upwards in magma. The mechanism by which these economic element-enriched magmas reach the surface through the crust has been unknown until a recent study published in *Nature Communications*. It transpires that there is a temperature-dependent zone at the base of the crust where the rising magma is not trapped, but instead escapes upwards through the crust. This "Goldilocks zone" is explained in the SciTechDaily article.

Being now retired and of a certain age, I found this article about diet and life expectancy rather intriguing. As I anticipated before reading the article, however, the optimising of your diet is very much more beneficial for younger folk and is only marginal for the older generation. Nevertheless, every additional day in our lives is a blessing, and we should all eat healthily in any case.

George Henry

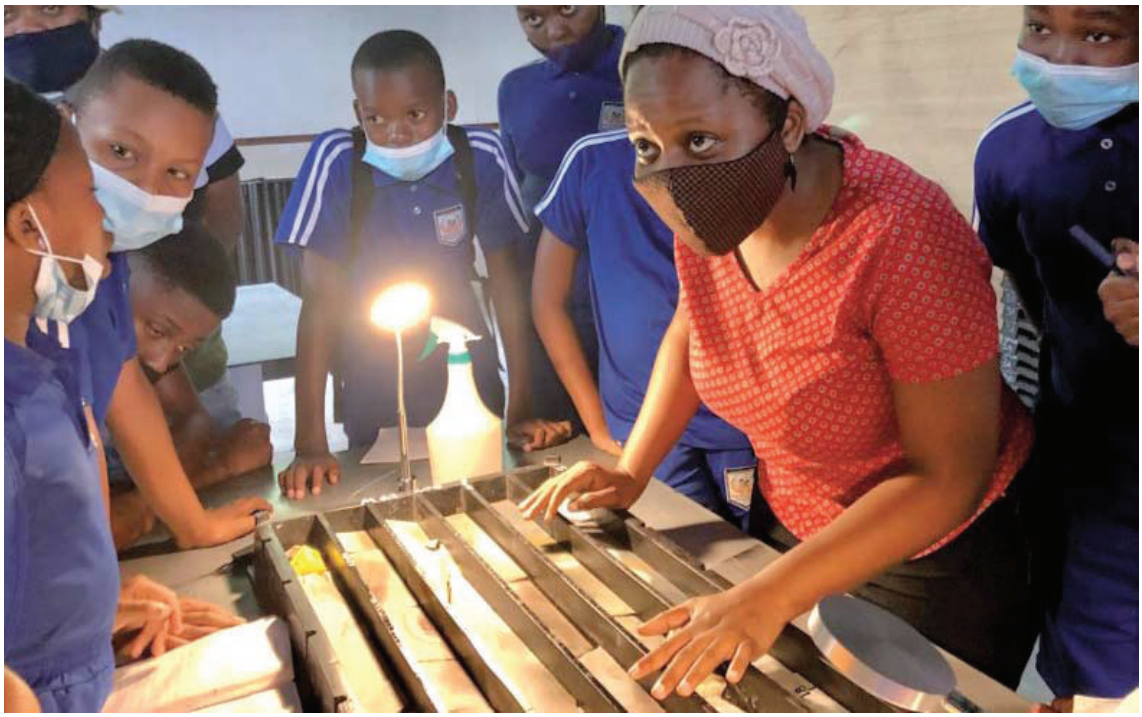
ICDP research drilling

ICDP research drilling in the Moodies Group of the Barberton Greenstone Belt is underway

ICDP (International Continental Drilling Program) research drilling in the Moodies Group of the Barberton Greenstone Belt (BGB) started in mid-November 2021 and will continue into May 2022. The Moodies strata are about 3.22 billion years old and up to 3.7 km thick. They record surface processes in very well preserved and correlatable fluvial-to-prodeltaic siliciclastic rocks at an extremely high resolution. The overall depositional rate of ~1 km/Myr is approximately comparable to mean depositional rates at modern passive-margin coastlines.

