U.S. Geological Survey

The Geologic Division Retirees Newsletter

Number 73 **Fall 2016**

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.

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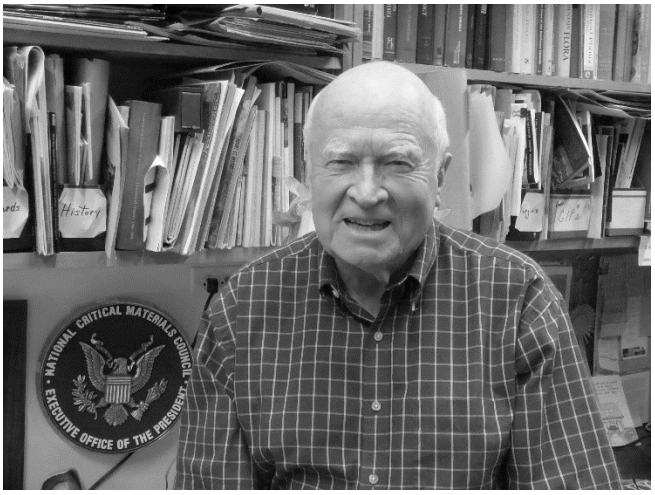
About the Cover:
April 8, 1986: Secretary of the Interior Donald Hodel (left center) presents the first atlas of the U.S. West Coast seafloor to British Ambassador Sir Oliver Wright (right center). Participants (left to right): James Gardner, Chief, Pacific Marine Geology; Dallas Peck; Hodel; Wright; Anthony Laughton, Chief, British Institute of Oceanographic Sciences; and Michael Sommers, IOS. The atlas was created using unique sonar technology developed by the British and computer-enhanced mapping techniques developed by the USGS. It revealed a large amount of information about previously unmapped volcanoes, faults, landslides, and other geologic features, and it was a major scientific achievement.

From the President



Rotation, But Not in a Circle: A Short History of Geologic Division Science Management

When I came into the Survey 56 years ago, I certainly was not conscious of the way "science management" worked in the Division. However, it began to sink in gradually that we had a distinctive management pattern that sustained high employee morale and consequent scientific productivity. While I can't trace the specific origin of the pattern, it appears possibly to date back to the career of Charles Walcott, who rose through Division ranks to be Chief Geologist and later to Director in 1894. The pattern went something like this: individual scientists entered on duty as junior geologists or as Physical Science Technicians (PSTs). They were assigned to projects managed by experienced people, the Project Chiefs, who served as mentors to the newcomers. (One of my first Project Chiefs, Jim Vine, taught me the valuable lesson about not parking a Government vehicle near a liquor store.) As the juniors gained experience and stature, they achieved promotion and some moved into the Project Chief positions themselves. The projects were managed in branches, and the Branch Chiefs supervised the Project Chiefs.

The essential qualifications for selection were a record of solid scientific accomplishment and strong ethical values, which took practical form in the support of peer-reviewed science. Secondarily, the selectees for Branch Chiefs were thought to have some degree of people management skills. The branches were administered under program offices, such as the Office of Mineral Resources, and these offices were all located in Washington and, after 1974, in Reston. Office Chiefs generally were selected from people who had been successful Branch Chiefs in their particular sub-discipline. Office Chiefs were the highly-experienced folks who were also potential Chief Geologists and who, in several instances, became Director of the Survey. The career of Dallas Peck is a good example, as he started as a PST in 1951 and moved through Project Chief, Office Chief, and Chief Geologist positions to become Director in 1982. The Offices also included Program Coordinators who, with their broad experience, became appropriate candidates for Branch Chief or Office Chief.

The fundamental criterion for selecting higher level managers was that they had to have significant scientific breadth. This ensured that they had a comprehensive grasp of how science was accomplished within the Survey, a complex and highly specialized process. The advantages of this Division management system were (1) the staff felt they were supervised by respected scientists who understood their work, (2) from long experience, the managers were highly dedicated to the goals of the Survey, and (3) the managers during their rise through the ranks had built relationships of trust that enabled them to do their jobs well. This is not to say that every person selected as a manager turned out to be ideal. There are examples of chiefs who were kindly invited to return to their science after a very brief tenure, so there were checks and balances. The saving grace of the system was managerial rotation: managers typically served in their jobs about 5 years, then rotated back to science. If you did not like your supervisor, you could take comfort that he or she was likely to be there for a limited time. This rotational management also gave rise to sayings such as, "Be kind to your field assistant for he or she will be your boss one of these days."

The overall effect of training and selecting managers from within the Survey had a highly positive effect on productivity, morale, and the long-term stability of the organization. Their level and breadth of knowledge were eminently greater than those of a person from outside the Survey, making them much

more effective in their tasks--they knew the Survey from the bottom up. It also kept fresh ideas flowing into the management structure, and the managers who returned to science to projects gained a useful understanding of broader issues pertinent to their work.

This rotational system served the Division, and the Survey, extremely well for 100 years. Though a lot has changed since the early 1990s, there are still important elements of this system in operation, in particular our enduring, ethical commitment to producing objective, impartial, peer-reviewed science in the service of the Nation.

John Keith

Several of you have asked about the names of the Survey retiree organizations. Last year the Water Resources Division retirees renamed themselves the U.S. Geological Survey Retirees. The Geologic Division Retirees remained the same, as did the National Mapping Division Retirees. The WRD retirees are the only ones with a website, so if you search the web for U.S. Geological Survey retirees, you will get the WRD organization. All three organizations welcome members from any part of the Survey.

John Keith

Treasurer's Report

Will return in the next issue.

New Members

Betty Adrian
Sarah Andrews
Mike Foose
Marianne Guffanti
Paul Hearn
Susan Russell-Robinson

Essays, Anecdotes, and History

Bill Fischer: A Retrospective

(Sue Sousa wrote suggesting that we do a retrospective on the career of Bill Fischer, with whom she worked for 20 of her 30+-year career in the USGS, "a most exciting time for this retiree." Bill died from drowning in July 1980. The following summary is taken from on obituary news release by Frank Forrester.)

Bill was born in Mount Olive, IL. He obtained a degree in geology from McKendree College, IL, and completed advanced courses in geology from the University of Illinois. He joined the USGS in 1942 as one of the nation's first photogeologists, interpreting geologic features from aerial photography. From 1944 to 1946, he served in the U.S. Navy as a photointerpretation officer in the Pacific area.

Bill gained international recognition for his research that proved the feasibility of expanding earth science knowledge through the use of high-altitude sensing. His research led to the concept and planning of the Earth Resources Technology Satellite (ERTS) system, now known as Landsat. During his USGS career, working as a geologist, cartographer, and photogrammetrist, Bill was a prime mover in demonstrating to the scientific and technologic communities the great value and utility of aircraft and spacecraft data in a practical and systematic approach to Earth surveys and resource studies.

Early in his career, as head of the USGS photogeology section, Bill directed the mapping of Alaska petroleum reserves and led the mapping of suspected uranium-bearing areas in the western United States. In the late 1950s and early 1960s, Bill's research in remote sensing techniques drew national and international attention. He showed, for example, that infrared and other scanning devices carried in aircraft could detect and monitor earth science and environmental phenomena. Using such techniques, he was able to map areas of subsurface heat with Hawaiian volcanoes and to detect areas where fresh groundwater was leaking into the Pacific Ocean from the Hawaiian Islands.

Spurred mostly by Bill's imaginative research, DOI established the EROS (Earth Resources Observation Systems) program in 1966. The program, managed by the USGS and carried out in cooperation with NASA, envisioned the use of remote-sensing observation instruments from a satellite to provide data interpretable for a variety of purposes in virtually the full range of natural and human resources activity. Under Bill's direction, the EROS program expanded and received broad support and participation not only from geologists, engineers, and cartographers in the United States but from specialists from nations on nearly every continent.

The pioneering research and perceptiveness of Bill's work was substantiated with the launching of the first ERTS satellite by NASA on July 23, 1972. From the initial conception of the world's first earth resources survey satellite system to the time of his retirement in November 1979, Bill played a key role in helping to plan national and international cooperative programs aimed at learning more about earth science phenomena, natural resources, and environmental changes from high-altitude platforms.

For his contributions to remote sensing research, Bill was the recipient of numerous honors and awards. In 1965, he received the American Society of Photogrammetry's Colonel Claude Birdseye Award for service to photogrammetry and for contributions to photointerpretation. In 1969, he was granted the Meritorious Service Award of the Department of the Interior and in 1973 was presented with DOI's highest honor, the Distinguished service Award. In 1974, he was selected as the first recipient of the annual William T. Pecora Award, sponsored jointly by DOI and NASA in recognition of "outstanding contributions of individuals or groups toward the understanding of the Earth and its atmosphere by means of remote sensing." In 1975, he was awarded NASA's Medal of Exceptional Scientific Achievement, and in the same year, in recognition of his work toward the development of the EROS program and the establishment of the EROS Data Center at Sioux Falls, SD, Bill was awarded an honorary Doctorate of Science degree from Augustana College at Sioux Falls.

Bill was the author or coauthor of more than 60 reports and maps on a number of varied topics in the fields of his interest. Active in numerous scientific and technical organizational activities, he was a past president and one of only 18 honorary members of the American Society of Photogrammetry. He also served on the National Academy of Sciences Committee on Remote Sensing of Environment. He was a member of the Cosmos Club and a member of a U.S. delegation to the Soviet Union related to the exchange of remote sensing data and science results from aircraft and satellites for analogous areas in the United States and the USSR.

History of the Fredericksburg Geomagnetic Center, Corbin, Virginia

Jack B. Townshend

July 17, 2006

(Jack Townshend was a geophysicist (geomagnetics) who worked for the Coast and Geodetic Survey and the USGS for 66 years, along with three years' military service, giving him just shy

of 70 years of service. John succeeded his father, Samuel, a 40-year observer at the original U.S. geomagnetic observatory at Cheltenham, MD. Jack continued in the position later in Fredericksburg, VA, and in Fairbanks, AK, until his retirement just prior to his death in 2012. Thus, father and son performed the same job for almost 110 years. The geomagnetic observatory in Fairbanks is now named the Jack B. Townshend College International Geophysical Observatory.)

Early History of the "Survey of the Coast"; U.S. Coast Survey and U.S. Coast & Geodetic Survey

The roots for the foundation of the NOAA NGSLTC and the USGS FMO go back in history to the early 1800s. In 1807, Congress authorized President Thomas Jefferson to establish an organization to survey the coasts of the United States. Jefferson chose Swiss-born Ferdinand Hassler to become the first Superintendent of this new bureau; this was the beginning of the oldest U.S. scientific organization whose expanded missions and responsibilities have continued to the present day with the missions of the USGS Fredericksburg Magnetic Observatory (FMO) and the National Geodetic Survey Laboratory and Training Center (NGSLTC) at Corbin, VA. Initially, the Coast Survey was not a scientific organization. It was an engineering organization that collected geographic and geophysical facts. It collected facts of this nature on a virtually unprecedented scale, devised means to process them accurately and rapidly for those times, and organized a distribution system to communicate findings to an interested public. Fundamental discoveries were made and in the quest for ever-increasing accuracy, rapidity of observation, and efficiency of data reduction, many engineering advances were made. Ferdinand Hassler died in 1843, and Professor Alexander Dallas Bache (great grandson of Benjamin Franklin) became the Superintendent of the U.S. Coast Survey.

