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Geochemistry and provenance of clastic to chemical metasedimentary rocks, Rosh Pinah area, Southern Namibia

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Whole-rock analyses of clastic metasedimentary rocks of the Rosh Pinah (RP) and Wallekraal Formations of the Port Nolloth Group, eastern Gariep Belt, provide insights into the provenance and depositional history of the early RP rift graben. Compositional data for some 325 samples of unmineralised argillite, feldspathic sandstone, and carbonaceous sandstone show well-defined correlations among major, trace and rare earth elements (n=110) that reflect mixing lines between original quartz-rich and clay-rich precursor sediments. Abundances of ferromagnesian elements, high field strength elements and REE are highest in fine-grained argillites.

The dominant siliciclastic rocks in the Rosh Pinah Mine and northern adjacent area consist of metamorphosed arkoses, subarkoses, wackes and shales, minor (sub-)litharenites as supported by a classification scheme of terrigenous sandstones and shales after Herron (1988). Due to intermediate to low Log (SiO_2/Al_2O_3) values, sediments are regarded as relatively mature, and strongly weathered as shown in their predominantly low log (Fe_2O_3/K_2O) ratios reflecting a feldspar dominance over ferromagnesian minerals.

RP metasediments can be discriminated in their tectonic setting, due to their variability in their TiO_2, Al_2O_3/SiO_2 and Fe_2O_3+MgO contents (Bathia, 1983). Most samples show chemical characteristics of passive continental margin sediments. RP samples can be attributed to a predominantly quartzose sedimentary provenance, distinguished by discriminant functions after Roser and Korsch (1988).

Palaeotectonic settings of Gariep Belt metasediments at RP are evaluated using discriminant diagrams based on data for relatively immobile trace elements and REE (Bhatia and Crook, 1986) in the following way: Immobile trace elements and REE data point towards fractionate I-type granites such as Goidab Massif, Vioolsdrif Granite and De Hoop Subgroup to be source terranes for quartz and feldspar-rich basal rift deposits. Diagrams using La-Th-Sc and Th-Sc-Zr/10 show argillaceous, carbonaceous and ferruginous RP clastic sediments with chemical features of passive margin to active continental margin greywakes. RP Formation and Wallekraal Formation volcaniclastic samples show considerable scatter on a La-Th plot largely falling outside the fields for continental arcs and active and passive margins.

Generally high $(La/Th)_{CN}$ ratios (approx. 7 to 14,09) as used by (Slack & Höy, 2000) show moderate to very high values (3,04 to 21,8) for Rosh Pinah metasediments suggesting derivation largely from calc-alcalic igneous or metaigneous rocks from the volcanic Orange River Group and from alkali granite and syenite bodies of the Richtersveld Suite. A small fraction of iron-rich detritus is believed to be derived from magnetite iron formations such as the older diamictite deposited in the immature continental rift of the Gariep Belt.

Hf vs. La/Th relationships (Floyd & Leveridge, 1987) suggest mainly a felsic arc source with increasing old sediment component possibly from a passive margin source. All samples have relatively low Cr and Sc, but high Co contents, and nearly all have high Th/Sc ratios ($>$0,6), precluding a significant component eroded from mafic or ultramafic rocks.

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