Geological Society of Africa

Newsletter

Volume 10 - Issue 2 & 3
(October, 2020)

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- Joint issues - apologize

Edited by
Tamer Abu-Alam
Editor of the GSAf Newsletter

http://gsafr.org/newsletter/

In the issue

Geological Society of Africa – Newsletter
Volume 10 – Issue 2 & 3
October 2020

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http://gsafr.org

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GSAf MATTERS

Editor apologizes

By Tamer Abu-Alam (GSAf newsletter editor and information officer)

Due to technical issues and other issues accompanied by the situation raised by the coronavirus, we were not able to publish issue 2 and issue 3 according to the plan. Here we come with a joint issue. The future issues should be released according to the time plan.

GSAf MATTERS: Postpone of CAG28 to October 2021

The GSAf council decided, after consulting the organizing committee of the next Colloquium of African Geology (CAG28), to postpone the colloquium to October 2021. The GSAf council hopes that the coronavirus will be over by this time and we will be able to meet physically in Morocco.

GSAf MATTERS: The current council will lead until October 2021

Due to the postponement of the CAG28 to October 2021, the GSAf will not be able to call for a general assembly before that date (i.e., October 2021). Therefore all the members of the GSAf voted with extending the roles of the current council until next October 2021. This comes clearly and aligned with the GSAf constitution.

GSAf MATTERS: New bank account

Due to the ongoing political conflict in Ethiopia where the main bank account of GSAf exists, the GSAf council decided to reactive a Nigerian bank account that was used previously by GSAf during one of the Colloquiums of African Geology. The council encourages all the members to pay their membership fees to the new bank account.

Bank account information:

Correspondent bank:	CITIBANK NEW YORK
SWIFT CODE:	CITIUS33
ROUTING OR ABA NO:	021000089
ACCOUNT NO:	3630321
BIC/Swift:	UNAFNGLA
FOR CREDIT TO:	UNITED BANK FOR AFRICA Plc
FOR FINAL CREDIT TO:	NIGERIAN MINING AND GEOSCIENCES SOCIETY
BENEFICIARY ACCOUNT NUMBER:	3002057016
SORT CODE:	033-192-736

The council stresses that

- The GSAf still owns the Ethiopian bank account.
- The GSAf still has a permanent office at Addis Ababa University
- The honorary treasurer (Prof. Asfawossen Asrat) has full access and controls the Nigerian bank account

GSAf MATTERS: In Memoriam: Professor Maarten J de Wit

AEON- Africa Earth Observatory Network and ESSRI- Earth Stewardship Science Research Institute, Nelson Mandela University, Port Elisabeth, South Africa.

Obituary by:

Wladyslaw Altermann (Vice-President of GSAf, South, University of Johannesburg, South Africa)

and

Olugbenga Okunlola (President of GSAf, University of Ibadan, Nigeria)

Professor Maarten de Wit has suddenly and much too early passed away on the 15th of April 2020. He was only 73 years old. Maarten de Wit, born in Den Haag, Netherlands on the 9th of January 1947, devoted most of his life to geosciences and to his beloved Gondwana continent (even one of his two children was named after Gondwana). This deep devotion included not only geosciences but also a continuous sympathy with the anti-apartheid movement, even long before democracy in South Africa was established. Maarten was equally loved by his family and students for his support of the underprivileged and his engagement in education and social development. He was one of Africa's most distinguished earth scientists whose research interests spanned from geodynamics and early earth processes to sustainability and environmental protection. In this role, he was the leader and initiator of manifold science education and scientific cooperation projects and the recipient of many national and international prices and distinguished fellowships, including:

- Shell Postgraduate Scholarship, UK (1969-1972).
- The Queens University Quest Fellowship, Canada (1983-1984).
- Lunar and Planetary Institute, NASA Fellowship, USA (1985-1986).
- Massachusetts Inst. of Technology, Crosby Professorship, USA (1992-1993).
- Honorary Doctorate of Science, Queens University, Canada (1993).
- McGregor Memorial Lecturer, Zimbabwe (2000).
- Jubilee Medal Awards, Geological Society South Africa (2003, 2004, 2008).
- Honours award, Geological Society South Africa (2006).
- GFZ-Potsdam Professorial Fellowship, Germany (2006-2007).
- Honorary foreign Fellow, Geological Society of America, USA (2007).
- Senior visiting Professorship, IPGP, France (2009).
- Honorary foreign Fellow, Geological Society, London, UK (2011).

- Gold award from S2A3, Southern Africa Association for the Advancement of Science (2013).
- South African Academy of Engineering: Annual Academy Lecture Series (2015-2016).

And for many years he was top-rated (A1) scientist by the National Research Foundation (NRF) in South Africa.

Prof Maarten de Wit has co-authored more than 225 internationally reviewed and widely cited publications and has supervised over 120 MSc, doctoral and post-doctoral research projects. He was member and chairman of several international scientific committees and served as editor for several journals (Precambrian Research, Gondwana Research, Terra Nova, Geobiology, Journal of African Earth Sciences, Episodes, etc.) and on several editorial boards of scientific books.

Next to the above widely recognized merits, Professor Maarten de Wit was also a controversial person with strong views, often not ready to compromise. Some of his ideas, publications and debates, e.g. on the tectonic aspects of the Barberton Greenstone Belt, on environmental protection, fracking or the sampling of protected heritage outcrops found strong opponents and met hot debates. He was not an 'easy person' but rather a character widely respected by his colleagues, even if his ideas and actions were sometimes not acceptable to them.

Maarten was a member and firm lover of the Geological Society of Africa (GSAf). He believed in an effective and beneficial GSAf that can act as a vanguard of geoscience research and development in Africa. His activities across Africa often included aspects of African development. His latest interest was the establishment of an integrated, standardized and certified laboratory for geosciences in Africa. This he discussed with the representatives of GSAf in Russia, in early October 2019. He made initial moves to win the President of Rwanda and other enthusiastic supporters to become major promoters, and to attract multi-lateral interests in developing this laboratory. This initiative was unfortunately slowed down by the COVID 19 pandemic. It is also on record that he was one of the early registrants for the CAG 28 scheduled to take place in Morocco in October 2020 (now shifted to 2021).

We commiserate with his family and the entire geoscience community in Africa and globally. One of the things we can do to keep up his legacy is to see that his dream of a developed and independent democratic continent of Africa does not die.

GSAf MATTERS: New deadlines for the CAG28, Sidi Mohamed Ben Abdellah University of Fez, Morocco (9th – 17th October 2021)

By: Prof. Youssef DRIOUCH; GSAf Vice President for Northern Africa

And organizing committee

Sidi Mohamed Ben Abdellah University of Fez, Morocco

Organizes

The 28th Colloquium of African Geology

CAG28

Theme

"Geosciences : The priceless substrate for African economic and social development"

9-17 October 2021

CAG28 postponement

The Colloquium of African Geology is the most important Geological event in Africa organised every two years under the auspices of the Geological Society of Africa. The next 28th edition will be organised in Fez, Morocco, October 9-17, 2021.

CAG28, initially programmed last October, is deferred to the fall 2021. The program proposed in the second announcement is slightly modified, completed and reedited in the third announcement available:

in English at:

http://www.fsdmfes.ac.ma/CAG28/MDocs/files/CAG%2028%20Fez%20Third%20announcement%20I.pdf

And in French at:

http://www.fsdmfes.ac.ma/CAG28/MDocs/files/CAG%2028%20Fez%20Troisieme%20Circulaire%20Fr.pdf

General Context

The Colloquium of African Geology (CAG) is a major biennial meeting organized under the auspices of the Geological Society of Africa (GSAf), where earth scientists globally have the opportunities to present their research results on topics related to Africa and surroundings areas, on a continental and international scale. It also affords the incubation, generation and execution of initiatives that lead to interaction between the Academia, Industry and the Society.

"GEOSCIENCES: THE PRICELESS SUBSTRATE FOR AFRICAN ECONOMIC AND SOCIAL DEVELOPMENT"

This major event is being held in Morocco in a particular context marked by the opening of Morocco towards its African roots via multilateral cooperation. The economic and demographic growth, the growing importance and integration of sustainable development concepts, in particular exploitation of mineral resources, sustainable management, exploration and exploitation of

mineral and water resources and land-use, urban planning and policies, have led African institutions and countries, to rely on public or private organisms devoted to geosciences.

The 28th Colloquium of African Geology aims to play an outstanding role in this process; by connecting people and bridging links between students, researchers, public/private institutions including the geological surveys, associations and decision-makers from different horizons. It is also important, in post-COVID projections, that GSAf as well as African continental, regional and national organizations, seek alliances in and outside Africa, to make geosciences in the heart of social and economic growth.

PARTICIPANTS, PARTNERS, ASSOCIATED ORGANISATIONS

- ✓ 400 to 600 participants expected,
- ✓ Four Moroccan universities in partnership :
  - Hassan II of Casablanca,
  - Cadi Ayyad of Marrakech,
  - Ibn Zohr of Agadir,
  - Chouaïb Doukkali of El Jadida.
- ✓ Sponsors :
  - Geoscience commissions of the African Union and United Nations (UNFC, AUC, AMDC- AMREC);
  - Office Chérifien des Phosphates (OCP) et Mohamed VI Polytechnic University (UM6P)
  - Office National des Hydrocarbures et des Mines (ONHYM) ;
  - Geological Survey of Morocco
  - Geological Survey of France BRGM (Bureau de Recherches Géologiques et Minières),
  - Hamilton University (USA) and AAPG.
- ✓ Associations (supporters):
  - GSAf/IUGS
  - AAWG ;
  - AMST ;
  - AMG ;
  - ATTARIK foundation ;
  - GASUP ;
  - Africa Géoservices ;
  - AGRFM
- ✓ Partner Journal (special issues)
  - Journal of African Earth Sciences (JEAS);

PRELIMINARY PROGRAM

The meeting will cover all topics of Earth and Planetary sciences. It proposes so far :

- **19 themes**; each theme has one or several sessions (more than 32 sessions so far) and each session has a dedicated keynote lecture.
- **6 plenary talks** (reserved to sponsors).
- 7 workshops.
- **10 fieldtrips** covering all Moroccan geological domains spanning from Precambrian to Quaternary.
- **Rich cultural program**. (Gala dinner, guided visites).

