

VIEWS

The Views section of the Newsletter began in 2010, the intent being to create a forum for ideas and discussion. Many interesting and thoughtful pieces have been published and we are grateful for the time that the authors have taken to generate ideas, write Views, and respond to editorial requirements. In this issue, we feature a Views article by Fred Graybeal (SEG 1974 SF). In addition to some wide-ranging comments, Fred makes suggestions on how SEG should help students and young professionals embark on a career in mineral exploration, particularly during the current down cycle. Fred's suggestions are new and provocative, and we used them to solicit immediate feedback from both seasoned and young professionals; seven comments are included in the full version, available online.*

Fred's comments caused some discussion and even a little soul-searching among those involved in SEG. That is always a good thing, but it is worth remembering that the staff in Littleton, and volunteers representing SEG Council, SEG Foundation, and numerous committees consistently do their best to address issues and manage SEG within numerous financial, legal, strategic, and practical constraints. The Views articles add constructively to the mix but are not always actionable. In his Presidential Perspective in this issue (p. 7), Bob Foster provides more of the SEG context.

Finally, Fred and the authors of the seven comment pieces collectively raise many interesting points. With editorial license, these question the role of SEG in the following:

- Research, education, and training with balanced programs among all three;
- Encouraging and connecting students with employment opportunities;
- Maximizing the number of students involved—even when jobs may not be available;
- Selectively seeking students who may have the best chance of employment;
- Adjusting SEG programs to match the cycles—in phase with the cycles if possible;
- Encouraging industry to be more involved with all of the above.

We hope you enjoy Fred's Views and the seven comments. If these, or the general summary questions above inspire you to write something, please don't hold back. We look forward to hearing from you.

John Thompson, Jeffrey Hedenquist
Editors of Views

Views columns are the opinions of the authors and do not necessarily reflect the opinions of the SEG.

SEG Programs Need More Practical Content

Frederick T. Graybeal (SEG 1974 SF)

This Views column will be printed in two installments. The full version can now be accessed online: www.segweb.org/views

INTRODUCTION

The recent employment situation for exploration and mine geologists is dismal, and even incremental improvement is unlikely for another few years. With numerous mergers and major cost-cutting initiatives being announced

Fred's career focused on metal exploration worldwide, largely with ASARCO Incorporated, from which he retired as chief geologist in 2003. He still consults, is a past vice-president of the SEG, has served on committees of the National Research Council and geoscience advisory boards of several universities and junior exploration companies, and is a recipient of the SME Dickerson and the SEG Ralph W. Marsden awards. He holds degrees from Dartmouth College (AB, 1960) and the University of Arizona (MS, 1962 and PhD, 1972).

weekly, the number of employed industry geologists and job openings will continue to decline. This trend means that many current and near-term graduating students in economic geology will either end up unemployed or never enter the mining industry. The myth of the Super Cycle is being exposed and I anticipate recurring, unpredictable, and even more sharply defined cycles of high and low metal prices in the future. These metal price cycles will lead to equally unpredictable employment cycles for industry geologists that, on a career time scale, will be multiple in number and career-ending in nature.

The SEG should take a more direct role in this issue by (1) redirecting, if possible, some of its current research funds and (2) seeking new unrestricted funding to (3) support practical initiatives that would assist graduating SEG student members looking for a career in industry. Continuing to fund students' study and research and then leaving them to their own devices to find

employment in an industry where jobs are disappearing rapidly seems misleading for an organization that has always been a leader in economic geology research and practical applications of the science to ore deposits.

SOME SPECIFICS

Should the SEG educate and train geologists for other fields? Multiple career paths are becoming common, but schools must be transparent about the likelihood of near-term employment in economic geology. Are enough SEG student members staying in this discipline to justify spending \$0.5M/year for research grants (Black, April 2015, *Newsletter* no. 101, p. 9)? The January 2016 *Newsletter* (no. 104, p. 42) lists 54 grants from the Stu Wallace Fund alone,



FREDERICK T. GRAYBEAL

and there are seven additional research funds (*Newsletter* no. 104, p. 44). Also listed are 15 short courses and 13 field trips for 2016 (*Newsletter* no.104, p. 52-53).

