Atlanta Geological Society Newsletter

Next meeting of the Atlanta Geological Society is
January 26, 2016
Fernbank Museum of Natural History (Clifton Road)
Social begins at 6:30 pm – Meeting begins at 7:00 pm

January 2016

ODDS AND ENDS

Dear AGS members,
A new year and at least it feels like winter, not like that warm and wet December we had. With this New Year comes some new insights into familiar concepts.

Just how did plate tectonics get started? Perhaps Venus can give us some clues. See page 5 for the story.

Can paleo soil give up details about past climates? Here is the second story in a few months from young PhDs researching into that often overlooked trove of knowledge just under our feet. See page 11.

My other revelation is trove of information tending towards the very specific and sometimes personal understanding of earth science and earth scientists. I discovered this in the landslide blog for the AGU. Who know there were so many people interested in landslides?
Ben Bentkowski,
Newsletter Editor

January Meeting

Join us **Tuesday, January 26, 2016** at the Fernbank Museum of Natural History, 760 Clifton Road NE, Atlanta GA. The meeting social starts at 6:30 pm and the lecture starts shortly after 7 p.m.

This month the speaker will be 2015-2016 AEG President Paul Santi, PG. who will be speaking on: Cultural and Economic Aspects of Hazard Mitigation: Debris Flow and Landslide Examples

The Speaker's bio and the presentation's abstract are presented on the following pages.

The sponsors for the evening are Atlas Geo-Sampling Company and Turn-Key Processing Solutions. We appreciate the sponsorship.

Please come out, enjoy a bite to eat, the camaraderie, and an interesting talk.

JANUARY SPEAKER'S INFORMATION

Mr. Santi's Résumé

He is also the Department Head of the Department of Geology and Geological Engineering at the Colorado School of Mines, where he has been on the faculty for 14 years. Previously, he taught for 6 years at the Missouri University of Science and Technology, and worked for 6 years as an engineering consultant in San Francisco and Denver. His recent research has focused on analysis, prediction and mitigation design for debris flows, landslide dewatering and analysis, engineering geology pedagogy, and general geologic hazard analysis. He holds Bachelor's degree in Geology and Physics from Duke University, an MS in Geology from Texas A&M, and a PhD in Geological Engineering from the Colorado School of Mines.

Abstract

Cultural and Economic Aspects of Hazard Mitigation: Debris Flow and Landslide Examples

This presentation calls attention to vulnerable groups who are disproportionately affected by debris flows and landslides. These populations tend to be economically restricted to live in relatively inexpensive and more dangerous locations; which are often topographically cramped due to expansion and development; and they have limited influence and power to bring about mitigation efforts. Technical issues have long been the focus of debris flow hazard reduction, but there is strong indication that socio-cultural issues are at least as important for effective hazard and risk reduction efforts. The key elements for success identified by those working in these communities include sensitivity to the type of relations and level of trust given to authority figures, importance of historical land ties, relative importance of socio-cultural values versus analytical decisions, cultural barriers even for translators, and sensitivity to the ethics, rights, and influence of the residents. A review of several debris flow disasters reveals some common elements, such as such as the difference between hazard awareness and hazard appreciation, the usefulness of rainfall thresholds as warning indicators, and the increased danger of events occurring at night. Another critical element is the recognition that land use restrictions are often ineffective, as unauthorized communities will spring up quickly in closed areas because they have nowhere else to live. Socio-cultural awareness may result in selecting designs that 1) focus on reducing risk rather than moving people out, 2) are simple and use local materials, local construction techniques and skills; 3) recognize limited financial means; 4) have minimal maintenance requirements, exposure to vandalism and scavenging, and 5) capitalize on local

Abstract (cont.)

Cultural and Economic Aspects of Hazard Mitigation: Debris Flow and Landslide Examples

techniques of dealing with other hazards, such as flooding, earthquakes, and landslides. Because of the difficulty in predicting and controlling landslides and debris flows, mitigation systems should employ multiple misappropriation of resources; and elements to enhance the chance of success. These can include education of the local populace, avoidance and warning to the degree possible, some combination of channelization and interception of debris, controlling drainage and runoff of water, modifications to house design and layout, and hillside treatment in disturbed areas. Examples will show how these systems can be tailored to fit widely varying socio-cultural settings.