Knowledge of geophysical phenomena, physical oceanography, marine geology, marine biology, and meteorology was furthered as an adjunct to the primary mission of charting the coast. Although Superintendent Bache was concerned with advancing the surveying and charting of the United States coast, he had the larger mission of using the Coast Survey as a tool to raise the stature of American science both within the United States and throughout the World. Bache closely directed the science and engineering accomplished by the military and civilian assistants working within the Coast Survey and distributed patronage to leading academic scientists for working on Coast Survey projects. He strongly influenced the organization and political awakening of the American scientific community through the American Association for the Advancement of Science and the formation of the National Academy of Sciences.

In 1843 and again in 1947, Congress provided authority for the U.S. Coast Survey to perform geomagnetic surveys. This was the beginning of an official journey that has led scientists for more than 160 years to map, investigate and study the elusive and sometimes little-understood magnetic forces of the earth and space. Before becoming Superintendent of the Coast Survey, Bache had a personal and professional interest in the study of the Earth's magnetic field and in 1840 had established the first magnetic observatory in the United States at Girard College at Philadelphia, PA. During the last half of the 19th century magnetic declination, dip, and intensity observations were made at various magnetic stations geographically established around the USA. The first isogonic chart was published in 1855 and theories started to be developed as to the location of magnetic poles.

By the 1850s, the philosophy of measurement and analysis had evolved greatly in the U.S. Coast Survey. Harvard mathematician Benjamin Peirce, a good friend of Superintendent Bache, in a Coast Survey report in 1854 wrote, "There is in every species of

observations an ultimate limit of accuracy beyond which no mass of accumulated observations can ever penetrate. A wise observer, when he perceives that he is approaching this limit, will apply his powers to improving methods, rather than to increasing the number of observations. This principle will thus serve to stimulate and not paralyze effort; and its vivifying influences will prevent science from stagnating into mere mechanical drudgery…."

In 1878, the name was changed from the U.S. Coast Survey to the U.S.Coast and Geodetic Survey (USC&GS) to reflect the role of geodesy. In 1899 the Division of Terrestrial Magnetism was established in the USC&GS. This was the beginning of the organization that is now called the "Geomagnetism Group" in the USGS, which has had many name changes and served under various government agencies but has continued uninterrupted, a systematic study of the magnetic field and magnetic surveys for more than 100 years.

The first permanent geographically located magnetic observatory in the United States was constructed and operational at Cheltenham, MD, in 1900 and continued uninterrupted operations until May 1956, when it was replaced by the Fredericksburg Magnetic Observatory. Additional permanent magnetic observatories were constructed in Sitka, Alaska in 1901 and Honolulu, Hawaii in 1902. At the time of this history in May 2006, the USGS operated fourteen (14) magnetic observatories that extend from Puerto Rico in the Atlantic Ocean to Guam in the Pacific Ocean to Barrow, AK, the most northern tip of the United States on the Arctic Coast of the Chukchi Sea.

In 1903 the USC&GS was transferred from the U.S. Treasury Department to the newly organized U.S. Department of Commerce. In 1926 the production of aeronautical charts was added to the USC&GS mission to meet the requirements of the new air transportation age.

History of the Development of the "Fredericksburg Geomagnetic Center"

In 1952, Congress authorized the construction of a new magnetic observatory to replace the Cheltenham Magnetic Observatory (CMO) and to serve as a primary focus for the U.S. Government's national effort to enhance geomagnetic field studies and monitoring programs, in support of scientific, general public, basic and national security needs of the United States. The CMO was located about 14 miles southeast of Washington, DC on grounds where the state of Maryland operated an orphanage and reform school for boys. The school's plans for expansion and the increased industry build-up in the area, including electrified railroads, eventually marginalized the quality of scientific research and data acquisition. A search for a replacement location led to the selection of a suitable 187.44-acre tract of land on the A.P. Hill Military Reservation in Caroline County, Corbin, VA, about 10 miles from Fredericksburg, VA. The Department of the Army transferred the tract of land to the Department of Commerce for construction of the new observatory by the USC&GS. The new observatory, named the Fredericksburg Magnetic Observatory and later renamed the Fredericksburg Geomagnetic Center (FGC), was officially dedicated on May 23, 1956.

History of ESSA, Occupancy of Geodesy at the FGC and Formation of NOAA

The work of the USC&GS was highly respected by the public, business, and scientific communities for its integrity, accuracy, and reliability. It operated effectively and efficiently serving the nation for well over a century with little interruption from organizational changes until 1965. In 1965 the USC&GS along with the Weather Bureau was transferred to the newly formed Environmental Science Services Administration (ESSA) within the Commerce Department.

In 1970 the National Oceanic and Atmospheric Administration (NOAA) was formed in the U.S. Department of Commerce, and the organization known as ESSA for five years was abolished. At that time the USC&GS and the Weather Bureau were transferred to NOAA. Under the administration of NOAA, the Weather Bureau was renamed the National Weather Service and the USC&GS was renamed the National Ocean Survey. In 1982 the National Ocean Survey was renamed the National Ocean Service (NOS) and was established as a line office of NOAA. Also in 1982, to acknowledge the geodetic portion of NOAA's mission, the part of NOS responsible for geodetic functions was named the National Geodetic Survey (NGS).

Transfer of Authority for the FGC from NOAA in Commerce to USGS in Interior

In September 1973 the responsibility for the NOAA geomagnetism and seismology research and data acquisition disciplines was transferred from NOAA in the Department of Commerce to the USGS in the Department of the Interior. The USGS and the NOAA entered into a Memorandum of Understanding to continue the cooperative efforts started in 1969; the FGC function would continue uninterrupted as a joint occupancy of the USGS Fredericksburg Magnetic Observatory and the NOAA-NOS Geodetic Instrument Calibration Center. This cooperative effort between the USGS and NOAA started in 1969 has continued and is operable at the time of writing of this portion of history in May 2006.

Touch of USGS History

With the transfer of the FGC in 1973, from NOAA in the Department of Commerce to the USGS in the Department of the Interior it is important to back up and include a touch of USGS history. Congress turned to the National Academy of Sciences in June 1878 and asked it to recommend a plan for and mapping the Territories of the United States that would secure the best possible results at the least possible cost. A committee of seven members appointed by the Academy recommended that the Coast and Geodetic Survey be transferred from the Department of the Treasury to the Department of the Interior, renamed the "Coast and Interior Survey," and be given responsibility for geodetic, topographic, and land-parceling surveys in addition to its existing work. The Academy committee also recommended that an independent organization, to be called the U.S. Geological Survey, be established in the Interior Department to study the geological structure and economic resources of the public domain.

Legislation to rename the Coast and Geodetic Survey and transfer it to the Department of the Interior and to establish the U.S. Geological Survey was included in the bill appropriating funds for the legislative, executive, and judicial expenses of the Federal Government for the fiscal year beginning July 1, 1879. The Democratic House and Republican Senate were far apart on some items in the bill, and it became evident that agreement could not be reached before adjournment. The Senate and House conferees agreed to combine into one item the sections establishing the geological survey and the the appropriation for the expenses of the U.S. Geological Survey. The sundry civil expenses bill included a brief section establishing a new agency, the United States Geological Survey, placing it in the Department of the Interior, and charging it with a unique combination of responsibilities: "classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain." Thus the United States Geological Survey (USGS) was established on March 3, 1879, just a few hours before the mandatory close of the final session of the 45th Congress, when President Rutherford B. Hayes signed the bill appropriating money for sundry civil expenses of the Federal Government for the fiscal year beginning July 1, 1879. Clarence King became the first

Director of the USGS, taking the oath of office on May 24, 1879.

Now more than 27 years into its second century, the USGS continues to fulfill its original mission of classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain. It conducts research both on the cutting edge of science and with reference to economic and other issues of national concern, to develop and apply innovative means of solving problems in resource management. It continues the challenge to advance the earth sciences in the service of the public and in cooperation with other agencies.

History in the Making by USGS and NOAA at the FGC in the 21st Century

In 2005 the USGS Geomagnetism Group and the NOAA National Geodetic Survey started a dialogue on the most effective and efficient use of the property at the Fredericksburg Geomagnetic Center, being aware that congressional action from1952 intended for the site to serve as a focus for the U.S. Government's national effort to enhance geomagnetic field studies and monitoring programs, in support of scientific, general public, basic and national security needs of the United States. After more than six months of dialogue and negotiations it was determined that as wise custodians of the federal government resources, it was in the best interest of the USGS and the NOAA missions to continue the two-fold role at the FGC Site, but in order to allow each agency more freedom for planning and conducting their mission responsibilities, that the ownership should be divided. The team recommended that 142.67 acres of the 187.44 acres of the land and all buildings, facilities, utilities, roads and the operational costs and responsibility on the 142.67 acres of land, known as part of the USGS Fredericksburg Geomagnetic Center of The Department of the Interior, be transferred to the National Oceanic and Atmospheric Administration of The Department of Commerce for operation of the NOS National Geodetic Survey Calibration and Training Center, and the USGS retain ownership of 44.77 acres of the 187.44 acres of the land and all buildings, facilities, electrical utilities and roads on the 44.77 acres of land, for the operation of the Fredericksburg Magnetic Observatory as authorized by congressional action (Public Law 338 – 82nd Congress, May 13, 1952). At the time of writing this portion of history in May 2006 the USGS, the NOAA, and the General Services Administration are proceeding with the official administrative process to implement this land transfer as soon as possible.

Significant Contributions by the Geomagnetic and Geodetic Programs at the FGC

During the past fifty years that the FGC has been in operation the geomagnetic and the geodetic programs conducted at the FGC site have made significant contributions to the scientific and public communities. It is noteworthy to mention just a few:

Geomagnetic Programs

- Proton GyroMagnetic Ratio determined by P.L. Bender and R.L. Driscoll of the National Bureau of Standards (NBS) with assistance from the FMO Staff
- U.S. and International Magnetic Standards determined and maintained at the FMO
- NASA calibrated satellite magnetometers with assistance from the FMO staff prior to sending them into orbit
- Hundreds of precision magnets and magnetometers calibrated by FMO staff for US agencies and other countries around the world
- Scientists from the US and other countries around the world trained in Geomagnetic Observatory and field operations. Many trained at the FGC became: Directors of Geophysical Institutes; University Professors; Director of a University

Space Study Program; Rear Admiral in the National Oceanic and Atmospheric Administration; Supervisor, Electromagnetic Radiation and Natural Space Environments Group, Reliability Engineering Office at the Jet Propulsion Laboratory

Geodetic Programs

- Invention of the Electronic Distance Measuring Instrument (EDMI) by Bud Leslie
- Photo triangulation measurements made taking images of satellites against the night sky
- Corbin Quad installed to test angulation capabilities of modern total stations
- Corbin Calibration Base Line (CBL) installed. Only CBL in the US measured over its entire length with invar tapes calibrated at the NBS
- Global Positioning System (GPS) Antenna Phase Center Calibration Site installed. Hundreds of GPS antennas from around the world calibrated at this facility

USGS Estimates 20 Billion Barrels of Oil in Texas' Wolfcamp Shale Formation

(Occasionally we like to include results of current Survey programs. The research that resulted in this discovery was conducted by Stephanie Gaswirth and other staff of the Denver energy team.)

