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Where our deepest passions intersect the world's compelling needs

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PERSONAL REFLECTIONS

GSA has made a huge difference in my professional and personal life. My mind carries meaningful specifics of GSA experiences that helped shape me. As a college senior I attended my first GSA Annual Meeting and gained a glimpse of the scope of what it means to be a geologist. At the GSA Annual Meeting held during my final year of graduate studies, Jim Zumberge, Dean of Earth Sciences at The University of Arizona, encouraged me to apply for the structural geology opening just being advertised there. After my first talk at a GSA Annual Meeting, Clark Burchfiel and Greg Davis motioned to me to join them for a beer and chat about the paper I had presented. At the Penrose Conference on the *Geophysics and Structure of Folded Belts in Switzerland*, I met my structural geology hero, John Ramsay. On a 1974 GSA Field Trip led by David Love through the eastern Idaho/western Wyoming thrust, I met Peter Coney for the first time. It was there that our conversations began in earnest about the Rincon Mountains and the Snake Range being part of a regionally coherent belt of metamorphic core complexes. Moreover, within the annual rhythm of GSA meetings, I treasure reconnecting with old friends and making new friends and colleagues.

I was drawn into geosciences by the three factors that Suzanne O'Connell and Mary Anne Holmes (2011) report as the main attractors for all who enter our discipline: positive undergraduate experiences in geology, love of the outdoors, and family influences. Had I been a woman or an unrepresented minority, I likely never would have found geosciences. More to the point, geosciences would have never found me. Mary Anne and Suzanne framed a goal in relation to attracting women and underrepresented minorities to the geosciences: having sufficient role models such that each undergraduate who might aspire to a career in geosciences will have an inspiration, a person whom they wish to emulate (Holmes and O'Connell, 2005, p. 14).

For the broadest ranges of individuals and communities, I want GSA to be a source of collective inspiration, enabling *individual geoscientists* and *communities of geoscientists* to do their best work, thereby advancing the science and its practice. Moreover, I want GSA to help leverage individual and collective accomplishments in ways that advance civilization and improve the human condition.

SUPPORTING INDIVIDUALS AND COHORTS TO DO THEIR BEST WORK

A good place to be in our individual professional lives is where our deepest passions and keenest skill-sets intersect the world's most compelling needs. We recognize passion when we see it in ourselves and in others. It takes the form of unusually high enthusiasm toward what we do and how we do it. At our best, and when life's circumstances permit, we have it in our elevated engagement in learning, discovering, communicating, and in solving "hairy" problems, whether working in academia, government, or private practice.

By and large, we seem to like what we do. I think there is a lot of geoscience career envy out there. We see this in the names of cars people buy: e.g., *Expedition*, *Explorer*, *Geo Tracker*, *Pathfinder*, *Compass*, *Mountaineer*. Consider how many models have names that conjure the images of geological exploration and discovery! Even journalists and politicians adopt our language. In September 2008, a *New York Times* reporter wrote that "tectonic shifts" in the U.S. financial industry shook the world's markets. The Associated Press exclaimed that Alan Greenspan told Congress that the international credit crunch was a "once in a century credit tsunami."

GSA supports the professional passion of individual geoscientists. GSA meetings, conferences, and field trips bring us together, creating both formal and informal venues for connecting with one another. We describe to others what we are doing ***and why***. We discuss, in person, geo-relevant current events, such as the trial verdicts (L'Aquila earthquake) and Hurricane Sandy. We prepare diligently to present our best thoughts at GSA meetings. At annual meetings, the narratives of, and narrations by, our medalists inspire us.

Passion and drive is one thing. Incorporating just the right skill sets is quite another. Especially in this age of new and emerging technologies, we recognize that skill-sets are transient—they wear out and need to be updated. New tools come along with increasing frequency.

When I was an undergraduate taking structural geology, one of the "right-of-passage" skill sets was using orthographic projection to determine net slip on a fault. I was so enthusiastic about this form of "sick fun" that I devoted much of my senior thesis research to orthographic projection solutions, the Holy Grail being rotational fault kinematics. Now, 50 years later, one of my undergraduate advisees explores a 3-D seismic volume of faulted strata, digitizes discrete stratigraphic horizons, maps the tip lines of tens of individual normal faults, and evaluates the gradient of slip for each of the faults.

