Iron and manganese anomalies in the Gowganda Formation, Huronian Supergroup, Canada. Rise of oxygen and a snowball earth at 2.2Ga

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Atmospheric oxygen level is considered to have been increased during the Paleoproterozoic(2.45-2.0 Ga). The first and largest manganese deposit in the Earth history, known as 'the Kalahari Manganese Field', is present in the Transvaal Supergroup, South Africa, and formed just above a low-latitude glacial sediments of the Paleoproterozoic age. Kirschvink et al.(2000) interpreted this as an evidence of the rise of oxygen in the atmosphere just after a snowball Earth event. However, there is no additional evidence to support these as global events in other areas.

The Huronian Supergroup in Canada consists of Paleoproterozoic sedimentary rocks, including three discrete glacial diamictite layers. We analyzed core samples of the Gowganda Formation, which is the uppermost glacial diamictites of the Huronian Supergroup, taken from the Cobalt area in Ontario, Canada. We found that there is a high manganese concentration interval which is preceded by iron concentration interval in the black laminated siltstone layer immediately overlying the last glacial dropstone. In order to confirm its significance, however, we should confirm that these features are common in the Gowganda Formation of other areas in Canada.

In this study, we therefore tried to explore the iron and manganese concentrations in the Gowganda Formation in the Elliot Lake and Espanola areas in Ontario, Canada. As a result, we found that there is iron concentration followed by small but significant manganese anomaly in the samples taken from laminated siltstone that immediately overlies diamictite of the Gowganda Formation in the Espanola area.

Because iron and manganese concentrate along the black laminas, concentrations of these elements could have been sedimentary in origin. Similarities in stratiglaphical position and differences in the degrees in concentrations of iron and manganese between Cobalt and Espanola areas might be derived from different depositional depth of each sedimentary basin.

The iron and manganese concentrations in the Gowganda Formation could be compared with those of the Kalahari Manganese Field in South Africa in terms of ages, supporting the idea that the atmospheric oxygen level rose globally after the extreme glaciations approximately at 2.2Ga