Welcome!

Welcome to the first edition of the AfricaArray newsletter. AfricaArray was officially launched in January 2005 with a first cohort of geophysics honors students at the University of the Witwatersrand. Through the efforts of many within the community AfricaArray has, in just eighteen months, achieved international recognition as a promising new initiative supporting capacity building for Africa’s natural resources sector. In this newsletter, we highlight some of the educational and research activities that have helped to established AfricaArray’s reputation as a successful grass roots organization, and describe a number of other activities that are in various stages of planning.

Over the past few years, we have had many opportunities to share our vision for AfricaArray with members of the African geoscience community. What started as a simple idea that resulted from a meeting between us in October 2003, expanded through a white paper and a series of workshops in 2004 to become a full-fledged initiative for, in the first instance, improving geophysics education and research in Africa, but more broadly for supporting capacity building for Africa’s natural resources sector. The achievements of AfricaArray reflect the energy, dedication and unselfishness of many within the African geoscience community who want to help build, and be part of, an African organization supporting world-class education and research. We thank all of you who, through much hard work, have made AfricaArray come to life.

We look forward to many more issues of this newsletter in the future containing reports about exciting educational achievements, important science discoveries, and new partnerships.

Andy Nyblade and Paul Dirks,
Co-Directors, AfricaArray
AfricaArray Seismic Network

In order to build science infrastructure, support the science community, and generate data sets for student research projects, AfricaArray has over the past eighteen months established a “backbone” network of permanent broadband seismic stations for recording earthquakes across eastern and southern Africa. The network includes 18 stations as of July 2006. An additional 6 stations are scheduled for installation by the end of 2006, and another five to ten stations will be installed in 2007.

The network has grown rapidly because of strong support from partner organizations in many countries that have provided access to existing infrastructure. In some cases, data from operational stations have been provided to AfricaArray. In other cases, access to existing vaults and some functional equipment has been provided. And in a few cases new stations have been built from scratch. It is anticipated that over the next few years the network will expand into many more countries, especially in central and western Africa. Substantial support for building the network has come from the Incorporated Research Institutions for Seismology (IRIS). IRIS has provided AfricaArray with many refurbished ReffTek data loggers for use in the network.

The map below shows the current and projected distribution of AfricaArray broadband stations that will be operational by December 2007. The eleven stations in South Africa belong to the South Africa National Seismic Network, and the next article in this newsletter describes significant upgrades to these stations that are nearing completion. The feature box on the next page shows a collage of photos and data from the AfricaArray station in Itezhi-tezhi (TEZI), Zambia that was installed in January 2006.
An example of an AfricaArray seismic station at Itezhi-Tezhi, Zambia, and data from the magnitude 7.0 Mozambique earthquake, 22 February 2006

Photo showing the seismic vault at station TEZI.

Fault scarp from the magnitude 7.0 Mozambique earthquake of 22 February, 2006 showing 1-2 meters of offset. (Courtesy of M. Mustafa, INAM, Maputo, Mozambique.)

Photo from inside the TEZI station showing the concrete pier, data logger and broadband seismometer (covered with foam insulation)

Vertical Ground Displacement Mozambique Earthquake 22 February, 2006 Magnitude 7.0 Station TEZI, Zambia Distance: 981 km

Map showing the location of station TEZI in Zambia and the epicenter of the magnitude 7.0 earthquake on 22 February 2006 in southern Mozambique. The epicenter location is shown with a “beachball” focal mechanism indicating that a normal fault ruptured during this earthquake.
The South Africa National Seismic Network (SANSN) is operated by the Council for Geoscience (CGS) and includes many broadband and short period stations. The CGS is providing data to AfricaArray from eleven broadband stations, which constitutes a very substantial commitment to AfricaArray on the part of the CGS. The locations of the stations are shown on the map below (yellow and blue circles). In addition to broadband sensors, these stations are equipped with EARS data loggers (built by the CGS) and a 24 bit digitizers.

During the later half of 2005, the CGS undertook a study at their Silverton (Pretoria) station to evaluate the possibility for using the SEISCOMP recording system (developed by GFZ- Potsdam) for recording in SEED format, and for using cellular communication systems for retrieving data in quasi real-time. The results of the study were promising, and in 2006 the CGS initiated a programme to install the SEISCOMP software and GPRS Cellular communication at all the SANSN stations. So far, the AfricaArray stations shown with yellow symbols on the map have been successfully upgraded.
Jane Gore is from Harare, Zimbabwe, where she is a lecturer in the Physics Department at the University of Zimbabwe. Jane began her postdoc in late 2005 by visiting Wits and early 2006 by visiting Penn State. During the first year of her programme, Jane is working on publishing two papers from her Ph.D. thesis on the crustal and uppermost mantle structure of the Zimbabwe Craton and Limpopo Belt using data from the Kaapvaal Seismic Project. In subsequent years, Jane will spend time at Wits initiating new research projects and in Zimbabwe setting up AfricaArray seismic stations, allowing her to better image the structure of the Zimbabwe Craton. Jane holds BSc (Hons) and Ph.D. degrees from the University of Zimbabwe.