Turn-Key Processing Solutions is in a growth segment of the mineral processing and bulk material handling industries. We are a service business that provides system integration, consulting, engineering and design, construction planning and project management for clients in the aggregate, cement, frac sand, industrial minerals, heavy metal mining and transportation industries. During the last 10 years, the company has developed a reputation for integrity, quality and excellence in management. We focus on providing the optimal solutions to our clients.

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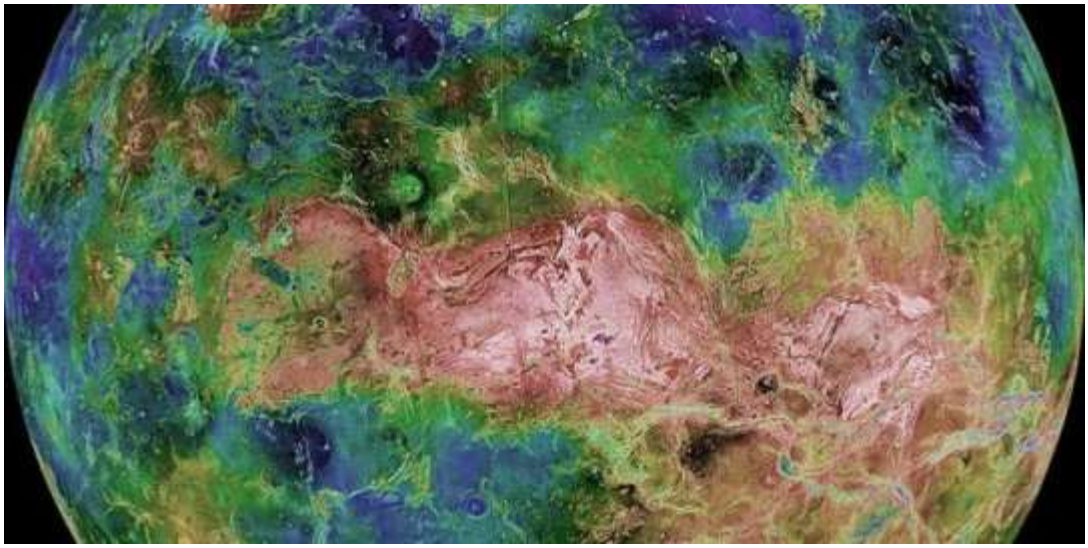
Plate tectonics thanks to plumes?

Date: November 11, 2015
Source: ETH Zurich http://www.sciencedaily.com/releases/2015/11/151111143225.htm
Summary:
It is common knowledge that the Earth's rigid upper layer called lithosphere is composed of moving plates. But just what mechanism first set plate tectonics into motion still remains a mystery. Scientists have now come up with one possible answer by using simulations.



Venus as a model: Today this planet looks like the Earth might have looked before the onset of plate tectonics. *Credit: NASA/JPL*

"Knowing what a chicken looks like and what all the chickens before it looked like doesn't help us to understand the egg," says Taras Gerya. The ETH Professor of Geophysics uses this metaphor to address plate tectonics and the early history of the Earth. The Earth's lithosphere is divided into several plates that are in constant motion, and today's geologists have a good understanding of what drives these plate movements: heavier ocean plates are submerged beneath lighter continental plates along what are known as subduction zones. Once the movement has begun, it is perpetuated due to the weight of the dense subducting plate.

But just as in the past, earth scientists still do not understand what triggered plate tectonics in the first place, nor how the first subduction zone was formed. A weak spot in the Earth's lithosphere was necessary in order for parts of the Earth's crust to begin their descent into the Earth's mantle. Was this weak spot caused by a gigantic meteorite that effectively smashed a hole in the Earth's lithosphere? Or did mantle convection forces shatter the lithosphere into moving parts?

