



THE GEODE

DEPARTMENT OF EARTH SCIENCE STELLENBOSCH OCTOBER 2019 *Issue* 06

SHARING A COLD ONE

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Earth's climate has fluctuated over the last 4.6 billion years and will continue changing thanks to the natural cyclicality and eccentricity of the Earth's rotation around the sun. The planet has been rather consistent with recording large climate changes. Earth has experienced at least five (5) major ice age periods and works on a 100 000-year cycle: the ice sheets grow for about 90 000 years, and then melts within 10 000 years in the warmer periods. The last ice age ended about 11 500 years ago, meaning that we should be entering into another ice age – but the Earth may be too warm for the next cycle to take place.

With climate change being one of the defining topics of the decade, words such as greenhouse gases, methane gas, CFC's, and CO₂ are immediately associated with the devastating effects of an ever-changing climate. Without Earth's natural greenhouse effect, life on Earth would not have evolved on the planet. However, greenhouse gases emitted by humans have been on a steady increase since the industrial revolution, and the natural balance has been altered.





The sea ice in the Antarctic retreats and advances with seasonal fluctuations. During the colder months, a powerful current of cold, dense and salty water circulates throughout the world's oceans, and plays a key role in regulating global atmospheric temperatures. Additionally, the phytoplankton that grows within the Southern Ocean also behaves as a biological carbon pump, consuming as much carbon dioxide as forests and land plants. Any changes on the production of this phytoplankton has the ability to negatively affect the carbon dioxide uptake and oxygen release, not only influencing the global atmospheric carbon dioxide concentrations and the surface temperatures, but also affecting the ecological food chain within the Southern Ocean. Yet, the carbon cycle of the Southern Ocean still remains poorly understood.

A research team from Stellenbosch University is dedicated to studying the changes and the effects of these changes in the Southern Ocean. The centre for Trace and Experimental Biogeochemistry (TraceEx) headed by Professor Roychoudhury of the Department of Earth Sciences is a virtual centre located in Stellenbosch that brings together national and international collaborating scientists. The research focuses on the Southern Ocean in order to understand the controlling role of trace metals and their isotopes on primary production, ocean acidification, and climate change. Scientists join the Winter and Summer cruises to the Antarctic Marginal Ice Zone on the R/V *S.A. Agulhas II*. This year, Stellenbosch has had the privilege of joining for the winter and a spring cruise. This will be the first time that they collect data from the Southern Ocean in spring.

During their time aboard the vessel, they collect and sample sea and rain water, frozen ice cores, frazil ice, snow and dust for trace element analysis, as well as various other accompanying parameters like nutrients, phytoplankton and isotopes. On board is a specialized 'Clean Lab' container equipped with instrumentation that is sensitive enough to determine trace element concentrations within the samples. The trace elements of concern include iron, zinc, cadmium, copper, cobalt, manganese and nickel, which are the essential micronutrients for phytoplankton growth, as well as lead and its isotopes to assess the anthropogenic imprint.

Trace elements play a key role in the health of the phytoplankton. One of the major controls of the abundance and availability of these trace metals are the freeze-thaw processes of the seasonal ice. This freeze-thaw process changes the distribution of the micronutrients, which affect the growth and types of phytoplankton that grow in the Southern Ocean. The research team is analysing the different types of phytoplankton pigments, as well as conducting oxygen and deuterium isotope analysis to delineate the deep-water masses, and understand the surface hydrological processes.

Photos courtesy of Andrea Baker



Loading trace clean GoFlow bottles onto a CTD rosette to collect water samples from different depths.



GoFlow bottles brought from clean lab in plastic bags to be loaded onto rosette.



CTD being deployed off side of ship to maximum depth while bottles are open to be flushed with sea water. On upcast the individual bottles are closed at different predetermined depths to sample the water column.

The spring cruise is currently underway, and is expected to return on the 28th November, 2019.

