U.S. Geological Survey

The Geologic Division Retirees Newsletter

Some of the Survey lunar sample investigators, 1969

Number 78 **Winter, 2020**

An organization of retirees of the Geologic Division, U.S. Geological Survey, who seek to keep in touch with each other and with their former Agency.

Officers

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President	Susan Russell-Robinson		
Vice-President	John Keith	703-648-4384	jkeith@usgs.gov
Secretary-Treasurer	Jim McNeal	703-648-6650	jmcneal@usgs.gov
Regional Officers			
East	John Keith	703-648-4384	jkeith@usgs.gov
Central	Marith Reheis		
Western	Patrick Muffler	650-329-5239	pmuffler@usgs.gov
Newsletter			
General Dogsbody	John Keith	703-648-4384	
Editor Emeritus	Bill Outerbridge		
Production	Dave Newman		
Directory Coordinator	Jim McNeal	703-648-6650	jmcneal@usgs.gov
References	Bob Tilling		rtilling@usgs.gov

Mailing Address
Geologic Division Retirees
U.S. Geological Survey
953 National Center
Reston, VA 20192

Email Addresses
gdretirees@gmail.com

About the Cover:

Posed in front the GSA Building in Washington, this group awaits their first lunar samples from NASA; first row, left to right--Mac Ross, Howard Evans, Harry Rose, Odette James, Ed Chao, Armin Helz; back row--Frank Cuttitta, Charles Annell, Ed Dwornik, Dave Stewart. Bob Smith, Steve Huebner.

From the President

I hope you all will read and enjoy the excellent write-up about Helen Foster, who turned 100 years old in 2019. Cynthia Dusel-Bacon highlights so many of Helen's accomplishments. During the spring of 2019, I was asked to provide photographs of USGS employees who were involved with investigating the rock samples collected during the historic Apollo 11 Mission – the landing on the moon on July 20, 1969. This was a nostalgic activity for me, as I have such vivid memories from the summer of 1969. That was the summer I first rode in an airplane, from Idlewild (JFK) to LAX. It was the first time I lived in a city, Santa Monica, staying with my mother's cousin and his family. It was the first time I watched color tv on a daily basis. It was also when I watched the moon landing with Cousin Eddie, who worked on installing tracking stations in Japan, Alaska, Greenland, and East Africa for the NASA program. He had great stories to tell about meeting Buzz Aldrin and Neil Armstrong while they were on a training mission. His stories made watching the walk on the moon's surface all the more interesting. Six years later, when I interviewed for a job with Bob (Robert L.) Smith, somehow or other we ended up discussing lunar rocks. Bob was interested in the story I shared about tracking stations. I was blown away by his story about the difficulty the lunar rock team had in trying to identify the "crusty" samples, viewing them through "port holes" into a sterile chamber. After three days, the team finally convinced the NASA officials to suit up Bob and allow him to break open a sample using a pick and hammer. After hefting the sample a few times, Bob hit it with a hammer. The specimen split exactly in half to reveal a sparkly interior. Four years ago, following Bob's passing a few days before he turned 96, I worked with the National Park Service on sorting and transferring his Jemez Mountains, N.M., collection to the Valles Caldera National Preserve. In one of the filing cabinets, I found Bob's Apollo 11 folders, which included several photographs of that lunar rock team. One of Bob's sons became custodian of the Apollo files. I was able to get digital copies to pass along to the USGS library. Many of the oldest members of our retiree organization (there are more than 40 in their 90s) were not only witnesses to history, but they made significant scientific discoveries. This newsletter is a great place to share that USGS legacy. Please submit articles or stories to John Keith at his email (jkeith@usgs.gov) or the postal address listed on the newsletter masthead.

Susan Russell-Robinson

Treasurer's Report

Treasurer's Report and Membership Statistics

This report summarizes the financial situation of the Geologic Division retirees as of the end of 2019. We published one Newsletter and one Directory. Expenses in 2019 exceeded income by $203.42. At this rate, we are maintaining a surplus that is sufficient so that we will not need to raise dues for several more years.

Net Worth, January 1, 2018		**8524.17**
2018 Income		
Dues & Donations	1592.00	
Total Income	1592.00	
2019 Expenses		
Newsletters & Directory	1795.42	
Total Expenses	1795.42	
Total Assets, December 31, 2019		**8320.75**

Note:

The 2020 Directory will be sent out with this Newsletter. Dues notices will be sent separately. Please check your information in the Directory and send any corrections on your returned dues statement. Also, donations to the GD Retirees are tax-exempt.

Membership Statistics:

At the end of 2019, we had 326 members. Those who have not paid dues since 2016 were dropped from the active membership list. About 65 members were USGS Emeritus geologists. The number of members has dropped steadily from the peak in 2000. The number of members for some past years follows (for the end of the calendar year):

2000 – 700	2010 – 453	2016 – 382	2018 – 332
2005 – 555	2015 – 398	2017 – 360	2019 – 326

Jim McNeal

New Members

Klaus Schultz
Carolyn Harrison

Appreciation to Kathleen Gohn:

For the past four years, Kathleen has contributed substantially to writing and editing of the Newsletter. As she moves on to other projects, we are all indebted to her for her great editing skill and dedication to our publication. Thanks, Kathleen!

This is also a good place to include a story from Bill Outerbridge. When Kathleen agreed to work on the GDR News, I related that to Bill, the retiring editor. He said, "That's great, she is a very good editor." I replied that I did not realize he knew her. He responded, "Oh yes, when she was new to the Survey, she was assigned one of my manuscripts. When she finished her editing, she returned my draft with no changes, so I knew she was an excellent editor!" (see Bill's memorial in this issue).

John Keith

Essays, Anecdotes, and History

CONGRATULATION TO HELEN FOSTER ON TURNING 100!

Cynthia Dusel-Bacon, USGS Geologist Emerita

Dr. Helen Laura Foster, retired USGS Research Geologist, celebrated her 100th birthday on December 15, 2019. Helen's 38-year career with the USGS was characterized by adventurous and productive geologic experiences in Japan and Alaska. Throughout her pioneering career, she showed fierce independence, competence, and enormous productivity, leaving a legacy of 173 articles, maps, reports, and abstracts. For more details about Helen's fascinating life, I refer readers to a 12-page, photo-rich article about her in Anomalies: Pioneering Women in Petroleum Geology 1917-2017 by Robbie Rice Gries.

Helen currently resides in her home in Carson City, Nevada, where she has lived since retiring from the Alaska Branch of the USGS in Menlo Park, California, in 1986. Her mind remains sharp and she strives to be as independent as possible, recently telling me that she planned to drive the 130 miles round-trip to Yerington, Nevada, in order to visit her preferred dentist, rather than seeing one locally.

Helen was born in Adrian, Michigan. Her childhood included lots of camping trips in her family's homemade camper, which resulted in an early love of nature. Her father died near the end of the Great Depression leaving her family with limited financial resources. Helen landed a scholarship to the University of Michigan and covered her expenses by working odd jobs. Helen was hooked on geology after the first two weeks in class and was able to cajole a geology professor into allowing her into the geology field camp in Wyoming in the spring of 1939.

Upon completion of her bachelor's degree, Helen taught for a year to earn money for graduate school and returned to the University of Michigan in 1942. One day, the chairman of the Geology Department, Dr. K.K. Landis, for whom Helen was working, asked what she thought about his idea to solve the difficulty in maintaining the department's normal activities, including field trips and field camps, owing to male student's participation in the war, and the urgent need for petroleum products in the war effort. His suggestion was to offer a concentrated program in petroleum geology, primarily for women. In the spring of 1943, nine women began Landis' program that included 12 weeks of fieldwork at Camp Davis, Wyoming. All nine women finished the program and received certificates in February 1944.

Helen completed her Masters and Ph.D. degrees by 1946. After teaching for a year and a half at Wellesley, an opportunity came up for Helen to join the Military Geology Branch of the USGS. In April 1948, Foster was en route from California to Tokyo, island hopping in a Military Air Transport DC 4, seated with other G.I. passengers on a canvas bench along the side of the fuselage.

In addition to working on the M 7.1 Fukui earthquake, which struck Japan shortly after her arrival, much of Helen's first year was spent visiting universities throughout the country consulting with

Japanese professors and compiling scientific literature and data on the geology of the formerly Japanese mandated islands. After a year, Helen agreed to continue with the Military Geology Branch in Japan on the condition that she be allowed to have a field geology project of her own: mapping the ash deposits from Mount Fuji. On weekends she climbed and observed volcanoes all over Japan.

Many weekends, Helen boarded a small ship for the island of Oshima, south of Japan, in order to photograph and observe the Mihara Yama volcano (Foster and Mason, 1955 GSAB). Helen was intrigued and excited when the volcano erupted and poured hot, glowing lava over the sides of the crater and hurled volcanic bombs at her—one of many instances in which Helen risked danger in order to make geologic observations. Japanese geologists were quick to recognize Helen's genuine interest in their work and the geology of Japan and treated her as an honored guest on field trips and meetings of the Geologic Society of Japan. A photo in the Anomalies article shows Helen front and center—where the eldest and most distinguished geologists always sat—in a large group photo at one of the Annual Meetings of the Geological Society of Japan in the early 1950s. At the time, Japanese universities and governmental agencies included no female professional geologists. Helen thinks that she likely had an effect in changing that situation; two women received their PhD's in geology while Helen was in Japan.

Foster experienced many other adventures in Japan while working for the USGS in 1948 to 1957. In 1952, after a military plane reported seeing a large area of discolored water south of Tokyo near the Izu Islands, Helen accompanied Sherman Neuschel, Chief of the USGS Pacific Island Mapping Program, when they flew out (in one of Gen. MacArthur's special planes) to investigate the site. As expected, they discovered that the discolored area was composed of pumice floating above an erupting submarine volcano, later to become known as Myojin-sho. What they hadn't anticipated was that, to their horror, the pilot disobeyed their instructions and flew directly over the area of pumice. They were fortunate to complete the flight without incident, but later that same day a massive eruption destroyed the ship and killed all the passengers on a vessel of the Japanese Hydrologic department.

Helen was given another challenging assignment when she became Chief of the Ishigaki field party on one of the islands in the Ryukyu chain (Foster, 1965 USGS Prof. Paper). The island was infested with a largely nocturnal poisonous snake for which there was no antivenin, as well as a well-camouflaged, fist-sized moth that caused a painful reaction if touched. Aware of the dangers, and true to form, Helen relished the adventure. One day while mapping in the jungle, Helen and her young 16-year-old Japanese assistant became lost and didn't make it back to their jeep before nightfall. A search group with lighted torches found the two women and led them back to the village. In Anomalies, Gries writes, "Helen said she had not been frightened, only excited that she had fulfilled another dream—that of seeing the jungle at night with its many phosphorescent insects and other phosphorescent inhabitants."

Helen experienced another unusual adventure at the end of the 1957 Pacific Science Congress in Bangkok when she joined a geologic field trip along the Mai Ping River in Thailand to examine rocks that would soon be inundated by a new dam. After flying north to Ching Mai, rafts were constructed out of bamboo that would be disassembled and sold at the end of the trip. In addition to two pole men, two people sat on the front of the raft and two were in the back, separated by a thatched roofed shelter, all just barely above water level. Adjacent to the shelter was a narrow walkway that contained a small enclosed hole that served as a toilet. Helen and the wife of an oceanographer were the only women on the trip. Helen

remembers the water of the Mai Ping River being extremely filthy with dead animals occasionally floating by. Most of time the rafts floated leisurely, but on a couple of exciting rapids, the passengers held their breath as the chickens squawked and pans rattled as the cook raft careened past the rocks. Occasionally, indigenous people along the river would beg the boat people for malaria medicine, offering to provide live snakes, or snakeskin belts and trinkets in exchange. When they camped at night, guards were posted to watch for tigers. In addition to animal dangers, there also was concern about human dangers as they were near the unsecured northern border of Thailand.

