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U–Pb detrital zircon ages of sediments from the Firgoun and Niamey areas (eastern border of West African Craton, West Niger)

Moussa Konaté [a,*], Yacouba Ahmed [a], Andreas Gärtner [b], Diafarou Alzouma Amadou [a], Hassan Ibrahim Maharou [a], Kamayé Tourba [a], Mandy Hofmann [b], Johannes Zieger [b], Ulf Linnemann [b]

[a] *Department of Geology, Groundwater and Georesources Laboratory, Faculty of Sciences and Technology, Abdou Moumouni University, PO Box 10662, Niamey, Niger*
[b] *Museum für Mineralogie und Geologie, Sektion Geochronologie, GeoPlasma Lab, Senckenberg Naturhistorische Sammlungen Dresden, Königsbrücker Landstraße 159, 01109 Dresden, Germany*

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ABSTRACT

This study uses field observations and new U–Pb ages of detrital zircon grains from three samples to question the stratigraphic position of the Firgoun and Niamey siliciclastic sediments, presumed to be Neoproterozoic in age. Sharing several lithological similarities with the Late Cryogenian "Triad" of the Taoudenni, Gourma, and Volta basins, the uppermost siliciclastic sediments of the Firgoun and Niamey areas were likely also deposited during this period. This is corroborated by matrix-supported diamictites with faceted or striated pebbles as well as by structures resembling cryoturbation processes. However, the detrital zircon U–Pb age record that we present here for the lowermost deposits of Firgoun and Niamey provides mainly Paleoproterozoic ages, and very few Archean ages, altogether in a range from 1822 ± 9 to 3392 ± 9 Ma. Therefore, the new data only show that the Firgoun and Niamey sediments were deposited before about 1800 Ma. Nevertheless, the U–Th–Pb zircon age data allows examining the possible provenance of the sediments. We show that the latter was likely in the westerly close vicinity of the studied areas. The Archean zircons are likely inherited, and possibly originating from a more westerly source. The nearby source of the Niamey and Firgoun sediments suggests that a high topographic relief was still existing in the south-central part of the West African Craton in the Mid Neoproterozoic.

1. Introduction

In Niger, the Firgoun and Niamey sedimentary deposits overlie unconformably the Paleoproterozoic terrains (Birimian Schists and Granites) of the southeastern edge of the West African Craton (WAC). Classically, due to their stratigraphic position, they have been considered as equivalent to the sediments of the neighboring Taoudenni and Gourma basins to the north (Bertrand-Sarfati et al., 1991; Miningou et al., 2017; Reichelt, 1972), and of the Volta basin to the south (Affaton, 1990) (Fig. 1A). However, few studies have been carried out on the Firgoun and

* Corresponding author.
E-mail address: konate.moussa@gmail.com (M. Konaté).