AfricaArray mine seismic network in South Africa

Through funding from the U.S. Department of Energy, a network of five broadband seismic stations will be built in early 2007 around the deep gold mines in the Carletonville district. Data from the network will be combined with in-mine seismic data as well as data from other AfricaArray stations to study the source properties of mining-related events and how seismic energy propagates at regional distances (200-1000 km). Partners in this project include the Council for Scientific and Industrial Research, the Council for Geoscience, Wits, Penn State, Lawrence Livermore National Lab (US), and Anglo Gold Ashanti.

AfricaArray geoscience eLearning project

A five year AfricaArray programme is being planned to develop a complete open access undergraduate geoscience eLearning package focused on African geology and tectonics, which will be made available via a dual program of CD-ROM delivery and on-line access. The on-line delivery of the materials may be in association with formal on-line training partners, and will commence with a course in geophysics. The materials will be initially developed by an AfricaArray team, but will then, in association with local African partners, be extended to support regional languages and geological contexts. Mark Jessell at the Institute de Recherche pour le Développement (Toulouse, France) is leading this effort, and anyone interested in participating should contact him (mjessell@lmtg.obs-mip.fr)

AfricaArray oil and gas courses

With the assistance from TOTAL, the Total Professeurs Association (a group of retired oil industry professionals and former employees of TOTAL) has agreed to provide specialist geoscience courses in oil and gas exploration, to supplement the Honours training programmes in Geology and Geophysics at Wits. This initiative will commence in September 2006 with a 2-week course in 3-D seismic surveys and reservoir characterization and a 2-day course in well log analysis. We hope to expand the course offerings in future years.

First Research Associates

In 2006, the first AfricaArray research associates began at Wits sponsored by Schlumberger’s Faculty for the Future Programme.

Jane Gore is from Harare, Zimbabwe, where she is a lecturer in the Physics Department at the University of Zimbabwe. Jane began her postdoc in late 2005 by visiting Wits and early 2006 by visiting Penn State. During the first year of her programme, Jane is working on publishing two papers from her Ph.D. thesis on the crustal and uppermost mantle structure of the Zimbabwe Craton and Limpopo Belt using data from the Kaapvaal Seismic Project. In subsequent years, Jane will spend time at Wits initiating new research projects and in Zimbabwe setting up AfricaArray seismic stations, allowing her to better image the structure of the Zimbabwe Craton. Jane holds BSc (Hons) and Ph.D. degrees from the University of Zimbabwe.

Lindsay Linzer is from Johannesburg, South Africa where she works for the Council for Scientific and Industrial Research (CSIR) in the area of mining seismology and mine safety. Lindsay is focusing on broadening her background in reflection seismology, global seismology and oil and gas geology by taking courses in these topics at Penn State University (2006, 2007). After completing her programme, Lindsay hopes to teach courses in these areas at Wits, thereby expanding the course offerings at Wits to include seismology topics relevant to oil, gas, and mineral exploration. Lindsay will also be working on publishing a number of papers on mine seismicity. Lindsay holds BSc (Hons) and Ph.D. degrees from Wits.
Eldridge Kagswane is from Pretoria, South Africa, where he works for the Council for Geoscience. He started his Ph.D. in August 2005 in the AfricaArray sandwich program, with co-supervisors Prof. Gordon Cooper at Wits and Prof. Steve Grand at the University of Texas - Austin. The primary focus of his Ph.D. research is to image the S velocity structure of the mantle beneath southern Africa by inverting seismic waves recorded at regional distances, and through tomographically inverting travel times from teleseismic S body waves.

Martin Brandt is from Pretoria, South Africa where he works for the Council for Geoscience. He started his Ph.D. program in Seismology at the University of the Witwatersrand (Wits), Johannesburg in January 2006. He obtained a BSc (Hons) in Geophysics (1992) from the University of Pretoria and completed an MSc (2000) at the University of Bergen, Norway. He is pursuing his Ph.D. part time through the AfricaArray sandwich program, with co-supervisors Prof. Paul Dirks at Wits and Prof. Andy Nyblade at Penn State University. Eldridge spent four months at Penn State in 2005 to get started on the first part of his thesis project, which entails jointly inverting surface wave group velocity measurements and receiver functions for lithospheric structure beneath southern Africa. Eldridge obtained BSc (Hons) and MSc degrees in Geophysics from Wits (1999, 2001).

New Students

A number of other AfricaArray students have begun or will soon begin in the post-graduate degree programs at Wits and Penn State. They include:

- Stephanie Scheiber started her M.Sc. at Wits in January 2006;
- Michelle Smith, Council for Geoscience, started her M.Sc. at Wits in March 2006;
- Mayshree Bejaichund, Council for Geoscience, started her M.Sc. at Wits in March 2006;
- Mark Jeoffreys started his Ph.D. at Wits in June 2006;
- Aubreya Adams started her Ph.D. at Penn State in 2004 and joined the AfricaArray team in September 2005;
- Angela Larson started her Ph.D. at Penn State in 2004 and joined the AfricaArray team in January 2006;
- Fred Tugume, Geological Survey and Mines Department, Uganda, will start his postgraduate studies at Penn State in August 2006; and
- Gabriel David, University of Dar es Salaam, Tanzania, will start his postgraduate studies at Penn State in August 2006.

