

AGI: Geoscience has the whole world in its hands

When you think of the key components required for life on Earth, three things immediately spring to mind: food, water and energy. Geoscientists are the people who research not only these three vital components, but instead focus their attention on the entire Earth system: its oceans, atmosphere, islands and continents, rivers and lakes, ice sheets and glaciers, soils, its complex surface, rocky interior, and metallic core. Nobody understands the importance of geoscience in the modern world better than **Dr Jean Bahr** and **Ms Allyson Anderson Book**, both from the American Geosciences Institute (AGI), who pinpoint education as the key remaining challenge in furthering scientific understanding of Earth's history.

Geoscience is the study of the Earth. The scientists responsible for such investigations, namely geoscientists, are known as the caretakers of Earth's resources, and their research looks at the Earth, its soils, its oceans, and its atmosphere as just some of the ways to further human understanding of Earth's interwoven processes and history.

The American Geosciences Institute (AGI) provides a collective hub from which global geoscientists can collaborate, share ideas and accumulate research to the benefit of the planet and everybody on it. The non-profit federation, founded in 1948, comprises 51 geoscientific and professional organisations that represent over 250,000 geologists, geophysicists, and other Earth scientists.

Through AGI's influence, geoscience research has become more accessible and publicised than ever before. Their current President, Dr Jean Bahr (JB), and Executive Director, Ms Allyson Anderson Book (AAB), spoke with us at *Research Features* to discuss how this transition has come about, highlighting the importance of novel geoscience events, such as Earth Science Week.

©Jean Bahr



Jean Bahr, President of the American Geosciences Institute (2016-17).

Hello Dr Bahr and Ms Anderson Book! Why do you think the geosciences are particularly important to life on Earth at this particular time?

JB: Geoscience is the study of our planet. It doesn't just include the rocks and the resources, but it also includes life and the history of life on our planet. In other words, the study of geosciences encompasses just about everything that's important to life on Earth. Geoscientists also have a broad understanding of the way our planet has evolved, and that offers a unique perspective on some of Earth's ongoing climatic changes.

To what extent do you think geoscientists should be responsible for alerting politicians to their findings, suggesting solutions, and advocating that these be put into practice?

JB: I think we have a huge responsibility to present our scientific findings, but what is then done with those findings is really a matter of public policy. I think we, as individuals, should certainly feel free to advocate for what we think are the consequences of those findings, but I don't think it's possible for the geoscience community to say what those findings mean in terms of what we should do. Our findings can inform us as to what may happen under different scenarios. So, for instance, if we do not reduce the emissions of carbon dioxide into the atmosphere, our science will inform us as to what the consequences of that could be: it's really a public policy decision whether you want to avoid that or not.

Geoscientists also have a broad understanding of the way our planet has evolved, and that offers a unique perspective on some of Earth's ongoing climatic changes

Does that responsibility weigh heavily, or does it simply feel like you present the information and then it's up to public policy to respond accordingly?

JB: It definitely weighs heavily on me as a person and I certainly have strong feelings about the directions that I think we should go in terms of public policy, but I can't speak for the entire geoscience community. Part of what informs my decisions on where we should go is my worldview and my values, and I don't know if all geoscientists share the same values.

Can you tell us about the background of the AGI and what it does?

JB: AGI was founded in 1948 in response to a directive from the National Academy of Sciences. Its purpose was to create a network of associations that represent geoscientists with a diverse array of skills and knowledge of our planet. There are similar federations, such as the American Institute of Physics. A lot has changed since 1948, but AGI continues to provide collaborative leadership and information to geoscientists, and serves as a voice of shared interests in geoscience.

Can you explain the role that the geosciences play in society's use of resources, resilience to natural hazards, and health of the environment?