Outside of school settings, GSA helps us with the "skill-sets" part of our individual lives. GSA Short Courses have been a vital means for staying abreast of new methods, approaches, and technologies. Since 1982, more than 300 short courses have been taught at annual meetings alone!

A second central mission embraced by GSA is doing all we can to support cohorts of geoscientists in common subdisciplines or specialty fields. We all understand the practical power of specialization, which is so clearly expressed in what we choose to work on and how we choose to work. The list of GSA's 17 Divisions reflects one way in which we arrange ourselves in subdisciplinary clusters. The programs of GSA annual and regional meetings are framed dominantly through lenses of Divisions, subdisciplines, and specialty fields. Every year at meetings I am overawed by the tenaciousness of specialized geoscience communities taking on seemingly intractable problems and bringing those problems to their knees.

Of course there is another side of this coin. It is not just the skill-sets that wear out. John Suppe (2008) once reminded us that even specialty fields wear down, typically lasting less than a scientific career. A given subdiscipline may become a "ghost town" or may just seem to disappear as the number of new specialties appear. Knowledge fragmentation is what results, driven partly by "scientists unable to stay abreast of all the research within their own discipline." Beth Fratesi and Len Vacher (2008) captured this by grouping journals into subdiscipline categories and mapping journal proliferation from 1945 to 2000. The emergence of new lines of research tends to be accompanied by the emergence of more and more specialized journals. No wonder that we feel, at times, like we are swimming upstream.

GSA concluded a long time ago that disciplinary cohorts are essential, but not sufficient, to sustaining healthy geosciences. We began to organize ourselves into regional sections way back in 1901. Furthermore, our primary publications always have been cross-disciplinary. Increasingly in the past five decades we see and attend cross-disciplinary sessions at our annual and regional section meetings. Of course, GSA's Penrose Conferences are designed to pull geoscientists together from different disciplines and from different career paths (academia, government, private practice). One hundred and fifty Penrose Conferences have been held since 1969, and we need to keep them coming.

ADDRESSING THE WORLD'S COMPELLING NEEDS THROUGH SPECIALTY EXPERTISE

Just like basic and applied science, the world's compelling needs that must be addressed through geosciences are ones requiring both specialty and unifying cross-disciplinary action. If we wish to be reminded of the most pressing of the world's needs, we can turn to the most stressed conditions on our globe. At the 34th International Geological Congress held in August 2012 in Brisbane, Australia, there was a theme session on "Geoscience Benefiting Low Income Countries." The theme statement related to "benefiting low-income countries" applies universally: groundwater management and rural health; geohazards; climate change; medical geology for human survival and welfare; geoplanning for urban development and infrastructure; the role of geosciences in protecting ecosystems; geoethics; the role of women geoscientists in resource development; construction and industrial minerals; and production of mineral and energy resources.

Similarly, AGI has identified *21st Century Challenges* that underscore the interplay of natural resources, environmental quality, and resiliency. NSF's *GEOVISION Report* (2009) has a comparable emphasis, addressing atmospheric, earth, and ocean sciences.

I believe the world's needs can be framed productively in everyday terms underscoring the threats our world faces—ignorance, thirst, hunger, environmental degradations, shortages, excesses, hazards, sustainability. These are clarion calls for the best we have to offer, **and at this moment in time.** Back in 1990, a friend and author, Robert Grudin, did not mince words: "A world population growing by a billion every decade, and increasingly demanding of technological conveniences, will make short work of existing energy sources and tear the environment to shreds" (Grudin, 1990, p. 130). Similarly, this year's GSA President's Medalist, Bill McKibben, puts things starkly. In his book, *Eaarth*, McKibben writes (2011, p. 23): "We've turned our cars and factories into junior volcanoes, and so we're not just producing carbon faster than the plant world can absorb it; we're also making it so hot that the plants absorb less carbon than they used to." He goes on to say (2011, p. 86):

> Suddenly you felt a little less confident that you were an 'Explorer,' a 'Navigator,' a 'Forester,' a 'Mountaineer,' a 'Scout,' a 'Tracker,' a 'Trooper,' a 'Wrangler,' a 'Pathfinder,' a 'Trailblazer.' You all of a sudden were in Kansas… not 'Durango,' or 'Tahoe,' or 'Denali,' or the 'Yukon.' 'Discovery' and 'Escape' and 'Excursion' suddenly seemed less important than the buzz-killing fact that it took a hundred bucks to fill the tank.

