Precambrian Research 281 (2016) 166–184

Contents lists available at ScienceDirect

Precambrian Research

journal homepage: www.elsevier.com/locate/precamres

A diverse and exquisitely preserved organic-walled microfossil assemblage from the Meso–Neoproterozoic Mbuji-Mayi Supergroup (Democratic Republic of Congo) and implications for Proterozoic biostratigraphy

B.K. Baludikay [a,*], J.-Y. Storme [a], C. François [a], D. Baudet [b], E.J. Javaux [a,*]

[a] Palaeobiogeology, Palaeobotany, Palaeopalynology Lab, UR GEOLOGY, University of Liège, 4000 Liège, Belgium
[b] Geodynamics & Mineral Resources Service, Royal Museum for Central Africa, 3080 Tervuren, Belgium

ARTICLE INFO

Article history:
Received 15 September 2015
Revised 29 February 2016
Accepted 22 May 2016
Available online 28 May 2016

Keywords:
DR Congo
Mbuji-Mayi Supergroup
Proterozoic
Microfossils
Biostratigraphy

ABSTRACT

A well preserved and diversified microfossil assemblage is reported from the Meso–Neoproterozoic Mbuji-Mayi Supergroup in the Kasai oriental Province, central part of Democratic Republic of Congo. A total of 49 taxa belonging to 27 genera were identified, including 11 species of unambiguous eukaryotes, 10 species of possible eukaryotes or prokaryotes and 28 species of probable bacteria. This assemblage is more diverse than previously reported but includes taxa reported in coeval worldwide assemblages. It is characterized by abundant sphaeromorphs, filamentous colonial aggregates and filamentous forms, as well as a relatively low diversity of acanthomorphs including the Late Mesoproterozoic and Early Neoproterozoic index fossil – *Trachyhystrichosphaera aimika* – reported for the first time in Central Africa. This species co-occurs with other taxa also reported for the first time in Africa: *Trachyhystrichosphaera botula*, *Jacutianema solubila*, *cf. Tappania* sp., *Valeria elongata* and numerous other taxa. Correlation with other geochronologically constrained successions that contain *Trachyhystrichosphaera* confirms *T. aimika* as promising index fossil to define the Late Mesoproterozoic–Early Neoproterozoic interval. The available biostratigraphic data enable to suggest a minimum Tonian age for the Mbuji-Mayi Supergroup. This age is consistent with the published and new geochronological data. Comparison with worldwide Proterozoic assemblages permits to define microfossil assemblages useful for biostratigraphy. This study significantly improves our understanding of the diversity of the Late Mesoproterozoic–Early Neoproterozoic biosphere, and in particular the diversification of early eukaryotes, preserved in the Democratic Republic of Congo rock record and more broadly in Africa where micropaleontological investigations are sparse.

1. Introduction

Proterozoic microfossils constitute a major source of paleontological information essential for understanding early life evolution. In particular, they document the evolution of biological innovations and patterns of diversification of early eukaryotes (e.g. Butterfield, 2015; Javaux, 2011; Javaux and Knoll, in review; Knoll, 2014) but are also helpful for biostratigraphic correlations and paleoenvironmental reconstruction of Proterozoic rocks (Butterfield and Chandler, 1992; Knoll, 2009; Knoll et al., 2006). To date, few paleontological investigations have been carried out in the Pre-Ediacaran Proterozoic of Africa. Prior to our new study presented here, two early studies investigated the micropaleontology of the Mbuji-Mayi (former Bushimay) Supergroup in Democratic Republic of Congo (DRC) (Baudet, 1987; Maithy, 1975). They reported respectively 34 and 41 taxa of organic-walled microfossils. However, our taxonomic revision, based on more recent work on Precambrian organic-walled microfossils (Butterfield et al., 1994; Hofmann and Jackson, 1994; Sergeev et al., 1997; Sergeev, 2009; Yankauskas et al., 1989) suggests that many of these were synonymous. Other studies report few acritarchs in the Late Mesoproterozoic Taoudeni Basin of Mauritania (Amard, 1984, 1986; Lottaroli et al., 2009), mostly species of *Leiosphaeridia* and *Arctacellularia*, although a new study evidences a higher diversity and the occurrence of acanthomorphs (Beghin et al., in review). Baudet (1988) reported 20 microfossil taxa, especially sphaeromorphs, in the Mesoproterozoic Kavumwe Group of Burundi (Deblond et al., 2001; Fernandez-Alonso et al.,

