USING SEISMIC REFLECTION TO INVESTIGATE THE CRUST IN THE SOUTHERN KAROO

L. Loots1, 2, R. J. Durrheim2, 3 and T. Ryberg4

1. CGS, lloots@geoscience.org.za 2. University of the Witwatersrand 3. CSIR, rdurrhei@csir.co.za 4. GFZ Potsdam, trond@gfz-potsdam.de

BACKGROUND

This seismic reflection data was acquired as part of the National Geophysics Program in 1992. The line is 100.5 km long and runs from Beaufort West in the north to Droëkloof in the south. It also extends over the Beattie Magnetic Anomaly (BMA), part of the Southern Cape Conductive Belt (SCCB), the Karoo Supergroup and the Cape Fold Belt (CFB).

The objectives of this research is to generate a subsurface image of the crust and to investigate the seismic character of the crust and BMA in this region. We also aim to better understand the tectonic evolution of this area.

ACQUISITION & PROCESSING

Figure 1: Satellite image of the southern Cape/Karoo indicating the location of the seismic reflection line and boreholes in the vicinity.

Figure 2: Localities of the seismic lines that were conducted under the National Geophysics Program and the CGS.

INTERPRETATION & DISCUSSION

Figure 3: Regional aeromagnetic map indicating the BMA (white dots), SCCB (black dashed lines) and the seismic reflection line (yellow).

Figure 4: Surface geology of the seismic reflection line and surrounding area.

Figure 5: Smoothed velocity model used for NMO correction.

Figure 6: Shot 600 with no corrections applied. You can see the strong p- and s-waves that suppress reflectors. A passing vehicle also created noise in the shot.

Figure 7: Shot 600 that was processed in the conventional way. Strong shallow reflectors can now be seen as noise has been muted and p- and s-waves suppressed.

Figure 8: Final migrated seismic reflection section.

Figure 9: Migrated section showing the general interpretation of the upper part of the crust.

Figure 10: Source for the BMA that lies in the NNMB basement.

Figure 11: MT data showing a highly conductive zone, below the BMA surface print at a depth that correlates with the seismic interpretation of the source for the BMA (from Weckmann et al., 2007).

Figure 12 & 13 show that in the south of the profile the general dip is to the north and in the north of the profile, the general dip is to the south. This may indicate that the basement is divided into 2 parts in this section.

Figure 14: Interpretation of part of the upper crust and the correlation with available borehole data.

The main stratigraphic units that comprise the upper crust is the Karoo and the Cape Supergroups. The distinct seismic signal of the Whitehill Formation can be traced throughout this seismic section. The lower crust is interpreted to be rocks of the Bushmanland Terrane that is part of the NNMB, but further interpretation is needed to establish if the basement can be divided into two parts.