

# Palaeoproterozoic high $\delta^{13}\text{C}$ carbonates from the Mako Supergroup, Eastern Senegal: A first record of the Lomagundi Carbon Isotope Excursion in West Africa

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The succession of the Palaeoproterozoic Birimian belt of the Kedougou-Kenieba Inlier of western Senegal is subdivided into the Mako and Diallé-Daléma supergroups. The c. 2.2 Ga Mako Sgp consists of tholeiitic pillow lavas overlying gabbros and ultramafic rocks. The pillow lavas are overlain by metacherts, shales, and carbonate rocks. This assemblage represents a deep-water, oceanic crust succession. It is intruded by calc-alkaline plutons, and covered by calc-alkaline lavas and pyroclastic rocks of the upper Mako Sgp, representing an oceanic island arc. The Diallé-Daléma Sgp consists of a thick (8-10 km) volcano-sedimentary succession, with calcitic and dolomitic marbles, conglomerates, breccias, greywackes, sandstones, shales, and ash beds, possibly deposited in a back-arc basin [1].

Carbonate rocks of the Mako Supergroup lie directly above tholeiitic pillow lavas, with associated banded cherts and some thin organic-rich black shales. These rocks also include hyaloclastic breccias, containing angular fragments of vesicular basalt, formed by explosive eruption of basalt on the seafloor and enclosed in a carbonate matrix. The Mako Sgp carbonates are mainly dolomitic marbles with minor calcitic marbles. Their C isotopic composition shows  $\delta^{13}\text{C}$  values ranging between +7.9 and +11.2 ‰ V-PDB (n=18), indicating that these carbonates were deposited during the Lomagundi Carbon Isotope Excursion (LCIE) in seawater composition between c. 2.2 and 2.06 Ga, recorded by high  $\delta^{13}\text{C}$  values of sedimentary carbonates with this age [2]. Their stratigraphic position and high  $\delta^{13}\text{C}$  values are similar to those of marbles associated with seafloor pillow lavas in the Ruwenzori Belt, Uganda [3]. Although the isotopic systems have been disturbed by metamorphism, as shown by large variations in  $\delta^{18}\text{O}$  and Mn/Sr values, the high  $\delta^{13}\text{C}$  values indicate a source from  $^{13}\text{C}$ -enriched seawater. The sedimentary carbonates of the Mako Sgp have a tentative Pb-Pb age of 2.15 Ga [4]. They overlie pillow lavas, which have yielded age of c. 2.197 Ga [5], and, since they display the LCIE, their age is constrained between c. 2.2 and 2.06 Ga. In contrast, metacarbonates from two quarries near Ibel, located in the Diallé-Daléma Supergroup, consist of highly deformed calcitic and ferroan, dolomitic marbles, with  $\delta^{13}\text{C}$  values ranging between -1.9 and +2.5 ‰ V-PDB (n=30). These  $\delta^{13}\text{C}$  values are within the range of normal marine carbonates, and are similar to previously reported  $\delta^{13}\text{C}$  values of the Diallé-Daléma Sgp metacarbonates from Ylimalo along the Falémé River, ranging from +0.3 to +1.7 ‰ V-PDB (n=4) [6]. The Diallé-Daléma Sgp metacarbonates have a Pb-Pb age of  $2065 \pm 33$  Ma [7]. Since they post-date the LCIE, their depositional age is likely to be in the range 2060-2030 Ma.

**Keywords:** dolomites, hyaloclastites, hydrothermal silica, sea-floor

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