Details of this program are available:

- on the website at: http://www.fsdmfes.ac.ma/CAG28/
- in the second announcement to be downloaded at: http://www.fsdmfes.ac.ma/CAG28/MDocs/files/CAG%2028%20Fez%20Third%20announcement%20I.pdf

CALL FOR ABSTRACTS CALL FOR PAPERS

- **You are invited to submit your abstract for an oral or poster presentation at the Conference Centre of Fez University. Dates, modalities, procedures and guidelines are available:**

Registration form at:
https://docs.google.com/forms/d/e/1FAIpQLScs6PPKikmOxMyQKe851sqVzRY_4wfzE8uC_48d2rxLIDyS-w/viewform:
Abstract submission form at :
https://docs.google.com/forms/d/e/1FAIpQLSfcMTV3WC-LtFztb2hVhmOz6VqZEZfTxj2ziWMTDI5pW335iA/viewform

- **A new call for publication in a special issue of the Journal of African Earth Sciences will be announced shortly.**

The provisional theme is:

"The growth of African Continental Crust through geological times. African Cratons and their margins."

This Special issue title is not restrictive in terms of topics and themes.

CAG28 participants interested in publishing their work in JAES are invited to prepare their manuscripts from now.

Please refer to the JEAS guidelines for authors. https://www.elsevier.com/journals/journal-of-african-earth-sciences/1464-343x/guide-for-authors

SCHEDULE

Abstract submission	March 1st, 2021 to June 20th, 2021
Notification of acceptance	Before July 25, 2021
Final program	September 19th, 2021

FEES

Category	Early bird registration (June 20th)	Late registration
GSAf member and affiliates	2200 MAD (200 €)	2750 MAD (250€)
Accompanying person	1100 MAD (100 €)	1600 MAD (150 €)
Student	1100 MAD (100 €)	1500 MAD (150 €)
Non members	2500 MAD (230 €)	2700 MAD (240 €)
Non academics	3000 MAD (285 €)	3500 MAD (335 €)
Booth per day (9 m^2)	5500 MAD (500 €)	6000 MAD (550 €)
Guided touristic visits (2 days, B&B and lunch)	2200 MAD (200 €)	2500 MAD (230 €)

Workshops and fieldtrip costs are indicated in the related web pages at:.

http://www.fsdmfes.ac.ma/CAG28/Program/CoursesandWorkshops,
http://www.fsdmfes.ac.ma/CAG28/Fieldtrips/Preconference et
http://www.fsdmfes.ac.ma/CAG28/Fieldtrips/Postconference

Registration fees will include:

- Attendance to plenary and conference sessions, poster sessions and booths;

- Transport to and from the conference centre;
- Abstract book, and program ;
- Lunches ;
- Morning and afternoon refreshments during programed breaks.

Sponsoring and related services

The organisation offers **five (5) sponsorship formulas**. Please contact us if you are interested in. Thank you

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Warmest greetings and welcome to Fez

email : cag28fez@gmail.com ; cag28fez@usmba.ac.ma;
Website: http://www.fsdmfes.ac.ma/CAG28
http://www.fsdmfes.ac.ma/CAG28/FR
Social Network: https://www.facebook.com/cag28fez/?modal=admin_todo_tour

GSAf MATTERS: Cooperation between GSAf and Geological Society of South Africa (GSSA)

The Geological Society of South Africa invites the members of GSAf to attend the GSSA online seminars. To facilitate this cooperation between GSAf and GSSA, the editorial office of GSAf made the calendar of the GSSA seminar series available online. The GSAf encourages its members to attend the GSSA seminars.

For the calendar, please visit http://gsafr.org/seminars/#GSSA

GSAf MATTERS: GSAf online seminar series

The GSAf invite all researchers, students from all around the world to attend a newly organized GSAf seminar series. We are aiming by this series to bring researchers interested in Africa geology to explore different topics. The seminar takes place online on the last Friday of each month at 14:00 GMT. The seminars are opened for anyone through the google meeting link: https://meet.google.com/cfd-huum-gup

Our next seminars are:

- The Cadomian (500-600 Ma) Convergent Margin of Gondwana: Is there Evidence for it in North Africa? By Prof. Robert Stern (The University of Texas at Dallas) on 27 November 2020. For more information, please visit http://gsafr.org/nov2020/
- What is a new mineral? Bahariyaite (KMnO4) as a case By Prof. Hassan Helmy (Professor of Mineralogy, Minia University, Egypt) on 11 December 2020. For more information, please visit http://gsafr.org/dec2020/

KNOW AFRICA (COVER STORY)

The first duckbill dinosaur fossil from Africa hints at how dinosaurs once crossed oceans

by Vicky Just, University of Bath

(Modified from https://phys.org/news/2020-11-duckbill-dinosaur-fossil-africa-hints.html)

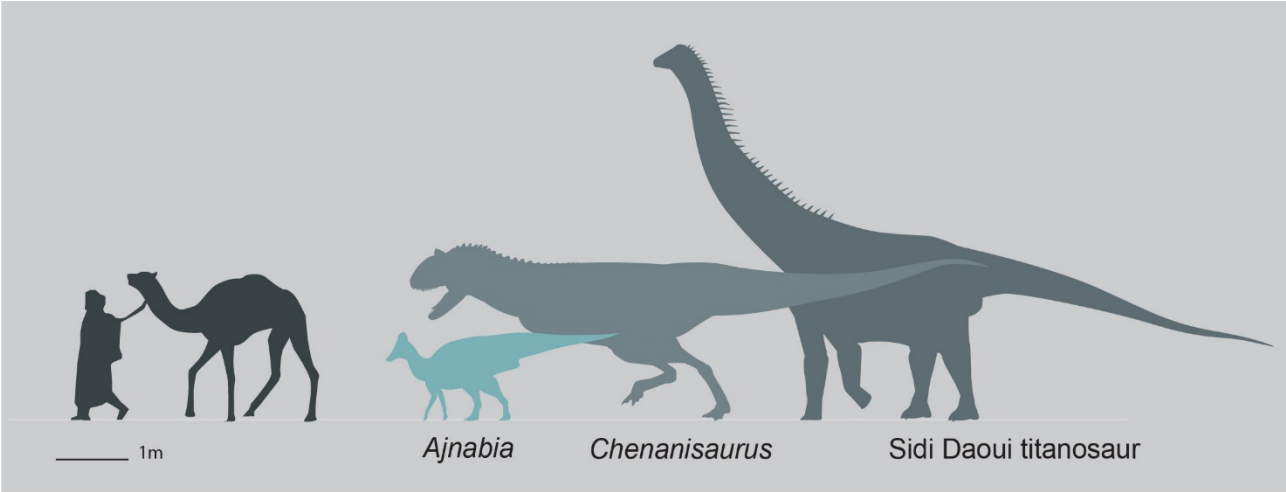
The first fossils of a duckbilled dinosaur have been discovered in Africa, suggesting dinosaurs crossed hundreds of kilometers of open water to get there.

The study, published in Cretaceous Research, reports the new dinosaur, Ajnabia odysseus, from rocks in Morocco dating to the end of the Cretaceous, 66 million years ago. Ajnabia was a member of the duckbill dinosaurs, diverse plant-eating dinosaurs that grew up to 15 meters long. But the new dinosaur was tiny compared to its kin—at just 3 meters long, it was as big as a pony.

Duckbills evolved in North America and eventually spread to South America, Asia, and Europe. Because Africa was an island continent in the Late Cretaceous, isolated by deep seaways, it seemed impossible for duckbills to get there.

The discovery of the new fossil in a mine a few hours from Casablanca was "about the last thing in the world you would expect," said Dr. Nicholas Longrich, of the Milner Centre for Evolution at the University of Bath, who led the study. Dr. Longrich said: "It was completely out of place, like finding a kangaroo in Scotland. Africa was completely isolated by water—so how did they get there?"

Study of Ajnabia's distinctive teeth and jawbones show it belonged to Lambeosaurinae, a subfamily of duckbills with elaborate bony head crests. Lambeosaurs evolved in North America before spreading to Asia and Europe, but have never been found in Africa before.



Silhouette showing the size of Ajnabia compared with humans and the contemporary Maastrichtian dinosaur fauna of Morrocco. Credit: Dr Nick Longrich

Reconstructing duckbill evolution, they found the lambeosaurs evolved in North America, then spread over a land bridge to Asia. From there, they colonised Europe, and finally Africa.

Because Africa was isolated by deep oceans at the time, duckbills must have crossed hundreds of kilometers of open water- rafting on debris, floating, or swimming—to colonise the continent. Duckbills were probably powerful swimmers—they had large tails and powerful legs, and are often found in river deposits and marine rocks, so they may have simply swum the distance.

"Sherlock Holmes said, once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth," said Longrich. "It was impossible to walk to Africa. These dinosaurs evolved long after continental drift split the continents, and we have no evidence of land bridges. The geology tells us Africa was isolated by oceans. If so, the only way to get there is by water."

In reference to this feat, the dinosaur is named "Ajnabia odysseus". Ajnabi being Arabic for "foreigner", and Odysseus referring to the Greek seafarer.

Ocean crossings are rare, improbable events, but have been observed in historic times. In one case, green iguanas traveled between Caribbean islands during a hurricane borne on debris. In another, a tortoise from the Seychelles floated hundreds of kilometers across the Indian Ocean to wash up in Africa.

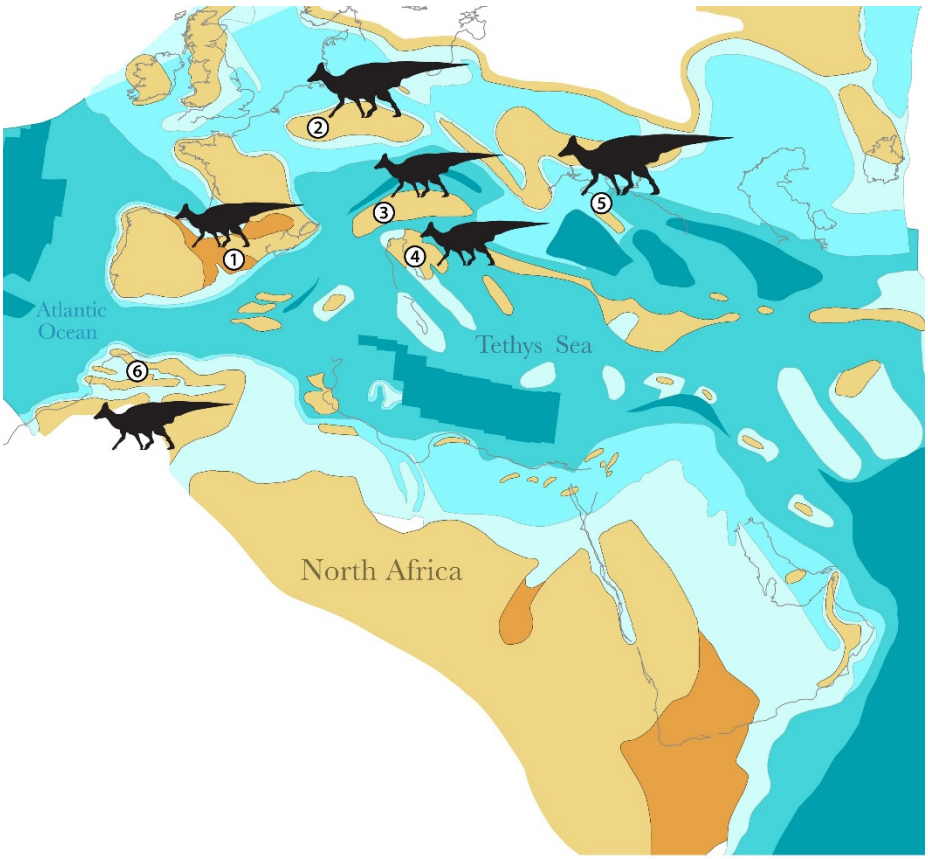
"Over millions of years," said Longrich, "Once-in-a-century events are likely to happen many times. Ocean crossings are needed to explain how lemurs and hippos got to Madagascar, or how monkeys and rodents crossed from Africa to South America."

