

Paper Number: 3030

An investigation of key seismic attribute analysis of the Whitehill Formation in the Karoo Basin

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The investigation of key seismic attributes of the Whitehill formation in the Karoo Basin utilising the historic seismic profiles housed at the Council for Geoscience (CGS). This seismic data is 50 years old and most of the data has degraded over time as they were stored as paper records at the CGS head office in Pretoria [1]. The data was scanned and digitised by Falcon Oil and Gas from paper records, which makes re-processing of the data not an option with the time, effort and money that would be required [2]. The purpose of this research is to utilise these historic seismic profiles to estimate the depth and potential of for shale gas in the shales of the Whitehill formation applying key seismic attribute analysis. Ninety nine seismic lines were selected for this study in the south western part of the Karoo Basin (see Figure 1).

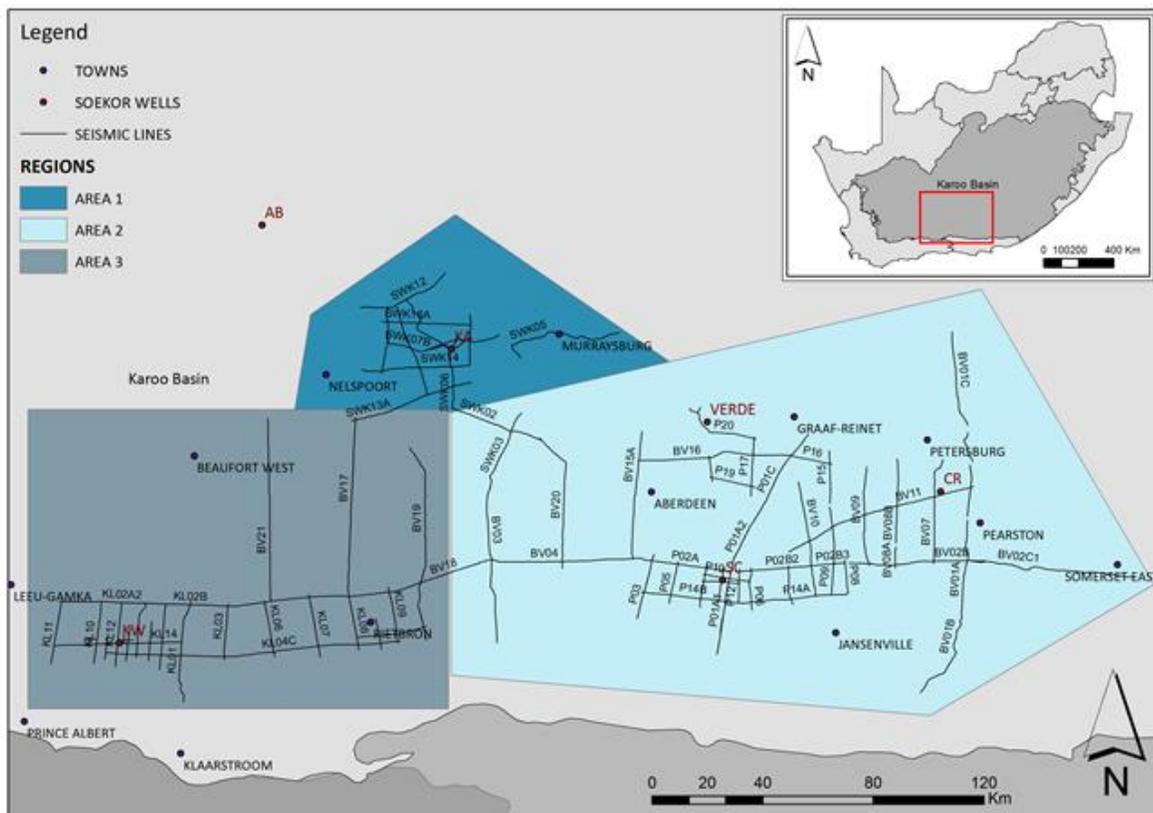


Figure 1: Study area and selected seismic lines interpreted in the south west part of the Karoo Basin

The scanned paper records can and have been used to identify the top of the Whitehill formation, which is the most distinct reflector though out the data. This has been used to create depth and time variation

maps (see Figure 2), horizon velocity variation maps and estimate thickness across the Whitehill formation.

