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Late Jurassic-Cretaceous fluvial evolution of central Africa: Insights from the Kasai-Congo Basin, Democratic Republic Congo

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ABSTRACT

The Congo Basin in central Africa is one of the largest intracratonic sedimentary basins in the world. The geological knowledge of Congo Basin is mainly based on studies from the central part of the basin ("Cuvette Centrale"). We present the results of sedimentary provenance investigations of the Jurassic–Cretaceous strata from the southwestern part of the basin, called the Kasai region. This study combines sandstone petrography with U-Pb and Lu-Hf analyses of detrital zircons to assess the stratigraphy, sedimentary provenance and drainage history of the Upper Jurassic-Cretaceous strata in the Kasai region. The stratigraphy is subdivided into a single Upper Jurassic unit (J1) and four Cretaceous units (C1–C4). Petrographically, sandstones from all units except the conglomeratic C3 are texturally and compositionally mature, dominated by quartzarenite and subarkosic compositions. These characteristics can be attributed to considerable recycling of older sedimentary strata and crustal sources, along with long distance fluvial and aeolian processes. The analyses of fifteen detrital zircon samples from the Upper Jurassic–Cretaceous strata yielded mainly Archean and Proterozoic zircons. This result suggests that sandstones are likely sourced from the underlying Archean-Paleoproterozoic Congo–Kasai Craton and from nearby Proterozoic mobile belts, particularly the Irumide and Lufilian Belts to the south of the basin. The dominance of Archean and Proterozoic detrital zircons in Upper Jurassic–Cretaceous strata suggests that the Kasai portion of the Congo Basin experienced exhumation and erosion, which is possibly associated with far-field reactivation of Archean and Proterozoic structures during and following Gondwana rifting in the late Mesozoic. A large fluvial drainage network sourced from the south of the basin, is interpreted to have developed across central Africa during the Late Jurassic–Cretaceous. This fluvial system is believed to have flowed northward across the Congo Basin and ultimately drained into a wrench fault system called the Central African Shear Zone, which extends in an ENE direction from the Gulf of Guinea through Cameroon into Sudan and Kenya.

1. Introduction

The intracratonic Congo Basin in central Africa is among the largest continental sedimentary basins in the world, covering ~1.8 million km^2 of Africa's landmass (Fig. 1: Kadima et al., 2011; Linol et al., 2014; Raveloson et al., 2015). This near-circular basin occupies most of the Democratic Republic of Congo (DRC, formerly Zaire), portions of the Republic of Congo, the Central African Republic (CAR) and Angola (Fig. 1). The Congo Basin contains up to 9 km of sedimentary strata ranging in age from late Precambrian to Recent (Daly et al., 1992; Roberts et al., 2015). The basin is typically subdivided into a central portion called the Cuvette Centrale and discrete thick strata (depocentres) around the periphery of the basin, including the Kwango, Kasai and Lundas (Figs. 1 and 2: Daly et al., 1992; Giresse, 2005).

Despite its size and resource potential (Milesi et al., 2006), the Congo Basin has received comparatively little detailed scientific attention until recently, which is largely attributed to thick vegetation cover and recurring socio-political instability in the central Africa region. Moreover, the geological knowledge of the basin is mainly limited to the investigations of the Cuvette Centrale, where four deep exploration well (drill) cores have provided a means of deciphering the basin's history (Fig. 1; Samba #1 (S), Dekese #1 (D), Mbandaka #1 (M) and Gilson #1 (G) wells; Giresse, 2005). Recent

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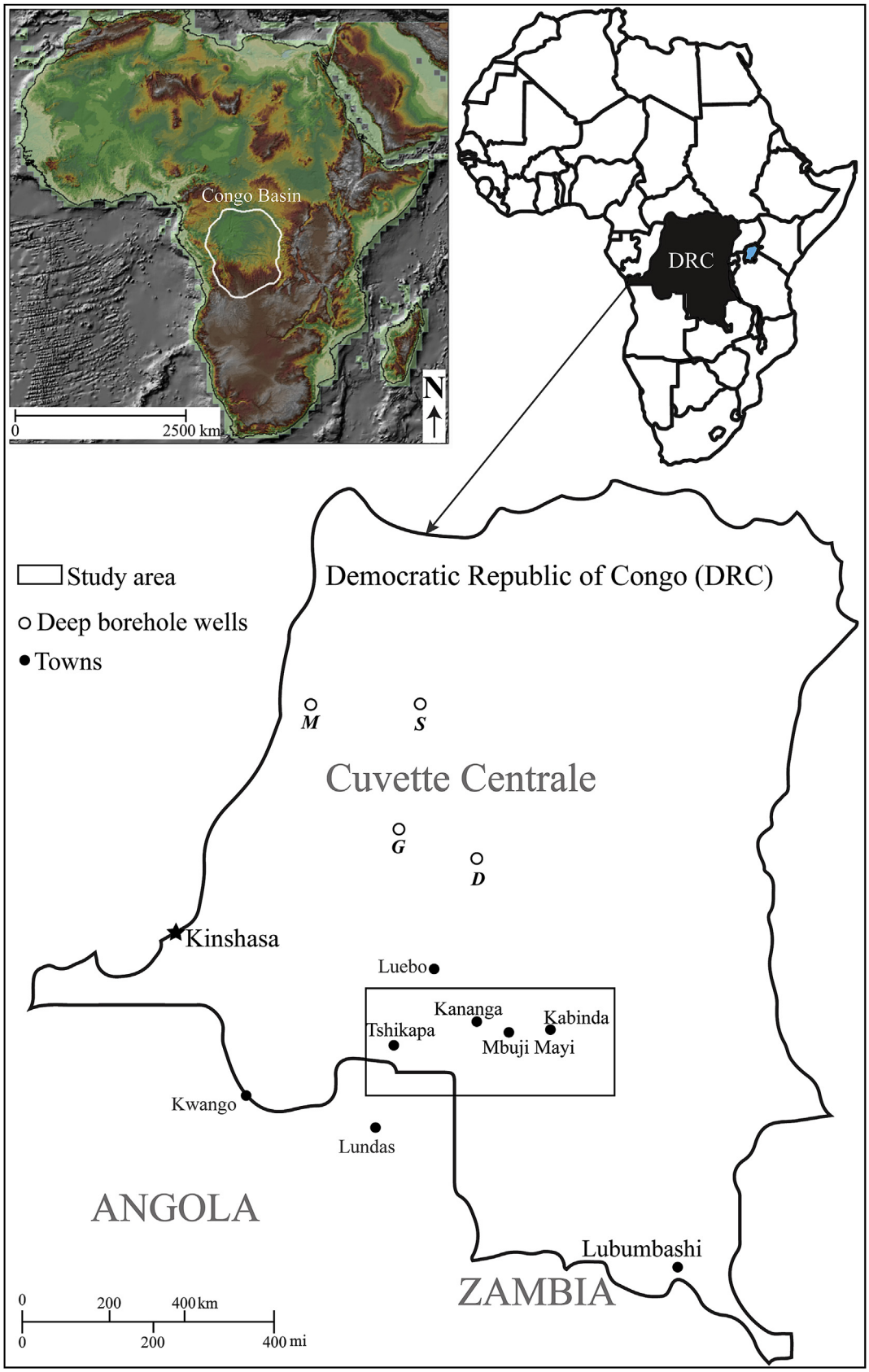

Fig. 1. Geographical location of the Congo Basin in central Africa (white outline). Location of the study area in the Kasai region of the Democratic Republic of Congo (DRC). Boreholes M, S, G and D are the four deep exploration wells drilled in the Cuvette Centrale.