

# The Confluence

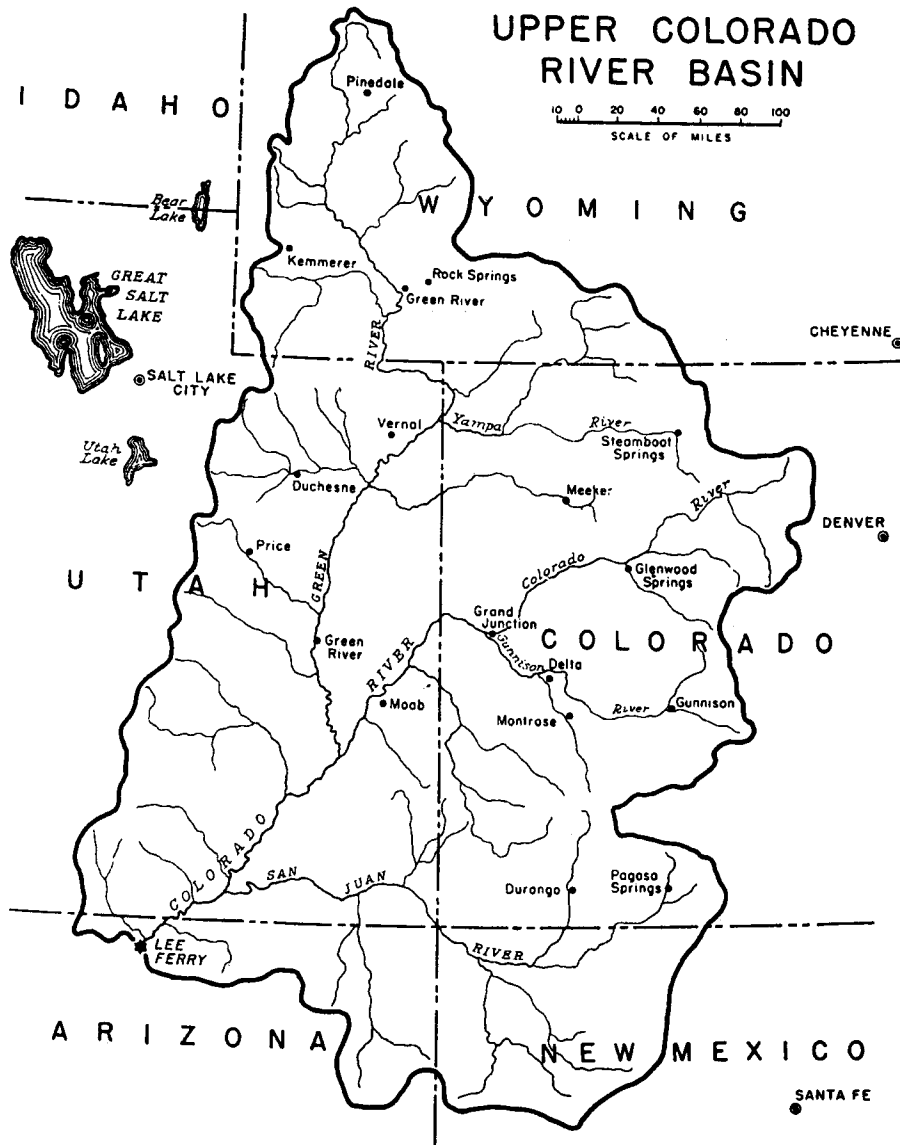
The Journal of Colorado Plateau River Guides

Volume 4, Issue 3, Winter 1997



MULE EAR DIATREME  
STEAMER "MAJOR POWELL"  
WILLIAM HIRAM EDWARDS  
WESTWATER CANYON  
GUIDE TRAINING

INTERNATIONAL BOATING  
WICKED WINDS  
NEVER ASK A GEOLOGIST...  
POETRY  
CROSSWORD PUZZLE



From the First Annual Report of the Upper Colorado River Commission, March 20, 1950.

# The Confluence

...wants to be the quarterly journal of Colorado Plateau River Guides, Inc. Colorado Plateau River Guides is a 501 (c) (3) non-profit organization dedicated to:

- \*Protecting the rivers of the Colorado Plateau
- \*Setting the highest standards for the river profession
- \*Providing the best possible river experience
- \*Celebrating the unique spirit of the river community

Guide Membership is open to anyone who works or has worked in the river industry of the Colorado Plateau

General Membership is open to those who love the rivers of the Colorado Plateau

#### Membership dues

- \$ 20 per year
- \$100 for 6 years
- \$195 for life
- \$295 Benefactor

General Meetings and Board of Directors Meetings will be announced

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We need articles, artwork, poetry, photos, stories, and opinions. This journal is composed with Microsoft Word on an IBM PC. If you use a word processor, we can translate most programs. Otherwise, please send your text double-spaced. Please include useful photos, charts, diagrams and artwork. There really is no deadline, but the beginning of each quarter works best.

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## DISCLAIMER

The opinions and statements made within the pages of The Confluence are those of the author and do not necessarily represent the position of the guide membership, the board of Colorado Plateau River Guides, nor Canyon Country Volunteers. If you have an opposing or supporting viewpoint please send your comments to CPRG.

### Nathaniel Galloway's Birthdate

Rosalyn Jirge spent more time at the Huntington Library this year to gather biographical information on Otis Marston, which will be compiled by John Weisheit; it will appear in an upcoming issue of *The Confluence*. These files provided a birthdate for Nathaniel Galloway to compliment the article on Galloway that appeared in *The Confluence* this spring (Volume 4, Issue 1). Nathaniel was born on January 11, 1854.

### New Editors for *The Confluence*

Steve Young, Michele Reaume and Anne Egger have each volunteered to produce an issue of *The Confluence* for the calendar year of 1998; John Weisheit will continue to be an editor as well. The editors are asking for manuscripts on all subjects, but two issues will be concentrating on Desolation and San Juan canyons. The clearing house will be the CPRG address, phone or e-mail as listed.

### SPECIAL THANKS TO:

Karla VanderZanden for a donation of \$500 to be used in developing an oral history program for Colorado Plateau River Guides. The oral histories will appear in *The Confluence* and will be archived at the Marriott Library, University of Utah.

Bill Bishop for a Lifetime Membership  
R. J. Johnson for a Lifetime Membership

### The Patrons of CPRG

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*Thank you for your support!*

# THE WORLD OF BOATING

by Darren Smith

**A**fter ten years of boating, with experience in running crafts ranging from 33-foot S-rigs to 12-foot inflatable kayaks, on rivers in Arizona, Colorado, Oregon, Utah, Idaho, and New Mexico, a river runner might start to think he/she is as about as good as they can get. Add being a private boater—with a bunch of variety—and a commercial guide—meaning even a greater amount of time on the water—and you will become even more sure of how great you are. Well, if you have half this much, or ten times this much experience, there is still a whole bunch you can do to grow as a boater.

During the spring of 1996, Joe Keys and I felt like it was time to expand our careers as boaters and to do something unique like: get on the international scale. Joe and I prepared great resumes, did an international search on river companies, and finally decided to quit our winter jobs. Our plan was: head to another country for the winter (their summer) and become international river guides. After sending information to about ninety different companies, spending an unbelievable amount of time on the phone, and saving money, we decided to go to New Zealand.

Going to New Zealand was one of the best decisions I ever made. I learned as much in three months, than I have ever learned in such a short period of time. Food was a major adjustment and the Kiwi food is pretty close to the States, when considering what people eat in some countries around the world. The food, in short, was chicken, pork and beef, are almost too expensive for a guide to afford, but mutton is the food a guide can afford and on most days; it is eaten as a sausage. Mussels are so cheap they are almost free and there is no such thing as a TACO BELL. If you are in the mood for Mexican food, their might be a Mexican food isle in some of the stores. MCDONALDS is the same, right up to the "Value Meals" and the "Kiddy Land". Chinese and Japanese take-aways are everywhere, and "pies" (homemade pot pies) are the fast food to die for. Tipping is unheard of in New Zealand and this has impacts on all forms of the service industry. Sitting around and waiting for service at a pub, or bar, is a waste of time, because there are no waiters or waitresses. After a great day on the river, the only tip is maybe a little advice. The people are super friendly and hitch hiking is considered a safe way to travel and sometimes a ride will lead to a warm home, dinner, and a place to sleep. All Americans behind the wheel of a car will, at some point, drive on the wrong side of the road. Toilets flush in a big splash; not in the opposite direction as ours do here in the northern hemisphere. Beer is dark, strong, expensive, and very good.

Are there some things to learn about white water rafting? Yes, an unbelievable amount. What I learned is different from what others might learn; but, I am sure all would learn something. My skills were solid, but I had limited experience with paddle boats, and I think Kiwis do things a little different than us anyway. On one of these paddle boat trips, the most important thing to teach the passengers are three simple steps: 1) have two hand holds in the right place, 2) get down on the floor of the boat, 3) tuck your chin into your chest and smile. These three steps are triggered by the "hold on—get down" command. The "hold on—get down" command is also the signal that the boat is going over a 21-foot waterfall and is probably going to flip. If the passengers did not

"hold on and get down" correctly, they were going to fly out of the boat and be underwater in aerated water for ten to forty seconds. The guides called this little swim: getting "green-roomed".

The guides are the ones who get "green-roomed" the most, because we would make final paddle adjustments to the boat before going over the 21-foot water fall, and sometimes only had one hand hold. My skill at righting a flipped boat is much improved, as I had to do that 27 times while in New Zealand. Two flips in a day is common; four times in a day is my record; I even flipped on Christmas day and New Years day. Running five trips in a day is not uncommon and was quite an adjustment from running multiple day trips. Ironically, all these flips, aerated swims and rescues, became invaluable experience for rowing/flipping in Cataract Canyon during June of 1997.

I learned that I was not really the great adventuring guide I had figured myself to be. Many of the guides I worked with had been working in other countries for years, and were trying to decide what country they were going to guide in next. I did have the advantage of being a guide who ran multiple day trips, motor rigs, and rowed boats. Most of the other guides experience was from running one and half-day paddle boat trips. The rivers sections are generally a bit more technical and I think this is because Kiwis do not sue, therefore the industry can run more risks. New Zealand is definitely an adventure tourism country.

**Two flips in a day is common;  
four times in a day is my record;  
I even flipped on Christmas day  
and New Years day.**

Sit back for a second and think about what you really do not know about the river industry. Remain confident in the fact that you are really pretty good at what you are doing, but do not limit yourself in thinking you are as good as they get. There are unlimited river running options out there. Imagine doing the next season where you did the last, whether it is multiple day motor or row trips in Cataract, Westwater, Dinosaur, and Desolation, like me, or running the Animas in various different crafts. You can bet at the end of the season—your pretty skilled. Take your season and extend it to September by running one day trips on the Gauly, or to Nepal (September/October) for multiple day trips during the monsoon season (high water, paddle and row boats) and then to New Zealand doing day trips over the Kaituna Falls (21-foot waterfall). A year of boating like this is sure to help any guide improve and make you hungry to learn what else there is out there in boating.

If you are thinking about expanding as a river runner, the U.S. has unlimited options. Coloma, California, is loaded with river industry; Oregon and Idaho have trips of all lengths and styles, as well as a billion other places in the U.S., Japan, Australia, and Costa Rica have great river industries and are all hiring international guides—especially Americans.

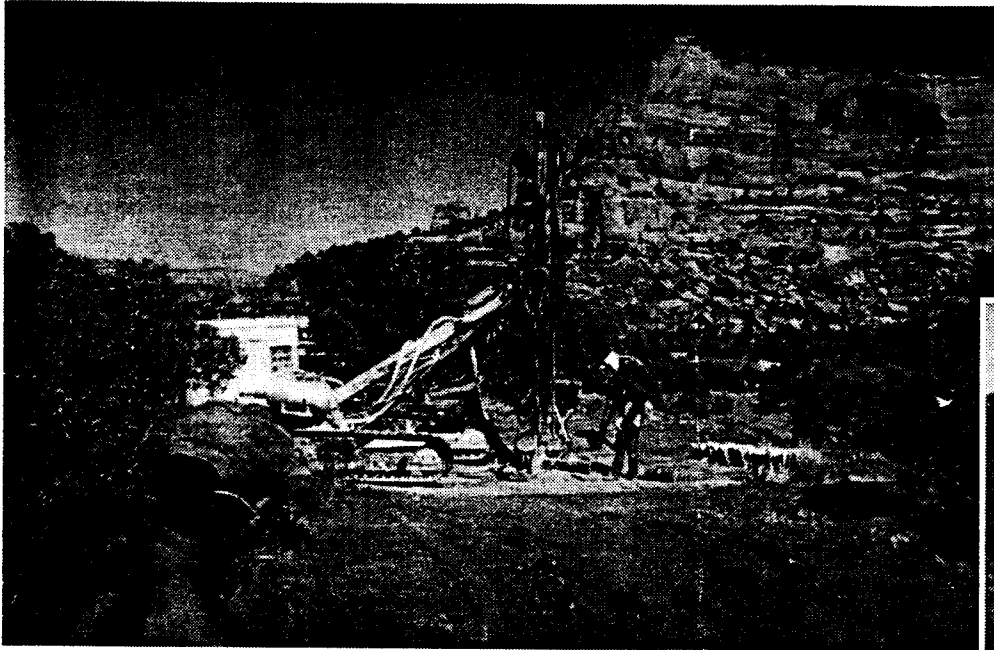
So what do you get out of going on the international scale as a boater? The biggest thing is the people you meet. Guides from all over the world are moving from place-to-place, depending on what is happening with the water and each of them will share an experience to help you grow. New languages and cultures, which will surely help you to grow as a guide. Variety in crafts and the way the different companies are operated will also add to your skills as a boat person. The most important thing is you will have a bunch of FUN.

See photo of the 21-foot waterfall run on page 4.



# Stop the drilling in Westwater

Canyon Entrance • Photographed Oct. 18, 1997



This heavy equipment is taking rock samples to determine subsurface mineral values for open pit mining. Three miles of roads have been graded and five large test pits have already been dug.

Fifteen holes between 25 to 100 feet deep are being drilled.



**At this rate,  
the next  
picture we  
send you of  
this site along  
the Colorado  
River could be  
of an open pit  
mine.**

**Westwater  
Canyon needs  
your voice  
now.**

**Be a Friend of  
Westwater-**

## Here's what can you do:

1. Call or write your Congressional representatives. (U.S. House or Senate in Washington D.C. at U.S. Capitol switchboard: 800-972-3524; or - names, phones and email addresses at: <http://www.webslingerz.com/jhoffman/congress-email.html>).