But the fact that duckbills and other dinosaur groups spread between continents, even with high sea levels, suggests dinosaurs traveled across oceans as well. "As far as I know, we're the first to suggest ocean crossings for dinosaurs," said Longrich.

The international team of scientists was led by the University of Bath with researchers from the University of the Basque Country UVP/EHU (Spain), George Washington University (U.S.) and the Natural History Museum of Sorbonne University (France) / Universite Cadi Ayyad (Morocco).

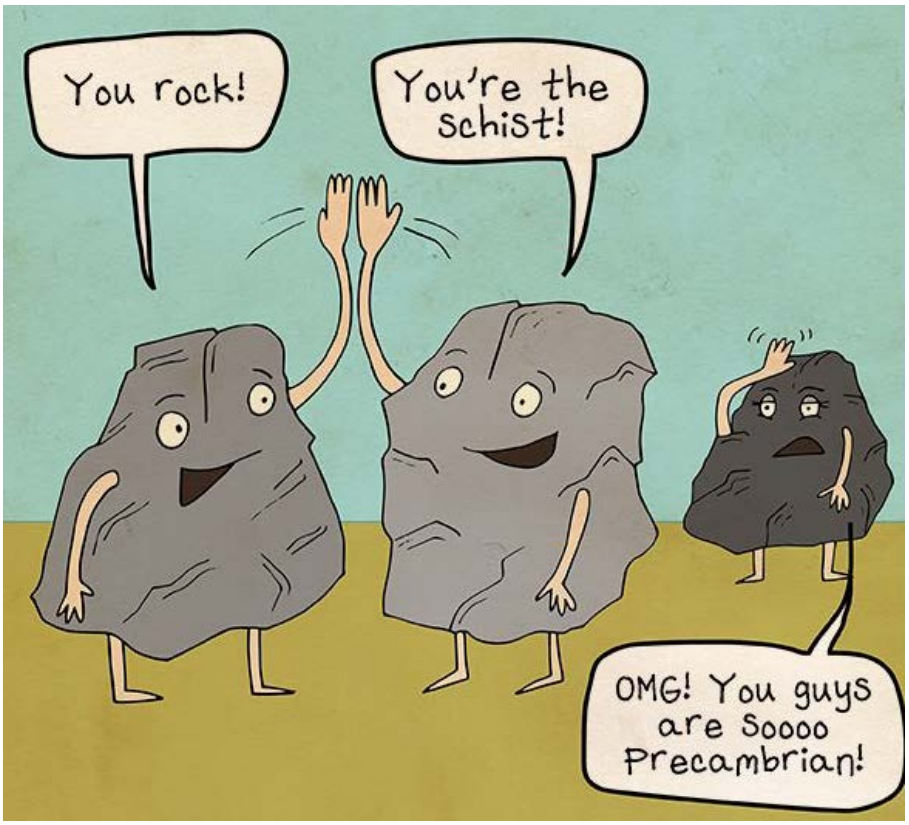
Dr. Nour-Eddine Jalil, from the Natural History Museum of Sorbonne University (France) said: "The succession of improbable events (crossing an ocean by a dinosaur, fossilization of a terrestrial animal in a marine environment) highlights the rarity of our find and therefore its importance.

"Ajnabia shows us that hadrosaurs have set foot on African land, telling us that ocean barriers are not always an insurmountable obstacle."



Map showing the location of duckbill dinosaurs during the Late Cretaceous period. Credit: Dr Nick Longrich

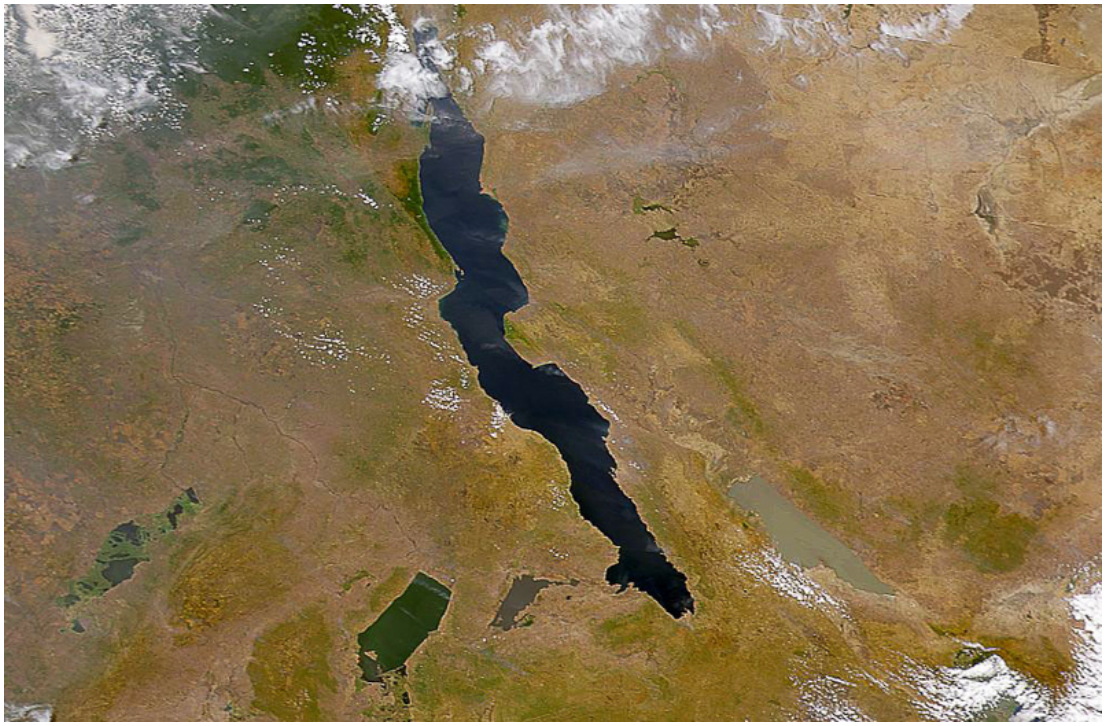
GEOLOGY COMIC



GEOLOGICAL EXPRESSIONS

Rift valley

A rift valley is a linear-shaped lowland between several highlands or mountain ranges created by the action of a geologic rift or fault. A rift valley is formed on a divergent plate boundary, a crustal extension, a spreading apart of the surface, which is subsequently further deepened by the forces of erosion. When the tensional forces were strong enough to cause the plate to split apart, a center block dropped down between the two blocks at its flanks, forming a graben. This drop of the center creates the nearly parallel steeply dipping walls of rift valley when it is new. This feature is the beginning of the rift valley, but as the process continues, the valley widens, until it becomes a large basin, that fills with sediment from the rift walls and the surrounding area. One of the most well known examples of this process is the East African Rift. Rifts can occur at all elevations, from the seafloor to plateaus and mountain ranges. They can occur in continental crust or in oceanic crust. Rift valleys are often associated with a number of adjoining subsidiary or co-extensive valleys, which are typically considered part of the principal rift valley geologically.



modified from https://educalingo.com/en/dic-en/rift-valley

Geological survey

A geological survey is the systematic investigation of the geology beneath a given piece of ground for the purpose of creating a geological map or model. Geological surveying employs techniques from the traditional walk-over survey, studying outcrops and landforms, to intrusive methods, such as hand augering and machine-driven boreholes, to the use of geophysical techniques and remote sensing methods, such as aerial photography and satellite imagery. Such surveys may be undertaken by state, province, or national geological survey organizations to maintain the geological inventory and advance the knowledge of geosciences for the benefit of the nation. A geological survey map typically superimposes the surveyed extent and boundaries of geological units on a topographic map, together with information at points and lines. The maps and reports created by geological survey organizations generally aim for geographic continuity and completeness in establishing the spatial patterns of near-surface rock units. The map may include cross-sections to illustrate the three-dimensional interpretation.

(modified from https://educalingo.com/en/dic-en/geosynclinal)

Contributions from geoscientists

Critical Metals Required for 4th Industrial Revolution such as Rare Earth Metals & Lithium

By: Ndeshihafela Panduleni Ndivayele

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The 4th Industrial Revolution amplifies the need for critical raw materials such as, Rare Earth Metals and Lithium which are required for developing modern technologies like touch screen devices, laptops, phones, aerospace components, lasers, healthcare materials that help treat cancer, fuelling nuclear batteries, television etc. These raw-materials need refinery methods developed through technical evaluations to optimize mining from low to medium-grade deposits for the world, in order to achieve the goal of having 100% renewable and green energy.

To go in-depth, the term "4th Industrial Revolution," is the same as the technological revolution which is blurring the lines between physical, digital and biological spheres. Technological applications such as artificial intelligence, autonomous vehicles or the Internet are becoming ingrained in our day-to-day lives, and even in our bodies. Think of voice-activated virtual assistants, face identification recognition or healthcare sensors, these come from resources we get from mining. Hence, mining plays an essential part of our day to day lives. The 1st Industrial Revolution gave us mechanised means of mining using steam powered lifts, drills and pumps. Moving forward, the 2nd Industrial Revolution brought in electricity and safer lighting methods. Then, the 3rd Industrial Revolution reduced human involvement in the mining process. However, the top 3 challenges faced by the mining industry are as follows:

- health and safety of the workers,
- environmental footprint a mine leaves,
- and lastly, operational efficiency.