JB: First of all, finding, assessing, and managing Earth's resources has always been an essential part of geoscience practices. The first geological studies were prompted by resource use, and geoscientists have been principal players in the search for energy and mineral resources. Energy resources don't only include fossil fuels like coal, oil, and natural gas, but they also include uranium for nuclear energy, and Earth's heat sources, which can be utilised to generate geothermal energy.

More recently there's been increased attention to the rare earth elements, which make up significant components of electronic equipment and things like solar panels. From my own field, it's a bit of an interesting tidbit that, if we think about what is mined the most in terms of all resources, it's water. So, of course geoscientists are therefore also

involved in determining where water resources are, quantifying both surface and underground water resources, determining what water-use rates would be sustainable under various scenarios, and predicting conditions that can lead to droughts and floods.

In terms of natural hazards, geoscientists are the ones who identify risks associated with landslides, earthquakes, and even volcanic eruptions. Some of these natural hazards can be predicted but, with other hazards that can't necessarily be predicted, we can interpret what their consequences will be, to give a projection of the occurrence likelihood.

In terms of the health of the planet, the health of people and ecosystems depends directly on access to resources such as water, as well as protection from natural hazards and toxic substances. One example of this is arsenic in drinking water, and that's been a significant problem in many parts of South Asia, Bangladesh, Vietnam, and even in the US in my home state of Wisconsin. We've done work looking at how to control the presence of naturally occurring arsenic in drinking water – so those are just a few examples.

What influence does the AGI have on the formation of public policy and decision-making?

JB: AGI has had a formal public policy programme for the last 25 years, and it works with coalitions and teams to communicate its shared goals with the geoscience community and to decision-makers. One of the specific things we do is that we sponsor internships, fellowships and congressional visits, all of which get geoscientists up to Capitol Hill, home of the United States Congress in Washington DC. Geoscientists from around the country come to Capitol Hill to discuss their research with policy makers, learn the basics of public policy, learn the outlook for federal funding of geoscience research and education, and gain first hand advice from AGI staff on how to conduct effective meetings with congressional staff. This experience helps to increase the visibility of geoscience and the engagement of geoscientists in public policy.

Many of our member societies don't have the resources themselves to hire staff to engage directly in the public policy process, so for them we serve as their voice in Washington and provide assistance to their members when they conduct congressional visits. We coordinate with member societies that have their own public policy programmes to ensure that we're working together, that we're

© A.A. Book



Susan Werner Kieffer (center) receives AGI's 2017 Marcus Milling Legendary Geoscientist Medal from AGI President Jean Bahr (left) and AGI Executive Director Allyson Anderson Book (right).

not sending out conflicting or redundant messages, and we leverage the whole community.

At the state and the local level, we also gather and disseminate geoscience information for decision makers, and we do that in a couple of ways. We run a programme called Critical Issues, which, during its recent Forum in Colorado, discussed the issues associated with managing groundwater resources in an area called the High Plains Aquifer. We also run a series of free webinars at AGI, including one several weeks ago focusing on flood risks, which attracted over 500 participants. These webinars provide people with a real-time conversation, and the recordings are available on-demand from our website. AGI is non-partisan, but we work to ensure that policy is informed by geoscience and advocate on behalf of the geoscience profession. For example, we publish reports and factsheets for new administrations and new members of Congress, and these are resources that our

members can use as talking points when they conduct visits with their, either federal, state or local, representatives.

The AGI has a strong publishing presence. Why is this aspect of communication important to the AGI?

JB: Unlike a lot of our member societies, AGI does not publish a peer reviewed primary literature science journal. Our flagship publication is a magazine called *EARTH*. This used to be called *Geotimes*, and it presents geoscience in a way that's easy to read. It's really designed for the public, as well as a broad sector of geoscientists who are interested in topics outside of their own specific expertise. I give it to my 93-year-old father who's an electrical engineer, and he loves it!