*Write or call especially if you are from Utah.*

Everyone should contact Vice-President Al Gore.

(White House, Washington, D.C 20500; email: <http://www.whitehouse.gov>).

Ask them to put a moratorium on mining activity in the Westwater Wilderness Study Area.

*They need to know that their constituency cares about Westwater preservation.*

2. Lend your support and financial aid to the volunteer group that is working for a moratorium - the Friends of Westwater. Absolutely all funds are used to cover expenses, such as postage, printing, long distance telephone charges. *For our efforts to have more clout in public arenas, we need your membership; so, even the simple gesture of being a Supporter is very helpful to us.*

Please complete and mail to:

Friends of Westwater, Inc. • PO Box 2011 • Grand Junction, CO 81502-2011

Visit our web site: <http://users.aol.com/pswinn/wwcov.html>

email: [rpuckjr@aol.com](mailto:rpuckjr@aol.com)

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Name \_\_\_\_\_

Address \_\_\_\_\_

Telephone \_\_\_\_\_ Email \_\_\_\_\_

Supporter (Free) Yes, I support the efforts of Friends of Westwater to preserve Westwater Canyon.

The Membership levels below include quarterly updates and all bulletins. We sincerely appreciate your support.

Friend (\$20)     Good Friend (\$50)     Corporate (\$100)     Very Best Friend (\$250 - \$500)

## The Sol Feinstone Environmental Award West Slope Activist Awarded for 1997

**H**arry "Skip" Edwards is one of two persons nationally to be awarded the 1997 Sol Feinstone Environmental Award for his volunteer efforts to preserve Westwater Canyon in Eastern Utah as wilderness. Nominated in late 1996, Skip was notified recently of this award at his home in Crawford, Colorado. An award ceremony was held in the Fall.

Westwater is on the Colorado River in Eastern Utah and is a spectacular desert-river canyon known internationally for its whitewater and unique black granite inner gorge crowned by towering red sandstone cliffs. In 1984 Westwater was designated a wilderness study area by Congress. The BLM was given the responsibility to manage the area under a "non-impairment" standard to protect the Canyon until Congress were to designate it as wilderness.

Friends of Westwater President Greg Trainor in responding to the award said that Skip is *the* one key person responsible for galvanizing thousands of persons to the dangers of losing Westwater Canyon to mining. In 1992, while acting as the BLM river ranger at Westwater, Skip discovered mechanized equipment being used by gold mine claimants to constrict roads inside of the Westwater wilderness study area—an activity strictly forbidden by federal law and not authorized by the BLM.

On his report, mine claimants were cited by the BLM and, in 1996, the Interior Board of Land Appeals ruled that claimants reclaim damage created within the WSA.

In 1995, on a chance remark made by a friend, Skip learned that the entrance to Westwater Canyon—an area of 1,800 acres—had been deleted from the 1995 Utah Wilderness Bill by mining interests in Grand County (Moab) Utah., the same interests responsible for the illegal road construction in 1992. These interests included a member of the Grand County Commission who was also one of several mine claimants working in the Westwater the area.

Skip resigned his position with the BLM and, with his own funds, traveled to Washington D. C. to talk to anyone who would listen about why Westwater deserved to be protected. His one-man campaign gained the attention of the nationally-respected High Country News which broke the story of Westwater attracting the attention of others wanting to help. Supported by staff of the Southern Utah Wilderness Alliance, friends of Westwater throughout the United States started their own campaign to remove the "1,800 acre Pene Deletion" from the 1995 Utah Wilderness bill. In early 1996 the wilderness bill was defeated by a coalition of western Democrats and moderate eastern Republicans who felt that the 1995 bill was deficient in the amount of Utah lands proposed for inclusion into wilderness.

At Westwater the threat of mining continues. As of this writing, mechanized equipment, despite a BLM approved plan of operation authorizing only hand tools, continues to be

stored and operated within the wilderness study area. Skip, now with the support of the recently-incorporated Friends of Westwater Canyon, is working full-time to publicize the BLM's blatant tolerance of the continued presence of this illegal equipment.

The Sol Feinstone Award was endowed in 1976 at the State University of New York, College of Environmental Science and Forestry. Sol Feinstone, in creating the award, felt that volunteerism by ordinary people was the key ingredient to preserving, maintaining and protecting the unique natural resources found in the United States.

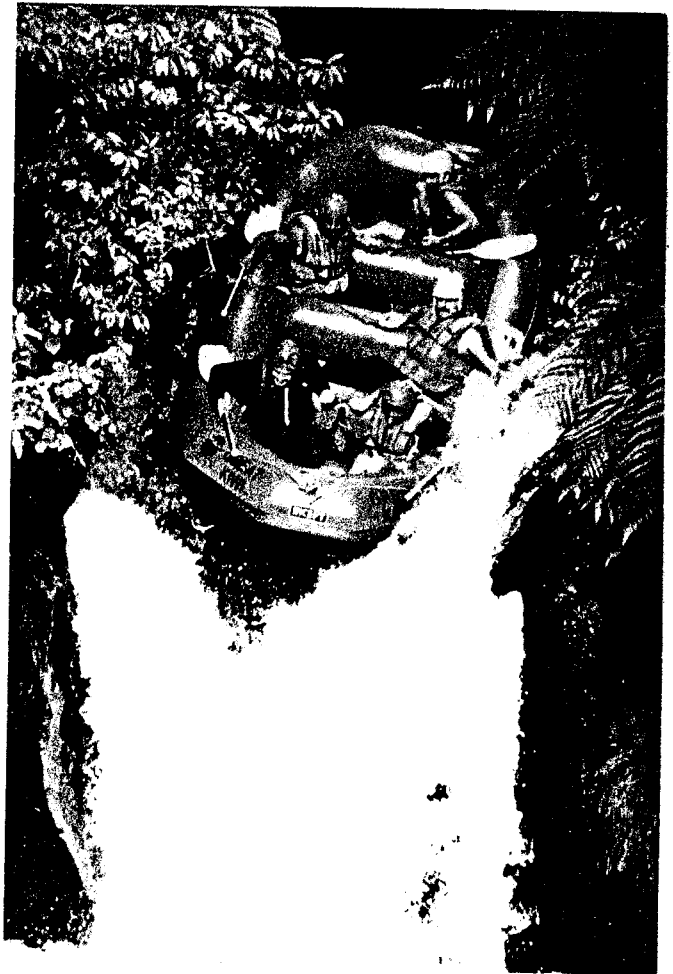
Awards Committee spokesperson, Lucy Popkess, said they were delighted to recognize Skip Edwards for his unpaid work on behalf of Westwater.

### FOR MORE INFORMATION:

Contact Friends Of Westwater Canyon  
P.O. Box 2011  
Grand Junction, Colorado 81502-2011  
(970) 245-7613

### WESTWATER WEB PAGE:

<http://user.aol.com/pswinn/wwcov.html>



21-foot waterfall in Kiwi land.

Photo courtesy of Darren Smith. See Darren's article on page 2.

# When the Wicked Wind Blows

by L. Lisa Lawrence

**A**s I groggily opened my eyes, the dramatic contrast between the red rock of the Colorado River Canyon and the blue Autumn sky came into view. It was another amazingly beautiful day on the Colorado Plateau. I was lucky enough to be right in the middle of paradise, instead of in some office in the city like so many people trapped in the rat race of the "real world". It was a wonderful day to be on the river, to be a guide, and just to be alive. I yawned, and stretched, when suddenly, my body was racked with pain so severe that I couldn't take a breath.

As my eyes began to focus, the "red rock" became a red brick building. I surveyed my surroundings and noticed: the intravenous lines in my arms, the catheter draining urine from my body, the strange devices strapped to my legs alternately inflating to circulate my blood, and flowers, lots of flowers. "Damn!", I quietly muttered

to myself as realized that I was not in my beloved canyon. Instead, I was beginning the third of eight days in the orthopedic ward in St. Mary's Hospital in Grand Junction, Colorado. My pelvis was fractured in three places and my spine was fractured through the hip joint. I had been in and out of consciousness for most of the previous two days due to shock, pain, and medication. Images began to flash through my mind: the storm front blowing in, me screaming (more like whimpering) to Clyde, our driver, that I couldn't move because my back was broken as he tried to lift the boat that was crushing my pelvis, the horrible popping and snapping noises my body was making, a woman holding my hand saying "Lisa, hold on, stay with us!!!", a physician talking about surgery and blood transfusions, and a haze of blowing sand and pain.

My morning, two days prior, had started out like any other day. I awoke in Castle Valley, Utah, greeted by red rock, a stunning blue sky, and the rather loud sound of Nelson, my friend's dog drinking out of the toilet. I staggered down the stairs in my usual semi-comatose state, to the great amusement of my friends. Their morning routines had come to include teasing me about my inability to function in the morning before I've had my coffee. After the morning ritual of communicating in grunts and crude sign language, being teased, and commenting on Nelson's drinking problem (the toilet), I headed up the river road to Moab, to get coffee and rig the trip. I noticed the clouds building up and a slight chill in the air as I drove. It was an amazingly beautiful, crisp, autumn day, vivid reds, blues, and glassy water, just like a postcard. I loved these days, and the solo trips, which were a calm and peaceful relief after the summer crowds and stress.

The winds were howling when we reached the put in. As I watched two guides from another company rowing with all their might against the wind, getting blown back up the river, I muttered, "I love my job" under my breath. The winds that came with these storm fronts usually made for a miserable, frustrating day. Clyde and I pulled the boat out of the water and up onto the ramp so we could tie it to the trailer, rather than allowing it to blow into the water and up the river. I took my time rigging, in hopes that the front would blow through quickly as they often do, or that it would get bad enough to call off the trip. And there I was, standing in the boat, which weighed at

least 400 pounds empty, strapping gear down, and rethinking the wisdom of attempting to row against this strong of a wind. Suddenly, I was blinded by sand, so thick that I was barely able to breathe. I was launched into the air by a force that I couldn't see. I looked up, in shock and disbelief to see that the raft was also flying through the air. I hit the ground stunned and bruised, and tried to scramble away from the boat, knowing how much it weighed and that it could kill me if it landed on me. I heard a sickening crunch as the metal frame of the boat crushed the right side of my pelvis and lower back. I tried to scream, but the sound that came out of me was some sort of breathless, guttural cry that a wounded animal would make. Clyde came running from the front of the bus. He tried to lift the boat off me, but it was too heavy and the wind was too strong. He asked me if I could crawl away from it, out of fear that he would let go of it and crush me further. My legs would not move, and my back and hip made horrible snapping and popping noises when I tried. "Clyde, I can't move, my back and my pelvis is broken." I was crying, more from the realization that life as I knew it was over than from the pain itself. Help arrived in the form of shocked and

horrified customers, who assisted Clyde in lifting the boat off of me, and getting me onto a backboard. I knew things were badly broken, but that nothing was grossly displaced. As a 12-year veteran paramedic, I also knew that one wrong move could kill or paralyze me, and that patients often die from the internal bleeding associated with pelvic fractures.

In one short freak moment, my whole life had been taken away from me, perhaps forever. River guiding was the job that filled

in time between my seasons as a park ranger, doing law enforcement, search and rescue and fire fighting, and my winter job as a ski instructor. Everything I did to earn a living and keep my sanity required that my body be intact. I had made too many personal sacrifices: financial security, a stable home, and personal relationships in order to live this adventurous life, to let it end this way. After discovering that I could wiggle the toes on my left foot, I decided that I didn't have time to feel sorry for myself, I had to come up with a plan. I was not going to give in to these injuries, I would fight with everything I had. As it turns out, I had 6 painful hours on that backboard, including trips to two different hospital emergency rooms to make that decision.

The next two days were touch and go. I was bleeding internally, and surgery and blood transfusions were still a possibility. My survival was attributed to "dumb luck", "divine intervention", and to the physical condition I was in at the time of the accident. My back, pelvic, and abdominal muscles, which were extremely strong from all the rowing and lifting, held everything pretty much together. On the second day a physical therapist came in and we worked on moving my legs. Once they decided that I was not going to bleed to death, I was encouraged to see if I could sit up, and even stand up with crutches. Once I was able to make it to the door of my room, I would not let anyone help me with anything, "Don't touch me, I'll do it myself." was my mantra during my eight day incarceration. I refused wheel chair rides to the rehabilitation gym, knowing that every moment spent sedentary would cause my muscles to shorten and atrophy. "Look, it's Super Woman," was what the nurses would say as I hobbled by, with my catheters and IV lines hanging off my crutches. The people who referred to me as "Super Woman" and later, "The Bionic Woman," and constantly commented on my positive attitude, didn't know how bad I was taking it. They did not see me when I awoke in the middle of the night, from terrifying

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# A Word to the Wise: Never ask a geologist, “What time is it?”

by Dave Focardi

nightmares of the accident, when I was crying alone in my room at midnight depressed and despondent, or when I would vomit and pass out in physical therapy because I had pushed my body past its limit.

It wasn't easy being “The Bionic Woman.” Some days, I just wanted to lie in bed and cry.

The weeks following my “incarceration” had their own difficulties. The first physical therapists I saw told me that for the first six weeks, I wouldn't be able to do much in the way of physical therapy, and would just have to take it easy and let my body heal. I did not buy into that, and insisted on a sports therapist and full professional athlete rehabilitation, much to the frustration of my doctor who wanted me to “slow down a bit.” I would set nearly impossible goals for myself, so that I would have a reason for deliberately causing myself so much pain every day. Two weeks after the accident, I started swimming, a few days later, riding a stationary bike and doing leg presses. I pushed my workouts to three hours a day, seven days a week. Even my sports therapist said she had never seen anything like it. I became obsessed with getting better, and the “Bionic Woman” jokes started in earnest, “We can make her better, stronger, faster.” I used homeopathic and metaphysical remedies to supplement the conventional medical care. After four and a half weeks, I could feel the bones were healing, so I began the painful task of learning how to walk, first in chest deep water in the pool, and later in the kitchen leaning on the counters, so that I wouldn't put too much weight on the fractures, and further injure myself. I was able to walk without crutches into the doctor's office at my six week check up, to be told that my x-rays looked excellent and that I could now start weight bearing exercise. “Go ahead and push yourself,” he said, and then laughed. Walking into that office had been one of my seemingly impossible goals, and it was time to set another. I told him that I wanted to ski on Thanksgiving day.