So, with the 4th Industrial Revolution, driverless vehicles, drones and advanced sensing technology will eliminate human involvement in risky aspects of mining. Thus, it will significantly reduce concerns regarding health and safety of workers. Furthermore, the 4th Industrial Revolution technologies can increase precision and accuracy of data and makes it more transparent as well as manageable. Real time data can also assist in specific mining use-cases like cutting back down time after a blast, cutting the time of evacuation drills, ensuring safe conditions and mechanical placement, cutting back on machinery downtime and cutting back on energy costs.

According to research, during the last 150 years, the mining business has been astoundingly effective in developing its efficiency. However, from the year 2000, there are indications of a slowdown. A few parts of this are plainly recurrent, and there are expanding worries that a portion of fundamental longer-term components, which have kept efficiency filling in the past are losing their power. Amongst these key components, are physical contributions that the 2nd Industrial Revolution brought to mining, most outstandingly in the form of larger equipment working in larger mines (Humphreys, 2020).

There is a debate in the industry around the appearance of a 4th Industrial Revolution and how it may "upset" the sector and convey another lift to efficiency through the advancement of intelligent mining. The mining business faces the possibility of increasing expenses as grades fall and waste volumes develop.

According to the university professor emeritus, Dr. Tilton contributed massively to the development of mineral economics in recent years and gave a helpful rundown of variables which drive change in Multifactor productivity (MFP).

- Innovation and technological change
- Resource depletion and ore quality
- Government guidelines
- Laborer quality
- Investment lags
- Economies of scale
- Limit usage
- Strikes, mishaps and other impromptu production stoppages
- Different factors, for example management, association and market structure

For work efficiency, one needs to include varieties in the amount of capital and intermediate products utilized for production. In traditional mining, when the mined rare earth metals prices decrease, staff members still have to be paid for economic stability and to keep the labourer quality standards, therefore, few options can be taken:

- Reduction of mine production,
- Target the high grades, and for the small tonnage mined, the business can receive more income
- When the price picks up again, the company can mine and sell the medium and low grades which would have a slightly closer price to that of 2nd option.
- This traditional method of mining has its bad and good impacts; for the world to move closer to the better impacts a great transformation has to occur.

A discussion on mining cannot be completed without mentioning urban mining. In traditional mining, if one processes 1 tonne of gold ore, one can get 5 grams of gold, however when one processes 1 ton of mobile phones, you can get 150 grams of gold, which is not as easy as it seems. In 2018, the world produced 50 million tonnes of electronic waste globally, a figure that's set to soar to a 120 million tonnes by the year 2050 according to Bank Lombard Odier & Co. There are around 25-50 billion internet-connected devices on the planet today amounting to several per person. The amount of raw materials needed to create enough devices to fulfil demand is set to double over the next 4 decades (Ethier, 2019). Extracting these materials through mining has social and environmental risks, and at the other end, waste from electrical and electronic equipment can contain heavy metals like mercury and lead, or flame retardants that are bad for human health and the environment.

So, the total value of materials contained in electronic waste is estimated at $62.5 billion (Ethier, 2019), therefore, traditional mining should innovate, and make room for transformation into the 4th Industrial Revolution by looking into new technology, new business cases that can bring solutions to issues that the planet is having, by recovering electronic waste, and putting it back into service. Companies like, Volkswagen are building a battery recycling plant, to recycle Electric Vehicles (EV) batteries which are made from Lithium. Apple, has the ambitious goal to make all its products from 100% recycled materials. It is very important that everybody, especially mining companies realise that this is a good refining method of technical evaluation for products made out of REE's to be recycled when possible. Its benefits are to recreate a safer environment, and in order to keep greenhouse gas emissions of global climate change below 1.5°C (the world is already at 1.0°C) and to reduce our emissions by 2030.

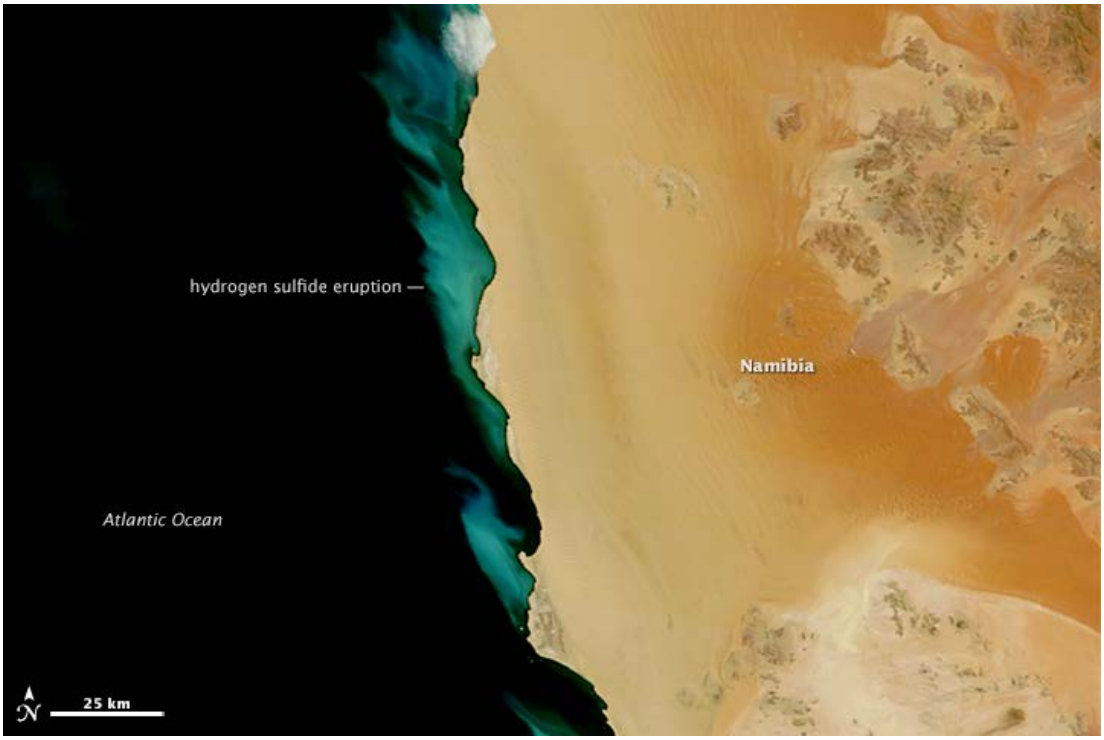
Wonders upon Namibia Marine-geology

By Abner Nghoongoloka (Abner.nghoongoloka@mme.gov.na)

The 40010 km Africa total coastline length would rank 10th longest in the world. It comprises the coastlines of 38 countries including Namibia with an approximately 1572 km long coastline, ranking 61st in the world and 10th in Africa. Namibia coastline hosts the Namib Desert, coastal climate and the Benguela sea current gave rise to complex and sensitive environments of diverse landscapes and ecosystem. Rich biodiversity, energy and mineral resources are characteristic of environments from the continental shelf through the continental slope into the deep ocean. These resources are exploited

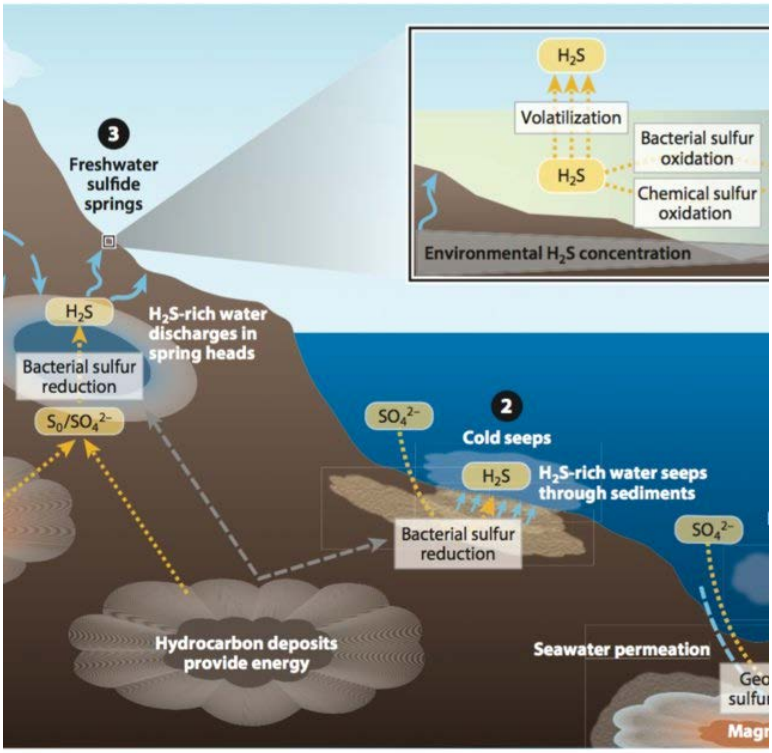
by industries, such as fisheries, mining diamonds, (potentially phosphates) and transport to provide a boost for economic development to the country, including regional and continental growth through employment, royalties and tax revenues, along with the opportunity for capacity development and training.

The human activities together with natural processes have led to some very dynamic coastal environmental wonders such as: a) Triggering of hydrogen sulphur plumes associated with mass mortalities of marine life and severely affect the fisheries industry; b) Court issue of public perception on seabed mining of phosphates inflict irreversible damage to Namibia's lucrative fishing industry; c) Mercury (Hg) concentrations of up to 0.193 ± 0.005 mg/kg in monkfish from area the Namibian shelf still below WHO limit (0.5mg/kg), could it be related to volcanic basement of the Walvis Ridge? Finally, the frequent earthquakes in the area of Kunene region, a region sitting directly on merging zone of continental margin and tectonically active Walvis Ridge.



NASA's (2015) Aqua satellite Naturally occurring plumes of hydrogen sulfide at sea surface
https://earthobservatory.nasa.gov/images/85338/hydrogen-sulfide-eruption-along-the-coast-of-namibia

Therefore, it has become critical to understand the geo-dynamics, geochemistry, sedimentology of the seabed, in order to manage the coastline environments in a sustainable manner. For these reasons, as a geoscientist, I extend my call to national, continental and international collaboration/ cooperation/ and support in conducting marine geology research towards the objectives of collect marine geology data; establish and maintain marine geoscience database; analyse and interpret marine geoscience data, disseminate marine geo-information in support of national technical advice for legislative, regulatory, in order to aid the science-based policy decisions by policymakers for a sustainable blue economy. Similar, the rest of 38 Africa coastline countries would lower cost implication, lessen the required sampling expertise, research vessel, and enables to locally documentation through the access of existing marine geology data.