Despite tight regional folding, the metamorphic grade of the Moodies Group strata is only lower-greenschist facies. There is a nearly complete absence of penetrative strain because many beds were cemented early-diagenetically, in particular in the hydrothermal halo of the Lomati River Sill

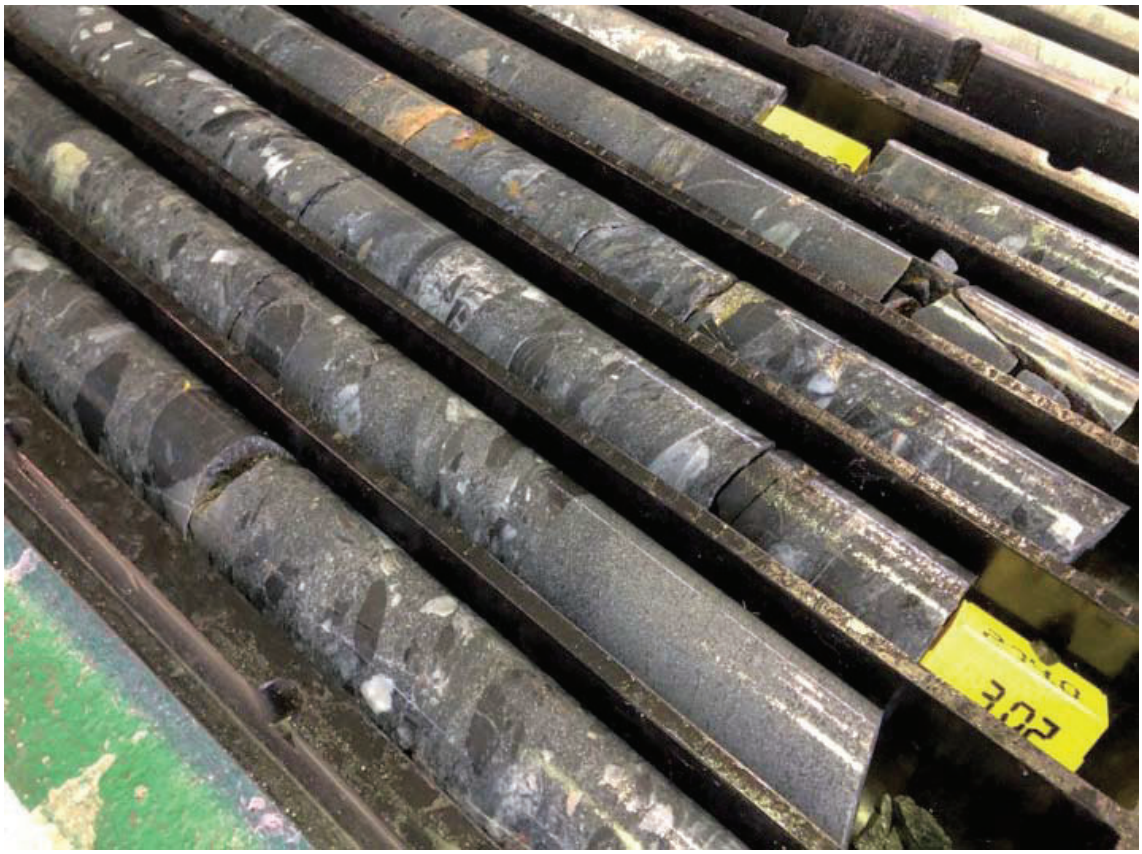
Site 2 is set up next to the parking bay (visible in the background) along the R40 Geotrail, which winds its way across the central Barberton-Makhonjwa Mountains. The fenced site measures only 15×15 m in diameter. The rig drills at a 45° angle through steeply inclined strata of the Dycedale Syncline at about 15–20 m/day.



School classes, delegations, local residents and tourists visit the exhibition. Here, Ms. Phumelele Mashele explains slabbed core to 8th grade learners from a local high school.

in the central BGB. This has preserved abundant primary micro- and macrotextures. Geological mapping has documented palaeosols, terrestrial evaporites, potentially aeolian strata, shoreline systems, tidal microbial mats, deltaic complexes, and marine ferruginous sediments or banded iron formations. Collectively, the Moodies strata provide a worldwide unique opportunity to reconstruct early bio-geo-atmo-hydrosphere processes and conditions, particularly those related to diverse and well-documented microbial life.

The high relief of the Barberton-Makhonjwa Mountains makes for locally excellent outcrops



In the targeted sections, Moodies strata show virtually no strain and are excellently preserved. They show commonly spectacular sedimentary structures in a variety of rocks types, including sandstones, tuffs, conglomerates, and subordinate shales and BIFs.

