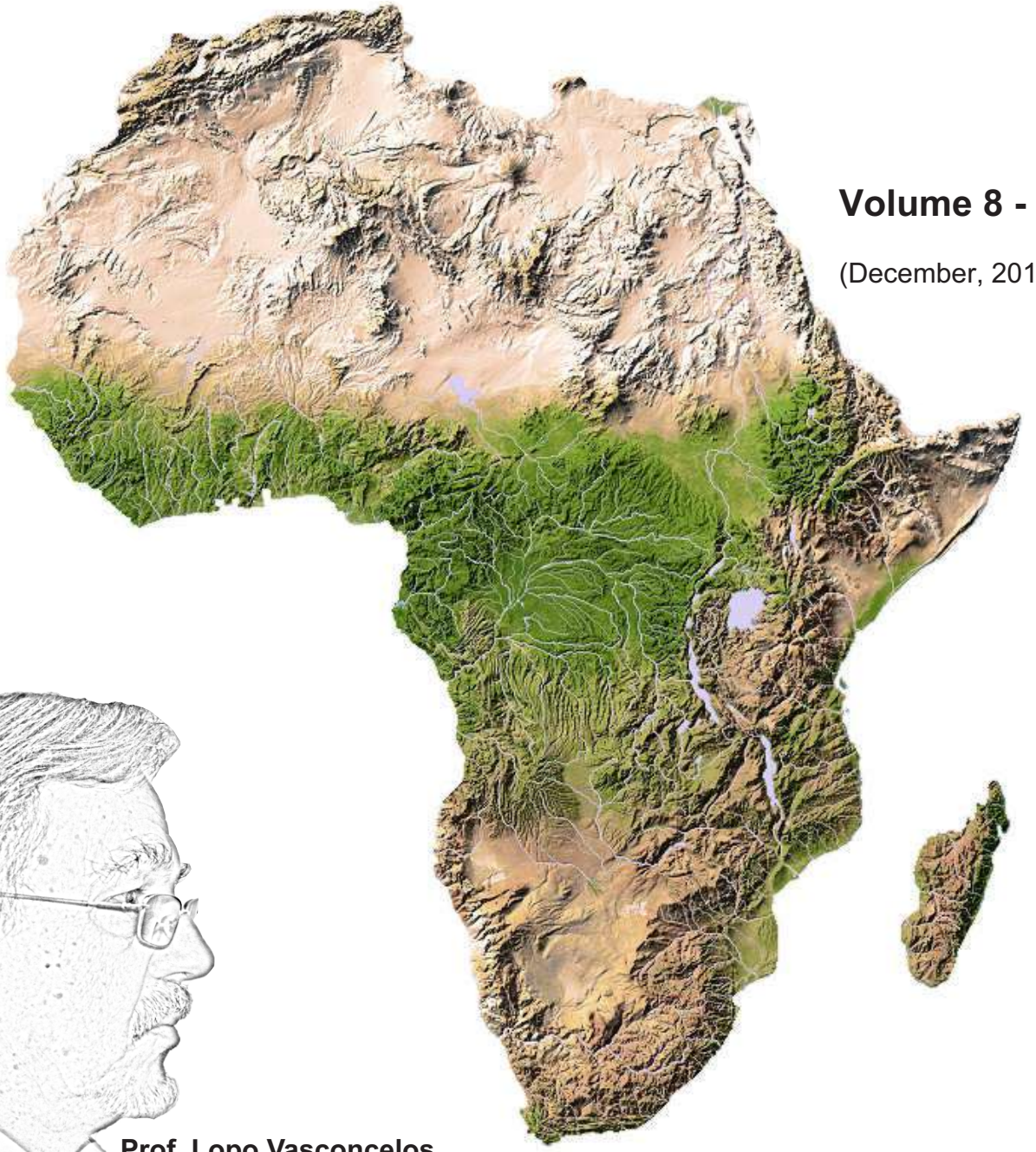
Geological Society of Africa

Newsletter



Volume 8 - Issue 8

(December, 2018)

Prof. Lopo Vasconcelos
Fellow of GSAf

Full story inside
the issue

Edited by
Tamer Abu-Alam
Editor of the GSAf Newsletter

In the issue

Geological Society of Africa – Newsletter
Volume 8 – Issue 8
December 2018

http://gsafr.org
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GSAf MATTERS

Geological Society of Africa signs memorandum of understanding with organisation of Africa Geological Surveys

By Anna Nguno (GSAf-counsellor for Southern Africa)

On the 09th of November 2018, during the 11th Organization of African Geological Surveys' Annual General Meeting, the Geological Society of Africa (GSAf) and the Organization of African Geological Surveys (OAGS) signed a Memorandum of Understanding (MoU) to further strengthen cooperation between the two bodies. With a shared interest in advancing Africa's socio-economic development and natural hazard mitigation, the MoU is hoped to consolidate the long-standing relationship that exists between both organizations and to provide a platform for greater geoscientific and technical collaboration.

The MoU objectives include:

a) Promote the exchange of information on key programs and initiatives;

b) Promote cooperation and consultation on matters of common interest in order to harmonize efforts in the discharge of respective missions and mandates and to further the economic and social development of African member states;

c) Provide for possible joint activities relating to capacity building, joint hosting of conferences and other professional activities;

d) Provide for an appropriate framework which enables the arties to facilitate and coordinate cooperation in the areas of mutual interest;

The President of the Geological Society of Africa (GSAf; Gbenga Okunlola) and the Vice-President of the Organization of African Geological Surveys (OAGS; Dr Rokhaya Samba) signing the MoU in Dakar, Senegal, 9th November 2018.

e) Set up appropriate channels for communication and exchange of information in order to ensure close consultations and exchange of views between the parties.

The 11th Organization of African Geological Surveys' Annual General Meeting (AGM) was held in Dakar, Senegal, during the second week of November 2018. The AGM was official opened by Dr Aissatou Sophie Gladima, the Minister of Mines and Geology (Senegal). Fifty-five (55) participants attended the meeting. The majority were OAGS members, with several attendees from OAGS's partners / stakeholders such as AUC, EuroGeoSurveys, UNDP, and representatives of the AU-AMREC-PARC (African Union - African Minerals and Energy Resources Classification and Management System - Pan African Resource Code) Working Group workshop.

Some of the participants of the 11th Organization of African Geological Surveys' Annual General Meeting (AGM), held in Dakar, Senegal, 9th November 2018.

GSAf MATTERS: ANESI program

Following the GSAf council meeting with Prof. Felix Toteu (outgoing Earth Science specialist UNESCO) and Moctar Doucoure (Board chaimanANESI program) the council has decided to host the ANESI program. Discussion about the transformation stage and how the GSAf will operate this program are on going. The council will keep the society informed with the progress.

GSAf MATTERS: ID number for GSAf members

Prof. Prosper M. Nude (Assistant Secretary General/Membership Secretary of GSAf) has proposed to assign an ID number for each member of the GSAf. The proposal was approved by the council. Dr. Abu-Alam (information officer,Newsletter editor and webmaster) is working now to create an automatic system that deals with our member database and assign these IDs. As a result, all members should be aware and expect to receive a couple of emails within a few weeks informing them of their ID and confirmation of member details.

GSAf MATTERS: 7th African Rift Geothermal Conference

Reported to GSAf by: Titus Habiyakare, Donatile Nkunzi and Jean-Claude Ngaruye

The African Rift Geothermal Programme was initiated during the Preparatory stage of the African Rift Geothermal Project for development of geothermal resources in the African Rift .It was done by the African Rift Geothermal Development Facility (ARGeo) Steering Committee meeting held in Nairobi in 2004. Biennial conference was decided to be held in ARGeo member countries on rotational basis with the purpose to exchange the information and experiences on exploration, development and utilisation of geothermal resources in East African Rift Region. The 7th conference (ARGeo-C7) held in Kigali, Rwanda at Kigali Convention Centre from 31st October to 2nd November 2018. The conference was attended by the 12 African country members which are Burundi, Comoros, Djibouti, DRC, Eritrea, Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia.

Kigali Convention Centre

The ARGeo-C7 was subdivided into 3 main parts: Pre-conference short courses, Main conference and field trip in Gisenyi geothermal area.

Pre-Conference Short Courses, Monday 29 October - Tuesday 30 October 2018 were carried out under the auspices of IPCU-AGCE. The training was delivered in 4 parallel classes:

- Course 1: Management and Financing for Geothermal Project Development
- Course 2: Low-temperature Geothermal Systems and Direct Use Applications
- Course 3: Geothermal Reservoir Engineering and Modeling
- Course 4: Geothermal Resource Decision Modules 1 and 2: Volcanic and Deep Circulation

The 2 days training course were fruitful as the attendees learned more from the experts. Certificates of participation were awarded to every attendee with respect to the attended course.

Team of one of these courses

The main conference was officially opened by Hon. Minister of Infrastructure of the Republic of Rwanda, Amb. Claver GATETE. Panel discussions were held on different topics such as global geothermal towards sustainable development and financing geothermal project. In addition, presentations from various participants working in geothermal field were given in parallel sessions.

The attendees learned a lot from different countries 'experiences and shared ideas on the use of geothermal energy and updated statistics on geothermal and other electricity generating sources. The countries were urged to use sustainable, renewable and clean energy.

GSAf MATTERS: Thematic cycle on Regional Geology of Morocco

Moroccan Association of Earth Sciences has reported its recent activities to the GSAf as:

The AMST, in association with ONHYM (National Office of Hydrocarbons and Mines), MEMDD (Ministry of Energy, Mines and Sustainable Development), OCP (Cherifian Office of Phosphates), MANAGEM (Private Mining Company) organised the first session of the thematic cycle on regional Geology of Morocco at Hotel Golden Tulip Farah (Rabat) on 5-6th October, 2018. CMT, MAYA-MAROC, SACEM, SSM and INFODIGIT companies were also associated to the event as sponsors.

From left to right: Dr CISSE; Mme BENKHADRA, Mr RABBAH, Mr MOUTTAQI, Mr SOUARE. Award Ceremony

Geology of Archaen and Pan-African orogenic belts and their related ore deposits were the main topics presented and discussed during 10 conferences animated by eminent speakers. The meeting saw the participation of more than 70 geologists from both academia and industry, coming from different Moroccan, African and European universities as well as from companies acting in mineral explorations and industries.

Participants to the AMST Meeting. October 5th, 2018

The opening ceremony was presided by Mr Aziz RABBAH Minister of MEMDD, Mme Amina BENKHADRA, CEO of ONHYM and Honorary President of AMST, Mr Abdellah MOUTTAQI, GS of ONHYM and AMST President. Essaid JOURANI, Geology Director and Lhou Maacha and Mohamed ZOUHAIR Heads of exploration represented OCP and MANAGEM, respectively. The Geological Survey of Morocco was represented by Mr Ahmed BENLAKHDIM & Ahmed MANAR.
Two eminent geology guests were awarded during a tribute ceremony: Dr Ahmed Tidiane SOUARE, former Prime Minister of the Republic of Guinea and Dr Aliou CISSE, currently head of the Geological Survey of Guinea.

At the end of the meeting A. MOUTTAQI animated a rounded table debate. Many recommendations have been adopted and will be sent to AMST members and to geology acting institutions for consideration.
Youssef DRIOUCH, GSAf VP for Northern Africa informed the assistance that the General Assembly of GSAf held at Aveiro (Portugal) on July 2018, assigned the CAG 28 organisation to Morocco at Fez University.
The next two sessions will be dedicated to the Variscan belt (June, 2019) and then to the Alpine belt (October, 2019).

GSAf MATTERS: Semaine des activités minière de l'Afrique de l'Ouest

Dr.Adama Sangare (GSAf Councillor for Western Africa) has reported to the GSAf that the SAMAO "Semaine des activités minière de l'Afrique de l'Ouest" was held in Burkina-Faso between 27 Sept and 29 Sept. More information about the event is from the following link: https://samao.org/

GSAf MATTERS: 2ème édition du Colloque International sur la géologie de la chaîne des Maghrébides et des régions voisines (CIGCM2018)

Second edition of the International Colloquium on Maghrebides and neighbouring areas geology. Setif, Algeria 4th-6th December 2018.