(1) In deep-sea hydrothermal vents: hot hydrothermal fluids are then ejected from the ocean floor through the vent system. In cold seeps and freshwater sulfide springs H2S is produced through the activity of sulfate-reducing bacteria under anoxic conditions.

(2) In cold seeps, water enriched with methane, hydrocarbons, and sulfate is forced upward through the sediments by pressure gradients.

(3) In freshwater sulfide springs, water of meteoric origin is enriched with H2S in groundwater reservoirs (Tobler, et al., 2016).

https://www.researchgate.net/figure/Overview-of-environmental-sources-and-fate-of-hydrogen-sulfide-H2S-in-some-major_fig2_303675213

Dead horse mackerel and sardines washed up at Long Beach, Namibia

https://www.facebook.com/informantenam/posts/1955080434558907?comment_id=1956421277758156

In summary, Namibia equates to 3.93% of Africa continental coastline geology along the Atlantic Ocean. This marine geology wonders would potentially be shared with neighbouring coastline countries i.e. Angola, South Africa. Thus, it requires a continental (Africa) to international research collaboration/cooperation and sharing research concepts in order to develop expertise and access the historic marine geology samples/data repositories as well as analytic facilities at affordable cost to establish the explanation of the 2020 (Seabed Mining and Fishing can co-exist).

https://www.fishingindustrynewssa.com/2020/07/06/namibia-phosphate-mining-saga- goes-back-to-court/

NEWS

About Africa

Tanzania finalizing permit for its first rare earth mine

(By Fumbuka Ng'wanakilala)

Bloomberg News | November 5, 2020 (modified from https://www.mining.com/web/tanzania-finalizing-permit-for-its-first-rare-earth-mine/?fbclid=IwAR2Dvwnnr9W55NlQKM1pUOyvMOq9C0Dd8JZSSTKFuXJC5FpMrXhjrWCuXVc)

Tanzania is in the final stages of approving a permit for the country's first rare earths mine to Australian company Peak Resources Ltd. as the government seeks a bigger share of revenue from natural resources.

The state is also finalizing a gold-mining license for another Australian company, OreCorp Ltd. at the Nyanzaga project in the northwest of the country, according to Mining Minister Doto Biteko.

The East African nation is Africa's fourth-biggest producer of the precious metal and plans to increase mineral earnings by at least a third during the next three years. It also has

vast deposits of coal, rare-earth metals, iron ore and gemstones.

"The government is in the final stages of awarding a special mining license to PR NG Minerals for it's Ngualla Rare Earth Project," Biteko said in an emailed response to questions. The company is a subsidiary of Australia-listed Peak Resources.

Rare earths are used in components for electric vehicles, smart phones, renewable energy equipment and defense applications.

Joint ventures

Gold mining, now Tanzania's leading foreign-exchange earner, is recovering following a slump after a crackdown on smuggling and a drawn-out dispute between the government and a unit of Barrick Gold Corp. froze exports.

The government intends to increase mining revenue to 701.1 billion shillings in 2023-24, from a projected 526.7 billion shillings in the current fiscal period. Tanzania will "increase revenues from the mining sector by 33%" by boosting production and exports, curbing smuggling and ensuring closer supervision of the industry, Biteko said.

Last month the government received its first cash dividend of $40 million from a 16% stake in a joint venture with Barrick. Tanzania plans to use the Barrick partnership as a model when negotiating joint-ownership deals with all major mining companies, including with AngloGold Ashanti Ltd., in line with mining laws passed in 2017, he said.

Ministry of Minerals Technical Committee on site at Ngualla. Credit: Peak Resources Ltd.

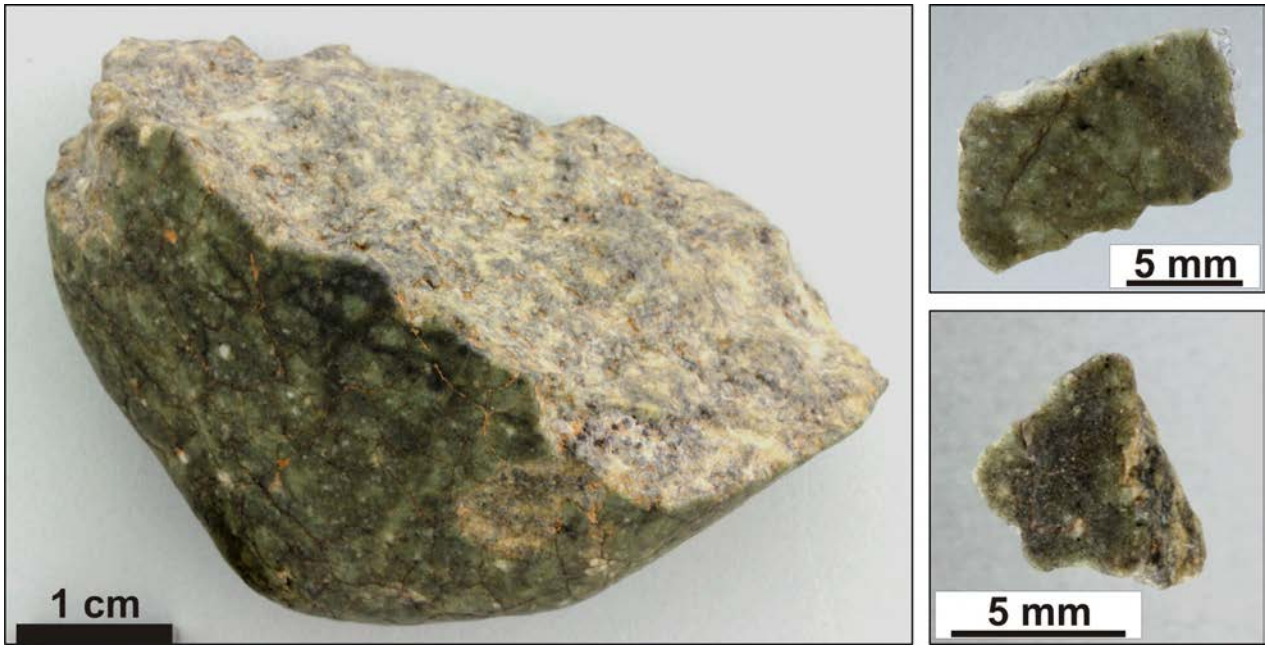
News: About the World

New mineral from the moon could explain what happens in the Earth's mantle

by University of Manchester (modified from phys.org)

A team of European researchers discovered a new high-pressure mineral in a lunar meteorite which is helping to explain what happens to materials within the extreme pressures of the Earth's mantle.

The new mineral donwilhelmsite is the first high-pressure mineral found in meteorites with application for terrestrial sediments dragged deep into the Earth mantle by plate tectonics. Mainly composed of calcium, aluminum, silicon,



and oxygen atoms, donwilhelmsite was discovered within the lunar meteorite Oued Awlitis 001 found in 2014 in the Western Sahara.

The meteorite is compositionally similar to rocks comprising the Earth's continents. Eroded sediments from these continents are transported by wind and rivers to the oceans, and subducted into the Earth's mantle as part of the dense oceanic crust. Once dragged to depths of about 460-700 km, their constituent minerals transform at high pressures and high temperatures existing at those depths into denser mineral phases, including the newly discovered mineral donwilhelmsite. In the terrestrial rock cycle, donwilhelmsite is therefore an important agent for transporting continental crustal sediments through the transition zone of the Earth's mantle (460-700 km depth).

Around 382 kilograms of rocks and soils have been collected by the Apollo and Luna missions, lunar meteorites allow valuable insights into the formation and evolution of the moon. Ejected by impacts onto the lunar surface and subsequently delivered to Earth, some of these meteorites experienced particularly high temperatures and pressures.

Dr. Vera Assis Fernandes of The University of Manchester measured the Argon isotopic composition of lunar rocks to date their complex history including magmatic formation, multiple impact bombardments, and the exposure to cosmic rays on the lunar surface, over billions of years. Dr. Fernandes explains: "During impact bombardment rocks like the lunar meteorite Oued Awlitis 001 experience extreme physical conditions. This often led to shock melting of microscopic areas forming veins or melt pockets within these meteorites.

"These shocked areas are of great relevance as they mirror pressure and temperature regimes similar to those prevailing in the Earth's mantle, and therefore are natural crucibles hosting minerals that are otherwise naturally inaccessible at the Earth's surface."

The new discovery is published in the journal American Mineralogist.

Mariana Klementova applied the cutting edge 3-D electron diffraction (3DED) technique, together with a specially developed software to solve, for the first time, the crystal structure of an extraterrestrial mineral. Dr. Vera Assis Fernandes determined the ages of various events in the complex history of this meteorite, including the formation of the new mineral donwilhlemsite. The new mineral was named in honor of the lunar geologist Don E. Wilhelms, an

American scientist involved in landing site selection and data analyses of the Apollo space missions that brought to Earth the first rock samples from the moon. Part of the meteorite Oued Awlitis 001 is now on display at the Natural History Museum Vienna.

This story originally appeared on https://phys.org/news/2020-11-mineral-moon-earth-mantle.html?fbclid=IwAR3zMEZq-6YamZW1W6kColx-WgRTXE5DsJbLuzUVrOQXnl7CihYby2tdnbI

News: About the World

How US Presidential Elections Are Impacted By Geology

By David Bressan (Nov. 3, 2020)

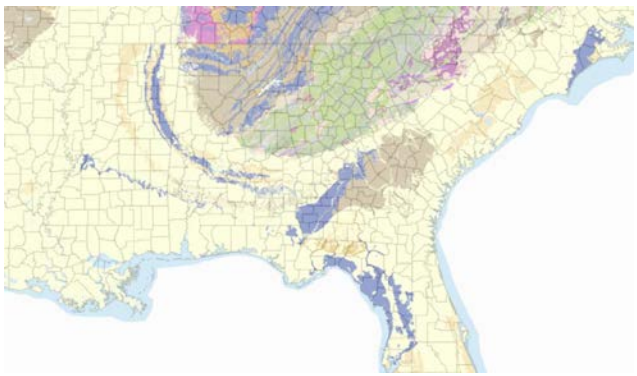
The U.S. as it appeared roughly 100 million years ago.

Ron Blakey/https://deeptimemaps.com/

In the Cretaceous period, some 115 million to 65 million years ago, the U.S. was divided by an inland sea into two landmasses, Laramidia to the west and Appalachia to the east. The ancient sea stretched from the Gulf of Mexico and through the middle of the modern-day countries of the United States and Canada, meeting with the Arctic Ocean to the north. At its largest, it was 2,500 feet (760 m) deep, 600 miles (970 km) wide and over 2,000 miles (3,200 km) long.