While in Japan, Helen met and became friends with Japanese people in many parts of the country and many walks of life: from Japanese schoolboys to Emperor Hirohito himself. An opportunity to possibly meet the Emperor came when Dr. K.O. Emery from the University of Southern California visited Tokyo and offered to show his newly completed first underwater scientific marine movie film to the Emperor, a marine scientist himself. The Emperor so enjoyed the film that he invited Dr. Emery and members of Helen's office to visit the palace and tour the grounds. At the last minute, the Emperor had a conflict and the group didn't see him, but they enjoyed a detailed visit of the palace grounds. Helen was most impressed by the Emperor's scientific laboratory with a beautiful, custom-made Nikon microscope and his laboratory notebooks. Helen later met the Emperor in person when she accompanied Professor Hisashi Kuno of Tokyo University to a ceremony where he received an award from the Emperor. Helen found the Emperor to be very friendly, down-to-earth, and interested in understanding Kuno's work.

After returning to the States in 1959, Helen was stationed in Washington DC, where she completed reports on her activities while in the Military Geology Branch in Japan, including an article in the AAPG Bulletin on the status of petroleum in Japan. A year later, Helen joined the Alaska Terrain and Permafrost Section of the Military Geology Branch of the USGS and began her 26-year geologic career mapping and studying the geology of Alaska. At first, she did fieldwork and map preparation for the Army Winter Maneuvers, along with reconnaissance geologic mapping. In 1965, Helen transferred to the Branch of Alaskan Geology in Menlo Park, California, and began mapping the geology of four 1° x 3° quadrangles in the vast Yukon-Tanana Upland of east-central Alaska for the Mineral Resources Program. The terrain and the geology posed many challenges, including its remoteness that required both helicopter-assisted fieldwork and remote backpacking. In addition, the rocks were poorly exposed and primarily consisted of multiply deformed and metamorphosed, undated metaigneous and metasedimentary rocks. In 1994, Foster synthesized the complex geology and mineral resource potential of east-central Alaska in a chapter of The Geology of North America, published by GSA.

It was my good fortune to have the experience of geologic mapping for one of the quadrangles (Big Delta) as Helen's field assistant from 1975 to 1977. Thus, began my own deep interest in the regional geology, petrology, and tectonics of east-central Alaska that was to last through 2014, when I retired, and the following 5 years and counting as an emerita research geologist. Helen's always accurate, objective and physically hard-earned maps have formed the basis for two generations of subsequent topical studies.

The two most obvious physical risks posed in conducting Alaskan fieldwork are bears and aircraft accidents. I know the risk of bears only too well, having lost both my arms as a result of a black bear mauling in 1977 while mapping in the Big Delta quadrangle. Both before and after my accident, Helen had many bear encounters, but fortunately they all ended without incident. A story that Helen recounted to me when I was first hired was how she had encountered two black bear cubs and quickly

discovered that the mama bear was bearing down on her. Having just unloaded her pack in order to make a quick foray to a distant outcrop, Helen thought to grab a can of boot grease and throw it at the bear, luckily hitting it on the nose. The bear gave a disgusted snort, gathered the cubs, and disappeared into the brush. Much later, in 1985, while doing a traverse on a ridge rich with ripe blueberries, a large grizzly approached Helen and continued to come closer and closer. Helen got on the radio to call the helicopter pilot to pick her up immediately. The bear circled Helen at a distance of about 15 feet while Helen held her backpack in front of her and talked to the bear calmly. Finally, the helicopter arrived and scared the bear away.

In the mid-50s, a near disastrous aviation accident occurred when Helen was making spot landings in an Army H-21 helicopter (flying banana) in brushy and marshy terrain with scattered trees. Because of the large size of the helicopter and the nature of the terrain, suitable landing spots near outcrops were few and far between. Helen indicated to the pilot the outcrop that she wanted to examine and the pilot chose a landing spot, started to land, but then picked up, saying that he could get them closer to the outcrop—not an uncommon, but often unwise, action on the part of helicopter pilots. In so doing, the pilot hit a tree and the helicopter made a hard landing. The wooden rotor blades shattered into flying projectiles, one of which came through the fuselage and landed just above Helen's assistant's head. Fortunately, no one was injured and the accident occurred just a few miles from the gravel road leading to Dawson across the Canadian border. Because Helen and her assistant knew the area well, it was decided that they would hike to the road. However, after further discussion the crew decided that it would not look good if two women walked out to get help while all the men waited at the helicopter, so the unenthusiastic copilot was sent to push his way through the brush with the ladies.

Helen's most serious, near disastrous aviation experience occurred at the end of the 1969 Alaska field season. She and her field assistant, Jo Laird (now Professor of Geology at the University of New Hampshire), had been dropped off by a Super Cub, piloted by Marvin Warbelow, on a gravel bar in the middle of the Middle Fork of the Fortymile River in the Eagle quadrangle. The women spent six miserable days trying to do geology in the rain and snow. They managed to make it to another gravel bar on the Fortymile River where Marvin was to meet them with fresh supplies. When they reached that gravel bar, they were dismayed to see that it was in the middle of the river. They waded out to the gravel bar and awaited the plane, shivering in their wet clothes in the snow. After Marvin landed, it was decided that, due to the miserable weather, rather than being resupplied, they would fly out of the area. It began to snow heavily again as Marvin made three attempts to get the Super Cub into the air, but on the third attempt instead of lifting off, the plane settled into the river at the end of the gravel bar and water rushed into the plane.

The trio made multiple trips in the freezing cold water of the Fortymile River to unload the plane and eventually to get it up on shore. Between forays, they attempted to warm up beside a roaring fire. Late in the afternoon after drying out, and taking a minimum of gear, they began a two-day hike to the village of Chicken on the Taylor Highway. After slogging along the river and up ridges, the group finally climbed a mountain ridge in a snowstorm. After orienting herself on a map, Helen led the group along the ridge and down to finally reach the shelter of a small cabin in a mining camp, closed for the year. The next morning, they were finally hiking on a trail to the Chicken airstrip, and from there were flown to the town of Tok. Tragically, Marvin Warbelow died a few months after this incident because of injuries that occurred from an explosion while he was painting his plane. His death represented a huge loss to the Native communities across Alaska where he had taught in the Eskimo and

Indian villages and flown the sick and injured to hospitals. In his honor, Helen saw that the rugged mountain that the trio had ascended in the snowstorm was officially named Mt. Warbelow.

Fast-forward 46 years to 2015 and Helen Foster, now age 96, joined a dozen people on an expedition, organized by Warbelow's children, to visit Mt. Warbelow. The expedition involved riding in ATVs, camping in dilapidated cabins, and hiking the final stretch across huge boulders to the top of the mountain. There can be no doubt that, once tough, always tough, in the case of this amazing woman.

USGS Releases Estimates for Global Undiscovered Copper Resources

Jane Hammarstrom

The U.S. Geological Survey completed the first global assessment of undiscovered copper resources for the two most significant global-mined-geologic sources of copper. Results indicate that a mean of at least 3.5 billion metric tons of undiscovered copper may exist worldwide, exceeding the 2.1 billion metric tons of already identified copper resources. The estimated mean of 3.5 billion metric tons of undiscovered copper resources represents about six times the amount of copper (600 million metric tons) produced from all types of deposits over a span of more than 100 years. In comparison, identified world copper reserves are on the order of 680–700 million metric tons. U.S. consumption is 2 million metric tons of copper per year whereas world consumption is about 20 million metric tons per year.

The study represents the first globally consistent and comprehensive analysis of copper from the two types of copper deposits (porphyry copper deposits and sediment-hosted stratabound copper deposits) that together account for about 80 percent of the world's mined copper. South America and Africa are the main sources for both identified and undiscovered copper resources of these two types, respectively. A simple economic filter was applied to the quantitative porphyry copper assessment results to address the question of what portion of in-place undiscovered porphyry copper resources might be economic. The economic filter applies assumptions about metal prices, mining methods, capital costs, recovery rates, mining depth, and availability of infrastructure. Estimates of the amount of undiscovered in-place porphyry copper resources that may be economic based on these assumptions range from none for some tracts to about 80 percent for other tracts, with an average of 50 percent.

The world has sufficient copper to last for decades. However, increases in exploration and growth in mining capacity will be necessary to identify and develop undiscovered resources to supply projected demand. Results of this study provide a regional and global context for evaluating copper resources; planning for future sources of copper; anticipating the economic, environmental, and social effects of copper mine development; and making land-use decisions. The USGS Global Copper Assessment was completed in cooperation with numerous international collaborators from national geological surveys, industry, and academia. The USGS is the principal Federal provider of research and information on nonfuel mineral resources. Supporting studies, including documentation of the assessment methodology, descriptions of individual tracts, and spatial data for use in geographic information systems (GIS) are available from the USGS Mineral Resources Program. Information on production and consumption of copper as well as general information about copper is available from the USGS. The report is *Assessment of Undiscovered Copper Resources of the World*, 2015, SIR 2018-5160, 236 pages, published 2019, by Jane Hammarstrom, Michael Zientek, Heather L. Parks, Connie Dicken, and the Global Copper Mineral Resource Assessment Team.

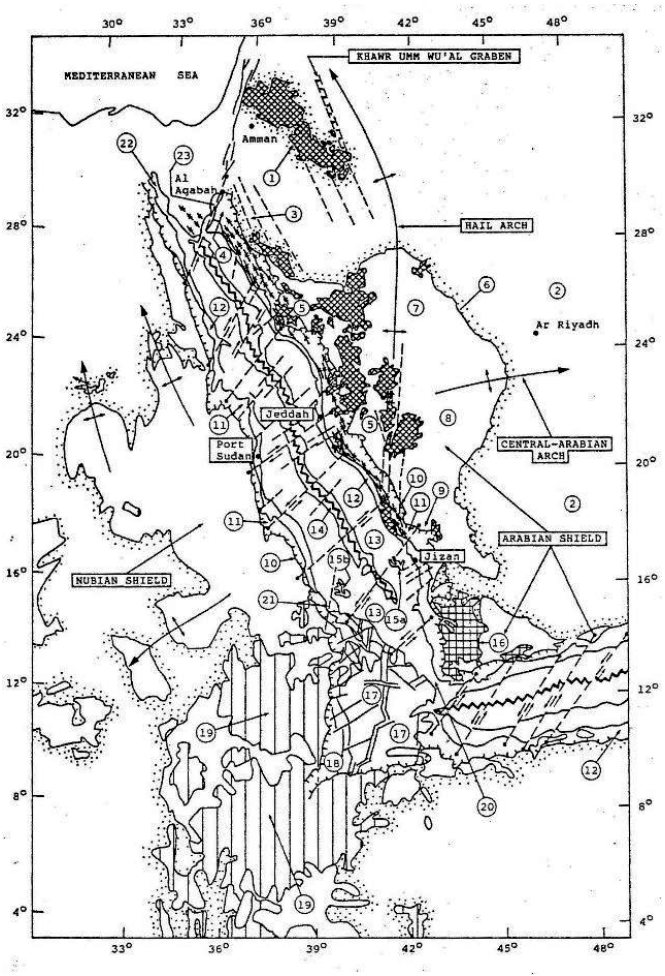
The USGS and My Saudi Arabian Tours
1970 – 1976 and 1978 – 1995
Part II

Don Hadley

Central and Southern Shield Fieldwork

I mapped one 1:100,000-scale quadrangle (Juqjuq) in the central part of the shield and nine in the southern coastal plain, two of these mapped in reconnaissance with Bob Fleck. In addition, Bob and I conducted a rubidium-strontium transect of the central Arabian Shield. As a part of this work, Ralph Roberts asked me to assess the geologic formation of the ore host rocks at Mahd adh Dhahab (thought to be the source of King Solomon's gold), with the possibility of discovering other potential ore deposits like this one.