In addition, Wits enrolled twelve students in the 2006 Geophysics Honours programme, who hail from no less than six countries (DRC, Namibia, South Africa, Uganda, Zambia and Zimbabwe).

First Postgraduate Students

Focus on Staff

AfricaArray Engineer at the Council for Geoscience

In late 2005, Gerhard van Aswegen began work at the Council for Geoscience as the AfricaArray engineer responsible for helping to develop and maintain the AfricaArray backbone seismic network. His position is funded jointly by the Council for Geoscience and by a grant from the U.S. National Science Foundation (NSF). The NSF funding also supports travel costs for Gerhard to visit partner countries and to ship spare equipment to partner countries for station maintenance. Gerhard has so far helped to install AfricaArray stations in Mozambique and Malawi, and will soon be traveling to Zambia.

AfricaArray Administrative Assistant at Wits

Verity Lloyd joined the AfricaArray team in early 2006 to take charge of the growing administrative responsibilities with AfricaArray. Verity has a wealth of experience to draw upon, having worked previously as events organizer and public relations officer for the Sun City resort looking after the likes of Elton John, Frank Sinatra and George Benson. She loves to travel, loves geology, and aspires to compliment her arts degree with a degree in the sciences.
AfricaArray has begun an annual field geophysics course run through the University of the Witwatersrand. Currently this course is part of the geophysics honours programme at Wits, and it has been opened to a number of U.S. students from historically black colleges in the U.S. In future we hope to include a limited number of additional participants from African institutions and organizations seeking to upgrade the training of students or employees in field techniques.

The 2006 field program was run during the last week of June and first two weeks of July, and was hosted at Modikwa platinum mine in the eastern Bushveld Complex. Modikwa Platinum Mine is a joint venture between African Rainbow Minerals and Anglo Platinum, and these companies have generously made resources available in support of the field course.

Prior to the field work, students spent time at Wits planning individual surveys and working out the commercial cost of each survey. The field school concentrated on collecting data in a mineralized region affected by faults and at least two generations of dolerite dykes. During seven days in the field, the students collected magnetic, gravity, differential GPS, resistivity and seismic refraction data. This was supplemented by a visit to a core shed to illustrate the variation in physical properties between rock types (density and magnetic susceptibility) and geologically log some of the core. After returning to Wits, the students continued to process, integrate and interpret the data sets, and compile their findings into a report.

Twelve students from Wits, four students from North Carolina A&T University (U.S.) and one student from Fort Valley State University (U.S.) participated in the course, taught by Sue Webb and Mike Jones from Wits, and Andy Nyblade and Audrey Huerta from Penn State, who were ably assisted by a group of Wits post-grad students.

Model for AfricaArray

Funding: How It Works

Funding for AfricaArray has grown through a leveraging process, whereby existing resources (mainly in-kind from African institutions) have been used effectively to secure new funding from public and private funding sources in Africa, Europe and the USA. Leveraging works by using support from a host institution to “seed” a new project and write a competitive proposal seeking additional funding for that project. It is through this process that AfricaArray has so far been successful in fund raising and will most likely continue to be successful in the future.

As a grass roots initiative to support education and research, AfricaArray cannot be sustained without buy-in and support from institutions and government agencies across Africa. Your support in identifying projects and linking them to funding opportunities is vital in growing AfricaArray, especially because many funding opportunities are country-specific and may not be known to outsiders. Existing AfricaArray resources may be of assistance to leverage support for starting a new project.

If you have a project that you would like to initiate as part of AfricaArray, then please contact the AfricaArray co-directors. New projects must fulfill the general aims of the AfricaArray programme and will have a better chance to succeed if you can:

1. Gain access to resources from your institution to support and/or seed the project; and
2. Identify a funding opportunity.
Above left photo shows students at work doing a resistivity survey along one of the grid lines in the target area.

Above right photo shows Andy Nyblade explaining the processing techniques involved in a seismic refraction survey.

Left photo shows students at work doing a magnetic survey along one of the grid lines in the target area.

Right photos show accommodations in the field (top) and one of the students getting ready to take a gravity reading (bottom).

We thank the following sponsors for their generous support:

**Government Agencies:**
- Council for Scientific and Industrial Research (South Africa)
- Department of Energy (USA)
- National Research Foundation (South Africa)
- National Science Foundation (USA)
- Royal Museum for Central Africa (Belgium)

**Companies:**
- African Rainbow Minerals
- Anglo Gold Ashanti
- Anglo Platinum
- BHP Billiton
- BP
- De Beers
- ExxonMobil
- Great Northern
- London Bullion Market Association
- Mineral Education Trust Fund (South Africa)
- Schlumberger
- TOTAL