The Wolfcamp shale in the Midland Basin portion of Texas' Permian Basin province contains an estimated mean of 20 billion barrels of oil, 16 trillion cubic feet of associated natural gas, and 1.6 billion barrels of natural gas liquids, according to an assessment by the U.S. Geological Survey. This estimate is for continuous (unconventional) oil, and consists of undiscovered, technically recoverable resources.

The estimate of continuous oil in the Midland Basin Wolfcamp shale assessment is nearly three times larger than that of the 2013 USGS Bakken-Three Forks resource assessment, making this the largest estimated continuous oil accumulation that USGS has assessed in the United States to date.

"The fact that this is the largest assessment of continuous oil we have ever done just goes to show that, even in areas that have produced billions of barrels of oil, there is still the potential to find billions more," said Walter Guidroz, program coordinator for the USGS Energy Resources Program. "Changes in technology and industry practices can have significant effects on what resources are technically recoverable, and that's why we continue to perform resource assessments throughout the United States and the world."

Although the USGS has assessed oil and gas resources in the Permian Basin province, this is the first assessment of continuous resources in the Wolfcamp shale in the Midland Basin portion of the Permian.

Since the 1980s, the Wolfcamp shale in the Midland Basin has been part of the "Wolfberry" play that encompasses Mississippian, Pennsylvanian, and Lower Permian reservoirs. Oil has been produced using traditional vertical well technology.

However, more recently, oil and gas companies have been using horizontal drilling and hydraulic fracturing, and more than 3,000 horizontal wells have been drilled and completed in the Midland Basin Wolfcamp section.

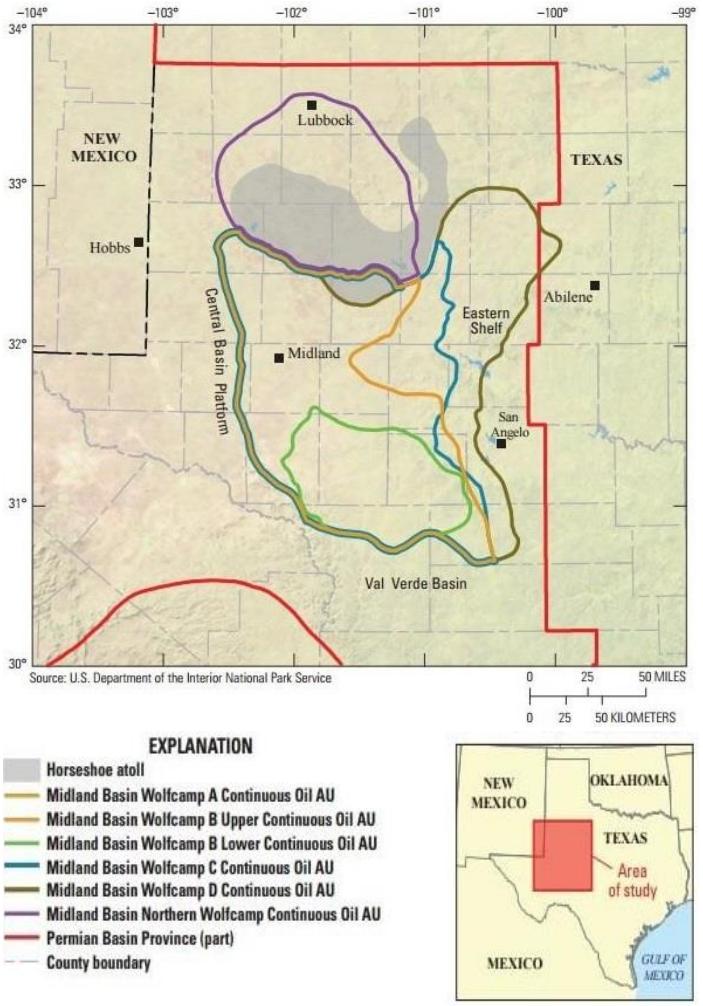
The Wolfcamp shale is also present in the Delaware Basin portion of the Permian Basin province but was not included in this assessment. The Permian Basin province includes a series of basins and other geologic formations in West Texas and southern New Mexico. It is one of the most productive areas for oil and gas in the entire United States.

Continuous oil and gas is dispersed throughout a geologic formation rather than existing as discrete, localized occurrences, such as those in conventional accumulations. Because of that, continuous resources

commonly require special technical drilling and recovery methods, such as hydraulic fracturing.

Undiscovered resources are those that are estimated to exist based on geologic knowledge and theory, while technically recoverable resources are those that can be produced using currently available technology and industry practices. Whether or not it is profitable to produce these resources has not been evaluated.

USGS is the only provider of publicly available estimates of undiscovered technically recoverable oil and gas resources of onshore lands and offshore state waters. The USGS Wolfcamp shale assessment was undertaken as part of a nationwide project assessing domestic petroleum basins using standardized methodology and protocol.



News from Retirees

Mike Carr (*Pat Muffler sent the following information, for those who don't know Mike: USGS planetary geologist Michael H. Carr has participated in almost every U.S., Russian and European mission to Mars. Since joining the USGS in 1962, "Mars Mike," as he is known among colleagues, has worked primarily in lunar and planetary studies. He participated in the USGS's lunar geologic mapping program and in a variety of Apollo program; as leader of the Viking orbiter imaging team, he directed the acquisition of 55,000 pictures of Mars and their subsequent interpretation. He participated in the selection of the site for the July 4, 1997, landing of Pathfinder on Mars but missed seeing live coverage of the Pathfinder landing, because at that moment he was leading the San Mateo County Mounted Sheriff's Patrol down the streets of Redwood City, Calif., in the Fourth of July parade. Among his many awards are a NASA Medal for Exceptional Scientific Achievement (1977); the DOI Meritorious Service (1979) and Distinguished Service (1988) awards; and the Geological Society of America's G.K. Gilbert award (1993). He was also the 1994 recipient of the National Air and Space Museum's Lifetime Achievement Award in Air and Space Science Technology. He is currently working as a Scientist Emeritus on the implications of Deuterium/Hydrogen ratios for the evolution of the Mars surface and atmosphere.)*

Mars is a busy place these days. There are six working spacecraft now at Mars. Four orbiters are mapping the surface topography, mineralogy and gravity field, detecting subsurface ice, monitoring global weather patterns, measuring interactions of the solar wind with the upper atmosphere, and so forth. Two rovers are moving across the surface acquiring ground truth. The flood of data is overwhelming. Several percent of the planet has been photographed from orbit at 30 cm /pixel resolution, and 60% of the planet has been mapped with a visible and near-infrared spectrometer with a 100 m spatial resolution. Over 500 papers were published last year on results

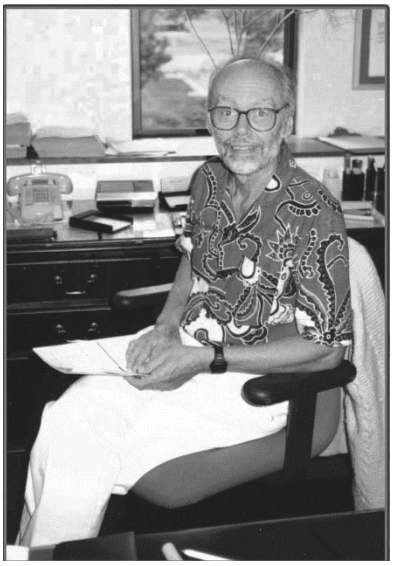
from one orbiter alone, the Mars Reconnaissance Orbiter. I recall that when I started studying Mars in the early 1970's there were fewer than 30 people actively involved in Mars science, and I knew them all. Now there are several hundred spread across the globe.

Present-day Mars is cold and dry. The average temperature at the equator is roughly the same as the average at the Earth's south pole, and only a minute amount of water is in the atmosphere. Almost all the near-surface water is in layered, ice-rich deposits at the poles, which contain enough water to form a 20-m-thick global layer. So present-day Mars is a very hostile place. But things were different in the past. At the end of heavy bombardment around 3.8 billion years ago, there is abundant evidence of fluvial activity, local lakes and possible ocean-sized bodies of water. The Curiosity rover landed in 2012 at the location of one of these lakes at the periphery of an alluvial fan and has since been moving across the lake deposits, having encountered conglomerates from the fan and layered mudstones deposited in the lake. The mudstones are of particular interest because they were deposited under neutral pH conditions and contain organics and other materials essential for life. It was a habitable environment, although whether life ever started on Mars is still undetermined. After this early fluvial-lacustrine era, global conditions appear to have changed. Indications of fluvial activity decline, and sulfate-rich deposits become more common. In 2004 the rover Opportunity landed on a sulfate-rich deposit that appears to have been deposited in an area with dunes and ephemeral inter-dune acid lakes. This era—around 3.5 billion years ago—was also characterized by large floods that must have left large bodies of water in the northern plains, where most of the flood features terminate. After about 3 billion years ago, conditions on Mars seem to have been mostly like today, although there were occasional floods and climatic perturbations caused by large variations in the tilt of the rotational axis.

Despite the story just outlined, huge uncertainties remain such as how warm and how wet was early Mars, how were those conditions enabled, where did all the water go that formed the lakes, rivers and floods, what caused the global climates to change and most importantly of all, did some form of life ever start on Mars. Most Mars scientists believe that, despite the enormous advances in robotics and instrumentation, confident detection of life, if any ever existed, will require samples returned to Earth. The first step toward that goal may be a new mission in 2020 that we hope will collect and store samples to be returned by some subsequent mission. (The full sample return mission is too expensive to be performed at one opportunity). I hope to see those samples some day, but I fear it is a long way off.

Larry and Buddie Rooney: In my last message, I expressed hope that my driver's license good to my 91st birthday would expire before me, and that seems likely. Last November I celebrated my 90th on a Mississippi paddle steamer. Ninetieths traditionally are occasions for family reunions but Whitefish in November is no place to visit by choice—generally gray and cold without the beauty of snow. Whitefish is great April into October and mid-December to March. I wanted to save our three sons discomfort or guilt.