Our specialty field expertise has been serving us well in any number of the global arenas of need, especially when intertwined with other specialty fields. James Dolan's current research in active tectonics illustrates the power of connecting specialty fields—in ways that inform probabilistic seismic hazard analysis and the goal of mitigating loss of life and property due to earthquakes. Dolan, like others, has been wrestling with the troubling fact that inferred fault slip rates based on geodesy sometimes outpace those inferred on the basis of geology. James and one of his students, Ben Haravitch, have been evaluating slip-rates on *big* faults, such as the northern Death Valley fault (Snow and Wernicke, 1989), on the basis of geologic mapping and LiDAR-based restorations of faulted geomorphic surfaces. Ages of faulted geomorphic surfaces are determined through cosmogenic surface exposure dating (Frankel et al., 2011). Dolan and Haravitch have concluded that the degree to which geologically based fault slip rates record the *actual* rate at seismogenic depths is strongly dependent on the structural maturity of the fault zone. When they compared the ratios of surface slip rate in large

earthquakes with slip at depth and plotted these as a function of fault-zone complexity, they discovered a way to "correct" the near-surface slip estimates using as a basis the overall maturity of the fault zone. Before a fault zone becomes "straight" and through-going, a considerable amount of the slip budget is diffused through distributed deformation away from the fault itself. To model seismogenic hazards, it is essential to know the *true* seismogenic slip rate.

STRATEGIC OUTLIERS

In spite of such sophisticated core science, we still struggle mightily in addressing particular strategic outliers that if not tightly connected to the core will threaten the capacity of the geosciences to make a difference in the manner to which we aspire. Among these strategic outliers are geosciences and public policy, geosciences and K–12 education, geosciences and the media, geosciences and the general public, and geosciences and its future workforce.

There is a sharp contrast between the ways in which we are excelling as individual geoscientists and cohorts of scientists in fundamental and applied research, versus our impact with respect to these strategic outliers. Why is this?

Part relates to internal dynamics and barriers within our own scientific culture. Our personal specialty goals and responsibilities tend to be all consuming. Furthermore, the work environments within which we operate tend to reward us most when we stick to our specialty areas. Thus it is natural for each of us to defer to our specialists in earth science education, public policy, the geoscience workforce, and in reaching the media and general public. However, part relates to persistent barriers presented by leaders ignorant of how Earth behaves and a public ignorant of how understanding the earth system is critical to our survival.

Given what is at stake in terms of the world's pressing needs, I believe that GSA is right to be distinguished by a broad and encompassing mission scope. Strong platforms have already been built within GSA for addressing strategic outliers. For example, way back in 1972, GSA established its Geology and Public Policy Committee (GPPC), whose products are position statements. Currently, we have 18 active statements (www.geosociety.org/positions/), covering "Geoscience Issues," "Education Issues," "Data Issues," and "Professional Issues." The framing of some position statements is straightforward. Others have a complexity that can be underscored through my uttering just one word: "Hydrofracking." The GPPC has initiated the development of a white paper on hydrofracking, with the goal of sorting facts from fictions. Part of my homework on this effort was attending the special session on "Shale Gas and Fracking" at the North-Central Section Meeting last spring. Jeffrey Daniels of Ohio State University presented. I heard Jeff say something powerful that applies at every turn within the outlier of geosciences and public policy: "geoscientists represent the only profession ***anywhere*** that knows how to picture the subsurface." Voters, communities, and public officials simply have no idea how to visualize what's down below, let alone discriminate what is factual from what is not, let alone evaluate proposed solutions.

I want to expand on Jeff's point. Geosciences ***is*** the only scientific community that can actually picture what happens right at, beneath, and deep beneath Earth's surface today, at any spot on the globe AND can picture past subsurfaces in relation to past oceans and past atmospheres over the spans of vast time and ever-changing circumstances AND can picture all of this dynamically, not simply statically. The pictures we all create of Earth's surface and subsurface, past, present, and future are not constructed through single disciplines or specialty fields. Emphasizing this moves us away from the forces of fragmentation: geology versus geophysics; hard rock versus soft rock; pure versus applied; academic versus professional practice; this specialty or that.