Reported by Moulley Charaf Chabou (charaf.chabou@hotmail.com; cigcm2016@gmail.com)

L'Université Ferhat Abbas de Sétif (Algérie) en collaboration avec le Centre de recherche en Astronomie, Astrophysique et Géophysique d'Alger (CRAAG) a organisé du 4 au 6 décembre 2018 la 2ème édition du Colloque International sur la géologie de la chaîne des Maghrébides et des régions voisines (CIGCM2018). Ce colloque a réuni plus de 200 participants venus de 6 pays : Algérie, Maroc, Tunisie, Egypte, France et république Tchèque. Les thématique abordées étaient très variées et incluaient aussi bien la géologie fondamentale (géologie structurale, tectonique, magmatisme, sismicité) qu'appliquée (Ressources minérales, ressources hydriques, géologie de l'Ingénieur, Génie Minier). Le programme du colloque comprenait 28 conférences plénières, 95 communications orales et 122 posters. Une excursion a été organisée le 6 décembre vers le site d'Ain Boucherit (région de Sétif) où des pierres taillées et des ossements fossiles portant des traces de boucherie ont été découvertes dans une couche datée de 2.4 millions d'années. Il s'agit du plus ancien site actuellement connu en Afrique du Nord et le deuxième plus ancien au monde où une activité humaine a été mise en évidence.

La GSAf était représentée par Youssef DRIOUCH, Vice-Président pour l'Afrique du Nord.

Photo de groupe du CIGCM2018

Photo de groupe prise sur le site d'Ain Boucherit lors de l'excursion organisée le 6 décembre 2018 en marge du CIGCM2018.

GSAf MATTERS: Special Publication of the Journal of African Earth Sciences

Proposed Special Publication of the Journal of African Earth Sciences

Title "**Earth Sciences for society: case studies from Africa and beyond**"

Guest editors: Ezzoura Errami, Zakaria Hammimi, Nasser Ennih, Bassem S. Nabawy, José Brilha

We would like to invite you to contribute to the Journal of African Earth Sciences Special Publication that we are working on as an outcome of the First International Congress on Geosciences (ICG1) hosted by the Faculty of Sciences, Chouaïb Doukkali University, El Jadida (Morocco), 22-24 March, 2018. The ICG1 is a joint organization of the 9th AAWG Conference (CAAWG9), the 2nd ArabGU International Conference (AIC2 and the 3rd International Conference on Geoparks in Africa and Middle-East (ICGAME3).

The special issue entitled “Earth Sciences for Society: case studies from Africa and beyond” is proposed to include high quality papers covering numerous Earth Sciences disciplines of regional interest concerns with Africa and beyond, e.g. geoheritage, Geoparks, Geohazards, Water resources, Remote Sensing Technologies, Environmental Geosciences, Engineering Geology, structural geology, Mineral Resources, Petroleum geology, Geochronology, Volcanology, Paleontology, Biostratigraphy, Paleo-anthropology, Sedimentology, Stratigraphy, Geomorphology, Geobotany, Quaternary Geology, and Geophysics.

We would like to inform that the special publication is open to all the participants of the ICG1, however all those who are interested in publishing in this special volume are welcome.

All papers should include a paragraph on how their research could contribute to human and sustainable development at the local, regional of international level.

For information concerning the journal and its guidelines, please consult the website of the Journal African Earth Sciences: https://www.journals.elsevier.com/journal-of-african-earth-sciences

The following agenda has been set up:

- First submission date: October, 2018.
- The date by which all papers should be submitted to the Guest Editors for review and the submission site will be closed: the process will done parallel with the submission as we have already received some papers. However, the submission of papers will close on 31st December 2018.
- The date by which manuscripts should be fully reviewed and final decisions made: June 30th, 2019.
- The date the Virtual Special Issue is expected to be published: September 2019.

Please note that the Elsevier Editorial System is ready for article submission.

Instructions for submission:

- The submission website for this journal is located at: https://ees.elsevier.com/aes/default.asp
- You should select VSI: Geosciences & Society when you reach the “Article Type” step in the submission process.

LETTERS TO THE EDITOR

The GSAf newsletter receives letters from members or non-members of the society which highlight important issues or scientific ideas. The letters should be short and to the point. The letters will be registered on the GSAf's website and subjected to a discussion among the society. Approved letters will be posted in the following newsletter.

Use tamerabualam@yahoo.com to send your letters.

The current registered letter is: "One More Geological Clue Still Pending; "The Obsidian of the Land of Punt" by Mahmoud A. Emam.

To follow the discussion around this letter, please follow the following link: http://gsafr.org/letter1/

WELCOME TO FEZ, MOROCCO (CAG28)

CAG28 – Fez, Morocco - 2020

Preparation is going - Moroccan Geology

By Prof. Youssef Driouch
Vice President of GSAf for
Northern Africa
youssef.driouch@usmba.ac.ma
ydriouch@gmail.com

Introduction: Nearly all the witnesses of African crust evolution from the Archean to present times are well exposed in Morocco recording the main related orogenic cycles:

- Reguibet shield has well exposed Archaen and Paleoproterozoïc terranes. Panafrican units outcrop in Ouled Dlim area, west of Reguibat shield.
- From Paleoproterozoic to Neoproterozoic terranes and their greenstone belts are famous in Anti-Atlas structural domain with their Phanerozoïc cover.
- The Variscan orogeny can be easily studied (Palaeozoic terranes are slightly affected by alpine orogenic cycle) in Eastern and Western Mesetas.
- The Atlas system provide a well exposed Mesozoic to Cenozoic sedimentary series deformed during the Alpine orogenic cycle and representing a part of the break-up of Pangea in Africa. The Rif belt which is a part of Gibraltar orogenic arc is the more recent orogen in Africa.

Morocco is also one of the richest countries in meteorites falls.

Because of this "amazing" and diversified geology and its very relevant educational and pedagogical interest, we have planned to give fields trips an important place in CAG28 organisation. Here we give you a preliminary idea on the Moroccan geology. We will provide regularly in our communication platforms details on each proposed fieldtrip.

Edited guide books: The Moroccan Geological Survey has edited nine volumes of geological and mining guide books. Many authors of these guides are implicated in CAG 28 preparation and organisation. A variety of geological excursions will be proposed:

Preconference field trips

- Middle Atlas and Haute Moulouya Valley (2 days). The targeted regions and terranes are:

- Middle Atlas aborted rift from Triassic to Cenozoic.

- The Mio-Plio- Quaternary volcanic province of Middle Atlas.

- Ahouli Mibladen Paleozoic inlier and its mineralised Triassic-Jurassic cover.
- Rif Belt at its contact with Miocene Saïss basin (separating Rif from the Middle Atlas) and related hydrothermal activities (1 day);

Post conference field trips

- Rif Belt. Mediterranean Alpine Belt: A transect from Fez, to Beni Bousera (3 days, from Fez).
- Moroccan Variscan Belt and its Meso-cenozoic undeformed cover (4 days, From Fès to Marrakech):

- Central, Rehamna and Jebilet massifs and related ore deposits of El Hammam; Aouam, Kettara and Guemmassa.
- Meso-cenozoic undeformed cover of Paleozoïc formations comprising Cretaceous-Eocene phosphate basins with visit of OCP sites and UM6P (1 day)

- High Atlas and Anti-Atlas (from Marrakesh and Ouarzazate, 4 days) comprising the following topics:

- Central and Western High Atlas geodynamics.
- Volcanic successions, Dyke and Sill Swarms of the Central Atlantic Magmatic Province (CAMP) of High Atlas and Anti-Atlas,
- Main Anti-Atlas inliers. Evolution of Northwestern WAC orogenic belt from Paleoproterozoïc to Neoproterozoic terranes with special emphasis to Mesoproterozoic and Paleoproterozoic Dyke and Sill Swarms of the Anti-Atlas.
- Visit of world class ore deposits of Bou Azzer and Imiter.

- Reguibat Schield, Ouled Dlim units (Northern Mauritanides) and their Meso-Cenozoic cover (3 days from Dakhla to Awserd and Tichla).

- Visit to Mgoun Geopark.

Field trips can also concern some other African geological units as Hoggar, Mauritanides, and Tunisian Atlas. Contacts and preparation are in progress.

During these visits, delegates will have the opportunity to experience Moroccan cultures both Arabic and Amazigh with their historical references, traditions, folk arts, handicrafts, the famous Moroccan cuisine, places of tourist interest, wildlife and much more.

The Moroccan Geological Survey has edited nine volumes of geological and mining guide books. Many authors of these guides are implicated in CAG 28 preparation and organisation.

KNOW AFRICA (COVER STORY)

Topographic map of Africa

A digital elevation model (DEM) is a 3D CG representation of a terrain's surface. In most cases the term digital surface model represents the earth's surface and includes all objects on it. DEM is representing height information without any further definition about the surface[1]. Mappers may prepare digital elevation models in a number of ways, but they frequently use remote sensing rather than direct survey data. One powerful technique for generating digital elevation models is interferometric synthetic aperture radar where two passes of a radar satellite (such as RADARSAT-1 or TerraSAR-X or Cosmo SkyMed), or a single pass if the satellite is equipped with two antennas (like the SRTM instrumentation), collect sufficient data to generate a digital elevation map tens of kilometers on a side with a resolution of around ten meters[2].

The cover of this issue is a DEM of Africa shows the topography of the continent.

Modified from: https://www.baroud.fr/cartes-topo-garmin-afrique/24-carte-topo-map-southern-africa.html

1- Peckham, Robert Joseph; Jordan, Gyozo (Eds.) (2007): Development and Applications in a Policy Support Environment Series: Lecture Notes in Geoinformation and Cartography. Heidelberg

2- "WorldDEM(TM): Airbus Defence and Space". www.intelligence-airbusds.com

OPINION

Is An African Space Agency Viable?

by Timiebi Aganaba-Jeanty

The African Union (AU) Heads of State and Government during their Twenty-Sixth Ordinary Session on 31 January 2016 in Addis Ababa adopted the African Space Policy (ASP) and Strategy as the first of the concrete steps to realize an African Outer Space Programme, as one of the flagship programmes of the AU Agenda 2063. Could this mean that an African Space Agency could become viable?

The African Space Policy As A precursor To An African Space Agency

In August 2010, the African Union (AU) Ministers of Communication and Information Technology called for the African Union Commission to conduct a feasibility study for the establishment of an African space agency called AfriSpace.

Through funding from the European Union, a European consortium undertook the feasibility study, highlighting the current situation of the use of space applications in Africa and made recommendations and created a road-map for the establishment of the Agency.

However, the case for an AfriSpace had been made as early as 1979 by Martin Rothblatt who proposed that AfriSpace should be formed to "coordinate and direct the continent's quest for pre-eminence in space technology".

The driver was to leapfrog development in communications and solar power development. In recent times, the need to establish a regionally coordinated program has been articulated by some African academics, and space related organizations. The apparent reasoning behind recent calls for an African Space Agency is in part the fact that the continent already has the following space related regional activities institutions:

- African Leadership Conference, a regional space organization - Regional African Satellite Communications Organisation (RASCOM) and
- a regional multilateral space project - African Resource Management Satellite Constellation (ARMS-C), which has now been formalized.

Following earlier discussions within the African Union (AU) on a proposed African Space Agency, the AU's 2009-2012 strategy affirmed Gottschalk's view that "through the launch of [an] African Union Space Agency, Africa will be able to negotiate better offers for satellite construction, space launches and technology transfer; and share data, scarce facilities and infrastructure much more than individual small countries can do on their own."

The initial AU's draft third strategic plan for 2014-2017 builds on this by further proposing the development of an African Space Policy and development of a constitutive convention by 2015 to establish an African Space Agency. However further drafts stated that the 2015 goal was to develop "space ...policy, programmes and strategic pan-African institutions and networks.

Alongside the AU Ministers of Communication and Information Technologies, AU interest in African regional space endeavours has been expressed through two other ministerial conferences in 2012; namely, by the Ministers of Science and Technology, and Ministers of Meteorology. All sought to investigate the feasibility of an African regional space programme.

While the Ministers of Meteorology established a task force to "explore the feasibility of developing and establishing an African Meteorology Space Programme leading to the launch and operation of an African Meteorological Satellite" its findings are not yet known. On the other hand, at a meeting in Khartoum, Sudan in September 2012, the Ministers of Science and Technology recommended, in the Khartoum Declaration, that the AU Commission "develop a space policy for the Continent in collaboration with relevant stakeholders; taking into account remote sensing applications and satellite imagery processing."

Following the Declaration, the AU Commission endorsed the establishment of a Working Group on Space Science tasked to develop a draft African Space Policy and Strategy. Comprised of members of the African Leadership Conference and national space agencies, a draft policy was completed in October 2013 and was presented for adoption at several AU summits following several meetings of the working group, most recently at the AU Summit in 2016.

The policy principles are focused the following factors:

1. Addressing user needs – harnessing the potential of space science and technology in addressing Africa's socio-economic opportunities and challenges.
2. Accessing space services – strengthening space mission technology on the continent in order to

ensure optimal access to space-derived data, information services and products.
3. Developing the regional and international market – developing a sustainable and vibrant indigenous space industry that promotes and responds to the needs of the African continent.
4. Adopting good governance and management – adopting good corporate governance and best practices for the coordinated management of continental space activities.
5. Coordinating the African space arena – maximising the benefit of current and planned space activities, and avoiding or minimising duplication of resources and efforts.
6. Promoting international cooperation – promoting an African-led space agenda through mutually beneficial partnerships.