Several remarks in the January 2016 issue of *Newsletter* require comment:

- “Smaller companies with promising assets need to find ways to fund their key assets....” (Kelley, p. 10). Small companies with no cash flow (there are hundreds) have limited survival options, those being to lay off geologists, shut down the drills, sell or deal away their key assets to pay off debt, and abandon their less well-tested prospects, usually in that order. Large-company behaviors are similar.
- “University geology programs expand during downturns”.... (Kelley, p. 10). This may be so for short periods, but data summarized by Murray Hitzman at the 2010 Keystone meeting (see Career Advice section under the Students tab on the SEG website; www.segweb.org) suggests the opposite over longer time intervals.
- Bob Foster, the 2016 SEG president, writes that “the pathway from graduation to career development should be seamless” and he calls for enhanced communication ... to ensure retention of SEG student members (Foster, p. 9). He also advocates for new student chapters and SEG training programs. I worry those well-meaning suggestions would simply put more young geologists on the street, still with no jobs. Career development is best accomplished with a career.

The above comments are accompanied by remarks from Dick Sillitoe in various publications that criticize large mining companies for eliminating exploration programs and disbanding their elite teams. I understand and share Dick’s frustration, but that prose resolves nothing. Although I hope Dick remains outspoken on this subject, lecturing mining companies where decisions are driven by the quarterly bottom line and shareholder demands won’t help. Action, not more communication, is the answer and the SEG needs to take a lead role.

How many student members will stay in the SEG after graduating? Black (July 2015, *Newsletter* no. 102, p. 8) commented on a notice in major Santiago, Chile, newspapers that discouraged

students from pursuing careers in geology due, among other things, to a lack of job opportunities at present. Does the SEG consider its research grants an efficient use of SEG funds when job opportunities are increasingly limited? There are 95 Student Chapters worldwide as of January 2016, including 11 additional chapters approved during the last year, plus 14 inactive student chapters (Hoal, *Newsletter* no. 104, p. 6). Are current students aware that job openings are at dismal levels (Robert, Oct. 2015, *Newsletter* no.103, p. 6), that worldwide growth of SEG membership has stalled (Black, April 2015, *Newsletter* no. 101, p. 9), and that prospects for improvement in the mining industry for the next several years are poor? Would the SEG’s reputation for outstanding science be jeopardized if it were possible to redirect a modest percent of its current research funds or generate new funding for practical initiatives that might enhance a graduating student’s background for a career in industry?

A “How to Map a Mine” short course does teach mapping, but it may not address daily issues such as slope stability, dilution and ore loss (grade control), continuity, quality assurance and control of sampling, and whether reality in the mine matches pre-mine forecasts—practices learned over time that develop skills needed to become an effective explorationist. Core logging is a specific form of mapping. A “How to Explore” course does not teach exploration. Exploration, to be successful, frequently requires non-linear thinking, the sort of learning that comes by doing, like learning to ride a bicycle. Few if any short courses teach the intangibles common to both exploration and mine geology, several of which were summarized by Moira Smith and John Thompson in their 2010 presentations at Keystone (see Career Advice section under the Students tab on SEG website).

Can the SEG in good conscience continue its current emphasis on meetings, research grants and student field trips, all high quality initiatives, when the future for employment is at best uncertain? The dilemma, of course, is that if there are no new geologists, who will be the future ore finders, grade-control experts, and resource modelers? Graduating students seem caught in the middle of this dilemma, not that this situation is any better for mid-career geologists with families.