FUTURE INITIATIVES

I look at challenges as glasses half full. Robert Grudin (1990, p. 159) sees things in a starker reality. For example, he commented on the way specialization and fragmentation are exploited in the political process:

> Politicians assemble in committees and call in experts to testify. … Natural scientists appear in force: business scientists, military scientists, government scientists, scientists from the academy. The specialists not only hold conflicting views but speak in different forms of jargon. The individual politician … must then make a decision. The politician's staff is consulted. One staffer has been sifting the media for editorial consensus. Another has been lunching with lobbyists. A third, who has hired consultants, summarized their report. A fourth phones in long-distance with word from the constituency. A position is hammered out in conference. A fifth staffer writes an appropriate speech, and the *interdisciplinary function of politics* has been fulfilled again. (emphasis added)

I believe that it is essential to blunt the interdisciplinary function of politics with the interdisciplinary function of geoscience. I want to urge our thinking creatively about potential new interdisciplinary initiatives that can accelerate GSA's, addressing ***all*** of the strategic outliers simultaneously and in ways that resist fragmentation and reward alignment. My thinking on this began more than a year ago when Geoff Feiss, president of the Geological Society of America Foundation (GSAF), challenged GSA Council and the GSA Executive Committee with the question: "If Dr. Penrose* walked into my office today and said I am willing to invest considerably into a large idea, what would that idea be?" Now that's a question worth thinking about.

Permit me for a moment to use this platform as a bully pulpit. GSA excels in managing the programmatic and logistical challenges in bringing geoscientists together, through Annual Meetings, Section Meetings, Penrose Conferences, International Conferences, Field Forums, and the like. We can harness these skill sets and experience in yet new ways. My idea takes the form of "Response Conferences to GEO-Events Impacting Population Centers." I'll describe what this means by pretending that we just

*__Editor's note:__ Richard Alexander Fullerton (R.A.F.) Penrose Jr. joined GSA in 1889, served on GSA Council from 1914 to 1916, was GSA vice president in 1919, a member of the Finance Committee from 1924 to 1929, established the GSA's Penrose Medal in 1927, and was GSA president in 1930. Upon his death in 1931, he left a generous bequest to GSA (more than $3 million dollars).

held one and that what you are about to hear is my *virtual* report to you on how it came about and what was accomplished:

MOCK REPORT

Good afternoon! GSA's most recent "Response Conference" was triggered by the M_W 5.8 earthquake that took place at 1:51 p.m. (local time) in northern Virginia on 23 August 2011. The epicenter was located ~130 km south-southwest of the nation's capital. Ground shaking lasted about 45 seconds.

Receiving most of media attention was the shaking of and damage to the Washington Monument. The monument suddenly began to sway, and those visitors inside, many of whom were school children, needed to make a quick escape down the stairs. The scene was captured on a surveillance camera inside the monument, 150 m above ground level. The Washington Monument experienced permanent damage expressed by fracturing and spalling, especially in the height interval between 140 and 160 m.

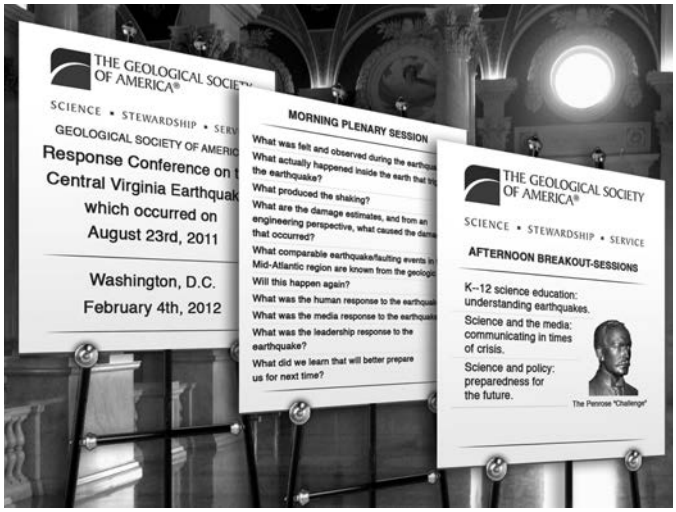
The White House and the Capitol were evacuated. Metro system trains ran at reduced speed while tunnels were inspected. Staff at the National Zoo reported that the apes were feeding normally up until 10 seconds before the quake, but then they abandoned their food and scrambled to the top of their habitat.