Continued on Page 7

Announcement for the next Atlanta Geological Society PG Candidate Workshop:

Date: January 30, 2016
Time: 10:00 am to 12:00 pm
Venue: Fernbank Science Center Annex
156 Heaton Park Drive,
N.E. Atlanta, GA 30307
678-874-7102
http://fsc.fernbank.edu/ Map to Fernbank

Speaker: Jim Kennedy, PhD, PG
Subject: GEOHYDROLOGY

Jim is the State Geologist of Georgia and holds B.S. and M.S. degrees in physics and geophysical sciences from Georgia Tech and a Ph.D. in geology from Texas A&M where he did research on reclaimed lignite mines. As State Geologist, he has worked on the Coastal Sound Science Initiative to manage salt-water intrusion into the Upper Floridan aquifer, permitting of coastal groundwater supply wells, and the State Water Plan. He also has provided expert testimony at the Office of State Administrative Hearings in support of landfill, quarry, and water withdrawal permits issued by the Georgia Environmental Protection Division. Prior to joining the EPD, Dr. Kennedy worked as a consultant and conducted engineering geology, groundwater supply, and environmental remediation projects in various areas of the United States and Europe.

Check with the receptionist as you come in Fernbank Science Center for directions to the classroom we will be using. The Center is approximately 1-mile north off East Ponce deLeon Avenue from the Fernbank Museum Of Natural History where the AGS monthly meetings are held.

Also, please forward this message to anyone interested in becoming a Georgia Registered Professional Geologist, or anyone who might be interested in the topic. The classes are open to all. Membership in the AGS is not required, however, $25 per year ($10 for students) is quite a bargain for one the most active geological groups in the Southeast.

If you have any questions, go to the AGS web site at http://www.atlantageologicalsociety.org or contact us below. We hope to see you there!

Ken Simonton, P.G. Ginny Mauldin-Kinney John Salvino, P.G.
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Atlanta Geological Society
Professional Registration Committee

Plate tectonics thanks to plumes? (cont.)

Venus as a model

Gerya is not satisfied with any of these potential explanations. "It's not trivial to draw conclusions about what set the tectonic movements in motion," he says. The ETH professor therefore set out to find a new, plausible explanation.

Among other things, he found inspiration in studies about the surface of the planet Venus, which has never had plate tectonics. Gerya observed (and modelled) huge, crater-like circles (coronae) on Venus that may also have existed on the Earth's surface in the early period (Precambrian) of the Earth's history before plate tectonics even began. These structures could indicate that mantle plumes once rose from Venus' iron core to the outer layer, thus softening and weakening the planet's surface. Plumes form in the deep interior of the planet. They rise up to the lithosphere, bringing with them hot partially molten mantle material that causes the lithosphere to weaken and deform. Halted by the resistance of the hard lithosphere, the material begins to spread, taking on a mushroom-like shape.

Such plumes also likely existed in the Earth's interior and could have created the weaknesses in the Earth's lithosphere needed to initiate plate tectonics on Earth.

Mantle plumes create weaknesses

The ETH geophysicist worked with his team to develop new computer models that he then used to investigate this idea for the first time in high resolution and in 3D. The corresponding publication has recently been published in *Nature*.

The simulations show that mantle plumes and the weaknesses they create could have actually initiated the first subduction zones.

In the simulations, the plume weakens the overlying lithosphere and forms a circular, thinning weak point with a diameter of several dozen to hundreds of kilometres. This is stretched over time by the supply of hot material from the deep mantle. "In order to make a ring larger, you have to break it," explains the researcher. This also applies to the Earth's surface: the ring-shaped weaknesses can (in the model) only be enlarged and subducted if the margins are torn.

Water lubricates the plate margin

The tears spread throughout the lithosphere, large slabs of the heavier rigid lithosphere plunge into the soft mantle, and the first plate margins emerge. The tension created by the plunging slabs ultimately sets the plates in motion. They plunge, well lubricated by the buried seawater of the ocean above. Subduction has begun -- and with it, plate tectonics. "Water acts as a lubricant and is an absolute necessity in the initiation of a self-sustaining subduction," says Gerya.