The Proposed Indicators to Track effectiveness of the policy are stated in the supporting African Space Strategy and include:

- Number of communities of practice
- Returns on investment
- Number of services and products using African capacities • Number of publications
- Number of patents
- Number of industrial designs • Number of space related-research centers
- Number of graduates in space related fields • Number of space related experts employed in space related professions
- A formal corporate governance structure established.
- Achievement of strategic goals
- A regulatory framework that is supportive of space activities
- Number of contributions in multilateral fora critical for the peaceful uses of outer space
- Coordination mechanism instituted by AU member states
- Number of orbital slots obtained for Africa
- Number of early warning systems on the continent
- Number of space missions
- Number of space receiving/transmitting/processing facilities
- Number of networks created and percentage of coverage Number of collaborative programs,
- Number of public-private partnerships • Number of intra-Africa institutional partnerships • Number of international partnerships
- Level of long-term funding secured from the continent • Financial mechanism developed.

Next Steps

The adoption of the ASP and development of a strategy although well received by those who understand the benefits of an African Space Programme has no significance in itself unless steps are taken to implement it.

The AU therefore request the development of an implementation architecture for the ASP and Strategy, taking into account requirements of different sectors and end-user groups; as well as a Governance Framework that covers the relevant legal requirements and protocols for an operational African Outer-Space Programme.

A policy can be implemented without a new international structure being developed but as both Sudanese and Egyptian officials have indicated interest in hosting an African Space Agency to coordinate the regional response to the space policy, here are some broadly based considerations for a future international space organization in Africa.

- The Policy and the Agency need to address real needs otherwise there will be no buy in from the public. When the needs have been identified the focus of the organization must be on creating programs to meet the needs, e.g. could the agency serve as a central procurement entity for African countries needing earth observation data? General strategies to be employed in the formation of the organization including focus on facilitative activities, focus on enabling activities, and full engagement in operational activities.
- Structural activities: In determining the nature of the organization constitutional conditions arise, including consideration of powers and duties of the body, decision making powers, the need for the organization to maintain stable relationship with the States which compose it and the myriad of other international organisations that will influence and be influenced by the presence of the new entity.
- Important political questions: How well and effectively will the organization be able to use the power conferred on it, will the organization be able to engage and retain the support and cooperation of members, and consider the competitive demands and challenges as members seek to determine what their equitable share of benefits are.

This story originally appeared on https://www.iafrikan.com/2016/02/10/does-an-african-space-policy-make-an-african-space-agency-viable/?fbclid=IwAR2PQhUKBhfF43DGaBGTU93Fm6pvUIDSD7ZMXuSMgjNiVMp8TF7DWSgKhEk

GEOLOGY COMIC

From: https://blog.geolsoc.org.uk/2014/12/07/door-7-sticks-and-stones/

GEOLOGICAL EXPRESSIONS

Plate tectonics: is a theory in geology which explains the process and dynamics of tectonic plate movement. The theory assumes that the lithosphere of the earth is divided into a small number of plates which float on and travel independently over the mantle and much of the earth's seismic activity occurs at the boundaries of these plates (modified from https://www.merriam-webster.com/dictionary).

Subduction: is an action or process in plate tectonics of the edge of one plate descending below the edge of another (modified from https://www.merriam-webster.com/dictionary).

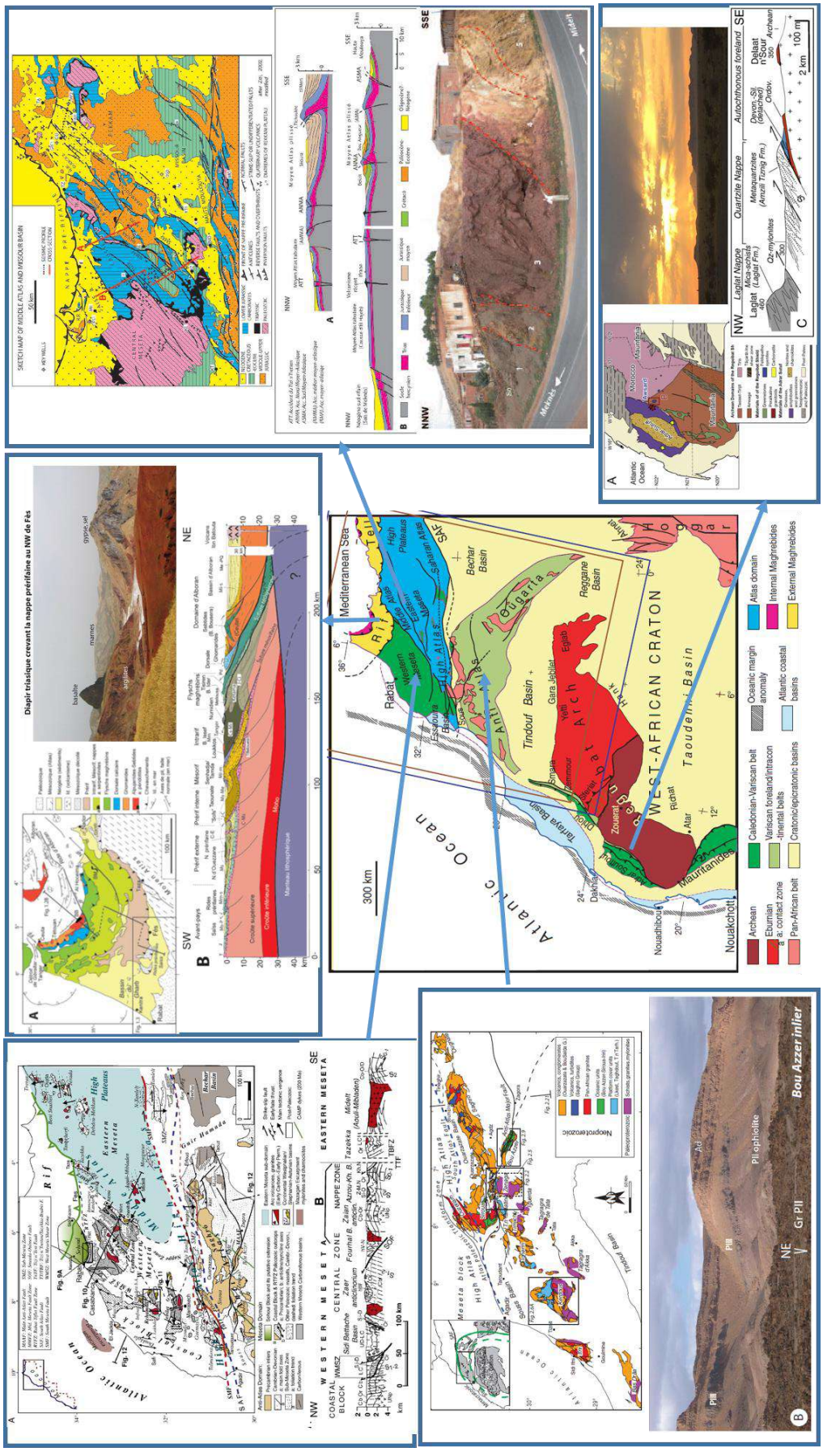
What is the difference between a ROCK and a STONE. "Stones are the missiles we use when our football team has won or lost a game, while a rock is the huge one that we can't use as a missile (a contribution from Prof. Beneah Daniel Odhiambo, GSAf Vice President for Eastern Africa).

A GEOLOGICAL FEATURE

Grand-Canyon, USA

Unfortunately, we did not receive any feedback from young African researchers on the Geology of the Grand-Canyon, USA that was posted on our pervious newsletter. However we post it here again, but this time we open the competition among all scientists and students from any continent. The best description of the Grand-Canyon geology will be published next newsletter with a photo of the author. Deadline for receiving the descriptions is 1 Feb 2019. (tamerabualam@yahoo.com).

WHERE CAN I READ MORE ABOUT MOROCCAN GEOLOGY



Moroccan main structural domains (sources are: A. MICHARD et al., Continental Evolution: The Geology of Morocco. Lecture Notes 1 in Earth Sciences 116, c_ Springer-Verlag Berlin Heidelberg 2008. A. MICHARD, O. SADDIQI, A. CHALOUAN, E. RJIMATI & A. MOUTTAQI (Eds). Nouveaux guides géologiques et miniers du Maroc. New geological and mining guidebooks of Morocco. NEW GEOLOGICAL AND MINING GUIDEBOOKS OF MOROCCO. Éditions du service géologique du Maroc. Le Maroc, paradis des géologues. Revue Géologues. Société Géologique de France. Numéro 194. Septembre 2017. Maroc mémoire de la Terre. Éd. du Muséum national d'histoire naturelle (France) and personnal documents and photos)

AN AFRICAN SCIENTIST

African Scientists can do great if they have the right working environment. In this series, we will put the spotlight on who found the right environment either in Africa or outside Africa.

Our African scientists of the current issue is a GSAf fellow

Prof. Lopo Vasconcelos was born in Lourenço Marques, colonial name of present Maputo, Mozambique, on the 8th March, 1953.

He completed all his studies in Mozambique, having graduated in Geology in December 1975 at the then University of Lourenço Marques, currently Eduardo Mondlane University, at the age of 22, being the first Mozambican geologist graduated after National Independence (25th June 1975).

Due to the massive exodus of Portuguese qualified personnel, including teaching and technical staff of the University, he was called to occupy the position of Dean of the then Faculty of Geology in May 1975, at the age of 23, until August 1980, when he was "released" to start thinking about his academic development. From 1981-1983, he took a professional internship at the State Secretariat of Coal and Hydrocarbons, participating with the Brazilian company CPRM-RS in the fieldwork for prospecting of the Coal Basin of Mucanha-Vúzi, Tete Province, on the northern bank of Cahora Bassa Lake. This field work was also used to start collecting samples and data for his PhD on a sandwich regime with the then Bergakademie Freiberg of the former German Democratic Republic, which he visited twice for 12 months in 1983-1984 and 1985-1986. Due to the fact that in between the region became war zone, he could no longer make field work so he had to cancel his PhD program.

Later, from 1990-1995, we was at the Porto University, Portugal, where he completed his PhD with the thesis entitled ***Contribution to the knowledge of coals from the Moatize Coal Basin, Tete Province, Republic of Mozambique***.

After his return from Portugal, he occupied the position of Head of Geology Department from 1996 to 2000 and, in that position, was coordinator of the Capacity Building Project between Utrecht University (The Netherlands) and the Department of Geology of Eduardo Mondlane University, which led to the training of several colleagues to MSc and PhD levels, as well as professional training of some technical staff With this project some labs were also equiped.

His teaching activities started when he was still a university student. He taught French classes at night courses for workers, and Geology to private school night shift students. At the university, he was also a monitor of the subjects of General Geology for the Degree in Biology, and Applied Geology for the Degree in Civil Engineering. Also participated in the campaign for adult literacy organized by the Academic Association of Mozambique (university student association).

In the first years after independence, and due to the abovementioned exodus of Portuguese staff, he was responsible for a series of disciplines for the courses of Geology and Mining and Civil Engineerings. Throughout his teaching career, he also taught Geology to the courses of Geography, Physics and Agronomy of his University, and for Geography of the then Higher Pedagogical Institute, not to mention the various classes of the propaedeutic course created in 1977 for workers, and in 1978 for students, when the Government closed the last two classes of the secondary education and put them under the responsibility of Eduardo Mondlane University.

In the scope of his professional activities he participated in the process of elaboration and revision of the syllabus of the degree in Geology, produced didactic texts for the students and the Guide of the Student of the Department of Geology. He also supervised several undergraduate theses, and co-supervised Master's Dissertations, and PhD Theses inside and outside EMU. At the request of the then Secretary of State for Technical and Vocational Education of the Ministry of Education, he also prepared the syllabuses for the technical courses of the Technical Institute of Geology and Mining to be then created in the Province of Tete.

In the area of research, Prof. Dr. Lopo Vasconcelos has developed several research projects, especially in his area of his expertise, the Coal Geology area, and has regularly published the results of his research in specialized scientific journals, as well as in national and international conferences.

He presented more than 50 papers at national and international scientific events, published more than 30 scientific papers, and gave talks in conferences and some foreign universities. He has been several times invited for reviewer of scientific papers, Editor and / or Co-Editor of Books of Abstracts and Summaries of Scientific Events, is a co-author of two book chapters.

He was a member of Organizing and Scientific Committees of National and International Congresses and Conferences such as the Workshop on Tertiary Sector Geoscience Education in Southern Africa (2000), 54th Annual Meeting of the International Committee for Coal and Organic Petrology (2002), the 7th Geochemical Congress of the Portuguese Speaking Countries (2003), the 21st Colloquium on African Geology-CAG21 (2006), the MMEC 2008 – Mozambique Mining & Energy Conference (2008), the 1st National Congress of Geology (2012), and the 2nd National Congress of Geology & 12th Geochemical Congress of the Portuguese Speaking Countries (2014).