For more information on the GEOTRACES and TraceEx program and to get involved, please visit:



<https://www.sun.ac.za/english/faculty/science/earthsciences/research/Environmental-Geochemistry>



@TracexS (<https://twitter.com/TracexS>)



@TracEx (<https://www.facebook.com/TracEx/>)



Or email Prof. Roychoudhury (roy@sun.ac.za) or Dr. Fietz (sfietz@sun.ac.za)



Sources:

<https://tracexsite.wordpress.com/>,
<http://www.sun.ac.za/english/Lists/news/DispForm.aspx?ID=6678>

<https://southernoceanfe.wordpress.com/>
<https://www.sanap.ac.za/research/>
<http://scale.org.za/>

NASA, NOAA, The Royal Society



A miner, cyclist, and conservationist walks into a bar...

Photos provided by author

AND RAISES IT.

FRANCOIS BURGER

It's quite hard not to notice, but the issue of climate change and pollution is a hot topic at the moment. Not only on campus, but worldwide. As Earth Science students who are likely to be working in the mining industry one day, it can be easy to feel conflicted if you are also environmentally conscious. One might argue that the demand for materials will be there regardless, so someone has to do it. That might as well be us, who won't be taking any shortcuts (cough). However, in some cases, mining companies might actually have a net positive impact on the environment they find themselves in (I swear I wasn't paid to write this).

Growing up in rural Zambia, I spent weekends cycling in the bush around our house with my dad and his friends. In my teenage years I did the same, although my company was female and our intentions weren't necessarily fitness related. What also changed was that each month, we had to cycle further to get into the forest. Trees are cut down daily to make charcoal, as electricity is a luxury and selling charcoal is the only source of income to many. In the dry season, air quality decreased dramatically and it was common to wake up in with a blanket of soot lying across the pavement. If you wanted to cycle to school, you had to wear a buff to be able to get through the thick smoke clouds that settled overnight in topographic lows around streams. In a third-world country with a struggling government, it is optimistic to wait on the government to speedily come up with drastic environmental reforms. This is where the role of large multinational mining companies starts. As guests in the host country, it is also their responsibility to contribute positively to society - this is termed Corporate Social Responsibility.

An example of a case study is First Quantum Minerals (FQM), a Canadian-based mining company that is operating the Kansanshi and Sentinel copper mines in the North-West of Zambia. The CFO is an avid cyclist and environmentalist who grew up in Zimbabwe, keenly aware of the detrimental effects of deforestation. Kansanshi is the older of the two mines, developed next to the town of Solwezi. Even though Solwezi is in central Africa, the only forest close to town is in a game park established by the mine. When FQM first started developing the copper deposit at Sentinel, there was no local town where workers could stay - they had to build their own town. FQM was aware of the negative environmental impact towns have in general, and using Solwezi as an example of what not to do, the company set out to develop a national outlier. The mine invested USD 200 million into building a town next to the Sentinel deposit called Kalumbila, with proper infrastructure, sewerage, streets lights, schools, medical facilities, and quality housing.



*The houses barely visible
in the background are
less than 2 km away...*

Kalumbila was designed around a handful of core principles, namely minimal environmental disturbance, prioritising walking and cycling as the main modes of transport, and creating infrastructure and incentives for businesses. Powerlines are underground, rather than overhead; streetlights are solar powered and town residents play football under solar-powered floodlights. A sawmill was constructed to make furniture for the upcoming houses, making use of all the trees that were felled to make place for infrastructure. Tree felling for charcoal is prohibited (with help of the local government) and alternative incomes for charcoal-sellers were provided. The burning of trash (prevalent throughout the country) is also not permitted within the town. Although these measures may not have an impact on the big picture, it certainly makes a world's difference to the locals.

I have cycled in the bush around Kalumbila and the greatest thing was that I didn't even have to leave the city's boundaries to enter the forest: the town is within the forest. The good air quality and the lack of pollution is unrivalled across the country, with the inevitable large-scale deforestation that occurs adjacent to large towns in Zambia being prevented. FQM also has a conservation farming program that empowers local farmers, which contributes to saving forests and increasing crop yields.

