

Event Review

SwissCham – Luncheon

22nd of June 2011, held at the Johannesburg Country Club
In Woodmead

Speaker: Prof. Raymond J. Durrheim

Geophysicist, Professor at CSIR, Principal Researcher -
CSIR Centre of Mining Innovation

Professor Ray J. Durrheim, Geophysicist,
Professor at SCIR, Principal Researcher – CSIR
Centre of Mining Innovation, Chair of the Global
Earthquake Model Programme (Sub-Sahara),
Director of AfricaArray,

SwissCham President Dr. Jürg A.Schalch
welcomed some 40 guests who had come to
hear prof. Durrheim's message on the topic:

“Africa: a deep History”.

A special welcome the President extended to the
Chargé D'Affair i.a. of the Swiss Embassy in
Pretoria, Mr. Heinrich Maurer.



Professor Ray J. Durrheim, Geophysicist

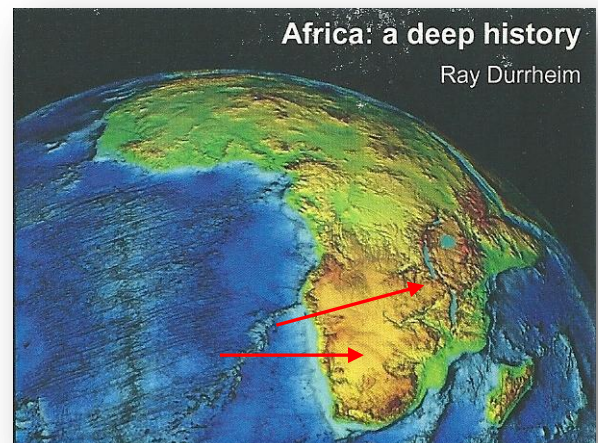


Dr. Jürg A. Schalch, SwissCham President

Professor Durrheim took us onto a journey through Africa's deep history, describing its fiery origins, the creation of its gold, platinum, diamond and hydrocarbon deposits and the emergence of humankind, concluding by discussing some of the challenges that face us today - how to live with earthquakes and volcanoes, and how to exploit our natural resources without compromising future generations (e.g. acid mine drainage).

Truth has many facets. Myths and stories tell us, help us work out where we come from, why we are here, where we are going to, Durrheim said.

Using our imagination as we look at our continent stripped bare, bumpy and cracked, perhaps it does resemble the scarred shell of a tortoise. The elevated hump in south and east Africa is known as the "African Superswell", Its origin has been the source of much debate. Also note the water-filled gashes of Lake Tanganyika and Malawi. The East African Rift, a classic example of a continental rift.



The scientific method is a reliable way of discovering how the mysteries of nature, while engineering is craft of harnessing natural materials and forces to mitigate risks and meet our needs.

We know that the Japanese earthquake and tsunami was caused by a sudden movement in the Earth's crust beneath the Pacific Ocean. The Japanese are the world leaders in earthquake and science and engineering. Consequently the effects, while serious, are not as catastrophic as they would have been had an event of this magnitude struck a country that was not as well-prepared.

We know where earthquakes (and their close cousins, tsunami's) are likely to occur. Fortunately the interior of Africa is remote from the regions of intense seismic activity, earthquakes therefore are quite rare in South Africa, apart from the districts where we made them through our deep mining. Nevertheless, earthquakes could pose a risk if they cause the failure of structures such as large dams and nuclear power plants.



Earthquakes are a perfectly natural phenomena. Just as temperature differences between the equator and poles drive movements of air, the hot core of the Earth drives slow convective motions in the Earth's interior. The theory of plate tectonics, developed in the 1970s, explains most (but not all) geological phenomena. That is the nature of the scientific method. No theory is ever regarded as an ultimate truth. New theories that provide an explanation of more

Phenomena are continually being developed. Seismology happens to be Prof. Durrheim's particular discipline. It deals with vibrations of the Earth caused by both natural phenomena and man-made sources. We seek to understand the cause of earthquakes and mitigate their effects, and also use the waves to image the interior of the Earth. Seismologists use a wide variety of methods. Essentially they all rely on

measurements of the speed with which seismic waves travel through the Earth, and the rate at which the energy is absorbed. The waves are reflected and refracted as the properties of the rocks change.

Seismic methods have much in common with medical imaging technologies such as sonar- scans and CAT -scans, our "patient" is just that much bigger. Note a feature of particular interest in the deep mantle beneath southern Africa. It is a region where the seismic velocity is significantly slower than elsewhere. This feature has been dubbed the "African Superplume". A slower velocity could indicate a different rock type, or a higher temperature. The spatial coincidence with the "African Superplume" and the "East Africa Rift System", and the idea of a genetic relationship naturally arises.

Seismological research started just over a century ago in South Africa, prompted by mining-related tremors that alarmed residents of early-Johannesburg, and posed a risk to mine workers. The first official investigation was convened in 1908, and as a result two seismographs were deployed in 1910. Tremors continued to occur as mines got deeper. In 1976 a mining-related tremor caused a block of flats in Welkom to collapse.



South Africa is blessed with an extraordinary endowment of mineral resources: diamonds, gold, coal, platinum, copper, manganese and iron. Once an ore body is discovered and capital is raised, we begin the business of sinking a shaft and mining the ore.

Our gold mines are the deepest mines in the world, by far. The mining of these ore bodies have posed particular challenges. One of these challenges is mining-induced seismicity, a major risk of deep-level mining. However, there is a positive side too. Our deep mines are unique "earthquake laboratories" in which we can study the nucleation and rupture of the rock at close range.

AfricaArray launched in 2005, a project with the goal of doing fundamental and applied earth science in Africa, and building capacity and institutions, Prof. Durrheim being one of the directors. Their permanent "backbone" network is comprised of about 40 seismic stations, now equipping 24 of these stations with cGPS and met packs, enabling to start work in the fields of hydrology, atmospheric science, climate change and space weather.

Of course, seismicity is not the only hazard of deep mining. As mines are worked out and allowed to flood, seismicity is induced. A more severe threat is posed by acid mine drainage (AMD), and occurs when old mine shafts and tunnels fill up, leading to underground water oxidizing with the sulphide mineral iron pyrite, otherwise known as "fool's gold". The release to the environment of mining waste can not only result in localised flooding in low-lying areas, but also in profound, generally irreversible destruction of ecosystems. This is a clear contemporary example of the costs of mining are being transferred to the next generation. We have to learn from this, and not leave nasty surprises for our children and grandchildren, be it ground water polluted by fracking, or regions sterilized by nuclear waste.

The Earth has seen many changes in climate and the extinction of many species. The difference is that we are not ignorant helpless creatures, but we have a measure of knowledge and some ability to alter our environment for good.

Ray Durrheim concluded his address with the following story:

It is said that there were four angels who witnessed God creating the world.

The first One said, "How do you do you do this?"

And the second one said, "What's it for?"

The third one said "How much is this costing you?"

And the fourth one - well, we'll come to the fourth one later.

Now the first one who asked "how do you do this", he became the scientist.

And the one who said "what's it for" became the philosopher or theologian.

And the angel who asked about the cost, that one became the economist.

Now the fourth angel applauded! That one became the worshipper.

“Surely we should applaud as we contemplate the awesome majesty of nature. But we cannot be passive spectators. We now know that our collective actions are affecting the Earth for worse and jeopardising the ability of our children to meet their needs. We need to use our knowledge, ingenuity and goodwill as scientists, economists, philosophers to plot a new course and cradle the Earth in our hand”, so his closing words.





Daniela Maurer for
SwissCham Southern Africa-
South Africa Chapter