He was invited to participate in various working committees of the Eduardo Mondlane University (with special relevance to its Commission for the Strategic Plan) and other State agencies, having integrated teams to design the respective Strategic Plan proposals, such as the Ministry of Science and Technology and Higher Education (Strategic Plan for Higher Education), and the Mozambican Parliament. He was also member of the University Council (1998-2002).

He is co-founder and 1st chair of the AGMM (Geological Mining Association of Mozambique – 2003-2010), and is member of several scientific and professional organizations, as GSAf (Geological Society of Africa, having been councilor – 1999-2003, vice-president – 2004-2013, and Newsletter editor – 2011-2018), ICCP (International Committee for Coal and Organic Petrology, having been vice-president – 2003-2011), IAGETH (International Association for Geoethics, having been vice-president – 2013-2018), GSSA (Geological Society of South Africa), TSOP (The Society of Organic Petrology), APG (Portuguese Association of Geologists) and GIRAF (Geoscience information in Africa).

In November of 2015, he presented the public exams for the promotion to Full Professor in Geology by Eduardo Mondlane University. He presented a research project entitled "***Characterization and possible use of coal ash used in brick kilns in the Moatize District, Province of Tete",*** and given a lecture on ***"Peats – a forgotten resource in Mozambique***".

2015.11.05. Public examinations for Full Professor

Along the more than 40 years of his career, he received some praises and acknowledgments for his work, namely:

- During CoGeo01, in 2012, he was honored by the AGMM at the opening session of the event, "for contributing to the teaching of Geology in Mozambique". Prize received from the hands of His Excellency the President of the Republic of Mozambique;
- At the closing session of the 3rd YES Congress (Young Earth Scientists) in August 2014, Dar es Salaam, Tanzania, was publicly honored by the YES organization as a Mentor and Network Advisor YES for unconditional support for YES initiative in Africa. Prize received from the Vice President of Tanzania.
- Awarded the 1st Degree Award of Excellence in Teaching, during the Academic Gala of the Eduardo Mondlane University, on September 19, 2014.
- During CAG27 in Aveiro, Portugal, July 2018, he received a recognition plaque for the work he had developed for GSAf and was awarded the GSAf Fellowship.

During CAG27 in Aveiro, Portugal, July 2018 – recognition plaque from GSAf. From left: Prof. Gbenga Okunlola (President of GSAf), Prof. Lopo Vasconcelos, Prof. Aberra Mogessie (Past president)

A great story of another African scientist who found the right working environment in Africa is waiting for us next issue.

AFRICAN GEOPARK AND GEOHERITAGE

M'GOUN UNESCO GLOBAL GEOPARK – Morocco

The M'Goun UNESCO Global Geopark is located some 100 km from Marrakech and 330 km from Casablanca, in the middle of the chain of the central High Atlas. Its territory covers an area of medium to high mountains. The climate of the Atlas is Mediterranean with Atlantic influences. M'Goun UNESCO Global Geopark consists of two zones, one with high rainfall, of 600 to 900 mm per year and with temperatures between 35°C and 3°C and another characterized by lower rainfall of 400 to 700 mm per year, temperatures between 30°C and 0°C. The snowfall is common from November to May at altitudes above 1,500 m.

The geological history of the territory of the M'Goun UNESCO Global Geopark fits into the geological evolution of the central High Atlas dating back to the Triassic period, 250 million years ago, while the main stages took place during the Jurassic period, about 180 million years ago. The UNESCO Global Geopark includes geological structures in a NE-SW intra-continental chain resulting from a structural reversal of a Jurassic basin tied to the collision of the African and European plates. It includes famous and spectacular footprints of sauropod and theropod dinosaurs and many deposits of bones. The territory contains numerous minerals: Copper, zinc, barite, iron, basalt, limestone and dolomitic Triassic red clays. The M'Goun UNESCO Global Geopark consists of a large number of geosites and geological sites showing several large tectonic structures of the Atlas Mountains that sculpt the landscape.

The Regional Education Academy and the Sultan Moulay Slimane University of Beni Mellal joined the Board of the UNESCO Global Geopark in order to have all the facilities to conduct effective programs. Similarly, the Association of Teachers of Life and Earth Sciences, very active in the territory and the Regional Direction of Water and Forests have always served on the Board of the UNESCO Global Geopark and lead interesting environmental educational activities. The M'Goun UNESCO Global Geopark fits into the area of geo-biodiversity - development. The various components of the UNESCO Global Geopark are elements of attraction and development of responsible mountain tourism at large and geo-ecotourism in particular. The georoutes and the geotopes allow visitors to visit the entire territory and to visit for longer period of time, which will only be of benefit to local people.

Modified from: http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/list-of-unesco-global-geoparks/morocco/mgoun/

NEWS

About Africa

Geologists Find Out How 2.6 Billion Years Old Rocks Were Formed at the Limpopo Complex

geologyin.com, (July 2018)

Cratons (from the Greek "power" or "might") are the areas of the oldest continental crust on Earth, and are preserved only in only a few places around the world. According to scientists, the Kaapvaal Craton in the South Africa and the Pilbara Craton in Australia (the most ancient of these structures) were the parts of Vaalbara, an Archean supercontinent.

The transformation of the lower parts of the cratons under the influence of heat emitted by the Earth's mantle may lead to the formation of rocks called granulites that frame cratons like belts. However, the processes that cause granulites to move upward from the lower part of the crust to the surface along the craton borders are still largely debatable. The oldest granulite belts were formed in the Archean (3 Ga years ago), which is only several hundred million years younger than the life on Earth.

The youngest granulites are about 0.5 billion years old. One ancient (2.7 Ga) granulite belt is situated at the Kaapvaal Craton at the borders of South Africa, Zimbabwe, and Botswana, not far from the famous Limpopo River. The Limpopo Complex is considered as a natural laboratory for study of relations between the oldest tectonic structures in the continental crust and therefore is of great interest for geologists.

"For the first time, we have strong reasons to assume that granite magmas in the Neo-Archean granulite complex of Limpopo (South Africa) have been formed in the course of tectonic interaction of this complex with the rocks of the Kaapvaal Craton as the complex was rising from the lower part of the continental crust," says Oleg Safonov.

Granulite is a metamorphic rock. It means that it forms in the course of transformation of other rocks under the influence of high temperatures. In the case of granulites, these temperatures are 750 to 1000 °C. Feldspars, quartz, garnet, pyroxenes, cordierite and other minerals are formed under these temperature giving the rock its granular texture.

According to one of the models, an important role in the formation of granulites is played by CO_2-rich fluids heated to over-critical temperatures. Graphite that is present in metamorphic rocks may help establish whether this model is true. Usually, graphite is formed in the course of modification of organic matter or decomposition of carbonates (salts of carbonic acid with CO_{32}- anion).

However, granulites form at deep levels where no organic matter is present, so the graphite formation mechanism is different—graphite is the result of interaction of granulites with mantle flows rich in CO2. Therefore, the presence of graphite in granulites is often considered as an evidence for this model. Its formation depends on pressure, temperature, and other parameters, and the study of graphite can tell a lot about them.

Geologists found graphite samples and fluid inclusions in quartz (volatile components trapped in the small cavities of minerals in the course of crystal growth) in granite rocks of the Limpopo granulite belt and analyzed them.

The researchers found that granite rocks intruded the Limpopo granulite belt began to crystallize at the temperature of 900 to 940 °C and the pressure of 7 to 9 kbar. The analysis of fluid inclusions in quartz confirmed that CO_2-rich fluids took part in their formation. The deviation of C-13 isotope content from standard values was found to be 6.52 to 8.65 permille (tenth of percent) for graphite and 2.5 to 5.58 permille for the fluids in quartz. This isotopic composition of carbon is usually prescribed to deep fluid flows from the mantle, confirming their external origin once again.

This, in turn, coincides with the model of CO_2-rich deep external fluids participating in the formation of granulite rocks and accompanying granites. However, having compared this data with the isotopic composition of carbon from the rocks of ancient cratons, the scientists concluded that the fluids migrated through the Limpopo complex from the cratonic rocks in the course of collision with the Kaapvaal Craton.

While the study of the rocks in the Limpopo granulite complex was of fundamental nature, the knowledge about the processes of their formation may be used for ore prospecting. "Rocks of ancient cratons are rich sources of various ore components. They are carried by magmas and fluids that originate in the course of transformation of these rocks." comments Oleg Safonov.

The data about the formation of the South African granulite complex is also relevant for Russia. The scientists plan to compare their conditions with the data about the formation of granulites in the Lapland belt that is situated between the Karelian Craton and the Inari Craton at the border between Russia and Finland.

This story originally appeared on
http://www.geologyin.com/2018/07/geologists-find-out-how-over-26-ga.html

News: About Africa

Sahara Dust May Make You Cough, But It's A Storm Killer

By Keith Randall, Texas A&M Marketing and Communications

The bad news: Dust from the Sahara Desert in Africa – totaling a staggering 2 to 9 trillion pounds worldwide – has been almost a biblical plague on Texas and much of the Southern United States in recent weeks. The good news: the same dust appears to be a severe storm killer.

Research from a team of scientists led by Texas A&M University has studied Saharan dust and their work is published in the current issue of the Journal of Climate of *AMS* (American Meteorological Society).

Texas A&M's Bowen Pan, Tim Logan, and Renyi Zhang in the Department of Atmospheric Sciences analyzed recent NASA satellite images and computer models and said the Saharan dust is composed of sand and other mineral particles that are swept up in air currents and pushed over the Atlantic Ocean to the Gulf of Mexico and other nearby regions.

As the dust-laden air moves, it creates a temperature inversion which in turn tends to prevent cloud – and eventually – storm formation.

On July 16, 2003, the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua satellite captured this image of a river of Saharan dust streaming out over the Mediterranean Sea and northeastward to Italy. (NASA)

It means fewer storms and even hurricanes are less likely to strike when the dust is present.

"The Saharan dust will reflect and absorb sunlight, therefore reduce the sunlight at the Earth's surface," said Pan.

"If we have more frequent and severe dust storms, it's likely that we have a cooler sea surface temperature and land surface temperature. The storms have less energy supply from the colder surface therefore will be less severe."

The study goes on to show that dust and storm formation don't mix.

"Our results show significant impacts of dust on the radiative budget, hydrological cycle, and large-scale environments relevant to tropical cyclone activity over the Atlantic," said Zhang.

"Dust may decrease the sea surface temperature, leading to suppression of hurricanes. For the dust intrusion over the past few days, it was obvious that dust suppressed cloud formation in our area. Basically, we saw few cumulus clouds over the last few days. Dust particles reduce the radiation at the ground, but heats up in the atmosphere, both leading to more stable atmosphere. Such conditions are unfavorable for cloud formation."

Zhang said that the chances of a hurricane forming tended to be much less and "our results show that dust may reduce the occurrence of hurricanes over the Gulf of Mexico region."

Logan said that recent satellite images clearly show the Saharan dust moving into much of the Gulf of Mexico and southern Texas.

"The movement of the dust is there," Zhang said, "but predictions of dust storms can be very challenging."

This story originally appeared on https://today.tamu.edu/2018/07/20/texas-am-study-sahara-dust-may-make-you-cough-but-its-a-storm-killer/

News: About the World

Arctic sea ice decline driving ocean phytoplankton farther north

news.agu.org (October 2018)

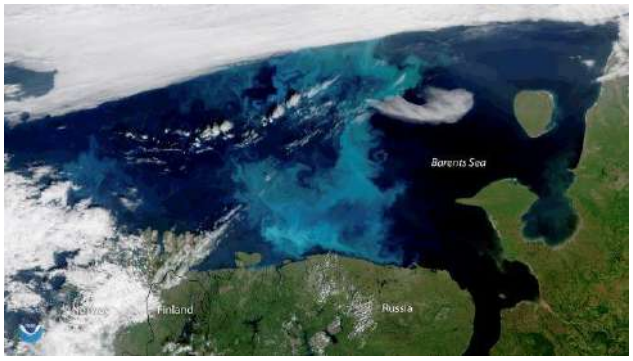
Phytoplankton blooms that form the base of the marine food web are expanding northward into ice-free waters where they have never been seen before, according to new research.

A new study based on satellite imagery of ocean color reveals phytoplankton spring blooms in the Arctic Ocean, which were previously nonexistent, are expanding northward at a rate of 1 degree of latitude per decade. Although blooms, or large explosions of phytoplankton, did not previously occur in this area, phytoplankton were present in the Arctic's central basin at low biomass. The study also found the primary productivity of the phytoplankton, or the rate at which phytoplankton are converting sunlight into chemical energy, is increasing during the spring blooms.

