Gold, Silver, Palladium and Platinum in Wyoming – Part III
(Gold Panning, Platinum Group Metals & Mining Scams)

By W. Dan Hausel (danhausel@yahoo.com)

INTRODUCTION

In previous articles, I described a few significant lode gold and gemstone deposits in Wyoming (Hausel, 2006 a,b,c). During the past 29 years, as head of the Metals and Precious Stones Section of the Wyoming State Geological Survey (WSGS), our Section became one of the more productive government entities in the country as we were able to identify over a hundred precious metal anomalies and deposits. To prove a point on the potential for discovery of non-fuel minerals in Wyoming, funding from grants from Union Pacific Resources led to the discovery of dozens of gold anomalies in areas that had received no modern exploration interest for the precious metals (Hausel and others, 1994). Who would have thought that gold could be found in a city dump? Yet we identified a small paleoplacer in the Laramie City landfill and recovered visible gold! We also identified dozens of other precious metal anomalies and found a long-forgotten hydraulic gold mine within a hundred yards of I-80, a mile west of Arlington that is actually visible from the interstate. While searching the Sierra Madre for copper, we also discovered a significant palladium-platinum-nickel-cobalt-copper-gold-silver (Pd-Pt-Ni-Co-Cu-Au-Ag) anomaly associated with a previously unrecognized pyroxenite massif (Hausel, 1995).

The number of anomalies identified by the WSGS during this 29-year period was unprecedented placing Wyoming in a position to attract numerous companies to search for precious and base metals as well as gemstones. The old adage – “Gold is where you find it” is now supported by several hundred occurrences described in Hausel (1989, 1997).

Placer and Lode. A lode is a mineral deposit found in place, such as a vein, stockwork, skarn, breccia, fault, etc. Placers are detrital deposits in unconsolidated sand and gravel typically found in creeks and rivers. A clear distinction between the two is not always possible. For instance, the Witwatersrand (South Africa) has been the most...
Welcome to
New Members...

Sven O. Egenhoff
Sven is an assistant professor at Colorado State University in Ft. Collins. He holds a Bachelors degree in Geology from Technische University Caluschtat, a Masters in Geology from the Universitat Heidelberg, and a Doctorate in Geology from Technical University of Berlin. Sven is a member of AAPG, GSA, and SEPM.

Shawna M. Gilbertson
Shawna is a geologist with EnCania Oil & Gas (USA) in Denver. She holds a BS in Geophysics and an MS in Geochemistry from the Colorado School of Mines. Shawna is a member of AAPG and SEG.

Debra K. Gomez
Deb is a senior geologist with SI International in Denver. She holds a BS in Geology from the University of Southern California and an MS in Geology from Northern Arizona University. Deb is a member of AAPG and AIPG.

Lauren K. Heerschap
Lauren is a geologist with Oso Energy Resources in Durango. She holds a BS in Geology from Wheaton College and an MS in Geology from the University of Colorado at Boulder. Lauren is a member of AAPG and GSA.

Don K. Henderson
Don is a consultant living in Ridgeway, Colorado. He holds a BS in Geological Engineering and an MS in Geology from the Colorado School.

(Continued on page 36)
Volunteerism. The very Heartbeat of our organization is the willingness of our members to offer their assistance and time to contribute to RMAG activities. Every organization has its volunteers and volunteering for any organization is fairly simple – someone calls, and you say YES… Ha! Gotcha!

I have developed several “Bite-Sized” volunteer opportunities. These “bite-sized” pieces of RMAG’s processes are designed so that no one person, or group of people, “chokes” on having “too much” to swallow. Each one of us has a million things to do every day, but can you spare one to three hours, maybe twice a year, to volunteer with RMAG? Sure you can!! And I can promise it will be a rewarding experience for each of you.

Below you will find a listing of volunteer opportunities which require 1-3 hours, 3-5 hours, 5-15 hours, and more than 15 hours. These will be “concentrated time” jobs – they all will have a time frame, and will be limited in schedule and calendar involvement. I would ask each of you - even those who are “out of the area,” to be available to participate in these short duration opportunities.

Every month there are a number of activities in which to participate. All of these activities have some level of volunteer need. The committee chairs, members, and organizers of these events will be thrilled to have you, and if you are looking to have a great time with your colleagues and provide some needed assistance – just call or email any committee chairman, any one of us on the RMAG Board, or contact the RMAG office directly.

One to Three (1-3) Hours of Commitment:

1.) Call 10 potential sponsors (S) or exhibitors (Ex) for events. Lists are provided and most are companies you work with now. This will require some email and follow-up. Events that need Sponsors and/or Exhibitors are: 3D symposium (S & Ex), Prospect Fair and Technofest (S & Ex), Fall Symposium (S & Ex), Golf, Tennis and Ski activities (S), Rockbusters Ball (S), and the Networking Happy Hours (S). Several members are needed to fill these slots.

2.) Help with Registration on the Day of Event. You are showing up anyway, aren’t you? Events that need help with registration are: 3D Symposium, Prospect Fair and Technofest, Fall Symposium, Spring or CBM Symposium, Golf, Tennis and Ski activities.

3.) Event Day Volunteer. Various fun things to do, especially at the Golf, Tennis, and Ski tournaments. Also needed is assistance for set up at the Rockbusters Ball. And since you are already going to be there, what are you waiting for?!

4.) Solicit Advertisers for the Outcrop, Mountain Geologist, and Website. Lists are provided and most are companies you work with now. Some email and follow up will be required. Primarily handled through the Publications Committee.

5.) Solicit Papers and Articles for various RMAG Lunch Talks, Publications, and Guidebooks. Handled through the Publications or Luncheon Program Committees, and generally are on an “as needed” basis. However, your assistance here might be to share a great talk you know about with the appropriate committee!

6.) Solicit Papers or Talks for upcoming Symposia. If you know of a great talk, let us know about it!! Papers

(Continued on page 33)
Friday Luncheon Program

March 2

March 16
“A Geologist’s View on Global Change: Does It Impact Us in Colorado?” Speaker will be Bob Raynolds, Research Associate, Denver Museum of Nature & Science, denverbasin@dmns.org.

Anadarko Petroleum Corporation has a long history in the Rocky Mountains. The 2006 acquisitions of Kerr-McGee and Western Gas Resources further established Anadarko as one of the largest producers in this region.

The Rockies resource base affords us considerable opportunities to discover, develop and deliver energy for America. In fact, when comparing Lower 48 natural gas production by region, the Rocky Mountains is growing against the trend.

For Anadarko, our Rocky Mountain assets are key to value creation and achieving a better balanced, more predictable growth profile. Our Rockies daily net production was 205,000 barrels of oil equivalent in fourth quarter 2006. We also have more than 2 billion barrels of unbooked net resource potential within this region.

Our portfolio is rich with “unconventional” properties, including tight gas properties in Wattenberg, the Greater Natural Buttes and the Pinedale/Jonah fields; coalbed methane development in the Powder River Basin; and enhanced oil recovery in Salt Creek. The company owns fee mineral rights in the 8-million-acre Land Grant that runs across southern Wyoming and into portions of Colorado and Utah. Additionally, Anadarko has gained significant midstream operations across the region.

This presentation will examine Anadarko’s strategy in the Rockies and how we’re positioning for future growth.

Friday Luncheon Program

The U.S. Rockies: Growing Against the Trend

Jim Kleckner, Vice President Operations, U.S. Rockies, Anadarko Petroleum Corp.
March 2

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For Luncheon Reservation/Information Call 303-623-5396

Luncheons will be held at the Marriott City Center at California and 17th St. Please check the event listing in the lobby for the room. People gather at 11:30 a.m., lunch is served at 12:00 noon, and the speaker presentation begins at about 12:20 p.m. The price of the luncheon is $25.00. Checks should be made payable to RMAG. No reservation is required for the talk only and the cost is $3.00. Please make your reservation prior to 10:30 a.m. on the Wednesday before the luncheon. Please Note: If you make a reservation and do not attend the luncheon, you will be billed for the luncheon. Cancellations are not guaranteed after 10:30 a.m. the Wednesday before the talk. You may send someone in your stead.

Your attendance is welcomed and encouraged. Bring a guest or new member!
A Geologist’s View on Global Change: Does it Impact Us in Colorado?

Bob Raynolds, Research Associate, Denver Museum of Nature & Science, denverbasin@dmns.org
March 16

Geologic time affords one the perspective to contemplate changes of process and phenomena spanning billions and billions of years.

In our lifetime and in our State, changes can be hard to discern. Some happen slowly and out of sight like falling water tables or rising CO₂ levels – but others are evident, even palpable. A challenge for us as informed geoscientists is to comprehend and communicate these changes both within our community and beyond, to the public.

To help me understand the issues, I have compiled global change curves recorded over millions, thousands, hundreds, and tens of years. These curves of change illustrate dramatic swings in climate. Each time-frame shows a different pattern...long term histories show that it has been far warmer in the past and that trends are cooling; shorter term histories emphasize the importance of orbital parameters in modulating global climate patterns, while still shorter term data sets emphasize the remarkable changes that have taken place in our atmospheric composition since the Industrial Revolution. The data speak eloquently, revealing trends and patterns that have often been obscured during the popular debate on global change.

This presentation will place Colorado in the context of some of the world-wide changes that are afoot. While a long way from sea level, and in a setting where slightly warmer winters might be welcomed by many, Colorado has already been dramatically impacted by recent changes that may be tied to global patterns. Consider the data sets and draw your own conclusions.

