Disturbances in the late Ediacaran-Cambrian marine carbon cycling tracked through paired carbon isotope evolution of the Bambuí Group, Brazil

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Coupled carbon isotope excursions in carbonate ($\delta^{13}C_{carb}$) and associated organic matter ($\delta^{13}C_{org}$) are frequently reported for the late Ediacaran. They are interpreted as the smoking gun for changes in the global carbon cycle, resulting from changes in organic matter burial rates, in the photosynthetic fractionation factor, or in the proportion of authigenic carbonate precipitation. Here, we present new paired $\delta^{13}C$ data ($\Delta^{13}C$) for the basal late Ediacaran-Cambrian Bambuí Group, recorded in a wide West Gondwana epicontinental setting. An extremely positive $\delta^{13}C_{carb}$ excursion (reaching up to +14‰) has been previously identified at the top of that succession and is associated with major paleoenvironmental changes in the basin. Apart from the basal post-glacial cap carbonate with typical low $\Delta^{13}C$ values, the $\delta^{13}C$ profiles are coupled, with constant $\Delta^{13}C$ values upsection also comprising the positive excursion interval (which is, so far, fossil-barren). This suggests strong changes in the isotope composition of the dissolved inorganic carbon ($\delta^{13}C_{DIC}$). Small $\Delta^{13}C$ lateral variations may indicate spatially controlled changes in the photosynthetic fractionation factor or in the contribution of non photosynthetic biomass to the sedimentary organic carbon. We suggest that the extremely positive $\delta^{13}C_{DIC}$ values of Bambuí Group do not record global changes in the carbon cycle, indicating instead a regional desequilibria between atmospheric CO_2 and the DIC in a restricted large basin. This desequilibria would result from extremely active methanogenesis coupled to methane escape to the atmosphere, with potential impacts on the global climate and on the metazoan marine colonization in the West Gondwana interior.