In their simulations, the researchers compare different temperature conditions and lithosphere states. They came to the conclusion that plume-induced plate tectonics could plausibly develop under the conditions that prevailed in the Precambrian around three billion years ago. Back then the Earth's lithosphere was already thick and cool, but the mantle was still very hot, providing enough energy to significantly weaken the lithosphere above the plumes.

http://www.sciencedaily.com/releases/2015/11/151111143225.htm

2 JANUARY 2016

A major rockslide on US2 near Wenatchee

Posted by dr-dave

A major rockslide on US2 near Wenatchee

The Washington State (USA) Department of Transport twitter account (@wsdot) has images of a major rockslide that occurred in US2 west of Waterville near to Wenatchee. This is not a trivial event by any means:

Looking at the third image, this is a complex wedge type failure on existing joints. There appears to be weathering on the newly exposed surfaces. Looking at the rest of the rock mass, the joint pattern is very complex, so this is a difficult slope to manage and mitigate.

Moving some of the large boulders is going to be a major task.
http://blogs.agu.org/landslideblog/2016/01/12/rockslide-wenatchee-1/

Editor's Note: This post is from a blog all about landslides maintained by Dave Petley who is the Pro-Vice-Chancellor (Research and Enterprise) at the University of East Anglia in the United Kingdom. His blog provides a commentary on landslide events occurring worldwide, including the landslides themselves, latest research, and conferences and meetings. If you go upstream on the AGU webpage you will find links to 13 other blogs. Click on any of those blogs and on the right side you will find links to even more blogs, mostly about earth science. So, click away and explore! http://blogs.agu.org/

Microplate discovery dates birth of Himalayas

Date: November 9, 2015

Source: University of Sydney

An international team of scientists has discovered the first oceanic microplate in the Indian Ocean--helping identify when the initial collision between India and Eurasia occurred, leading to the birth of the Himalayas.

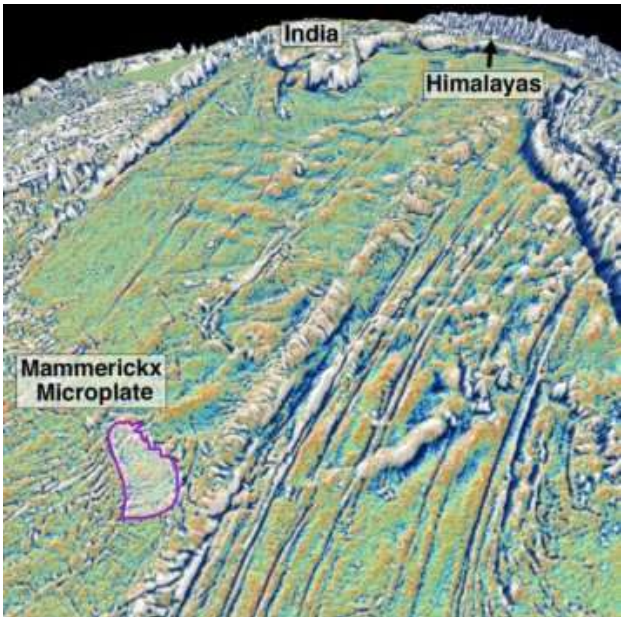
Although there are at least seven microplates known in the Pacific Ocean, this is the first ancient Indian Ocean microplate to be discovered. Radar beam images from an orbiting satellite have helped put together pieces of this plate tectonic jigsaw and pinpointed the age for the collision, whose precise date has divided scientists for decades.

Reported in *Earth and Planetary Science Letters*, the team of Australian and US scientists believe the collision occurred 47 million years ago when India and Eurasia initially smashed into each other.

Researchers led by the University Of Sydney School Of Geosciences discovered that crustal stresses caused by the initial collision cracked the Antarctic Plate far away from the collisional zone and broke off a fragment the size of Australia's Tasmania in a remote patch of the central Indian Ocean.

The authors, comprising Professor Dietmar Müller and Dr Kara Matthews from the University of Sydney and Professor David Sandwell from the Scripps Institution of Oceanography, have named the ancient Indian microplate the Mammerickx Microplate, after Dr Jacqueline Mammerickx, a pioneer in seafloor mapping.

The Mammerickx Microplate rotation is revealed by a rotating pattern of grooves and hills that turn the topography of the ocean floor into a jagged landscape. These so-called "abyssal hills" record a sudden increase in crustal stress, dating the birth of the Himalayan Mountain Range to 47 million years ago.