“This is insane! I must be out of my mind,” I said, as I stepped into my ski bindings. It was Thanksgiving day in Aspen Colorado, it had only been seven weeks since the accident, and I'd only been walking without crutches for a little over a week. I began to suspect that my doctor didn't really think I would go through with it, and had just been humoring me. I slid out onto the snow towards the ski lift below, knowing that there was no turning back. I was afraid, and in pain, but managed five nervous trips down the bunny hill. It will take time and practice to regain my confidence and coordination, but I had taken a huge first step. As I sat down with friends for dinner that night, I truly knew what it was to be thankful.

I have come a long way, but have farther to go. My life is still about intense pain and recovery, and will be for several more months. With goals met, goals still to be met, and the support of wonderful friends I know I can do it, and come out of this physically and emotionally stronger. The accident has reaffirmed what is important to me, and how important it is to live every day to its fullest, because life can be taken from us in an instant. I am looking forward, and am constantly setting new goals for my recovery. I will progress as a ski instructor, perform technical rescues at the park, and row the Grand Canyon next fall. I feel good about my life, but I still get a cold chill down my spine when the wind blows.



No shit, there I was, a commercial oar boat, four paying guests and my wife of one and a half years swamping, with Cat at 70,000 cfs. In the middle of all this, one of the guests asks, “Dave, you're a geologist, how come the cliffs are so straight up and down?” Well, to answer that, all you have to do is read Powell's account of The Exploration of the Colorado River and Its Canyons, and pay attention to the part about erosional recession. In the event you can't turn to your bookshelf and leaf through your copy of Powell's tome, erosional recession is basically the principle that once erosion starts, the shape of the cliff remains the same as erosion progresses. The steepness is due to the competence of the sandstone beds compared to the underlying shale beds. Competence refers to the hardness and induration of rock layers, induration refers to the lithification of the sediments, or the degree to which they hold together. In other words, the sandstone beds are far more resistant to erosion and hold together, maintaining a solid cliff-like appearance while the softer shale layers underneath are worn away. Clay erodes by a variety of methods, one of the most significant being the adsorption (not aB sorption) of water molecules, thus causing the clay to swell if it's a smectite, or at the very least becoming soft and plastic when wet. In this vulnerable state, clays tend to erode much faster than sandstone. Consequently, an undercut forms under the sand cliff, which being a more competent formation, really wants to hold together. When the sandstone does fall apart, it comes off in large chunks, leaving a steep cliff face behind. The Wingate sandstone with the soft Chinle and Moenkopi underneath it is a textbook classic example of this. I know of Ivy League geology field trips that come out to Moab just to see this in real life. Powell was the first geologist to note that the shape of cliffs, if viewed aerially, maintain the same essential shape once the erosional process has begun, as well as a few other very essential principles of geology. Well, can you believe it!? During that incredibly verbose description, all hazards of Cataract Canyon were miraculously passed.

Now we're hiking up Dark Canyon, and another guest asks, “Dave, what's this red stuff in the gray rock and why is it hollow inside? And hey!, what are these white crystals in the middle of this little red pocket!” The answer to this question explains the geologic history of several layers encountered in the typical hike up Dark once one is past the Lake Foul deltas. The following is paraphrased from an excellent article in the Four Corners Geological Society's 1987 Cataract Canyon guide book, from an article by David B. Loope and Gregory B. Kuntz from the University of Nebraska, Lincoln, NE, entitled: “Evidence of Evaporite Growth Within Marine Limestones of the Upper Member of

**Growth Within Marine Limestones of the Upper Member of the Hermosa Formation (Pennsylvanian), Cataract Canyon, Southeastern Utah.** This guidebook may be too inaccessible to many of our readers due to technical prolixity, finances, boringness or ennui.

In any case, the nitty gritty 60 second, don't have time to dawdle answer is: the red stuff is chert (a silica dioxide—or quartz in a pretty color) and the white crystals are usually quartz, except they are shaped like gypsum! This means that originally there were gypsum crystals in there that were replaced by quartz at some point. Before I get into how that happened, I'll give you another clue: if you pay attention on your hike, or even in one of the Dark camps on the left, you will see several places where the gray limestone layers have a vertical crack filled with sandstone. These cracks tend to be about 2 to 5 inches wide, and taper down to a point. The cracks start at the bottom of a sandstone layer and cut down through a gray limestone layer, sometimes as deep as 10-12 feet. After the double waterfall, and on the long stretch before the upper big falls where many people JUMP and DIVE into the evacuation pool, one can see a sand filled desiccation crack at least 10-feet deep that can be traced to the other side of the creek.

First, lets look at how the gray limestone layers are formed. Imagine a large mud flat, full of small and microscopic life that makes calcite shells-like seashells, but really small. An environment that results in a calcium carbonate (limestone) producing environment is generally warm and wet, and conducive to life. There are worms or some animal that burrows through the mud, and as this thing goes through the mud it changes the chemistry of the limestone mud. At this point, the article uses the geologists cop-out, which is the often used phrase, "It's a poorly understood phenomenon." In any case, for some reason so complex and detailed that if the real reason worm burrows through limey muds allowed chert/flint/chalcedony to form ever gets out, peace will reign in the Middle East, only young Germans will have bad swims, and boatmun will all have excellent retirement funds set up by their wealthiest guests. In any case, one can see dark gray chert blobs and tubes in the lighter gray limestone, and occasionally in the center of these tubes a little red chert or even a red bubble of chert with white crystals inside that. The worms alter the limey mud and create a chemical preference for the formation of chert in the future.

Here's the theory. Big mudflats, worms burrowing and altering the limey muds, the water goes away and the place dries up. Large and deep cracks form in the mud, and sand blows in and fills the cracks. Now the environment is a dry one and evaporative minerals like gypsum form in the limey muds. As the muds dry up, stuff like gypsum comes out of solution and forms in the altered worm burrows in ball like shapes known as botryoidal (pronounced 'boat-tree-oy-dull') nodules. The place gets buried again by mudflats and the process starts over again. Now at some future time, the evaporites (gypsum) are silicified, meaning they get replaced by chert (the red stuff). Remember, we have 200 million

years for groundwater, burial, pressure and heat to change things, although the timescale for these chemical processes to occur is, you guessed it, a poorly understood phenomenon. Presumably, the dark gray chert tubes are formed before this. With the silicification of the evaporites, it happens in such a way that the white quartz crystals are shaped like gypsum crystals. Silica dioxide molecules repalce the calcium sulfate molecules while maintaining the gypsum crystal shape. These are known as chert pseudomorphs after gypsum. Get it? White crystals look like gypsum, but are really quartz. The difference in color, from red on the rind to white in the middle is due to microscopic spheroidal iron oxide blebs. Iron oxide is, of course, rust, and is responsible for a lot of that red color the careful observer will note in the rocks of this area. Congratulations if you got this far, and the usual disclaimer prevails, any errors are due entirely to my interpretation of the data, or if I'm lucky, due to the changing interpretation of new or old evidence by people who spend a lot more time studying this stuff than I do. Geologists are just making all this up anyway. There hasn't been a new "known" thing since continental drift became accepted. For the simplified version, at least.

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## RIVER MAGIC

Laid back comfortably on my carpet of grass,  
Fresh and pungent aromas, reminiscent of spice.  
Sweet aura of tranquillity as the night hours pass,  
Beneath God's great creation, joy beyond price.

Above as my ceiling is this brilliant heaven,  
Aurora Borealis, a seldom in the desert display.  
The twinkle and flash of shooting stars and then,  
Scorpius and Sagittarius marking my southward way.

I slumber with the whispering of the river running past,  
Murmuring it's promise of elation on the morrow:  
In distant background rapids rumble, flowing fast,  
Bringing dreams of past adventures to banish any sorrow.

Pale light in the eastern sky slowly covers each star,  
In this cool desert, a wildlife symphony about to begin.  
Sounds near the cook stove makes solitude fly afar,  
Camp coffee aroma blending with the quickening din.



## The Major Powell Inscriptions

by Jim Knipmeyer

One stretch then another, I sit up in my bed,  
Glance up the canyon, freshly lit in the morning glow.  
Sheep in yon' meadow, full curl ram their proud head,  
Grazing peacefully, untroubled, a special morning show.

I eat breakfast, clean camp, load my boat; The river beckons,  
Check the area, boatman shotgun; I push out and feel the  
current.

Blue heron on gray rock, like a pterodactyl of past aeons,  
Cliff-side pictographs! An ancient ones message, left when off  
he went.

There's an eagle; a parson preaching from a pulpit of sticks,  
A Black Cormorant like a sentinel, guards my slow descent.  
Merganser chicks off in the eddy; piggyback and doing tricks,  
My senses overflow, my imagination is nearly spent.

A dazzling sun reaches deep, cool shadows disappear,  
Falcons soar among the cliffs, prey beware this predator pure.  
Turkey vultures dance their disco; fluttering wings so very near,  
Is that thunder in the distance or big rapids? I'm not sure!

Deep rumble and vibration, my boat floats ever nearer,  
I tie off in an eddy: I must view this one all around.  
Crashing water and white foam declaring nature's furor,  
Big holes and high waves, my choices certainly abound.

Heart pumping wildly, I pick quickly and walk back,  
Pushing out and pulling hard, I feel the rush and hear the roar!  
I spin left and miss a rock, slam a hole and ride it back,  
Current talons mauling, I hit my line down the bore!  
Plunging through the waves, the water looms ever dimmer,  
Darkness is all around me, like inside a violent thundercloud.  
Bright sunlight as I break through! Is anyone a swimmer?  
With a mouth full of cotton, I look back and I feel proud.

The tumult fades back the silence seems to scream,  
My thumping heartbeat recedes, my trembling hands slow.  
I relax on the oars, a big smile begins to beam,  
Crack a beer, celebrate now! Soon the river will quicken it's  
flow.

Why are most boatmen so laid back and so very calm?  
Why doesn't time matter in the course of these events?  
The rivers' sweet magic provides my soul a strong balm,  
Nature's potency overwhelms all, mortal worries it prevents.

I choose to focus on what's important in the overall realm?  
A cold beer, a fine cigar and good friends from afar.  
Knowing the good fortune that lies at the boat's helm,  
And in enjoying God's gifts, camping on His sand bar.

Paul Smith - 1997

The above title does not refer to the famous Colorado River explorer Major John Wesley Powell, but rather to the steamboat *Major Powell*, namesake of the intrepid river runner. The *Major Powell* was the first steam-powered craft to navigate the waters of the Green and Colorado rivers in the canyon country of southeastern Utah. It had a brief, but somewhat controversial history during the last decade of the nineteenth century.

The rather small steam launch was open-decked with a canvas canopy, 35-feet long, with an eight-foot beam. Her two six-horsepower steam engines turned twin screws and were reportedly designed to burn either coal, wood, or fuel oil. Purchased in Chicago in 1891, she was shipped by rail to Green River, Utah, and christened the *Major Powell* in August of that year.

The steamboat was the idea of B. S. Ross of Rawlins, Wyoming, who in 1890 had journeyed by rowboat down the Green River to the first rapid on the Colorado, some four miles below The Confluence. Impressed with the canyon scenery, he interested a few friends and formed the *Green, Grand & Colorado River Navigation Company*. Their intent was to run a line of excursion boats down the Green to a hotel they planned to build at Spanish Bottom.

After two rather unsuccessful attempts in 1891 and 1892 to reach the limit of "practical" navigation at the head of Cataract Canyon, the Ross scheme fell through. Early the following year, however, it was taken up anew by William H. Edwards, a veteran of the Stanton and Best expeditions down the canyons of the Green and Colorado in 1889 and 1891. He persuaded friends in Denver to lease the *Major Powell*, and in March and April of 1893 made two trips down to the "first cataract" and back. Two inscriptions still to be seen along the Green and Colorado were left during the first of these two voyages by Edwards.

The first is found on the left bank of the Green, between the mouths of Horseshoe and Hell Roaring canyons, at about Mile-58. It is the remnants of a once-painted inscription reading, "UP APR-2nd 1893." Just to the right and slightly lower are the names "Edwards," "Howard," and "Graham." The names and date are on the side of a large boulder, higher than river level, and about 30 or 40 feet from the bank. The paint is mostly gone, and what can now be seen is actually the paint "scars" on the rock surface.

The names are those of William H. Edwards, H. F. Howard, and G. M. Graham, the "crew" of the *Major Powell* on its first 1893 trip. Howard was said to have been an old Lake Erie



“Major Powell” inscription at Spanish Bottom. Photo by Gregory Crampton. Courtesy Marriott Library, University of Utah.

steamboat engineer, while Graham was reportedly a health-seeker from Montreal. They had set out from the Wheeler Ranch below Green River, Utah, in early March, reached Spanish Bottom about the 24th, and then returned up the Green. The round trip took almost a month. Much of their time was spent cutting and gathering wood for the boiler or towing the boat over shallow sandbars.

The “UP” in the inscription was a mystery until perusal of the Edwards testimony given during the so-called River Bed Case in 1929. At that time Edwards testified that,

going down on the first trip we tried to mark the channel as near as we could, so when we came back we would have something to work on ....We would mark on the rocks the line of the turn, so we could tell about what direction to go, then mark them back the other way, and vice versa, whichever way we happened to go. We didn't mark it all, but in places where it was bad [sand] bars, where we had lots of trouble, we would try to mark it.

Evidently, then, the “UP” was one of the upstream channel markers, and was reached on the return trip on April 2nd.

In the diary of his 1947 Green-Colorado river trip, boater Harry Aleson recorded the inscription as “Apr 24, 1889,” but

this was obviously a mis-reading. The three names are all indicative of the Edwards voyage. The second 1893 trip was commenced on April 27 after a “ten-day” layover, so the 24 for the day-date is certainly incorrect. A close examination by the author in the summer of 1993 revealed Aleson's “4” to be a remnant of the letters “nd.” The same held true for his “1889” year-date. The second “8” was actually a 9, while his “9”, was in reality the lobes of the number 3.

The second *Major Powell* inscription is located at the extreme southwestern tip of Spanish Bottom on the Colorado River. Also painted on the side of a large boulder, it is much fainter, even, than the one up the Green and was, in fact, entirely missed by this author on his first search for it in June of 1991. Only after obtaining a copy of a photograph taken of the inscription by Utah historian C. Gregory Crampton in the early 1960s, was I able to locate the almost invisible markings. It was a case of being able to see it only if you knew exactly where to look!