We continue to travel much and may wobble though Australia again in February and March and around Italy in April. The "may" is operative only with regard to health because all arrangements have been made for the trips. Part of the Australian venture will be on the Ghan from Adelaide to Darwin. We have ridden the Ghan from Alice Springs to Adelaide but at that time there was no train north from Alice Springs. We have also ridden the



India Pacific from Sydney to Perth.

I wrote a story of my life to retirement, printed it, and released it on Amazon early this month. I was amazed that a friend ordered it (*A Ricochet Life*) and received it before I had seen a copy.

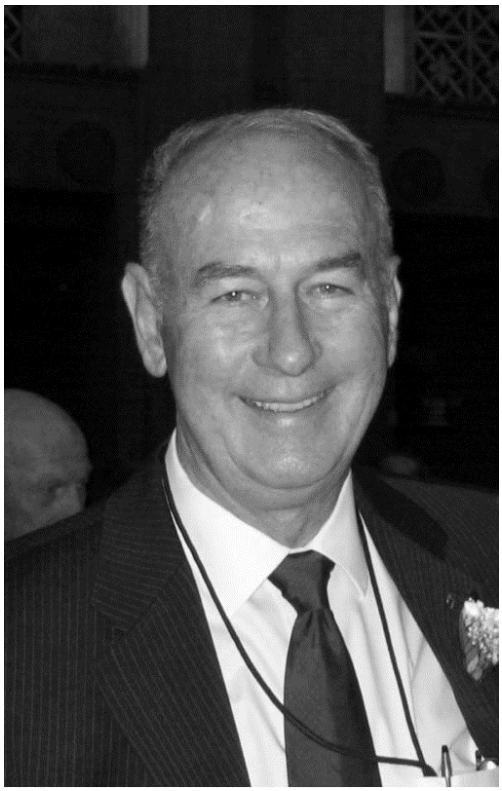
Rob Wesson has published a book, *Darwin's First Theory,* on Darwin's immersion in geology during his early scientific career. According to Kirkus Reviews, Wesson "hits the jackpot when he concentrates on his subject and reveals that 20 years before Darwin wrote *On the Origin of Species,* his genius was already in evidence. A welcome addition to Darwin studies." The book will be available from Amazon on April 11.

Rob at the AESE dinner

The following abstract is from Rob's address to the Association of Earth Science Editors (AESE) annual dinner last September.

"Most Americans, even if they know something about Charles Darwin, don't know that he started his real scientific career as a geologist. Or that his first published theories were not about natural selection, but about what we now call tectonics. My last years at the USGS were largely spent in front of computer screens. When I retired, I wanted to spend time in the field, to reconnect with what got me interested in geology in the first place, and to write something that would appeal to a lay audience about how geologists think, and why that is important. I followed Darwin's geologic trail through South America, Wales, and Scotland. I met and worked with modern geologists pursuing many of the questions that Darwin pondered 180 years ago. After memos and papers, narrative nonfiction was a dare and a joy. Weaving together the threads of Darwin's geology and my own adventures, constructing a compelling narrative arc, and finding a commercial publisher, all proved challenges. The test of success will be when *Darwin's First Theory* hits the street."

Memorials



Charles G. "Skip" Cunningham (1940-2017) was an internationally recognized economic geologist specializing in the genesis of volcanic-hosted ore deposits. In addition to distinguishing himself as a

scientist with the USGS, Skip was an exceptional individual and a great mentor who had that rare quality of making everyone around him better and happier. He was universally esteemed by his colleagues and friends – a true gentleman and scholar.

Skip passed away on January 2, 2017. Born on December 5, 1940, he was the son of Robert and Mildred Heydt. He is survived by his wife of 48 years, Cheryl, his daughters, Wendy Littman and Betsy Cunningham, and 4 grandchildren. Parkinson's had progressively diminished his body, but not his wonderful spirit.

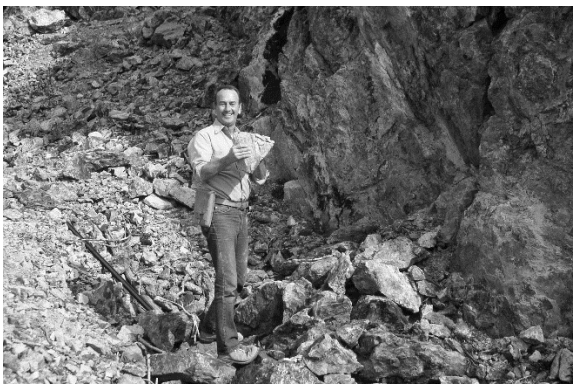
Early on, academics did not interest Skip, and he left high school to enlist in the U.S. Coast Guard for 4½ years, departing with his GED. However, after this slow beginning, Skip "took on" education with the enthusiasm with which he embraced everything in life. He first earned an Associate's Degree from Norwalk Community College, followed by a B.A. in Geology/Physics from Amherst College, an M.S. in Geology/Chemistry from the University of Colorado, and a Ph.D. in Geology/Chemistry from Stanford University in 1973. He then spent a year teaching at Syracuse University, where students voted him the best geology professor.

In 1974, Skip joined the USGS and spent the next 33 years pursuing a remarkable career researching ore deposits in volcanic and subvolcanic environments. To help unravel the mysteries of ore genesis and mineral resource evaluation, he combined his love of fieldwork with advanced isotopic and geochemical lab techniques. Skip was an outstanding collaborator who worked with a large network of colleagues and students. He published over 150 papers and maps on ore deposits throughout the Western United States and the Circum-Pacific region. He championed the Marysvale volcanic field, UT, as a natural laboratory for developing genetic models that describe the processes involved in the formation of various types of acid sulfate deposits and their supergene destruction.

Skip also spent much of his career working on ore deposits in South America. He played a critical role in the formulation and execution of the InterAmerican Development Bank Project in Bolivia, Chile, and Peru. At Potosi, Bolivia, he determined that the world's largest silver deposit had formed in a volcanic dome, leading to a genetic model for these deposits that is used by exploration companies worldwide.

Skip's work on paleothermal anomalies also has changed exploration strategies. At Rico, CO, he documented the existence of a major paleothermal anomaly, which led to the discovery of a world-class molybdenum deposit 1 km beneath the surface. By documenting the paleothermal anomaly surrounding the Bingham Canyon porphyry copper deposit, he recognized its genetic link to two Carlin-type gold deposits located at a distance of 7 km, which also formed as part of that giant hydrothermal system.

At the USGS, he was the Deputy Chief of the Office of Mineral Resources and the Coordinator for the Development of Assessment Techniques Program. For 18 years, he served as secretary and member of the Board of Directors of the Economic Geology PubCo., was Vice President of Society of Economic Geologists, and was a member of the SEG Research Committee. He was on the editorial board of *Ore Geology Reviews* for 7 years.



Skip received numerous awards including the Department of the Interior's prestigious Distinguished Service Award "*in recognition of his exceptional contributions to the U.S. Geological Survey and the*

international community in the field of economic geology." He was also the recipient of the Government of Japan Science and Technology Agency Research Award for Foreign Specialists, and was elected Honorary Visiting Professor on the Science Faculty, National University of San Luis, Argentina.

As colleagues, we have all known great geologists, but few have experienced such a great person as Skip. Each of us remembers his smile and the positive attitude that he exuded. It affected us all. Skip's work will stand the test of time, and his spirit will live forever in those he touched.

Daniel O. Hayba, Robert O. Rye, Charles H. Thorman, W. David Menzie II, Joseph A. Briskey, John A. DeYoung, Jr., John R. Gray, Peter D. Rowley

John M. De Noyer was born on May 19, 1926, in Kalaw, Burma, and passed away on June 6, 2016, at the age of 90. He lived in Burma with his missionary parents until he was 7. In 1933 they moved back to the United States where he and his sister grew up near Texarkana, TX. He served as a medic in the U.S. Army in World War II from 1944-1946 and in the Ordinance Division during the Korean conflict from 1950-1951. In those years the G.I. Bill gave many veterans an opportunity to attend college. He earned a B.A. in mathematics from Chico State College and an M.A, and Ph.D. from the University of California, Berkeley.

From 1957 to 1965 John served on the faculty of the Department of Geology and Mineralogy of the University of Michigan in Ann Arbor, where he attained the rank of Associate Professor. While at Michigan he also served as acting Head of the Acoustics and Seismic Laboratory at the Willow Run Laboratories and spent a year at the Institute for Defense Analyses in Washington, D.C. In 1965 he became Deputy Director for Nuclear Test Detection in the Advanced Research Projects agency in the Office of the Secretary of Defense. The name of the project was VELA.

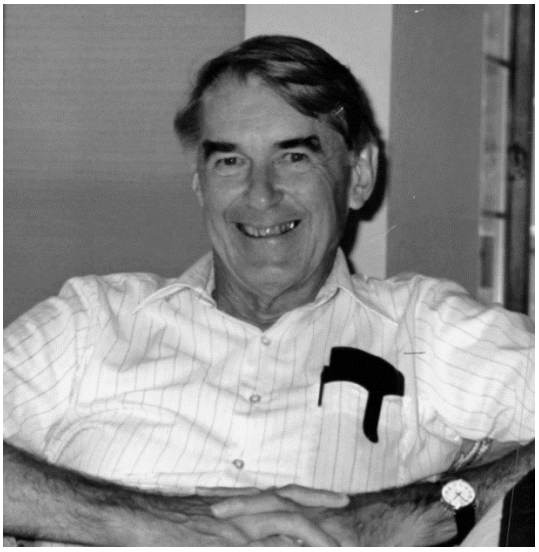
In 1967 he was asked to join the USGS as the Assistant Director for Research. This was a time when the "Space Age" was being recognized for its value to the civilian community. John worked closely with NASA and transferred to NASA in 1969 as Director of the Earth Observation Programs. In addition to the meteorological satellites the Earth Resources Technology Satellite (ERTS) was being developed. ERTS was launched in 1972. (ERTS was later renamed LANDSAT). The success of the LANDSAT program is outstanding. It is the longest active program in NASA, and the partnership between NASA and the Department of the Interior, who stores and distributes the data, is an excellent example of interagency cooperation.

John returned to the USGS in 1972 and directed the Earth Resources Observation Systems program (EROS) for distribution and training for uses of the LANDSAT and other remotely sensed data. His last position was as a research geophysicist at the USGS.

John retired in 1991 and with his late wife, Ann Csonka, turned attention to local civic and environmental affairs. He served on the Herndon Town Council for 16 years between 1988 and 2004 and was Vice Mayor from 1990 to 1992 and January 2004 to June 2004. They were both active in nature education and did pro bono consulting for various groups that

included Huntley Meadows, Chapman's Landing, Maryland Native Plant Society, Maryland DEQ, various individuals, and home owner groups. An area of special interest was the National Pipeline Reform Coalition to foster adequate regulation and enforcement for pipeline safety. John was appointed to the Fairfax County Environmental Quality Advisory Council (EQUAC) where he served from 1989 to 1996. He was Chairman of EQUAC from 1991 to 1994.