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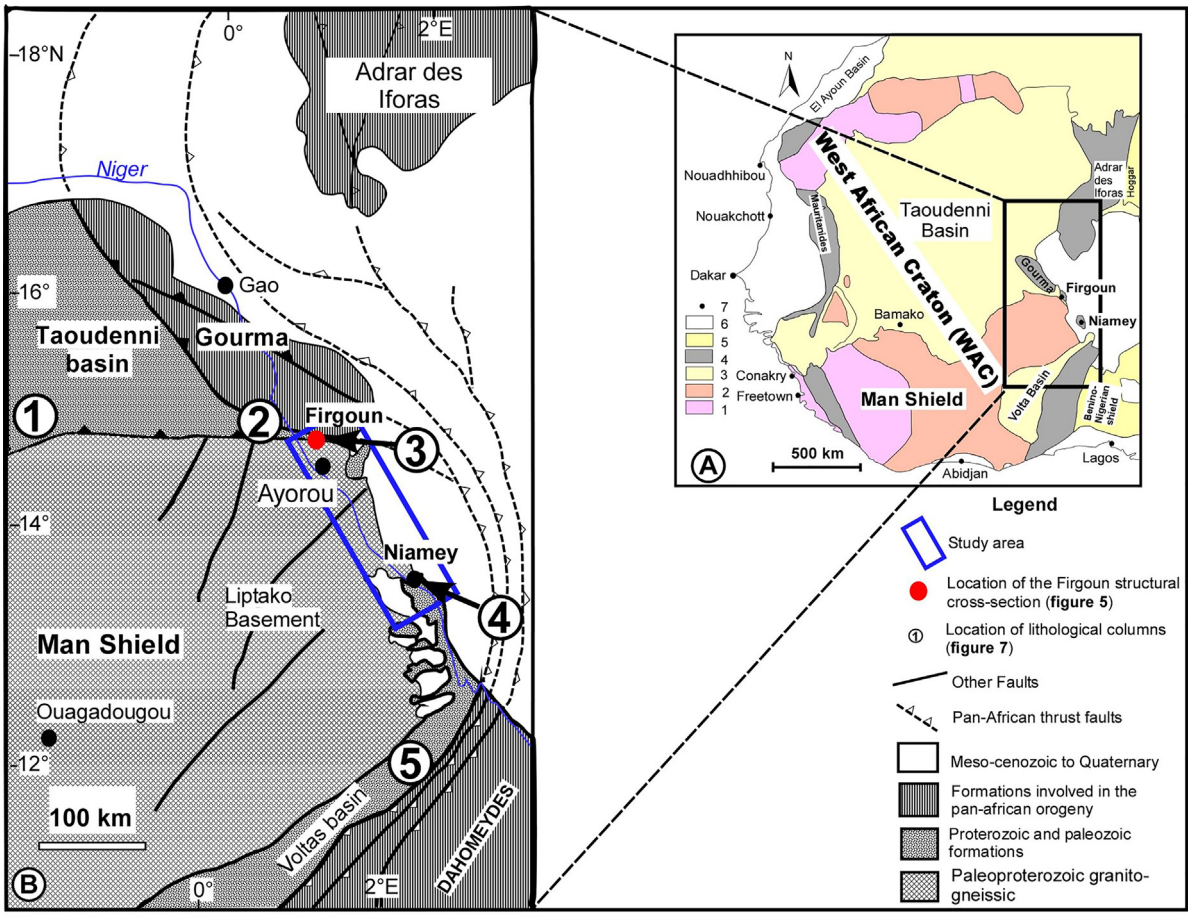

Figure 1 :

Fig. 1. (A) Overview map of West African Craton (modified from Trompette, 1973). 1: Archean; 2: Birimian; 3: Palaeozoic basins including the locally-found Late Precambrian; 4: Mobile zones; 5: Eastern continental blocks; 6: Post-Palaeozoic terrains; 7: Towns. **(B)** Enlarged detailed geological map of the northeastern border of Man Shield with the location of the study area, in the structural context of Liptako (southwestern Niger, West Africa, from Affaton et al., 2000, modified).

Niamey sediments, so that their age and origin are still debated.

The Firgoun terrains are considered as the equivalent of the basal deposits of the Ydouban Group of Gourma (Supplementary Table 1) (Machens, 1972; Reichelt, 1972). The Ydouban group comprises, from bottom to top, conglomerates and quartzite sandstones, a pelitic formation (shales), a siliceous formation (cherts and jasper) and a carbonate formation (limestones and dolomites, locally stromatolitic) (Delfour, 1965). Similarly, the Niamey and Firgoun sediments are made of sandstones and conglomerates. The Ydouban Group rests unconformably on the Birimian basement, cratonized around 2400–1900 Ma (Abouchami et al., 1990; Boher et al., 1992; Linnemann et al., 2011; Zhao et al., 2002). The stratigraphic position of the Firgoun and Niamey sediments is still a subject of controversy. According to Bertrand-Sarfati et al. (1991), the Ydouban Group is Late Proterozoic in age, based on the type of stromatolites it contains. However, the position of the "Triad" (tillite, limestones, silexite), which was defined afterwards as a major stratigraphic marker in West Africa (Deynoux et al., 2006; *see next section*), has not been clearly specified in their work (Supplementary Table 1). Machens (1972) considers an Infracambrian or Tarkwaian age for the Niamey sandstone, while Affaton et al. (2000) assign them to the Neoproterozoic. The lack of fossils in these sandstones and conglomerates prevents any biostratigraphic age determination. Therefore, in the present study, we performed U–Pb dating of a large population of detrital zircons collected in three samples from the Firgoun and Niamey sediments.

At least a maximum age of deposition can be deduced from the youngest U–Pb ages of the detrital zircons. However, the actual age of deposition can be much older due to inheritance issues (Cawood et al., 2012).

The U–Pb detrital zircon method provides new information on the non-fossiliferous sediments age and their provenance. The compilation of available zircon ages from the surrounding areas (e.g., Gärtner et al., 2017, 2018, this issue) allows suggesting potential paths of sedimentary transport at the time of sandstone and conglomerate deposition.

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