Microplate discovery dates birth of Himalayas (cont)

The ongoing tectonic collision between the two continents produces geological stresses that build up along the Himalayas and leads to numerous earthquakes every year--but this latest finding indicates how stressed the Indian Plate became when its northern edge first collided with Eurasia.

The new research shows that 50 million years ago, India was travelling northwards at speeds of some 15 centimetres a year--close to the plate tectonic speed limit. Soon after it slammed into Eurasia crustal stresses along the mid-ocean ridge between India and Antarctica intensified to breaking point. A chunk of Antarctica's crust broke off and started rotating like a ball bearing, creating the newly discovered tectonic plate.

The discovery was made using satellite radar beam mapping from space, which measures the bumps and dips of the sea surface caused by water being attracted by submarine mountains and valleys, combined with conventional marine geophysical data.

Lead author Dr Matthews explains: "The age of the largest continental collision on Earth has long been controversial, with age-estimates ranging from at least 59 to34 million years ago. "Knowing this age is particularly important for understanding the link between the growth of mountain belts and major climate change."

Co-author Professor Müller said: "Dating this collision requires looking at a complex set of geological and geophysical data, and no doubt discussion about when this major collision first started will continue, but we have added a completely new, independent observation, which has not been previously used to unravel the birth of this collision.

"It is beyond doubt that the collision must have led to a major change in India's crustal stress field--that's why the plate fragmentation we mapped is a bit like a smoking gun for pinning down the collision age."

Co-author Professor Sandwell from the Scripps Institution of Oceanography said humans had explored and mapped remote lands extensively but the same was not true for our ocean basins.

"We have more detailed maps of Pluto than we do of most of our own planet because about 71 per cent of the Earth's surface is covered with water," Professor Sandwell said.

"Roughly 90% of the seafloor is uncharted by ships and it would take 200 ship-years of time to make a complete survey of the deep ocean outside continental shelves, at a cost of between two- to three billion US dollars.

"That's why advances in comparatively low-cost satellite technology are the key to charting the deep, relatively unknown abyssal plains, at the bottom of the ocean."

Journal Reference: Kara J. Matthews, R. Dietmar Müller, David T. Sandwell. **Oceanic microplate formation records the onset of India–Eurasia collision**.*Earth and Planetary Science Letters*, 2015; DOI:10.1016/j.epsl.2015.10.040

www.sciencedaily.com/releases/2015/11/151109103908.htm

Growth rings on rocks give up North American climate secrets

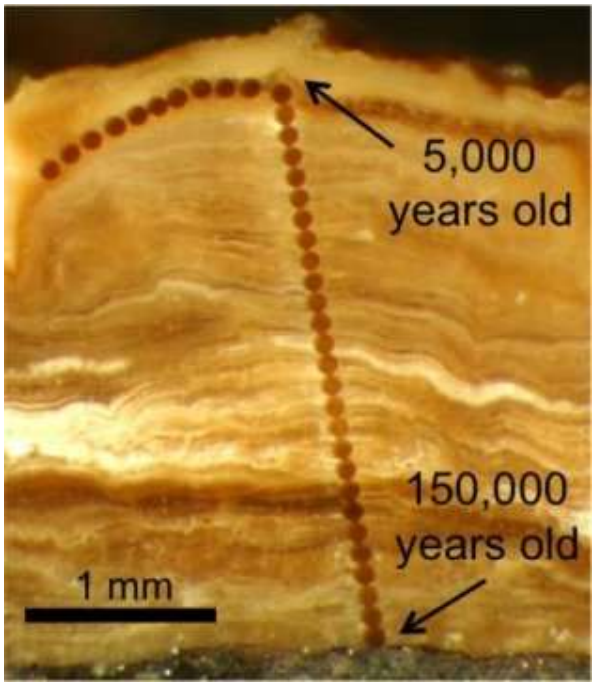
3 millimeters of soil deposits detail 120,000 years of climate history

Date: January 11, 2016

Source: University of California - Berkeley

Summary:

Scientists have used soil deposits that form growth rings on rocks to provide a detailed picture of North American climate over a 120,000-year time span.



