

The hospitable environment of the Earth that we know today was born during the late Neoproterozoic between approximately 780 and 540 million years ago. During this time, the supercontinent of Rodinia had already formed and was beginning to break apart along the equator. During this break up, massive amounts of magmatism (including volcanism) were documented, which changed the chemical composition of our atmosphere and oceans. These changes in composition led to a series of glacial periods, of which at least two were probably global. These global glacial events, however, were critical for the rise of life as we know it today. After the glaciations ended, the oceans were rich in nutrients that allowed life to flourish. As life flourished, the oxygen concentration in the atmosphere increased dramatically, which allowed more and more complex life to develop. With the increasing oxygen concentrations and emergence of multi-cellular life, a critical point was reached 541 million years ago: the biological ‘big bang’. This biological ‘big bang’ marks the Ediacaran-Cambrian boundary, when the biological diversity of life increased dramatically, leading to the world that we know today.

This global consensus, however, is not without controversy. Many of the mechanisms which allowed for the build-up of atmospheric oxygen and the development of multi-cellular life, remain poorly understood. One of the keys necessary to understand this controversy better is accurate and precise geochronology (i.e., age dating), on key intervals across this time period. This will assist when used in conjunction with other studies on geochemical and geobiological cycles and indicators.

Several areas exist where rocks from this time period are preserved, and one of the best is in Namibia and South Africa. This includes the more altered Gariep Belt and the less altered Nama Group. These rocks include a variety of sedimentary and volcanic rocks deposited in the late Neoproterozoic. However, many contradictory correlations have been made on the glacial rocks (i.e., diamictites), preserved within the Gariep Belt and the Nama Group. This includes their timing, and whether they are from four, three or two glaciations. Resolving these timings and correlations will be the goal of this study, using a combination of mostly geochronological techniques. This is needed, as the four glaciations documented may be the product of structural complexity. This is important, as some of the diamictites are controversially interpreted to have formed before and after the known global glaciations: the Sturtian and Marinoan. This complicates any modelling of the geochemical and geobiological cycles and indicators of the Earth at this time. As diamictites are very diagnostic units, they can be used in the rock record as tracers. With better chronological constraints, in combination with better structural and stratigraphic analysis, whether four, three or two glaciations exist can be finalised. Resolution through a better chrono-stratigraphy will assist in this modelling of the Neoproterozoic Earth.