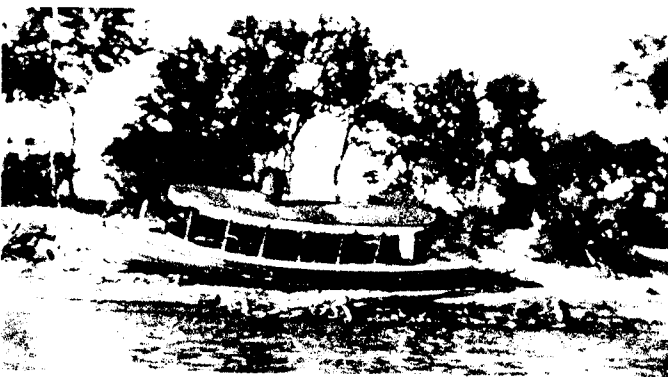
The inscription reads, “1st Steamer MAJOR POWELL MAR. 24 -'93.” Not visible in the photograph, but recorded by Crampton immediately below the date, were the names “- H. Edwards,” “H. F. Howard,” and “---- Gr----.” These are, of course, the same three names of the crew of *the Major Powell's* first 1893 trip. The statement “1st Steamer” is another point of contention in the *Major Powell* story. In a newspaper article written for the Denver Colorado Sun on July 3, 1892, it was claimed that in April of that year, rancher

Arthur Wheeler and three companions, under the auspices of B. S. Ross, took the *Major Powell* down to where Cataract Canyon begins. However, William Edwards in his 1929 testimony claimed credit for taking the first steamer to the head of the cataracts, as the Spanish Bottom inscription attests.

This author would tend to agree with the latter claim. In the 1892 news story several statements and descriptions are given which would lead one who is familiar with the region to question whether that party even made it to below The Confluence. At one point a so-called "Mormon fort" is described as being located at the junction of the Grand, where the Colorado River begins. This sounds much like the "Moqui Fort," some 40 miles up the Green in Labyrinth Canyon. In another place the article states that the Colorado River "is increased materially in volume by the waters of Grand River," but that for "sixteen miles" it is safe for boats until "at the end of that distance the Cataract cañon begins." It is, of course, only four miles from The Confluence to the first rapid in Cataract.

Later in April, 1893, Edwards and a new "crew" made a second round-trip voyage from Wheelers Ranch to Spanish Bottom and back. Once again, though, plans for establishing a steamboat service through the canyons did not materialize. According to Edwards, the *Major Powell* was brought upriver from Wheelers Ranch in 1894, scrapped for the engines and boiler, and the hull left to be swept away with the next high water. Even here, however, there is disagreement.

In an article in the Utah Historical Quarterly in 1960, Colorado River historian Otis R. "Dock" Marston states that the *Major Powell* was taken down the Green River and then up to Moab and back in 1896. He then goes on to say that the "news" tells of a run down the Green to the Colorado and on to the foot of Cataract Canyon! Unfortunately, Mr. Marston does not quote any sources for either of the above two statements.



**The steamer *Major Powell*.** Courtesy of Utah Historical Society. For more information on the steamboats of the upper basin in the Colorado River, see the article by Roy Webb in *Canyon Legacy* #5; the journal of the Dan O'Laurie Canyon Country Museum, Moab.

## William Hiram Edwards

### Testimony: River Bed Case The Steamer "Major Powell"

Compiled by John Weisheit

*With special thanks to Jim Knipmeyer, Rosalyn Jirge, Roy Webb and the staff at the Marriott Library at the University of Utah.*

He made another trip down the Colorado in the spring of 1893. He was in charge of this expedition. He thought that there were a lot of tourist who would like to see the Colorado River from the upper end, as he recently been down in that country. He thought it would be possible to operate a boat down from Green River [Utah] to the junction of the Green and the Colorado Rivers, and take tourists down there.

Previous to this time some parties from Salt Lake and Rawlins, Wyoming, had shipped a steam launch to [Green River, Utah] from Chicago, which had been launched, run down as far as the Wheeler ranch and abandoned. He leased that boat and made an attempt to see what he could do with the river.

This boat was known as the *Major Powell*, and he believes was about thirty-five feet long, with an eight foot beam, equipped with an upright boiler with two six horse engines, connected to twin screws, and drew about eighteen inches. This boat had been laying there for a year or more, and when he came over to Green River, he got a small boat and went down to the Wheeler ranch in February, or the first of March. He came part way by water and part way by ice, as the river was still frozen over at that time.

The boat that he had was a little skiff, and he dragged it over the ice, until he got down there. He examined the *Major Powell* to see what would have to be done with it, and then he returned to Denver. He hauled the small boat back to Green River by wagon. In Denver he got a friend of his, an old lake marine engineer, secured the necessary material to repair the boat, and he and the marine engineer and one other man returned to Green River, repaired the boat and started down the river. The boat had been tied up on the shore above the water. They put the boat in the river, got up steam, and everything was in good shape. They started down the Green River from Wheeler's ranch, located about twenty-five miles below the Green River railroad bridge.

Besides himself, there was H. F. Howard, now dead, and a man named Graham. He doesn't know what became of Graham. The boat had originally been built to burn coal oil; he changed it over to burn wood, and spent a good many hours of hard work, cutting wood for the boat. They would run as far as they could with a load of wood, then cut another load, and do the same thing over and over.

On the first trip down, he tried to mark the channel as near as possible, so that when he returned he would have something to work on. He would leave marks on the rocks at the turns, so he could tell what direction to go.

He didn't mark all of the river; only the places where there were bad bars; where they had lots of trouble, but

"the marks didn't do any good. When we came back the channel wasn't where it was when we went down.

**Question:** On your way down the river did you experience any difficulty with sand bars?

**Answer:** Plenty of it.

**Question:** How did you get off these sand bars?

**Answer:** Sometimes we would pull off with block tackle; sometimes dig it out; various ways we would work it. Sometimes we would reverse the boat; back down and run the propellers backwards and tear out the sand and get through that way.

BY THE SPECIAL MASTER:

**Question:** What month was this?

**Answer:** This was in March or April; I think we didn't get started until about April the first trip.

BY MR. BLACKMAR:

**Question:** Block and tackle, you used that by making it fast to something ashore?

**Answer:** Yes, by pulling.

**Question:** Then did you have a capstan to wind it in with?

**Answer:** No, we had none.

**Question:** How did you operate that end of it?

**Answer:** Main strength and awkwardness,

**Question:** Did this sand bar trouble continue on down to the junction?

**Answer:** As I remember, all the way down.

**Question:** And at what point did you turn around?

**Answer:** At about quarter of a mile above the first rapid in the Colorado River.

**Question:** Just tell me about the progress of your trip up the stream.

**Answer:** The trip was not quite as hard, coming up, as it was going down, because we would have the chance to back off the bars and try other places; but it took about ten times as much wood coming up as it did to go down.

**Question:** You spoke about making the channel going down. Was that some suggestion this lake captain made?

**Answer:** Yes, he suggested that.

**Question:** Did you get any results from those markings?

**Answer:** No.

**Question:** Why not?

**Answer:** Because the channel had changed before we got back.

**Question:** Do you recall whether or not during that intervening time the water had risen or fallen?

**Answer:** It had risen.

**Question:** How far up the river did the *Major Powell* go?

**Answer:** To Wheeler's ranch.

**Question:** Did you attempt to run it further up the river than Wheeler's ranch?

**Answer:** I did not.

**Question:** And why not?

**Answer:** Because I didn't think it possible to get it up there; too much rock and rough water.

He made a second trip down the Green River, about ten days after the one just described. On this second trip they had a little better help. Besides himself and Mr. Howard there was Mr. McClane, Mr. McDonald, and Lute Johnson. Mr. McDonald was a different man than from the one on the San Rafael expedition.

On the second trip they carried more fuel, except wood, and went down the river to about the same place he went to on the first trip. It took them about three weeks to make the round trip, about evenly divided going down and coming back.

On the second trip the river had begun to rise a little.

**Answer:** The river was quite a little higher, but it shifted the bars so the information we tried to have on the first trip didn't do us much good on the second; had to go through all preliminaries of finding channel on the second the same as the first.

**Question:** How long did it take you to make that second trip?

**Answer:** I think about the same time as the first.

**Question:** And the same distance?

**Answer:** Made it the same exactly, the same distance.

**Question:** Coming up the river did you have about the same trouble as you did on the first trip?

**Answer:** Well, yes, about the same; we had quite serious trouble getting out of the Colorado. The Grand River had had some flood that had gone down.

**Question:** Just a little too far, and our boat wasn't strong enough to pull us out of there; the only way we could get out of there was by use of a block and tackle, a lining along the shore.

**Question:** Did you get the boat up to Green River?

**Answer:** No, sir.

**Question:** Whereabouts did you leave it?

**Answer:** Wheeler's ranch.

**Question:** On the second trip?

**Answer:** On the second trip.

**Question:** And tied it up at Wheeler's ranch?

**Answer:** Yes.

In 1894 he was over on the Green River, with a mining company, about seven or eight miles below the bridge on the Green River, and while he was there four fellows brought the boat, *Major Powell*, to his camp and abandoned it.\*

This was at a point fifteen miles above the Wheeler's Ranch. They took the engine and boiler off the boat, and took them to Green River. He believes the hulk went down the river. The Rio Grande Western Railroad Company was in a way interested in this boating venture, as it was through the young Mr. Dodge that the trip was undertaken; and while they didn't finance the trip, they furnished transportation and did everything they could to help.

On the second trip, Mr. Lute Johnson accompanied the expedition, as he was a newspaper man, and they hoped to have publicity, when they got the boat going.\*\*

Between the Best Expedition and the first trip of the *Major Powell*, he went in on the San Juan River, during the placer mining boom of 1892. He left the railroad at Green River, Utah, had a pack train of horses and mules, and went through Hanksville to Hite, across the Colorado River, up White Canyon, and south to the San Juan river, about forty miles below Bluff. He was hired to make this trip by the Rio Grande Western Railroad.

*End of article. This was an excerpt of Mr. Edward's testimony, which also included the Stanton Expedition, the Best Expedition and various other enterprises, while he earned a living on the Colorado Plateau in the late 19th Century. Edwards ended up in Compton, CA, as an owner/operator of an ice plant. Harry Aleson mentions, in his diaries, meeting Edwards on Lake Mead at Pearce's Ferry in the late 1940s; Edwards was fishing.*

\*A picture of this mining operation is featured in the Canyonlands guide by Westwater Books on page 14. This is the mining operation that George Flavell received Edward's hospitality at—in 1896.

\*\*An article by Lute Johnson was published in 1893 for the DENVER REPUBLICAN concerning the Denis Julien inscriptions found in Labyrinth Canyon.

# The Mule Ear Diatreme: Just a Blob of Cookie Dough

by Anne Egger

The San Juan River between Bluff and Clay Hills teaches a remarkably succinct geologic lesson. Even the most oblivious travelers can't fail to notice the abrupt changes in scenery as they pass through Comb Ridge and into the canyon. More intentional observers come specifically to explore, or explain, the geology of the San Juan. Recently, I was lucky enough to be part of a trip whose participants traveled here specifically to explore and explain the Mule Ear diatreme. The diatreme stands just west of a prominent feature on Comb Ridge called the Mule Ear. Just before the river takes a sharp right turn to enter the canyon, this dark, three-pronged hill suspiciously blocks the horizon. Those of you who have been down the San Juan may have camped in its shadow, or even hiked up its flanks. It offers a superb view, a chance to grub for garnets, and something a little different from the omnipresent archaeology.

Though the diatreme was extensively studied by Eugene Shoemaker in 1956<sup>1</sup> and mapped in 1972 by Shoemaker and others<sup>2</sup>, many fundamental questions about it remain unanswered. How old is it? Where did it come from? How did it get here? Why is it here? How does it fit into the big picture of the Colorado Plateau? The purpose of our trip was to try to answer a few of these questions (while avoiding the wrath of Hurricane Nora).

Our group was not the first to ask seemingly basic questions about the diatreme. The unusual mixture of metamorphic gneiss, large blocks of distant sandstones and shales, deep-earth minerals, and scattered garnets prompted one geologist<sup>3</sup> in 1912 to suggest a glacial origin, such as a terminal moraine. Considering the total lack of anything that could be described as lava, it was a pretty good guess. But the glaciers never made it to the canyonlands, and that theory didn't last very long. In 1915, another researcher<sup>4</sup> recognized it as an intrusive body, probably with igneous origins. He and other authors saw that the Mule Ear diatreme is part of a larger group of volcanic intrusions, loosely termed the Navajo field, which includes Shiprock, Agathla Peak, Alhambra, Moses

Rock, Cane Valley, and Boundary Butte, as well as several smaller intrusions and dike systems (see Fig. 1).

Still, no further explanation for the diatreme was available until 1956, when Shoemaker described them while searching for uranium. His paper remains the definitive study and was the starting point for our journey. In his words, the Mule Ear diatreme consists of "a central zone of pipe-like masses of serpentine tuff with a few fragments of basement rock surrounded by large blocks of country rock derived stratigraphically from above and below the present level." In other words, as you follow the trail from camp up to the top of the diatreme, you go from the layered rocks you are accustomed to seeing (like the DeChelly Sandstone and Halgaito Shale), to big blocks of stuff you might be accustomed to seeing, but not on this stretch of the San Juan (like gneiss and Mancos Shale), to stuff you may have never seen before ("pipe-like masses of serpentine tuff"). Figure 2 is a generalized geology map of the area.

Clearly, this is not what we usually think of as volcanic aftermath—no lava, no cinder cone. No wonder those original explorers were confused. Our group of six, of varying levels of expertise and knowledge, managed to pick their way through many of these still unresolved questions. What follows are some of the partial answers (see glossary at end).

## So, what is it?

Shoemaker's description, while accurate, is just a physical description, what you see when you hike on the diatreme. But what is a diatreme? The definition given by the American Geological Institute tells us that a diatreme is "a breccia-filled volcanic vent formed by a gaseous explosion."<sup>5</sup> For now, let's concentrate on the first part of the definition, the "breccia-filled volcanic vent" and relate it to Shoemaker's serpentine tuff.