The field of earth sciences has enjoyed a series of profound revolutions in thought that have cascaded throughout our science. The understanding of evolution, the appreciation of the depth of geologic time, and the advent of plate tectonics are three of these. I propose that the recognition of the dynamic character of global climate shares rank among the top five breakthroughs that have impacted our multidisciplinary science. We live in the era where this recognition is taking place and the manifestations are becoming evident to our citizenry. Earth scientists have the opportunity to place these issues in perspective and to assist the populace in making informed, cost-effective decisions about reasonable strategies with which to approach our new era. Join the fray.

Dr. Bob Raynolds has been a Principal Investigator in the Denver Museum’s research project to study the geology and groundwater resources of the Denver Basin. He has worked and traveled extensively around the world, and one of his specialties is sedimentation in active orogenic areas.
productive gold deposit in the world. The ‘Rand’ mines are in hard, brittle rock mined to depths of more than 12,000 feet. These are classified as fossil placers, since they were formed in ancient rivers more than 2.5 billion ago, but the US government would classify them as lodes based on the 1872 Mining Law.

Some placers contain detrital gold with other heavy minerals referred to as black sands. These back sands are dark opaque minerals with above average specific gravity that may include magnetite, pyroxene, amphibole, ilmenite, garnet, sphene, chromite, monazite as well as some uncommon light-colored minerals with high specific gravity such as cassiterite and scheelite.

Other minerals of interest in some placers include ruby, sapphire, diamond, platinum and palladium. While exploring the central Laramie Range of southeastern Wyoming for diamonds, some recovered concentrates contained trace amounts of ruby and sapphire (Hausel and others, 1988). These gems were traced to nearby alumina-rich mica schist and gneiss. One ruby-sapphire gneiss was identified that locally had as much as 20% corundum (ruby and sapphire). Even more impressive was the discovery of high quality iolite (gem-quality cordierite) within a few hundred feet of the corundum (Hausel, 2002). The iolite forms spectacular, transparent, blue gemstones with strong pleochroism that result in gems that change color when rotated in light (Hausel and Sutherland, 2000; Hausel, 2006d).

As the carrying capacity of a stream diminishes, heavy minerals tend to concentrate. Such areas are marked by a distinct increase in black sand at the stream bottom, along the leading edge of stream meanders, behind obstructions (i.e., rocks) and anywhere where there is a decrease in water velocity. Many streams lack sufficient velocity to carry gold, platinum and palladium any distance, as a result, precious metals typically occur in ‘paystreaks’ that are often formed during flash-flooding events or in heavy spring runoff.

In some extreme cases, heavy minerals can transport over great distances. Diamond has a specific gravity of 3.52 (compared to 2.87 for quartz) but is 6,000 to 8,000 times harder. Because of extreme hardness, this relatively heavy mineral can survive stream transport over distances of more than 600 miles (Erlich and Hausel, 2001)! Such a great transportation distance for gold is not plausible. Gold is too heavy (s.g. = 15-19.3) and too soft. When found in streams, the yellow metal is thought to come from a nearby source.

Gold may concentrate in stream meander banks, some of which are high and dry. One of my favorite places to take groups in past was in the Bobbie Thompson campground adjacent to Douglas Creek in the Medicine Bow Mountains. The gravels in the campground contain enough gold to keep one’s interest, even where the gravels lie several yards from the stream bank.

WHERE TO PAN GOLD

Wyoming’s placers are scattered throughout several historical gold districts. A few may be interesting for the layman to search for gold, diamonds and other gemstones and are briefly described below with more details published in Hausel (1989).

**Lewiston district.** The Lewiston district is one of several historical districts in the South Pass greenstone belt (Archean) along the southern tip of the Wind River Mountains. In the 1890s, a 500-foot paystreak was mined at Wilson Bar on the Sweetwater River (Figure 1). Lewiston

(Continued on next page)
Figure 1. Map of the Lewiston area. (1) Wilson Bar, (2) Mint Mine, (3) Strawberry Creek, and (4) Giblin Gulch (modified from Hausel, 1986)
is a similar district to the South Pass-Atlantic City district and lies in the eastern limb of the South Pass synclinorium; whereas the South Pass-Atlantic City district lies along the western limb (Hausel, 1991; 2006b). The gravel in the bar yielded 370 ounces of gold ($233,100 in gold at current prices – $630/ounce). The gold was traced upstream to the Burr lode where one pocket of ore (lode) yielded >3,000 ounces of gold ($1,890,000 at current prices). Some specimen-grade rock was exclaimed to contain as much as 1,690 ounces per ton (opt) gold!

Several rich pockets (ore shoots) were intersected in lodes in the Lewiston district. Samples collected northeast of the Hidden Hand mine in the Mint-Gold Leaf shear zone included a 2.5 foot composite chip sample that assayed 1.29 and 3.05 opt gold (Au) as well as specimens of quartz with considerable visible gold.

Because of rich shoots in some lodes, conditions were favorable for the formation of paystreaks downstream. Unfortunately, very few streams occur, and the few that do have limited gravel. Even so, one prospector worked a small area of Strawberry Creek, which cuts across several lodes and after a few weeks, recovered about 25 ounces ($15,750) of gold including nuggets 0.5 inch across with only primitive hand tools. Some other placers yielded nice nuggets. Historic reports indicate that nuggets (3 and 4.5 ounces) were recovered in Two Johns Gulch in 1905. In 1944, five ‘good size’ nuggets were found in the Big Nugget placer. Possibly, these two gulches are the same as Giblin Gulch where in 1932, several nuggets were found including two that weighed 5.2 and 5.3 ounces.

Giblin Gulch is very limited in length with no appreciable gravel volume and drains into Strawberry Creek. It is dry except during spring runoff. The Gulch cuts across the southwestern end of a lode near the Mint-Gold Leaf mine. Since this shear zone projects into the mouth of the gulch, it is thought that the gulch may overlie a rich ore shoot that has provided a source for nuggets (Hausel, 1991a).

South Pass-Atlantic City District. The South Pass-Atlantic City district lies west of Lewiston and encloses several auriferous shear zones along with dozens of potentially rich ore shoots. Specimen-grade ore recovered from the Carissa mine in 1908 assayed as high as 260 opt gold (Hausel, 2006b). In fact, on every field trip that I led to the Carissa mine during the past 25 years, someone found one or more showcase specimens of gold ore (Snyder and others, 1989; Hausel and Love, 1991) (Figure 2).

At the nearby Duncan mine, a 1-foot composite chip sample collected in a folded shear assayed 0.96 opt Au suggesting that this rich shoot is a steeply-plunging saddle-reef similar to those at the Carissa. At the Mary Ellen mine to the east, early reports indicated pockets of ore were intersected that contained as much as 50 opt gold (Figure 3). Farther east, the Miners Delight mine intersected rich pockets of gold. Historical reports indicate that miners pumped water from the shaft into nearby Spring Gulch below the mine so they could placer the drainage and recovered several 1 and 2 ounce nuggets as well as a 6-ounce nugget. One quartz specimen found in 1873 was as large as a water bucket and described by one witness: “it looked as if it could contain a pound of gold.” Another group of miners on Yankee Gulch northeast of the Miners Delight recovered 8 to 15 ounces of gold per day including one nugget that weighed about 5 ounces. This placer is also dry except during runoff.

The principal gold placer in the South Pass greenstone belt is Rock Creek (Figure 4). Rock Creek has yielded...
Gold, Silver, Palladium and Platinum in Wyoming – Part III
(Gold Planning, Platinum Group Metals & Mining Scams)

(Continued from page 8)

Figure 3. Gold specimen from the Mary Ellen mine provided to the author by Steve Gyorvary (mine owner) that could potentially assay at least 50 opt Au or higher.

Figure 4. Map of part of the South Pass-Atlantic City district. (1& 2) Rock Creek (3) Big Atlantic Gulch, (4) Smith Gulch, (5) Miners Delight mine (modified from Hausel, 1987; 1988a, b).

(Continued on page 10)
Figure 5. Remains of the E.T. Fisher washing plant along Rock Creek used to recover nearly $19 million in gold (at today’s prices) prior to the second World War.

impressive specimens. One fist-size piece of quartz found in the drainage in the past contained 24 ounces of gold. A boulder found nearby in 1905, had an estimated 630 ounces of gold! Another nugget weighed 34 ounces (see Hausel, 2006b).

From 1933 and 1941, the E.T. Fisher Company dredged 6 miles of Rock Creek and recovered 30,000 ounces ($18,900,000 at today’s prices) of gold (Figure 5). To the west, nearby Willow Creek cuts the same rock units as Rock Creek, yet only a small part of Willow Creek was ever mined. Willow Creek has a smaller volume of gravel but is probably richer since it has an excellent source for gold. For example, the Carissa lode drains into this creek and host rich, steeply plunging, saddle reef ore shoots in a very large folded shear structure that is locally 1,000 feet wide. Unfortunately questionable legislation resulted in the Carissa being purchased by the State of Wyoming and incorporated into the South Pass City historic site to expand the site and preserve the historic mine workings.

However, this deposit potentially contains more than a billion dollars in gold and was not only removed from mining, but many of the significant workings and geological structures were scheduled for reclamation.