At the time, the USGS was conducting a drilling and sampling program at the ancient mine site by Ron Worl, Ralph Roberts, Bob Luce, Frank Dodge, Charlie Smith, and Abdul Aziz Bahdady. The aerial photograph (p.6 in the previous GDR News) shows the site as it existed in the late 1970s, after the Saudi Arabian Mining Syndicate mining operations ceased in about 1951. USGS work at Mahd ceased after the British group Gold Fields began mining following the dedication of the mine in 1980. The dedication was held by Sheik Ahmed Zaki Yamani, Minister of Petroleum and Mineral Resources. Summing up my work in the Kingdom, I will briefly mention some of the events and situations that might be of interest of those who worked with the Survey Mission in Saudi Arabia.

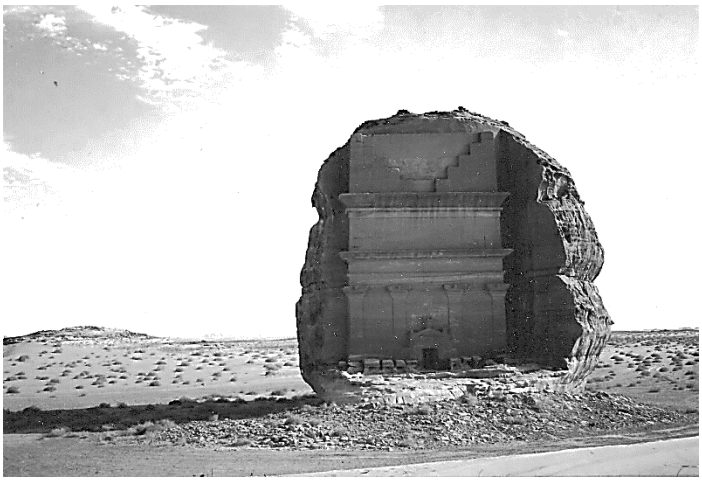


Map of the Red Sea and surrounding countries
showing major geologic features and principal physiographic elements. Physiographic elements are keyed below.

1. Arabian Harrats (basalt fields) (cross ruled)
2. Interior Homocline or Arabian Platform
3. Al Hisma Plateau
4. Median Peninsula
5. Hijaz Province
6. Edge of Arabian-Nubian Shield
7. Northern Najd Province
8. Southern Najd Province
9. Asir Province
10. Escarpments (hachured)
11. Escarpment Mountains Province (blue)
12. Coastal Plain (yellow)
13. Continental Shelves or Main Trough in Red Sea
14. Axial Trough (red)
15. Archipelagos; a- Farasan, b- Dahlak
16. Yemen Volcanic Plateau
17. Afar or Danakil Depression (purple)
18. Ethiopian Rift Valley (full extent not shown)
19. Ethiopian Plateau (mainly vertical lines)
20. Straits of Bab el Mandeb
21. Gulf of Zula
22. Gulf of Suez
23. Gulf of Aqabah

On weekend leave once, out of personal interest, I surveyed the Hijaz Railroad from Muhit near al Madinah to Tabuk. At Mada'in Salih I met one of the Emir's staff members briefly. I did not have the opportunity of meeting the Emir at that time, but later did when I was compiling the 1:250k quadrangle that included both Mada'in Salih and Al 'Ula. As a courtesy to the Emir, I invited him to take a helicopter survey of his domain. He agreed, and we flew about the area to give him a good view of it. During the flight with the Emir and Saud, I asked my pilot, Bob Fryer, to land on top of the huge basalt plateau of Harrat al Quweira, overlooking Mad'in Salih. Naturally, the Emir invited us for a Goat Grab following the helicopter survey, but, as politely as possible, I asked for a raincheck on a better day, and he agreed. We thanked him marra wajid (very much) and were on our way.

Bell Jet Ranger and Bell 47 in the Asir; these were essential for our fieldwork in many remote areas.



Casir al Farid, the main Nabatean tourist attraction in S. Arabia and in the quad where I gave the Emir a helicopter tour.

During mapping of the Wadi Hali quadrangle, we were in the rugged area between the escarpment and the coastal plain. This was monsoon time, and rainstorms could quickly spin up. One did, and we were in it. Since we had taken the doors off the Bell 47 helicopter, and the wind was very strong, Saud was petrified and urgent to get us on the ground. We did and stayed there for the night. It was too late in the day and the storm too long lasting for us to be able to get back to camp. Our camp crew was worried for us. It was quite a chilly night, and sleeping on the ground sans blanket was not pleasant. Doing so in the presence of nighttime visitors of the creepy crawly type was not pleasant either. Not to give anyone the frights, but I photographed a nine-inch scorpion in the Musaylim quadrangle. A sting can kill you! I thought it was some kind of Prehistoric lizard that got lost in the wilds of the Saudi desert and could not believe my eyes when I saw it.

Mapping in the al Birk quadrangle led to an unpleasant situation but a pleasant outcome. In one area of the quadrangles, we landed to look at some outcrops. Bedouin were relatively nearby. Shortly, a group of Bedouin men came over in a highly agitated state. Ghanim Jeri, my guide and assistant, spoke to them. He shortly related that we were scaring both the

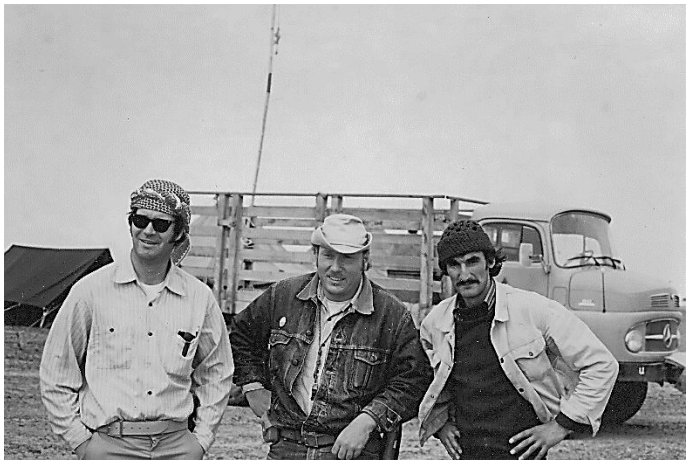
goats and women. Ghanim explained what we were doing, but the Bedouin were not satisfied, and became more threatening. I told Ghanim that it was time to leave, fearing they might start throwing rocks or worse. They had firearms, and rocks on the turning helicopter blades would not be good. We left forthwith without further incident. We flew back to camp and pondered the situation. Ghanim and Saud said the Emirs of the area should be consulted. Saud and I consulted the Emir to the east, and Saud and Ghanim consulted the Emir of al Birk. The latter Emir, together with a contingent of staff and guards, drove into the area of disturbance and spoke to the Bedouin. Later in the day, we learned that the Bedouin were ok with our work but would like some help with locating water. I wasn't sure I would be of much help in that regard but would give it my best shot. A wadi with some fairly deep sand and gravel might offer the best potential. It might offer some ponding of ephemeral water similar to Wadi Hadiyah. The only problem here was that there were no Wadi Hadiyah's in the Al Birk area. Ghanim and I went back the next day, and the Bedouin were friendly and excited. I showed them the most likely source of obtaining water in the area, but explained that, if possible, they should go lower in the wadis toward the coast to locate deeper sands and gravels and possible standing water in them. A further problem with Bedouin-dug wadi wells is that during heavy rainstorms the wells would likely fill up with sand and gravel. They could of course put a barrier upstream to block inflow, but it was not likely they would do that. Further, Bedouin are known itinerant people; they are here one day, gone the next, having grazed out an area. Whether my "ad hoc" inexperienced hydrology did any good for the Bedouin, I never learned.

Juqjuq Area

This quadrangle had a most interesting range of Precambrian rocks, from huge granitic batholiths eroded into amazing shapes to high-grade gneisses, schists, and marbles. The quadrangle was on strike with the Yafikh quadrangle to the southeast mapped by Dwight Schmidt, so he and I saw each other's rocks and discussed them and their evolution.

Geochronologic Transect

Bob Fleck and I conducted a geochronologic transect from the coastal plain to the northeastern edge of the shield. We collected granitic suites primarily from quadrangles that I studied, and he and I studied also with Doug Stoeser at the eastern edge of the shield. Both Doug and I offered observations on the rocks and terrains involved in the transect. Bob wrote the final report for the mission, and I supplied some photography of the areas sampled here, and later. Shown here is a photograph at the end of the transect.



Bob Fleck, Doug Stoesser, and Peter Rentacar (helicopter engineer) at the northeastern terminus of the Arabian Shield, the end of Bob's geochronology transect.

Fieldwork Reviews by Reston Staff

For both local geologists and visiting OIG and Reston management (referred to as firemen), assessments of the field program were held every few months to evaluate the program in both Jiddah and in the field. Here I show, in photographs described briefly, some of

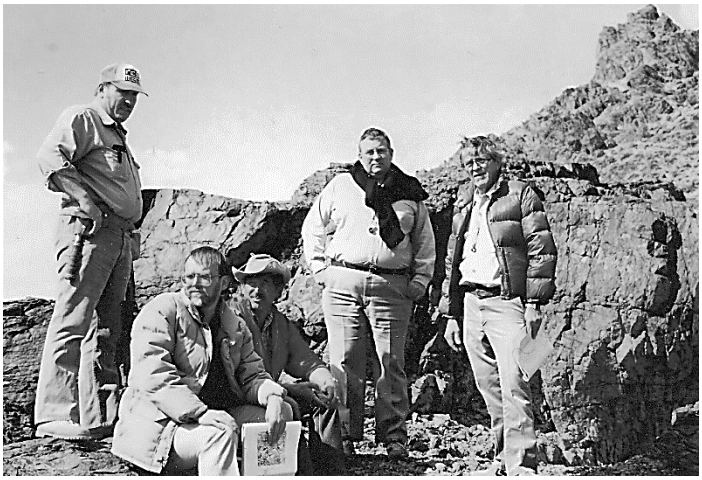
the areas where trips were conducted and all staff. In western Saudi Arabia, the physiography is a coastal plain along the Red Sea, uplifted escarpment, and mountainous terrain toward the inland of the Kingdom, extending from Yemen to about Medina. Northward of Medina, the terrain northeast of the coastal plain is mountainous but has no uniform lifted escarpment like the southern shield region.

Final Comments: Living in Jiddah, and R & R

My work and my family's experiences were the greatest times of our lives. I cannot overstate how much I enjoyed working with my Saudi crews. They were always helpful and courteous with me and with any situation or difficulty. With great humor at all times, they loved pranks and ribbing. After our first year living alone on Medina road, the remainder of our living experiences could not have been more enjoyable. When the Survey's new 7-house compound was completed, we moved to it. At that time, there were three other compounds: ours, across from the American Embassy compound, the Chief's, and one toward downtown Jiddah. Other than USGS families, we socialized with many others living in other housing, including American Embassy staff, employees of other embassies, Ministry helicopter pilots, foreign businessmen, and my dear Saud and his family. R & R was varied. Parties were held with people in the USGS, and with various other groups as noted above. Travel to other parts of the Middle East was common, such as Beirut (Lebanon), Amman and Petra in Jordan, Turkey, Cyprus, Yemen, and most notably Persepolis in Iran. In the Kingdom, camping in the desert was great fun. As a reader of this will surmise, top on the list was Mada'in Salih as far as desert sites go. But for most geologists, Mahd adh Dhahab was high on their list. And a USGS Red Sea beach site south of Jiddah was enjoyed by all.

