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AfricaArray seismological studies of the structure and evolution of the African continent

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The AfricaArray programme was launched in 2005 to conduct research that promotes development in Africa by building human and infrastructural capacity in support of the mineral exploration, mining, geohazard and environmental sectors. The AfricaArray "backbone" network now consists of 51 geophysical observatories in 20 sub-Saharan countries. Most stations are equipped with broadband seismometers, while 25 stations have continuous GPS sensors and 22 stations have meteorological packs. In addition, several temporary seismic arrays have been deployed to investigate the seismotectonics of the East African Rift System, the extent of the Congo craton, and the rifting of Mozambique and Madagascar.

In this paper we will present results pertinent to large-scale crustal and mantle geodynamic processes that have been obtained by AfricaArray researchers. Brandt and Mulibo elucidated the relationship between the African Superplume, Superswell and the East African Rift System by studying the seismic velocity structure of the mantle. Kgaswane jointly inverted P-wave receiver functions (PRFs) and surface waves, and found that the Kalahari Craton lower crust is largely mafic, except for a few terrains such as the Kimberley. Kgaswane also produced evidence that supports a link between the eastern and western lobes of the Bushveld Complex. Mangongolo used surface wave tomography to define the south-western boundary of the Congo Craton. El Tahir used PRFs to investigate the crustal structure of the Khartoum Basin, while Tugume determined the Moho depths and Poisson's ratios of the Precambrian crust in East Africa. Manzi reprocessed 3D reflection seismic data covering part of the Witwatersrand goldfields using seismic attribute analysis methods, and has provided new constraints on the evolution of the Basin during the Neoarchean. Loots interpreted a 105 km 2D seismic reflection profile immediately to the north of the Cape Fold Belt, imaging the Karoo and Cape Supergroup rocks and the seismic fabric of the basement. A zone of strong reflectors was found beneath the 1000 km linear Beattie Magnetic Anomaly. As more stations are deployed and data are accumulated and interpreted, an increasingly comprehensive picture of the structure and evolution of sub-Saharan Africa is emerging.