Placing the adjacent Willow Creek is restricted by the State because trace amounts of mercury were purportedly detected in the gravels. However, there is no natural source for mercury in this district. If mercury does exist in the gravel, it had to be introduced by Man. Thus only a minor and limited quantity of mercury would exist as this was a valuable commodity in the late 1800s. So any modern mining would only serve to remove the limited supply of the pollutant.

Many drainages in the South Pass-Atlantic City district offer good sites to search for gold, particularly those that lie downstream of the SAM shear zone complex. One group of prospectors mined a small area downstream from the complex along Rock Creek and recovered a cache of nuggets. Another mined Smith Gulch recovering an average of 20 ounces a week. Another prospector found a 7.5-ounce nugget along Rock Creek using a metal detector, and still another found over a hundred nuggets using a metal detector in the waste piles along the creek banks. By examining the 1:50,000-scale map in Hausel (1991), good places to search for gold are easily identified downstream from the SAM (South Pass City-Atlantic City-Miners Delight) shear zone complex (see Hausel, 2006b).

Other Areas. One of the better areas outside of South Pass to search for gold is Mineral Hill in the Black Hills of northeastern Wyoming (see Figure 2 in Hausel, 2006c). This is a beautiful and secluded area along the Wyoming-South Dakota border. Mineral Hill is a Tertiary alkalic volcanic plug that contains gold in quartz veins and
Gold, Silver, Palladium and Platinum in Wyoming – Part III
(Gold Planning, Platinum Group Metals & Mining Scams)

(Continued from page 10)

breccias. I collected some vein samples from a prospect known as the Treadwell open cut that assayed as high as 3.8 opt gold and 9.7 opt silver. So there is a very good primary source for a nearby placer gold deposit, particularly in Sand Creek. Prior to 1893, more than 9,000 ounces of gold (> $5,670,000) were recovered in the area including 2.5-ounce nuggets in nearby Bear Gulch. In recent decades, walnut-size nuggets were recovered from the area.

The Medicine Bow and Sierra Madre Mountains in southeastern Wyoming also have some areas favorable for placer gold. In the Centennial Ridge District, 0.1 to 0.25 ounce nuggets were found on Mill Creek. At a prospect known as the Mother Lode on the nearby Middle Fork of the Little Laramie River, dozens of pyrope garnets (kimberlitic indicator minerals) were panned by attendees of one WSGS field trip a few years ago (Figure 6). With such success in finding anomalies like these, one must wonder why there isn’t more research and exploration of these type of mineral resources?

On the west flank of the Medicine Bow Mountains, many small nuggets and some pyrope garnets of kimberlitic affinity were found on Douglas Creek south of the Bobbie Thompson campground. The nuggets were coarse and jagged suggesting derivation from nearby lodes (the largest known nugget weighed 3.4 ounces). In recent years, several nuggets (0.5 to 1 inch across) were found in Bear Creek, a tributary. At the eastern edge of the district, 40% of the gold from Spring Creek was in the form of small, coarse nuggets that included a 2.5-ounce nugget recently found.

The nearby Sierra Madre (to the west) is known for copper; relatively little gold was produced in the district. Even so, I came across a quartz vein along the Encampment River with visible gold that lies uphill from Purgatory Gulch, a dry tributary. This relationship suggests that Purgatory Gulch may provide metal detector enthusiasts with opportunities to search the gravels for gold. Another place of note is Mill Creek in the northwest, which was dredged for gold sometime in the past. And one of the more interesting mysteries in the Sierra Madre was the recovery of 299 gold nuggets by a prospector with a metal detector (Rick Mattingly, personal communication). Where the nuggets were found, has not been disclosed.

North of Sinclair, the Seminoe Mountains enclose a group of small historical mines on Bradley Peak. When I examined the Penn mines in 1981, I recovered more than a dozen specimen-grade samples of quartz with visible gold. One sample assayed 2.87 opt (Hausel, 1981) Following the report on my reconnaissance survey, the

(Continued on page 12)
Seminoe Mountains were combed by claim-stakers in a short-lived mini-rush that resulted in every motel in Rawlins being filled with prospectors, geologists, and treasure hunters (Blackstone and Hausel, 1991).

Probably the only good placer in this district is Deweese Creek, which drains the mines and the large propylitically-altered zone that encloses the mines, but I have found no record of anyone searching this creek for gold (Hausel, 1994). Another puzzle is a large paleoplacer, which I call the Miracle Mile that extends from Deweese Creek east to the North Platte River, and continues for an unknown distance easterly pass the North Platte River. A few years ago, I panned out several gold flakes in this dry placer along with 8 pyrope garnets and 4 chromian diopsides (pyropes and chromian diopsides are tracer minerals used in the search for diamond). I was able to scrounge up some money from a grant and my own pocket to have several of these tested for geochemistry. All of the pyropes we tested with the University of Wyoming’s electron microprobe were sub-calcic, high-magnesium pyropes chemically similar to garnets recovered from diamondiferous pyrope harzburgites in kimberlites. This suggests that there may be a nearby, hidden, significantly rich diamond deposit! Unlocking this puzzle will take considerable sampling and mapping, but the benefits should be obvious. This is the kind of work that should be done by the WSGS, as most companies cannot afford such an extensive grassroots project and need this kind of support from the state.

In addition to gold, some interesting platinum-group metal anomalies have been identified in Wyoming. On December 29, 2006, gold was valued at $637/ounce. Palladium was selling for $332, platinum $1,132 and rhodium was valued at $5,030/ounce! These precious metals are typically found in rare ultramafic rocks. Some of these rare rocks are found within a platinum-group metal province in southeastern Wyoming (Hausel, 1991b, 2000).

**PLATINUM-PALLADIUM-NICKEL**

Anomalous platinum, palladium and nickel associated with ultramafic and gabbroic intrusive complexes have been identified by a number of researchers in southeastern Wyoming. This province, referred to as the Wyoming platinum-palladium-nickel (Pt-Pd-Ni) province, is centered on the Cheyenne Belt, a major Precambrian suture (Karlstrom and Houston, 1978) (Figure 7). This structure separates the Archean Wyoming Province (>2.5 Ga) from Proterozoic volcanogenic gneissic basement complex known as the Green Mountain terrain (Houston, 1983; Houston and others, 1975).

Three intrusives, in particular, have yielded anomalies. These are the Mullen Creek and Lake Owen layered complexes, and the Puzzler Hill ultramafic massif. Other anomalies are reported in the Centennial Ridge amphibolite, the Laramie Range anorthosite, and in the Douglas Creek placers, but these have yielded only weak and scattered anomalies. The anorthosite complex appears to have high potential for discovery of these metals and other significant minerals resources, but to date the complex remains relatively unexplored for rare metals and gemstones, even though it may contain one of the largest gemstone deposits in the world.

Some of the more significant mineralization recognized in this region to date includes: (1) Cu, Au, Ag, Co, Pt, Pd, Ni anomaly at Puzzler Hill (Hausel, 1997); (2) cumulate sulfide mineralization in 12 horizons at Lake Owen (Loucks and Glasscock, 1983, 1989), and (3) epigenetic Pt, Pd, Au, Cu, and Ag in hydrothermally altered shears in mafic schist in the Mullen Creek complex (McCallum and Orback, 1968; McCallum and others, 1975).

The Cheyenne Belt represents a Proterozoic subduction zone. Platinum-bearing mafic and ultramafic rocks south of this shear zone lie in a eugeoclinal terrain that represent ophiolite remnants stacked against the subduction zone and thrust upon the Archean craton (Paul Graff, personal communication, 2000).

Pt-group mineralization in the relatively undeformed Lake Owen complex is clearly magmatic and associated with cumulate layers. In the New Rambler district (Mullen Creek complex), mineralization occurs in hydrothermally-altered mafic cataclasites. The mineralization was either leached from mafic rocks by hydrothermal solutions, or remobilized from the layered complex during shearing (McCallum and Orback, 1968). Platinum in the Centennial Ridge district is restricted to narrow zones of altered, mafic...
Figure 7. Generalized location map along the Cheyenne Belt (Mullen Creek - Nash Fork shear zone) and the Wyoming Platinum-Palladium-Nickel Province (modified from Graff and others, 1982). Pt-group and Ni anomalies parallel the Cheyenne Belt and include the Laramie anorthosite batholith in the Laramie Range, the Lake Owen and Mullen Creek layered mafic complexes, and the Centennial Ridge amphibolite in the Medicine Bow Mountains. To the west in the Sierra Madre, the trend projects to the Puzzler Hill pyroxenite, Elkhorn gabbro and Woods Mountain peridotite (Hausel, 1991; 2000). A geophysical anomaly along the northern edge of the Sierra Madre, north of the Belt, suggests the presence of a hidden, mafic complex underlying Phanerozoic rocks in that region (Paul Graff, personal communication, 1997).
metagnieus schist and gneiss and appears to have been leached from mafic country rock (McCallum, 1968). Detrital platinum in the Douglas Creek district may have been derived from the Mullen Creek complex.

**Lake Owen complex.** The Lake Owen layered complex intrudes rocks south of the Cheyenne Belt. The complex is virtually unaffected by metamorphism and crops out over a 25 mi² area. The funnel-shaped intrusive is tilted at one side exposing a cross-section with 18 cyclic units (Loucks and Glasscock, 1990). The cyclic units are defined by large-scale repetitions of two or more units in the lithologic sequence: troctolite, olivine-gabbro, gabbronorite and Fe-Ti oxide gabbronorite (Loucks, 1991). The lowermost cyclic unit has a strike length of 1.8 miles and the uppermost unit 7.5 miles. Portions of the intrusive are hidden under gravel.