There are those who fault Society members for encouraging students to choose careers in economic geology when there are no jobs. They also say cycles are good because the weak companies should fail (no guarantees in a free enterprise system) and the well-prepared geologist will be recognized and will survive. Times change and despite industry-related SEG programs such as mapping and core logging, additional preparation for an industry position is required as discovery rates decline and junior companies, that do not have the time, funds, or staff for in-house training programs, begin to dominate the exploration and mining landscapes. There is no question that a firm background in ore deposit science is necessary for an industry career, but it is not sufficient. Have SEG programs that prepare students for careers in industry lagged behind programs preparing students for careers in research? If so, should this situation be rebalanced?

I was informed by the SEG that a direct grant to a graduating student for a defined term of work at an operating mine is seen as a service to a for-profit company and non-profit 501(c)3 groups like the SEG may not use tax-exempt donations to benefit a for-profit entity. The difference between SEG funding geologic work at a mine and a mineral zoning study at the same mine (the company benefits either way) seems vague at best and ore deposit research would not suffer if a small amount of SEG research funds were redirected to more practical aspects of economic geology. I was also advised that most SEG student support funds are subject to donor-intent legal conditions that limit their use. Finally, income from field trips and short courses support the Littleton office. SEG’s options are clearly limited regarding the use of existing research-directed funds for industry-related programs.

THREE PROPOSALS

First, I propose that the SEG reexamine all existing research funds to determine the possibility that some might be redirected to more practical programs.

Second, I propose that the SEG establish a new fund for a student–industry internship program. This idea was mentioned by John Black (p. 8, July 2015, *Newsletter* no. 102), who suggested that opportunities be

identified to support internships for graduating students to gain experience in their chosen career path. Large companies do fund internships from cash flow (personal communication from David Kelley, 2016), but the numerous smaller companies generally cannot. An internship would provide practical work experience and extend the student's network. That's how you start a career—the first indication to future employers of a commitment to the exploration and mining business. To preserve the SEG's non-profit status perhaps the cost of an internship could be shared 50-50 with the SEG and the company in an amount that would cover local market costs for room, board, and a modest salary.

Third, I propose development of a two-week program covering the business and technical aspects of resource estimates, mine design, metallurgy, development, and production, including the preparation and understanding of disclosure, compliance, and information documents (43-101 reports, news releases, website summaries, preliminary economic assessments, pre-feasibility studies, etc.) for the interval between discovery and production. The course would focus on what an entry-level investment analyst should know during a due diligence review of an exploration or development project and would emphasize junior companies that have made a large share of recent discoveries. Some investment houses provide the reverse—an ore deposits short course for their analysts.

The short course would not provide in-mine experience, but it would expose students to a career path using

their knowledge of ore deposits. It would also be relevant to work in the junior company sector where in-house training and mentoring capabilities are generally limited, but where a broad understanding of the mining business is important and where the majority of future exploration and mining geology jobs may be.

FINAL REMARKS

These three proposals, for SEG to assist young professionals in the transition from being students into employment, reflect my personal view that exploration is a business, not a science, and I include near-mine exploration and mine geology in that view. To express this more broadly, exploration and mine geology are business strategies for a natural resource company. Exploration and mining geology are nevertheless critically reliant on the geological sciences. In the junior-company universe the geologist must be prepared to function on many different fronts in addition to the science; in many respects that person is more of a generalist in a staff of one compared to a large company where specialists and mentors are common. It is this view that drives my advocacy for additional practical training for future industry geologists. Having these proposals funded and run by the SEG also reflects my view that, whatever proposals might evolve, the product will be high in quality, as expected of the Society.

The proposals are not intended to transform the Society in any way. I support research funded and published by the SEG and recognize the importance

to individual SEG students' careers. However, it is both future discoveries from exploration programs as well as new exposures in operating mines that provide the raw material for advances in ore deposit research. The proposals outlined above would be initial steps to that end, by preparing and helping keep industry-focused SEG students—the future ore finders—in the business.