In addition to the rocks of recognizable origin (such as the Mancos Shale and Dakota Sandstone) that litter the slopes of the diatreme, one can also find something a little different. Near the top of the hill are several blocks of what could be Wingate Sandstone (see Figure 2). Taking a closer look at the blocks, however, you can see the apparently uniform sandstone is actually a matrix containing approximately 10% angular fragments of just about everything, from local sedimentary units to deeper igneous and metamorphic sources. Shoemaker calls this stuff "reconstituted sedimentary material," but it is also a breccia, and it makes up the majority of the central zone of the diatreme in one form or another. This stuff is important because it was created in the diatreme event, unlike most of the other rocks. Its constitution can tell us a lot about what happened.

<sup>1</sup> Shoemaker, E.M., 1956, Occurrence of uranium in diatremes on the Navajo and Hopi Reservations, Arizona, New Mexico, and Utah. Page, L.R., Stockton, H.E., and Smith, H.B., compilers, Contributions to the geology of uranium and thorium by the USGS and Atomic Energy Commission for the UN International Conference on peaceful uses of atomic energy, Geneva, Switzerland, 1955: USGS Professional Paper 300, p. 179-185.

<sup>2</sup> Stuart-Alexander, D.E., Shoemaker, E.M., and Moore, H.J., 1972, Geologic Map of the Mule Ear Diatreme, San Juan County, Utah, USGS Miscellaneous Geologic Investigations Map I-674.

<sup>3</sup> This geologist was E.G. Woodruff, who offered his theory of glacial origin in the 1912 publication *Geology of the San Juan Oil field, Utah*: USGS Bulletin 1103.

<sup>4</sup> Woodruff's theory was refuted by H.E. Gregory in his 1915 publication: *The igneous origin of the "glacial deposits" on the Navajo Reservation, Arizona and Utah*: American Journal of Science, 4th series, v. 40, p. 7-115.

<sup>5</sup> This and other definitions, based on the *Dictionary of Geological Terms*, 3rd edition, prepared by the American Geological Institute, Robert L. Bates and Julia A. Jackson, editors.

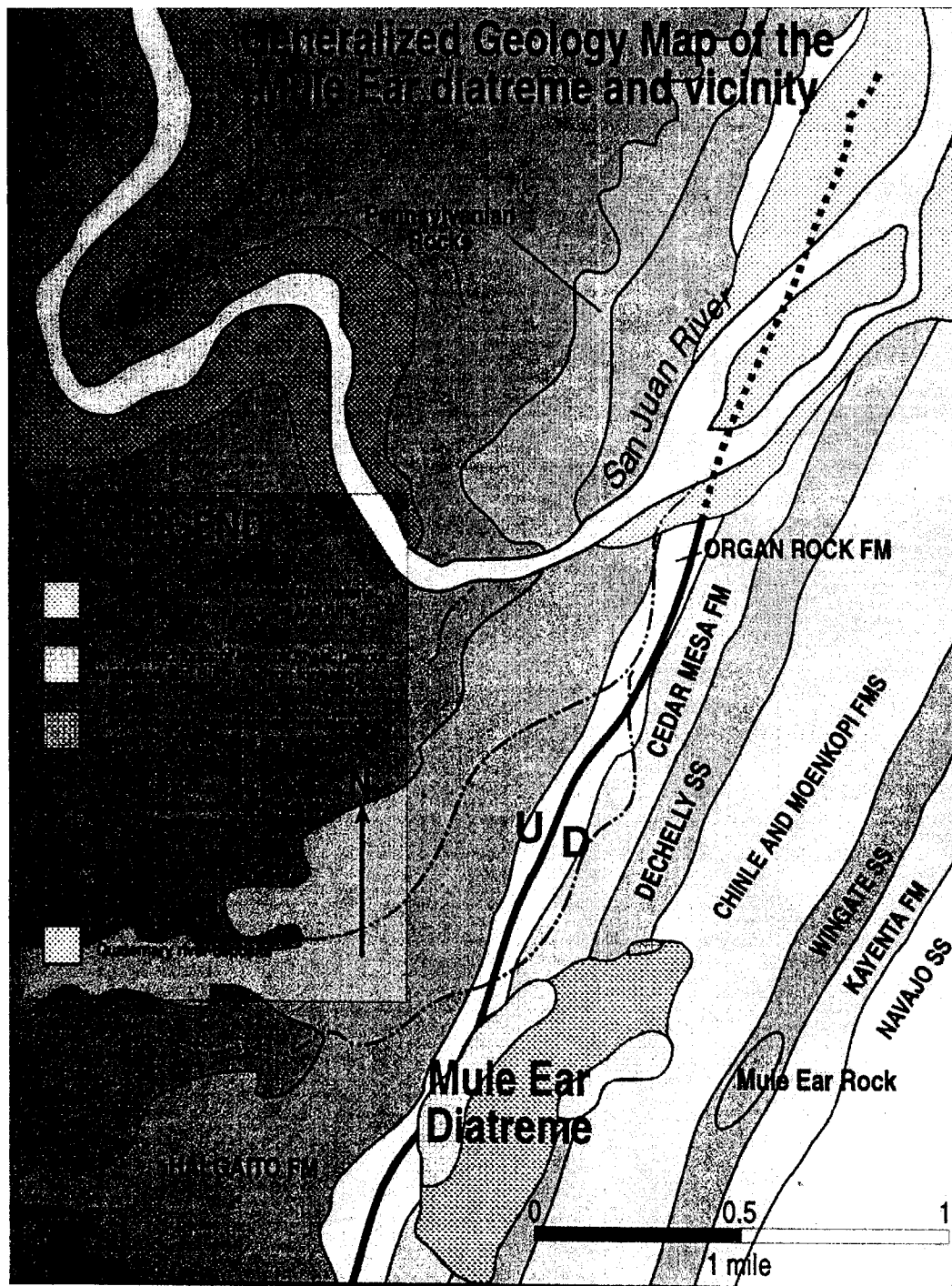


Figure 1

The breccia (or reconstituted sedimentary material) forms walls around small crater-like depressions at the top of the diatreme. The craters are filled with green patches of bare ground—here is our serpentine tuff. Some people call it kimberlite, after Kimberley, South Africa, where it contains diamonds. Many of the minerals present in kimberlite are indicative of fairly great depths in the earth. For example, the green color comes from serpentine, which is a metamorphic product of olivine. Olivine is a fairly common mineral in the upper mantle and oceanic crust, placing it at 30 km or so

below the earth's surface. In fact, researchers<sup>6</sup> have concluded that Moses Rock, a diatreme a few miles south of the Mule Ear, is about 200 km deep. This places it well into the upper mantle. Of course, volcanoes originate in the molten rock of the upper mantle, so these great depths should not come as a surprise. However, many of the rocks and mineral assemblages that can be found on the diatreme not only indicate this great depth, but are most commonly found in melting oceanic crust. What is oceanic crust doing popping up to the surface hundreds of miles from where it can be found? We'll get back to this question when we look at the big picture below.

#### How did it get here?

Let's return to the second part of our definition, "caused by a gaseous eruption." Since molten rock never made it to the surface here, the mechanism of emplacement must be something else, i.e., gas. But where did the gas come from? The eruption of the diatreme itself was likely a phreatic explosion, or the heating of groundwater or volatile CO<sub>2</sub> to the point that it becomes steam and must find an escape route to the surface. The resulting gaseous discharge prompted Don Baars to infamously call it "mega-geo-fart."

There are two basic ideas about how this can happen. In the first, a crustal crack or weakness exists through which ground water can percolate down deep enough to contact hot magma. The molten rock quickly vaporizes the water (or CO<sub>2</sub>), sending steam barreling back up through the crack, tearing off rock fragments, as it goes. The second is more confusing, but needs to be mentioned. In this scenario, a rising intrusion is stopped by some barrier and crystallizes, releasing CO<sub>2</sub> vapor. The

<sup>6</sup> McGetchin, T. R. The Moses Rock Dike: Geology, Petrology, and mode of emplacement of the kimberlite—leaving breccia dike. Ph. D. thesis, California Institute of Technology, 1968.

gas, trying to escape to the surface, initiates a crack in the crust by which to do so. Both cases presuppose a source of magma, even though it doesn't reach the surface. Something needs to create the vapor. There are several small intrusions and dikes in the area that would suffice, if their eruption times roughly coincide with that of the diatreme (we'll cover that in the next section).

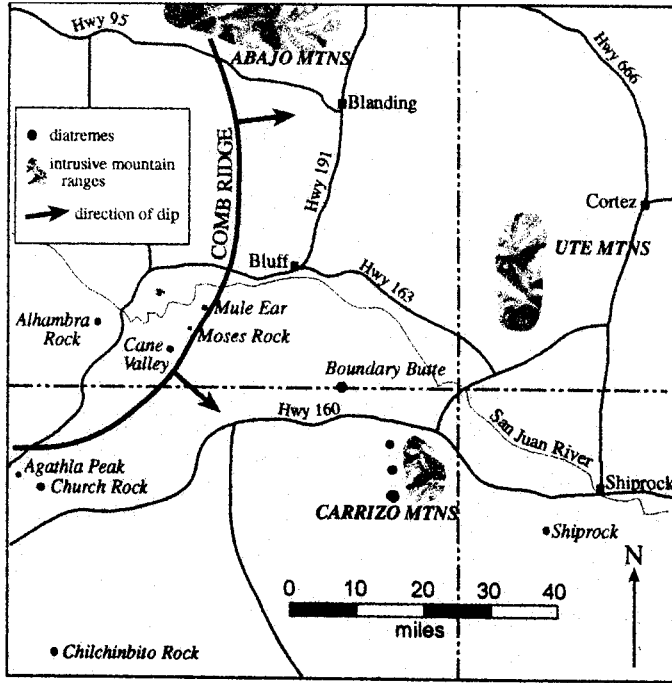


Figure 2. Location of diatremes in the Four Corners Area

In any case, once the vapor is created, a few important things happen. First of all, as the gas rises, tearing off chunks of the country rock, it begins to act somewhat like a debris flow. In the same way that a debris flow can carry enormous boulders down relatively minor drainages<sup>7</sup>, the turbulent flow rising through the crust could bring large rock fragments explosively to the surface. Both events involve a process called fluidization, where vapor or water may only compose 10-50% of the actual flow—the solids basically become liquefied under pressure.

Secondly, like a debris flow or a flash flood, these rocks would have reached the surface at extremely high velocities—some estimate at twice the speed of sound. How do we know this? Although we've mentioned the angular rock fragments in the breccia, the large blocks of deeper layers are fairly well rounded. That means that they were hitting each other and the walls of the diatreme as they traveled to the surface, implying turbulent flow. In turn turbulent flow indicates high speed. In profile, diatremes look similar to tornadoes (also an example of high speed and turbulence), grabbing more rock fragments from the walls as they spin, gaining more erosive force and widening the vent.

<sup>7</sup>The classic case of this in river running history is Crystal Rapid in the Grand Canyon, which was a minor riffle until 1965, when a major debris flow filled the river channel with the "debris" that must now be carefully maneuvered.

Thirdly, high speed means that you have a high pressure gradient. This we have, since the eruption is moving from the upper mantle (very high pressure) to the surface of the earth (relatively low pressure). The other thing that accompanies a drop in pressure, of course, is a drop in temperature. (In terms of weather, this is often spoken of as adiabatic cooling. As an air mass rises, it expands under less pressure, which manifests itself as a drop in temperature). Therefore, the eruption would have occurred at "cold" temperatures, somewhere around 300-500° C<sup>8</sup>.

Therefore, the diatreme arrived at the surface through (1) fluidization of the rock with a gaseous matrix, causing (2) high velocities and turbulent flow, but the large drop in pressure caused the "magma" to exit at (3) cold temperatures. Rather than hot lava erupting at the surface, you have something more akin to cookie dough, a semi-solid matrix full of chocolate chips, raisins, oats, and other pieces—the rock fragments grabbed from the walls—all mixed together.

#### How old is it?

When the cookie dough exploded out of the vent, it would have sent up quite a plume. As the dust settled, however, much of the debris would have collapsed back into the vent, forming a shallow crater and allowing rocks of high stratigraphic units to fall back into the vent. Like an avalanche causes snow to compact and cement, the disturbed rocks would compact tightly in the crater; what was once a hole is now a positive topographic feature. This assumption allows an estimation of age; the age of emplacement can't be older than the youngest rocks found in the mixture. In this case, the Mancos Shale is the youngest stuff found, from the late Cretaceous, approximately 5000 feet above the present erosional surface. Given the rate of erosion of that intervening mile of sediments, one researcher<sup>9</sup> estimated emplacement occurred approximately 30 million years ago, in the Oligocene.

Shoemaker cited the use of another method to estimate a date of emplacement.<sup>10</sup> From one of the granitic xenoliths on the diatreme, he produced two apatite fission track dates<sup>11</sup>, one of 28±3 and the other of 30±3 million years. One sphene fission track date was much different—690 my. The force of the diatreme eruption was enough to cause fission in apatite, but not sphene; the sphene date reflects the date of its original formation, while the apatite reflects the date of its alteration. In other words, the explosion had to be hot enough to melt one

<sup>8</sup> If 300° C is Cold, what is hot? Generally, the molten rock erupting from a volcano reaches temperatures around 1200° C. That's hot.

<sup>9</sup> McGetchin. See footnote #6.

<sup>10</sup> C.W. Naeser apparently performed the apatite fission track and sphene dating.

<sup>11</sup> The force produced by the diatreme was apparently enough to produce fission (the splitting of a heavy nucleus into two parts). The tracks left by the parts as they move away from each other can date the occurrence of the event. I mention the minerals used for completeness, but it isn't important to remember them.

thing but not affect another (a typical day in July on the San Juan is hot enough to melt butter but not boil water).

The temperature necessary to produce fission in apatite is 300° C. The temperature needed to produce fission in sphene is 500° C. Therefore, the eruption had to occur between those two temperatures, corresponding well with the physical evidence we looked at above.

One more date is important. As we saw above, the diatreme needs to have a vapor source that whose age approximates its own. Shoemaker also notes that one of the small dikes located within ten miles of the diatreme was dated to 27 mya, coinciding nicely with the diatreme. He concludes that these magmatic intrusions probably played a role in the formation of all of the diatremes in the area.