Anomalous platinum was detected in labradorite-bearing gabbroic norite and cumulate sulfides were identified in at least 12 stratigraphic horizons in the complex with zones containing elevated gold and Pt ± Pd (Loucks and Glasscock, 1990). Four of these are reported by Loucks (1991) to have laterally persistent precious metal anomalies (Pt-group metals + Au mineralization > 1 ppm). The mineralization is spotty but includes zones up to 15 feet thick with strike lengths of more than 1 mile (Loucks, 1991).

A second distinct lithologic association of sulfides with titanomagnetite cumulates is found near the tops of some cyclic units (Loucks and Glasscock, 1989). In two units, mineralization consists of bornite + chalcopyrite + carrollite (CuCo₂S₄) + millerite + Ti-poor magnetite ± PGM minerals [moncheite [PtTe₂], merenskyite [(Pd, Pt)(Te, Bi)₂]], michenerite (Pd, Bi, Te), cooperite (PtS) ± Au-Ag-Pd alloys in pink labradorite gabbronorite. In one unit, stratiform bornite-rich mineralization (with ppm level Au+Pt+Pd) is continuous for at least 1.2 miles. In another, mineralization extends over a strike interval of 6 miles and includes Au-Ag alloys, Pt-arsenides, Pt-Pd tellurides and sulfides associated with disseminated chalcopyrite, pentlandite, pyrrhotite, pyrite, gersdorffite (NiAsS), bornite, millerite, and PGM-bearing carrollite (Loucks, 1991).

Vanadiferous titanomagnetite cumulates are persistent in gabbro norite near the tops of some cyclic units. Sixteen principal Fe-V-Ti-oxide cumulate layers with a lateral persistence of 3 to 7.5 miles have been identified. Six of 11 layers are of sufficient thickness to warrant evaluation for economic potential (Loucks, 1991). Loucks and Glasscock (1989) estimated surface mineable vanadium oxide cumulates included 1.4 billion tons valued at $33 billion (1988 prices).

**Mullen Creek complex.** The Mullen Creek layered complex to the west of Lake Owen forms a large, 60 mi², deformed, gabbroic complex (Figure 8). The northern edge of the complex is truncated by the Mullen Creek-Nash Fork shear zone, which contributed to its deformation.

Loucks and others (1988) recognized 21 cyclic units in this complex. On the basis of petrography, the complex was subdivided into a Lower Series, the Jays Roost Series, and an Upper Series. The Jays Roost Series is of interest as it has cyclic units that closely resemble the stratigraphy of Lake Owen (Loucks and Glasscock, 1989).

A copper-gold gossan discovered along the northern flank of the complex near the turn of the 19th century, resulted in the development of the New Rambler mine. A shaft sunk to a depth of 170 feet with more than 5,000 feet of drifts and crosscuts, cut hydrothermally altered metapyroxenite and metagabbro in shear-zone tectonites and mylonitic gneiss (McCallum and Orback, 1968; McCallum and others, 1975). The New Rambler mine is a classic supergene enriched deposit that was capped by a porous spongy limonite and jaspilite gossan overlying a 75-foot thick oxidized zone. The oxidized zone included copper carbonates and oxides with dendrites and nuggets of native copper and some copper sulfides. These grade down from 75 to 100 feet into the supergene zone with platinum-bearing covellite and chalcopyrite (McCallum and others, 1975). Below 100 feet, supergene assemblages graded into primary mineralized rock with quartz-pyrite-chalcopyrite veins and minor sperrylite. The association of epigenetic platinum and palladium in the shear zones suggests the ore was remobilized from a hidden, as yet undiscovered, platinum reef at depth (McCallum and Orback, 1968), or laterally.

The mine sporadically operated from 1900 to 1918. Operations terminated after a fire destroyed the mine buildings. After the fire, the mine manager estimated...
probable reserves at 7,000 tons of 7 to 8% Cu, 0.25 opt Pt, with some gold and silver. Total metal production was reported at 1,753,924 pounds of Cu, 171.35 ounces of Au, 7,346 ounces of Ag, 170.16 ounces of Pt, and 451.4 ounces of Pd (Needham, 1942). Silver Lake Resources (1985) estimated platinum-group metal production was more on the order of 16,870 ounces of Pd and 910 ounces of Pt. In addition to platinum and palladium, iridium was also detected. According to Knight (1902) a composite sample of dump material from the mine yielded 0.06 opt Pt, 0.04 opt Ir, 0.04 opt Pd, 0.10 opt Ag, and a trace Au. Much of the platinum was incorporated in the copper ore. Two assays reported by Knight (1902) included: (1) an assay of copper minerals which yielded 0.10 to 0.70 opt Pt, and (2) seven carloads of covellite ore that contained 0.40 to 1.4 opt Pt.

A search of nearby structures resulted in other Pt-group discoveries. The Blanche shaft was sunk west of the New Rambler to a depth of 160 feet and intersected copper at 120 feet (Kleunder, 1982). The host rock is sheared felsic gneiss, metagabbro, and metadiorite (McCallum and Orback, 1968). Two select samples contained limonite, abundant malachite and cuprite, with traces of chalcocite and sperrylite. These assayed 6 and 17 ppm Pt, 30 and 20 ppm Pd, and 20 and 17% Cu (Loucks, 1976).

**Centennial Ridge District.** North of the Lake Owen complex and northeast of Mullen Creek, platinum was
reported in some mines in the Centennial Ridge district in mafic metaigneous rock. The mineralization was spotty. Gold ores in the district occur in sulfide-rich zones in mafic mylonite, graphitic fault gouge, and in strongly chloritized shear zones. Platinum was restricted to narrow zones of altered, mafic metaigneous schist and gneiss and appears to have been remobilized from the mafic country rock (McCallum, 1968).

**Puzzler Hill.** Puzzler Hill lies 6.5 miles northwest of Encampment. This is a relatively new discovery, even though the property was mined for copper near the turn of the 19th century. Puzzler Hill is a pyroxenite massif in contact with Late Archean gneiss and lies north of the Cheyenne Belt.

Rocks forming Puzzler Hill include pyroxenite and actinolite-chlorite schist. Mineralized samples yielded 0.01-4.43% Cu, 66 ppm-3.72% Ni, 14 ppb-0.29 opt Au, <5-828 ppb Pt, 5 ppb-0.12 opt Pd, <0.1 ppm-0.19 opt Ag, 21-831 ppm Co, 64-294 ppm Cr, and trace Pb and Zn (Hausel, 1995). Beeler (1906a) reported the mineralized zone was traced 2 miles on the surface and varied from 14 feet at the Charter Oak mine to 100 feet wide elsewhere. Where the mineralized structure was widest, the ore consisted of quartz stringers mixed with low-grade material. The Charter Oak shaft was driven to a depth of 488 feet (Beeler, 1905) with more than 2,300 feet of shafts, winzes, raises, and tunnels on four levels (Saratoga Sun, 1907). Ore reserves were estimated at 680,000 tons to a depth of 300 feet.

**Elkhorn Gabbro.** The Elkhorn gabbro in the Sierra Madre was intruded by olivine-gabbro that was in turn intruded by peridotite and mafic pegmatite dikes. Collectively, these represent a reversely zoned intrusive complex (Snoke and others, 1982). The ultramafic portions of such complexes are the zoned “Alaskan type” ultramafic complexes that are the source of placer platinum-group metals in Alaska, as well as the Ural Mountains, Russia (Loucks and Glasscock, 1989). This complex remains unexplored.

**Laramie Anorthosite batholith.** The Cheyenne Belt was intruded by an anorthosite batholith in the Laramie Range east of the Medicine Bow Mountains. The 350-mi² batholith is dated at 1.42 Ga to 1.53 Ga (Smithson and Hodge, 1972). The batholith has long been considered a potential source of disseminated and massive Ti-Fe-V deposits (Hagner, 1968), but also hosts two very large gemstone deposits that include labradorite gems with excellent fire and potentially the largest iolite gemstone deposit in the world (Hausel, personal field notes). Some pyrrhotite, chalcopyrite, pyrite, and sphalerite have been reported in norite, hypersthene syenite, and anorthosite. Near the southern edge of the batholith, the Strong mine forms a polymetallic deposit and produced some Cu, W, Mo, Ag, Au, and Pb. Some samples also yielded 1.0% Ni (Beeler, 1942). Anomalous nickel was also reported from nearby properties (Beeler, 1906b). The batholith is essentially unexplored for Pt-group metals as well as Ni.

**Other Anomalies.** There are several other interesting anomalies associated with mafic and ultramafic rocks in this province. For information on these, it is recommended to review Hausel (2000).

**MINING SCAMS**

In any treatise on gold and platinum, one needs to include those characters who make gold and platinum mines out of nothing. This has been a shady profession (not dissimilar to many political offices) for hundreds of years. In Mark Twain’s book *Roughing It* he defines a gold mine as “a hole in the ground with a liar standing over it.”

Wyoming is no exception. During my 29 years at the WSGS, I worked with investigators at the Secretary of State, US Postal Inspector and FBI to foil some scams. We were able to stop the transfer of nearly $1.5 billion in funds from potential investors interested in giving money for properties that were in many cases nothing more than glorified kitty litter.