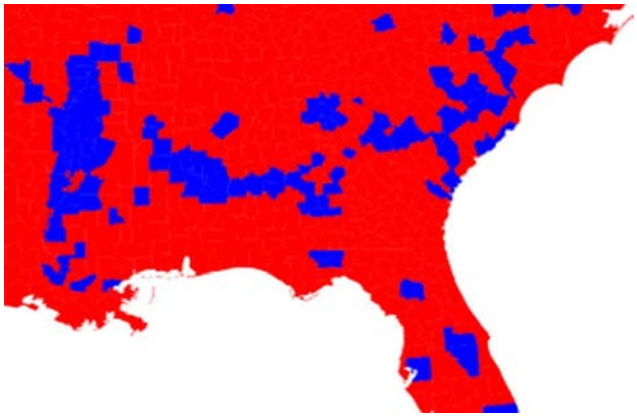
In the south, the seashore of the Cretaceous sea stretched across the modern states of South Carolina, Georgia, Alabama, Mississippi and Arkansas. When the ocean water receded some 60 million years ago, it left behind a layer of fossiliferous sediments forming a large arch still recognizable today on geological maps. Erosion started to dismantle the chalk layers, and water dissolved the nutrient-poor carbonate minerals until only clay minerals and sandy sediments remained, leading to the unusually mineral-rich soils.

Farmers flocked to the Black Belt, named for its rich, dark soils. The fossil seashore would develop into some of the richest farmland in the U.S. With the development of the cotton industry, large plantations were established in this area. To farm the swaths of cotton crop, farmers used black slaves, some of which who would eventually be freed and settle in the region that they were forced to work in, their decedents living in this area to this day. African Americans make up over 50%, in some cases over 85%, of the population in Black Belt counties.



Simplified geological map of the southeastern United States with Cretaceous marine sediments (in blue) forming an arch crossing South Carolina, Georgia, Alabama, Mississippi and Arkansas. USGS

In 2000, 2004, 2012, and especially 2016, when Democratic candidate Hilary Clinton faced off against Republican President Donald Trump in the presidential election, 88 percent of the votes in the black belt went to the Democratic Party. The same region that had once been covered in ocean water, leading to the fertile Black Belt, was almost an exact replica of the district's that had voted for Clinton.



Map of the 2016 presidential election results. The states are colored red or blue to indicate whether a majority of their voters voted for the Republican candidate, Donald Trump, or the Democratic candidate, Hillary Clinton, respectively.

Mark Newman/University of Michigan

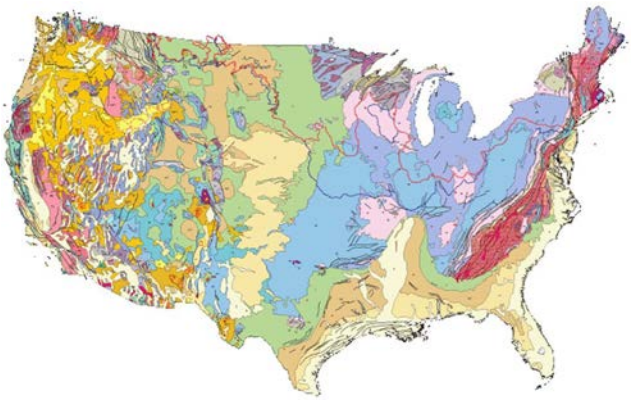
Hillary Clinton led in the polls and won nearly three million more votes than Donald Trump. But because the U.S. uses an electoral college system, where the president is not chosen directly by the voters but by representatives in the electoral college that will cast their ballots for president and vice president, winning the most votes doesn't always win you the election.

The rich coal fields in Ohio, West Virginia, Pennsylvania and Maryland formed as a result of two continents colliding some 300 million years ago. Former peat deposits deposited in the foreland basins of the early Appalachians were buried, compressed, heated, and finally pushed up again, forming now coal seams. The coal fueled the economic growth of cities like Pittsburg, Detroit, Chicago and Cleveland. With the discovery of large coal fields in other parts of the world, especially China, the large industrial centers experienced a steady decline due to growing global competition. Republican candidate Donald Trump promised in 2016 to support the struggling coal industry and to limit imports, likely an important factor explaining the votes he got all over the U.S. northeast.

The Driftless Area is a region west to the Great Lakes in Wisconsin, but also covering parts of Minnesota and Iowa, that escaped glaciation during the last ice-age. Lacking deposits of glacial drift, hence the name, that end to generate weathered and fertile soils, and not smoothed by miles-thick ice-sheets creeping over the land, its topography is both hillier and more deeply dissected by river valleys than surrounding areas. Farming is more difficult here, and the landscape is dotted with farms and small towns, but there are basically no larger cities to be found. The election map shows that most countries in the Driftless Area voted Democrats in 2012, while rural areas across the country voted Republicans. It seems that more liberal politics, combined with financial hardship experienced by the local farmers and accentuated by the poor soils, convinced them to vote for Barack Obama, ensuring his reelection as the 44th President of the United States. However, as the only constant in life is change - another important lesson in geology - the 2016 map shows most of the blue countries replaced by red, reflecting a change in their preferences and their voting behavior.

Map of the 2012 presidential election results. The states are colored red or blue to indicate whether a majority of their voters voted for the Republican candidate, Mitt Romney, or the Democratic candidate, Barack Obama, respectively.

Mark Newman/University of Michigan



Geologic map publication from U.S. Geological Survey. The red line marks the maximal extent of the Laurentide ice sheet some 20,000 years ago. Areas in blue and red are mostly outcrops of ancient rocks forming a rugged terrain.

USGS

This story appeared on https://www.forbes.com/sites/davidbressan/2020/11/03/how-us-presidential-elections-are-impacted-by-geology/?sh=742f5d542b90&fbclid=IwAR2Lxp9U4T3DtXM4zcs6FzH0ChOntGrdy67cqbGynWJfWtheoRCwY-RBcQU

News: About the World

Magma speed record set by Icelandic volcano

The ancient event was the geologic equivalent of a sprinting cheetah—and it may help researchers better understand how to detect future eruptions.

By Robin George Andrews (National Geographic)

Lava sprays during an eruption of the Holuhraun fissure at the Bardarbunga volcano in Iceland. Researchers studying a similar but much more ancient Icelandic event called the Borgahraun eruption have revealed that it set a speed record for magma rising from the base of the crust to the surface.

Photograph by ARCTIC IMAGES, Alamy

Iceland, a land famous for its resplendent waters, glacial scenery, and bubbling hot springs, is not usually top of mind when it comes to breaking speed records. But the chilly island nation in the North Atlantic is also famous for its volcanological prowess, and as new research reveals, it once hosted the fastest magma ascent ever recorded for a basaltic volcano.

Reported in the journal Nature Geoscience, scientists examined the remnants of the 7,000- to 10,500-year-old Borgarhraun eruption in Iceland, and they found that the molten rock there rose 15 miles, from the base of the crust to the surface, in a mere 10 days.

That may not sound particularly speedy, and to be clear, it's not technically the fastest magmatic rise known to science. That accolade belongs to the kimberlites, ancient explosive volcanoes that propelled mantle material to the surface at frankly ridiculous speeds of around 110 miles an hour, carrying diamonds from the depths far closer to the surface.

Still, the ascent is the fastest known for this ubiquitous family of molten rock—making it the magmatic equivalent of a sprinting cheetah. And clocking the speed of Borgarhraun's magma may help with future forecasts of when similar volcanoes today are gearing up to erupt. (Find out why these are the most dangerous U.S. volcanoes.)

"Each volcano has a different story, has a different personality," says Chiara Petrone, an igneous petrologist at London's Natural History Museum who was not involved with the work. But while different soccer players may all behave uniquely during a match, they all follow the same basic rules—and that idea applies to volcanoes, Petrone says. As such, unspooling the history of this one freakish eruption may help scientists better understand others yet to come.

Volcanic time travel

To work out how fast ancient magma moved, scientists study crystals trapped in long-frozen lava. The physical and chemical idiosyncrasies that they feature in their final resting state betray the ways in which they formed. That means experts can effectively see their evolution through time, all the way back to their creation at hellish depths.

That's often easier said than done, though. Magma is a complex mixture of solids, liquids, and gases that move about and often separate, all while experiencing a myriad of changing environmental conditions, says Jenni Barclay, a volcanologist at the University of East Anglia not involved with the work. That means crystals from a single eruption can contain signatures pointing to all kinds of wildly differing stories.

Fortunately for geologists, the Borgarhraun lava flow deposit, found in Iceland's Northern Volcanic Zone, has such a wealth of well-preserved minerals that it clearly told an interesting story, and a team led by Euan Mutch, an igneous petrologist at the University of Cambridge, couldn't resist diving in to find out more.

Mutch and his colleagues took a close look at a mineral named clinopyroxene, which has a composition that is sensitive to pressure. The point at which multiple minerals can exist simultaneously within the original magma also changes with pressure, and as pressure tracks with depth, these properties allowed the team to estimate how far below our feet the minerals were stored. (Find out about a seemingly dormant volcano that unexpectedly has magma simmering underneath.)

These mineralogical barometers indicated that the magma came from just above the boundary between the crust and the mushier mantle, or about 15 miles down. That's only one part of the story, though—the researchers then needed to know how fast the magma rushed up to the surface.

During their magmatic journey, Borgarhraun's viridescent olivine crystals also developed layers of rings around their central cores. The cores and their outer layers feature different chemical makeups, and while the olivines cook in the magma, the cores and layers exchange chemical elements. Petrologists have spent ages melting olivines in laboratories, so they know that the extent of this chemical exchange tracks with how long the crystals were stored in the magma before they erupted.

Mutch and his colleagues used Borgarhraun's olivines to obtain a range of times for the magma's ascent. As expected for a chaotic magma mixture, they varied greatly, from days to several weeks. Considering the magma's properties, while making reasonable assumptions about the volcano's plumbing and the magma's migration, the team suspects that the complex soup clambered up 15 miles' worth of volcanic piping in about 10 days.

Forecasting future murder blobs

Like other flavors of magma, Borgarhraun's molten rock also contained dissolved carbon dioxide. As magma rises, the pressure on it drops, and the gas emerges from the melt as bubbles.

The gas can then separate from the magma, rush up the volcano's rocky throat, and beat the magma to the surface. Alternatively, the gas can get stuck and emerge with the magma during the eruption. In this case, based on the properties and ascent rate of Borgarhraun's magma, the carbon dioxide did make a break for it, but levels only spiked at the surface no more than two days before the eruption.