This is a magnified photograph of a cross-section through a 3 mm-thick pedothem soil deposit from Wyoming. The line of dots are laser ablation sampling spots that are 0.1 mm in diameter. The innermost mineral material is about 150,000 years old, and becomes progressively younger towards the outside.
Credit: Erik Oerter

Scientists have found a new way to tease out signals about Earth's climatic past from soil deposits on gravel and pebbles, adding an unprecedented level of detail to the existing paleoclimate record and revealing a time in North America's past when summers were wetter than normal.

A research team led by soil scientists at the University of California, Berkeley obtained data about precipitation and temperature in North America spanning the past 120,000 years, which covers glacial and interglacial periods during the Pleistocene Epoch. They did this at thousand-year resolutions -- a blink of an eye in geologic terms -- through a microanalysis of the carbonate deposits that formed growth rings around rocks, some measuring just 3 millimeters thick.

"The cool thing that this study reveals is that within soil -- an unlikely reservoir given how 'messy' most people think it is -- there is a mineral that accumulates steadily and creates some of the most detailed information to date on the Earth's past climates," said senior author Ronald Amundson, a UC Berkeley professor of environmental science, policy and management. http://www.sciencedaily.com/releases/2016/01/160111162655.htm

Growth rings on rocks give up North American climate secrets (cont.)

The study, to be published Monday, Jan. 11, in the *Proceedings of the National Academy of Sciences*, shows the rich potential held within soil deposits known as pedothems, which form growth rings on rocks. The samples used in the study came from Wyoming's Wind River Basin. Because these soil deposits are commonly found in drylands all over the world, they can provide a rich source of data for paleoclimatologists, the authors said.

120,000 years of history in 3 millimeters of rock

Pedothems are a powerful complement to existing geological records of past climate, including ice cores, lake and ocean sediments, and stalactites and stalagmites in caves. They have the advantage of being fairly ubiquitous in regions now populated by humans, unlike the polar regions where ice cores are often obtained.

Key advances in the ability to precisely analyze micro-samples of soil deposits enabled researchers to extract telltale signs of climate change.

"By using micro-analytical measurements on spots as small as 0.01 mm in diameter, we can develop time series of past climate conditions in a way that no one has done before," said Oerter. "It is evident that the carbonate coatings formed in concentric bands around the rocks, much like the annual growth rings in a tree, except that these laminations form over timescales of several hundred years."

The researchers used laser ablation and an ion microprobe, much like a tiny dental drill, to obtain microscopic samples for analysis. Uranium isotopes were used to date the deposits, while oxygen and carbon isotopes revealed clues about the precipitation, temperature and soil respiration at the time the mineral was formed.

For instance, warmer rain from the Gulf of Mexico will result in higher levels of oxygen 18 compared with the cold precipitation from snowstorms blowing eastward across the Rockies. The ratio of carbon 13 and carbon 12 isotopes reflect levels of soil respiration, which is a proxy for plant productivity.

Finding what other records couldn't

The new data revealed that 70,000 to 55,000 years ago, in the midst of a minor ice age, the pattern of precipitation in North America shifted from one dominated by a west-to-east flow of storms from the north Pacific to a south-to-north flow from the Gulf of Mexico. The researchers attributed that to a stable, high-pressure system that parked itself over massive ice sheets that covered eastern Canada and northeastern United States, which helped bring up more air from the south.

That atmospheric circulation translated into wetter summers and drier winters in central North America, a reverse of the usual pattern in which more precipitation falls in the winter.

"This is a new insight from geologic sources of paleoclimate data," said Oerter. "The techniques that we developed can now be applied to similar soil deposits to fill in key gaps in the paleoclimate record. The information will be useful to improve the accuracy of climate models by providing known conditions to calibrate them to."

