Provenance studies on the Neoarchean the Ventersdorp Supergroup (South Africa)

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The Ventersdorp Supergroup (VS) is a well-preserved and only weakly metamorphosed volcano-sedimentary succession of Neoarchean age (2.85-2.65 Ga) that covers extensive tracts in central southern Africa. The stratigraphic thickness of the VS is very variable but can reach ca. 5100 m; it is composed of sedimentary rocks, including volcani- and siliciclastites, reworked tuff beds and few carbonates, intercalated with thick successions of volcanic rocks of bimodal composition. All previous attempts to relate the origin of the VS to a specific plate tectonic environment were restricted to the interpretation of the geochemical signature of the volcanic rocks and is still a matter of contention. Petrographic and geochemical evidence suggest sedimentary lithologies of the Kameeldoorns Formation (KDF), stratigraphically in the lower part of the VS, and the Bothaville Formation (BVF), representing in the upper part of the VS, were deposited in two distinctly different tectonic environments, with contributions from different source areas. Rapid facies and thickness variations, low compositional and textural maturity and a homogeneous, proximal source area for the KDF indicate rapid deposition in a tectonically active extensional basin. The provenance of the BVF point to greatly diminished tectonic and volcanic activity, and variable contributions from different sources including Mesoarchean basement. The sedimentary units of the VS may thus mark the transition of the Kaapvaal Craton from active extension and profuse volcanism (KDF), into a long-lasting period of tectonic quiescence (BVF) more commonly associated with the deposition of thick platform dolostones and Superior-type iron formations in the lower part of the Transvaal Supergroup. Moreover, the Neoarchean VS represents typical geochemical parameters for so-called post-Archean sedimentary rocks, supporting the hypothesis that craton consolidation in South Africa ended much earlier than in other regions of the earth.

The crustal evolution of the Central Andes during the Neoproterozoic to the Silurian

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The crustal evolution of the Central Andes from the Neoproterozoic to the Silurian was subject of long-lasting dispute. Was crustal growth related to terrane accretion or recycling of existing crustal material combined with andesitic magmatism? Provenance studies incorporating petrographical, geochemical and isotope geochemical analyses were applied to the Neoproterozoic Puncoviscana Formation, the Cambrian Grupo Mesón, the entire Ordovician strata of the Argentinean Puna, the Cordillera Oriental and to Silurian successions in NW Argentina. Neoproterozoic metasedimentary rocks are covering a region from 22ºS to 29ºS and covering the hypothetical terrane boundary between the Arequipa-Antofalla and Pampia Terrane from west to east. Geochemical and petrographical data point to a first to second cycle deposit making a foreland-basin position related to the collision of the Pampia Terrane with the easterly Gondwana boundary most probable. A typical passive margin signature cannot be identified. During the Cambrian, the Puncoviscana basin deposit were recycled and deposited in mature intra-cratonic basin successions of the Grupo Mesón. During the Lowermost Ordovician, a continental volcanic arc evolved diachronically at the western boundary of Gondwana, where the main volcanic activity can be observed during the Arenig, with a NW-SE orientation of the volcanic arc. The signal of volcanic activity did not reach Tremadocian to Arenigian deposits in the Cordillera Oriental, c. 400 km basin inwards to the east. During the Llanvirnian the volcanic activity died north of 27º, whereas further to the south, in the Sierra Famatina, volcanogenic rocks were deposited. However, large turbidite sequences buried the volcanic arc succession in NW Argentina and developeded from a back-arc basin to a retro-arc fore-land basin. Unroofing of mainly siliciclastic rocks and syn-erosional uplift of the marine volcanic arc led to an arc signature in sparse adjacent Silurian deposits. This signal is only locally seen and can be explained by heterogeneities in the basin morphology and varying uplift magnitudes of the so-called Puna-arch during the Oclóyic Orogeny.