The decline in Arctic sea ice over the past several decades has made way for areas of open water where phytoplankton can thrive, driving their northward expansion, according to the study's authors. The researchers are unsure what effect this expansion will have on the food web, but the results suggest the decline of ice cover is impacting marine ecosystems in unforeseen ways.

If sea ice continues to decline, it could drive phytoplankton spring blooms farther north and increase primary

productivity even more. These changes could affect the fate of the Arctic Ocean as a carbon source or a carbon sink, according to the study.



This true-color image, captured by the NOAA-20 satellite on July 30, 2018, shows a large phytoplankton bloom in the Barents Sea. *Credit: NOAA Environmental Visualization Laboratory*

"If the ice pack totally disappears in summer, there will be consequences for the phytoplankton spring bloom," said Sophie Renaut, a Ph.D. student at Laval University in Quebec City, Canada, and lead author of the new study in Geophysical Research Letters, a journal of the American Geophysical Union. "We cannot exactly predict how it will evolve, but we're pretty sure there are going to be drastic consequences for the entire ecosystem."

Phytoplankton in the ecosystem

Phytoplankton are microscopic organisms that live in water, consume carbon dioxide and release oxygen through photosynthesis. In this process, they convert sunlight into chemical energy. Phytoplankton form the base of the marine food web, indirectly feeding everything from small fish to multi-ton whales.

Phytoplankton growth depends on the availability of carbon dioxide, sunlight, nutrients, water temperature and salinity, water depth and grazing animals, according to the NASA Earth Observatory. When conditions are ideal, phytoplankton population growth can explode, or bloom. While a bloom may last several weeks, the lifespan of an individual phytoplankton is seldom more than a few days.

Phytoplankton in the Arctic Ocean typically bloom every spring. In the past, phytoplankton blooms have been virtually absent from the highest Arctic latitudes, because these areas are usually covered by sea ice. In recent decades sea ice has declined, breaking up earlier in the spring or not forming at all in some areas of the Arctic.

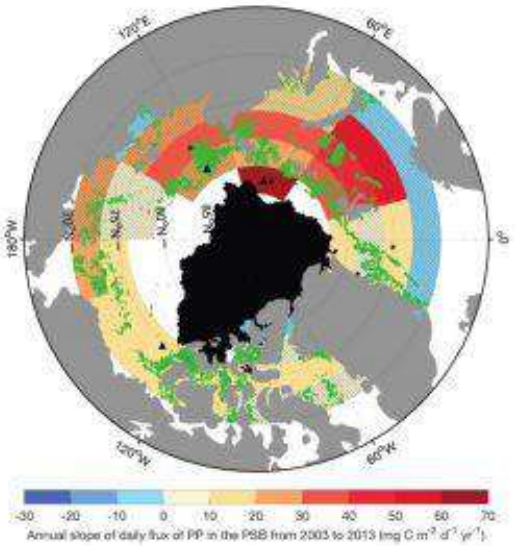
In the new study, Renaut and her colleagues wanted to see if recent sea ice declines have had any effect on spring phytoplankton blooms. They used satellite observations of ocean color—which provide estimates of phytoplankton biomass and primary productivity—to track changes of the blooms each spring from 2003 to 2013.

They found the spring blooms are expanding farther north and increasing in primary productivity. In the spring and summer months, net primary productivity in the Arctic Ocean increased by 31 percent between 2003 and 2013, according to the study. The researchers also found that these blooms in the Barents and Kara Seas, north of Russia, are expanding north at a rate of 1 degree of latitude per decade.

Unexpected effects of sea ice decline

Sea ice melt occurring earlier in the season creates larger open water areas that act as incubators for phytoplankton growth and elongate their growing season, according to Renaut.

The authors suspect spring blooms could someday extend into the Arctic's central basin, which encompasses almost everything north of 80 degrees latitude. Primary productivity, though, would likely remain low due to a lack of nutrients. Less ice cover means spring blooms and under-ice blooms may also have to compete for light and nutrients, thus altering the flow of the marine ecosystem. The results suggest a large change in this region, which has never been free of ice cover.



Estimates of annual trends in daily flux of primary productivity (PP) during the phytoplankton spring bloom determined from satellite ocean color data. Green pixels correspond to new phytoplankton spring blooms observed since 2010. *Credit: S. Renaut et al. 2018*

"The polar regions—the Southern Ocean and the Arctic Ocean—they're really important because they play a critical role in regulating the global climate," Renaut said. "If sea ice disappears completely in summer in the Arctic Ocean,

which is what we expect in some decades, it's going to have an impact on the ecosystem but also likely on the climate."

Patricia Yager, professor of Marine Sciences at the University of Georgia who was not involved with the new study, said the earlier algal bloom growth they observed in some areas could have considerable impacts if animals are not yet ready to graze on the phytoplankton.

"Such a mismatch in time could cause major changes to the Arctic food web, impacting not only the local animals and the people who live there, but also the global population of migrating animals who depend on these Arctic resources," Yager said. "What happens in the Arctic does not stay in the Arctic."

Cecile Rousseaux, a research scientist at the Universities Space Research Association, who was not involved in the new study, said the study advances research in this area by investigating individual regions of the Arctic for phytoplankton productivity, and represents evidence of the effects that reduced ice cover have on the biochemical cycle of the Arctic Ocean. However, Rousseaux noted that the study does have limitations.

"It is also important to remember that we are currently limited by the amount of data available to study these changes," Rousseaux said. "Longer time series of satellite data will allow us to confirm whether these trends in phytoplankton productivity persist or not."

This story originally appeared on https://news.agu.org/press-release/arctic-sea-ice-decline-driving-ocean-phytoplankton-farther-north/

News: About the World

Earth's inner core is solid, 'J waves' suggest

By Australian National University

A new study by researchers at The Australian National University (ANU) could help us understand how our planet was formed.

Associate Professor Hrvoje Tkalčić and PhD Scholar Than-Son Phạm are confident they now have direct proof that Earth's inner core is solid.

They came up with a way to detect shear waves, or "J waves" in the inner core -- a type of wave which can only travel through solid objects.

"We found the inner core is indeed solid, but we also found that it's softer than previously thought," Associate Professor Tkalčić said.

"It turns out -- if our results are correct -- the inner core shares some similar elastic properties with gold and platinum. The inner core is like a time capsule, if we understand it we'll understand how the planet was formed, and how it evolves."

Inner core shear waves are so tiny and feeble they can't be observed directly. In fact, detecting them has been considered the "Holy Grail" of global seismology since scientists first predicted the inner core was solid in the 1930s and 40s.

So the researchers had to come up with a creative approach.

Their so-called correlation wavefield method looks at the similarities between the signals at two receivers after a major earthquake, rather than the direct wave arrivals. A similar technique has been used by the same team to measure the thickness of the ice in Antarctica.

View of Earth from space, showing North Africa, Europe and the Middle East. Elements of this image furnished by NASA.

"We're throwing away the first three hours of the seismogram and what we're looking at is between three and 10 hours after a large earthquake happens. We want to get rid of the big signals," Dr Tkalčic said.

"Using a global network of stations, we take every single receiver pair and every single large earthquake -- that's many combinations -- and we measure the similarity between the seismograms. That's called cross correlation, or the measure of similarity. From those similarities we construct a global correlogram -- a sort of fingerprint of the Earth."

The study shows these results can then be used to demonstrate the existence of J waves and infer the shear wave speed in the inner core.

While this specific information about shear waves is important, Dr Tkalčić says what this research tells us about the inner core is even more exciting.

"For instance we don't know yet what the exact temperature of the inner core is, what the age of the inner core is, or how quickly it solidifies, but with these new advances in global seismology, we are slowly getting there.

"The understanding of the Earth's inner core has direct consequences for the generation and maintenance of the geomagnetic field, and without that geomagnetic field there would be no life on the Earth's surface."

The research has been published in the journal Science.

Journal References:

Hrvoje Tkalčić, Thanh-Son Phạm. Shear properties of Earth's inner core constrained by a detection of J waves in global correlation wavefield. *Science*, 2018; 362 (6412): 329 DOI: 10.1126/science.aau7649

This story appeared on https://www.sciencedaily.com/releases/2018/10/181019135124.htm

News: About the World

Earthquakes Can Systematically Trigger Other Ones on Opposite Side of Earth

Source University of Cambridge

New research shows that a big earthquake can not only cause other quakes, but large ones, and on the opposite side of the Earth.

The findings, published today in Scientific Reports, are an important step toward improved short-term earthquake forecasting and risk assessment.

Scientists at Oregon State University looked at 44 years of seismic data and found clear evidence that tremblors of magnitude 6.5 or larger trigger other quakes of magnitude 5.0 or larger.

It had been thought that aftershocks -- smaller magnitude quakes that occur in the same region as the initial quake as the surrounding crust adjusts after the fault perturbation -- were the only seismic activity an earthquake could lead to.

But the OSU analysis of seismic data from 1973 through 2016 -- an analysis that excluded data from aftershock zones -- provided the first discernible evidence that in the three days following one large quake, other earthquakes were more likely to occur.

Each test case in the study represented a single three-day window "injected" with a large-magnitude (6.5 or greater) earthquake suspected of inducing other quakes, and accompanying each case was a control group of 5,355 three-day periods that didn't have the quake injection.

"The test cases showed a clearly detectable increase over background rates," said the study's corresponding author, Robert O'Malley, a researcher in the OSU College of Agricultural Sciences. "Earthquakes are part of a cycle of tectonic stress buildup and release. As fault zones near the end of this seismic cycle, tipping points may be reached and triggering can occur."

The higher the magnitude, the more likely a quake is to trigger another quake. Higher-magnitude quakes, which have been happening with more frequency in recent years, also seem to be triggered more often than lower-magnitude ones.

A tremblor is most likely to induce another quake within 30 degrees of the original quake's antipode -- the point directly opposite it on the other side of the globe.

"The understanding of the mechanics of how one earthquake could initiate another while being widely separated in distance and time is still largely speculative," O'Malley said. "But irrespective of the specific mechanics involved, evidence shows that triggering does take place, followed by a period of quiescence and recharge."

Earthquake magnitude is measured on a logarithmic 1-10 scale -- each whole number represents a 10-fold increase in measured amplitude, and a 31-fold increase in released energy.

The largest recorded earthquake was a 1960 temblor in Chile that measured 9.5. The 2011 quake that ravaged the Fukushima nuclear power plant in Japan measured 6.6.

In 1700, an approximate magnitude 9.0 earthquake hit the Cascadia Subduction Zone -- a fault that stretches along the West Coast of North American from British Columbia to California.

Collaborating with O'Malley were Michael Behrenfeld of the College of Agricultural Sciences, Debashis Mondal of the College of Science and Chris Goldfinger of the College of Earth, Ocean and Atmospheric Sciences.

This story appeared on geologyin.com, https://www.geologyin.com/2018/08/earthquakes-can-systematically-trigger.html?fbclid=IwAR2ewzJcxBKGuDytVnwnmPdMNkQyHpHDsqXw34SKc_5nB7zNjnE5eU4otpQ

News: About the World

Quake split a tectonic plate in two, and geologists are shaken

An intense temblor in Mexico was just the latest example of an enigmatic type of earthquake with highly destructive potential

By Robin George Andrews (October 2018)

In September 7, 2017, a magnitude 8.2 earthquake struck southern Mexico, killing dozens and injuring hundreds. While earthquakes are common enough in the region, this powerful event wasn't any run-of-the-mill tremor.

That's because part of the roughly 37-mile-thick tectonic plate responsible for the quake completely split apart, as revealed by a new study in Nature Geoscience. This event took place in a matter of tens of seconds, and it coincided with a gargantuan release of energy.

"If you think of it as a huge slab of glass, this rupture made a big, gaping crack," says lead author Diego Melgar, an assistant professor of earthquake seismology at the University of Oregon. "All indications are that it has broken through the entire width of the thing."

Such colossal fragmentation events have been observed before in a handful of places around the world, and all these epic earthquakes have one thing in common: No one really knows how they happen. This information gap matters, because huge populations from the western seaboard of the Americas to the eastern shores of Japan could be threatened by these enigmatic earthquakes.

For one thing, the deep quakes can induce strong shaking over a wide area that can level plenty of multistory buildings. One that took place beneath the Chilean town of Chillán in 1939, for example, killed at least 30,000 people. And when they happen near an ocean coastline, their destructive potential could be magnified.

"My real worry over these kinds of events is the tsunami," Melgar says.

Buildings sit in shambles after a powerful September 2017 earthquake devastated Mexico's southern coast.

World's most elusive earthquakes

Tectonic plates, also known as lithospheric slabs, are made up of the planet's crust and the hot-but-solid upper mantle. They constantly move around Earth's surface, either grinding side by side, crumpling up into one another and forming mountains, or descending under another plate in what is referred to as a subduction zone.

