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A study of the heavy mineral suite of the sandstones of the Ecca Group of the Karoo Supergroup

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The Karoo Supergroup comprises successions of sedimentary and volcanic rocks spread across southern Africa. In neighbouring South Africa and Namibia these rocks are well exposed and the lithostratigraphy is well constrained by the fossil record, whereas in Botswana the succession is largely covered by the Kalahari sands. Analysis of detrital minerals using SEM techniques has proven very useful in determining provenance. Here we present the preliminary conclusions of a study of the heavy mineral suite of the sandstones of the Ecca Group of the Karoo Supergroup using .SEM – EDAX along with standard SEM microscopy to investigate the provenance and comment on the likely source rock. Samples were taken from a borehole (10181C, Kang, Central Botswana) and the heavy mineral fraction was separated using standard preparation techniques; analyses were conducted on a Philips XL30 ESEM equipped with an EDAX EDS system.

SEM-EDAX results show a progression in garnet composition down hole to include more pyrope rich garnets, which is indicative of derivation from a sediment source evolving from a region of higher to lower grade metamorphism. There are also some more grossular garnets present, potentially indicating a minor igneous component. Grain morphology was noted to remain similar regardless of grain size. Garnets here are quite broken indicating relatively short transport path/time, however some show rounding which may be due to dissolution.

Examination of larger grains using SEM indicated that many were not monomineralic and in fact formed a type of breccia. These breccias comprise a range of minerals including rutile and staurolite. Some of the material appears to be a titanian pyrope (garnet), this is significant as these types of garnet are particularly associated with kimberlites, suggesting that these very high grade metamorphic rocks are a potential source for the sediment. Detrital feldspars overgrown with barite were also noted. The barites are particularly associated with the feldspars and do not form a cement within the sandstone. This suggests that at least some of the detritus resided in an evaporitic type environment for some time before being broken up and deposited in its final resting place. Consideration of just some of the detrital particles found here indicates that not only is the source of detritus interesting with some unusual components, but that by examining individual detrital grains we can suggest intermediate steps in the transport history of the detritus