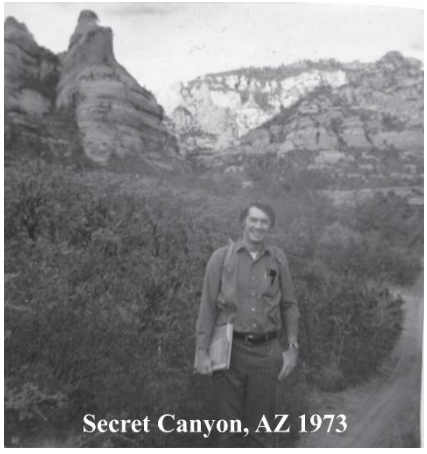
John married Doris Hope Hoffman on November 3, 1951. The marriage ended in divorce after their four children were grown. Early years in the D.C. Metro area were in Chevy Chase, MD, with his first wife and children. John moved to Herndon in 1983 where he remained with his second wife, Ann Csonka - the love of his life. Ann passed away on March 1, 2014. His surviving children are Barbara De Noyer in Gaithersburg, MD; Perry De Noyer and his wife Bonnie in Waldorf, MD; and Emory Riley in Falls Church, VA. Daughter Linda Jespersen passed away in Colorado in 2002. Stepchildren are Carol Brown in Eldersburg, Maryland; and Steve Csonka and his husband George Parenteau in Sarasota, Florida.



Val Leroy Freeman of Golden, CO, passed away on May 23, 2016 a month before his 90th birthday. He was born in Long Beach, CA to Cecil and Marjorie Freeman. After graduating from Long Beach Polytechnic, Val attended Cal Tech and Occidental College while in the Navy's officer training program. He had served just a brief time near Japan, as an Ensign on the John L. Williamson, DE 370, when WW 2 officially ended. Val said that it was during his time at sea, when he was "a mile from the nearest rock" that he read a college text book on geology, which he found in the ship's library. He graduated from Univ. of Calif. at Berkeley with a BS in Geology in 1949. He earned his MS in 1954.

Val worked for the US Geological Survey for 36 years, from 1949 to 1985. During his career he worked on the geology of uranium-bearing rocks, geologic mapping, the mineral potential of wilderness areas, lunar geology and coal resources. He worked in AK, CO, NM, UT, MT, TX, ID and AZ. From 1949 to 55, Val did geologic mapping in Montana and worked on the stratigraphy of the Morrison Formation in CO and NM. He was in Fairbanks, AK 1955 – 57, and then moved to the Denver Federal Center, where he worked until 1970. During this time, he was spending summers in the wilderness areas around Aspen and Snowmass.

In 1970, Val was transferred to the lunar geology program in Flagstaff, AZ. He worked with the astronaut training and mission simulations, preparing for geologic tasks on the moon's surface. He also worked with the mission planning team designing traverse plans and maps to accomplish the maximum amount of science during their time on the surface. Val was one of the field geologists that accompanied the Apollo 16 crew on a training trip to Hawaii. He was on the mission planning team for Apollo 17. Val


Secret Canyon, AZ 1973

returned to Denver in 1974 and was assigned to coal research in western Colorado. When he retired in 1985 he was the Deputy Chief of the Coal Resources Branch.

Val is survived by his wife, Betty of Golden, CO; his daughters, Jill (Doug) Michener and Rebekah (Peter Dybing) Sabia; three step-daughters, an adopted son, four stepsons, his sister, Audrie Wing and brother, Don Freeman, 15 grandchildren, and five great-grandchildren. Val enjoyed genealogy, playing the recorder, square dancing, traveling, walking, listening to music (especially jazz) and sipping a good glass of wine. Family and friends celebrated his life at a private gathering in June. 2016.

--Jill Michener and Rebekah Sabia

Charles Wilbur (Chuck) Naeser, 76, of Herndon, VA, passed away on November 18, 2016, at Virginia Hospital Center in Arlington, from complications of lymphoma. He was surrounded by his family.

Chuck was born in 1940 in the District of Columbia, where his father, Dr. Charles R. Naeser, was a longtime professor and Chairman of the Chemistry Department at George Washington University. Chuck graduated from Falls Church High School in 1958, obtained an A.B. in Geology from Dartmouth College in 1962 and an M.A. in 1964, and in 1967 obtained the first Ph.D. in the geological sciences awarded by Southern Methodist University. His 38-year career as a Research Geologist at the USGS began in 1967, first in Menlo Park, then in Denver for 22 years, and from 1993 in Reston.

Beginning with his Ph.D. thesis, Chuck was a pioneer in the emerging field of fission-track thermochronology, a technique for determining the age and thermal history of rocks, which was in its infancy when he began his career. He developed many of the practical techniques of the method and its wide-ranging applications that are now used in labs around the world, including determining the thermotectonic history of mountain ranges and sedimentary basins, origin and location of ore deposits, age of volcanic ashes, and evolution of landscapes. He used the method to help solve diverse geologic problems in many parts of the world, in cooperation with scientists from both within and outside the USGS. Along the way, he was always generous with his time in tirelessly introducing other scientists to the method through short courses and lectures and in mentoring students and professionals from the United States and many other countries who came to his Denver lab to learn fission-track analysis. He was an Adjunct Professor at Dartmouth College in the 1980's and at the University of Wyoming (1984-1995). He served as an advisor and examiner on many M.S. and Ph.D. theses from U.S. and overseas universities and was an invited reviewer on countless manuscripts and research proposals. At the same time, he was an author on more than 330 papers and abstracts reporting the results of his own research. His publications have been cited more than 7800 times in journals and other scientific publications worldwide. Chuck retired from his long and distinguished career at the USGS in 2005. Along with his wife, Nancy D. Naeser, he remained in active research as a Scientist Emeritus at the USGS in Reston until the time of his death.

In recognition of his work, Chuck was elected a Fellow of the Geological Society of America (1974), received the Colorado Scientific Society 1980 Best Paper Award, was selected by Life magazine as a member of their hypothetical ideal 15-person international dream team to study the origins of early man (December 1981 issue), and was awarded the Department of the Interior Meritorious Service Award (1993). He was elected a Councilor of the Colorado Scientific Society in Denver (1982-1984). In September 2016, at the 15th International Conference on Thermochronology in Brazil, he became only the second recipient of the Laslett Prize, awarded by the International Standing Committee on Thermochronology for "extraordinary contribution to the field of fission-track thermochronology."

Appropriate for someone who spent his entire career in fission tracks, his other passions were fishin' and tracks (both actual trains and model trains, particularly the G-scale garden railway in his backyard). Rumor has it that he caught his first fish, in the Tidal Basin, at age 11 months, not long after he received his first model train set. He was Treasurer of the Denver Garden Railway Society and spent many happy hours in Virginia running model trains for the annual holiday train shows at the USGS and Colvin Run Mill Park. He remained an avid fly fisherman all his life, in beautiful mountain streams and rivers from the Rocky Mountains to the Amazon, Atlantic Coast saltwater, and the farm pond out his back gate in Virginia. He fished on cherished canoe trips to the Quetico Provincial Park wilderness area in northwestern Ontario, beginning as a child with his family and ultimately spanning nearly 60 years and four generations of the Naeser family, to his son, son-in-law, and grandson.

Growing up in Virginia, Chuck was an Eagle Scout. He remained active in Scouts as Assistant Scoutmaster of BSA Troop 499 in Lakewood, CO, in the 1980's. He enjoyed skiing since his earliest days at Dartmouth College where he was a manager for the ski team. His last ski day, at age 75, on Easter Sunday 2016 with his son at Copper Mountain west of Denver, was some of his "best skiing in years"—beautiful day, perfect snow. And, like so many geologists who spend time outdoors, he enjoyed birding. Since retiring, he and Nancy have spent time in Arizona, watching birds and generally thriving on their love of the West.

He is survived by his wife, Nancy; daughter Christiana Naeser Zelloe of Marblehead, MA, son Robert B. Naeser of Denver, CO, and their mother, Barbara S. Naeser of Marblehead, MA; sister Dr. Margaret A. Naeser of Boston, MA; son-in-law Joseph J. Zelloe; daughter-in-law Hilarea Amthauer; four grandchildren, Jack and Molly Zelloe and Oscar and Vivian Naeser; aunt Anne Naeser of Janesville, WI; and his many caring and supportive friends.

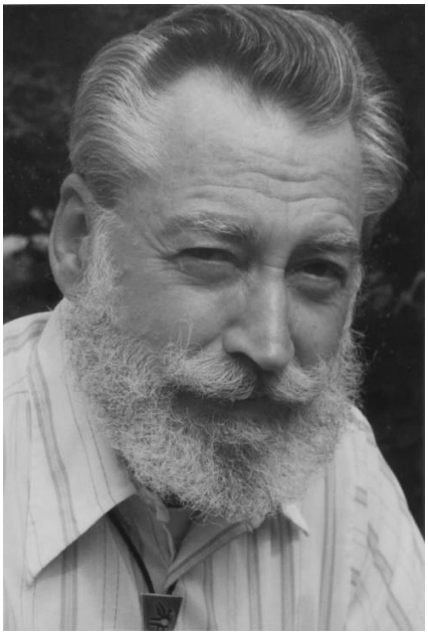
A memorial service will be held in the spring. Donations may be made in Chuck's memory to the Department of Earth Sciences, Dartmouth College, 6105 Fairchild Hall, Hanover, NH 03755, or to the Roy M. Huffington Department of Earth Sciences, Southern Methodist University, P.O. Box 750395, Dallas, TX 75275.

Nancy Naeser

Robert Brett O'Sullivan (1923-2016) died June 4, 2016, at the age of 92. He received his Bachelor's Degree from Yale and Master's Degree from the University of New Mexico. He served in the Army Air

Force. He joined the USGS in 1951 - the same year he and Betsy were married.

He loved his work, primarily on the Navajo reservation and Western slope. His family is very proud of his contributions to geology. A family friend while studying at the Colorado School of Mines was awe-struck and asked, "Is your father THE Robert O'Sullivan?" A son after telling another geologist about his dad got the response, "Robert O'Sullivan? Isn't he rather famous?" He walked 3 miles a day until age 89 and continued to walk a mile or more a day until a recent illness. After retirement he continued going to the geology office until March of 2016. Survivors are his wife Betsy, children Nancy, Brett and Jim, and four grandchildren.



Robert Leland Smith (1920–2016), renowned volcanologist and distinguished scientist with the USGS, was a world authority on ash-flow tuffs, silicic volcanism, and caldera structures. Bob died peacefully in Sacramento, California, June 17, 2016, a few days short of his ninety-sixth birthday. His publications on ash flows and their deposits brought about an international revolution in understanding explosive silicic volcanism and, in his fifty-year career, he profoundly influenced USGS programs and countless scientists.