#### **A short note about metamorphism.**

The eruption of the diatreme, at a cold temperature, did not produce significant metamorphism as many volcanic eruptions can. Typically, high grade metamorphism will not occur until the temperature reaches 550° C. Low grade metamorphism, on the other hand, can occur at the temperatures seen in the diatreme, producing some hardening of the country rock. This may account for the prominence of the Mule Ear itself, which rises hundreds of feet higher than the surrounding ridge.

#### **How does it fit into the big picture?**

The volcanism that has occurred in the Colorado Plateau is somewhat unusual. Most volcanic activity, aside from hot spots, occurs on plate margins: the "Ring of Fire" that surrounds the Pacific plate and includes the Cascades, Mount Fuji, and other well known threats is the prime example of this phenomenon. The volcanic fields that rim the plateau, such as the San Francisco Peaks and Mount Taylor, are extremely far inland. They (along with our diatreme) need another explanation.

Most attention has been focused on a rogue plate known as the Farallon plate. This small bit of oceanic crust was subducted under the North American plate beginning 100 mya. Most subducted plates just dive straight down into the mantle, where they begin to melt and form volcanoes near the plate margin (like the Cascades). It appears that the Farallon plate, for some reason, scraped along the bottom of North America for awhile first, wreaking all kinds of havoc, before starting its dive to the mantle halfway across the continent<sup>12</sup>. This could account for not only our little diatreme, but much of the inland volcanism and uplift. Hence the appearance of

<sup>12</sup> Grand, Stephen P., van der Hilst, Rob D., and Sri Widiyantoro, 1997. Global Seismic Tomography: A Snapshot of Convection in the Earth, GSA Today v.7, no. 4, April 1997. This is a relatively recent development in geology. A method called global seismic tomography uses P- and S-waves to generate high resolution pictures of the deep earth, up to about 2800 km. Differences in speed of these seismic waves indicate differences in composition and temperature. A recent publication shows a cold slab descending below the North American continent, which could only be the Farallon plate. "

those minerals common to ocean crust, as we mentioned before.

#### **Why here? and other unanswered questions**

Why the diatremes of the Navajo field erupted where they did is still a mystery. They seem to follow no pre-existing structural patterns. The Mule Ear diatreme alone, in fact, occurs along a fault. The fault, however, is localized around the diatreme, where the dips of the layers on Comb Ridge and the Lime Ridge anticline are the steepest. So, which came first, the fault or the diatreme? Earlier, we mentioned the possibility of the eruption propagating its own crack—perhaps the pressure of the Mule Ear explosion forced a larger crack to open in an area that was already under compressional stress from folding. Or perhaps, as the growing force rose to the surface, it found the pre-existing fault and followed the path of least resistance.

Baars proposes a possible explanation for the general distribution of the diatremes.<sup>13</sup> First, he notes that the most abundant volcanics occur on the margins of the Colorado Plateau, prior to its uplift. At that time, the plateau was still a basin, receiving sediments being shed from the Rocky Mountains. The weight of these sediments would cause the plateau-to-be to sink, folding the rocks at the edges like a pie crust into a pie pan. At these edges, cracks would open from the tensional stress, allowing magma to escape. Baars notes that many of the diatremes within the plateau similarly form rings around large basins (such as the San Juan and Black Mesa basins), where the rocks begin to "drape" over the basin margins, and could be creating similar results on a smaller scale. However, not all of the diatremes occur on basin margins.

Another problem: there are a few things conspicuously absent from the debris. Once you turn into the upper canyon, you float through 60-odd miles of canyon framed by limestone cliffs, at times reaching 1400-feet thick. And yet there are no limestone fragments found on the diatreme. Where did it all go? In an arid climate like the southwest, limestone is extremely resistant. Where water is plentiful, however, like in the Mexican lowlands, limestone virtually melts. Could the high pressure steam have evaporated fragments of limestone that made it into the cookie dough, actually creating more volatiles? Our group was stumped.

But another important question remains. Like the Navajo field, the Kimberley region in South Africa also contains a high concentration of diatremes. The diatremes there contain a rather high concentration of diamonds. So why do our anthills glitter with garnets and not diamonds? Alas, once again, we must accept that we will never get rich running rivers.

Getting rich was not the purpose of our journey anyway. A lesson in geology, succinct or not, was our purpose, and it was well fulfilled. The unanswered questions grow fewer and more refined as we gain understanding of the fundamental

<sup>13</sup> Baars, Donald L., 1972, The Colorado Plateau



nature of the earth. The Mule Ear diatreme is just a tiny glimpse into the earth's history, but it reflects the larger picture as well.

### Glossary

- breccia:** A coarse-grained clastic rock composed of angular rock fragments supported by a mineral cement or fine-grained matrix.
- country rock:** The rock enclosing or traversed by a mineral deposit. In this case, the layered sedimentary strata (the Wingate, Chinle, DeChelly, Cedar Mesa, and Halcito Formations) are the country rock through which the diatreme intrudes.
- debris flow:** A moving mass of rock fragments, soil, and mud, more than half of the particles being larger than sand size. Rapid debris flows can reach 160 km/hr.
- diatreme:** A breccia-filled volcanic vent formed by a gaseous explosion.
- Farallon plate:** A small tectonic plate of oceanic crust that was subducted by the North American plate at the San Andreas fault starting 100 million years ago. This subduction probably has a lot to do with the formation of the Colorado Plateau and its inland volcanics.
- fluidization:** The process by which a solid begins to act like a fluid, producing things like debris flows (see above) and diatremes.
- gneiss:** A foliated rock formed by regional metamorphism in which bands of light colored minerals alternate with bands of darker minerals.
- kimberlite:** An alkaline peridotite containing abundant phenocrysts of olivine... From Kimberley, South Africa, where it contains abundant diamonds (unlike at the Mule's Ear, unfortunately).
- metamorphism:** The mineralogical, chemical, and structural alteration of solid rocks by the physical and chemical conditions found at depth in the earth's crust. Metamorphic rocks have not been completely melted, or they would become igneous rocks; they have simply been subjected to extreme pressure and heat. Through metamorphism, limestone will become marble, sandstone can become quartzite. Other metamorphic products include slate, schist, and gneiss.
- moraine:** A glacial deposit. A terminal moraine is deposited at the furthest advance of a glacier, where it begins to recede.
- phreatic:** generally, of ground water. A **phreatic explosion** occurs when ground water is heated and expands due to a local igneous heat source, causing an eruption.
- serpentine:** A common rock-forming mineral, often green or gray in color. It is always a secondary mineral, derived from the alteration of magnesium-rich silicates like olivine.
- tomography:** The process by which subsurface images are created, through seismic analysis.
- tuff:** A general term for all consolidated pyroclastic rocks. In other words, stuff that comes spewing out of a volcano and solidifies, if it's not lava.
- turbulence:** Basically, confused flow. Flow lines do not follow any pattern, but are heterogeneously mixed.
- xenolith:** A foreign inclusion in an igneous rock. The Mule's Ear diatreme contains large blocks of Mancos Shale Burro Canyon Conglomerate, and Dakota Sandstone, which would be considered xenoliths in this context.



# Professional Guide Training Opportunities for 1998 by Canyonlands Field Institute

## BACKCOUNTRY INTERPRETATION COURSES Open Enrollment

### DESERT WATERS '98. April 17 (eve.) to 19, 1998

Calling all river guides to this spring "rendezvous" event and workshop co-sponsored by CFI, CPRG and Headwaters Institute. A keynote address in town Friday night, river films and tales sets the tone for this year's event. The theme "Rethinking Western Water" looks at western water politics on the Colorado River system (including river hydrology, affects on flora and fauna, project history, pro/cons of current proposals to "undo" certain water projects). All-day Saturday on the Fisher Towers stretch of the Colorado River (Moab "daily" includes both facts and methods for hands-on interpretation to guests. CPRG hosts Sunday morning leadership development session. Wind up at Big Bend Park for a FUN afternoon cookout, games and gear prizes. Chance to meet and socialize with other guides, outdoor gear and agency reps. 15-hour course certificate.

**FEE:** \$20 (\$18 for members of CFI or CPRG). Includes cookout and a Desert Waters T-shirt! **Pay in full to register.**

### BACKCOUNTRY INTERPRETATION COURSES (by request) Suitable for jeep, bike, scenic flight, ski or river guides/outfitters.

#### COLORADO PLATEAU GEOGRAPHY FOR GUIDES (Previously: Interpretive Skills I)

For first-year (or new to the area) guides, this course gives you an overview of regional geography, basic geology, cultural history, and lands management. Includes introduction to teaching methods. 10-hour course certificate. (1 eve, 1 day.)

#### TEACHING OUTDOORS: INTERPRETATION FOR BACKCOUNTRY GUIDES (Previously: Interpretive Skills II)

For managers and experienced guides, this course shows you how to engage and inspire your guests (or train your guides). Communication principles, learning styles, age-group concerns, interpretive planning, "tool kits" and idea exchange. Adapts classic interpretive and outdoor education methodologies for realities of backcountry trips. "Hands-on" techniques emphasized for audience involvement. Practicals/video feedback. 10-hour course certificate. (1 eve, 1 day.)

#### TEACHING ABOUT YOUR PUBLIC, PRIVATE AND TRIBAL LANDS (New course)

As hosts to America's public lands, guides have tremendous opportunity to inform and inspire guests to be active citizens. This course overviews land ownership and management on the Colorado Plateau, characterizing the differences between various state and federal agencies (NPS, BLM, USFW, USFS etc.). Overview of regional Indian tribes and sovereignty, key wildlands legislation such as the Wilderness Act, Antiquities Act, and the Colorado River Compact. Includes hands-on demonstrations, videos. 10-hour course certificate (1 eve, 1 day).

**FEES FOR: BY-REQUEST INTERPRETIVE COURSES****I. Fees for Moab-based 10-hour course:**

\$30 / participant                      \$27 / CFI member

**II. Fees for "on-location" courses (within 8-hour drive of Moab):**

\$60 / participant                      \$54 / CFI member

Fees based on 10 minimum paid spots, at either rate. Maximum 30. One complimentary spot per company. Fees for courses outside Moab include CFI instructor travel costs. Host companies need to arrange for classroom and AV needs. One-two instructors provided, depending on group size.

**III. A SPECIALIST FOR YOUR TRAINING TRIP**

Inquire about a specialist to accompany your company training trip (Geology, Riparian Ecology and Guide Teaching Methods). Within 8-hour drive of Moab. Company provides all logistics and equipment. CFI covers instructor travel, teaching materials, and certificates of completion.

- A. Two-day trip \$850 (10-hour certificate)
- B. Three-day Trip \$1050 (20-hour certificate)
- C. Four-day trip \$1250 (25-hour certificate)

Deposit/Payment for By-request: \$200 group deposit is requested to confirm the program on our calendar. Balance of payment 45 days prior.

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**SAFETY and EMERGENCY MEDICAL**  
**Open Enrollment**

**WILDERNESS FIRST RESPONDER**

**Full course:** January 17 to 26 • **Refresher:** January, 23 to 26, 1998  
Full course and Refresher options. Instruction by Wilderness Professional Training: Steve Lyons and guests.

WFR emphasizes backcountry care in a prolonged transport context. Includes CPR. Exceeds requirements for Red Cross ER; preferred by National Outdoor Leadership School (NOLS), Outward Bound, some outfitters. Videos, outdoor practicals, written test. Full course is 72-hours and refresher is a 32-hour course. Instructional notebook provided for full course. Provides 3-year WFR and 1-year CPR certification.

**FULL COURSE FEE:** \$400 (\$385 / CFI members) **Deposit:** \$150  
**REFRESHER FEE:** \$225 (\$210 / CFI members) **Deposit:** \$75

**AMERICAN RED CROSS EMERGENCY RESPONSE**

**Full course:** April 13 to 17, 1998.

Instructors: Sheri Griffith, Jim Braggs and guest instructors. This 45+ hour course is designed for any professional who may be called upon to give first aid in the line of duty; includes CPR. Videos, outdoor practicals, written test. Days and one evening. Includes text, and supplies. Provides 3-year ER and 1-year CPR certification.

**FEE:** \$155 (\$140 / CFI members) **Deposit:** \$75 (Workbook available for additional fee)

**RECERTIFICATION for EMERGENCY RESPONSE**

February, 24 to 26 • April 3 to 5, 1998

Instructor: Michele Reaume and guest instructors. A 25-hour refresher class for those who hold current American Red Cross Emergency Response certificates set to expire in 1998. Lectures, videos, practicals, supplies, written test. Provides 3-year ER and 1-year CPR certification. Bring your own text and workbook (May be purchased).

**FEE:** \$70 (\$63 / CFI members) **Deposit:** \$25

**COMMUNITY FIRST AID AND SAFETY**

**Full Course or Recertification. May 8, 1998.**

**Note:** Precedes River Skills I which starts Friday eve, May 8.

**Instructor:** Michele Reaume.

An American Red Cross 8-hour course that provides basic knowledge and skills necessary to help sustain life, reduce pain and minimize consequences of injury until more advanced medical help arrives. Replaces "Standard First Aid". Includes CPR. Videos, practicals, written test. Provides 3-year Community First Aid and 1-year CPR certifications. Includes text and supplies.

**FULL COURSE FEE:** \$35 (\$31 / CFI members).

**RECERTIFICATION FEE:** \$20 (\$18 / CFI members). Text available for additional fee.

**NOTE:** Those seeking a Type I Utah Boatman's license need to take either Emergency Response or Wilderness First Responder. Community First Aid is acceptable for Type III and IV licenses. Please check with your employer on requirements.

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**SAFETY and RIVER SKILLS**  
**Open Enrollment**

**RIVER SKILLS - LEVEL I (on the Colorado River)**  
**May 8 (eve) to 10, 1998**

**Instruction by CFI's River Study Program.** For novice river guides and private boaters, this course offers an introduction to river ecology, boat rigging, rowing skills, throw ropes, safety practices, basic boat patching, low impact camp routines. One night at CFI's Field Camp and one night on river. Meals included. Boats/logistics provided. 20-hour course certificate.

**FEE:** \$120 (\$108 / CFI members). **Deposit:** \$40

**WESTWATER RIVER RESCUE (on the Colorado River)**  
**April 24 to 26, 1998**

**Instructors:** Barry Miller and Rachel Schmidt. For experienced boaters (Class III), river researchers and rangers. Course starts with a full-day class session in Moab followed by a river trip in Westwater Canyon. Special considerations for rafting high-volume rivers: instream rescues, rigging, swimming rapids, righting flipped rafts, Z-lines, safety talks, rescue scene management. Meals included; boats/logistics provided. 25-hour course certificate.