It has been noted that due to the lack of velocity logs and sonic logs that a velocity model needed to be created to determine depth conversion:

1. $DEPTH = 2523.6(TWT) - 66.171$
2. $TWT = 0.0004(DEPTH) + 0.0277$

The depth range for the Whitehill estimated was 1200 m (1.2 km) to 4800m (4.8 km).

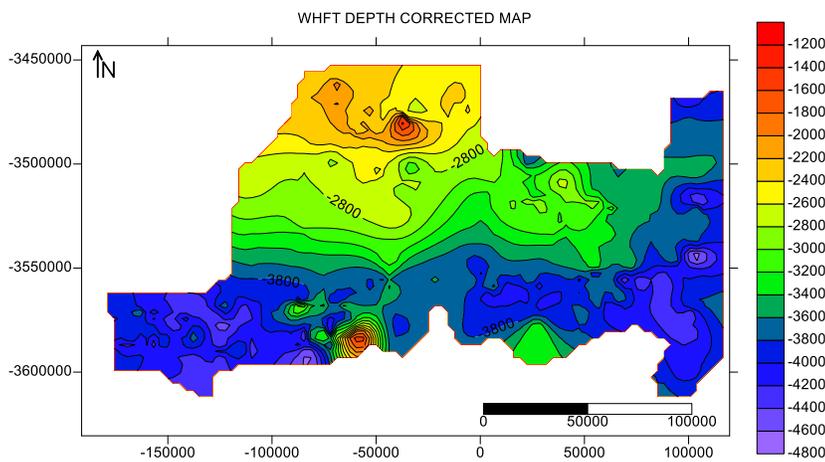
Essentially the data proved acceptable in establishing the topographical shape and depth of the Whitehill but lacked in estimating the thickness. Interpreting the base of the Whitehill proved to be more challenging due to the poor data quality and this was confirmed by Schreiber-Enslin (personal communication 31 Oct 2015) [3].

The Horizon Velocity Analysis yielded results that concluded that with the current data set it could not be used as a hydrocarbon indicator as the lack of velocity data and the less than accurate well to seismic tie data [2].

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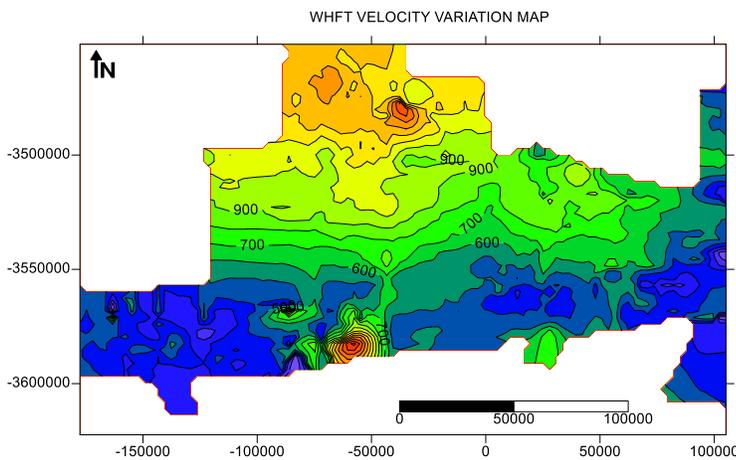
Figure 2: Whitehill Formation Top (WHFT) depth corrected map



The investigation of both Horizon Velocity Variation and Amplitude Variation produced inconclusive results in order to be hydrocarbon indicators and this is purely due to the poor data quality.

However, more research and data acquisition need to be done in order to conclusively ascertain whether it truly is economical. The lack of good resolution seismic data and geophysical and petrophysical logs for boreholes has made it considerably difficult to answer the notorious question of whether shale gas exploration in the Karoo is something to be considered or not.

Figure 3: Whitehill Formation Top velocity variation map



velocity variation map

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