amid the rubble of his newest project: remodeling his childhood home. He grew up here, across the street from his best friend, David Rose. But Bill left soon after graduating high school, and didn't return until three years ago.

On this chilly winter morning he reclines in a black chair in his bedroom, gazing thoughtfully at a string of Christmas lights on the wall that make the shape of a tree, with little stuffed bears dangling from them. He's a manly man, a guy who used to work in construction, who has a booming laugh and deliberate countenance as he thinks back to describe his best friend. David was smart—too smart for his own good in a town that didn't

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exactly cater to children. "He was one of these weirdly intelligent people. We were putting transistor radios in fountain pens in the 1950s. We used to run down to the civil service and take the exam for people so they could pass it. We finally got caught because somebody got such a high score on it they called him in and said, 'Nobody gets that high a score.'"

Alter, 59, has a long gray ponytail and smooth, boyish face, and he remembers those days with a smile. The rough-and-tumble stories, the bombs they'd make, the desert they'd set on fire, the competitions—they're good memories, special memories.

After high school, their new interest became scuba diving. There was one equipment rental place for scuba gear, which happened to be run by the one instructor in town—Harry Wham (years later, Wham was murdered). He taught Rose and Alter the basics, and they would go salvage diving in Lake Mead, looking for old wrecks and other treasures. Then they heard of the mysterious Devil's Hole under the desert, and the tales of a fish that lives no where else in the world.

The pupfish (Cyprinodon diabolis) have been isolated in that deep chasm in the desert for at least 20,000 years, left behind by wetter days when this dry and dusty place was underwater. Back then, springs around the area were connected to one another. But when the landscape dried out, the different pools and holes were isolated, as were their inhabitants. During one of these times, the pupfish were stranded and evolved into what they are today—a unique species. Their swimming hole is about 30 feet long and five feet across, and leads into what's described as an underwater Grand Canyon. The massive, watery void is a fault heated by geothermal energy and goes on as far as the eye can see, branching into rooms and fissures and fractures that are chaotic and interconnected, like the scarring from a rock hitting a windshield. The abyss is thought to go on for at least 150 miles under the desert at depths of more than 460 feet. That's the farthest anyone's ever dived, and they didn't come within sight of the bottom. Over time, it came to be known as Devil's Hole. What kid with an eye for adventure, for danger, wouldn't be enticed? So David and Bill began going out there in the summer of 1965, taking along two of their diving buddies: Bill's brother, Jack, and Paul Giancontieri, David's brother-in-law. They began to scope out the area in preparation for a dive, plotting out where to go and what equipment they would use. Once, they even rented diving gear, scaled the fence and made it into the water, only to be caught by the National Park Service and given a ticket for trespassing. To a bunch of bored young men, that their mission was illicit only made the dive more appealing.

So they tried again, and this time they had a plan. They left on a Sunday afternoon, June 20, 1965. Like before, they rented equipment and then drove more than 90 miles out through the desolate desert and Ash Meadows Wildlife Refuge to Devil's Hole. This time, the four arrived at dusk, hauled their equipment from the car down to a narrow rocky path, and began heaving hundreds of pounds of tanks, lights, cameras and other gear over the chain fence than surrounded a hole of water so deeply azure that it appears black.

The area around the hole is rocky terrain – as if a natural warning to keep out – and so dangerous that today the National Park Service brings ladders to climb down the 10-foot drop. After scrambling down the large boulders and carefully stepping over slippery small rocks, the young men made their way down a steep incline to the chasm. There, they waited for nightfall so the dark would cloak them and their chances of getting caught would be slim. They talked and nervously joked around. While they waited, they had a clear view of the pupfish that feed on the shallow shelf of the water. Only a few inches deep and covered with dark green algae, it's a perfect viewing area for the silvery fish, which are just brely as long as a quarter.

Even 40 years later, Bill Alter has a vivid memory of what happened next. When darkness fell, they plunged into a pocket of water so warm that it is sometimes compared to going inside a mother's womb. With lights and cameras, they swam past the milky-white walls and gray floor taking photos of the pupfish. To ensure their safety, they had attached a 125-foot rope to the surface, knowing they might need it to find their way out.

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Like spelunkers in a cave, they touched the white side walls in wonder. They swam in and out of crevices, and experienced a new depth of darkness. They swam through the entry way, which is like a large staircase going downward. It's lined with the small bones and skeletons of rodents, another unheeded natural warning left from the feeding of the owls that roost above. From there, the entry way has three descending ledges – at about 10 feet, then another 10 and finally 20 feet. Down they went, deeper into the darkness. Jack and Paul, the two less experienced divers, remained at more shallow levels while Bill and Dave plunged downward, 80 feet past dozens of caves and crevices down to a large, thin structure known as Anvil Rock.

They saw magnificent overhangs. Rooms inviting exploration. Jagged crevices that stretched in every direction, like shattered glass. Narrow passages that look like exits. Down there, especially in that kind of darkness, up and down feel synonymous. It takes skill not to get disoriented. "You look around, you get lost quick down there," says Alter. "Lose orientation at all, and you're toast."