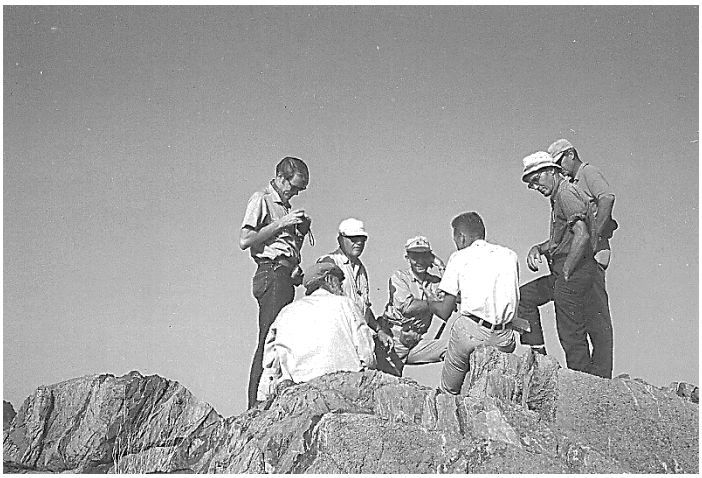
I arranged a trip for American Ambassador John West and Mrs. West to visit the gold mining site. Ron Worl was guide and host for the trip. After lunch Mrs. West collected several ore samples. She sent these to her jeweler in South Carolina, and he fashioned polished and framed pendants of Mahd adh Dhahab ore for lady dinner guests at the Ambassador's residence. For an R & R camping trip, I suggested to the Worls and Elliotts that we go to the spectacular granite terrain in the Juqjuq quadrangle noted above. Afterwards, we could drive through some interesting desert terrain and meet friends coming from Aramco, Dhahran, at ad Dawadimi. Going north from Juqjuq, we met our friends at the appointed site, although some doubted my guiding ability. On one of the trips to Mada'in Salih, we stopped for a short period at Qalat as Sawrah, one of the Hijaz RR stations with a nearby Selim I Caravanserai and well. Jerry Sanders, one of our compadres, decided he would go down the ladder shown here to the water level. I advised him against such a move. Down he went; fortunately, he returned. On another outing with Gary and Todd Selner and children, we went to Mahd adh Dhahab. The mining site was in the process of gearing up for mining. The incline, or a portion of, was completed and we were given an underground tour with the troops.

The most complete derelict train on the Hijaz Railway between Damaxcus and al Madinah. The train was here when I mapped the area in 1970.



Visiting firemen and local geologists: left to right—Doug Stoesser, Bob Hamilton, Carl Hedge, Tom Ovenshine, and Charlie Smith.

al Wahbah volcanic crater, about 900 feet deep; as the crater is not visible on low approach, I asked our pilot to come in low and drop abruptly at the crater edge so that Bob Hamilton and Tom Ovenshine got quite an unexpected roller-coaster thrill!



More visitors and mission staff in the Asir: left to right—Bill Greenwood, Glen Brown, Thor Kiilsgaard (Mission Chief), Bill Overstreet, Dwight Schmidt, Hank Cornwall, and Ralph Roberts.

Jim Elliott, Doug Stoesser, and Jim Cole with a slick basaltic cairn at tungsten exploration site in the northeastern shield.

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(Don has an extensive list of references on Saudi Arabian geology and a series of illustrations on the evolution of Saudi Arabia and the Red Sea. He will be glad to send these materials to any of you who would like more on this subject. His email is donhadley1@hotmail.com. -- Ed.)

From Precambrian Iron Formation to Mars

Norrie Robbins

When I worked in our USGS building in Reston, Virginia, it was filled with all sorts of great scientists, doing original and applied research. In the office next to me, economic geologist Bob Schmidt was working on the Precambrian Banded-iron Formation. These iron-rich rocks were deposited from the time of the beginning of rocks, 3.8 billion years ago, until 800 million years ago. They are found at the ancient centers of every continent. He had worked on the iron- and manganese-bearing rocks primarily in Minnesota, Wisconsin, and Brazil. His colleague and former classmate at University of Wisconsin, geologist Gene LaBarge, had worked on Proterozoic and more ancient Archean Iron Formation rocks in Wisconsin, Canada, Greenland, and Australia. Bob and Gene were former students of geologist Stan Tyler at University of Wisconsin. Tyler was one of the granddaddies of Banded-iron Formation studies. He was convinced that the Iron Formation was deposited by iron bacteria. All three men were economic geologists. I don't think they had ever taken a biology course, which is typical of the training for most geologists. So even though Stan had implanted the idea in the minds of all his students, none had a clean grasp of how to test this. However, Bob and Gene did their work using thin sections. In their 30-year or so careers of working on Iron Formation, each man had kept meticulous notes of which thin sections had unusual forms of minerals.

I thought it so sweet, the way these two men held out to prove their professor's hypothesis that iron bacteria precipitated Iron Formation. Next door to Bob, I was working on iron bacteria in Huntley Meadows wetland in Alexandria, VA. When Bob heard that I was working on iron bacteria, he obviously called Gene. And he called me into his office to look at one of his thin sections. I saw a beautiful hematite-coated filament that looked like a filament of the iron bacterium *Leptothrix ochracea*. Of course, Bob had

seen this a long time ago, but didn't know what to call it. Soon my office was filled with thin sections from Bob and Gene. You have to understand that these were very high-quality thin sections. Both men had hundreds of thin sections, and they handed me their very best ones. As I started reading the literature on Iron Formation, I realized that other younger scientists had looked at thin sections of these rocks too. But theirs were mostly from a single or maybe two collecting trips to wherever. Funding agencies don't typically pay professors for multiple collecting trips, so the younger guys didn't have a stash of thin sections that represented 60 years of work. And thus, Bob, Gene, and I got to publish significant papers on minerals probably formed by iron bacteria. We never said that modern iron bacteria were alive 1.9 billion years ago, but instead their morphologies or forms were similar, and their behavior with iron may have been similar. There was something else that both men were interested in—the oldest iron-bearing rocks on Earth. These rocks are 3.8 billion years old from the west coast of Greenland, where they are called the Isua Iron Formation. Even though the rocks are highly metamorphosed today, they were once sediments. Gene had a friend with the Greenland Geological Survey, geologist Peter Appel. He asked Peter to send me some of those rocks so I could make thin sections, dissolve the rocks with my palynology techniques, and look for unusual iron shapes. I looked at the residues under the scanning electron microscope and light microscope. Some structures were hollow, some were rounded, and some were entwined. The round microstructures in those rocks looked like the modern-day iron bacterium *Siderocapsa*, except they were covered with distinctive knobby projections. I published a new form named after Peter, *Appelella ferrifera*.

I have a piece of that rock glued down on a card, and I share it with kids and adults to touch whenever they hear a talk by me on the oldest rocks on Earth. Though it is useful, it's not as stunning as polished rocks of younger Precambrian Banded Iron Formation that are striped red and black. I use a magnet to show people that it doesn't stick to the bands of red hematite, but it does stick to the bands of black magnetite. This is important information, the difference between the red iron oxide and the black iron oxide. Previous to 800 million years ago, the ocean was changing its chemistry so that sometimes red iron oxide precipitated and at other times black iron oxide precipitated. To a geochemist, this says the ocean shifted between oxygenated and anoxic conditions. To make the story more complex, there are white layers of silica in the 1.9 billion- year-old rocks. Gene found rounded structures in the white layers, about 20 micrometers in size and coated with red iron sprinkles. He interpreted these rather large round structures as the fossilized remains of siliceous algae that he named *Eosphera*. Another classmate of Gene and Bob, Tsu-Ming Han made an amazing observation. Where he worked at the Empire Mine in Michigan, under the microscope he saw that the black magnetite in the more metamorphosed Negaunee Iron Formation was coating elongated, red iron oxide hematite rods. He discovered this in polished sections of the rocks and therefore demonstrated that the magnetite was a later overgrowth, the result of later metamorphism. So I got to hypothesize that rod-shaped iron bacteria could have formed the hematite there too. Several years later, when I was working on peat deposition in wetlands around Lake Superior, I went to visit Tsu-Ming at the Empire Mine. He really wanted me to collect some of the macroscopic filaments that were visible to the eye there. He thought the filaments were algae in these 2.1 to 2.2 million-year old rocks. The only field boots I had were rubber boots for wandering around in wetlands. I showed up in these boots, and we took off driving in his pick-up truck along a bench (flat surface) of the open pit mine. His plan was to hang me off the mine face, attached to a rope that was slung around the

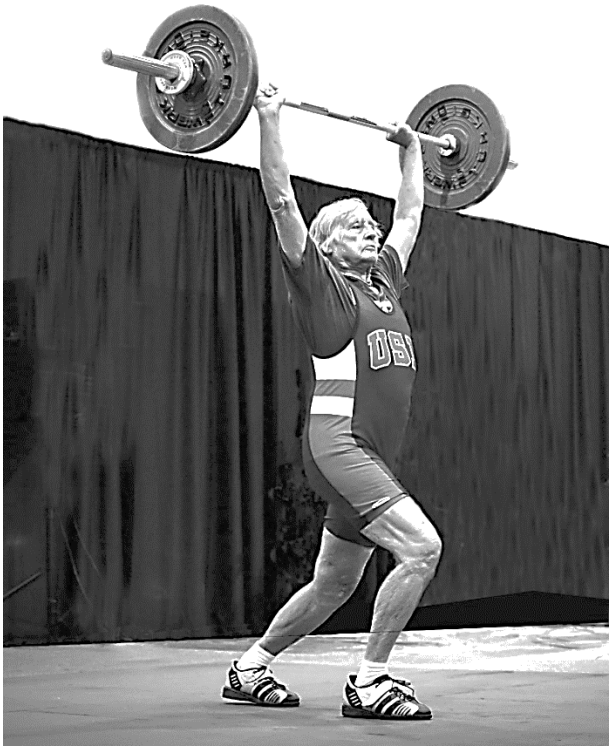
bumper of the vehicle. And thus, hanging off the cliff face wearing my rubber boots, I collected a bag full of samples with filaments from a layer about 30-feet down. This was a field activity I never shared with my mom.

Iron Bacteria on Mars

Of course, I had no way of knowing yet if there are iron bacteria on Mars. But my father, physicist Arthur Iberall, and I started talking about the possibility. We had read the 1974 paper of Fred Hoyle and Chandra Wickramasinghe, who developed a hypothesis called Panspermia. Their idea was that life started elsewhere and was seeded onto the Earth via meteorites. As I explained above, the earliest rocks on Earth have rod-shaped and spherical iron minerals which suggested to me they could have been formed by iron bacteria. So someday, somebody might find iron bacteria as a link between the Earth and Mars. There are all sorts of interesting things we know about Mars. Mars has red soil, which means the iron is in the oxidized state. That being true, it could have begun in the reduced state in water. Mars had rivers, and satellite images clearly show that some rivers started as ground water discharging from upslope sites. There are meteorites on Earth that could only have come from Mars. Nobody has ruled out two-way transfer of material from meteorites hitting the Earth and spreading spores to Mars. In 1992, Dad and I wrote a paper on the possibility of finding mineral remains of iron bacteria on Mars. I suggested that a great test would be to collect some of the red sediment along Martian drainage channels. However, I do have a personal opinion about this—I do not want humans to expand off the Earth. I think our species has done enough damage to one planet. Despite my personal misgivings, I expect to live long enough to watch people walking on Mars and collecting sediments and rocks there.

