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The Sedimentology of the Rooihoogte Formation of the Transvaal Supergroup in the Carletonville area, South Africa.

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The Great Oxidation Event (GOE) is characterised by a drastic rise in atmospheric oxygen which occurred on Earth between approximately 2.45 and 1.9 Ga. The main line of evidence supporting this phenomenon is described by sulphur mass independent fractionation (SMIF), where there is an observed disappearance of SMIF in the geological record between 2.4 and 2.3 Ga [1]. This age, in turn, overlaps with the depositional age range of the Rooihoogte Formation (~2.48 – 2.36 Ga) of the Pretoria Group of the Transvaal Supergroup [2].

The Rooihoogte Formation sits at the base of the Pretoria Group, which unconformably overlies the Penge Iron Formation of the Transvaal Supergroup [2]. The Rooihoogte Formation has been proven to be a lateral time equivalent in the western and central Transvaal Basin of the Duitschland Formation in the east [3], where the SMIF signal decreases towards the top [4]. The base of the Rooihoogte Formation possibly marks the transition towards the disappearance of SMIF, and therefore also the GOE, with a complete disappearance of SMIF in the Upper Rooihoogte Formation [5].

This study focuses on the Rooihoogte Formation in the Carletonville area, South Africa, where a better understanding of the sedimentology as well as the vertical and lateral depositional facies variations were established by studying multiple drill-cores.

A karst breccia is present at the base of the Rooihoogte Formation and this breccia is observed throughout the study area. The breccia varies in thickness (~18 metres – 46 metres), with the thickest occurrence in the southwest, thinning towards the northeast. A thin unit of black shale (~2 metres – 4 metres) occurs within the top of the chert breccia, indicating temporary siliciclastic and organic carbon input. Towards the southeast, the black shale occurs as multiple thin units interbedded with the breccia, indicating siliciclastic input was episodic in this region and therefore, that the southeast was further from the sediment source. There is an erratic occurrence of glacial diamictite of ~1 metre thick overlying the chert breccia in three drill cores. A variety of laminated black shales overly the breccia and diamictite (where present) that range in thickness from ~6 – 12 metres. The shales are thickest towards the southeast and are interpreted to represent a period of glacial lacustrine deposition [2, 3]. These laminated shales then grade upwards into a siltstone and then a quartzite. This unit is generally capped by a granulestone bed in the southwest, whereas coarse immature quartzites are more prominent in the northwest, again suggesting proximity to the sediment source in the latter region. These units are overlain by a chert breccia, sometimes capped by a diamictite that then grades into shale. The shale is then capped by a unit of black chert ~2 metres thick which is prominent throughout the study area.

The Rooihoogte- and Timeball Hill Formations were deposited in a deltaic environment, with the sediment source to the northwest and the coastline towards the southeast [3]. The sequence is marked

by two glacial periods followed by transgressions, with a period of regression between the two glacial periods [2].

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