They went through a narrow passageway and into a deeper chasm. One that opened up into oblivion and went on in every breathtaking direction for as far as their lights would go. The sight was dizzying, overwhelming and incomprehensible, even though it was right in front of them. The enormous open spaces seemed more science fiction than reality. Bill laughs when asked if he knew how potentially threatening the situation was. "It was dangerous as hell, and at worst it was deadly," he says. What better reason to explore deeper?

When the batteries on their lights started to run low, as well as the oxygen in their tanks, they began their ascent. They just had to find the rope. And they did. On their way back up they passed Jack, who was still exploring the caverns closer to the surface. When they returned to their base on the ground, they expected to find Paul waiting for them. He wasn't there. They knew that Paul's oxygen would be running low, and that he was an inexperienced diver. So Bill helped David out of his near-empty tank and into a fresh one, and David immediately plunged back into the water without a word. Jack emerged as Bill put on another tank of oxygen. While Jack waited, Bill followed his friend back into the water. But he soon realized that his lights were failing. His friends could have been within 10 feet of him, and he'd never have known. Still, he frantically searched, plunging down to more than 175 feet. As his air grew low in the darkness, his survival instincts took over and he slowly found his way back to the top.

THE CLARK COUNTY SHERIFF'S Underwater Rescue team, led by none other than Harry Wham – the man who'd rented them the equipment and taught them all they knew – searched the hole for 36 hours looking for the two lost divers. They drove stakes into the rock above the water and hung powerful spotlights, illuminating the darkness and setting up a light of hope that could be seen for miles. The families arrived and held vigils, praying that the divers had somehow managed to find an air pocket within the cave. Authorities flew in teams from Washington, D.C. and Hawaii, and rescuers went down to depths of 315 feet. Early on, they discovered a dimly lit flashlight that either Paul or David had dropped. Later, at 150 feet below the surface, a rescue diver found a chamber extending 60-feet upward, and inside it was a decompression chart that could have been used by one of the divers. But further exploration found nothing.

The search became front-page news, and high school photos of the two lost young men were published. There's David Rose, with a devious glint in his eye, and an oversized chin that's struggling to combat laughter. And Paul Giancontieri, with his serious stare, his boyishly big ears and dark, probing eyes. Both are dressed in suits and bow ties, likely looking forward to a summer of fun and adventure – next to headlines that told a different story: " Cavern Traps LV Youths," "Old Lake Holds Lost Vegas Boys."

Just before 2 p.m. on Tuesday, June 22, Nye County Sheriff George Barra met with Lt. Walter Butt of the Clark County Sheriff's office and other leaders of the rescue effort, and they concluded that the 44 divers in the rescue party had spent the maximum time they could at a depth of 200 feet without endangering their lives. There was still one more crevasse that hadn't been checked to their satisfaction, so them made one final dive at 10 p.m., even as Episcopalian and Methodist ministers were en route to the scene.

Seven divers went down for a final time. When they resurfaced after about an hour empty handed, David's mother collapsed. The ministers arrived, and the reality of the situation began to set in. "Watery Grave for Vegans," said the *Las Vegas Sun's* headline. "Devil's Hole Wins Fight of Man Against Nature," read the *Las Vegas Review-Journal*. The next day's papers published information about the memorial services. Both families re-

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quested that in lieu of flowers, contributions be made to the Sheriff's Underwater Rescue team.

Two boys, lost in a deep water hole in the middle of the desert, quickly became the stuff of legend. Bill remembers men coming home from Vietnam talking about it, having read about it in *Stars and Stripes*. Theories began to circulate, an attempt to make sense of the mystery. There were purported sightings of the young men, and some even suggested that they'd faked their own deaths. Sometimes people teased Bill, threatening to send their enemies diving with him. He laughs at the memories, shrugging off the often cruel jokes. But the laugh is just a little too hard, and the eyes a touch too shiny.

He left soon afterwards. Though he'd planned to attend college in town, he had to get away. Arizona became suddenly appealing. From there he went to LA, and then Vietnam. He came back to Las Vegas only to fix up the house and sell it. Then he'll go move back to San Francisco with his wife. Occasionally, he still goes diving.

In the 40 years since that fatal dive, the story has drifted into urban legend. Some think it's nothing more than a tale cooked up to keep trespassers away. But to the divers for the National Park Service who conduct research down in Devil's Hole, and for those who are part of the safety teams accompanying the biologists, it's still very real.

In early December a team of five divers ventured into the hole to search for equipment that had been lost in a flood, and to take measurements of the area. There's a rope down there, they report – some noticed it for the first time, others insist it has been there for years. The divers were all familiar with the story of the young men, and the feelings are mixed as to whether or not the bodies could still be down there, 40 years later, waiting to be discovered. Tom Jaskulski, a safety diver on the team, says that when he's in the hole the young men are never far from his thoughts. " I always consider it and I always keep a wary eye looking for any evidence," he says. "But it's one of those mysteries. Nobody knows."