The characteristics of modern day gold scams in the West often involve the following:

1. A secret process to recover gold and platinum,
2. The accidental discovery of platinum group metals in the gold ore,
3. Assays and reserves that are absurdly high and beyond ridiculous,

(Continued on page 18)
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W. Dan Hausel was the most productive geologist in the history of the WSGS and produced more than 550 publications including 10 books on geology and mineral deposits, and lectured to more than 500 groups and conferences around the continent. He is considered one of the leading specialists in Archean greenstone belt geology and mineral deposits and diamond deposits.

During his tenure with the State, he discovered dozens of precious metal, gemstone, base metal and industrial mineral deposits and mapped nearly a 1,000 mi² of complex geological terrain including the two largest kimberlite districts in the US, the largest lamproite field in North America and greenstone belts at South Pass, Seminoe Mountains and Rattlesnake Hills. His discovery of some poly-gem deposits led to his finding the two largest iolite gemstones in the world – one stone of more than 1,900 carats and a second that weighed more than 24,000 carats!

Dan received more than 100 awards from entities outside the State including the Wyoming Geological Association’s 2004 Distinguished Service Award for grateful recognition and outstanding endeavors and contributions to the work and progress of the Association. He resigned from the WSGS after 29 years and formed a geological consulting firm (W. Dan Hausel, Geological Consulting, LLC) and currently contracts to search for diamonds and precious metal deposits for some foreign companies.

ABOUT THE AUTHOR

W. Dan Hausel takes a break from mapping in the Granite Mountains of Wyoming (photo by Robert Odell).

(4) Assay reports from questionable assayers that charge very high prices for their assays (typically many times that of a legitimate lab).

(5) Often a connection to groups, companies, and assayers in Utah and Arizona.

(6) An absolute guarantee of investment returns and much more.

A few of the more interesting investigated included a deposit near Mountain Pass, California. Gold was conveniently discovered adjacent to a paved highway in unconsolidated wind blown sand and dirt. A mill was set up on the property (actually a small tool shed), and a small pit was dug with a backhoe to show investors that some work was taking place. This particular company claimed to have discovered a rich gold deposit – so rich, that the ore reserves (there are always reserves in every scam even though there is almost never any field evidence of drilling) averaged 8 to 12 opt Au. During the use of their secret process to extract gold from the unconsolidated sand, they had accidentally discovered 12 to 15 opt Pt in the ore. The reserves totaled about 10 times that of all the gold mined in all of human history!

In the company profile, information about the secret proprietary process used to recover ‘invisible’ gold was described with buzzwords and phrases such as heap leaching, gold mobilization, precipitation with organics, etc. However, when all of these descriptions were waded through, the process simply came down to leaching invisible gold with tap water!

The company sold blocks of ore to investors. Estimates were made indicating that each ton of ore contained an average of $3000 in gold. Since the platinum was accidentally discovered later, the company

(Continued on next page) ▼
felt obligated to throw the platinum in at no additional cost to the investor. The ore was sold in blocks of 100 tons at a price of only $20,000. Based on the gold alone, the investor should have cleared a minimum profit of $280,000. And that didn’t include the platinum! To be sure that everyone was satisfied, if any investor purchased a block of ore, and for some crazy reason it did not contain the typical 8 to 12 opt Au, the company would throw in another 10 tons for free. Sounds too good to be true? The US Postal Service and FBI estimated that these scam artists walked off with more than $20 million in investments. Even during the fraud trial, these scoundrels continued selling parcels of ore over the phone at court recesses.

This is nothing compared to other scams. One involved a gold discovery at Pine Mountain west of Casper. This is one of two favorite places for mining scams in Wyoming. I received inquiries from a fraud investigator from a bank in New Jersey who had been contacted by the Secret Service. A group of not very bright investors was attempting to transfer the first $100 million (of a $1 billion price tag) to invest in this property. With no geological appraisal or information to support the presence of a world-class gold deposit at this locality these investors were trying to buy the property based on a one-paragraph report from a University of Wyoming professor who certified that this deposit had an ore reserve of 286,000,000 ounces (> $177 billion in gold)! Luckily, no one lost money due to the quick thinking of the Secret Service. But even so, this faculty member still occupies the hallowed halls of the university!

More recently, another group of foreign investors were ready to send $350 million to a scam artist in Nebraska to finance an ore deposit on Iron and French Creeks in the Medicine Bow Mountains. This is another favorite locality for scams. The area has impressive outcrops of pyrite-rich graphitic schist that, to the layman, looks like gold. But in reality, the rocks contain no precious metals. This was touted as the richest discovery in the world – a deposit with ore reserves certified by a Certified Utah Appraiser calculated in the $trillions of dollars. Assays averaged 11 opt Au, with equally high silver, platinum, palladium and rhodium. To be sure they were not over exaggerating the value of the ore to their customers, the scam artists decided to throw out one sample that was anomalously high (> 1,200 opt Pt)!

**SUMMARY**

There are several legitimate gold and some platinum-group metal deposits and anomalies in Wyoming. Often, one may see weekend prospectors searching for gold in some of the state’s placers (Wyoming and Colorado also has diamond placers, which no one seems to have paid much attention to). Wyoming and Montana also have sapphire and ruby placers of interest.

**REFERENCES CITED**


The recently released film entitled “Geo Families” is a unique interview-based documentary that looks into the culture and personality of geologists using stories, comments and reflections from seven different geological families. Designed for all ages, “Geo Families” aims to entertain and educate geologists and non-geologists alike with real stories of exploration, discovery and community.

You will probably recognize somebody in the film since the large majority of featured geologists are current RMAG members and the initial concept and funding for the film came from Brian Richter, a long standing member of RMAG. As the son of a geologist, Brian wanted to record the contributions and influence of geologists on the next generation and to look at some of the themes and characteristics of geology that are passed down. The fundamental love of the outdoors and the drive to understand the mysteries of the Earth is evident in all of the featured geologists, and it is refreshing and inspiring to see people of all ages who are unified by these common interests.

“Geo Families” is lighthearted, fun and educational. Geologists will find that many of the stories about family camping trips, fieldwork, lean times and world travel will ring true in their own lives. The excitement of the featured geologists is contagious, and even non-geologists will walk away with a greater appreciation for the earth sciences field. Sponsored by the RMAG Foundation and featuring the Weimers, Sonnenbergs, Pritchetts, Pomeroys, Stewarts, Meckels and Richters, “Geo Families” is a must-have for RMAG members’ libraries.

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13th Annual 3-D Seismic Symposium. See page 40 for more information.

March 12-13, 2007  
AAGP Spring Education Conference. See page 45 for more information.

March 13, 2007  
Desk & Derrick Meeting. “Global E&P-Business Dynamics—How Are They Shaping the Energy Future?,” Pete Stark, IHS Energy. Luncheon begins at 11:30 a.m. in the Hershner Room in the Wells Fargo Building, 1700 Lincoln. For reservations, please contact Saundra Thompson at Saundra.Thompson@anadarko.com or by calling her at 720-264-2835.

March 20, 2007  

March 22, 2007  
SIPES Luncheon. Ernie Morrison of Mull Drilling in Wichita, Kansas, will present a paper on Sand Arroyo Creek Field in Stanton County, Kansas, which produces from Mississippian-St. Louis oolitic shoals. Cost of the luncheon is $20. Luncheon begins at 11:30 a.m. at the Wynkoop Brewery. For reservations please contact the SIPES Denver Chapter message line at 303-730-2967 by no later than Monday, March 19th.

March 27, 2007  
RMS-SEPM Luncheon. “Stratigraphy of the Lewis Shale and Fox Hills Sandstone, Wyoming: Applications to Understanding Shelf-edge to Base-of-slope Changes in Stratigraphic Architecture of Prograding Basin Margins,” David Pyles, Colorado School of Mines. Cost of the luncheon is $15.00, walk-ins (talk only) are $3.00.

Lunch is served at noon, talk begins at 12:30 p.m. at the Wynkoop Brewery. For reservations send an email to Luncheons@rmssepm.org or contact Dave Uhl, David.Uhl@EnCana.com or 720-876-5092.

April 24, 2007  
RMS-SEPM Luncheon. “Shale Gas Potential of the Niobrara Formation in Wattenberg Field, Denver Basin,” Gus Gustason, El Paso Exploration & Production. Cost of the luncheon is $15.00, walk-ins (talk only) are $3.00. Lunch is served at noon, talk begins at 12:30 p.m. at the Wynkoop Brewery. For reservations send an email to Luncheons@rmssepm.org or contact Dave Uhl, David.Uhl@EnCana.com or 720-876-5092.

May 4, 2007  
SEG/EAGE Distinguished Instructor Short Course, Concepts and Applications in 3D Seismic Imaging, Denver, Colorado. See page 41 for more information.

June 4, 2007  
Coalbed Methane Symposium, Marriott City Center Hotel, Denver, CO.

June 21-24, 2007  
RMS-SEPM Field Trip, Sequence Stratigraphy and Reservoir Characterization of the “Middle” Mesaverde Group: Genetic Linkage from Rock Springs Uplift (WY) to Sand Wash Basin (CO) to Middle Park Basin (CO). Leaders will be Ron Steel, University of Texas at Austin, and Jeff Crabaugh, ExxonMobil Production.
Gold, Silver, Palladium and Platinum in Wyoming – Part III
(Gold Planning, Platinum Group Metals & Mining Scams)

(Continued from page 19) ▼


Knight, W.C., 1902, Notes on the occurrence of rare minerals at the Ramber mine: Engineering and Mining Journal, v. 73, p. 696.