Norrie with Bob Schmidt

Norrie with her father, Arthur Iberall



Fassett Still Going Strong

(excerpted from the Albuquerque Journal, July 26, 2019)

Jim Fassett, 86, of Santa Fe, was recently the oldest of 562 competitors at the USA Weightlifting American Open II event here. He was able to beat his previous record of 98.2 pounds. A few years ago, Jim's wife Sarah suggested that he do weight training. When he demurred, she bought him a membership in her gym as encouragement. The gym owner took an interest in helping Jim, and eventually his modest efforts developed to the level of joining competitive events. Compared to his previous sport of marathon running, he says lifting is more satisfying and takes a lot less training time. Also, there is a rewarding social aspect to the sport, as the lifters in his gym are very supportive of each other. Since 2015, Jim has won 4 national championships in his class, and he is going for a fifth this spring. He needs 10 wins to be inducted into the Weightlifting Hall of Fame, and he plans on making that goal by age 92.

Memorials

Glenn H. Allcott, 1931-2019

Glenn Allcott died Saturday, August 24, 2019 at his home in Detroit, Texas, following a long battle with Alzheimer's. Glenn was born in Chamberlin, South Dakota, November 22, 1931. He attended school and graduated from high school in Belle Fourche in 1949. After serving in the U.S. Army as an Artillery Sergeant in the occupation of Germany, he attended South Dakota State College, receiving his M.S. degree in 1959. After his graduate studies he joined the U.S. Geological Survey where he worked as an exploration geochemist. He served as Chief of the Branch of Exploration Geochemistry and later as Chief of the Office of Mineral Resources, Retiring in 1993, he moved to Seguin, Texas, to be close to family and dedicated his time to many different pursuits and hobbies. He loved to travel, tinker, and build things. His kind presence and solid principled advice endeared him to all that knew him. A strong man to the end, he had a big heart and will be sorely missed. He was fortunate to have loved and been loved by two wonderful women in his life. Shirley, his wife of 34 years, preceded him in death, and he is survived by his wife of 26 years, Virginia. Glenn leaves seven children, sixteen grandchildren, and four great grandchildren.

Sarah Andrews Brown, 1951-2019

Geology has sadly lost two female role models in one person – Geologist and writer Sarah Andrews Brown died in a tragic aircraft accident July 24, 2019. Sarah has been a role model and an inspiration for many women geologists, both in her own life as a professional geologist, teacher, pilot, and award-winning author and in the fictional life of the character she created - Em Hansen, a forensic geologist who solved murder mysteries using her geologic knowledge, curiosity-driven intellect, and stubborn determination. Sarah earned her B.A. in geology at Colorado College and got her first job in geology with the Survey in Denver, working with Eddie McKee. She went on to earn her M.S. in earth resources at Colorado State University and then became a petroleum geologist for Amoco and Angus Petroleum. In 1986, Sarah and her husband Damon Brown moved to California, and she became a consultant in the environmental industry. It was during this time that she began to write her murder mysteries, and after the birth of her son she decided to simplify her life and be a mother and writer. As her son got older, she taught geology part-time at Sonoma State University in California and became a guest lecturer around the country. Throughout her career she won many awards, including the Journalism Award of the American Association of Petroleum Geologists in 1999, the James T. Shea Award of the National Association of Geoscience Teachers in 2001, the Special Award of the Association of Engineering Geologists in 2003, and the President's Medal of the Geological Society of America in 2016.

Through her eleven books in the Em Hansen series, Sarah brought the passion and excitement of geology and scientific discovery to the general public and to her legions of geologist fans. She was a regular attendee at GSA annual meetings, often doing book signings and visiting with her colleagues and friends. She utilized her contacts in geology to the fullest by involving her geologist friends in her book research, often arranging trips in the field so she could accurately capture the setting and investigations that were being featured in each book. Frequently her friends would show up as thinly disguised characters in her books, easily recognized by mutual colleagues, and not all her friends met with happy endings in her murder mysteries! Sarah managed to weave together the fun of a well-written murder mystery with accurate science and vivid details of the environment where her books were set. In addition, she raised thought provoking issues; for example, *Bone Hunter* (1999), raises the issue of vertebrate fossils as commodities for sale; *Fault Line* examines the pros and cons of informing the public about geologic hazards; and her last book, *Rock Bottom* (2012), tackled creationism. In 2005 she created a new role model, Valena Walker, a geology graduate student working at McMurdo Sound in Antarctica. Sarah won an Artists and Writers Grant from the National Science Foundation so she could journey to McMurdo Sound and live among the researchers for a period of two months. She eloquently captures the beauty of Antarctica in *In Cold Pursuit* (2007). Sarah Andrew Brown's untimely death is a tragedy to her friends and colleagues, but she will be greatly missed by many more who never had the pleasure of meeting her. [For a list of her books go to https://www.sarahandrews.net/]

-----Lynn Wingard

Jack Boatwright, 1951-2018

John L. Boatright, seismologist with the Survey in Menlo Park, died September 20, 2018. Born in Portsmouth, VA, Jack grew up with diverse passions: sailing, baseball, jazz, literature, mathematics, and science. He received B.A. and M.S. degrees in geophysics from Stanford University and a Ph.D. at Columbia's Lamont-Doherty Observatory. George Choy, one his long-time co-authors recalls Jack's time at Lamont characterized by "unique perspectives, incisive comments, and pungent humor." Jack began his 38-year career with the Survey in 1980. He made major contributions to the development of broadband seismology. His series of papers on this topic with George Choy and Linda Seekins established the basis for teleseismic estimation of radiated earthquake energy and developed the techniques for reconciling various types of earthquake data to give reliable seismic energy estimates. Jack was committed to effective communication of our science to the public and devoted a great deal of effort to this issue. After the 1989 Loma Prieta earthquake, Jack gave a public talk in San Francisco near the heavily damaged Marina District. To a distraught audience, he carefully explained Bay Area seismic risk in terms that they could understand, and his rational approach was able to calm fears and answer concerns about future risks. Over several years, he contributed substantially to the city's Seismic Safety Committee plans for mitigating future events. Recognizing his exceptional contributions, the city issued a proclamation in his honor. Jack knew that what mattered most to people affected by earthquakes was shaking intensity, and he took the lead on implementing ShakeMap for Northern California. Jack was a generous mentor and strong advocate for advancing women in geology. He excelled at fatherhood and helped his children, Charlie and Phoebe, to be themselves. He was great at engaging them and their friends in his work, devising ways to explain earthquake mechanics to them when they were young. Jack is survived by his wife of 33 years, Tia Lombardi, son Charlie and daughter Phoebe, and his sisters Dorsey and Tolly. When Jack died, he was at his best. We were lucky to have known him, to have worked with him, and to have enjoyed his sly humor and wise counsel.

-----excerpted from a memorial in Seismological Research Letters, V 90, Number 2A, by Andrew J. Michael, Tia Lombardi, and Thomas C. Hanks

Peter Robin Brett, 1935-2019

Robin Brett, the Australian-born scientist who was one of the first to study rocks from the moon during NASA's Apollo space program, died at home in Washington on Sept. 27, 2019. He was 84 and suffered from Alzheimer's Disease. As chief of the geochemistry branch from 1969 to 1974 at the Lyndon B. Johnson Space Center in Houston, Robin was responsible for much of the planning for the massive study of the Apollo lunar samples. He conducted research on the materials brought back by astronauts on successive flights. He was also involved in planning missions, debriefing astronauts, relaying scientific information to the NASA community, and working

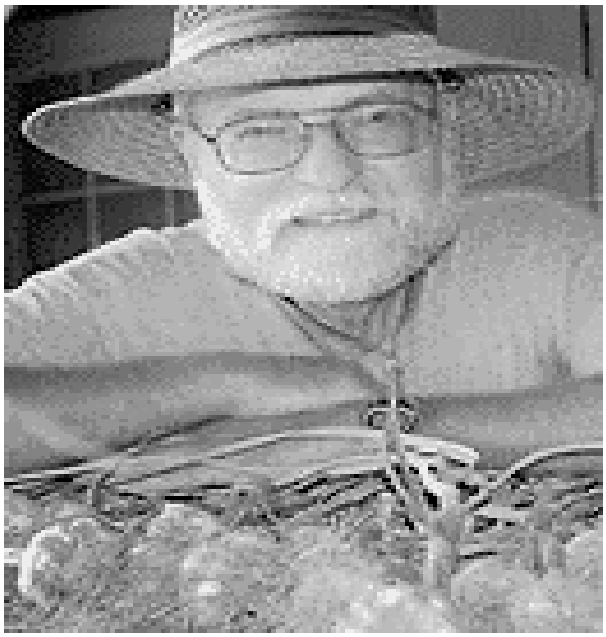
with the press. “Lunar rocks had captured the public imagination, and via the press, Robin facilitated continuing public enthusiasm and comprehension of the science involved in this incredible engineering feat,” said Peter Wyllie, former professor of geology at California Institute of Technology, when he presented Robin with the Distinguished Public Service Medal of the Mineralogical Society of America in 2005. “I hoped that I could excite the taxpayers about the knowledge and insights we gained from extra-terrestrial science and why it mattered,” Brett said. “By learning about the moon, we learn much more about the earth at present, by putting its past in context. We still have not answered many questions about the moon, but we have come a long way since 1969.” With the early lunar missions, there was a fear that moon dust might harbor some lethal threat to humankind, so the astronauts were quarantined in a sealed off section of the Lunar Receiving Lab (LRL) where Robin and the other scientists worked. After the Apollo 12 astronauts – Pete Conrad, Alan Bean and Richard Gordon – had settled in, there was a spill in the LRL, potentially exposing Robin and his colleagues and sending them into quarantine with the astronauts. He received a NASA Exceptional Scientific Achievement Award in 1973 for his work in Houston.

Before his career with NASA, Robin worked at the U.S. Geological Survey in Washington and retuned there in 1974 until he left in 1978 to head the Division of Earth Sciences at the National Science Foundation. He and his staff were responsible for the funding of earth science research and the Ocean Drilling Program, a multinational effort to explore and study the composition and structure of the Earth's oceanic basins. Brett studied undersea sulfur hot springs, using the tiny research submarine Alvin with the program, previously called the Deep Sea Drilling Project. He returned to the USGS in 1982 to pursue research and published more than 90 papers on mineral deposits, lunar petrology, meteor impact structures, and the biological extinction of the dinosaurs. He was the first, in 1992, to suggest that heavily shocked anhydrite was a major killing mechanism of the dinosaurs when a meteor crashed into Mexico’s Yucatan Peninsula 65 million years ago. Starting with the moon landings, Robin learned the importance of educating and informing those outside the science community about the importance of earth science. “Few disciplines, no matter how meritorious, can survive if the public and decision makers do not find them interesting and relevant to everyday life,” he said. “If we have not convinced them that basic science is fundamental to our existence, then we have failed ourselves and our future.”