As one can see, a mining company can contribute to a host country in more ways than just through taxes. The environmental consciousness displayed by the company is mostly due to the fact that the people in charge would like to keep cycling in pristine environments...which may not be the best motive, but still brings about great results. Sport can be more than just fitness! Except golf - that's a hobby...



Air pollution does have its moments



HOW DARE YOU? IT'S NOT A PREDICTION, IT'S HAPPENING!

GUEST WRITER SUBMISSION

Monday, 7 October 2019: Church Square, Cape Town

The present-day global warming trend is of particular importance, as most of it is the consequence of anthropogenic activity since the mid-20th century. This global warming trend has also been continuing at an exceptional rate, over decades to millennia. A global rebellion for criminal inaction on the ecological crisis has been declared. We are facing an extraordinary global emergency.

On Monday, 7 October 2019, Extinction Rebellion initiated another climate strike in the City of Cape Town, and a few Earth Science climate activist from Stellenbosch University joined. Extinction Rebellion is an action driven, non-violent, global movement, which aims to achieve alarming governmental action through civil disobedience. For the sake of our own, humankind needs each and every individual to stand with us in this combat for the endurance of human civilisation in an efficient way. The fight for our existence can be won, but it has to start TODAY! It is our dedicated obligation to rebel for the redemption of our species and the environment on which it is reliant.

We call on one and all, young or old, irrespective of your political principles, to join the fight for the survival of our societies and life on Earth...the fight for our children and their

right to breathe! Let us form a world that is suitable for generations to come by fashioning a nation that is healthy, spirited and adjustable, and completely in connection with the Earth. We must withdraw from our comfort zones and take action for amendment. We live in a deadly system, but no one individual is liable.

Acting with honesty and consideration results in positivity, and in the end we will realise what we have done for the amenity of life. We trust that we should inform others about what is approaching us and would like to see the changes happen required to guarantee survival for upcoming generations. We will not silently be led to extinction by the leaders and legislators. We will challenge the state of affairs with righteousness, spirit and harmony. Let's make the world Greta again?

"People tell me I should study and become a climate scientist so I can solve the climate crisis. But the climate crisis has already been solved. We already have all the facts and solutions. All we have to do is to wake up and change." – Greta Thunberg

MARIGE CARSTENS, 13 October 2019



Photos provided by Francois Burger

Geology students and lecturers settling their differences on the paintball field





Undergrad Earth Science class of 2019



POSTGRADUATE REPRESENTATIVES

The time had come to choose a new postgraduate representative for the upcoming year, and Earth Science is lucky to not only have one, but two representatives. Tanisha and Tahnee will both be representing Earth Sciences on the postgraduate committee. More importantly, they will be representing the postgrad students of the department. Part of their function is to (i) provide representation for postgrad students, (ii) maintain and advance the welfare of all postgrad students, (iii) promote the principle of equality of all postgrad students, and (iv) to provide a democratic and transparent forum in which postgraduate students' affairs and interests can be governed. A formal email will be sent out to the postgraduates with more specific details.

You can contact

Tahnee at tahneeotto@sun.ac.za or

Tanisha at 18191010@sun.ac.za if you have any queries/problems at this stage.

Want to get involved?

The Geode is created by us, for us, so we gladly welcome anyone wanting to be involved in whatever way. If you would like to join the team / feature as a guest writer / showcase some field photos, or even just have ideas or suggestions on how we can improve, feel free to contact Tahnee at tahneeotto@sun.ac.za or Bianca at 19870493@sun.ac.za

THE GEODE

TEAM

Meet the gems behind The Geode. Here are their responses to the question: ***"What life lesson did 2019 teach you?"***



TAHNEE OTTO
EDITOR IN CHIEF

"Mental health is super important during your studies. It can make or break you, so do what you need to, to stay sane."



BIANCA OOSTHUIZEN
EDITOR, LAYOUT & DESIGN

"You need very little to be happy."



TANISHA SCHULTZ

"It's okay to say 'no'."



FRANCOIS BURGER

"I don't even know what I don't know."



LIAM QUINLAN

"Do what you can with the time that you have."