Along these various plate boundaries, you get earthquakes when friction generates stress that's ultimately released. But quakes can also occur far from these plate boundaries, in the part of the slab that's been pushed through a

subduction zone and into the lower mantle. (Here's what will happen when Earth's tectonic plates grind to a halt.)

"If you bend an eraser, you can see the top half being extended and stretched, whereas the bottom bit is squashed and compressed," Melgar notes. The same applies to these slabs. This bending can activate faults within the slab and trigger what are known as intraslab earthquakes.

Intraslab quakes are happening all the time at low to moderate magnitudes, often on faults involving side-to-side movement or the upward push of a block. On occasion, some incredibly energetic ones happen on so-called normal faults, where the movement of a chunk of rock follows gravity's lead as it falls downward.

Melgar points to the 1933 Sanriku earthquake in Japan, which came in at a magnitude 8.5, as a good example of one of these intraslab normal quakes. Another would be the magnitude 7.8 Tarapaca earthquake in northern Chile in 2005. Sometimes, as in southern Mexico, the rupture can cut right through a slab. The same is thought to have happened beneath Iran in 2013 during a magnitude 7.7 tremor.

The hotel 'Ane Centro' was damaged after a 8.2 magnitude earthquake in Matias Romero, Oaxaca, Mexico.

Photograph by Angel Hernandez, EPA

Whether they feature this type of dramatic severance or not, these powerful quakes are inherently mysterious. Seismic surveys normally used to visualize tectonic movements can't penetrate to such depths. The mapping of oceanic slabs is also in its infancy, and there's not much high-resolution historical data to go on. That means geoscientists are currently scrambling for ways to best explain what's going on.

Plate tectonics pandemonium

The new study's geophysical measurements and models found that the Tehuantepec quake in Mexico was even more bizarre than any of the others. Normal faults can only rupture where the slab is being extended within the shallower segments. The Tehuantepec quake rupture, however, spread to even deeper parts of the slab that should be compressed.

This is potentially solvable. The paper suggests that the slab is being pulled down by its own weight so effectively that gravity is creating a major extensional force. This trumps the expected compressional forces, thereby allowing normal faulting to take place.

Far more problematic is the rupture's staggering reach, which extended to a depth of around 47 miles. At this point, temperatures exceed 2,012°F, hot enough to permit the rocky slab to act more like a mushier plastic. A quake like Tehauntepec requires rock to be cooler and therefore harder, so it can break in a more brittle way.

Powerful normal fault earthquakes can take place in deep-ish parts of slabs, says study coauthor Emmanuel Garcia, a tectonics expert at Kyoto University. However, this only really applies to truly ancient tectonic plates that have had many millions of years to cool down, which makes them more prone to break in a brittle fashion.

The Tehauntepec quake involved the Cocos plate, which is a relatively young 25 million years old and is somewhat warmer than plenty of other tectonic plates. That, according to Melgar, makes the 2017 slab-splitting tremor "unheard of."

"Something funny is going on with the slab in Mexico," says Eric Fielding, a geophysicist at NASA's Jet Propulsion Laboratory who coauthored a paper on the 2013 Iran quake.

Making a break for it

Part of the solution, according to Melgar's team, may involve deep water. As the Cocos slab heads into the subduction zone under the North American plate, it bends and cracks. This creates normal faults, which take in seawater. As the slab passes into and through the subduction zone into the lower mantle, it warms up and dehydrates. This dehydration creates mechanical weaknesses and can cause brittle fracturing, creating small quakes or, perhaps, a huge one. The same theory was applied to the 2013 Iran and 2005 Chilean quakes.

The fact that the Cocos plate is younger and warmer could have created a "perfect storm" of events, suggests Stephen Hicks, a seismologist at the University of Southampton who was not involved in the new research. The plate's relative warmth might mean that the vital dehydration process took place quicker, creating brittle conditions and faults early on that could eventually slip in a violent manner.

Melgar adds that when the oceanic Cocos plate first formed at a fiery mid-ocean trench, its cooling pattern created little

hills and valleys in its rock. These imperfections may have eventually formed zones of weaknesses that could have generated the Tehuantepec earthquake, making this a story of destruction tens of millions of years in the making.

However, he notes, it still seems curious that brittle fracturing could take place so spectacularly at such hellishly hot depths. The slab could be oddly cold or made up of some strange rocks, he suggests, but both ideas go against what scientists expect conditions down there to be like.

Either way, figuring out the root cause of intraslab normal quakes is more than just an intellectual endeavour. Whether they are shallow or deep, these tremors can be powerful enough to suddenly shift any seafloor nearby, pushing vast quantities of water forward and creating tsunamis.

The Tehauntepec tremor took place on the landward side of the subduction zone, so the seafloor wasn't deformed enough to create more than a 10-foot tsunami. By contrast, the 1933 Sanriku quake took place on the oceanward side of the subduction zone and created a devastating 66-foot tsunami.

When it comes to these strange, destructive earthquakes, "we don't truly know what's happening, to be honest," says Hicks. But it's clear that solving this titanic mystery could one day be a life-saver.

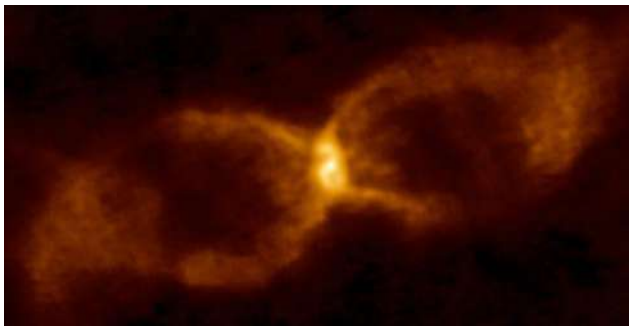
This story appeared on nationalgeographic.com
https://www.nationalgeographic.com/science/2018/10/news-tectonic-plate-split-earthquakes-tsunamis-geology/

News: About Space/Astronomy

When white dwarf meets brown dwarf, POW!

By Deborah Byrd in Space (October 14, 2018)

In 1670, skywatchers saw a nova, a star that appeared where none had been before. Today's astronomers have learned it was a collision between an aging white dwarf star, and less massive brown dwarf.



Astronomers now think this hourglass-shaped image of the object known as CK Vulpeculae is the result of a collision of a brown dwarf and a white dwarf. Image via ALMA (ESO/NAOJ/NRAO)/S. P. S. Eyres

In the 1600s, western astronomers were just emerging from centuries of medieval thought, when the heavens were thought to be unchanging. You can imagine their astonishment when – in July of 1670, in what had been a blank, dark sky – some observers witnessed a bright pinprick of light that appeared, faded, reappeared, and then disappeared entirely from view. At that time, astronomers called such an event a nova or new star. This one was located in front of the constellation Cygnus the Swan and so received the name Nova sub Capite Cygni (a New Star below the Head of the Swan). Modern astronomers have learned it wasn't a new star. It wasn't even a spectacular collision of two main-sequence stars, as announced in 2015. Instead, using data from the ALMA telescope in Chile, astronomers now believe the event was a collision between an aging white dwarf star and a brown dwarf (star with too little mass to ignite thermonuclear fusion and thereby shine as most stars do).

The object in question is now called CK Vulpeculae.

The new work is based on observations with the Atacama Large Millimeter/submillimeter Array (ALMA) in northern Chile. The astronomers studied the debris from this explosion, which takes the form of dual rings of dust and gas resembling an hourglass with a compact central object (see image at top). Sumner Starrfield of Arizona State University is a co-author on a paper published in the peer-reviewed journal Monthly Notices of the Royal Astronomical Society. He said in a statement:

It now seems what was observed centuries ago was not what we would today describe as a classic 'nova.' Instead, it was the merger of two stellar objects, a white dwarf and a brown dwarf. When these two objects collided, they spilled out a cocktail of molecules and unusual isotopes, which gave us new insights into the nature of this object.

How did they conclude that the collision was between a white dwarf and a brown dwarf, and not two main-sequence stars, as had been reported earlier? They did it by studying the light from two more-distant stars, shining behind the the dusty remains of the merger. These studies let the astronomers detect the telltale signature of the element lithium, which is easily destroyed in the interior of a main

sequence star, but not inside a brown dwarf. Astronomer Stewart Eyres of the University of South Wales (@astrostewey on Twitter) and lead author on the paper explained:

The presence of lithium, together with unusual isotopic ratios of the elements carbon, nitrogen and oxygen point to material from a brown dwarf star being dumped on the surface of a white dwarf. The thermonuclear 'burning' and an eruption of this material resulted in the hourglass we see today.

According to the researchers, the white dwarf would have been about 10 times more massive than the brown dwarf, though much smaller in size. As the brown dwarf spiraled inward, intense tidal forces exerted by the white dwarf would have ripped it apart. Starrfield remarked:

This is the first time such an event has been conclusively identified.

Bottom line: In 1670, skywatchers saw a nova, a star that appeared where none had been before. Today's astronomers have learned it was a collision between an aging white dwarf star, and less massive brown dwarf.

The constellation Cygnus the Swan, with Vulpecula. Image via SkyTonight.org.

This story appeared on earthsky.org, (14 October 2018) https://earthsky.org/space/when-white-dwarf-meets-brown-dwarf

News: About Space/Astronomy

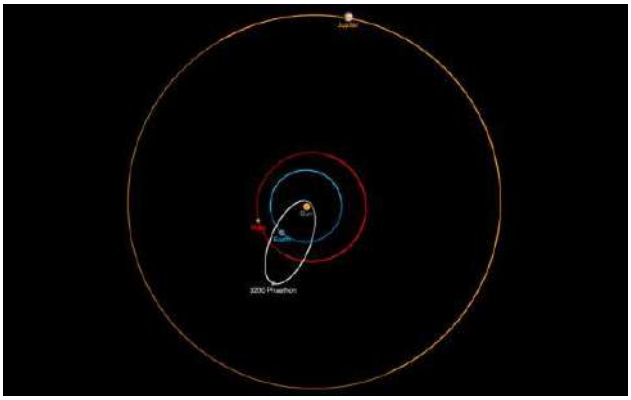
Asteroid Phaethon breaks all the rules. It acts like a comet, it supplies particles to a meteor shower. Oh, and it's blue

By Matt Williams (October 2018)

Having studies countless asteroids in near-Earth space, astronomers have come to understand that the majority of these rocks fall into one of two categories: S-type (grey) and C-type (red). These are defined by the types of materials on their surfaces, with S-type asteroids being primarily composed of silicate rock and C-type asteroids being made up of carbon materials.

However, there is also what are known as blue asteroids, which make up only a fraction of all known Near-Earth Objects (NEO). But when an international team astronomers observed the blue asteroid (3200) Phaeton during a flyby of Earth, they spotted behavior that was more consistent with a blue comet. If true, then Phaeton is of a class of objects that are so rare, they are almost unheard of.

As they stated during the course of the presentation, the team analyzed data from NASA's Infrared Telescope Facility (located atop Mauna Kea in Hawaii) and the Smithsonian Astrophysical Observatory's Tillinghast telescope, which is located on Mount Hopkins in Arizona. What they found was that Phaeton's appearance and behavior indicate that it has the characteristics of both an asteroid and a comet.



This diagram shows the highly eccentric orbit of 3200 Phaethon. Credit: NASA JPL

For instance, like all asteroids, Phaeton is known to reflect more light in the blue part of the spectrum than other classes (hence the name). However, Phaeton sets itself

apart by being one of the bluest, and having the same color over all of its surface. This is an indication that it may have recently been uniformly heated by the Sun.

"Interestingly, we found Phaethon to be even darker than had been previously observed, about half as reflective as Pallas," Kareta said. "This makes it more difficult to say how Phaethon and Pallas are related."

Its orbit is also one of the very eccentric, taking it so close to the Sun that it reaches temperatures of up to about 800 °C (1500 °F). Similarly, it appears like an asteroid in the sky (as a small dot versus a cloudy blotch), but also releases a tiny tail of dust when it gets closest to the sun. This is a indication that Phaeton's composition includes volatile elements (such as water, carbon dioxide, methane, ammonia, etc.) that sublimate as it warms.

The 2015 Geminids over the LAMOST observatory in China. Image credit and copyright: SteedJoy

Lastly, Phaeton is thought to be the "parent body" of the annual Geminid meteor shower because of how its orbit is similar to those of the Geminid meteors. Prior to Phaeton's discovery in 1983, scientists believed that all meteor showers were due to active comets. As Kareta explained:

"At the time, the assumption was that Phaethon probably was a dead, burnt-out comet, but comets are typically red in color, and not blue. So, even though Phaeton's highly eccentric orbit should scream 'dead comet,' it's hard to say whether Phaethon is more like an asteroid or more like a dead comet."