* Corresponding authors.
E-mail addresses: bkbaludikay@ulg.ac.be (B.K. Baludikay), ej.javaux@ulg.ac.be (E.J. Javaux).

http://dx.doi.org/10.1016/j.precamres.2016.05.017
0301-9268/

2012). In the Neoproterozoic Kwahu Group of Ghana (>0.85 Ga Abetifi and Anyaboni formations), Couëffé and Vecoli (2011) reported 10 genera: *Leiosphaeridia*, *Pterospermopsimorpha*, *Synsphaeridium*, *Coneosphaera*, *Arctacellularia*, *Navifusa*, *Satka*, *Valeria*, *Trachysphaeridium* and putative *Trachyhystrichosphaera* (the latter is doubtful based on published illustration, where no processes are visible, cfr. their figure 6.8).

To improve our understanding of the Late Mesoproterozoic–Early Neoproterozoic biosphere evolution and especially the microfossil record of Central Africa, we studied the assemblage of organic-walled microfossils preserved in fine-grained siliciclastic rocks of the Meso–Neoproterozoic Mbuji-Mayi Supergroup, in the Sankuru-Mbuji-Mayi area, DRC (Figs. 1 and 2).

Our new study of a larger number of samples (263) from 5 drill cores, using a non-standard maceration protocol minimizing mechanical shocks, reveals an exceptionally diverse and well-preserved assemblage of 49 taxa of organic-walled microfossils. Among those, 22 taxa are reported for the first time in the assemblage but are known elsewhere. Comparison with coeval worldwide assemblages shows that the Mbuji-Mayi assemblage is more diverse but includes taxa known elsewhere except for one possible new taxon (unnamed acanthomorph), permitting to develop a worldwide biostratigraphy for the Late Mesoproterozoic–Early Neoproterozoic interval.

2. Geological setting, depositional environments and age of the Mbuji-Mayi Supergroup

The Mbuji-Mayi Supergroup is a sedimentary sequence unaffected by regional metamorphism (Raucq, 1957), deposited in the intracratonic failed-rift Sankuru-Mbuji-Mayi-Lomami-Lovoy Basin (SMLL; Delpomdor and Préat, 2013; Delpomdor et al., 2013a,b) which extends from SE to NW between North Katanga and Kasai provinces. In the South-eastern part of the SMLL Basin (i.e. Northwest Katanga Province), the Mbuji-Mayi Supergroup overlies the Mesoproterozoic Kibaran Belt while in the North-western part of SMLL Basin, where we focused our work (i.e. Oriental Kasai Province), it rests unconformably upon the Archean Kasai Block (Fig. 1; Cahen and Mortelmans, 1947; Raucq, 1957, 1970). Amygdaloidal basaltic lavas overlie the Mbuji-Mayi Supergroup, at the confluence of Mbuji-Mayi and Sankuru rivers (Cahen et al., 1984). Lithostratigraphically, the Mbuji-Mayi Supergroup consists of two distinct successions; a lower siliciclastic sequence (~500 m thick) of the BI Group and an upper carbonate sequence (~1000 m thick) with stromatolitic build-ups and black shales of the BII Group (Figs. 2 and 3; Raucq, 1957, 1970). The sediments which formed the BI Group came from the Kibaran Belt, the Bangweulu and Kasai blocks. They indicate a detrital transport from the SE and/or E of SMLL Basin (Delpomdor et al., 2013a). The BI Group comprises six subgroups in ascending order: BIa, BIb, BIc, BId, BIE and BIe. The BIa is not represented in the Western part of the SMLL Basin (i.e. Sankuru-Mbuji-Mayi area), but has been observed in the South-eastern part, especially near Makululu and Kiandoki villages (Cahen and Mortelmans, 1947) and the BIE is only visible in the Kafuku Region. The BII Group, which comprises mostly transgressive carbonates, consists of five subgroups in ascending order: BIIa, BIIb, BIIc, BIId and BIIe. Detailed descriptions of these subgroups have been given in Raucq (1957, 1970) and updated (especially for the carbonates) in Delpomdor et al. (2013a, 2015).