Vice President Joe Biden was at a campaign stop in Virginia touting the administration's energy policy. He blamed the earthquakes on the extraction of natural gas by hydrofracking. As reported in the *Washington Times*, things got political in a hurry when Benjamin Cole, communications director at the Institute for Energy Research, was quoted as saying: "The worst-kept secret in Washington is Vice President Biden's penchant for exaggeration … now he's pretending to be a seismologist."

Circulating on the Internet was the view that this was not a natural earthquake but was an earthquake created as a result of an underground nuclear detonation.

Six months following this earthquake, on Saturday, 4 February 2012, The Geological Society of America, in partnership with its Associated Societies and the United States Geological Survey, held a "Central Virginia Earthquake Response Conference" in Washington D.C. The purpose was to host a public retrospective on science and society dimensions of the earthquake event.

GSA was able to work swiftly because five years ago a structure of working committees had been established to forecast possible to probable geo-incident events in North America, and to populate working teams of experts. The critical planning window after the earthquake was on the order of eight weeks. During that time, GSA reserved a venue in the D.C. area; established a Saturday calendar date; notified the Executive Branch, the Hill, the Pentagon, and emergency responder



Virtual foyer at response conference.

MORNING PLENARY SESSION

What was felt and observed during the earthquake?
What actually happened inside the earth that triggered the earthquake?
What produced the shaking?
What are the damage estimates, and from an engineering perspective, what caused the damage that occurred?
What comparable earthquake/faulting events in the Mid-Atlantic region are known from the geologic record?
Will this happen again?
What was the human response to the earthquake?
What was the media response to the earthquake?
What was the leadership response to the earthquake?
What did we learn that will better prepare us for next time?

Middle poster.

agencies; alerted teachers and professors in the region, urging them to consider incorporating the conference into the curriculum; communicated the planned event to the media and the general public; and invited the membership of GSA to turn out in force. GSA accomplished this through close cooperation between its Boulder, Colorado, headquarters and its Northeastern and Southeastern Sections.

The program followed the standard blueprint for Response Conferences, with two main rules for engagement: 1—no "geospeak" is permitted; 2—admission for students, teachers, media, and elected officials is free-of-charge. The morning session was plenary and addressed critical questions. Workshops were held in the afternoon.

At the upcoming GSA Annual Meeting in Charlotte, the plenary speakers and workshop facilitators from the

Northern Virginia Earthquake Response Conference will hold debriefings on what they presented and will report on the responses from students, teachers, media, public officials, and the scientific community. A number of GSA members noted that we commonly lament how difficult it is to connect with members of the media, and yet, because of the Response Conference, the media came to us.

CONCLUDING THOUGHTS

I thank Geoff Feiss for demonstrating that when the right question is asked, we elevate our science and our imagination generally. Let each of us think hard about how ***we*** would respond to a Dr. Penrose. And let us elevate our collective thinking the way R.A.F. Penrose did and envision what the world's needs will require of us.

In conclusion, what guides my value system as your GSA President is to have GSA continue to function in ways that help individual geoscientists and communities of geoscientists do their best work, thus advancing the science and its practice, and thus leveraging individual and collective accomplishments to advance civilization and to improve the human condition.

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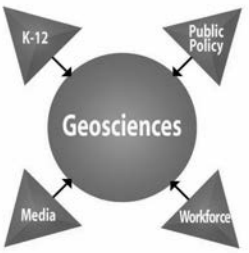
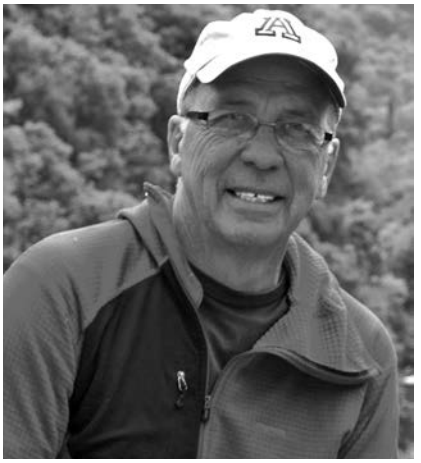
Video of Davis' Presidential Address and his PowerPoint presentation are online at **www.geosociety.org/gsatoday/PresAddress.htm**.





George H. Davis, GSA "Lifer"