DEG Spheres of Influence February 2017

Division of Environmental Geosciences Mission Statement and Purpose

What is the DEG? Get a refresher of the mission statement and purpose of the Division of Environmental Geosciences.

President's Column

Environmental issues are a worldwide concern - the Division of Environmental Geosciences has an obligation to provide science-based opinions of these issues to educate the public, government officials and other petroleum industry professionals.

Drinking Water Protection – Regulation Matters!

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The Good, the Bad and the Ugly / RPSEA Report

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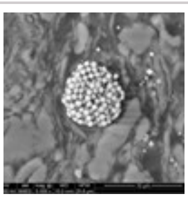


Beauty in Geology – The Beauty of the Microscopic World in Geology

The micro can be just as beautiful as the macro to geologists … take a look for yourself.

Division of Environmental Geosciences Mission Statement and Purpose

February 2017

- **Educating** the membership of AAPG and the general public about important issues that affect petroleum energy minerals exploration and production.
- **Communicating** to the general public and government agencies the Association's commitment to protect the environment while developing the world's natural resources in a responsible manner.
- **Applying** the expertise developed in the petroleum/energy minerals industries and hydrogeology to resolve environmental problems.
- **Promoting** environmental self-regulation within the petroleum/energy minerals industries.
- **Providing** relevant educational opportunities and services for professional development of the AAPG membership through seminars and conferences in environmental geosciences, hydrogeology and related fields.

President's Column

February 2017 | By Timothy Murin

Environmental issues related to energy development are not confined to the United States – they are worldwide concerns. While the United States is leading the research on issues ranging from induced seismicity related to deep wastewater injection and possibly hydraulic fracturing, the preservation of water and air quality, fugitive gas emissions and the mitigation of offshore oil spills, other countries also are confronted with these same matters.

I met with several representatives from Nigeria at the Africa Region meeting at ACE 2016 in Calgary last summer, and their primary objectives in energy development are to preserve water resources and animal life. Ireland recently completed an independent study to determine if onshore exploratory wells should be drilled and what are the potential environmental impacts. The United Kingdom also is reluctant to engage in developing petroleum reserves because of possible adverse impacts from drilling and hydraulic fracturing. Canada is actively looking to collaborate with government agencies and universities to research topics related to the responsible development of reserves while protecting the environment.

The Division of Environmental Geosciences has an obligation to provide science-based opinions of these issues to educate the public, government officials and other petroleum industry professionals. We have several committees that would welcome input on these subjects from both members and non-members. Two new committees are being formed that will provide expertise on induced seismicity and fugitive gas emissions. Please look at our website at aapg.org to learn more about the division and ways that you can be involved to help resolve some of the potential environmental problems facing the industry that may hinder energy development.

Drinking Water Protection – Regulation Matters!

February 2017 | By Dan Jackson

Reliable access to safe, clean drinking water is something most people in the United States take for granted. We turn on our tap and out comes clean water! We brush our teeth, wash our clothes, cook our meals and bathe our children. In the United States, it's abundant, reliable and relatively cheap. Even kings of the past didn't have such luxury.

How did we get to this healthy, safe place – and more importantly, how do we stay here?

As far back as 400 B.C. Hippocrates recommended boiling and straining water. A 200 B.C. Sanskrit manuscript instructed: "It is good to keep water in copper vessels, to expose it to sunlight and filter it through charcoal." The Romans and other civilizations began using sand filter for drinking water.

Drinking water treatment continued to evolve, but sporadically. In 1840, cholera epidemics claimed 8,000 lives in New York City and 5,000 in New Orleans. A London cholera outbreak in 1854 was traced to a single contaminated well.

By 1860 major U.S. cities and towns had over 400 water systems, and by 1900 over 3,000. But the water often was unsafe and caused disease.

Sand filtration and chlorination treatment to address biological contamination began in the early 1900s, and in 1912 U.S. Congress passed the Public Health Service Act, authorizing water pollution surveys especially related to human health.

The Secretary of the Treasury adopted the first standards in 1914, which introduced the concept of maximum contaminant limits. Cholera and typhoid fever cases saw rapid declines – in 1900, there were about 76,000 cases. By the 1920s it decreased to about 35,000, and by 2006 there were only 353 cases.

In the 1940s and '50s, widespread use of new pesticides and other man-made chemicals raised concerns about chemical contaminants, especially related to unknown, long-term effects on human health and the environment.

In 1962 the Public Health Service set minimum standards for all public drinking water supplies under the Federal Water Pollution Control Act. In 1972 it was amended as the Clean Water Act, aiming to restore and maintain surface water quality by regulating contaminant discharge into "waters of the U.S."

The Safe Drinking Water Act (SDWA) was passed 1974. It expanded the federal role in state's safe drinking water by setting enforceable standards for all community water systems, and setting injection well protections for underground sources of drinking water. The SDWA compelled the Environmental Protection Agency (EPA) to set national drinking water standards for both naturally-occurring and man-made contaminants, and placed the primary authority for administering and enforcing those standards at the state level.

In the oil and gas world, regulations relating to waste water disposal and water handling have helped drive better industry practices – practices that are now widely adopted standards. And it's not as if regulators did it singlehandedly – they didn't. The American Petroleum Institute and other groups have played their part. The efforts from all groups have combined to provide today's regulatory framework that effectively protects our drinking water sources.

But what does the future hold?