Robin was the first American to be named Secretary General and President of the International Union of Geological Sciences. At various times, he was president of the Meteoritical Society, the Geological Society of Washington, and chairman of the planetology section of the Geological Society of America. In 2002, Brett was presented with the Superior Service Award of the U.S. Department of the Interior for outstanding career and contributions to the mission of the USGS. “Your leadership at the NASA lunar laboratory is legendary and frontier breaking,” said Charles Groat, then-director of the USGS. “Your work (at NSF) substantially advanced the earth sciences and deep-sea drilling programs of the United States.” After he retired from the USGS, Robin became a part-time administrative judge for geology-related cases of the Nuclear Regulatory Commission from 1998 to 2003. He also served on the executive board of the International Counsel for Science, the umbrella organization for all scientific unions. Born in Jan. 30, 1935, in Adelaide, South Australia, he received his B.S. in geology from the University of Adelaide in 1956, and then left Australia to attend Harvard, where he earned an M.S. and Ph. D. in geology and geochemistry in 1963. During his stay at Harvard and after, Robin was a visiting pre-doc and post-doc at the

Geophysical Laboratory, Carnegie Institution of Washington working with Gunnar Kullerud on sulfide systems. Robin's Ph.D. dissertation, published in *Economic Geology* in 1964, was the basis for his being awarded the Waldemar Lindgren Award in 1964 by the Society of Economic Geologists. He is survived by his wife, Jill Davidson Brett; his sister, Virginia Rebler, two daughters Abigail Brett Miller and Victoria Brett; two step-sons Timothy Stokes Merrill and William Alexander Merrill, as well as four grandchildren, Brooks, Sophia, Lila and Lucas. His first marriage to Abigail Trafford ended in divorce. Astrogeologist Eugene Shoemaker, and his wife Carolyn, named an asteroid after Robin in 1999. Shoemaker, a friend and mentor, had worked with him in Houston. *The Dictionary of Minor Planet Names* describes the asteroid's namesake: "A known organizer, Brett has directed his activities toward advancing international cooperation in research; the fact that he is known as a 'nice guy' with a great sense of humor may have helped." In a letter to Robin, Carolyn Shoemaker wrote, "Hope you'll enjoy knowing that a little planet bearing your name will be in orbit in our solar system for centuries to come."

---*Jill Brett and Harvey Belkin*



David L. Campbell, 1941-2019

Dave Campbell died December 21, 2019 at his home in Tiffin, Iowa, from complications of brain cancer. Dave was reared on his family's farm near Tiffin. He graduated from the University of Iowa in 1963, where he majored in physics and mathematics. Funded by a graduate scholarship from NASA, he then earned M.A., 1966, and Ph.D., 1969, degrees in geophysics from University of California-Berkeley. While at Berkeley, he helped install World-Wide Standard seismographic stations in California, and he worked the summer 1968 for NASA at Ames Research Center, Sunnyvale, CA, on a project simulating moon craters. After graduation, he taught geophysics for five years at Krumb School of Mines, Columbia University, New York City. In New York, he met Katharine Parker. In 1971, they exchanged their wedding vows standing under the tall burr oak tree in the front yard of the family farm in Iowa. In 1974, he began a 26-year career with the Survey in Denver, CO. He did field studies all over the U.S., especially in the Rocky Mountains and in the Alaska Range; and he also worked on the Precambrian shield of Saudi Arabia. He used many different geophysical techniques in his studies, especially magnetics, electromagnetics, and

ground-penetrating radar. During the 1990s, Dave served as Chief of the Geophysics Branch, supervising more than 250 employees in Denver, Reston, and Menlo Park. In 2001, Dave and Katharine retired to the 10 acres across the road from the place where Dave had been reared. They started an apple and pear orchard, certified the property ("Adelyn's Organic Garden") as organic, and grew vegetables and honey for Iowa City Farmer's Market for the next 13 years. During this time, Dave was also an Adjunct Professor in the Geosciences Department, University of Iowa, sang and played guitar and banjo with several local amateur groups, and served for many years as secretary of the East-Central Iowa Beekeepers Association. Dave is survived by wife Katharine, daughters Gwyneth (John) Rost of Belchertown, MA, Rhona Campbell (David Schneider) of Silver Spring, MD, granddaughters Anastasia and Eleanor Schneider, brother D. Douglas Campbell (Ann) and family of Tiffin, and sister Nancy (Roger) Utman and family of Papillion NE.

-------*from the Iowa Press-Citizen*

Nancy Couse, 1941-2019

Nancy L. Couse of Golden, Colorado, died June 10, 2019 at Collier Hospice Center. She graduated from Cornell University in 1963 and received her Ph.D. from University of Wisconsin in genetics. She later married George Desborough and moved with him to Golden, Colorado, when he joined the Survey. She taught genetics at Denver University until she made a decision to become a Certified Public Accountant. Nancy owned and operated her CPA practice for over 30 years in the Denver area, retiring at the end of 2018. She enjoyed the nature of Colorado in its mountains and rivers as well as many road trips with George through the American Southwest.

Bonnie Crysdale, 1942-2019

Formerly a Survey geologist, and wife of Mike Duncan, Bonnie is survived by Mike and her daughter Cris Ann and son Kent.

Bart Ekren, 1923-2019

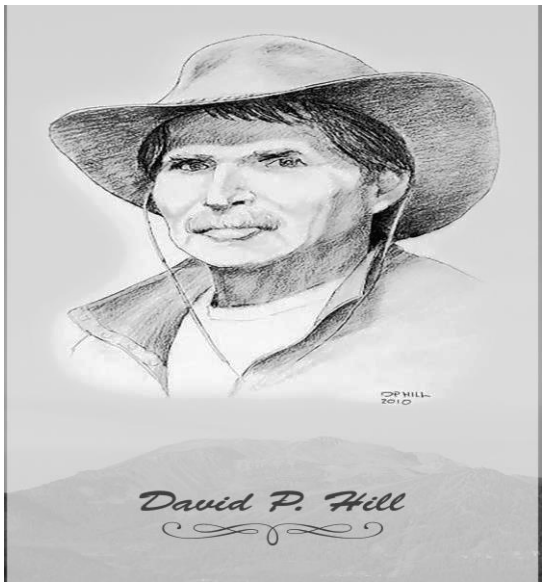
Einar Bart Ekren, formerly of White Sulphur Springs, Montana, died August 19, 2019 at Spring Creek Inn, Bozeman, MT, surrounded by family. He was born in Webster, South Dakota, the son of the late Einar and Martha Ekren. Most of his early school years were spent in Kensal, North Dakota. On August 10, 1948, he married Doris Mullis, in Grand Forks North Dakota. Bart and Doris had four children. He graduated from University of North Dakota with a B. S. in Geology. After graduation he went to work for Texaco and then later for the Survey. He retired from the Survey in 1984. He was a consulting geologist and conducted independent mineral exploration after his retirement. His final field season was in 2015. He served in the U.S. Army during World War II with the 75th Infantry Division in Europe. After his discharge with the rank of Sergeant, he returned to North Dakota to continue his studies which had been interrupted by the war. He is survived by his daughter and son-in-law, Nancy and Ken Hendry of Livermore, CO.; daughter and son-in-law, Sally and Greg Brainerd of Livingston, MT; daughter Anita Ekren of Loveland, CO; grandchildren, Clint and Taylor Ekren of Newberg, OR; Lindsey Greeb of Fort Collins, CO; and Heidi Brainerd of East Helena, MT; and four great-grandchildren. Bart was preceded in death by his wife, Doris, his son Bart, and his granddaughter Katy.

Charles Sherman Gromme,' 1933-2019

Sherman Gromme' (left), Mike Churkin (center), and Jack Hillhouse (right) at the Yukon River near Circle, Alaska (1980).

Sherm Gromme,' retired USGS geophysicist and well-known pioneer in the field of paleomagnetism, passed away February 18, 2019. Sherman studied geophysics at UC Berkeley under the guidance of Prof. John Verhoogen, completing his Ph.D. in 1963. His dissertation topics explored paleomagnetism of the Franciscan Formation and the Sierra Nevada batholith. While at Berkeley, Sherman excelled as a designer of instruments and FORTRAN programmer for data analysis. He began an association with recent Berkeley graduates, Allan Cox and Richard Doell, who had started the Rock Magnetics Laboratory (RML) at USGS in 1959. In 1965, Sherman joined Cox, Doell, and geochronologist Brent Dalrymple as part of the RML team and spent his entire career at USGS, Menlo Park. After a few years, the RML team and other international researchers conclusively proved the existence of global geomagnetic polarity reversals. As a graduate student, Sherman had contributed a key result for the emerging geomagnetic polarity time scale by defining the Olduvai normal-polarity event. The match between the on-land geomagnetic polarity time scale and seafloor magnetic stripes was obvious by 1966, and widespread acceptance of plate tectonics quickly followed. RML was awarded a NASA contract to analyze magnetism of Apollo 11 and 12 lunar specimens (1971), and Sherman made critical improvements to the magnetometer system in the Lunar Receiving Laboratory, Houston. Sherman took the helm of RML in 1972 and held that position until his retirement in 1995. For three decades he collaborated with dozens of post-docs, doctoral candidates, USGS personnel, and a host of international researchers. He was generous with his time to train visitors and new employees. Sherman's published research covers a broad range of topics: geomagnetic polarity time scale, Franciscan Formation tectonics, Sierra Nevada tectonics, Great Basin volcanism, Apollo moon rocks, Alaska microplate tectonics, paleomagnetism methods, and more. His happiest moments came at the helm of a boat, designing a new instrument, or crafting beautiful furniture in his wood shop. Sherman was predeceased by his daughter Leah Gromme LaFlam, and is survived by sons Lane and Lance Gromme, eleven grandchildren, and six great-grandchildren.

--Jack Hillhouse



David P. Hill, 1935-2018

Dave passed away among family and friends at Stanford Hospital on the December 26, 2018. Dave

was born in Livingston, Montana to Sanford and Gerda Hill. He spent much of his youth with Yellowstone National Park as his backyard, joined by his younger brother Richard and sister Judy. It was there that Dave developed a curiosity and fascination with nature and the earth. After earning his Eagle Scout Award, Dave attended San Jose State University and achieved a B.S. in geology. He worked for the Survey in Golden, CO, while attending the Colorado School of Mines, earning an M.S. degree. While in Golden, Dave met Ann Rivers, and they married in June, 1961. In 1965, after their son, Peter, was born, the family moved to Hawaii where Dave was a scientist at the Hawaiian Volcano Observatory. He subsequently earned a Ph.D. in geophysics from the California Institute of Technology in 1971 and then accepted a position at the Survey campus in Menlo Park, where he spent the remainder of his 58-year career. Dave was an internationally recognized expert in the fields of theoretical and observational seismology. His research forms the basis of much of what is known of the structure, composition, and thermal state of active tectonic, volcanic, and geothermal areas, and he published more than 90 papers in prestigious scientific journals. In 2005, Dave was presented with the Department of Interior's highest honor, the Distinguished Service Award for outstanding scientific achievement. He was a member of national and international science advisory panels, served on the editorial boards of journals, mentored young scientists, and was an elected Fellow of both the American Geophysical Union and the American Association for the Advancement of Science. Dave balanced scientific achievement with a strong commitment to public service. Translating complex scientific concepts into words that capture the interest and imagination of the American public came naturally to Dave, and his efforts were to great effect. He was a recipient of the Department of the Interior's Public Service Recognition Award and the Eugene Shoemaker Communications Award, and he was awarded the Distinguished Public Service Medal from the Mineralogical Society of America. Beyond science, Dave was an accomplished artist, a craft he practiced and perfected his entire life. Through his chosen medium, portraiture, Dave captured the character of many friends and colleagues. His portraits reflect the soul of a man committed to accepting people as they are, without judgment. Dave will be deeply missed by his wife Ann, son Peter and wife Hope, grandchildren Sarah and Nicholas, and his brother Rich and sister-in-law Diane and their children. The loss is felt too by countless friends and a large, diverse community of earth scientists. To quote one colleague: "He was a gentle man, a scholar, a steady and ethical leader, and the finest of humans."