This kind of activity has only been seen twice in the history of astronomical observations, with Phaeton and one similar object that defies classification as either an asteroid or a comet. For these reasons, the research team theorizes that Phaeton might be related to, or have broken off from, (2) Pallas, one of the larger objects in the Main Asteroid Belt (and also a blue asteroid).

Currently, the team is conducting observations of 2005 UD, another small blue asteroid which may related to Phaethon. By determining if it and Phaethon share the same properties, they will gain valuable insight into what this comet/asteroid's true nature is. In addition, the study may have implications on future asteroid-rendezvous missions, like the Japanese Aerospace Exploration Agency's (JAXA) DESTINY+ technology demonstrator.

Artist's impression of JAXA's Demonstration and Experiment of Space Technology for INterplanetary voYage, Phaethon fLyby with reUSable (DESTINY+) probe . Credit: JAXA

This mission, which stands for Demonstration and Experiment of Space Technology for INterplanetary voYage, Phaethon fLyby with reUSable probe, is scheduled to conduct a flyby with several NEOS, including Phaeton, after launching in 2022. The purpose of this mission will be investigate the origin and nature of cosmic dusts, which are key sources of organic compounds on Earth – and therefore intrinsic to life.

In addition, the demonstrator will observe dust from Phaeton and map its surface to gain a better understanding of the mechanisms behind dust ejection. In this respect, this mission could help us to better understand the differences between comets and asteroids. Moreover, the highly unique object it will study could help us to better understand the origins of life in our Solar System.

The work was funded by the NASA Near-Earth Object Observation program (NEOO) grant. In addition to Karten, the team included multiple members of the LPL, the NASA Johnson Space Center, the Planetary Exploration Research Center at the Chiba Institute of Technology, and the Planetary Science Institute (PSI).

This story appeared on universetoday, (25 October 2018) https://www.universetoday.com/140357/asteroid-phaethon-breaks-all-the-rules-it-acts-like-a-comet-it-supplies-particles-to-a-meteor-shower-oh-and-its-blue/?fbclid=IwAR2FFwzqK6JXLjNwmdOYdhPwFtHrq4Vbut3NTo2iB0czhtIDcFhK24ETZoI

GEOETHICS

Asteroid mining might actually be better for the environment

The first study of its environmental impact suggests that extracting resources such as platinum from asteroids might be cleaner than doing so on Earth.

By Emerging Technology from the arXiv (October, 2018)

A certain kind of investor, asteroid mining is a path to untold riches. Astronomers have long known that asteroids are rich in otherwise scarce resources such as platinum and water. So an obvious idea is to mine this stuff and return it to Earth—or, in the case of water, to a moon base or Earth-orbiting space station.

There is no shortage of interest in these ventures. In the last decade, investors have funded half a dozen companies that have set their sights on various nearby rocks. To many observers, it's only a matter of time before such a mission gets the green light.

But profit margins are only part of the picture. A potentially more significant aspect of these missions is the impact they will have on Earth's environment. But nobody has assessed this environmental impact in detail.

Today, that changes thanks to the work of Andreas Hein and colleagues at the University of Paris-Saclay in France. These guys have calculated the greenhouse-gas emissions from asteroid-mining operations and compared them with the emissions from similar Earth-based activities. Their results provide some eyebrow-raising insights into the benefits that asteroid mining might provide.

The calculations are relatively straightforward. Rocket launches release significant amounts of greenhouse gases into the atmosphere. The fuel on board the first stage of a rocket burns in Earth's atmosphere to form carbon dioxide. For kerosene-burning rockets, one kilogram of fuel creates three kilograms of CO_2. (The second and third stages operate outside the Earth's atmosphere and so can be ignored.)

Reentries are just as damaging. That's because a significant mass of a re-entering vehicle ablates in the upper atmosphere, producing NOx such as nitrous oxide (N_2O), a greenhouse gas that is about 300 times more potent than CO_2. By one estimate, the space shuttle released about 20% of its mass in the form of N_2O every time it returned to Earth.

Hein and co use these numbers to calculate that a kilogram of platinum mined from an asteroid would release some 150 kilograms of CO_2 into Earth's atmosphere. However, economies of scale from large asteroid-mining operations could lower this to about 60 kilograms of CO_2 per kilogram of platinum.

That needs to be compared with the emission from Earth-based mining. Here, platinum mining generates significant greenhouse gases, mostly from the energy it takes to remove this stuff from the ground.

Indeed, the numbers are huge. The mining industry estimates that producing one kilogram of platinum on Earth releases around 40,000 kilograms of carbon dioxide. "The global warming effect of Earth-based mining is several orders of magnitude larger," say Hein and co.

The figures for water are also encouraging. In this case, the authors calculate the greenhouse-gas emissions from an asteroid-mining operation that returns water to anywhere within the moon's orbit, a so-called cis-lunar orbit. They compare this to the emissions from sending the same volume of water from Earth into orbit.

The big difference is that a water-carrying vehicle from Earth can haul only a small percentage of its mass as water. But an asteroid-mining spacecraft can transport a significant multiple of its mass as water to cis-lunar orbit. "Substantial savings in greenhouse gas emissions can be achieved," say Hein and co.

This interesting work should help to focus minds on the environmental impacts of mining, which are rapidly increasing in profile. But it is only a first step. There is significant uncertainty in the numbers here, so these will need to be better understood.

Other factors will also eventually need to be taken into account. The Earth-bound mining industry could become more environmentally friendly by using renewable energy rather than burning coal to generate power (as it does in South Africa). Rocket launching could also become greener if more eco-friendly fuels are developed. Both these things would change the numbers.

There are also emissions that this analysis does not take into account. For example, it does not include the emissions from mission control on Earth or from launch-pad construction. Then there are the ongoing effects of rocket launches on the ozone layer, which also need to be considered.

So there is more work to be done. But Hein and co have taken a significant first step toward realistic environmental life-cycle assessments for asteroid mining, a task that will surely become more pressing as this industry matures.

This story appeared on technologyreview.com, (19 October 2018)
https://www.technologyreview.com/s/612311/asteroid-mining-might-actually-be-better-for-the-environment/?utm_medium=social&utm_source=facebook.com&utm_campaign=owned_social&fbclid=IwAR3yOETyGiYlAKwnkKE7jkiXClxNNHBq9tDl7NNQcEvrRjLdYcmydtSN7SY

GEOETHICS

The Trump administration knows the planet is going to boil. It doesn't care

Trump's team used few weeks ago to sneak in disastrous, linked policies on climate change and child refugee camps

By Bill McKibben (October 2018)

In the cloud of toxic dust thrown up by the Kavanaugh hearings last week, two new Trump initiatives slipped by with less notice than they deserve. Both are ugly, stupid – and they are linked, though in ways not immediately apparent.

In the first, the administration provided the rationale for scrapping President Obama's automobile mileage standards: because Trump's crew now officially expects the planet to warm by 4C. In the environmental impact statement they say it wouldn't make much difference to the destruction of the planet if we all keep driving SUVs.

The Trump years are a fantasy land where we pretend we can go on living precisely as in the past, unwilling even to substitute electric SUVs for our gas guzzlers. Photograph: Mandel Ngan/AFP/Getty Images

The news in that statement is that administration officials serenely contemplate that 4C rise (twice the last-ditch target set at the Paris climate talks). Were the world to actually warm that much, it would be a literal hell, unable to maintain civilizations as we have known them. But that's now our policy, and it apparently rules out any of the actions that might, in fact, limit that warming. You might as well argue that because you're going to die eventually, there's no reason not to smoke a carton of cigarettes a day.

Meanwhile, reporters also discovered that the administration has set up what can only be described as a concentration camp near the Mexican border for detained migrant children, spiriting them under cover of darkness from the foster homes and small shelters across the nation where they had been staying.

Not an extermination camp – these aren't Nazis – but a camp that literally concentrates this "problem" in one place: a tent city in the middle of the desert. Schooling is not available there, as it was in the shelters they came from; instead the kids are given "workbooks that they have no obligation to complete. Access to legal services is limited."

That camp is linked to climate change because, first, it's in a desert. If you searched high and low across the North American continent, you could barely find a place hotter and drier than Tornillo, Texas, where in June the average high is 96F and where, as one climate data source succinctly puts it, "there is virtually no rainfall during the year".

But the link goes much deeper. Most of those migrants are from Central America and Mexico, and they might as easily be described as refugees fleeing gang violence (much of it rooted originally in the US) and a changing climate. Guatemala, El Salvador and Honduras first saw an outbreak of coffee rust linked to higher nighttime temperatures; the El Niño that began in 2015 led to years of unprecedented drought. Deep new droughts this summer wiped out more harvests: "total or partial loss of crops means that subsistence farmers and their families will not have enough food to eat or sell in coming months," the UN's Food and Agriculture Organization warned. The author Todd Miller, writing in the Nation, described meeting men trying to jump a train in Guatemala headed north toward the border. "When I asked why they were heading for the United States, one responded simply, "No hubo lluvia." ("There was no rain.")

This will, of course, get steadily worse in the years ahead – every climate forecast shows deserts spreading and water evaporating across the region. And of course more migration will follow, in every corner of the world. The World Bank predicts we may see 140 million climate migrants before long, and given the chaos that even a million people

fleeing the (partially drought-fueled) crisis in Syria created, we better come to grips. Some of that migration will be internal – perhaps six million people will abandon their coastal property in Florida alone, according to recent reports. And much of it will be international, as people flee because their lives depend on it.

Telling people to stay home is not an option – when there's no water, or when the floods come each year, or when the sea rises into your kitchen, people have to leave. Period.

And telling people to stay home is not a moral option, either. Because the climate chaos setting off waves of refugees is born above all from the unconstrained migration of carbon dioxide molecules from America over the last century. No wall can prevent the exhaust from our armada of oversized cars from raising the temperature in Mexico; if Guatemala could ship its changed climate back north it doubtless would, but it can't. We have to realize that global warming stems from the fact that we are a world without atmospheric borders, where the people who have done the least to cause the problem feel its horrors first and hardest. That's why, over the last half-decade, the environmental and migrant-rights movement have grown ever closer.

The Trump years are a fantasy land where we pretend we can go on living precisely as in the past, unwilling even to substitute electric SUVs for our gas guzzlers, and able to somehow insist that the rest of the world stay locked in place as well. It's impractical, it's unfair, and when it ends up with camps for kids in the desert it's downright evil.

This story appeared on theguardian.com, (2 October 2018)
https://www.theguardian.com/commentisfree/2018/oct/02/trump-administration-planet-boil-refugee-camps?CMP=fb_gu

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Regional geological formation and speleogenesis of the Fossil Hominid Sites of South Africa: UNESCO World Heritage Area
Earth-Science Reviews, In press, accepted manuscript, Available online 3 October 2018
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The Tuareg shield terranes revisited and extended towards the northern Gondwana margin: Magnetic and gravimetric constraints
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Archean-Paleoproterozoic transition: The Indian perspective
Earth-Science Reviews, In press, accepted manuscript, Available online 23 November 2018
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Nature and assembly of microcontinental blocks within the Paleo-Asian Ocean
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Systematic review of geochemical data from thermal springs, gas vents and fumaroles of Southern Italy for geothermal favourability mapping
Earth-Science Reviews, In press, corrected proof, Available online 20 September 2018
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Insights into geological processes with CO2 remote sensing – A review of technology and applications
Earth-Science Reviews, In press, accepted manuscript, Available online 26 November 2018
Manuel Queißer, Mike Burton, Ryunosuke Kazahaya

Ecological persistence, incumbency and reorganization in the Karoo Basin during the Permian-Triassic transition
Earth-Science Reviews, In press, corrected proof, Available online 21 October 2018
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Extensional crustal tectonics and crust-mantle coupling, a view from the geological record
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Geological reconstructions of the East Asian blocks: From the breakup of Rodinia to the assembly of Pangea
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Rhyacian-Orosirian isotopic records from the basement of the Araçuaí-Ribeira orogenic system (SE Brazil): Links in the Congo-São Francisco palaeocontinent
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Neoproterozoic magmatic and metamorphic events in the Cuchilla Dionisio Terrane, Uruguay, and possible correlations across the South Atlantic
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The 920–900 Ma Bahia-Gangila LIP of the São Francisco and Congo cratons and link with Dashigou-Chulan LIP of North China craton: New insights from U-Pb geochronology and geochemistry
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Alexandre de Oliveira Chaves, Richard E. Ernst, Ulf Söderlund, Xinping Wang, Tomas Naeraa