A scientific society that accepts responsibility for supporting student training and research programs should, in my view, accept an implied responsibility for making that training relevant to future employers and developing connections between the students and those jobs. The SEG's research grants fulfill that objective for future researchers, but what about the current SEG student members who want careers in industry? That career path now encompasses roughly 58% of the SEG membership. If the SEG is going to encourage students to study economic geology and half or more will seek positions in industry, then SEG programs should reflect that career path. Better preparation leads to better chances of surviving downturns.

It is not the job of the SEG to function as an employment agency; rather, service to members has always been a hallmark of the Society and, as times change, changes in related programs need consideration, whether or not they are within the current scope of the Society's activities. I hope that my views will motivate SEG members to share their ideas on this issue, followed by action taken on the most promising proposals. ^{SEG}

Commentary on "SEG Programs Need More Practical Content"

Fewer, Larger, Research Grants?

Murray Hitzman, *Dept. of Geology and Geological Engineering, Colorado School of Mines, Golden, CO 80401 USA (SEG President 2005; SEG 1978 F)*

Fredrick Graybeal makes a number of important points in his proposal for the Society to reconsider its support of student research grants. It is always time to reflect on how the Society's programs work or do not and to adapt to changing conditions. The past several years have been particularly tough for employment in the mining industry. Though I believe it more likely than does Fred that the current downturn will begin to end soon, there is no doubt that this down cycle has been disastrous for many in the industry, particularly young people.

Before moving to the specifics of Fred's suggestions, I would like to take a step back. I am one of those Fred mentions who started with excellent mentoring in a company (Anaconda) and received on the job training in both mine geology and exploration. That training served me well as I moved through the mining industry and later in both government and academia. Fred is absolutely correct that the way to learn exploration or mine geology is to do it, not through university courses or short courses conducted by SEG or others. However, the days of companies investing in long-term training of young geoscientists appears to be largely over (though there are exceptions and I try and steer my students to those companies.)

However, it is critical to note that an advanced degree in economic geology can be a gateway to a wide variety of fields. Over my academic career probably almost a third of my graduate students have not gone on to be employed in the mining industry. For some students this was because they graduated at a time with poor employment opportunities in the industry. For most, however, it was because they found another field, which they found more attractive for some reason, that utilized their economic geology skill set. A large

number of my students are (still) happily employed in the petroleum sector, others work in government, primarily in the "regulatory" sphere—land agencies such as U.S. Forest Service, BLM, etc. or in MSHA - but also in the USGS or national or state geological surveys in other countries.

One of the reasons I have found that employers beyond the mining industry like our students (and I suspect it would be the same for economic geology students at other institutions) is that they (1) have a sound foundation in basic mathematics, physics, chemistry, and computing; (2) tend to be geoscience generalists rather than specialists but have a firm grasp of mineralogy/petrology, stratigraphy, structure, and geochemistry; and (3) have significant field experience demonstrating that they actually can work through complex geological problems in 3- and 4-D, can take care of themselves in unpredictable situations, and are at least somewhat self-sufficient. The pragmatic, generalist skill sets required for a career in economic geology give students the toolkit they need to successfully enter a number of geoscience-related fields such as petroleum geology, environmental geology, and entry-level hydrology. They are also generally well prepared for careers in the IT field, particularly in GIS areas. Finally, a number of my students have entered the financial field, both as analysts in the minerals sector, but also more broadly in finance. I suspect that many young economic geologists are entrepreneurs at heart!

I share Fred's desire to re-examine the subject of SEG student research grants and concur with him that it would be highly advantageous to have a program that would help young graduates obtain internships. I worry, however, how the Society could pick which companies to support with the funded internships. I strongly believe the Society should work with industry to encourage them to develop more internships for students. The SEG could perhaps have training courses directed at cadres of students who would be undertaking company internships—though I believe a number of the current SEG short courses, particularly those by individuals such as Bill Chavez, accomplish what is needed.