Bob was born in Sacramento, California, on June 30, 1920 and grew up on the family property nearby in rural Fair Oaks. His father, W. Leland Smith, raised exotic pheasants and other rare game birds and his mother, Elma A. Smith was a florist. Young Bob acquired a keen interest in ornithology, botany, and nature in general, becoming a serious collector of natural objects, including insects, reptiles, wildflowers, native plant specimens, bird eggs, rocks and minerals, and artifacts. Boyhood exploits along the American River and family expeditions to Nevada deserts instilled in him an acute sensitivity to the beauties of nature and a love of outdoor life. Later in life, this true naturalist became a superb birder and horticulturalist, who cultivated ferns, dwarf conifers, and other primitive species including a large collection of cycads that he nurtured and raised primarily from seed.

Bob excelled at science in high school, then attended Sacramento Junior College where his interest in mineralogy grew, and subsequently transferred to the University of Nevada, Reno to pursue geology, graduating in 1942. After a year at Columbia University, Bob joined the Mineralogy and Petrology section of the USGS in Washington, D.C., in 1943 under the direction of Clarence S. Ross. Bob's USGS career was interrupted in 1944, when he began three years with the U.S. Navy, serving aboard the destroyer USS *Nelson*. Duty as a gunnery officer resulted in serious hearing impairment, a disability that Bob steadfastly shouldered and largely overcame one-on-one and in small groups through lip reading and a hearing aid, but that severely limited his ability to attain the personal visibility that could result from service on committees and participation in scientific meetings, particularly large forums such as the

Geological Society of America and American Geophysical Union annual meetings.

During the summer of 1946, while awaiting final discharge from the Navy, Bob briefly visited C.S. Ross and E.S. Larsen, Jr., in the Jemez Mountains, New Mexico, where they had begun systematic geologic mapping and petrologic studies. The following winter, he attended the University of California, Berkeley, where Howel Williams kindled his enthusiasm for volcanology and an interest in calderas. Upon returning to the USGS in 1947, Bob joined Ross in the Jemez Mountains and spent the next ten summers there while devoting office time to studying welded tuffs and providing mineralogical and petrological service for other Survey projects. During this time, he and Ross concluded that perlite was the product of hydration of obsidian, likely containing magmatic water from the parent obsidian and a larger proportion of added meteoric water. Collaboration with Irving Friedman resulted in several papers (1958–1966) that presented isotopic proof of this concept, some of the first measurements of the high-temperature viscosity of hydrous rhyolitic glass, and development of obsidian hydration dating, a method based on diffusion of water into obsidian that could be rapidly applied to artifacts and source materials by measuring the thickness of the hydrated rim on natural glass surfaces using an optical microscope. The obsidian hydration dating method enabled chronological ordering of archaeological artifacts and assemblages, thereby opening up entirely new dimensions of archaeological research that might otherwise have remained inaccessible.

Modern concepts of ash flow emplacement, welding, cooling, crystallization, and chemical zonation were formulated by Smith and coworkers from study of the Bandelier Tuff in the Jemez Mountains. Bob's early work with Ross led to the iconic USGS Professional Paper 366, "Ash-flow tuffs: Their origin, geologic relations, and identification," begun in the early fifties and published, after printing delays, in 1961. Growing out of study of the Bandelier Tuff in the Jemez project, Bob also wrote, and published in 1960, two seminal papers, "Ash flows" in the review series of the *GSA Bulletin*, and USGS Professional Paper 354-F, "Zones and zonal variations in welded ash flows." These three publications, rich with outcrop, hand specimen, and thin section photographs, and originating the cooling unit concept, enabled geologists to communicate and compare tuffs using a common language. Moreover, the review paper elucidated the violent eruption of vast amounts of gas-charged silicic magma, the intimate association with caldera collapse, and the emplacement mechanism, welding, cooling, and crystallization of ash-flow deposits. These papers ushered in a revolution in field and petrologic study of previously enigmatic ash-flow tuffs, the products of the largest explosive volcanic eruptions. Collectively, as of this writing, the three have been cited over 1,300 times. The Professional Papers proved so popular as guides and teaching tools that they were reprinted and are still made available by the New Mexico Geological Society.

Also begun in the 1950s was Bob's association with Roy A. Bailey. Bob had become convinced that Redondo, the central domical mass within the Valles Caldera, was the result of post-subsidence structural uplift rather than differential collapse of the caldera. Bob and Roy set out in 1957 to remap Redondo in greater detail in order to document the evidence. Soon thereafter, visits to calderas of the San Juan Mountains of Colorado convinced the pair that the uplift process, and its relationship to magma chambers and ring complexes, was a general phenomenon. First presented at the Geological Society of America meeting in Denver in 1960, then in 1962 at the International Association of Volcanology meeting in Tokyo, their concept of resurgent cauldrons saw print in the classic 1968 paper of the same name in GSA Memoir 116 in honor of Howel Williams. This paper has so impacted volcanology and related fields of igneous petrology

and mineral deposit geology that it currently has nearly 700 citations. The pioneering 1960, 1961, and 1968 papers led the way to discovery of many other calderas in the western U.S. and worldwide.

Bob's Jemez work with Roy Bailey netted additional exceptional products. Compositional zonation of ash-flow tuff and evidence for zonation of its source magma chamber were meticulously documented in the pioneering 1966 *Bulletin Volcanologique* paper on the Bandelier Tuff. The *Geologic Map of the Jemez Mountains, New Mexico* (Smith, Bailey, and Ross, 1970) compiled the results of years of geologic mapping onto one sheet that portrays the now-classic Valles Caldera and the Bandelier Tuff, along with precursory and postcaldera volcanics. It has served as a foundation for extensive later research by geologists from universities and the Los Alamos National Laboratory. Lastly, Smith and Bailey's collaboration with Richard Doell and Brent Dalrymple resulted in discovery of the Jaramillo paleomagnetic event that became a key piece of evidence in the proof of sea-floor spreading early in the formulation of plate tectonics.

In the 1970s, the Survey's Geothermal Research Program was ramping up and Bob became one of its senior advisors. Under that umbrella, he collaborated with Herbert Shaw on the cornerstone paper for assessing igneous-related resources on the basis of composition, size, and lifetimes of volcanic systems (Smith and Shaw, 1975; updated 1979). At the same time he worked with Bob Luedke on compilation of a series of nine maps of late Cenozoic volcanic rocks in the western U.S., Alaska, and Hawaii. Bob contributed a synthesis paper (Smith and Luedke, 1984) to the National Research Council–National Academy of Sciences book on Explosive Volcanism based on the accompanying Luedke and Smith (1985) USGS map. The seventies also brought fruitful collaboration with Thomas P. Miller on the volcanoes of the Alaska Peninsula and eastern Aleutians. From this came important papers that demonstrated the ability of pyroclastic flows from a caldera-forming eruption to surmount topographic barriers (Miller and Smith, 1977) and that identified, dated, and characterized the many Holocene and late Pleistocene calderas of the eastern Aleutian arc (Miller and Smith, 1987). Additionally, Bob worked with Donald Richter on reconnaissance geologic mapping of the immense Wrangell volcanoes in 1971–1974, resulting in three fifteen-minute geologic quadrangle maps.

The GSA Rocky Mountain Section meeting in Albuquerque, New Mexico, in May of 1976 featured the symposium "Ash-Flow Tuffs—16 years after Smith (1960)" and resulted in GSA Special Paper 180 in Bob's honor (1979). The lead paper in that symposium volume is "Ash-flow magmatism" by Robert L. Smith. This landmark paper (over 700 citations by 2016) laid out the systematic relation of caldera size to ejecta volume, argued for nonerupted magma volumes as much as ten times those erupted, stated that magma chambers grow by accretion of repeated inputs of relatively primitive magma, illustrated the concept of a shadow zone created by low-density differentiated magma through which denser less-differentiated magma cannot penetrate, proposed that the production rate of differentiated magma is typically 10^{-3}km^3/yr, suggested that potential for ore deposit formation can be related to specific stages of volcanic histories, and culminated in the synthesis presented in "Figure 12. Model showing relationships among volume, depth, periodicity, and composition" for igneous systems that erupt silicic magma. Implicit in Bob's model is that nonerupted crystal-rich magma solidifies as plutons and batholiths, what has come to be known as the popular "mush" model. The fundamental principles set forth by Bob in 1979 remain essentially intact after nearly forty years.

The 1979 paper also contained a section on geochemical evolution of the Bandelier–Valles system, an indication of Bob's fascination with trace-

element chemistry of silicic magmas and its potential relation to metallic ore deposits. He had amassed detailed chemical analyses of natural glasses, mainly obsidians, that he obtained not only from the Jemez Mountains, but from around the world, through closely working with colleague David Gottfried and USGS chemists. Collaboration with Ray Macdonald and John E. Thomas of the U.K. Universities of Lancaster and Reading, respectively, resulted in Professional Paper 1523 (1992), "Chemistry of the subalkalic silicic obsidians". His lifelong interest in obsidian chemistry and hydration processes also led to collaboration with Richard Hughes, focusing on archaeological applications (Hughes and Smith, 1993).

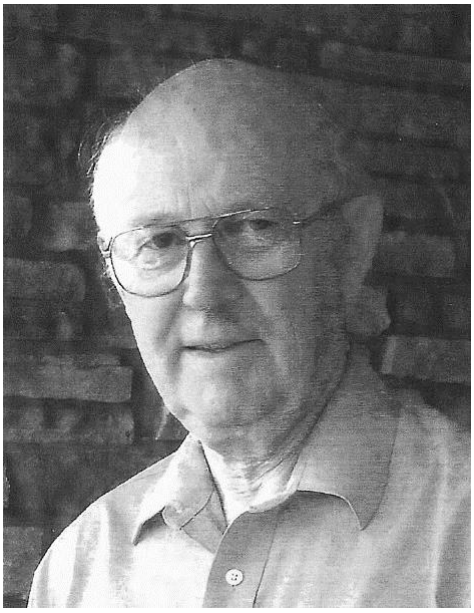
The papers on hydration of obsidian launched a career-long parade of invitations for Bob to speak at conferences and symposia in Latin America, Italy, Japan, New Zealand, and the U.S. Topics, of course, included ash-flow tuffs and resurgent calderas but also granitic magma origins, magma–hydrothermal systems, ore deposits, magma chambers, and potential lunar analogs of terrestrial calderas. The Society of Economic Geologists selected Bob for its Distinguished Lecturer–Research for the 1983 SEG–GSA Annual Meeting. He was Editor for North America for *Bulletin Volcanologique*, now the *Bulletin of Volcanology*, from 1967 to 1975. Bob's broad knowledge of volcanism led to his participation in field training of the Apollo astronauts and on the Preliminary Examination Team for the first lunar sample returns, as well as on high-level panels on international cooperation in volcano studies, on explosive volcanism for the National Research Council, and on hot dry rock geothermal assessment for the Department of Energy. His impact on USGS science programs in volcano hazards, geothermal research, and mineral resources was profound. He served as Chief of the USGS Branch of Field Geochemistry and Petrology during its first years, 1960–1966.