Opportunities for partnership continue, and the challenges are many and complex. Our aging water infrastructure needs replacing, and new chemicals and technologies pose very real human health challenges.

In the oil and gas sector, hydraulic fracturing and wastewater handling remain hot topics. There are equally challenging topics across all industrial sectors. Yet our common goal persists – clean, safe, available drinking water now and for our future generations.

As we move into our future, it remains clear that when it comes to safe drinking water, regulation matters!

(Editor's note: Dan Jackson is a regulatory specialist with Impact Geo Consulting Ltd., Louisville, Colo.)

The Good, the Bad and the Ugly / RPSEA Report

February 2017

The Research Partnership to Secure Energy for America (RPSEA) was founded in 2002 as a non-profit national consortium. Subsequent to a competitive award, it was organized in accordance with Title IX, Subtitle J, Section 999 (Section 999) of the Energy Policy Act of 2005 (EPAct).

The program's goal was to provide research and development to ensure the safe and efficient production of domestic resources to the citizens of the United States. RPSEA achieved its program goals by facilitating public-private partnerships while identifying and developing new methods and systems for exploring, producing and transporting energy resources.

RPSEA conducted both onshore and offshore R&D as well as supporting small U.S. producers through their Unconventional (Onshore) Resources Program, Ultra-Deepwater (Offshore) Program and Small Producer Program. RPSEA's membership consisted of multiple research universities, five national laboratories, oil and gas producers, operators, service companies and various independent research institutions.

This major government-industry collaboration ended in January of this year.

The original objective of the Section 999 was to "maximize the value of natural gas and other petroleum resources of the United States." However, the Deepwater Horizon incident caused the government and industry to reassess their approach to exploration and development operations and R&D needs.

In late 2010, the Department of Energy made the decision that all future RPSEA projects should be directed mainly toward safety and environmental sustainability. In addition, issues related to onshore development – such as water usage and treatment, induced seismicity, wellbore integrity and greenhouse gas emissions – were added to the objectives of the original program. As a result, the research RPSEA funded was focused to ensure that risks associated with the development of ultra-deepwater and unconventional resources were fully understood.

Through their various programs, RPSEA supported natural gas and oil resource development, enhanced the efficient use of energy and supported the development of intellectual capital and a skilled workforce. The technologies that were developed through this program have had an enormous impact and are well documented. Technology transfer has been a vital component of the program from its inception.

• **The Ultra-Deepwater Offshore Program** identified and developed technologies, research and development that ensure safe and environmentally responsible exploration and production of hydrocarbons from the ultra-deepwater portion of the Outer Continental Shelf (OCS) in an economically viable manner.

Examples of projects include improved well control technologies, improved well design and construction, improved subsea monitoring instrumentation, research on sensors and increased understanding of complex fluid phase behaviors.

• **The Unconventional Onshore Resources Program** has helped increase the supply of domestic natural gas and other petroleum resources through reducing the cost and increasing the efficiency of exploration and production, all while improving safety and minimizing environmental impact.

Examples of projects include maximizing efficiency of hydraulic fracturing operations, isolation of producing formations and wellbores from shallower formations, prediction and mitigation of induced seismicity, and demonstrating and integrating technologies to facilitate early utilization and commercialization.

While this government-industry collaboration ended in January of this year, it is the hope of many to see these types of relationships and partnerships continue.

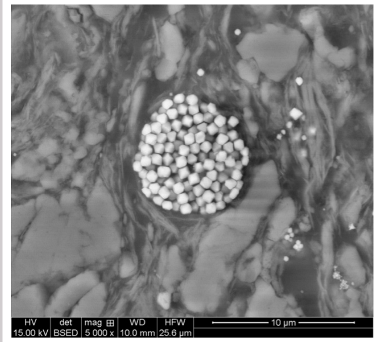
For more information please visit the following websites:

- http://www.rpsea.org/
- http://www.rpsea.org/media/files/files/175c2c7e/NEWS-DOC-RPSEA_Strategic_Plan_Final-09-21-16.pdf
- http://www.ogj.com/articles/2016/09/rpsea-reorganizing-adding-fund-sources.html
- https://www.onepetro.org/conference-paper/OTC-20309-MS
- http://www.spe.org/news/article/energy-research-funding-the-next-generation
- http://www.offshore-mag.com/articles/2016/07/rpsea-to-highlight-ultra-deepwater-technology-advances.html
- http://worldmaritimenews.com/archives/57468/usa-remora-secures-award-under-rpsea-ultra-de

Beauty in Geology – The Beauty of the Microscopic World in Geology

February 2017

The mineral pyrite is an iron sulfide (FeS2) commonly found in organic rich sedimentary rocks. There is nothing more mesmerizing to a microscopist when analyzing a shale sample then coming across a multitude of pyrite framboids (a texture described from the French word “framboise,” for raspberry). Framboidal pyrite stand out like a bright sun against the backdrop of darker and much duller clays and organics.



So, while most “Beauty in Geology” content is about beautiful landscapes and formations, the micro can be just as beautiful as the macro to geologists.

We hope you enjoy these images of pyrite framboids in Marcellus Shale taken with a Field Emission Scanning Electron Microscope.

If you are interested in learning more about pyrite framboid formation we highly recommend Wilkin and Barnes, 1997, Formation Processes of Framboidal Pyrite, Geochimica et Cosmochimica Acta, Vol. 61, No. 2 pp 323-339.