We also produce geoscience curricula, to provide students from nursery upwards with Earth science learning materials in their schools. At the university level, we have a

Geoscience is at the base of the societal pyramid and, without us putting a framework in place, the world's GDP suffers ”

© Celia Thomas/AGI



The entrance to the Smithsonian Museum of Natural History, highlighting National Fossil Day - an important event within Earth Science Week.

laboratory manual that's used in introductory geology courses, and then of course we have GeoRef, which is an online subscription database which contains practically all published geoscience literature. If you explore the AGI website you'll find a lot of publications there, related to Earth science education and public policy related areas, as well as our Glossary and Geoscience Handbook, which are essential for geoscientists working in the field.

AGI is particularly interested in publications focused on education, and some of these come out in conjunction with a major programme that we sponsor called Earth Science Week. This weeklong event, which runs from 8-14th October 2017, is an attempt to engage students across grade levels in hands-on geoscience learning. We really want to ensure that teachers have access to good baseline material, and we want students to understand the connections between human society, science, and the Earth more broadly.

AAB: What is especially great about Earth Science Week is that we get to partner with several federal agencies, international organisations, and geoscience groups from all around the world, as well as private industry and other non-profit organisations, to put together educational materials in a sort of database that we call the Earth Science Week Toolkit. The Toolkit showcases all the different activities that come around during Earth Science Week, and we send that out globally now.

We have had activities run in South America, Japan, China, and all variety of places. Now in

its 20th year, we are really trying to extend the week's outreach further, and we are hoping that Earth Science Week will be in all 50 states of the United States soon enough.

What is the current situation in terms of workforce development for geoscientists?

JB: Based on data from the AGI Workforce Program's most recent report, we're expected to have a deficit of about 90,000 geoscientists in the US by 2024. We have an ageing population in a lot of the industries that traditionally hire geoscientists, so meeting that future demand is going to require strong investments in education and professional development. Year on year, there are certainly fluctuations in hiring.

The oil and gas industry in the US has been in a bit of a downturn in the last couple of years, after doing quite a bit of hiring in the preceding two years. And, in environmental geoscience right now, there's a lot of uncertainty related to the new administration, because a lot of the work they do is partly driven by regulations which are likely to be removed. However, in the long run we will still need clean water, mineral resources and energy, so I think there's going to remain a strong demand for geoscientists over time.

What particular challenges will geoscientists need to address during the next decade?

JB: I think all of us are going to need to address the changing climate. With continually increasing global demand for clean water, energy, and mineral resources, alongside increasingly dense populations and natural hazards, the climatic impacts are going to be amplified. Likewise, I think with those

challenges there's also some excitement in the way we can, as geoscientists, continue to develop new tools that help us do better jobs of forecasting natural hazards, and of quantifying water resources. So, for example, there's a satellite mission called GRACE which uses gravity measurements to determine changes in the water holding capacity of large areas – such as the central valley of California. Some of those tools have really revolutionised our ability to look at these things on a global scale. While there may be lots of challenges, there are also lots of opportunities.

AAB: If you look at modern society, there are a few key things you have to have in order to actually grow and improve your economy. You need access to health care, energy, natural resources, and, perhaps most importantly, food and water. When you look at those different areas, what sits at the base is a geoscientist – so, for instance, you're not going to have great crop yields if you don't have a geoscientist working on the mineral content of soil.

Geoscience is at the base of the societal pyramid, and without us putting a framework in place that addresses some pretty fundamental challenges, the world's gross domestic product (GDP) suffers.

• *For more information on the American Geosciences Institute, Earth Science Week or their fantastic magazine, EARTH, please visit their respective websites at www.americangeosciences.org, www.earthsciweek.org & www.earthmagazine.org.*



Contact

American Geosciences Institute
4220 King Street
Alexandria
VA 22302-1502
USA

E: outreach@americangeosciences.org
T: +1 (703) 379-2480
W: www.americangeosciences.org
Twitter: /AGI_Updates
Facebook: /AAndersonBook
Facebook: www.facebook.com/agiweb/