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Geochemistry and Weathering History of Sandstones from Balfour Formation,Karoo Basin, South Africa: Implications for Provenance and Tectonic Setting

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The study aimed at interpreting the provenance of the Balfour Formation of the Beaufort Group in the southeastern part of the Karoo Basin, South Africa by integrating the geochemical composition and weathering history. There is a major lack of understanding of the Karoo basinal fill in this part of South Africa. Hence, geochemical analysis of the sandstones from the Balfour Formation was carried out to interpret and reconstruct the tectonic setting and post depositional change for the first time.

The sandstones of the Balfour Formation are typically arenitic and arkosic clastic rocks of the Karoo Basin deposited during Late Permian to Early Triassic period. Geochemically, the major and trace element concentrations of the Balfour sandstones reveal relative homogeneity of their source. Chemical characteristics also indicate that these rocks are mature first order sediments derived from igneous and / or meta-igneous rocks of predominantly felsic composition. The sandstone is rich in SiO_2 (average content 71.60%), followed by Al_2O_3 (14.44 %,) and low contents of Fe_2O_3+MgO (1.78%) and TiO_2 (0.44%). Geochemically, the sandstones are classified mainly as litharenites and arkoses. The data plot in the dissected and transitional arc block provenance fields of QFL (quartz-feldspar-lithic fragments) diagram, which suggests an active margin and continental island arc provenance preserving the signature of a recycled provenance. The Chemical Index of Alteration (CIA) value ranging from 62.07 to 66.18% indicates the recycling processes, and shows that the source area has undergone a moderate degree of chemical weathering. The source of the Balfour Formation sediments, therefore, was an uplifted terrane of folded and faulted strata from which had been sourced detritus of sedimentary and metasedimentary origin.

Keyword: Formation, sandstone, geochemistry, Karoo Basin, tectonic setting and provenance.