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The aftershock sequence of the 5th August 2014 Orkney earthquake

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On 5 August 2014 at 12:22 hours (local time), an earthquake of local magnitude $M_l = 5.5$ occurred in the Orkney area in the North West province, South Africa. The event had a depth of 4.7 km and showed strike slip faulting which is different from normal faulting observed for the shallow (about 2 km) mining events in the Wits basin. This earthquake is the largest recorded to date around the mining regions of South Africa. More than 1000 aftershocks were recorded within a month. The events were relocated using the double difference method to delineate the source of the events. A north-south trend of seismicity was revealed by the relocated events, with a diffuse cluster to the north of the main event. A depth profile shows two clusters, one at a depth of about 2 km to the north of the main event and the other at depth between 3 and 6 km south of the main shock. Aftershock temporal analysis showed a p value of 0.76, which was attributed to the complexity of the faulting system and high stress field in the area. Focal mechanism solutions determined from 18 aftershocks also show the complexity of the area. Stress inversion analysis results from the focal mechanism solutions show that an extensional stress field is predominant in the region. It is possible, that the main event occurred on a fault outside the mining horizon and reactivated faults located within the shallower mining horizons, especially in the northern diffuse cluster. These results suggest that the area has a complex heterogeneous faulting structure as indicated by low p value and complex focal mechanism solutions.