One thing the Society might consider is to award fewer research grants but make individual grants larger in amount. The majority of SEG research grants cover a very small proportion of the costs of a research degree by a student. Larger grants would ensure students graduated with less debt and would allow research to be conducted on projects companies may be unwilling (or unable, as is currently the common case) to fund. It might also help students from one part of the world to attend a university in another part of the world.

I look forward to comments from the Society membership on this important issue—particularly from student members and recent graduates.

Leave Employment to Industry

M. Stephen Enders, *Dept. of Mining Engineering, Colorado School of Mines, Golden, CO. 80401 USA (SEG President 2011; SEG 1981 F)*

Members of SEG owe Fred Graybeal a thank you for having the courage to speak up about how the Society uses its funds, how it handles student support, and how it might be able to address a major employment challenge for graduating students in economic geology. Although I don't agree that SEG should use its funds to pay for student internships in industry, I'm delighted we can have this debate.

Over my 40-year career as an exploration and mining geologist, I have found it very difficult to change how industry thinks. Even at the executive level, I have lost many battles to change how a company approaches employment practices for geologists in a dramatically cyclical industry. So any solution to the student and young professional employment challenge is unlikely to change as a result of SEG efforts. The Society's role is better focused on how to better handle its own business.

The exploration business and mining industry are not going away. The simple long-term demographics of an expanding world population and demand for better lives, created to a great extent by the developing world, will continue

to drive demand for mineral resources. Mines are non-renewable resources that will continue to be depleted and will need to be replaced by new discoveries and renewed by new technologies. Economic geologists will still be required as a result, even if we work differently in the future than we have in the past.

As a former SEG International Exchange Lecturer and current Honorary Lecturer, past President of SEG Foundation and the Society, I have had the great pleasure to meet many students around the world. What I tell them is that a job is not a career, and that a career as an economic geologist will likely involve many jobs working for different companies, breaks for education and the inevitable layoff and dismissal. It is a dramatically cyclical business, and students need to manage their lives, careers, and personal finances with this in mind.

Development of SEG's Student Programs and the creation of the Education & Training Program was driven by demand from industry for more employees and for training of new professionals that was not obtainable at universities nor, sadly, provided at most of the companies. It makes sense to me to support more students at lower funding per student during upswings in the employment market. It also makes sense for SEG to support fewer students and provide more funding per student during the downtimes. Just like greenfield exploration funding, it makes sense to provide funding for SEG student programs consistently at modest levels over the long run.

The business of SEG should be to advance science and discovery in the field of mineral resources. Let's leave the business of employment for economic geologists to industry.

SEG's Job: Transfer of Knowledge

Dan Wood (SEG 2010 F)

I agree with the sentiment of Fred Graybeal's proposal, but observe that SEG lacks the financial resources to have any real and lasting impact on the plight of graduating economic geologists by the mechanism proposed, irrespective of source of SEG funding. However, I would endorse SEG providing seed-funding through the university sector to better prepare economic

geology graduates for future mining industry employment, by making use of the extensive practical knowledge acquired by members over the past 50 years of discovering orebodies.

Strange as it may seem when so many economic geologists are presently unemployed, the mining industry will face a major challenge in the not too distant future because of age demographics. It will be a challenge the industry previously has never had to seriously address, on a scale that it is ill-prepared to handle, and will be caused by massive loss of knowledge and experience as industry's older cohort of economic geologist departs.

This is already underway and, whereas in the past there was a much broader demographic spread to ameliorate the effect when experienced geologists left industry, this time the experience buffer that previously protected industry from its habitual folly won't be there and mining will suffer significant wealth-destroying consequences as a result. In my experience, the mining industry has never excelled at mentoring young geologists and most of us learned our trade by making mistakes, if we were fortunate enough to work for companies that tolerated this form of apprenticeship.

