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Detrital zircon age population study from rocks of the Karoo Supergroup, Eastern Cape Province of South Africa

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The provenance areas to most of the stratigraphic units of the Karoo Supergroup in the Main Karoo Basin of South Africa are poorly understood and require investigation. This research involved a U-Pb detrital age population study on the full stratigraphic succession of the Karoo Supergroup in the eastern most part of the Main Karoo Basin. Detrital zircon age data were extracted from seven rock samples collected from each of the main stratigraphic units of the Karoo Supergroup, as well as a sample representing the underlying Devonian Msikaba Formation. In order to better constrain the provenance areas of each sedimentary unit, a total of some 900 zircon grains were analyzed by LA-ICPMS. On average, 77 percent of the grains yielded ages that were more than 90 percent concordant. The newly extracted detrital zircon age population data, along with other published scientific data, were used to propose likely source areas of the sedimentary detritus of the Karoo succession in the eastern part of the basin.

Given the similarities observed between the detrital zircon population data from the Msikaba- and Dwyka Formations, as well as the south-westerly directed palaeocurrent and palaeo-ice flow directions [1,2], it became apparent that these two formations share similar source regions. The ages of the zircon grains reflect provenance from rocks of the Late Mesoproterozoic to Lower Devonian periods. The Neoproterozoic Mozambique Belt of East Africa and its age equivalents in Antarctica are identified as possible source regions. Mudrocks of the Ecca Group yielded no zircon grains, however detrital zircon population data collected from samples of the Beaufort Group show remarkable differences when compared to those of the Msikaba- and Dwyka Formations. The most striking difference between the samples was the sudden influx of much younger detrital zircon grains (±305Ma to ±203Ma), which are similar to those of the Ecca Group described by Vorster [3]. The Gondwanide Orogeny, which was situated south of the Main Karoo Basin at the time of deposition of the Beaufort Group [3], is proposed as the primary provenance area.

Detrital zircon populations in the samples representing the Molteno- and Elliot Formations resemble those obtained from the Beaufort Group, however there are clear differences in the relative abundances of the zircon populations. The youngest zircon population that is the most dominant population in the Beaufort Group makes up the least abundant population in the samples from the Molteno- and Elliot Formations, implying that tectonic activity and uplift in the Gondwanide Belt had started to subside. Furthermore the presence of detrital zircon grains of Early Jurassic Age (±180Ma) in the Molteno Formation suggests an additional source region became available. This source may have been presented by volcanic activity related to the development of the Karoo Igneous Province [4]. A detrital zircon grain with an age of ±166Ma collected from the Clarens Formation further imply that the deposition of the Clarens Formation must have been coeval with the extrusion and intrusion of rocks associated with the Karoo Igneous Province. The rocks of the Cape Supergroup are the major source areas to the Molteno- and Elliot Formations, while the Pan-African Belts are the main provenance areas

to the sedimentary rocks of the Clarens Formation. The data ultimately allows for the development of a tectono-sedimentary model that explains the deposition of the Msikaba Formation and the Karoo Supergroup in the eastern part of South Africa.

References:

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