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Weathering and climate change recorded in ca. 2.32–2.06 Ga sedimentary rocks of the Pretoria Group, Transvaal Supergroup, South Africa

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The shallow to deep marine sedimentary rocks of the ca. 2.32 to 2.06 Ga Pretoria Group (Transvaal Supergroup, South Africa) record an almost complete succession from the onset of the Great Oxidation Event (GOE) to the positive carbon isotope excursion of the Lomagundi Event (LE) [1, 2]. Of this succession, lower Pretoria Group has been intensively investigated for atmospheric and oceanic redox conditions [3]; however, the link between rising atmospheric O_2 levels, climate changes, and continental weathering patterns during this critical time interval in Earth's history is less well studied.

Here, we report newly obtained high-resolution major and trace element data for several drill cores through this critical stratigraphic interval with the aim of addressing the aforementioned links within the context of sedimentological observations. The uppermost Rooihoogte and lower Timeball Hill formations (TBH) record intense continental weathering in the sediment source area in the wake of the GOE under warm, humid climate conditions. However, a marked decrease in weathering intensity is observed for the upper TBH, indicating cooling and culminating in the deposition of the Rietfonteindam Diamictite, which records a low-latitude glaciation event. Through the diamictite and into the overlying Boshoek Formation, weathering intensity increases again due to a renewed climatic warming, continuing into the overlying red beds of the Dwaalheuwel Formation, which record extreme weathering in the sediment source area under possible hothouse conditions. Decreasing weathering intensity across the overlying Strubenskop and Silverton formations, the latter deposited during the main phase of the LE carbon isotope excursion, suggests a cooling trend, associated with high atmospheric O_2 levels, although not linked to a major glaciation. Weathering intensity increases again in the uppermost Silverton and Magaliesberg formations, possibly due to renewed warming and associated with atmospheric O_2 decrease during the late stage of the LE. Our new data highlight a dynamic response of climate and continental weathering during the rise of atmospheric oxygen between 2.3 and 2.0 Ga.

[1] Guo et al. 2009; *Geology 27*, 399–402.
[2] Bekker et al. 2008; *EPSL 271*, 278–291.
[3] Coetzee et al. 2006; *S. Afr. J. Geol. 109*, 109–122.