When Park Service volunteers go underwater, slipping under enormous rocks and into the depths of the earth, their blue wet suits begin to fade after only a few feet. Their white tanks turn to a blur when they've gone about 20 feet, and the waves from their fins cease after just a minute or two. But the air bubbles keep coming, the only sign that there is human life down below. The bubbles will stop for a while, and then start again in uneven intervals, *blub-bing* to the surface, as the air takes the most direct escape route to the surface.

How long those bubbles – the last traces of life from David Rose and Paul Giancontieri – continued to surface 40 years ago, no one will ever know. And no one will ever know if they did, in fact, find a pocket of air and wait, praying they'd be found as the rescue divers searched in vain, even as the mysterious cavern was transformed into their mystical tomb.

News from the Treasurer

Marilyn M. Weiss

For Transactions Between: 1/1/04 to 12/30/04

Account Name	Withdrawals	Deposits	Subtotals	Totals
Beginning Balance			**$12,989.57**	**$12,989.57**
Membership				
Dues	$30.00	$7,205.00	$7,175.00	
Mailings	$113.68	$0.00	($113.68)	**$7,061.32**
Conference				
Registrants	$50.00	$1,570.00	$1,520.00	
Costs	$1,361.04	$0.00	($1,361.04)	
Misc.	$612.70	$350.00	($262.70)	**($103.74)**
Newsletters				
Production	$1,622.95	$0.00	($1,622.95)	
Travel/Conferences	$500.00	$0.00	($500.00)	**($2,122.95)**
Board Meeting				
Phone Charges	$387.90	$0.00	($387.90)	**($387.90)**
Scholarships/Donations				
Scholarships	$2,500.00	$0.00	($2,500.00)	
Donations	$1,000.00	$0.00	($1,000.00)	**($3,500.00)**
General				
Educational Materials	$15.00	$0.00	($15.00)	
P.O. Box	$24.00	$0.00	($24.00)	
Misc.	$21.38	$0.00	($21.38)	**($60.38)**
Misc. Meetings				
Phone Charges	$59.70	$0.00	($59.70)	
Other	$17.30	$0.00	($17.30)	**($77.00)**
Web				
Net Provider	$95.40	$0.00	($95.40)	
Want Ads	$0.00	$30.00	$30.00	**($65.40)**
Field Trip				
Registrants	$200.00	$2,755.00	$2,555.00	
Costs	$2,588.59	$0.00	($2,588.59)	**($33.59)**
TOTALS				**$13,699.93**

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Area Coordinators

We are looking for coordinators in many of the following areas. If you are interested, please contact Dave Nemetz.

Western Area
(LaCrosse, Black River Falls, Eau Claire, Chippewa Falls, surrounding area)
Position Open.

Southern Area
(Madison and surrounding area)
John Tweddale
BT^2
Phone: 608-224-2830 and 608-224-2839
jtweddale@bt2inc.com

North Central Area
(Stevens Point, Wisconsin Rapids, Wausau, Rhinelander, surrounding area)
Tod Roush
Maxim Technologies
Phone: 715.845.4100; Fax: 715.842.0381
troush@maximusa.com

Northeast Area
(Green Bay, Appleton, Oshkosh, Fond du Lac, surrounding area)
Position Open.

Southeast Area
(Milwaukee, Sheboygan, Racine, Kenosha, surrounding area)
Position Open.

Join the Wisconsin Ground Water Association Today!

WISCONSIN GROUND WATER ASSOCIATION MEMBERSHIP APPLICATION/RENEWAL FORM

Please take a few moments and become a member of, or renew your membership in, WGWA. Annual dues are $15 for students, $30 for individuals, and $25 per person for corporate memberships of six or more. Dues are payable to "WGWA." Complete the following form and send, with check, to:

Wisconsin Ground Water Association
P.O. Box 8593
Madison, WI 53708-8593

Individual Membership: Regular Member:____$30 Student Member:____$15
Name:_____ Title: _____
Firm/Agency: _____
Mailing Address:_____
City, State, ZIP Code: _____
Telephone Number:_____ Fax: _____
E-Mail:_____

Are you interested in participating in any WGWA Committees?

___ Newsletter ___ Membership ____ Web Site ___ Legislation ___ Program & Education
___ Please check if you do not wish to be listed in a WGWA membership directory.
___ Please check if you don't have e-mail access and need to receive the *WGWA Newsletter* via regular mail.

Corporate Membership Discount (six or more individuals): ____$25/individual
Firm:_____
Mailing Address:_____
City, State, ZIP Code: _____
Telephone Number:_____ Fax: _____
Corporate Individuals (include each individual's e-mail address, if available. Attached additional page if necessary):

Name	Title	E-Mail
1.)		
2.)		
3.)		
4.)		
5.)		
6.)		

___ Check here if your company does not wish to be listed in a WGWA membership directory.
___ Check here if you don't have e-mail, and need to receive the *WGWA Newsletter* via regular mail.