Beyond the published record, Bob's indelible influence boosted the careers of generations of geologists. As teacher and mentor, Bob made countless excursions with Survey and other, often foreign, geologists to their field areas (notably in later years, to Bolivia). The beneficiaries reaped immense benefit from his knowledge, enthusiasm, and encouragement. For example, Roy Bailey wrote that Bob's "recognition of the Timber Mountain structure as a caldera and his continuing interest in [geologic] mapping problems at the Nevada Test Site, not only accelerated the progress of mapping there, but had a profound influence on the morale and enthusiasm of colleagues working in that vast desert purgatory."

Bob was a Fellow of GSA, AAAS, and the Mineralogical Society of America, a member of the International Association for Volcanology and Chemistry of the Earth's Interior (IAVCEI), the Mineralogical Societies of Great Britain and Italy, the American Ornithologists Union, the American Fern Society, and the Cycad Society, as well as a Charter Member of the Geochemical Society. He received the Department of the Interior Meritorious (1974) and Distinguished (1983) Service Awards, an honorary D.Sc. from Lancaster University, U.K. (1989), and the inaugural IAVCEI Thorarinsson Medal (1987). Bob was promoted to Senior Scientist, one of a small number of "supergrade" USGS positions, in 1983. Subsequently, his office was moved from Reston, Virginia, to Sacramento, California, and the Smiths took up residence on the family property in Fair Oaks. Bob retired from USGS in 1993 and continued working with geochemical data and interacting with colleagues by correspondence and with academic geologists in the Sacramento area until his health declined twenty years later. Over this time, honors and recognition continued, including Honorary Fellow of the Geological Society of London (1996) and the Martin A. Baumhoff Special Achievement Award of the Society for California Archaeology (2005). Bob

Smith was predeceased by son Michael and is survived by Barbara M. Smith, his wife of 64 years, sons Leland and David, and three grandsons.

Charles R. Bacon



Ronald Richard Tidball was born into the teeth of the Great Depression on July 13, 1930, in Greeley, CO, to Claude Lester and Marilla Demaris Tidball. He grew up in Eaton, CO, helping his parents in their dry cleaning business. While Ron did learn how to shovel coal for the boiler and operate the cleaning machinery, more importantly, the work ethic he developed served him the rest of his life.

Ron attended Eaton High School and graduated in 1948, second in his class. During his senior year, he was hired by the school district to drive the school bus to gather in the "farm kids" from the newly consolidated Eaton school system. Old friends still recognize him as their bus driver.

Ron left Eaton in 1948 to attend Colorado A&M College at Fort Collins. He studied Forestry. He enrolled in advanced ROTC thereby deferring the draft until his graduation. Ron graduated from CSU in 1952 with a Bachelor's degree and a commission in the Air Force. He was assigned to Aircraft Control and Warning and was sent to Misawa AFB, Japan, where he served for 2 years.

Ron took full advantage of the GI bill, earning a Master's Degree in Forestry from the University of Washington. He earned his PhD in soil science from the University of California at Berkeley in 1965. Ron returned to Denver and worked for the USGS for 30 years, until his retirement in 1995. He worked on projects in 9 western states, and published a number of scientific papers.

Ron married Grace Anderson in 1953. Three children resulted from this marriage: Lory Tidball Rhine, Richard Stanley Tidball and Linnea Tidball O'Mealy. Ron's marriage ended in 1972. In 1975 he re-married. Jean McLarty Tidball was a mathematics teacher in Denver Public Schools. Together they rode many miles as touring bicyclists, visiting New Zealand, the Canadian Rockies, France and Great Britain. In 1977 they purchased a home in Tabernash, CO, where they spent weekends, then in 1996 made Tabernash their full time residence. Ron used his forestry skills to remove beetle killed trees from their property.

Ron had prepared well for retirement, completing a course in antique clock repair at the Emily Griffith Opportunity School in Denver. He had a small clock repair business in his home. He cultivated an interest in mosses and read widely. Recognizing the onset of aging, Ron and Jean moved to MacKenzie Place in Colorado Springs in 2008. Ron developed Adult Macular Degeneration. His ability to practice the activities he enjoyed decreased. He began studying braille. Early in 2014, during their yearly trip to Cancun, Ron fell over a wall he didn't see and suffered a severe head injury. From that time until his death, he suffered from aphasia as well as increasing blindness.

He will be remembered for his curiosity and tenacity as well as his gentle manner in the face of increased physical challenges. He will be missed.

Jean McLarty Tidball

John R. Van Schaack grew up on farms in California and Yakima, Washington while his father worked at the Hanford nuclear facility there. Along with his nine siblings he learned to be very self-reliant and solve problems independently to keep the farm going. He became a medic in the U.S. Army during the Korean War era and then went on to earn a degree in geology from San Jose State.

He joined the U. S. Geological Survey in 1961 and became part of Lou Pakiser's crustal studies group in Denver. There they developed a group of signature-yellow panel trucks outfitted with multi-sensor seismic recorders. Geophones would be spread out over miles and connected to the trucks by reels of wire. Explosive seismic sources were detonated, with coordination and timing performed via radio communications. These refraction studies were carried out all over the country for the next five years, and the yellow trucks were even shipped to Norway to record seismic data.

In 1966 the group moved from Denver to Menlo Park to form the new National Center for Earthquake Research (NCER). Here, along with Jerry Eaton and many others, he started building the USGS's California seismic network. Originally they used commercially available telemetry electronics, but the need for ultra-low power to permit remote operation for extended periods led Van Schaack to develop seismic telemetry equipment using newly available CMOS integrated circuits. This equipment could run in the field for months to years before requiring a change of batteries and fit into a relatively small postholes in the ground. These pioneering designs were even emulated by the commercial seismic equipment providers for sale to their customers. He also helped develop the large format FM tape recording system that captured continuous real-time data from up to 600 seismic sensors.

Beginning in 1976, John spearheaded the development of large set of 120 portable seismic recorders for crustal studies experiments, known as the SCRs. These units incorporated precision timing to allow independent recording of refraction sources while spread out over hundreds of kilometers. This system saw extensive use in Saudi Arabia and became the workhorse of the USGS crustal experiments for the latter 1970s and all through the '80s.

While heading the operations and development of the seismic network, John also began to take on administrative responsibilities for the Seismology Branch as well, first serving as Associate Branch Chief for many years and, for a time, as Acting Branch Chief. John was always the quintessential hands-on guy though. He never hesitated to pitch in wherever he could help. Even while serving as an administrator, you could find him in the field helping get holes drilled and filled with explosives. Most of what he knew about electronic design he taught himself while working on the job.

In the early 1980s, John guided the development of the next-generation GEOS portable seismic recorder system for aftershock studies. These state-of-the art digital systems recorded on digital tape and had 16-bit resolution. After a contract to build them commercially fell through, USGS personnel carried on the project to completion. He, along with the rest of the group, received a patent for this accomplishment in 1986.

Also in the 1980s, John embarked upon an effort to create an extensive microwave radio network running the length of California in order to serve as the backbone for telemetry of seismic data. He partnered with the Army Corps of Engineers to share the use of their microwave system while building mountaintop sites to extend telemetry into new regions. The system enabled the seismic network to expand into remote portions of the California Coast Ranges, where leased telephone telemetry was unavailable or prohibitively expensive. While it has been upgraded over the years, the microwave system continues to serve as the backbone of the USGS Northern California Seismic Network.

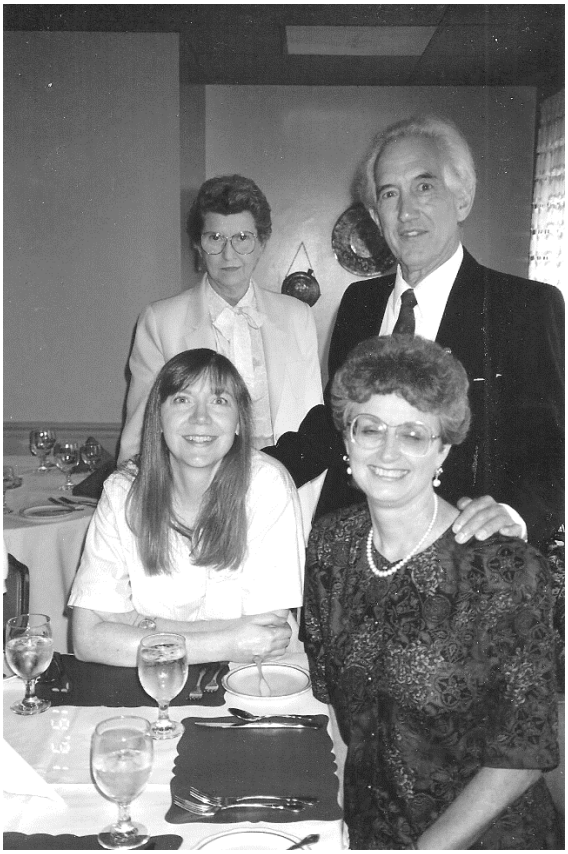
Over the years John mentored and helped advance many individuals who came to work for the earthquake group. He always looked out for the interest of the employees around him to make sure they could be successful and thrive. John Van Schaack's quiet and understated demeanor stands in contrast to the substantial legacy he left behind. He was dedicated to the USGS mission of earthquake monitoring and advancing science through innovative development of seismic recording and telemetry systems. The trust in the USGS to reliably monitor and report on earthquakes in California is a testament to the solid foundation he developed.

Gray Jensen

Other Deaths

Kay Baker, 2015
Bill Cashion, April 19, 2016
Gary Dixon, January 14, 2017
Nelson Hickling, January 22, 2017
Dick Keefer, December 23, 2016
Mereth Meade, May, 2013
Gene Roseboom, December 22, 2016
Beth Overstreet, May 9, 2015
Bill Overstreet, March 14, 2016
Jean-Claude Thomas, December 30, 2015

Foursome at Mystery Luncheon



Clockwise from top left: Betty Miller, Jim Clarke, Barbara Chappell, and Kathleen Gohn at unknown event, 199l. If readers can add information, please let us know.

RETIREE PUBLICATIONS
2007 - 2017

Note:
The references below are compiled from information available as of 15 January 2017. These references are "new" since the Spring 2016 Newsletter (Number 72). 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 Odette James (e-mail: o.b.james@verizon.net) as back-up, for listing in the next Newsletter and for updating the Master List.

ROBERT B. FINKELMAN publications:

Finkelman, R. B., 2012, ***Lunacy: Discarding a piece of the moon***: *GSA Geotales*, p. 28.

Finkelman, R. B., 2015, ***Review of 'Tweeting Da Vinci' by Ann C. Pizzorusso***: *IMGA Newsletter 26,* p. 3-4.