Keith Ketner, 1921-2019

Keith Brindley Ketner passed away peacefully on June 18 surrounded in love by his three daughters Mary Gladstone, Jacqui Ketner and Paula Zavitz. Keith was predeceased by the love of his life, Donna Mulder Ketner. Born in 1921 in rural Boscobel, Wisconsin, Keith fully lived the major transitions of 20th century. He grew up in a home without running water until he was ten years old and experienced the challenges of the great depression. He was a pilot in World War II and worked as a research geologist for the Survey in a long period when his field of science went through profound changes. Keith never stopped learning or adventuring in life. He kept going to his lab every day until his late 80s and publishing his research in leading geological journals well into his 90s. He loved skiing, hiking through the Nevada wilderness to collect rock specimens, riding his bicycle, and watching birds. Keith and Donna traveled extensively across the world. Keith often described himself as the luckiest man alive. His children, grandchildren, and great grandchildren will dearly miss him, but always will remember his inspiration. Contributions may be made to The Nature

Conservancy to help maintain the many bird boxes that Keith installed in the parks and nature areas around Arvada.

----from the Ketner family

Stanley J. Luft, 1927-2019

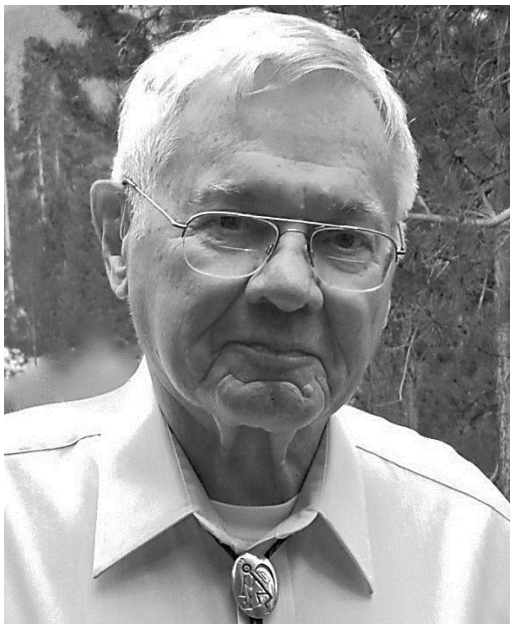
Stan Luft was born Sept. 26, 1927, in Turin, Italy. He passed away on June 6, 2019. His father was, Dr. Max G. Luft, one of the inventors of artificial silk (later known as rayon), and his mother was Olga Felddegen. Stan was an artilleryman in the U.S. Army in Korea, 1946-47. He earned a B.A. in geology from Syracuse and an M.S. from Penn State. He worked as an exploration geologist with several companies, and he organized the Geology Dept. at the Univ. of Oriente, Cuba, in the late 1950s. He and his young family fled to the U.S. in 1960 with only the traditional "shirts on their backs." He joined the Survey in Denver in 1961, retiring in 1988. Throughout his career, he considered himself primarily a field geologist, preferring to make geologic maps while working in and enjoying the great outdoors. Stan published over 75 publications, mainly bedrock maps. He was a Fellow of the Geological Society of America. Stan had a significant impact in philately, specializing in French postal history, and publishing over 145 articles and five books on this subject. He received the John Luff Award of the American Philatelic Society for distinguished philatelic research, and he served as President of the Stamp Collectors Club of Denver and of the national-level Denver stamp show. Stan was fortunate to be married to two wonderful ladies, first to Dr. Anita Navarrete, with whom he had four sons. After her death in 1987, he met and married Eleanor Shearer, with whom he traveled widely until her death in 2018. Stan is survived by his four sons from his first marriage, Anthony, Andrew, Stephen, and Edmund, four grandchildren, and 2 great-grandchildren. Donations in his name may be made to the Food Bank of the Rockies or the Wilderness Society.

Marjorie MacLachlan, 1925-2019

Marge died in Lakewood, CO, on October 21, 2019. She had a 40-year career with the Survey, and for many years was the Geologic Names Committee representative for Central Region. Her patient, conscientious attention to correct stratigraphy in our maps and books was a significant contribution to maintaining our reputation for the highest standards in our publications. She is survived by her sister Martha and several nieces and nephews.

Jo Ann Marranzino, Mar. 4, 1925- Nov. 30, 2019

She was born Jo Ann Zontine in Rockvale, CO. After graduating cum laude from Loretto Heights College in Denver, she met Al Marranzino in 1948, and they were married in 1950. After Al's retirement in 1980, they moved from Lakewood to Estes Park. After Al's death in 2011, Jo Ann returned to Lakewood. She is survived by sons Thomas, Robert, and James, daughters Jeanie and Diane, 7 grandchildren, and numerous great-grandchildren.



Alfred T. Miesch, 1927-2019

Al Miesch was born May 10, 1927, in Hammond, Indiana. Al grew up mostly in the Calumet region of

Indiana, and he graduated from Catholic Central High School in 1945. He served in the U.S. Navy aboard the USS Harmon as a Fireman 1st Class. He graduated from St. Joseph College, Indiana in June, 1950, with a major in geology. During his time at St Joes, he was elected captain of the football team and was later inducted into the St. Joseph's College Sports Hall of Fame. On August 5, 1950, he married Norma (Tillie) Jean Krause, his high school sweetheart. He received his M.S. from Indiana University in 1952 and his Ph.D. from Northwestern University in 1957, both in geology. He and Tillie moved to Grand Junction, Colorado, in 1953 where Al began a 33-year career with the Survey. His work in Grand Junction involved research on the distribution of minor elements in association with uranium on the Colorado Plateau. He moved to Denver in 1959 where he continued his work on element distributions in rocks, soils, and plants, ultimately becoming Chief of the Branch of Geochemical Census, which he later renamed Branch of Regional Geochemistry. In this capacity he began a working relationship with scientists in the public health field to investigate the potential role of geochemistry in human health, primarily heart disease. His research, along with that of others in the branch, eventually helped promote the establishment of The International Society of Geochemistry and Health. He represented the United States at UNESCO meetings in Paris and at the World Health Organization in Geneva. Al was internationally known for his pioneering work on computer-based statistical techniques applied to problems in environmental geochemistry. He received the Department of Interior's Meritorious Service Award in 1973 and the Distinguished Service Award in 1983. He returned to Grand Junction in 1983 for his final three years with the Survey. In his career he published 85 scientific papers. He and Tillie moved back to the Denver in 2015 to be with their extended family. Al enjoyed fishing and camping with family and friends, was an avid reader, and was a devoted Bronco fan. He was dearly loved by his family, and he is survived by his wife of 69 years, Tillie, two daughters, Nancy (Fred) Stanley and Kathy (Michael) Ley; two grandchildren, Tyler (Sara) Ley and Maribeth Ley Miller; and three great-grandchildren, (Harper and Hannah Ley and Charlotte Miller). Al requested no memorial service. The family respectfully requests that donations be made to the American Macular Degeneration Foundation.

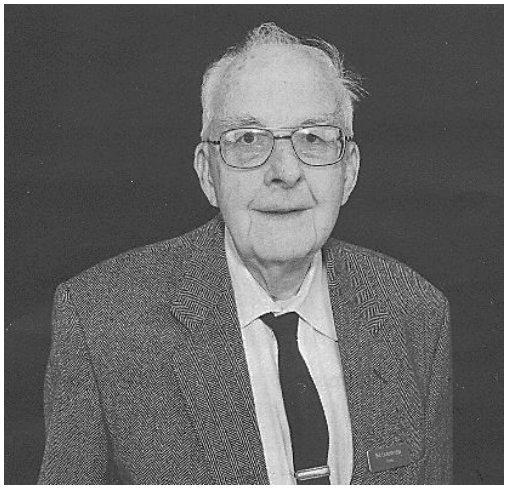
----*from the Miesch family*

Barbara Orkild, 1930-2019

Barbara passed away peacefully on April 11, 2019, at the age of 88. She was born Barbara Slater Howarth on August 31,1930 in Chicago, Illinois. She grew up four blocks from Lake Michigan in her mother's family home built on the edge of the sand dunes. Barbara grew up with two older sisters, Marjorie and Alice. She graduated from Senn High School in 1948 and attended University of Illinois at Navy Pier where she met her husband, Paul, in a geology class. After a brief romance they were joined in matrimony on August 21, 1951. First years of marriage were spent in Washington D.C. where Paul was employed by the USGS and Barb by Ball and Associated, an oil and gas company. Several years later the couple moved to Grand Junction, Colorado where Paul and Barb had their first child, Ted. In 1958 the family moved to Lakewood, Colorado where three more children were born, Molly, Martha, and Maggie. Barbara's interests included the Cavy Club; bowling; assisting Paul with preparing Porsches for concours; traveling; and, raising her grandchildren Michelle, Rae Ann, Hannah, and Paris. Her travels included trips to Australia to visit her daughter Martha, and her grandchildren Jake and Caitlin. She also enjoyed spending time in England with her sister Alice, cousin Millie, and nephew Richard. Barb had a passion for her pets including her cats, dogs, and guinea pigs.

Donations in her name may be made to the Cat Care Society of Lakewood, CO.

-----from the Orkild family



William F. Outerbridge, 1930-2019

Bill Outerbridge was born July 20, 1930, at Ft. McPherson, GA, to naval officer (later Admiral) William W. and Grace Outerbridge. Bill and his brothers grew up traveling widely due to their father's naval career. In the 1930s, they lived in Shanghai, China, during both the Japanese invasion of Manchuria and the communist revolution, while their father patrolled the Yangtze River on a U.S. naval vessel. Bill and his family also lived briefly in San Diego, Annapolis, Newport, RI, and Arlington, VA. Bill attributed his longevity to immunity acquired from swimming at age 5 in the Annapolis River below the outfall of the city sewage treatment plant. During World War II they lived in Tifton, GA, near Grace's parents. The brothers had many exciting adventures, including clipping off all of a neighbor's roses and killing her goldfish by slapping the pond with a plank. These childhood experiences left Bill with a trenchant dry wit and lifelong appreciation for mischief, though these qualities were often camouflaged by a placid demeanor and quiet voice. In college, Bill avoided anything to do with military life and pursued his strong interest in geology. He graduated from Brown University in 1952 with a B.A. in geology and earned an M.S. from American University in 1958. He joined the Survey in 1952. Early in his career he mapped in Utah for the uranium program; later he studied the engineering properties of limestones and then moved to Kentucky for the major mapping project there. His published Kentucky maps include the Inez, Offut, and other quads in Eastern Kentucky. While in Pikeville, he met Dorothy Roberts at a church bridge club, and this led to their marriage in 1966, a double wedding with Dorothy's brother Dwight and wife Beatrice. At the conclusion of the Kentucky program in the mid-1970s, Bill and Dot moved to Reston. During his remaining years with the Survey, he worked on coal ash and other coal resource issues. Bill and Dot were devoted cat owners, hosting as many as 14 at one time. Family members have fond memories of visiting with the cats, watching Bill operate his miniature steam engine and firing his cannon (usually on July 4th). Dorothy died in July of 2015, after 49 years of happy marriage with Bill. After retirement, Bill continued as an Emeritus with the Survey until his health no longer allowed him to work. He was well-known for bringing doughnuts to the Energy-Minerals Branch on Fridays, a gift that is greatly missed. He served as editor of the GDR News for several years. He also cared for their cats until he had to go to assisted living. But he made sure that the cats all found good homes when he had to give them up. He is survived by his brother Robert and wife Alice, by sister-in-law Michele, and numerous nieces, nephews, and their children—and cats.