FERNBANK MUSEUM of NATURAL HISTORY

Special Exhibitions
Humans in Space Youth Art Competition

See an inspiring selection of winning entries from the international Humans in Space Youth Art Competition. Youth ages 10-18 were asked to visually communicate their vision of the future of space science, travel and exploration. The competition is part of the Humans in Space Art Program and received more than 2,000 entries from 52 countries. Fernbank's display will feature 30 of the winning entries. This temporary exhibition located in ***The Star Gallery***, Lower Level.
Learn More

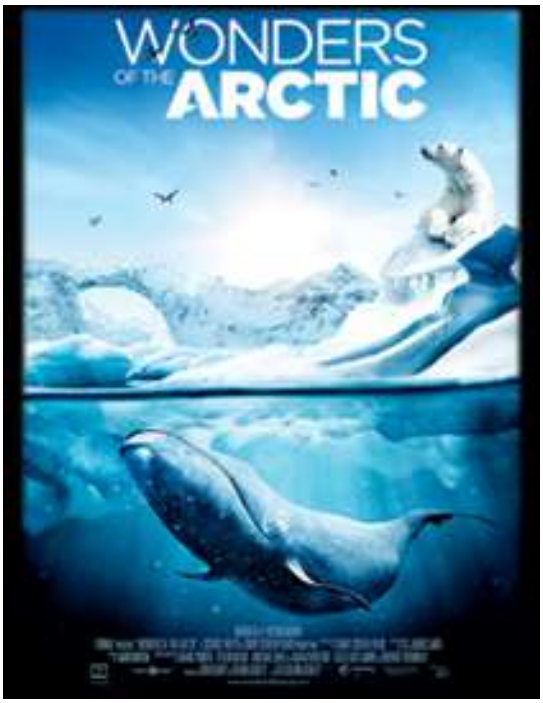
Coming Soon
Wild Music
On view February 6 – July 31, 2016
Whales compose, bullfrogs chorus, songbirds greet the dawn, and people everywhere sing and dance. What do we all have in common? Music is all around us. Explore sound and music in nature and in life through whimsical, hands-on activities.
Learn more
Creatures of Light: Nature's Bioluminescence
On view March 26 – August 14, 2016
Explore the extraordinary organisms that produce light, from the flickering fireflies found in backyards around the world to the alien-like deep-sea fishes and other fantastic creatures that illuminate the perpetually dark depths of the oceans. Learn how, where, and why scientists study this amazing natural phenomenon.
Learn more
The World's Largest Dinosaurs
On view Sept. 17, 2016 – Jan. 2, 2017
What does it mean to be big? Go beyond traditional fossils and explore the greatest, most massive dinosaurs ever discovered as they would have looked hundreds of millions of years ago. Visitors will have a chance to examine life-sized bones, muscles, internal organs, and more to discover the staggering anatomy of some of the biggest creatures that ever lived.

FERNBANK MUSEUM of NATURAL HISTORY

Fernbank Museum of Natural History

(All programs require reservations, including free programs)

Now Showing in the Fernbank IMAX movie theater:



Wonders of the Arctic

Now showing through February 11, 2016*

Enter a glittering world of ice and snow, where polar bears tussle, huskies howl and narwhals dive through turquoise waters. In this wilderness at the top of the world, tiny flowers blossom in the brief but brilliant summer and whales breach in an iceberg-studded ocean. This is a story of survival in one of the most unforgiving environments on earth, an environment dominated by a single element: ice.

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Wild Africa

Showing through April 28, 2016*

Travel from enchanted forests to the boiling edge of the underworld, from celestial ice-capped mountains and lava-spewing volcanoes, to crashing waterfalls and deep fantastical seas. And experience some of the greatest gatherings of wildlife ever captured on film with up-close-and-personal animal encounters and absolutely stunning scenery.

Learn more

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AGS 2016 Meeting Dates

Listed below are the planned meeting dates for 2016. Please mark your calendar and make plans to attend.

2016 Meeting Schedule

January 26	February 23
March 29	April 26
May 31	June 28
August 30	September 27
October 25	November 29

PG Study Group meetings

last Saturday of the month.

January 30
Speaker: Jim Kennedy, PhD, PG
Subject: GEOHYDROLOGY

February 27
March 26
April 30

AGS Committees

AGS Publications: Open

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ATLANTA GEOLOGICAL SOCIETY

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For further details, contact the AGS Treasurer: Lucy Mejia: telephone: 404-438-9584; Lucytaylor360@gmail.com

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