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Atlantic- to Andean type basin inversion along the southern margin of Gondwana: U-Pb detrital zircon evidence form the Cape- and lower Karoo Supergroups and correlatives in Argentina and the Falkland Islands.

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The similarities in litho- and bio-stratigraphy between the successions of the Cape- and Karoo Supergroups (South Africa) and those of the Ordovician to Early Permian successions in Argentina and the Falkland Islands have long been recognized [1, 2]. Although the stratigraphy, sedimentary facies and depositional environments of these units have been well studied, the nature of the source areas of these rocks remains poorly understood. In addition, no in-depth provenance study has been conducted on the transition from Ordovician to Early Carboniferous successions to Early Permian successions along the southern margin of Gondwana.

In an attempt to better constrain the provenance areas of these sedimentary successions, detrital zircon grains were extracted from a total of 65 samples representing the Cape-and lower Karoo Supergroups, the Ventania System (Argentina) and the West Falkland- and Lafonia Groups (East- and West Falkland). LA-ICP-MS U-Pb age determination of the detrital zircon populations has revealed remarkable similarities in age distribution patterns of the correlative units. The sedimentary units of the Ordovician to Early Carboniferous Cape Supergroup contain a major Neoproterozoic- and secondary Mesoproterozoic age component: a trend that has also been observed in the time equivalent units of the Argentine Ventania System and the West Falkland Group. Minor populations of Archean-, Paleoproterozoic- and Early Paleozoic aged grains are also present. Neoproterozoic aged detritus was likely sourced from Brasiliano- and Pan Africa Belts, while the Western Sierras Pampeanas (South America), the Namaqua-Natal Metamorphic Province (South Africa) and the Cape Meredith Complex (Falkland Islands) have been suggested as possible sources for Mesoproterozoic detrital zircon grains. The detrital zircon population patterns of the glaciogenic Dwyka Group (Karoo Supergroup), Sauce Grande- (Ventania System) and Fitzroy Formations (Lafonia Group) closely resemble those of the underlying arenaceous units, thus implying that there has been no major change in source areas.

In the Laingsburg-, Ripon- (Ecca Group, Karoo Supergroup), Tunas- (Ventania System) and Port Sussex Formations (Lafonia Group), all of Permian age, a prominent “juvenile” detrital zircon component, also of apparent Permian age appears, accompanied by an array of smaller Archean to Carboniferous zircon populations. While erosional re-sampling of the underlying units of the Cape Supergroup, Ventania System and West Falkland Group is proposed as a possible source for the Archean to Carboniferous aged detritus,an influx of detritus from a new source region is clearly apparent.. The sudden change occurred between the times of deposition of the Cape Supergroup and the Ecca Group, and their time based equivalents. This change can be related to a rapid transition from a more “passive”, Atlantic type basin, where drainage was mostly from the continental mass of Gondwana, to a situation where mountain building (most likely in the form of an arc-like setting) resulted in major uplift to the south of these time equivalent basins. An extensive magmatic arc, referred to as the Gondwanide Orogeny, which affected the southern edge of Gondwana at this time, was thus most likely a major source of detritus from the

times of the deposition of the Ecca Group onwards, with deposition of the majority of the succession of the upper Karoo Supergroup taking place in a foreland basin setting.

References:

[1] Du Toit (1927) Carnegie Institute, Washington, Publications, 381.

[2] Adie, R.J. (1952) Geological Magazine, 89: 401-410.