Igneous and detrital zircon U-Pb and Lu-Hf geochronology of the late Meso- to Neoproterozoic northwest Botswana rift: Maximum depositional age and provenance of the Ghanzi Group, Kalahari Copperbelt, Botswana and Namibia
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Neoproterozoic sedimentary rocks track the location of the Lhasa Block during the Rodinia breakup
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Geochronological characterization of a transition zone between the Mozambique Belt and Unango-Marrupa Complex in SE Tanzania
Precambrian Research, In press, accepted manuscript, Available online 28 November 2018
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New constraints from detrital zircon ages on prolonged, multiphase transition from the Cadomian accretionary orogen to a passive margin of Gondwana
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The evolution of the Arabian-Nubian Shield and survival of its zircon U-Pb-Hf-O isotopic signature: A tale from the Um Had Conglomerate, central Eastern Desert, Egypt
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First evidence of Archean mafic dykes at 2.62 Ga in the Yilgarn Craton, Western Australia: Links to cratonisation and the Zimbabwe Craton
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Regional folding, low-angle thrusting and permeability networks: Structural controls of gold mineralization in the Hope reef at Fairview Mine, Barberton Greenstone Belt, South Africa
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A review of the mineral potential of Liberia
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Multi-stage and multi-sourced fluid and gold in the formation of orogenic gold deposits in the world-class Mana district of Burkina Faso – Revealed by LA-ICP-MS analysis of pyrites and arsenopyrites
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Petrology, geochemistry and stable isotope studies of the Miocene igneous rocks and related sulphide mineralisation of Oued Amizour (NE Algeria)
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Geology of the Ngualla Carbonatite Complex, Tanzania, and origin of the Weathered Bastnaesite Zone REE ore
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A pilot study to test the reliability of the ERT method in the identification of mixed sulphides bearing dykes: The example of Sidi Flah mine (Anti-Atlas, Morocco)
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Mixing of magmatic-hydrothermal and metamorphic fluids and the origin of peribatholitic Sn vein-type deposits in Rwanda
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A common deep source for upper-mantle upwellings below the Ibero-western Maghreb region from teleseismic P-wave travel-time tomography
Earth and Planetary Science Letters, Volume 499, 1 October 2018, Pages 157-172
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Towards subduction inception along the inverted North African margin of Algeria? Insights from thermo-mechanical models
Earth and Planetary Science Letters, Volume 501, 1 November 2018, Pages 13-23
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Active fault system across the oceanic lithosphere of the Mozambique Channel: Implications for the Nubia–Somalia southern plate boundary
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Absence of thermal influence from the African Superswell and cratonic keels on the mantle transition zone beneath southern Africa: Evidence from receiver function imaging
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Calcium isotopes in enamel of modern and Plio-Pleistocene East African mammals
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A 10-fold decline in the deep Eastern Mediterranean thermohaline overturning circulation during the last interglacial period
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The roles of climate and human land-use in the late Holocene rainforest crisis of Central Africa
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Rift evolution in regions of low magma input in East Africa
Earth and Planetary Science Letters, Volume 506, 15 January 2019, Pages 332-346
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Source characteristics of the 2017 Mw6.4 Moijabana, Botswana earthquake, a rare lower-crustal event within an ancient zone of weakness
Earth and Planetary Science Letters, Volume 506, 15 January 2019, Pages 348-359
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Geophysical evidence for crustal and mantle weak zones controlling intra-plate seismicity – the 2017 Botswana earthquake sequence
Earth and Planetary Science Letters, Volume 506, 15 January 2019, Pages 175-183
Max Moorkamp, Stewart Fishwick, Richard J. Walker, Alan G. Jones

Quaternary International

Determinants of savanna-fire dynamics in the eastern Lake Victoria catchment (western Kenya) during the last 1200 years
Quaternary International, Volume 488, 20 September 2018, Pages 67-80
Daniele Colombaroli, Geert van der Plas, Stephen Rucina, Dirk Verschuren

Subsistence mosaics, forager-farmer interactions, and the transition to food production in eastern Africa
Quaternary International, Volume 489, 30 September 2018, Pages 101-120
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The last hunter-gatherers of China and Africa: A life amongst pastoralists and farmers
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Provenance, paleo-weathering and -redox signatures of estuarine sediments from Ghana, Gulf of Guinea
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The first bone tools from Kromdraai and stone tools from Drimolen, and the place of bone tools in the South African Earlier Stone Age
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The emergence, spread, and termination of the Early Later Stone Age event in South Africa and southern Namibia
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Holocene large mammal mass death assemblage from South Africa
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Exploitation of sheep (Ovis aries) and goats (Capra hircus) by Iron Age farmers in southern Africa
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Taphonomy of burnt bones from Wonderwerk Cave (South Africa)
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Taphonomic interpretations of the Haasgat HGD assemblage: A case study in the impact of sampling and preparation methods on reconstructing South African karstic assemblage formation
Quaternary International, Volume 495, 30 November 2018, Pages 4-18
Justin W. Adams, Douglass S. Rovinsky

EVENTS

In Africa and about Africa (More information about the following events is on: http://gsafr.org/events/)

- Nigerian Mining and geosciences society (NMGS) – 55th international conferences & Exhibition (17-22 March, 2019)
- The 5th International Symposium on Innovation & Technology in the Phosphate Industry will be held in 2019 at Mohammed VI Polytechnic University – Congress Center, Benguerir, Morocco. More details will be available in December 2018

- In the frame of the igcp638 “Paleoproterozoic Birimian Geology for Sustainable Development”, of a special volume dedicated to mineralizations: Geological Society of London (Lyell Collection) special volume : “Mineralizations within Cratons, Metacratons and Basins”. The detailed “Call for Papers” will be sent after the first item below is reached.
    - Upload first a title (even provisional) of the article, the authors and the e-mail of the corresponding author [deadline of paper proposition: Nov. 22nd, 2018]: submit
    - Beginning of final submissions of papers through the portal of the Geological Society of London: Dec. 22nd, 2018 (hopefully)
- The 3rd edition of the KENYA MINING FORUM Conference & Exhibition, 12-13 November in Nairobi, at the Safari Park Hotel.
- Technology Day & African Exploration Showcase – 15-16 November, Glenhove Conferencing Centre, Johannesburg.
- 5th International Conference on Scientific Research ISR-2019 (RENEWABLE ENERGY & WATER SUSTAINABILITY) – Sharm El Sheikh-Egypt, March 26-29 (Tu.- Fr.), 2019.
- Colloquium Magmatisme, Métamorphisme et Minéralisations Associées (3MA-11), April 23-24, 2019 El Jadida, Morocco. Abstracts submission: 15 January 2019.
- Special Issue “The East African Rift: Tectonics, Magmatism and Natural Hazards”. International Geosciences and Geoparks Programme Project Proposal Call.
- The 5th edition of Mauritanides 2018 – 11-13 December 2018 – Nouakchott, Mauritania
- The 5th ISR conference on Renewable Energy & Water Sustainability 26-29 March 2019 in Sharm El-Sheikh, Egypt. More information: http://isr.tanta.edu.eg

Rest of the World (More information about the following events is on: http://gsafr.org/events/)

- Water Future International Conference – “Towards a Sustainable Future” to be held 23-27th September 2019 in Bangalore, India.
- 12th International Conference on Earthquake Resistant Engineering Structures – 5-7 June 2019, Seville, Spain.
- 11th Inter Guiana Geological Conference: Tectonics & Resource Potential of NE South America. 19 – 20th February 2019, Paramaribo, Suriname. More information
- Energy and Sustainability 2019 – 8th International conference on Energy and Sustainability, 3-5 July 2019, Coimbra, Portugal.
- The International Earth Science Olympiad, Daegu, South Korea August 26 to September 03, 2019.
- International Conference on Geoscience for Society (GeoSoc), Bangladesh Shilpakala Academy, Segunbagicha, Dhaka, Bangladesh – March 14-17, 2019.
- ECOSUD 2019 – 12th International Conference on Ecosystems and Sustainable Development, 19 – 21 June 2019 – Valencia, Spain.
- River Basin Management 2019 (10th International Conference on River Basin Management Including all Aspects of Hydrology, Ecology, Environmental Management, Flood Plains and Wetlands – 8 – 10 May 2019, Alicante, Spain.
- EGU (European Geosciences Union) General Assembly 2019 will bring together geoscientists from all over the world to one meeting covering all disciplines of the Earth, planetary and space sciences. Call-for-sessions: until 6 September 2018. Abstract submission: October 2018–10 January 2019. Support application: October–1 December 2018.

OPPORTUNITIES

Two years Post Doc Opportunity: Geophysics – Soil physics – Agrogeophysics	Liege, Belgium	28/02/19
Geophysical Research or Staff Scientist (Energy Geosciences) - 85937	Berkeley, CA,, USA	07/01/19
2018 Postdoctoral Fellowship Program	Moss Landing, CA, USA	20/03/19
Research Scientist in the field of neotectonics	Potsdam, Germany	13/01/19
Postdoctoral research scientist - Data Scientist Changes in dust fluxes and paleoproductivity across the past glacial/interglacial cycles in the Southern Ocean	Bremerhaven, Germany	01/02/19
Scientist in economic geology	Trondheim, Norway	21/12/18
Postdoctoral Research Fellow in Hydrology/Hydrogeology	Aberdeen, UK	20/01/19
Master of Petroleum Geoscience	Perth, WA, Australia	03/01/19
Postdocs in signal processing and machine learning of geophysical data - 1012275	Aarhus C, Denmark	21/12/18
Research Scientist Position - Marine Biogeochemistry	Kiel, Germany	31/12/18
UCD Post-doctoral Research Fellow Level 1 or 2: Discrete element numerical modelling of the evolution of fault systems	Dublin, Ireland	08/01/19
RawMatCop Manager	Berlin, Germany	31/12/18
UCD Post-doctoral Research Fellow Level 1 or 2: The kinematics of fault systems in offshore Ireland - implications for fault related trapping and leakage	Dublin, Ireland	08/01/19
International Master of Research course in Solid Earth Sciences	Paris, France	28/02/19
Earth Observation Data Scientist	London, UK	28/12/18
Cambridge C-CLEAR NERC DTP PhD Studentships	Cambridge, UK	03/01/19
Ph.D. position in Statistical Seismology: Enabling dynamic earthquake risk assessment	Zurich, Switzerland	06/01/19

Research Associate - Measurements of zeta potential in carbonate rocks	London, UK	18/01/19
BPI Senior Research Fellowship: 2019-2024	Cambridge, UK	31/12/18
Postdoctoral Investigator (m/f) in the area of Marine Biogeochemistry	Geesthacht, Germany	06/01/19
Postdoctoral Research Associate / Postdoctoral Research Fellow: Mineralogy and geochemistry of environmentally friendly marine concrete materials	Exeter, UK	08/01/19
Postdoctoral position in atomistic modelling	Potsdam, Germany	06/01/19
Manager Geosciece Mapping Through Cover - MIS18090	Perth, Australia	23/11/18
Geoscientist or Mining Engineer (M.Sc)	Hannover, Germany	11/12/18
Post-doctoral Research Fellows	Sydney, Australia	01/01/19
High-Pressure Experimental Geoscientist	Sydney, Australia	17/12/18
Post-Doctoral Researcher - Atmospheric Inverse Modelling	Wellington, New Zealand	18/12/18
3 MSc positions - Geomicrobiology and Mine Waste	Saskatoon, SK, Canada	22/12/18
Research Assistant - development of sedimentological databases	Leeds, UK	21/12/18
Visiting Faculty Exchange Fellowships, Cooperative Institute for Modeling the Earth System	Princeton, NJ, USA	15/01/19
Wiss. Mitarbeiter / Wiss. Mitarbeiterin (Preadoc), Sedimentäre Systeme: Earthshape - Earth Surface Shaping by Biota (Earthshape.net)	Berlin, Germany	10/12/18
2 PhD Student Positions - Coral Climatology	Bremen, Germany	31/01/19
Associate or Senior Editor (Biogeosciences)	London, Shanghai, New York, or Berlin, UK	05/12/18
PhD position in geochemistry & stable isotope research	Erlangen-Nürnberg, Germany	27/11/18
Full-time PhD Studentships	Milton Keynes, UK	21/01/19

Post-Doctoral Position Utilizing U-PB LA-ICP MS Geochronology	Stockholm, Sweden	15/12/18
Researcher position in the Geomatics Division - Remote Sensing Department	Barcelona, Spain	14/01/19
Post Doctoral Fellow Mineral Exploration Mapping	Sudbury, ON, Canada	15/12/18
4 MSc students and 1 PhD student to conduct mapping-based research	Sudbury, ON, Canada	26/01/19
PDF/Research Associate Positions, geological mapping-based research	Sudbury, ON, Canada	31/12/18
PDF/Research Associate in Applied Exploration Geophysics	Sudbury, ON, Canada	15/12/18
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Experienced Geophysicist	Nottingham, UK	26/11/18
M.Sc in Uranium Exploration	Brandon, Canada	28/02/19

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