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<table>
<thead>
<tr>
<th>Play and Prospect Assessment</th>
<th>Rockies &amp; Worldwide Resource Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Richness</td>
<td>Paradox</td>
</tr>
<tr>
<td>Oil and Gas Generation Potential</td>
<td>Denver</td>
</tr>
<tr>
<td>Thermal Maturity</td>
<td>Uinta</td>
</tr>
<tr>
<td>Gas type and maturity</td>
<td>Piceance</td>
</tr>
<tr>
<td>Rates of Oil and Gas Formation</td>
<td>Wind River</td>
</tr>
<tr>
<td>Oil and Gas Inversion</td>
<td>Great Basin</td>
</tr>
<tr>
<td>Numerical Simulation (Modeling)</td>
<td>Ouachita basins</td>
</tr>
<tr>
<td>Producibility-Commerciality</td>
<td>Western Canada</td>
</tr>
</tbody>
</table>

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Leigh passed away after a lengthy illness endured with much grace and some humor. He had a long active career in geological exploration extending over North America and parts of the southwest Pacific. Leigh was a member of the Rocky Mountain Association of Geologists for over 50 years.

Leigh graduated from the University of Michigan in 1943, receiving his degree in geology. He joined the U.S. Navy in World War II and served in the European Theatre. He was serving as a young Ensign on an LST serving Omaha Beach on D-day in 1944. He later served in the Pacific Theatre on an APA returning military from the islands to the mainland.

After the war Leigh joined the United States Geological Survey, Alaskan Division, and for two years spent entire summers on the North Slope of Alaska in a party of two geologists and four camp hands floating down rivers mapping the surface geology of the area north of the Brooks Range. The party was flown out for the expedition in bush planes with canvas canoes slung beneath the planes and above the floats. They subsisted on supplies flown out previously and stored in steel drums which sometimes resisted the local bears.

Leigh next went to work for Gulf Oil Company, working out of Durango, Colorado, doing plane table mapping of surface structures in the Southwest Colorado/Utah area. He struck out on his own in early 1951, moved to Denver and supervised wells for Dunn & Boring in the Denver and Powder River basins. His next association was with Dave Dodge of Carver-Dodge Exploration. This group mounted a successful program in western Canada along with continued US Rocky Mountain activity. Leigh helped Carver-Dodge mount an exploration program in New Zealand which utilized his expertise in surface geological exploration.

Leigh continued to follow developments in the Rocky Mountain states and in the early 1970’s discovered and developed the DeNova Field in Washington County, Colorado. He continued the drilling and production of natural gas wells in the Niobrara Formation until his late illness intensified.

He was an active golfer, fly fisherman, skier, and long distance hiker. He once hiked the Colorado Trail with his friends Tom Cole and Rollie Rogers. His many friends have recently commented on his sense of humor. He was impish in his joy of friends and the vagaries of life.

Leigh Barksdale personified what a man should be in his devotion to his family, his country, his profession and his friends. Who could ask for more?
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and talks can cover various topics depending upon the program.

7.) Peer Review of Papers for Publication. These opportunities will be on an “as needed” basis and will cover various topics depending upon the publication. Final review will be handled through the Publications Committee.

8.) Solicit NEW members for RMAG. You are already doing this, aren’t you? Show the prospective member how to download the membership form from the website or provide the form to the prospective member.

9.) Cover for the RMAG Staff at the RMAG booth at the Prospect Fair, or AAPG, and/or SEG Convention. Usually this is for a short time, as the office staff may need a “break” during the day.

10.) Volunteer to Be a Candidate for an RMAG Office. Being a candidate is a short time frame, but if you win, you can expect to spend 24-40 hours in your duties for the year.

Three to Five (3-5) Hours of Commitment:

1.) Chair a Session at an Event or Symposia. You are going to attend the talks anyway, might as well have the best seat in the house! Events that need this assistance are: 3D Symposium, Prospect Fair and Technofest, Fall Symposium, Spring or CBM Symposium.

2.) Volunteer to be an AAPG Delegate or Alternate. The two meetings for this occur once with the Rocky Mountain Delegates before the AAPG convention, and then at the Delegates’ meeting at the national convention. You will see all of your friends there, and you will get to know the issues being raised in the national organization!

Five – Fifteen (5-15) Hours of Commitment:

1.) Become a Chairman of a Committee for an event or symposia. You will be the Coordinator and will have several folks to help you. Besides having a great team behind you, you will organize, execute, and monitor the progress of your committee. Committees may include Sponsorship, Advertising, Exhibitors, Paper Solicitation, Paper Reviews, Abstract Book, Speaker Gifts, and Audio-visual.

2.) Provide the Audio-Visual Assistance for an event. You get to “set up” and see the talks first!! You will assist the speakers and guests in having their talks in the proper format and ready for display.

3.) Be a Committee Member for an Event or Symposia. You get a chance to work with some fine folks and have great satisfaction for a job well done. A listing of potential committees is in #1 above.

4.) Prepare and Give a talk at the RMAG Lunch Meeting. 20 talks per year are needed, and you can really show your stuff to your colleagues!

5.) Volunteer as Speaker Chairman. You contact and arrange for potential speakers, and coordinate the calendar for the RMAG luncheon meetings.

6.) Volunteer as the AAPG Delegate Chairman. The chairman contacts all of the current and alternate delegates, arranges for an informational meeting prior to the AAPG Convention, helps ensure that the Rocky Mountain Section is fully represented by our delegates, and assists in the verification of those delegates at the AAPG Delegate meeting.

7.) Volunteer to be a member of one of the RMAG Committees. There are a number of committees to choose from:


Greater than Fifteen (>15) Hours of Commitment

1.) Become the Chairman for an Event or Symposia (15-20 hrs Est). You get to organize, execute, and monitor the progress of the Event. You will contact the speakers, review the talks to be presented, and define the Abstract and Program publication. You will gather assistance through sub committees, monitor and coordinate their activities, and sometimes you even get to choose the cool “thank you” gifts.

2.) Offer to become a Co-Editor of the Mountain Geologist, Outcrop, or other Publication. The co-editors of any publication are extremely important to the financial health of the RMAG. We are fortunate to have had, and continue to have, wonderful editors for our RMAG publications.

And of course, volunteer to be a member of the Board of Directors, run for office, and have a great time participating in anything you wish to choose to do. We need you!! ▼
Upcoming Workshops
By PTTC

Hydraulic Fracturing—Measurement, Characterization, and Analysis
March 13, 2007, 8:30 am – 4 pm, Petroleum Club, Billings, Montana
Fee: $100, Instructor: Jennifer Miskimins, Golden, CO
This one-day workshop is intended to demonstrate recent advances in hydraulic fracturing techniques and how they can be used to characterize the producing reservoir. The basics of hydraulic fracturing are discussed and lead into the complexities associated with treatment design and analysis. Special issues such as non-Darcy flow, G-function analysis, and “mapping” techniques are covered. Case studies demonstrating analysis and various fracturing practices (such as “slickwater” fracs) are presented.

GIS and GPS for Earth Scientists
March 20, 2007, 8:30 am – 4 pm, Colorado School of Mines, Berthoud Hall Rm. 201
Fee: $95, Instructor: Joseph Kerski, ESRI Boulder CO.
This workshop will emphasize fundamental GIS concepts such as data models, coordinate systems, and spatial queries. Attendees will explore the functionality available in ESRI’s ArcGIS software using mining and petroleum data. The course will also cover how to collect coordinates using GPS receivers and use them within ArcGIS, as well as how to locate and format elevation data, satellite image data, and data specific to the class participants’ needs.

Register online: www.pttcrockies.org
For more information, contact Mary Carr, 303.273.3107, mcarr@mines.edu
The 2006 Board prepared the 2007 budget, which was discussed and passed by the new board. We are already ahead of projection because of the membership renewals coming in. As a reminder, if you haven’t renewed your membership, please do so as this March *Outcrop* will be your last if you don’t.

RMAG is having a full schedule of short courses, seminars and symposia in 2007, and we urge you to participate. The 13th annual 3D seismic symposium is scheduled for March 6th and is titled Peak Action 3-D Seismic Technology in the Rockies. The 2007 Coal Bed Methane Symposium is scheduled for June 4. More information will be forthcoming. Check the RMAG website for a complete and changing list.

We have a lot of fun planned, as well. The GeoLand Ski Day is going to be on March 2, and the RMAG Golf Tournament will be on June 25.

Jewel Wellborn reminded the Board that RMAG and Rocky Mountain geologists have not been well represented as officers in AAPG lately. If you would like to offer your name as a candidate for national office, talk to Jewel, look in the Explorer, or go to the AAPG website ([AAPG.org](http://AAPG.org)).

Publication costs make up a big part of our budget. In an attempt to reduce costs, the Board decided to no longer mail the *Outcrop* to our international members. Each month an email will be sent with the web link to find the *Outcrop* online.