Finkelman, R. B., 2016, ***Review of "Minerals & Human Health" by Larissa Dobrzhinetskaya***: IMGA Newsletter 27, p. 14-15.

Huang W, Sun L, Ma Y, Wan H, Tang X, Du G, Wu W, Qin S, and Finkelman R. B., 2007, ***Distribution and geological feature of the Coal-Ge deposit of Shengli coalfield in Inner Mongolia of China [J]***: Journal of China Coal Society, v. 32, no. 11, p.1147-1151. (in Chinese with English abstract).

Huang W, Ma Y, Sun L, Wan H, Tang X, Du G, Wu W, Qin S, and Finkelman R, B., 2007, ***Petrographic characteristic and metallogenetic environment of Coal-Ge Deposit in Shengli Coalfield, Inner Mongolia, China [J]***: Acta Mineralogica Sinica, 2007, v. 27(z1), p. 20-21. (in Chinese).

Huang W, Tang S, Tang X, Chen P, Zhao Z, Wan H, Ao W, Xiao X, Liu J, and Finkelman R. B., 2010, ***The Jurassic coal petrology and the research significance of Northwest China [J]***: Coal Geology &Exploration, 2010, v. 38, no. 4), p. 1-6. (in Chinese with English abstract).

Huang W, Ao W, Weng C, Xiao X, Liu D, Tang X, Chen P, Zhao Z, Wan H, and Finkelman R. B., 2010, ***Characteristics of coal Petrology and Genesis of Jurassic Coal in Ordos Basin [J]***: Geoscience, 2010, v. 24, no. 6, p. 1186-1197. (in Chinese with English abstract).

Armienta, M., Finkelman, R. B., and Rubio, H., 2013, ***Medical Geology: Its relevancy to Mexico***: *Tecnociencia Chihuahua*, Vol. VII, No. 3, p. 152-162.

Hasan, S. Finkelman, R. B., and Skinner, H. C., W, 2013, ***Geology and health: A brief history from the Pleistocene to today***: Geological Society of America Special Papers, Vol. 501, p. 155-164.

Selinus, O., Alloway, B., Centeno, J. A., Finkelman, R. B., Fuge, R., Lindh, U., and Smedley, P., 2013, editors, ***Essentials of Medical Geology, Revised Edition***: Springer, 805 p.

Williams, L., Finkelman, Robert, and Faruque, Fazlay, 2013, compilers, ***Abstracts with Programs, The 5th International Conference on Medical Geology***: IMGA, 76 p.

Lu Xukun, Tang Yuegang, Zheng Baoshan, Finkelman, Robert B., and Belkin Harvey E, Hou Xianxu, and Guo Xin, 2013, ***Trace element geochemistry of some Chinese coals***: *International Pittsburgh Coal Conference*. Paper and abstract.

Rapant, S., Cveckova, V., Dietzova, Z., Fajcikova, K., Hiller, E., Finkelman, R. B., and Skultetyova, S., 2014, ***The potential impact of geological environment on health status of residents of the Slovak Republic***: Environmental Geochemistry and Health; v. 36, no. 3, p. 543–561.

Centeno, J. A., Finkelman, R. B., and Selinus, O., 2014, editors, *Geosciences*, ***Special Issue on Medical Geology: Impacts of the Natural Environment on Public Health***.

Wells, A., Islam, T., Tarloff, K., Chakraborty, J., and Finkelman, R. B., 2015, ***Medical geology in the state of Texas***: *IMGA Newsletter,* vol. 25, p. 4-17.

Shifeng, D., Yan, X., Ward, C. R., Hower, J., Zhao, Lei, Wang, X., Zhao, Lixin, Ren, D., and Finkelman, R. B., 2016, ***Valuable elements in Chinese coals: A review***:*International Geology Review*. June 2016.

Hower, James C., Granite, Evan J., Mayfield, David B., Lewis, Ari S., and Finkelman, Robert B., 2016, ***Notes on Contributions to the Science of Rare Earth Element Enrichment in Coal and Coal Combustion By-products***: *Minerals*, Vol. 6, no. 32.

Centeno, Jose A., Finkelman, Robert B., and Selinus, Olle, 2016, editors, ***Medical Geology: Impacts of the Natural Environment on Public Health***: MDPI press, Basel, Swutzerland, 238 p.

Chakraborty, J., Varonka, M., Orem, W., Finkelman, R. B., and Manton, W., 2017, ***Geogenic organic contaminants in the low rank coal-bearing Carrizo-Wilcox aquifer of East Texas***: Hydrogeology Journal, **DOI**: 10.1007/s10040-016-1508-6.

ERIC R. FORCE publications:

Force, E. R., 2016, ***Tectonic activity in antiquity: Counterintuitive long-term cultural responses and implications for the modern world*** (abstract only): Society for Applied Anthropology Annual Meeting p. 77.

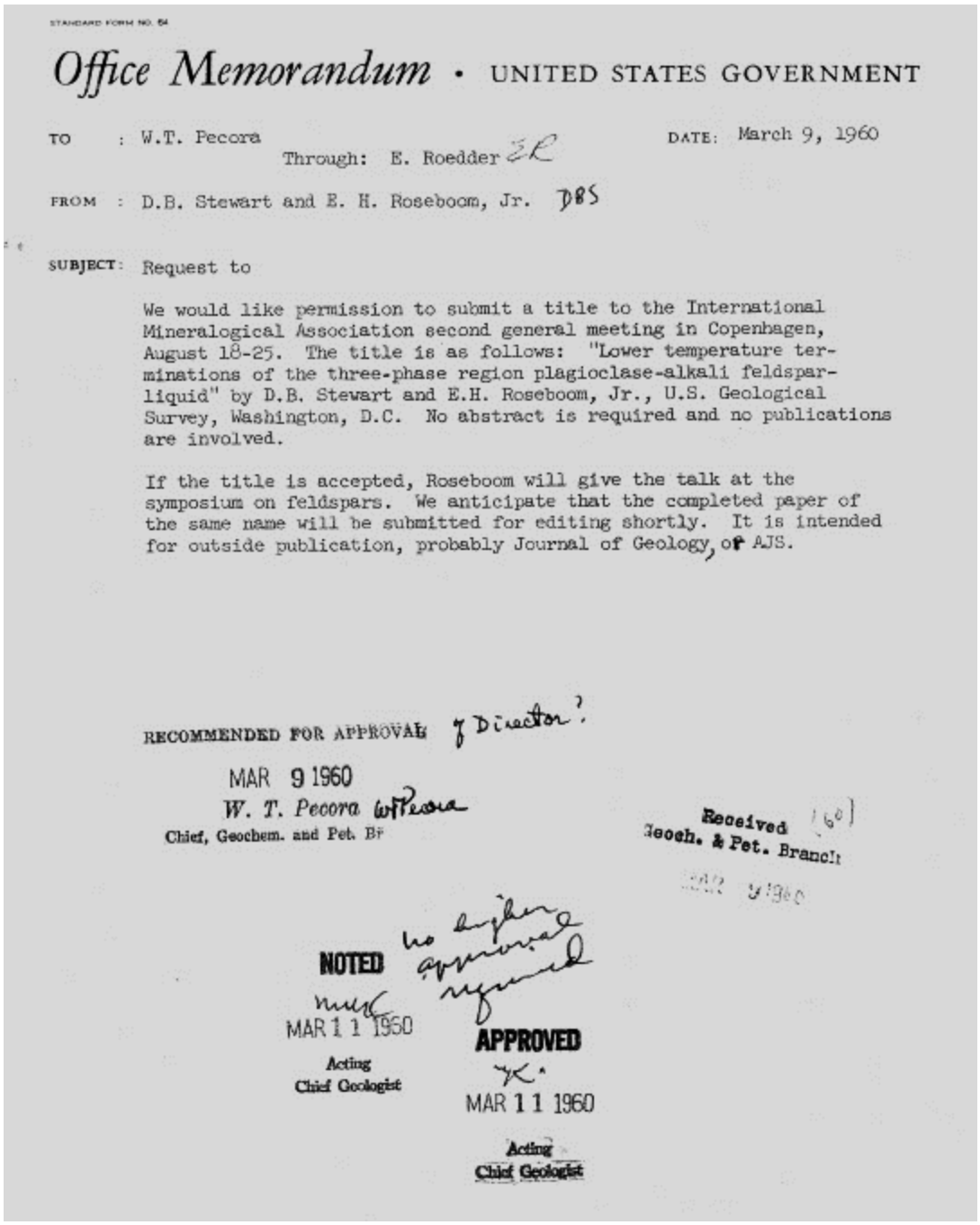
Hoffman, S. M., and Force, E. R., 2016, ***Calamities and response: Lessons from the archaeology and ethnography of tectonic activity, and cultural intersections past and present*** (abstract only): Society for Applied Anthropology Annual Meeting, p. 96.

JOHN P. LOCKWOOD publication:

Lockwood, J. P. 2016, ***Review of M. P. Poland, T.J. Takahashi, and C.M. Landowski (Eds) Characteristics of Hawaiian Volcanoes; USGS Professional Paper 1801***: Bulletin of Volcanology, v. 78, no. 2, p. 207-208.

CHARLES W. NAESER publication:

Naeser, C.W., Naeser, N.D., Newell, W.L., Southworth, S., Edwards, L.E., and Weems, R.E., 2016, ***Erosional and depositional history of the Atlantic passive margin as recorded in detrital zircon fission-track ages and lithic detritus in Atlantic Coastal Plain sediments***: American Journal of Science, v. 316, February 2016, p. 110-168.



STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : W.T. Pecora Through: E. Roedder EL DATE: March 9, 1960

FROM : D.B. Stewart and E. H. Roseboom, Jr. DBS

SUBJECT: Request to

We would like permission to submit a title to the International Mineralogical Association second general meeting in Copenhagen, August 18-25. The title is as follows: "Lower temperature terminations of the three-phase region plagioclase-alkali feldspar-liquid" by D.B. Stewart and E.H. Roseboom, Jr., U.S. Geological Survey, Washington, D.C. No abstract is required and no publications are involved.

If the title is accepted, Roseboom will give the talk at the symposium on feldspars. We anticipate that the completed paper of the same name will be submitted for editing shortly. It is intended for outside publication, probably Journal of Geology, or AJS.

RECOMMENDED FOR APPROVAL ? Director?

MAR 9 1960

W. T. Pecora WTPecora

Chief, Geochem. and Pet. Br

Received 1960
Geoch. & Pet. Branch
MAR 9 1960

NOTED no higher approval required

MAR 11 1960

Acting Chief Geologist

APPROVED

MAR 11 1960

Acting Chief Geologist

Miscellaneous History Dept.: An International Travel Request from 1960: Pecora was Chief of Geochemistry and Petrology, and he was not sure whether it needed approval of the Director. The Acting Chief Geologist approved it, but it's unclear from the scribbled signature who that was. Perhaps readers with long memories can tell us?