This cohort of departing economic geologists has priceless and irreplaceable knowledge and experience that can never be regained once lost, because of the "golden age" of exploration during which these geologists served their apprenticeships, learned by doing, and practiced the art that some eventually mastered, with the latter discovering ore bodies. This learning came at enormous price to industry, although the cost is probably impossible to accurately quantify, but is reflected in the average cost of orebody discovery.

The loss of so many experienced economic geologists over a very short period, without backup, is unprecedented and robs new graduates of the opportunity to learn how to become an ore finder, except by repeating the mistakes made by the old cohort in learning the skill of discovery. However, the demand on new economic geologists is not to make the types of discoveries the older cohort made. History will show these orebodies were much easier to discover than those the new generation will have to make.

Underpinning the new discoveries will be the old cohort's knowledge

and, as a learned society, SEG has the responsibility to ensure that as much as possible of this knowledge is transferred to future economic geology graduates. The issue is how to use this knowledge in university undergraduate courses in economic geology and prepare industry-ready graduates with discovery skills. A starting point would be for SEG to support a number of universities with an economic geology focus to work with industry-experienced members to develop programs for transferring this knowledge.

Student Funding Bridges the Gap

Honza Catchpole, Sumitomo Metal Mining, Vancouver, Canada (SEG 2012)

The contribution of Dr. Graybeal touches on a sensitive issue: What can the SEG do to mitigate increasing unemployment in the economic geology community? I agree with Dr. Graybeal that discussion about fund use is appropriate and that new and more practical funding strategies could be considered by the SEG and its members in order to help graduate students start a career in the industry.

While the SEG plays a strong part in bringing academia and industry together, it probably is not the mission of the Society to fund salaries for industry jobs. The Society could rather try to find ways of convincing companies about the need and benefit of a long-term and sustainable investment in geologic staff. This is probably quite the challenge.

The idea for a Graduate Internship Program could be one way to get students access to practical experience. Rather than long internships paid by SEG funds, the program could organize a number of placements (e.g., 3-month) with specific goals (e.g., sampling programs, core logging, GIS), similar to summer internships. Participating companies could receive certain recognition by the SEG, but financially the placement would be largely supported by industry. Again, this might be a challenging undertaking.

I also feel that is necessary to emphasize here that the current funding provided by the SEG for various student support programs does have practical ends and indirectly supports

employment. As a geology student until I completed my PhD degree in 2011, I had the chance to take advantage of generous SEG-funded programs and grants that were initiated or expanded by the Society about 10 years ago. The technical knowledge gained and industry insight and contacts made on field programs and SEG conferences have made a strong impact on my career and on those of other young geologists that I know. Some of my more notable experiences were made while interacting with geologists working in the mining and exploration industry.

Now is a critical time to continue student support. As pointed out by Dr. Graybeal, there will be a considerable number of people leaving the industry, many for good. Student numbers can be expected to decrease in the next years following the deteriorating prospects of employment in the resource and energy sectors. As President Foster pointed out in the January 2016 issue of the *SEG Newsletter*, the Society needs to continue and attract geoscientists to careers in economic geology.

A certain number of unemployed geologists are returning to universities, starting degrees in geology, management, or other related areas. This provides a buffer of a couple of years and these geologists are later available for industry openings. By funding research the SEG indirectly helps retain this experienced workforce.

SEG Events Promote Networking

Libby Sharman, *Sharpman Consulting, Vancouver, Canada (SEG 2012)*

Dr. Graybeal's comments on the current struggles facing our industry are timely and much appreciated. It is true that new graduates and early career geologists are some of the worst affected by the current downturn, and there are already many who have departed industry completely or moved sideways into associated careers with more stability.

Graduating students are entering the work force with less experience as it is becoming harder to find summer field jobs. They are also competing with geologists with many years of experience for entry-level jobs. Those geologists who are still working are accepting lower pay, with longer rotations, and are having to become creative and utilize

diverse skill sets to do more as companies have limited resources. I am one of those who have, since completion of my PhD in 2011, gone from a Project Geologist, to core-logging geologist, to sidestepping into communications and community engagement, before starting a consulting business that utilizes all of this experience.