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**RMAGA Luncheon**

The March 15, 2007 luncheon/program meeting of the RMAGA will be held at Pinehurst Country Club. Social Hour will start at 11:00 a.m. and lunch will be served at noon. We will be honoring the past presidents since our founding in 1953. The program will be presented by our member Marilyn Starke, “ORCHID FEVER,” or “YOU TOO CAN GROW ORCHIDS IN DENVER!” The cost is $17.00 per person.

Any spouse of an RMAG member or any female geologist is eligible to join the Auxiliary. Also, any spouse of a former member of RMAG or other associations of geologists are eligible to be a member. If you are interested in attending the luncheon, or in finding out more about RMAGA, please call Janet Foster at 307-757-1153.

---

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Owner, Texas Geological Inc, established 1996
Tel: 713-221-3210 e-mail: robert.milam@juno.com
Fax: 832-201-8530

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**Highlights of the January RMAG Board Meeting**

By Richard Parker (raparker@parkergeo.com)

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Welcome to New Members

(Continued from page 2)▼

He holds a PhD in Geology from McMaster University. Simon is a member of AAPG, GSA, SEPM, SCPG, and IAS.

Jason M. Rohlfing
Jason is in the Business Development department at eLynx Technologies in Denver. He holds a degree in Business Marketing from the University of Colorado at Boulder. Jason is a member of SPE.

Anthony G. Ruedi
Andy is retired and living in Lakewood. He holds a BA in Geology from the University of California and a BS in Business Administration from Regis University.

J. Frederick Sarg
Rick is a research professor for the Colorado Energy Research Institute at the Colorado School of Mines. He holds a BS and MS in Geology from the University of Pittsburgh and a PhD in Geology from the University of Wisconsin at Madison. Rick is a member of AAPG and SEPM.

Anthony J. Skeryanc
Tony is Division Geologist-Unconventional Resources Division for Pogo Producing Company in Houston. He holds a BS in Geology from the University of Texas at Arlington and an MS in Geology from the University of New Mexico. Tony is a member of AAPG and SEG.

Bruce H. Wiley
Bruce is Principal Geologist at ConocoPhillips in Denver. He holds a BA in Geological Sciences from Middlebury College and an MS in Geology from the University of Washington. Bruce is a member of AAPG and SEG.

Kevin Wright
Kevin is a processing manager for Fairfield Industries in Denver. He holds a BS in Geology from Southern Illinois University.

Karen B. Tomanek
Karen is a staff geologist with Ellora Energy in Boulder. She holds a BS in Geology from Winona State University.▼

of Mines as well as a Masters in Divinity from the University of the South in Sewanee, Tennessee.

Sam Holt
Sam is Rocky Mountain Regional Manager for Fairfield Industries in Denver. He holds a BS in Mathematics from Louisiana Tech.

Steen A. Jergensen
Steen is a geological engineer with Newfield Exploration in Denver. He holds a BS in Geological Engineering from the Colorado School of Mines. Steen is a member of AAPG.

Margaret Johnson
Margaret is Data Logic Solutions & Log Services Account Manager with IHS in Houston. Margaret is a member of HGS, SUT, and MTS.

Glenn R. McCaslin
Glenn is a mudlogger/geologist for Pason Systems USA in Golden. He holds a BA in Geology from Southern Oregon University. Glenn is a member of AAPG and SEG.

Raymond S. McCleery
Scott is a senior geologist with Petroleum Development Corporation in Bridgeport, West Virginia. He holds a BS in Geology from the University of Pittsburg and an MS in Geology from the University of New Orleans. Scott is a member of AAPG.

James Reese McKay
Reese is a professional land surveyor for Fransen Pittman in Englewood. He holds a BS in Geology from Northeast Louisiana University. Reese is a member of ACSM and PLSC.

Joe F. Meglin
Joe is a senior geologist with Samson Resources in Tulsa. He holds a BS in Geology from Colorado State University at Pueblo and an MS in Geology from the University of Oklahoma. Joe is a member of AAPG.

Simon A.J. Pattison
Simon is an associate professor in the Department of Geology at Brandon University in Brandon, Canada.
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Gather all project data automatically for copies and backups. Convert the database during copy, too!

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Create and save queries that can operate across all KINGDOM projects, and be available inside KINGDOM itself!

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Relink to centralized seismic data to rid your network of data duplication and confusion. Save storage space!

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3-D SEISMIC "Peak Action"

The RMAG and DGS Present:
13th ANNUAL 3-D SEISMIC SYMPOSIUM
Tuesday, March 6, 2007: Marriott Hotel, Downtown Denver, Colorado

The 2007 symposium features 3-D seismic case histories showing the value of seismic information as well as the latest acquisition, interpretation, and imaging techniques. Experience the latest in 3-D technology during your breaks in the expanded vendor area next to the main ballroom. Attendance last year: 600

Keynote Speakers: Colin Bruce, BP North American Gas and Jim Hollis, VP New Ventures, Input/Output, Inc.
“BP’s World-Record Seismic Program Near Wamsuttur, Wyoming”

Kickoff Speaker: Bob A. Hardage – Senior Research Scientist, Texas Bureau of Economic Geology:
“Seismic Technologies for Independents & Unconventional Resources”

Twelve Talks Including:
- Vermillion Basin Structural Style & Pore Pressure Prediction – SW Wyoming / NW Colorado
- Integrated Fracture Analysis – 3-D Seismic Attributes – Natural Buttes Field, Utah
- Renaissance at Rulison Field – Visualization of 9C-4D Seismic with Borehole Microseismic Data
- Barnett Shale Fracture Illumination/Stress Orientation from 3-D Volumetric Curvature Analysis
- High Resolution 3-D Seismic for EOR CO2 Flood at Salt Creek Field, Wyoming
- Cost Effective 3-D Seismic for Shallow Gas Structures – North Central Montana
- 3-D Attributes for Fracture Trends in Mid Continent Miss. Carbonate Reservoirs, Kansas
- Modern 3-D Seismic Technologies in the mature San Juan Basin, New Mexico
- Fracture Lineaments Calibrated to Volumetric Curvature, Canadian Rockies Foothills, BC

Sponsorship Opportunities and Exhibit Space is Available
Find updated information at www.rmag.org or www.denvergeo.org

REGISTRATION FORM

Name: __________________________ Name Tag: __________________________

Company: __________________________ Email: __________________________

Address: __________________________

City: __________________________ State: __________ Zip: __________ Day Phone: __________

___Registration fee THROUGH February 16th for RMAG/DGS Members:--------- $140.00 $____

___Registration fee THROUGH February 16th for Non-Members:------------------$165.00 $____

___Registration fee AFTER February 16th for BOTH Members & Non-Members:-----$185.00 $____

___Full-Time Student Registration:---------------------------------------------------------- $ 40.00 $____

Student ID Number (required)

(No cancellations or refunds after February 16, 2007) Total Enclosed $____

Payment: [ ] Check (payable to RMAG) [ ] Visa [ ] MasterCard

Name on Credit Card (Print): __________________________ Expiration Date: __________

Card No.: __________________________ Zip Code of Billing Address: __________________

Signature (credit cards only) __________________________

Mail or FAX this registration form to:
RMAG * 820 16th St., Ste. 505 * Denver, CO 80202 * 303-573-8621 * FAX: 303-628-0546

For Online Registration: http://www.rmag.org

If you register online you must receive a confirmation notice by return email within 24 hours or your registration was not accepted by our computer. Please call RMAG to register (303-573-8621).
SEGM/EAGE DISTINGUISHED INSTRUCTOR SHORT COURSE

Concepts and Applications in 3D Seismic Imaging

By Dr. Biondo Biondi

Denver, CO – May 4, 2007

Colorado School of Mines
Metals Hall
The Green Center
1500 Illinois Street
Golden, Colorado 80401

Presentation: 8:00 am – 5:00 pm
Registration: 7:30 am

Important: Please complete a separate form for each registrant

Name _____________________________________________

Company Name _______________________________________

Street Address _________________________________________

City, State, Zip ________________________ Country________

Phone ___________________________ Fax ___________________________

Email _______________________________________________________

SEG Member/Student Member □Yes □No DGS Member/Student Member □Yes □No

If available-SEG Member ID# ____________________________

Cost: (Check ONE)
□ Member of BOTH SEG and DGS ……. $110.00   □ Student Member of BOTH SEG and DGS…. $ 10.00
□ Member of SEG only……………….. $134.00   □ Student Member of SEG only ………………. $ 15.00
□ Member of DGS only………………. $185.00  □ Student Member of DGS only ………………. $ 10.00
□ Member of neither SEG nor DGS…… $ 209.00 □ Student Member of neither SEG nor DGS… $ 15.00

* If you paid the non-DGS member DISC rate, a DGS membership form will be available for you to complete.

If you paid the non-SEG member DISC rate, SEG will mail you a paid membership application after the DISC presentation.

SEG Student membership dues provided for by Halliburton Energy Services, Inc.

Lunch is included with the course

AMOUNT ENCLOSED: $_________________

Make checks payable to Denver Geophysical Society. Please, DO NOT send cash.