Scientists today regularly monitor volcanic vents for gas emissions, because they can indicate that magma is beginning to rise and depressurize, perhaps culminating in an eruption. But, had they been able to look for a surge in carbon dioxide prior to that ancient eruption, the Borgarhraun lava would have arrived with little advance warning.

Just like the impressive magma ascent speed, it's possible that this ability to keep hold of carbon dioxide until the last

moment may apply to other volcanoes, perhaps those in Iceland with similar magma types and carbon contents. No one wants an eruption sneaking up on them, so that might sound concerning.

Borgarhraun's behavior won't apply to volcanoes everywhere, though. As Mutch notes, volcanoes have contrasting magma and gas contents, meaning the way they belch their gases will be very different. Some volcanoes continuously unleash carbon dioxide, whereas others are far less gassy overall. (Here's why the volcano that built Bermuda is unlike any other on Earth.)

And sometimes, Barclay explains, carbon dioxide may emerge at the surface because a shallow magma pond is easing off some volcanic indigestion, with no eruption involved. This range of possibilities and uncertainties is one of the many reasons why volcanologists today monitor multiple variables at volcanoes for troubling signs.

A major aim of the type of science in this latest paper is to match up these deduced magmatic properties with modern-day volcano observations. If, for example, likely magma speeds could be paired with seismic signals that indicate when an ascent is underway, it would give volcanologists a clearer timeframe as to when a volcano might unleash its potentially hazardous molten material.

But while this sort of science is making great strides, it has to make plenty of assumptions because there are still plenty of missing data, so matching the magmatic shenanigans of the past to present observations remains a huge challenge.

"It's a shame no one was around 8,000 years ago with a seismometer," Mutch says.

This story appeared on https://www.nationalgeographic.com/science/2019/07/iceland-volcano-set-magma-speed-record-borgarhraun-eruption-forecasting/?cmpid=org%3Dngp%3A%3Amc%3Dcrm-email%3A%3Asrc%3Dngp%3A%3Acmp%3Deditorial%3A%3Aadd%3DCompass_20201031&rid=48DFEF88C6C1EFCAEB4A49A8447A1B69&fbclid=IwAR3dmMV7AcDisNbapm9i5jc61nyY76SrLaIP3otLziJj9nICa-6-yXX8Zgw

News: About the World

When huge masses of salt move underground: lessons from outcrops that go beyond the table salt

Ramon Lopez (Nov. 3, 2020)

Aerial view of the El Gordo Anticlinal (foreground) and La Popa Mountain (background). Credit: Ramon Lopez

There is a place in the NE of Mexico where anyone can learn heaps about the dynamics of the ground beneath our feet while enjoying the wonders of the desert. Geologists call the area 'La Popa Basin. La Popa means "The Bow", a name that comes from the shape of one of the mountains in this area, which resembles the front part of a very large boat. This place is a perfect training field for geologists and engineers who work for

hydrocarbon industry and projects on the capture and storage of greenhouse gases. There are superb exposures of not only salt but, more importantly, of sedimentary rocks where oil, gas and water can be either extracted or stored. In any case, the place is very eye-catching for many people regardless of their personal interests: There is a plethora of cactuses and other amazing desert plant species on an arid landscape, herds of wild horses, a series of mountain ranges encircling the area and … salt, loads of salt. One can walk over 3 km2 of white (CaSO4 ± 2H2O). Remember that 'salt' can appear in many other chemical forms apart from table salt (NaCl). If you go to La Popa, take this advice: wear sun glasses and protect yourself with sunscreen. This salt reflects the sunlight as if you were skiing in the Alps.

So, how did all this salt got there? To answer this question, it is necessary to explain the formation of the salt deposits but also something else that might be surprising: how it moves underground. Massive volumes of salt are common in the underground all around the world; particularly beneath the seafloor next to coastlines but also on the continents. Most of the ancient salt deposits precipitated on ancient sea floors due to changes in temperature, relatively high-evaporation rates of water and other physical and chemical processes. Salt piled up year after year creating deposits up to several hundred of meters thick. When salt precipitation ceased, these deposits got covered over time by mud, sand or sometimes even lava flows. The whole process typically takes several millions of years. Some of these salt deposits can move underground. These movement can be observed in underground salt mines and seismic data shows evidences of salt movement sideward, upward, and even downward! (Figure 1).

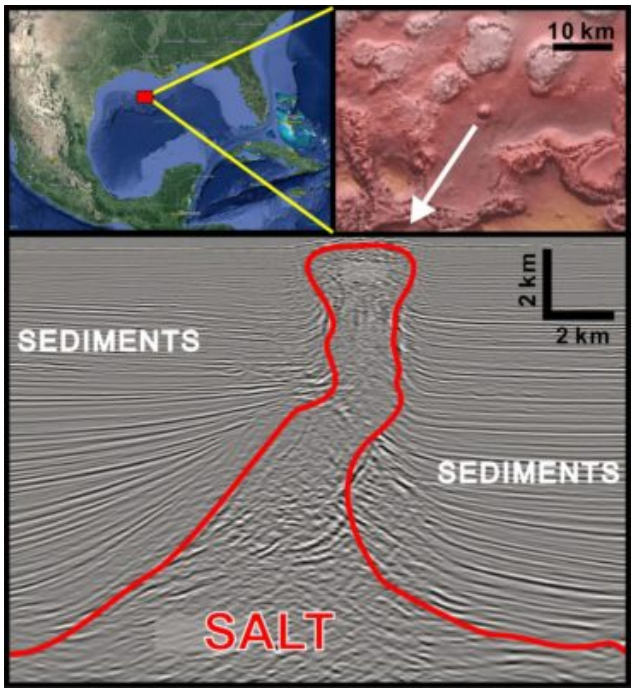


Figure 1. The seismic image at the bottom shows a vertical 2D section of Auger Diapir. This salt diapir has reached the seafloor surface at the north of the Gulf of Mexico, as the BOEM (2020) bathymetry imagery shows. The salt moved upwards creating a bulge or dome (see Google Earth capture at the top right). Seismic image modified from Hearon et al., 2014.

How is this possible? Main controlling factors are the Earth's gravity field, density differences of sediments and rocks, and the movement of our continents. Simply put, salt tends to be less dense than the sediment or the surrounding rock, which cause the salt to flow over long terms. Such flow rates are comparable to the movement of glaciers, where ice also moves very slowly. The role of density in the upward movement of salt is an analogue to oil in water. If one introduces oil with a dropper at the bottom of a glass filled with water, the drop of oil will quickly move to the water surface. A common mistake is to think that is the oil that moves actively upwards. In fact, it is the water that is 'pushing' the drop of oil upwards. This is because water weighs more than oil, so it is moved by the gravity field to a position closer to the Earth centre. This may look rather trivial, but it is probably counterintuitive for most people. If we have a mass of salt surrounded by denser rocks and sediments, the latter will try to get beneath the salt. But as you can imagine, it is not easy for solid rock to flow like water does. Rocks are solid and they cannot move easily and push salt up. This means that salt can only move if either something else encourages those rocks to displace or if space is created for the salt to move. Tectonics is therefore an important process in salt movement, as it is able to displace vast amounts of rock volumes. Both extensional and compressional tectonics can result in the reduction of the thickness of crust and hence a reduction of weight on underlying salt layers. The buoyancy of salt would eventually facilitate the rise of salt (e.g. in pull-apart basins). Tectonic processes also form fractures that behave as conduits for salt to move along. La Popa Basin is unique in that it exposes so clearly masses of salt that moved upwards through the Earth's crust. One of these salt masses, named El Gordo Diapir ('The Fat'), is probably the one that best exposes both its salt deposits and the surrounding sedimentary rocks (Figure 2). Compressive forces related to the opening of the Gulf of Mexico formed folds and fractures and squeezed the salt upwards.

Figure 2. Aerial view of the El Gordo Diapir (encircled in red). Credit: Ramon Lopez

Concurrently the movement of the salt deformed its adjacent sedimentary rocks. All these tectonic features in the form of folds and fractures at wide range of scales can be observed in the El Gordo Diapir area. The very diapir is spatially associated with a thrust anticline that once was part of a submarine fold and thrust belt (Figure 3). This makes it great analogue of petroleum plays related to this type of tectonic setting (e.g. Salinas Basin, Gulf of Mexico). This is one of the few places where we can observe and study the complex interplay between salt movement and tectonics. It is a natural laboratory for the oil and gas and even mining industry, but also for projects that intend to store greenhouse gases or radioactive waste within salt giants. It is an amazing fact that these large salt reservoirs play a vital role in tackling modern energy demands, as well as a tool to fight the climate change.

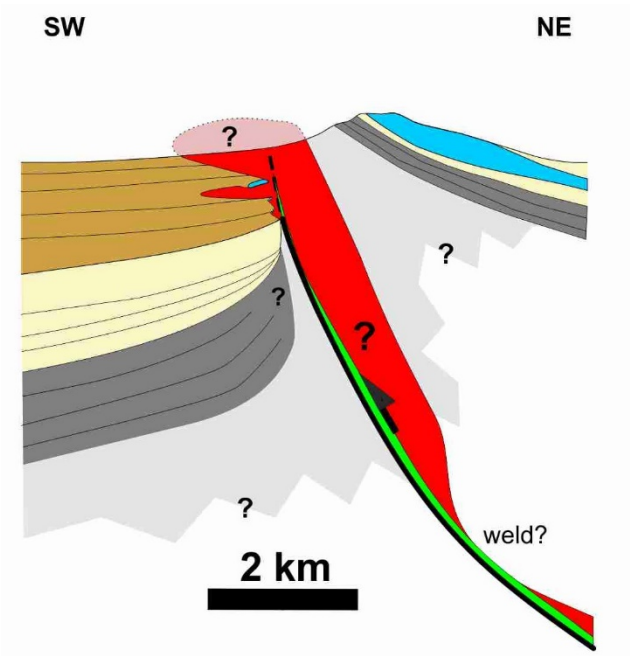


Figure 3. Cross section of the El Gordo Diapir from recent detailed mapping in the area. Salt in red. Credit: Ramon Lopez

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News: About the World

Geologist helps confirm date of earliest land plants on Earth

by Kristin Strommer, University of Oregon (Nov 4, 2020; phys.org)

A new UO study confirms what earth scientists have long suspected: Plants first appeared on land about 460 million years ago, in the middle of a 45-million-year-long geologic period known as the Ordovician.

