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Detrital zircon provenances and geodynamic evolution of the Congo Basin

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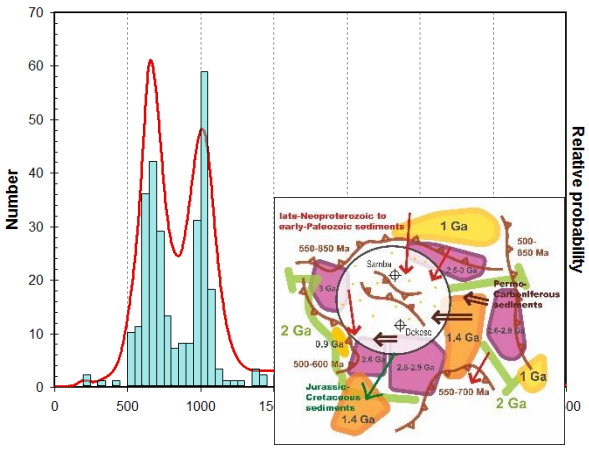
The Congo Basin (CB; ca. 1.8 million km^2) is the largest intracratonic basin of central Gondwana, originated from the amalgamation of Precambrian shields (inset Fig. 1) during the Paleoproterozoic (Eburnean; 1.8-2.1 Ga), late Mesoproterozoic (Kibaran; 1.0-1.4 Ga) and Neoproterozoic (Pan African; 550-800 Ma). It is filled with between 1 and 6 km thick continental sequences representing a long Phanerozoic record of sedimentation and basin subsidence, commonly inferred to be related to a long-lived 'cold spot' in the underlying mantle. We describe the CB stratigraphy from fieldwork in the Kwango region (southwest margin of the CB), and from 1950-1970's seismic sections linked to deep boreholes near the centre of the basin. In addition, we report on U/Pb detrital zircon dates from the main stratigraphic groups to constrain the age and source provenances of its sediments (Fig. 1).

The CB is underlain by deformed Pan African siliciclastic and carbonate platforms that include Cryogenic glacial deposits (600-700 Ma). The lowermost sequence comprises upper Neoproterozoic to lower Paleozoic 'red-beds' about 1000 m thick (the Inkisi, Banalia and Biano Groups), with zircon dates predominantly at 950-1100 Ma and 600-800 Ma derived from the Oubanguides and Central Sahara Belts flanking the northern margin of the basin. The overlying Lukuga Group is dated by paleobotany from mid-Carboniferous to the Permian, suggesting a hiatus of the mid-Paleozoic. The sequence contains two 'lower glacial beds' and black shales, in total 400 to 800 m thick, and with relatively abundant zircons of 1.85-2.05 Ga and 1.37-1.42 Ga derived, respectively, from Eburnean and Kibaran sources in east-central Africa as focussed through paleo-glacial valleys along the eastern margin of the CB. This upper Paleozoic glacial-deglaciation sequence is unconformably overlain again by red-beds (the Triassic Haute-Lueki Group) comprising conglomerates and red sandstones up to 1800 m thick in the centre of the basin. The angular unconformity that separates these two 'Karoo-age' sequences may be linked to far-field flexures due to Permian-Triassic collisional processes along northwest and southern margins of Gondwana (e.g. the Mauritanian-Variscan and Cape orogens). The uppermost 600-1200 m thick, Jurassic-Cretaceous sequence of the CB overlies a second regional unconformity, interpreted to be related to intracontinental deformations associated with the initial break-up between East and West Gondwana (160-180 Ma). This ubiquitous peneplanation surface is covered by red sandstones and fossiliferous mudstones of the Stanleyville, Loia, Bokungu and Kwango Groups, including ephemeral marine, aeolian and two successive lacustrine deposits, which contain rich fish and non-marine crustacean faunas of Kimmeridigian and Albian-Cenomanian age. Detrital zircons from the aeolianites (the Dekese Formation of the Kwango Group) have dates very similar to that of the older red-beds, but also rare younger grains dated at 190 and 240-290 Ma, most likely sourced from late Paleozoic-Jurassic magmatism and arc-volcanism of the proto-Andes (e.g. the Choiyoi and Chon Aike Provinces), active along the convergent southwest margin of Gondwana. Based on this new stratigraphic data, subsidence modelling shows that



the Phanerozoic evolution of the CB is multi-phased, with successive episodes of subsidence and uplifts. Although it appears difficult to relate these phases of subsidence to specific events, it is clear from this study that the initiation and development of the CB related to global processes during the formation and break-up of Gondwana/Pangea, and not to a single mantle cold spot.

Figure 1: Frequency plot of U/Pb detrital zircon dates from the Phanerozoic CB. Inset=sketch map of surrounding Precambrian basement with sediment dispersal directions.