

South Africa Mapping project – Vredefort Dome

With rocks aging from a few million years to 3500 million years, South Africa contains the greatest record of the evolution of our planet than anywhere else on earth. This is why I, along with 2 fellow students, decided it was an interesting area for a project contributing to 25% of our undergraduate degree.

The Vredefort Dome, located in the Witwatersrand basin, approximately 120km south west of Johannesburg is an area of active research by international scientists. We were fortunate enough to be able to study this remarkable geological feature in order to produce geological maps (of approximately 15 km²) and in time, an accompanying geological report.



Figure 1- Vredefort Dome location

A typical day mapping would involve heading into the field at approximately 7am, from here we would walk in a specific piece of land, taking notes at any outcrop or rock exposure. I would make independent notes including which rock unit I was observing and any interesting features. Along with this I took orientation measurements where possible including bedding, jointing, flow direction and more. Each outcrop I stopped at would be labelled as a locality on a basic map of the area which will eventually become a geological map. We will also produce cross sections of the area to show our thoughts of what deformation has happened below the surface. Whilst in the field, I also collected samples of interesting rock types which will be used to create a thin section which I can analyse in further detail under a microscope for discussion in my project.

An example of a sample collected was a migmatitic granitic gneiss. This is part of Archaean Basement Complex which consists of rocks that underlie the core of the dome. This sample shows banding on couple mm scale indicating very high grade metamorphism indicative of high pressures or temperatures.



Figure 2- pseudotachylitic breccia at local quarry

Another interesting rock we were able to observe was a pseudotachylitic breccia. These outcrops consist of dykes several metres thick containing large clasts of host rock. The volumes of pseudotachylite found in the Dome are much larger than any found in fault zones anywhere in the world with one exception, the Sudbury impact structure in Canada.



Figure 3- pseudotachylite outcrop on Erfdeel farm (boots for scale)

The presence of staggering volumes of pseudotachylite along with many other observations have led many scientists to believe the deformation and structure of the Vredefort Dome has an impact origin. Impact craters have distinct crater shapes (elevated rim and interior depression), the elevated rim creates a characteristic ring structure visible both from huge distances away, and on close by measurements.



Figure 4- screenshot of bedding measurements I collected showing characteristic ring structure (Field move clino app used)



Figure 5- ring structure of the Dome, half eroded due to glacier