How to rectify this drain of talent from our industry is a question that is raised in every downturn and I applaud Dr. Graybeal for proposing some solutions. I do not, however, agree that it is the SEG's role to facilitate and support employment for geologists beyond advertising jobs and providing networking opportunities. In this specific space, it may be worthwhile for the SEG to host industry think-tank sessions on how to encourage companies to adapt their business models to preserve their geological staff. It is important for companies to recognize the value of the geologists that they have employed and trained and find ways to extend their employment rather than geologists being the first to go when money is scarce.

I would like, as an alternative, to propose the SEG focus rather on providing subsidized access to on-going training and networking opportunities to new graduates and early career geologists, such as now occurs with the yearly SEG-SGA-UNESCO training courses in Latin America. Invariably (especially in the current economic climate) these geologists are the last to be allocated company funding to attend conferences and short courses for on-going professional development, if they are employed at all. There are, of course, many companies that do offer support for this but also many that don't.

This support could be administered through similar merit-based processes as are used to fund students to attend these events, but perhaps not to such a large degree. This would assist the least-supported sector of our industry in enhancing their skill set, gaining exposure to networking opportunities where job opportunities may be identified, and keeping them engaged in the industry.

I know from personal experience that some of my most invaluable experiences and opportunities have come from attending SEG events, and I doubt my career path would be what it has been without these occasions. I have been fortunate that my participation in these conferences and short courses has been

supported by a company or through volunteering. If the SEG were able to provide support to less lucky recent graduates, they too would be able to reap the benefits of opportunities the SEG already provides.

Funded Field Trips Lead to Employment

Tivadar Hunor Kun (*SEG 2015*)

I was born in Hunedoara, Romania, and in 2010 I graduated with a B.Sc. in geology from Babeş-Bolyai University in Cluj-Napoca, Romania. In 2012 I received an M.Sc. degree in geology with an ore deposits focus from Eötvös Loránd University in Budapest, Hungary. I would like to thank my academic supervisors, István Márton and Ferenc Molnár, for their patience and endless support toward my professional formation.

As a student member of SEG, I received a grant to join the 8th SEG Foundation Student Field Trip in 2011, visiting some IOCG and Cu-Ag deposits in northern Chile. I have to acknowledge the field-course coordinators, William Chavez and Erich Petersen, for their efforts to make this field course an experience of a lifetime for me. I also thank the professional members of the SEG for their financial and moral support, which made my attendance at this field course possible. Because of this opportunity, I was able learn firsthand about these types of deposits, as well as have the opportunity to make connections with local professionals in Chile, which led directly to the job that I have today.

When I finished my M.Sc. in Budapest in mid 2012, I was contacted by SCM Carola, a medium-scale Chilean company mining an IOCG-type deposit in the Punta del Cobre-Candelaria ore district. They offered me a position to work as geologist, starting in 2013. I must thank SCM Carola and staff for their belief in a young geologist, giving me the opportunity to prove my capabilities at their company. I am proud to be part of a very professional team, where my duties include development of short- and long-term plans for mining exploration, working with mining engineers to ensure that production targets are met, and producing monthly and yearly production reports.

After more than three years of working as geologist in Chile, I thank the SEG for providing the opportunity for students to make connections with professionals. I have also just attended the SEG-SGA-UNESCO course in Copiapó, a rare chance for students and young professionals to interact with and learn from experts, in both the classroom and the field. In ending, I ask SEG members to continue the support of student participation in field courses and other training opportunities, which help students to start their professional career in a positive manner. The course that I attended, visiting world-class ore districts, was certainly instrumental in starting my career.

Student Chapters/ Lecturers Inspire

Juanita Rodriguez (*Student 2010, Recent graduate 2015, Member 2016*)

I am a geologist from Bogotá, Colombia. For me the SEG, together with the Student Chapters that I have been part of, have had a great impact on my life, both professionally and personally.