Payment by credit card: CARD:   ______ MasterCard       ______ Visa     ______ American Express

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Attn: Fran Leestma
7144 E. Warren Drive
Denver, Colorado 80224-2531

Telephone: 303-757-2942
Fax: 303-755-9791
Email: dgs@denvergeo.org

For information visit the DGS website at: www.denvergeo.org

REGISTRATION INFORMATION

To pre-register, the completed registration form must be received at the address noted no later than April 18, 2007

The registration fee includes course materials, continental breakfast, lunch, and break refreshments. Participants are responsible for their own hotel and travel arrangements. Payment of the tuition for the program is to be made in advance. Registration is on a first-come, first-served basis. This course has a maximum class size limit; early registration is urged. If the course is fully subscribed at the time your registration is received, you will be notified and placed on a waiting list as an alternate. On-site registration is discouraged due to class size restrictions, but will be provided on a space-available basis.
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2007 AAPG ROCKY MOUNTAIN SECTION MEETING

Rocky Mountain Rendezvous
Snowbird, Utah
October 7-9, 2007

Abstract Deadline:
April 20, 2007
www.utahgeology.org/RMS-AAPG.htm

Technical Program
Oral, Poster, and Poster/Core sessions

- Rockies Oil and Gas Plays
- Advances in Sed/Strat
- Geophysical and Structural Advances
- Completion/Development Advances
- Shale gas
- CBM exploration and development
- Environmental and Regulatory

Short Courses
Oct. 6: Depositional Environments, Diagenesis, and Hydrothermal Alteration in the Mississippian Leadville Formation, Paradox Basin, Utah.
Inst.: David Eby and Thomas Chidsey

Inst.: Robert Bereskin

Field Trips
Oct. 6-7: Structural Geology of the Central Utah Fold-Thrust Belt.
Leader: Daniel Schelling

Oct. 7: Uplift and Evolution of the Central Wasatch Range, Utah.
Leader: Daniel Horns

Oct. 10-12: Classic Geology and Reservoir Characterization Studies of Central Utah.
Leaders: Tom Morris, Craig Morgan, Scott Ritter, Marc Eckels

Contact Information:

Technical Program Co-Chairs:
David Lambert
geologydave@gmail.com
801-953-3373

or
Rich Newhart
richard.newhart@questar.com
801-324-2090

General Chair:
Paul Anderson
paul@pbageo.com
801-364-6613

Meeting website:
www.utahgeology.org/
RMS-AAPG.htm

Field Trip Chair:
Brad Hill
bradhill@utah.gov
801-538-5315

Short Course Chair:
Mike Laine
michaellaine@utah.gov
801-537-3359
Short Courses

Seismic Interpretation in Fold- and Thrust- Belts Using Fault-Related Folding Techniques
Date: May 21-24, 2007
Location: Houston, Texas
Tuition: $995, AAPG members; $1,095, non-members (increases to $1095/1195 after 4/23/07), includes course notes and refreshments
Content: 2.8 CEU
Instructor: Professor John H. Shaw, Harvard University, Cambridge, MA
Who Should Attend
This course is intended to assist E&P professionals involved in the interpretation of seismic reflection data for trap delineation and reservoir characterization in both orogenic and passive margin fold-and-thrust belts. The course should also be a useful for supervisors who evaluate structural interpretations to assign and reduce drilling risks.

May Education Opportunities with AAPG!!

Field Seminars

Complex Carbonates Reservoirs: The Role of Fracturing, Facies and Tectonics
Leaders: Raffaele Di Cuia, G.E.Plan Consulting (Italy); Claudio Turri, Total S.A. (France), Davide Casabianca BP plc (UK)
Dates: May 19-25, 2007
Location: Begins in Naples and ends in Rome (Italy)
Tuition: $2,800.00 (increases to $2900.00 after 4/06/07); includes guidebooks, transportation expenses during the field seminar, all meals during the course.
Limit: 15
Content: 4.2 CEU
Who Should Attend
Petroleum/exploration geologists and geophysicists who are involved in interpreting carbonate sequences/ reservoirs in sub-thrust and thrust belts; reservoir geologists and engineers that deal with the 3D characterization and distribution, at reservoir scale, of carbonate facies and fracture/faults.

Controls On Porosity Types and Distribution in Carbonate Reservoirs
Leaders: Evan K. Franseen, Kansas Geological Survey, Lawrence, KS; Robert H. Goldstein, University of Kansas, Lawrence, KS; Mateu Esteban, REPSOL-YPF, Mallorca, Spain
Dates: May 20-25, 2007
Location: Almeria Region, SE Spain, begins and ends in Las Negras, Spain. Fly from London/Barcelona/Madrid
Tuition: $2,500 USD, dependent on exchange rate (increases to $2,600 after 4/06/07), includes field transportation, all meals and lodging during trip, guidebook
Limit: 15
Content: 4.8 CEU
Who Should Attend
Petroleum geologists, engineers, and geophysicists who are involved in interpreting carbonate sequences.

Modern Terrigenous Clastic Depositional Systems
Leader: Walter J. Sexton, Athena Technologies, Inc., Columbia, South Carolina
Dates: April 13-20; May 12-19; September 22-29, 2007
Location: Begins in Columbia and ends in Charleston, South Carolina
Tuition: $2,500 (increases to $2600 one month prior to each start date), includes ground transportation to Charleston, water transportation, guidebook, beach cookout, modern core workshop, lunch on the fluvial day, and CD-ROM
Limit: 27
Content: 5.6 CEU
Who Should Attend
Geoscientists and engineers who need to understand the sedimentology, facies architecture, and sequence stratigraphy of modern terrigenous clastic depositional systems in tidal estuarine, incised valley, shelf, shoreface barrier island, fluvial and alluvial environments.

For further information, please contact the AAPG Education Department
Phone: 918-560-2650; Fax: 918-560-2678; e-mail: educate@aapg.org
Or log on to www.aapg.org/education/index.cfm
The RMAG Professional Awards Committee is seeking a few new members. This committee has the unique task of identifying geoscientists and others who deserve to be recognized for their contributions to the geosciences, human needs, education, public service, and journalism, and then to annually recommend to AAPG and RMAG the candidates who deserve recognition. If you are interested in serving on this committee, please contact Tricia Beaver, Committee Chair at tricia.beaver@state.co.us or (303) 894-2100 ext. 115.

In addition, the RMAG Professional Awards Committee is seeking nominee suggestions for the AAPG Honors and Awards to be presented at the 2008 AAPG Annual Convention. The following categories with brief descriptions are provided to assist RMAG members in recommending candidates to our committee. Please contact Tricia Beaver, Committee Chair at tricia.beaver@state.co.us or (303) 894-2100 ext. 115 or with any ideas. Thanks for your thoughtful input in nominating those who deserve recognition.

**AAPG Honors and Awards**

**Sidney Powers Memorial Award**

The Sidney Powers Memorial Award is a gold medal given in recognition of distinguished and outstanding contributions to, or achievements in, petroleum geology.

**Honorary Members**

Honorary membership is bestowed upon persons who have distinguished themselves by their service and devotion to the science and profession of petroleum geology and the Association.

**Michel T. Halbouty Human Needs Award**

The Michel T. Halbouty Human Needs Award is given each year by the Association as an exceptionally high honor to an individual for the most outstanding application of geology to the benefit of human needs, and to recognize scientific excellence.

**Outstanding Explorer Award**

The Outstanding Explorer Award is given in recognition of distinguished and outstanding achievement in exploration for petroleum or mineral resources, by members who have shown a consistent pattern of exploratory success, and with an intended emphasis on recent discovery.

**Distinguished Educator Award**

The Distinguished Educator Award is given to recognize distinguished and outstanding contributions to geological education including, but not limited to, teaching and counseling of students at the university level. Funded by Dr. and Mrs. Grover Murray, this award can also be given for education of the public and management of educational programs.

**Special Awards**

Awards are given when, in the Executive Committee’s judgment, persons are deserving of recognition for some outstanding accomplishment which does not otherwise qualify for existing honors or awards.

**Public Service Award**

The Public Service Award is a walnut plaque bearing the recipient’s name, the date, and citation. It is given to recognize contributions of members to public affairs and to encourage geologists to take a more active part in public affairs.

**Pioneer Award**

The Pioneer Award is given to long-standing members who have contributed to the Association and who have made meaningful and significant contributions to the science of geology.

**Distinguished Service Award**

The Distinguished Service Award is a walnut plaque that is presented annually to those who have distinguished themselves in service to AAPG.

**Journalism Award**

The Journalism Award is given to any suitable person in recognition of notable journalistic achievement in communications by any medium that contributes to public understanding of geology and the technology of oil and gas exploration. The award is a walnut plaque bearing the words, “For notable journalistic achievement in communications contributing to public understanding of geology.” The recipient need not be a member of the Association.
In 2000, the RMAG Foundation instituted an award to honor teachers who have promoted "Excellence in Teaching of Earth Science" to elementary or secondary school students. The recipient receives a commemorative plaque and a $500 cash award, provided by the RMAG Foundation. The award honors the best earth science teachers in the Front Range area from either an elementary or secondary school. If you are a teacher or have a teacher in mind that you would like to nominate, contact the Popular Geology Committee through the RMAG office at 820 16th Street, Suite 505, Denver, CO 80202, by telephone at 303-573-8621, or email at admin@rmag.org to receive an application form. The application deadline this year is April 20th, with the winner to be announced on or before May 17th.
## GEO-CALENDAR

**March 2007**

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<tr>
<th>SUNDAY</th>
<th>MONDAY</th>
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<td>13th Annual 3-D Seismic Symposium</td>
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<td>AAPG Education</td>
<td>13 Desk &amp; Derrick Meeting</td>
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<td>18</td>
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<td>20 DWLS Luncheon</td>
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