A total of 11 microfacies are recognized from the BIe to BIIe subgroups showing that carbonates were deposited in a marine environment that evolved to evaporitic marine, lacustrine and

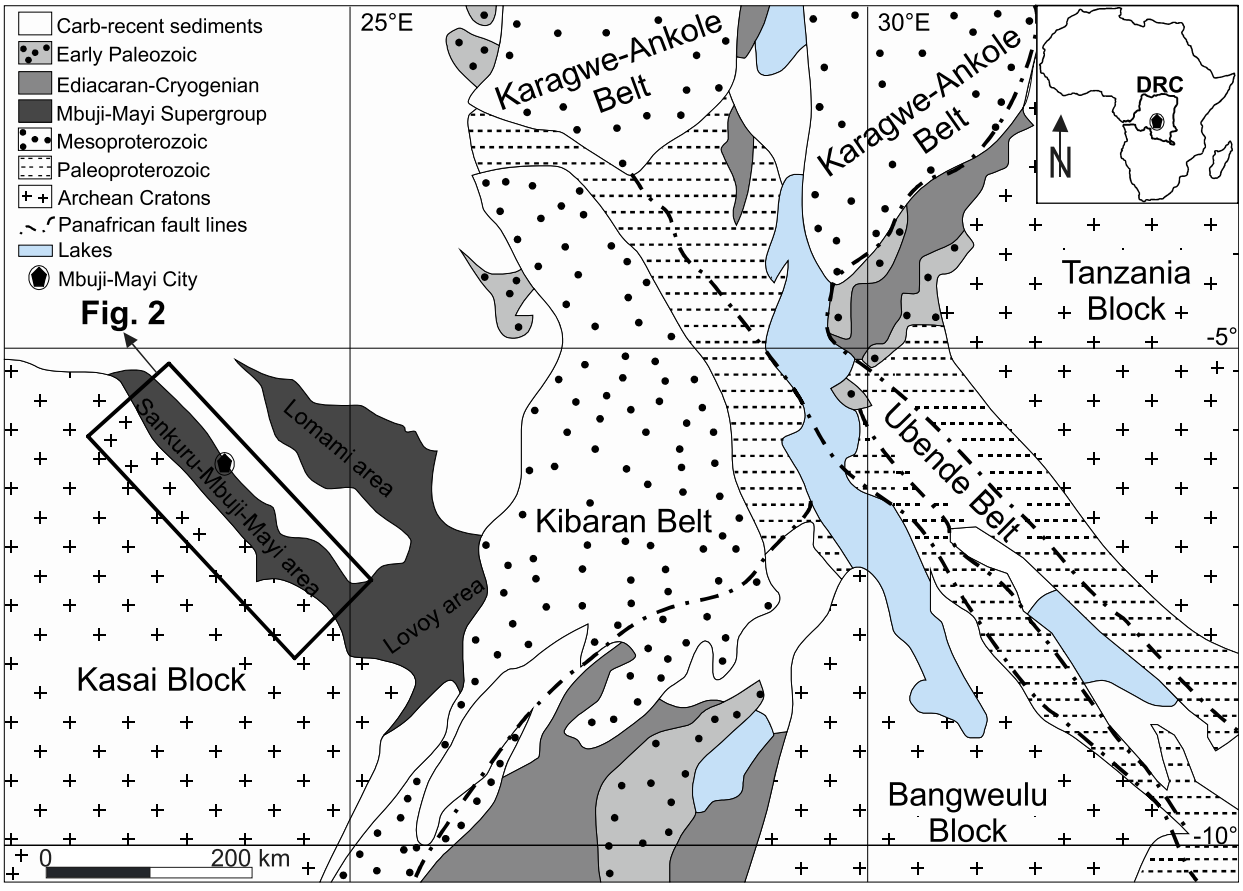

Fig. 1. Tectonic setting synthesis of some Paleoproterozoic–Neoproterozoic Basins in Central Africa (Modified after Kadima et al., 2011 and references therein).