**FEE:** \$260 (\$245 / CFI members). **Deposit:** \$85

**ADVANCED WESTWATER RIVER RESCUE (Colorado River)**  
**May, 1 to 3, 1998.**

Back by popular demand!! **Instructors:** Barry Miller and Rachel Schmidt. For experienced boaters (Class III+), river researchers and rangers, outdoor adventure course instructors. This intensive hands-on course involves rock and river rescue scenarios designed to hone backcountry rope/ rescue skills. Participants will be actively involved in shore and boat-based rescue scenes, and learn multi-point anchors, mechanical advantage, raising and lowering systems, lining boats around rapids, safety analysis and rescue protocol. Full-day class session in Moab followed by overnight river trip in Westwater Canyon. Meals included. Boats/logistics provided. 25-hour course certificate. **PREREQUISITE:** CFI's WW Rescue or River Skills II or similar 2-3 day course.

**FEE:** \$260 (\$245 / CFI members) **Deposit:** \$85

**Note:** Plan ahead! River Skills II (Dolores River, technical water) will not be offered again until 1999. We will alternate that course with the Advanced Westwater River Rescue course every other year.

**RIVER RESCUE COURSES** (by request)

For Your Training Trip. One instructor per course: Barry Miller, Michele Reaume, or other qualified guest instructors.

I. One-day course (10-hour certificate) \$65/ person (\$58.50 / CFI member). Minimum of 10. Max 30. One complimentary spot.

II. Multi-day (instructor accompanies your training trip) - flat rate percompany/group.

A. Two day trip \$950 / group (10 hour certificate)

B. Three day trip \$1250 / group (20 hour certificate)

C. Four day course \$1550 / group (25 hour certificate)

**NOTE:** CFI provides course outlines, handouts, rescue practice equipment, skills checklists, certificates of completion as for all other courses. Optional college credit available with notice. Hosting company provides all meals, equipment and trip logistics. Within 8-hour drive of Moab.

**DEPOSIT / PAYMENT FOR RESCUE BY-REQUEST COURSES:** \$200 deposit to confirm on calendar, balance 45 days prior. For one-day course, company billed, following for any walk-ons.

**To Register:** For open-enrollment courses, send a deposit and request the program outline for the course. For By-Request programs, please contact Karla VanderZanden, CFI's Executive Director to make arrangements.

**Balances:** Due 45 days prior to start date. payment may be made with cash, check, or Visa / MC card. For courses that don't include camping / meals, there are hostel and camping options available in Moab.

**Outfitters:** who are, or become, CFI Business Associate members (\$100 / year) can offer discounted course fees to employees.

**Scholarships** available!

**Certifications:** provided for documentation.

**College credit:** for additional \$10 - 40 filing fee.

Ask about CFI's **Whitewater Academy for Teens**, June 25 to July 1, 1998. For ages 13 to 18. Scholarships available for this program.

**Underwriters:** National Fish and Wildlife Foundation, The Dumke Foundation, The Maki Foundation, Utah Travel Council, Canyonlands Natural History Association, Bureau of land management, National Park Service, Utah Division of Wildlife Resources, Headwaters Institute and Utah Guides and Outfitters.

**For Additional Information:**

Canyonlands Field Institute

P.O. Box 68

Moab, UT 84532

435 259-7750

800 860-5262

e-mail: [CFIinfo@canyonlandsfieldinst.org](mailto:CFIinfo@canyonlandsfieldinst.org)

Website: [www.canyonlandsfieldinst.org](http://www.canyonlandsfieldinst.org)

**Wilderness Medicine Seminars**

by Wilderness Medicine Institute

**WILDERNESS EMERGENCY MEDICAL TECHNICIAN**

This course is designed for outdoor leaders, search & rescue team members, backcountry rangers, rural ambulance attendants, and other individuals who provide emergency care in remote settings. While fulfilling the DOT requirements for certification, this 180-hour program significantly can expand the required topics to address the issues involved in extended care and introduces back-country rescue techniques.

**Teton Science School;** Kelly, Wyoming. \$1,835\*\*

November 24 to December 19

**Wilderness Medicine Institute;** Pitkin, Colorado. \$1,685\*\*

December 29, 1997 to January 23, 1998

**Yosemite Community Education Center;** Oakhurst, CA. \$TBA

March 23 to April 17, 1998

**Wilderness Medicine Institute;** Pitkin; Colorado. \$1,685\*\*

May 25 to June 19

**WILDERNESS FIRST RESPONDER**

This course is designed to provide outdoor leaders, guides, rangers and travelers with the knowledge needed to deal with emergencies in remote settings. It is an 80-hour curriculum that meets all national standards for urban and extended care situations. Emphasis is placed on prevention and decision making.

**University of Southern Colorado;** Pueblo, Colorado. \$300

September through December

**Wilderness Medicine Institute;** Albuquerque, NM. \$425

September through December

**Wilderness Medicine Institute;** Bend, Oregon. \$480\*

October 13 to 22

**Paragon Guides;** Vail, Colorado. \$450

October 25 to November 3

**Teton Science School;** Kelly, Wyoming. \$425

December 1 to 11

**Front Range Mountain Guides;** Boulder, Colorado. \$425

January 2 to 11

**Whitman College;** Walla Walla, Washington. \$TBA

January 9 to 18

**EDUCO;** Loveland, Colorado. \$450

March 7 to 16

**University of California;** Santa Cruz, California. \$TBA

March 20 to 29

**Summit Adventures;** Bass Lake, California. \$TBA

April 3 to 11

**WILDERNESS FIRST AID.** (May be used as a WFR refresher.)

Offered since 1975, this two or three-day course is used by many organizations to introduce first aid and long-term patient care to trip leaders, camp counselors, guides and rescue team members. In addition it is often used for recertification by those with previous training. We recertify current cards from the following organizations only: SOLO, NOLS, WMA OR WPT.

**Charles Wright Academy;** Tacoma, Washington. \$TBA

August 23 to 24

**Ashland Outdoor Store;** Ashland, Oregon. \$125

October 4 to 5

- Oregon State University;** Corvallis, Oregon. \$TBA  
October 11 to 12
- University of Puget Sound;** Tacoma, Washington. \$TBA  
October 25 to 26
- Paragon Guides;** Vail, Colorado. \$125  
November 15 to 16
- Boise State University;** Boise, Idaho. \$125  
November 15 to 16
- Wilderness Medicine Institute;** Pitkin, Colorado. \$110  
December 13 to 14
- Wilderness Medicine Institute;** Albuquerque, NM. \$125  
January 10 to 11 (recertifications only)
- Wilderness Medicine Institute;** Albuquerque, NM. \$110  
February 7 to 8
- California Poly-Tech Univ.;** San Luis Obispo, CA. \$TBA  
February 14 to 15
- University of California;** Santa Cruz, California. \$TBA  
February 21 to 22
- Wilderness Medicine Institute;** Pitkin, Colorado. \$110  
February 21 to 22

#### EMT-B REFRESHER/TRANSITION COURSE

State of Colorado approved refresher and upgrade to new curriculum. Also qualifies as NREMT.

- Wilderness Medicine Institute;** Pitkin, Colorado. \$185  
November 14 to 17
- Wilderness Medicine Institute;** Pitkin, Colorado. \$TBA  
March 13 to 16

#### WILDERNESS/RURAL EMT/FR MODULE

This module upgrades EMT's and/or First Responders to the current standards in Wilderness/rural pre-hospital medicine. The curriculum is based on the NAEMSp Rural Committee's guidelines and the Wilderness Medical Society's WPHEC curriculum. Pre-approved by the Continuing Education Coordinating Board for Emergency Medical Services for 48 hours of CEH.

- Yosemite Joint Union High School Dist.;** Oakhurst, CA. \$TBA  
October 3 to 8
- Wilderness Medicine Institute;** Pitkin, Colorado. \$295  
November 7 to 12
- Wilderness Medicine Institute;** Pitkin, Colorado. \$TBA  
March 6 to 11

#### WILDERNESS MEDICINE INSTITUTE SPECIAL

Enroll in the EMT-B Refresher/Transition course and the Wilderness/Rural EMT/FR module together and save \$55!

- Wilderness Medicine Institute Special ;** Pitkin, CO. \$425  
November 7 through 17.

**Unless otherwise marked, all prices include tuition only.**

- \*includes lodging and tuition only  
\*\*includes meals, lodging and tuition.

**For additional information:**  
Wilderness Medicine Institute  
P.O. Box 309; 413 Main Street  
Pitkin Colorado 81241-0309  
Voice: (970) 641-3572;  
Fax: (970) 641-0882  
E-mail wildmed@rmi.net  
Website: www.fcinet.com/wmi



# Boat Repair Clinic

by Clark Hatch

This is a **sample** itinerary for our Boat Repair Clinic which will be conducted for the 1998 season. The date and time will be determined after the next meeting of Utah Guides and Outfitters and will probably be held on a date that will be convenient for those attending the Dinosaur National Monument interpretive training trip. Please contact your employer after the UGO meeting for these details around late March or early April. The course will be held in Vernal, Utah, in cooperation with Don and Meg Hatch River Expeditions.

- Introduction of different types of material used by major whitewater boat manufacturers.
- Introduction of different types of glues used, and key ingredients to look for to match glue with materials.
- On-river patching techniques:
  - 1) Key items to have in your patch kit including the new "trick" tools.
  - 2) Major rip repair.
  - 3) Temporary repair.
- Off-river patching techniques:
  - 1) Essential tools that should be used in boat repair.
  - 2) D-ring removal and repair.
  - 3) Valve boot replacement.
  - 4) Valve replacement.
  - 5) Seam tape use.
  - 6) Pressure relief valves.
- Red blower maintenance and tricks to make them last longer.
- Vulcanizing your old military boat; what to use and how to do it
- Bring your own beer and tell river stories afterward.

Brands of boats we will cover: Avon, Achilles, Aire, Riken, Sotar, Maravia, Rubber Fabricators, Hyside, Domar. Boats we can't cover at this time would be Wing Inflatables, Colorado Headwaters and possibly a few others. This is due to the fact that they are new to the market, and I have not had enough experience with these to justify spending time on techniques for these particular models.



## Notes From the Glen

Nowadays, conversations that mention "Glen Canyon," create irritated statements that color the topics at hand. If you have thoughts, of a chance to run the canyons once named Mound and Monument, or a continuation of the same old, here are some things on the Colorado arm that have come up of notice this summer. Some is information that didn't reach all circles or even the playing ground; feedback and ideas to evolve what is developing would be nice. A lot of things were learned at the Glen Canyon National Recreation Area (GCNRA) meeting in late October. Some of the topics below were discussed, while other points are based on conversations with different people.

•In 1996, Glen Canyon National Recreation Area put into effect: no up-running past Imperial Canyon, except in NPS emergency situations. It was decided that down-stream travelers did not need extra navigational hazards on the river. Theoretically the regulation guarantees campsites to down-stream travelers. When lake users are above Imperial Canyon, generally they are so, due to the lack of knowing about the regulation. To solve the lack of knowledge, a sign is proposed to be set up below the inundated rapid #28 (river left). The buoy near Mille Crag Bend has done a lot for

previous camping problems, so these signs should slow or stop most up-river travel into the rapids. Getting hull numbers of boats that are in violation of this regulation is up to the down-stream users to copy; those numbers can be then turned in to the Hite rangers.

••Camping on the lake did cause some headaches for Kerry Haut and the other rangers at Hite. The Mille Crag buoy has almost erased the problems once had on the up-lake stretch with camping. Unfortunately, there were a couple unique situations this summer. When down-stream users sign in at the register box, above the rapids in Cataract Canyon, it does not guarantee the user to get the camps that they signed for. That register box is voluntarily and helps every one plan itineraries to avoid congestion on down the river and on the lake. So the register box works excellent for us river enthusiast's, only so far as the lake. When we get to the lake other parties are joining our community. These new parties don't have an ability to get to the sign-in box and register into our system. All lake users can camp where they choose in applicable sites on the lake. The buoy at Mille Crag Bend, eludes to lake users that down-stream traffic needs the camps and to avoid camping up-lake. Powellites can camp up-lake if they want to, so if someone is in the camp you signed for, you can not kick them out. You should explain your side of the story and be prepared to squeeze in somewhere else. Please do not get discouraged about the sign-in box, keep using the thing. It really sorts some of the congestion in the canyon and on the lake within our community. "If you don't use it, your just baggin' your friends and fellow boaters".

**Please! If you see driftwood collecting on the Mille Crag buoy, stop and clean it off.** It took a long time to get that buoy in place and it is suspected that to have it fixed, the time would take even longer.

•••Yes, the boat ramps were a source for more frustration this year. Remember if you have a run-in with someone who is a "little off the handle" don't let it get your dander up. "Two senseless people in an argument are worse than just a single senseless one."

**Potash:** Some folks enjoy rigging trips on the side of the ramp that allows the only access for the trailers that float boats off. One solution is to paint the deep ramp side one solid color and label it with bright lettering. A post-it board at the rest room would be great, with a description of where to rig on the ramp, ect. CPRG would like to do a clean-up around the launch point, which would be a nice time to put the board up. **The spring clean-up for Potash is planned for this March, call or drop us a line to express your interest.**

**Hite:** There was some non-positive interaction between the power boaters wanting to use the east side of the Hite ramp and with commercial and private rafters taking out. It sounded as though the rafters were where they needed to be, doing what they should, but maybe a little slower and more spread-out than usual. Unfortunately some power boaters thinking that the rafters were taking up to much room and were blocking there access to the water. I guess the east side of the Hite ramp is the cool side now, and every one thinks its where to launch or retrieve power boats from. Maybe we could switch sides and get the courtesy dock? Or we could paint the Hite ramp as well, then paint a stenciled description for the two sides. Maybe some of the new Fee Recovery money can be used to build a rafters boat ramp (see next topic).

•••The 98' season is going to bring automated fee machines to the Hite area. Yes, GCNRA is a Fee Recovery area. Each boat is \$20.00 a year if it has a motor, if you are there for only a week its \$10. Compound this with a vehicle entry fee as well, and you can see that the lake will be churning up some revenues to deal with some of the overused and overcrowded areas. 80% of the money generated stays in Glen Canyon for improvements. During the 97' summer the Wahweap area started charging while the rest of the lake

did the status quo thing. The extra money paid for extra interpretive lake rangers to go around and educate people on camping etiquette and it also paid for some floating RV pump-out stations.