-----from the Outerbridge family

Robert C. Pearson, 1926-2019

Bob passed away on September 11, 2019, at the age of 93 in Arvada, Colorado. He is survived by his wife of 64 years, Alma Rae Pearson, his daughter Carol, two sons, Eric and Carl, four grandchildren, and three great grandchildren. Bob was born on March 6, 1926, in Oil City, Pennsylvania. After high school he

was drafted and served his country during World War II in the United States Navy on the USS Robert Paine, USS Coates, and USS Delong. These ships were escorts for ships carrying troops and supplies across the North Atlantic during 1944 and 1945. After the war, Bob attended Upsala College and completed his bachelor's degree in 1950. Later he received his master's degree from Pennsylvania State University in 1952. Also, in 1950, Bob started working with the United States Geological Survey (USGS) in Denver. There he met his future wife, Alma Mae Pearson, who was also from Oil City and working in Denver as a secretary for a petroleum company. They were married in 1955 and, except for two years of administrative work in Washington D.C. during 1969 to 1971, lived in the Denver area.

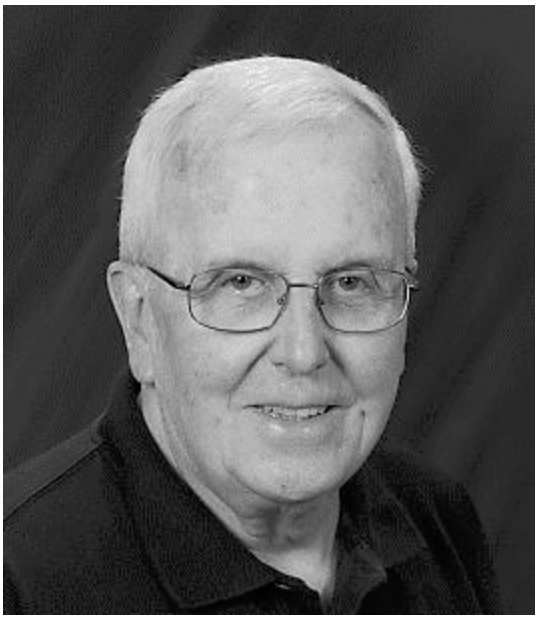
Bob had a long and distinguished career working for the USGS from September 1950 until his retirement in January, 1992. He was liked and highly respected by his many friends in the USGS and was a superb expert in the art of geologic mapping. His early work from about 1952 to 1960 was in the Wet Mountains and the Holy Cross quadrangle in Colorado with Quentin Singewald and Ogden Tweto, from which work Bob authored or co-authored several reports and maps. In 1961 to about 1964, Bob mapped and described the geology and the gold deposits of the Republic graben in the Bodie Mountain quadrangle of northeast Washington. During that work he discovered a middle Eocene fossil fish that was subsequently named for Bob; *Libotonius pearsoni Wilson*, a fish that is distantly related to the modern trout-perch family. During the 1960s and 1970s Bob was engaged in administrative duties under the Wilderness Program in Washington and Denver and mapped the geology and described the mineral resources in several reports on the Popo Agie Primitive Area, Wyoming, and the Indian Peaks Wilderness Study Area, Colorado. From 1980 to 1992, Bob was the Project Chief-Coordinator for the mineral resource assessment of the Dillon 1 x 2 degree quadrangle, Montana. He was the principal author of the USGS Circular on the Mineral Resource Assessment of the Dillon quadrangle, based on ten USGS maps of which Bob was author or coauthor of five. While doing all this, he also contributed to several reports on wilderness study areas. Bob was an ardent outdoorsman, accomplished fly fisherman, and avid gardener. He was a lifelong walker and enjoyed hiking the mountains of Colorado and Montana. He also tied his own flies for his fishing trips and built beautiful landing nets. He was the ideal companion for numerous fishing trips in Colorado, Montana, and Alaska. Each year his beloved backyard garden supplied fruits and vegetables to his family and friends from his bountiful crops.

All who knew Bob recognized him as a gentle, loving husband, father, grandfather, great-grandfather, and loyal friend. He will be greatly missed but fondly remembered and leaves us a legacy of thoughtfulness, honesty, and kindness.

------*Jim Elliott, Dave Lindsey, and the Pearson family*

Louise Reif , 2019

Louise was hired by Rich Ebens in 1979 as secretary for the Branch of Regional Geochemistry in Denver. Later in her career she was secretary for the Branch of Central Mineral Resources. She is fondly remembered by many friends from both groups as a delightful person with a great sense of humor and as a stalwart worker who made the Survey a better place by her enthusiasm, dedication, and cheerful personality.



Zell Peterman, 1934-2019

Zell Edwin Peterman, 84, passed away peacefully on July 21, 2019 among his family and friends in Lakewood, Colorado. Zell was born on November 29, 1934 in Edna Township, Cass County, Iowa to Lloyd and Edna (Hudson) Peterman. The youngest of three brothers, he was delivered on a farm in a house built by his father. He graduated from Loveland High School in 1953 after which he attained a B.S. degree in Geology and Mining Engineering from the Colorado School of Mines in 1957. He continued postgraduate studies at the University of Minnesota and received an M.S. degree in Geology and Geophysics in 1959. He went on to complete a Ph.D. in Geology and Geophysics in in 1962 at the University of Alberta, Canada. Zell had the good fortune of meeting and marrying Gladys Irene Hendry in Edmonton, Alberta while completing his Ph.D. They were happily married for 59 years. They raised a family together - two sons, Bruce and Brian, and had many adventures, mostly geologic, throughout the years. He loved his grandchildren, Alexander and Kaylyn immensely, and they learned a lot from their Grandpa, both are good at cribbage. He loved dogs, initially his own and later his sons' dogs including the most recent addition of Clou, the cat that thinks she's a dog. He enjoyed cooking for family and trying out new and fun recipes on the clan along with the occasional bottle of wine from worlds away. Golfing was another love. Gladys and Zell golfed regularly after he retired and kept swinging away to improve their game as well as spread the "golf fever" to other potential players. Zell enjoyed all these pastimes, but he loved geology and his profession. He enjoyed teaching geology to anyone who would listen. He carried that love of his craft with him always and he made a great life for himself and his family. Zell Peterman joined the United States Geological Survey (USGS) in 1962 and conducted research in geochronology of geologic terrains focusing on Precambrian basement rocks in Wyoming, Montana, North Dakota, South Dakota, Lake Superior, and upper Michigan. He was a pioneer in many geologic disciplines of geochronology, geochemistry, and applied isotope geology and focused his research on scientific and practical problems. He also did work in Sweden with a colleague. In September 2002, Zell was awarded the Distinguished Service Award which is the highest honorary recognition an employee can receive within the Department of the Interior. He was a Fellow of the GSA, SME, and Mineralogical Society and Member for the RMAG and AGU. He had over 160 peer reviewed papers published in numerous professional publications and is well known for his scientific contributions to the field of geology. He retired from the USGS in 2007 but continued to work as an emeritus. Additionally, he established ZEP, LLC, a consulting company for engineering and professional geologic services. Zell is survived by his wife, Gladys; his sons, Bruce (Kirsten) Peterman of Broomfield and Brian Peterman of Aurora, CO; his brother, Gordon (Mary) Peterman of Tempe, AZ; his grandchildren, Alexander Peterman and Kaylyn Peterman.

-----from the Peterman family

Lynn Yehle, 1929-2019

Lynn Yehle passed away on October 22, 2019 at the age of 90 in Lakewood, Colorado. He was born in Milwaukee, WI, in 1929. He was predeceased by his wife Fran and is survived by his daughter Suzanne; two sons, Jim and Alan; 7 grandchildren; and 1 great grandchild. Lynn served his country during the Korean War in the U. S. Army Signal Corps. Lynn earned his Bachelor and Master's degrees at University of Wisconsin, completing the latter in 1954. He had a long and distinguished career working for the Survey from September, 1954, until his retirement in July, 1990. He then served as an Emeritus until 2016. His field investigations were in Alaska in the Copper River Basin, Cook Inlet, and Chitna areas, primarily doing surficial geology. He published over 80 articles and maps relating to Alaska. Lynn enjoyed hiking with Fran, his wife of 57 years, in the Colorado Mountains and always remained a geologist at heart.

Other Deaths

Daphne Ross, wife of Mac
Ed Young
Evelyn Wiesnet, wife of Don

RETIREE PUBLICATIONS 2009 – 2019

Note: The references below are compiled from information available as of 22 January 2020. These references are "new" since the Spring—Summer 2019 Newsletter (Number 77). An effort is made to compile **ALL** known publications (whatever year) by Geologic Division Retirees (GDR) for inclusion in the Master List of GDR Publications (now being maintained and updated by Bob Tilling). Please send complete references for any new publications (**but not those still "in press"**) to Bob (e-mail: rtilling@usgs.gov or volkno.rit@gmail.com), with cc to Jim McNeal (e-mail: jmcneal@usgs.gov) as back-up, for listing in the next Newsletter and for updating the Master List.

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From the Files of the Pick and Hammer Club

For many years Reston Pick and Hammer produced an annual April Fool's Day tableau. In 1981, the Survey was "between Directors," as Bill Menard had left, and Dallas Peck had not yet been appointed. So P & H decided to appoint its own choice for Director. This tableau theme is derived from a familiar movie of that period of time. From left to right: Bruce Lipin, John Keith, Helen Beikman (as Dir. Viola Savonarola, sitting at John W. Powell's desk in his chair), Nick Van Driel, Andrea Maberry, and John Maberry.

The 1985 tableau was named after George Otis Smith, Director from 1907 to 1930. George Otis was known for his emphasis on better communication with the public, especially after his speech, "Plain Geology," was delivered before the Society of Economic Geologists in 1921. Left to right: Gene Robertson, Jack Epstein, Elliott Spiker, Susan Russell-Robinson, Kathleen Gohn, John Keith, Bruce Lipin, Liz Koozmin, Sheila Martin, John Jones.


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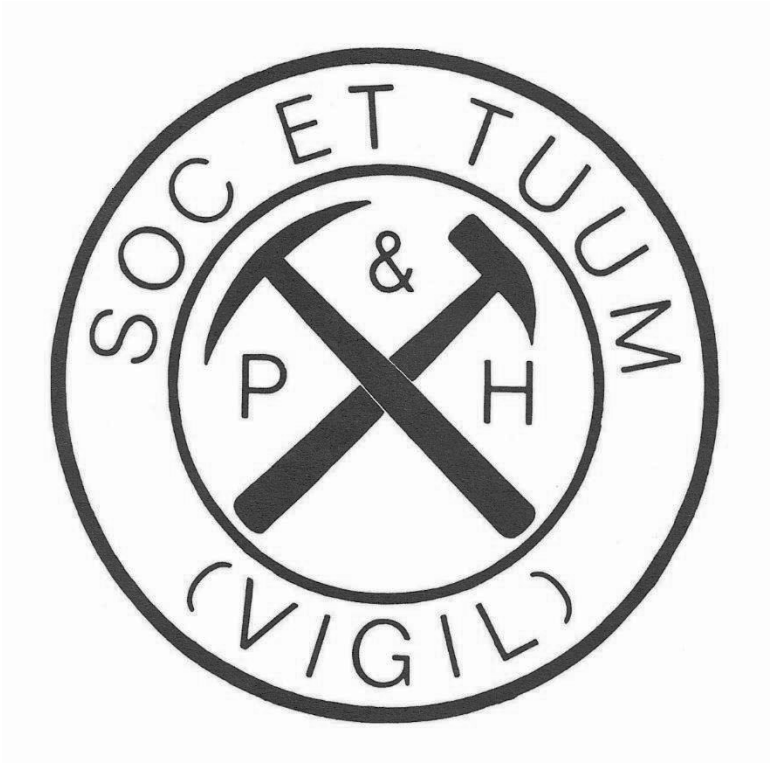
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