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Detrital zircon geochronology of the Lower Karoo Group in the N'Condédzi Basin, Mozambique

Geocronologia de zircões detríticos do Grupo do Karoo Inferior da Bacia de N'Condédzi, Moçambique

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Sumário: *A Bacia de N'Condédzi, pertence ao conjunto de bacias sedimentares moçambicanas do Ciclo Karoo. O preenchimento sedimentar consiste numa sequência detrítica, com ca. 2000 m de espessura, depositada em ambientes lacustres e aluvionares. Com a finalidade de conhecer a proveniência dos terrenos fonte das rochas detríticas, foram estudadas para geocronologia U-Pb, as populações de zircões detríticos de arenitos interceptados em três sondagens. Independentement, da idade dos arenitos (Lopingiano – Triásico Superior), a população dominante de zircões detríticos está no intervalo 1140 – 920 Ma com pico aos ca. 1035 Ma, sugerindo uma constância temporal das áreas fonte, restritas a terrenos formados durante a consolidação do Supercontinente Rodínia (1400 – 1000 Ma). Todavia, e apenas nos arenitos do Triásico Inferior, ocorre uma segunda população de zircões com idades U-Pb entre os 670 – 490 Ma, com picos aos 618 e 525 Ma., sugerindo o envolvimento transitório de terrenos associados ao Ciclo Pan-Africano.*

Palavras-chave: *geocronologia de zircões detríticos, Karoo, estudos de proveniência, Moçambique, Bacia de N'Condédzi*

Keywords: detrital zircon geochronology, Karoo, provenance, Mozambique, N'Condédzi Basin

The N'Condédzi Basin is one of the several Karoo depocenters located along the Zambezi River valley in the Province of Tete, in central west Mozambique. The development of the N'Condédzi Basin is related to the brittle reactivation of high-strain shear zones of the Zambezi Belt, formed during the Pan-African Orogeny (650–500 Ma). Its northern boundary corresponds to the Mwanza Fault, a brittle structure formed by the reactivation of the Sanângoè Shear Zone during the early(?) Permian and related to the initial tectonic phases of this sub-basin development. The Mwanza Fault is a prominent geomorphologic feature at the northern boundary of this sub-basin, separating the granites and gneisses of the Mesoproterozoic Furancungo Suite and the flat region of the hanging-wall fault block that corresponds to the Karoo sedimentary rocks. In the southern margin of this sub-basin, Karoo sedimentary rocks rest either unconformably over the Mesoproterozoic gabbros-anorthosites of the Tete Suite or are faulted against the later rocks. The stratigraphic succession of the N'Condédzi Basin is better known in the subsoil due to boreholes drilled for coal exploration. Galasso et al. (2019) describe the Karoo stratigraphic units, their lithologies and the ages of the N'Condédzi Basin.

The preliminary results presented in this abstract are based on three coal exploration boreholes described by Galasso et al. (2019) for palynology. The stratigraphic sequences of the three boreholes form a composite succession spanning the time interval between the Lopingian (upper Permian) and the Carnian (Upper Triassic). Borehole A1TM-058 attained a total depth of 1000 m: at its base are the basement rocks of the Mesoproterozoic Tete Suite, which are unconformably overlain by a thick lacustrine to alluvial succession consisting of clast-supported conglomerates, siltstones, sandstones, black carbonaceous mudstones, and coal seams beds. Several dolerite sills intruded into the borehole

sequence. A Lopingian age was assigned to the entire sequence of this borehole. Five sandstone from different depths were sampled and analysed for U-Pb zircon detrital geochronology. Borehole CIMT-014 has a total depth of 500 m, and the Permo-Triassic boundary was tentatively identified at ca. 484.5 m depth. From the Permo-Triassic boundary upwards, the core of the borehole consists of variegated mudstones, conglomerates, and red sandstones deposited in alluvial environments. Palynomorphs dated this part of the sequence as Lower Triassic to Upper Triassic (Carnian). No Middle Triassic palynomorphs were identified, likely due to a hiatus caused by a tectonic event during the Middle Permian. Eight sandstone samples were analysed for zircon detrital geochronology, one from the Lopingian, five from the Lower Triassic, and two from the Upper Triassic. Lastly, borehole A1TM-039 is a ca. 550 m thick alluvial sequence composed of variegated mudstones, red sandstones, and conglomerates, in which mudstones at the base yielded palynomorphs of Upper Triassic age. Two sandstone samples from this borehole were analysed for detrital zircon geochronology.

The results are discussed according to the stratigraphic position of the sandstone samples analysed. Hence, the six samples of Lopingian-age sandstones are dominated by U–Pb detrital zircon ages within a 1068–986 Ma age range with a peak at 1035 Ma. A subpopulation of U–Pb zircon ages occurs within a 950–840 Ma interval without a distinctive age peak. The Lower Triassic detrital zircons from borehole CIMT-014 show two well-defined sub-populations. One is very similar to the detrital zircons found in the sandstones of the Lopingian age and is within the interval 1140–920 Ma, with a peak at 1032 Ma. The second population shows a broad spectrum of ages within the interval 670–490 Ma, with two discrete age peaks at 618 and 525 Ma. The four sandstone samples of the Upper Triassic analysed are dominated by detrital zircon ages within a 1076-992 Ma age range with a peak at 1035 Ma. There are no other distinctive detrital zircon sub-populations in the Upper Triassic age sandstones, although the youngest detrital zircons are within the 750-640 Ma age range.

The results of the detrital zircons indicate source terrains dominated by Mesoproterozoic rocks. Geologic units of this age outcrop extensively in the region and are represented by terrains formed during the Rodinia supercontinent assemblage (1400-1000 Ma). These terrains are represented in Tete Province and the northern provinces of Niassa, Cabo Delgado, Zambézia and Nampula. Most Mesoproterozoic terrains are overprinted by metamorphism and plutonism of Neoproterozoic age with a dominance of Pan-African ages, which could be the source terrains for the presence of detrital zircons of that age interval in the sandstones of Lower Triassic age. However, the Pan-African detrital zircon population is only found in sandstones in the Lower Triassic and is regarded as a unique feature of the sandstones of the Lower Triassic. The presence of the Pan-African population is probably related to tectonic events at the Permo-Triassic boundary and in the Lower Triassic that exposed source terrains in the catchment areas with Pan-African signatures that were buried before that time interval. However, during the Upper Triassic, the detrital zircon population indicates that source terrains with a Pan-African signature were no longer exposed. A probable link to other geological processes, rather than tectonism, related to the global environmental crisis associated with the Permo-Triassic limit is also currently being investigated as a likely hypothesis for the presence of the Pan-African detrital zircon population in the Lower Triassic sedimentary rocks of the N'Condédzi Basin.

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