Starting the system in one place and spreading it out the next year sounds very viable and makes good business sense. Few glitches are expected when the system goes lake wide, except at Hite and the San Juan arm. Both are unique because of the rafters. As you read this, I imagine that you are wondering, how in the world is this going to impact the river traffic that travels into GCNRA. Will Canyonlands National Park and the San Juan BLM charge river users at one time, when they get their permit, or will they have to pay two separate charges to two different agencies. If a group has one motor to go on the lake and they need to drive five cars into Hite or Clay Hills, do they have to pay five times the amount for all the vehicles? What about the commercial companies and their system of vehicles and buses that go in and out? Of the money collected how much will the river runners see used for things that help them? A separate boat ramp, a nice sewage place to clean toilets, or some other expensive capital improvement that hinders wilderness experiences for the vacationers in the area? **We are going to need help on this one. We need some thoughts and ideas to bring to the table on this one!**

••••Some new commercial services are popping up on the lake. Most of the services, I suspect, will happen near Page, AZ. Some might operate on the "river arms," and if they do, I was told that existing impacts would be looked at. The "river arms" seem to be maxed out, i.e., the lack of camping sites and the congestion at hiking places. Any how, here are the new services: boat brokering / guided hunting trips / instruction classes for: water skiing, knee boarding, wake boarding, captain's pilot license and boater services / kayak and canoe tours / mountain bike tours / personal water craft (PWC) tours (concession only, on Lake Powell) / special tours (lakewide) such as: photographic, wildlife viewing, and education (all of which are subject to concessionaire first right of refusal).

•••••Stay tuned to some new legislation that will ban personal water craft from National Parks and Recreation areas, except where the superintendents allow their use. Letter writing is going to be the key on this one. The superintendents will keep areas closed to the use only if they receive enough letters to do so. If you want PWC's to be closed out from Imperial Canyon to the Hite Bridge, write a letter to the Glen Canyon superintendent. The same would be true to the flat water in Canyonlands National Park. At the time of this printing, it is not sure where this regulation stands in Washington D. C., except that it looked very able to succeed in clearing all the bureaucratic hoops needed. We will send out the pertinent information when it's status is done.

•••••Since CPRG supports the Glen Canyon Institute's mission to drain Lake Powell, I think it should be known that there are organizations developing to save Lake Powell. People should and do have a choice on where they stand on this controversial issue.

In numerous communities there are circles of people who have opposing views with their neighbors and / or co-workers, which don't tear their friendships and respect of each other apart. Let's be like that!

If you would like to get more info on "The Friends of Lake Powell" write:

**Friends of Lake Powell**  
**P.O. Box 7007; Page, AZ. 86040**  
**email: friends@lakepowell.org**  
**Website: www.lakepowell.org**

Stay tuned, lots of questions are going to be answered this winter. Give us your ideas or volunteer to help, we can only go to so many meetings and devote so much of our time. **We need some help here!**

**T-Berry**

# Crossword Puzzle

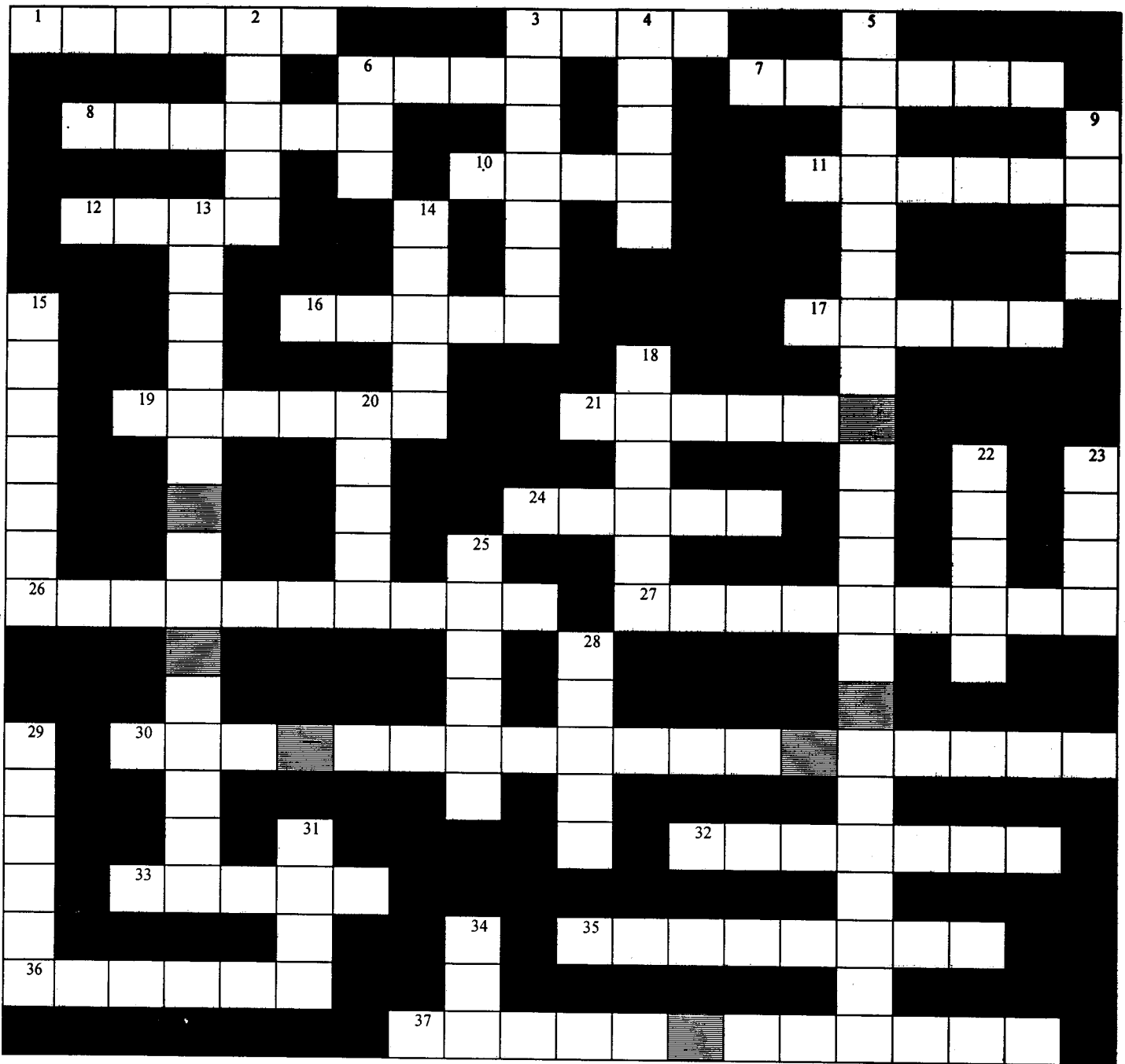
**Theme:** A River No More: The Colorado River and the West by Phillip Fradkin

## ACROSS

1. A side canyon. A dam site in Western Grand Canyon that includes the Hualapai Nation. This dam was not built due to a successful campaign by the Sierra Club.
3. A nickname. George was the trip leader on a Grand Canyon river expedition that author Philip Fradkin participated in. A Moabite who wrote an article for The Confluence; a skilled rock climber. Quote: "Sheesh!" Wears sarongs.
6. A place name. A "park" below the confluence of two rivers where the hermit Pat Lynch lived. A dam site the Sierra Club prevented from being built in the state of Colorado.
7. Last name. Herbert became president in 1929; a Quaker; Ph.D. in engineering; a post-WWII humanitarian. He was Secretary of Commerce and chaired the committee that formulated the Colorado River Compact of 1922. The first high dam on the Colorado River is named after him.
8. Name of a dam on the San Juan River which was authorized by the Colorado River Storage Project Act of 1956 (CRSP). It supplies water for a coal-burning, electric generation plant, near Farmington, New Mexico.
10. A river. A dam on a tributary stream of the Colorado River; forms Dillon Reservoir that diverts water by a tunnel under the Great Divide to the Front Range of Colorado.
11. Last name. Floyd was the commissioner of Bureau of Reclamation (BuRec) when the dams of the Colorado River Storage Project were built.
12. Last name. Elwood was the commissioner of BuRec when the dams of the Boulder Canyon Project were built. A reservoir that shares the border of Nevada and Arizona is named after him.
16. A chemical compound that is essential for life as we know it. Los Angeles, Maricopa and Clark counties would not be the population clusters they are today without the technical delivery systems engineered to transport this fluid.
17. Last name. Stewart is a great-grandson of John Doyle Lee. He was an Arizona congressman and Secretary of the Interior when the dams of the CRSP were built. A trustee of a non-profit called the Grand Canyon Trust. A major player in the formation of Canyonlands National Park.
19. Last name. Carl was an Arizona senator—practically forever. When Grand Canyon National Park was formed in 1919 he stipulated that dams could be built in the park. The visitor center at Glen Canyon Dam is named after him.
21. A river. This river is the major tributary of the Green River and does not have a dam on it. Powell called it the Bear River.
24. Last name. Orrin is a senator from Utah and called the Sagebrush Rebellion "the second American Revolution [which is destined to emancipate the West] from economic and political control by the Federal government." Ironically, he fought President Carter's plan to cut many federally funded water projects in the West.
26. A valley. A project, in Utah, was built in 1913 and developed a river that flows into the Green River from the Uinta Mountains.
27. A dam on the Salt River that was completed in 1910, even before Arizona became a state. It is named after the president that signed the Newlands Act of 1902 into law which formed the bureaucracy that is now called the Bureau of Reclamation.
30. Three words. A man-made delivery system that diverts Colorado River water from Imperial Dam. The system parallels the Mexican

border to provide irrigation for the farmers of the Imperial Valley in California. Part of the Boulder Canyon Project.

32. The first of two words. A gorge; a dam built in the Red Creek Quartzite. This dam is part of the CRSP and was dedicated by John F. Kennedy. The dam was retro-fitted to discharge warmer water to improve downstream fish habitat. Like Glen Canyon Dam the bedrock structures leak.
  33. A Last name. Arthur was the first deputy commissioner of the Reclamation Service and a nephew of John Wesley Powell. A dam that forms Lake Mojave is named after him. A power plant downstream of the dam has its coal delivered by a slurry pipeline from Black Mesa on the Navajo / Hopi Reservations.
  35. A last name. Wayne was a powerful Colorado congressman who was fundamental in the development of the upper basin projects. Three dams on the Gunnison River, as a unit, are named after him. (The system is also referred to as the Curecanti Project.)
  36. A lower basin state, which like California, has no major watershed to contribute to the Colorado River system. Francis Newlands, a congressman from this state, introduced the bill that started the Reclamation Service. The river right side of Hoover Dam is in this state.
  37. Two words. A dam built in Yosemite National Park in 1917, which the Sierra Club was unable to stop. In 1920 the Federal Power Act made it unlawful for a private company to build dams in national parks. This law, however, does not really prevent the Federal government from building dams in national parks. Consequently, Rainbow Bridge National Monument is flooded by Glen Canyon Dam.
- ## DOWN
2. An old name for a river. During the formative period of the Colorado River Compact, the state of Colorado considered it an embarrassment not have a river named after their state. A name change occurred in 1921.
  3. A name of a canyon that is now flooded by Lake Mead. It was the name for an Act of Congress that built Hoover and Imperial dams, and laid the groundwork for the Parker-Davis Projects, which were all instrumental to the development of the lower basin aqueducts and irrigation canals.
  4. A river. The major tributary of the Colorado River which joins in Canyonlands National Park. Though correctly termed as a tributary, in 1950 and 1951, it did contribute more water to the system, at this point, than did the Colorado River.
  5. Three words. The theme of Fradkin's book. The legal document that was decided upon at Santa Fe, New Mexico, in 1922, that allocated water to the seven states of the Colorado River basin. Arizona did not ratify this agreement until 1944.
  6. A geologic time frame longer than an Era.
  9. A last name. Howard was the governor of Arizona when Arizona filed suit against California over Colorado River water issues in 1953; this case took 12 years to decide.
  13. Three Spanish words for two rivers. A proposed water project in southwestern Colorado that would pump water from the one river shed into the other. It is very controversial because the expense greatly outweighs the benefits.
  14. A dam on the Snake River that failed catastrophically in 1974 and killed 11 people; damages: two billion dollars. Fontenelle Dam, on the Green River, is an earthen dam of similar design and is considered to be the weakest link in the Colorado River basin.
  15. A river in west-central Colorado that basically flows north to its confluence with the Colorado River above Moab. The dam on this river is called McPhee. Otis Marston did the first descent down this river in 1948.



**18.** Last name. Jimmy was president of the United States when he vigorously waged war on Western water projects. He was the best powerful friend a free-flowing river ever had.

**20.** A river. A major tributary of the Colorado that flows through Vail, Colorado. Also the largest predatory bird in North America, which finds sanctuary in our canyons.

**22.** A last name. Harold was the most influential Secretary of Interior the United States has ever had because his programs put America back to work during The Depression. His biography is three inches thick. He recommended to Franklin Roosevelt the creation of Escalante National Monument in the late 1930s. Had this monument been established, Glen Canyon Dam might never have been built.

**23.** A chemical compound of sodium and chloride that poses a great threat to the economic stability of the agriculture industry in the lower basin and Mexico.

**25.** Last name. David is called the "Archdruid" in a book written by John McPhee. His efforts kept rivers flowing in the national park

systems of Dinosaur and Grand Canyon. He is currently active in restoring the Colorado River in Glen Canyon.

**28.** A major tributary of the Green with its confluence just below Ouray, Utah. Powell spent some time here before his 1869 river Expedition.

**29.** A river. This river headwaters in the Colorado Plateau, but it will travel through the Basin and Range before its confluence with the Colorado River (Lake Mead). Powell ended his first river trip at its mouth. It passes through Zion National Park.

**31.** A river. It has a dam on it that was completed in 1928 and is named after Calvin Coolidge. The headwaters are in New Mexico and its major tributaries are the Salt and Verde rivers.

**34.** Last name. John was a Mormon pioneer who developed a crossing of the Colorado River in northern Arizona. The Colorado River Compact decided that the point of dividing the upper basin from the lower basin would be one mile below the mouth of the Paria River, where his home was built.

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