When I was an undergraduate student I found out about the SEG, and with some classmates, we began the unknown experience of founding a Student Chapter in Bogota. At the beginning it was a little difficult because not many people were interested, but soon we were so many students that we did not know how to organize ourselves. Over time, we could organize better and developed some internal and external lectures. One of them was in 2010, when we invited SEG Regional Lecturer Dr. Alvaro Crosta (SEG 2008 F), from the University of Campinas, to Bogotá to give a lecture about remote sensing and spectral geology applied to mineral exploration. From that moment I became very interested in continuing in this field of study and in 2012, I moved Brazil, in order to undertake M.Sc. study at the University of Campinas with Dr. Crosta as my advisor. He helped me to find a very interesting project for my thesis, on a Gold Fields epithermal gold discovery in Chile, supported by our SEG Sponsor Francisco Azevedo (SEG 1996 F).

At the University of Campinas I was part of the SEG Student Chapter and, fortunately, I obtained an SEG Student Research Grant; this helped me to develop my research with all the support that I needed. After I graduated, I worked for one year in Mexico and now I am working with Gold Fields in Chile, the same company that supported me during my M.Sc. research.

If I have not known the SEG and all the opportunities it gives for students, I do not know in which field of geology I would be in this moment. This Society has not only given me academic support, it has also provided me the opportunity to know amazing geologists, and above all, incredible friends.

And finally, A Comment on Frederick T. Graybeal's Article and Subsequent Commentaries

David J. Hall *Erris Resources Limited, London*

The points raised by Fred Graybeal are very relevant as we continue with a disruptive phase in our industry.

The SEG can play a more practical role in the development of economic geologists, and the combined views of Fred and the subsequent commentaries offer ways of addressing this. Fred mentioned that "career development is best accomplished with a career." How true! I support the idea of more practical, two-week training and development programs covering both the business and technical aspects of our industry. I think that some of us, as the "old codgers" with our links to Student Chapters, can help to address this training task in a practical way. Each Student Chapter has an industry advisor and the role of that person must be enlarged such that they can introduce practical training programs to the students. In addition, if the SEG prepares a thorough "in-house" business and technical course, many experienced members could present this to students to help them more fully understand the profession and possible career options. This could be done cost

effectively, as the industry advisor is typically on hand locally. This would allow the Society to support universities in the manner that Dan Wood has proposed. This involvement can include field trips led by the industry supervisor for chapters and individual students at a relatively low cost to students, allowing them to study ore deposits in both the field and mine setting.

The idea of student-industry internships is good but as Murray Hitzman noted, there would be issues to pick eligible companies. The industry is small—companies that want to become "SEG Affiliated" can be proposed and listed for approval in the same way we currently accept Fellows. These companies must show that they recruit "interns," perhaps on expenses-only but at least offering a step up the ladder of experience. The notion of a specific fund is probably beyond the financial capability of the Society, as \$0.5M of grants would only support 20 interns at \$24K/y (\$2000/m).

I disagree with Steve Enders' statement that the business of SEG should be to advance science and discovery in the field of mineral resources, and that we should leave the business of employment for economic geologists to industry. The exploration business is about discovery, and by assisting young geologists to gain relevant experience, the SEG can help to develop the next generation of ore finders. A better understanding of mineral resources will also assist the industry, as too many companies promote resources that will only ever be that—resources but never reserves.

Finally, Fred points out that he anticipates recurring, unpredictable, and even more sharply defined cycles of high and low metal prices in the future. Good geologists, like good projects, survive the ups and downs. I have been involved in employing many young geologists but the attrition rate has been high, more leaving than staying, either back to academia, into oil and gas or another sector completely. I have kept the good ones, supported them and they have gone on to lead companies either for me or other people. The ultimate aim of us old codgers is to support the Society of ECONOMIC geologists in any way possible to develop these new ore finders and leaders. 