Authored by geologist Greg Retallack and published in the international journal The Palaeobotanist, the study describes a series of plant impressions in an Ordovician rock deposit from Douglas Dam in Tennessee. While previous studies have revealed fossil evidence of invertebrate animals in the deposit, Retallack's is the first to identify whole fossil plants, including mosses, liverworts and lichens.

Retallack, director of the Condon Fossil Collection at the Museum of Natural and Cultural History, said those whole-plant impressions offer a key support to Ordovician land plant theories.

"Fossil spores liberated from rocks have indicated a likely presence of nonvascular plants like these, and soil analysis and carbon isotope studies have all pointed to the likely presence of land plants during this period, but this is the first line of direct evidence," he said.

If land plants emerged and proliferated 460 million years ago, they may have directly contributed to a decrease in atmospheric carbon dioxide and, in turn, to the global cooling that fueled an explosion of new marine life during the Ordovician and eventually ushered an ice age that occurred about 445 million years ago.

The deposit under study, comprised of rocks formed when most of Earth's land mass was combined into the supercontinent Gondwana, was removed when Douglas Dam was constructed for the Tennessee Valley Authority in 1942. Sections of the deposit have since been preserved at the University of Cincinnati and the Smithsonian Institution, where Retallack conducted parts of the study.

"It's another example of how dusty old museum collections can produce truly extraordinary new finds," he said.

One of the newly identified fossil moss species, Dollyphyton boucotii, has been named for legendary singer Dolly Parton, whose Dollywood theme park is located a few miles away from the original rock deposit.

This story appeared on https://phys.org/news/2020-11-geologist-date-earliest-earth.html?fbclid=IwAR2hlXUW04TPmqNMBBJR9q_DinCUTwdeZVX4wcNgnEqEVL7U5oBaaSkZCeg

News: About the World

7 Billion-Year-Old Stardust Is Oldest Material Found on Earth

Scientists recently identified the oldest material on Earth: stardust that's 7 billion years old, tucked away in a massive, rocky meteorite that struck our planet half a century ago.

Stars have life cycles. They're born when bits of dust and gas floating through space find each other and collapse in on each other and heat up. They burn for millions to billions of years, and then they die. When they die, they pitch the particles that formed in their winds out into space, and those bits of stardust eventually form new stars, along with new planets and moons and meteorites. And in a meteorite that fell fifty years ago in Australia, scientists have now discovered stardust that formed 5 to 7 billion years ago -- the oldest solid material ever found on Earth.

"This is one of the most exciting studies I've worked on," says Philipp Heck, a curator at the Field Museum, associate professor at the University of Chicago, and lead author of a paper describing the findings in the Proceedings of the National Academy of Sciences. "These are the oldest solid materials ever found, and they tell us about how stars formed in our galaxy."

The materials Heck and his colleagues examined are called presolar grains-minerals formed before the Sun was born. "They're solid samples of stars, real stardust," says Heck. These bits of stardust became trapped in meteorites where they remained unchanged for billions of years, making them time capsules of the time before the solar system

But presolar grains are hard to come by. They're rare, found only in about five percent of meteorites that have fallen to Earth, and they're tiny-a hundred of the biggest ones would fit on the period at the end of this sentence.

But the Field Museum has the largest portion of the Murchison meteorite, a treasure trove of presolar grains that fell in Australia in 1969 and that the people of Murchison, Victoria, made available to science. Presolar grains for this study were isolated from the Murchison meteorite for this study about 30 years ago at the University of Chicago.

"It starts with crushing fragments of the meteorite down into a powder ," explains Jennika Greer, a graduate student at the Field Museum and the University of Chicago and co-author of the study. "Once all the pieces are segregated, it's a kind of paste, and it has a pungent characteristic-it smells like rotten peanut butter."

This "rotten-peanut-butter-meteorite paste" was then dissolved with acid, until only the presolar grains remained. "It's like burning down the haystack to find the needle," says Heck.

Once the presolar grains were isolated, the researchers figured out from what types of stars they came and how old they were. "We used exposure age data, which basically measures their exposure to cosmic rays, which are high-energy particles that fly through our galaxy and penetrate

solid matter," explains Heck. "Some of these cosmic rays interact with the matter and form new elements. And the longer they get exposed, the more those elements form.

"I compare this with putting out a bucket in a rainstorm. Assuming the rainfall is constant, the amount of water that accumulates in the bucket tells you how long it was exposed," he adds. By measuring how many of these new cosmic-ray produced elements are present in a presolar grain, we can tell how long it was exposed to cosmic rays, which tells us how old it is.

The researchers learned that some of the presolar grains in their sample were the oldest ever discovered-based on how many cosmic rays they'd soaked up, most of the grains had to be 4.6 to 4.9 billion years old, and some grains were even older than 5.5 billion years. For context, our Sun is 4.6 billion years old, and Earth is 4.5 billion.

But the age of the presolar grains wasn't the end of the discovery. Since presolar grains are formed when a star dies, they can tell us about the history of stars. And 7 billion years ago, there was apparently a bumper crop of new stars forming-a sort of astral baby boom.

"We have more young grains that we expected," says Heck. "Our hypothesis is that the majority of those grains, which are 4.9 to 4.6 billion years old, formed in an episode of enhanced star formation. There was a time before the start of the Solar System when more stars formed than normal."

This finding is ammo in a debate between scientists about whether or not new stars form at a steady rate, or if there are highs and lows in the number of new stars over time. "Some people think that the star formation rate of the galaxy is constant," says Heck. "But thanks to these grains, we now have direct evidence for a period of enhanced star formation in our galaxy seven billion years ago with samples from meteorites. This is one of the key findings of our study."

Heck notes that this isn't the only unexpected thing his team found. As almost a side note to the main research questions, in examining the way that the minerals in the grains interacted with cosmic rays, the researchers also learned that presolar grains often float through space stuck together in large clusters, "like granola," says Heck. "No one thought this was possible at that scale."

Heck and his colleagues look forward to all of these discoveries furthering our knowledge of our galaxy. "With this study, we have directly determined the lifetimes of stardust. We hope this will be picked up and studied so that people can use this as input for models of the whole galactic life cycle," he says.

Heck notes that there are lifetimes' worth of questions left to answer about presolar grains and the early Solar System. "I wish we had more people working on it to learn more about our home galaxy, the Milky Way," he says.

"Once learning about this, how do you want to study anything else?" says Greer. "It's awesome, it's the most interesting thing in the world."

"I always wanted to do astronomy with geological samples I can hold in my hand," says Heck. "It's so exciting to look at the history of our galaxy. Stardust is the oldest material to reach Earth, and from it, we can learn about our parent stars, the origin of the carbon in our bodies, the origin of the oxygen we breathe. With stardust, we can trace that material back to the time before the Sun."

"It's the next best thing to being able to take a sample directly from a star," says Greer.

This study was contributed to by researchers from the Field Museum, University of Chicago, Lawrence Livermore National Laboratory, Washington University, Harvard Medical School, ETH Zurich, and the Australian National University. Funding was provided by NASA, the TAWANI Foundation, the National Science Foundation, the Department of Energy, the Swiss National Science Foundation, the Brazilian National Council for Scientific and Technological Development and the Field Museum's Science and Scholarship Funding Committee.

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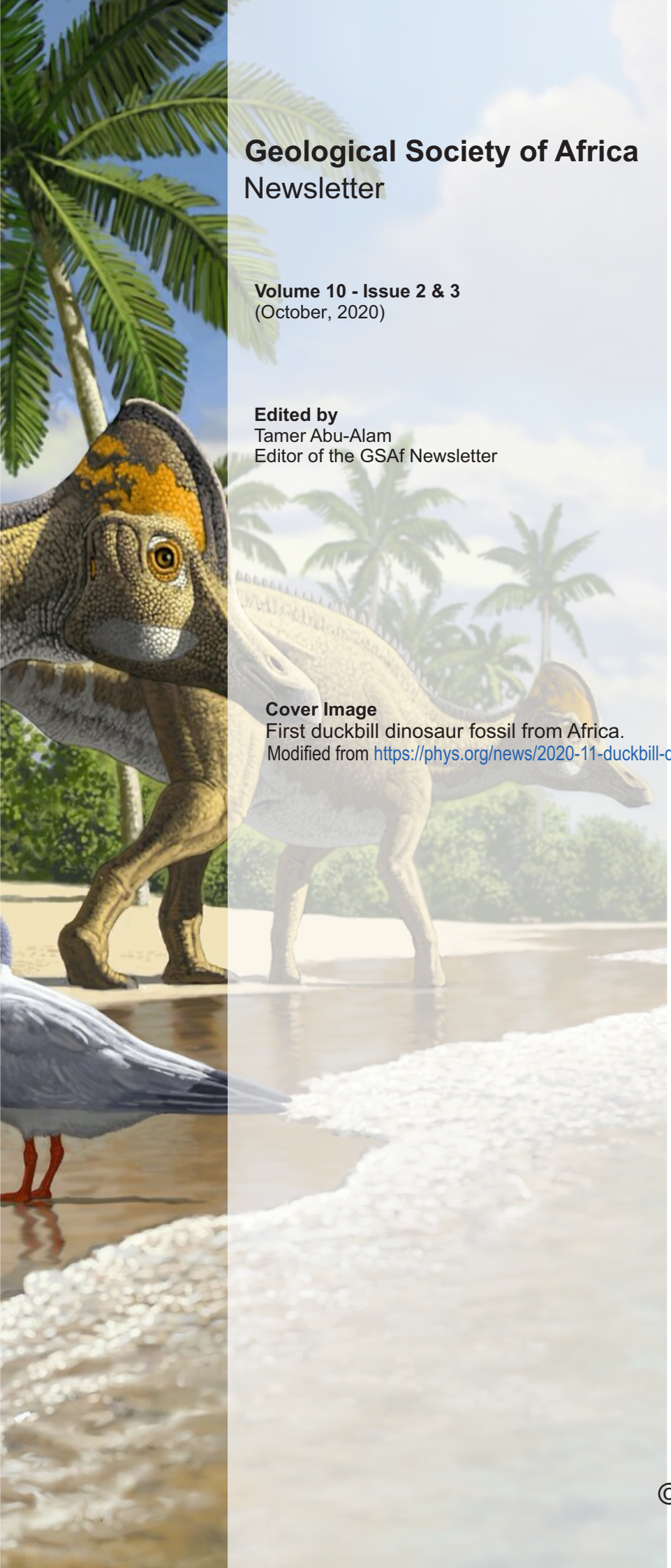

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First duckbill dinosaur fossil from Africa.
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