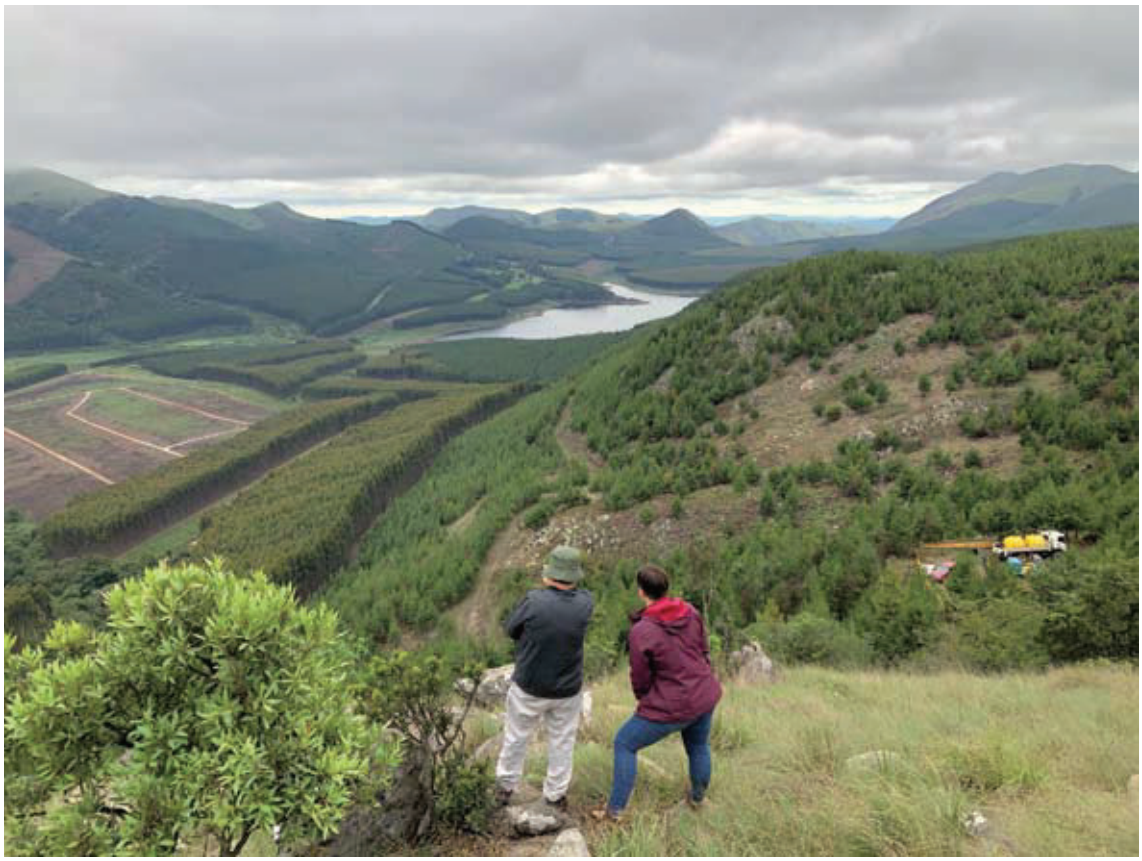
BASE temporarily uses part of a large former industrial hall in the centre of Barberton. The front section (foreground) is used to showcase the geology of the Barberton Greenstone Belt, the objectives and locations of the drilling program, and its relevance for the World Heritage Site. Core processing (background) can be observed by the visitors up-close.

that allow the prediction of subsurface geology to some degree. However, the effects of oxidative weathering run deep. Eight inclined diamond drill core holes in the Saddleback Syncline, the Eureka Syncline and the Stolzburg Syncline of the central BGB, each 350–450 m in length, are planned, to obtain continuous sections suitable for geochemical and time-series analyses.

Drilling aims at coring selected stratigraphic intervals that show diverse and structurally undisturbed siliciclastic facies transitions, associated with lava flows, tuffs, primitive soils and vadose-zones, prodelta rhythmites, jaspilites and BIFs, and/or microbial-mat sandstones. In selecting the sites, the science team placed particular emphasis on avoiding hydrothermally mineralised zones. At the time of writing (March 8, 2022), two fully cored boreholes of 280 and 340 m length, respectively, are completed. Three rigs are currently operating: two of them investigate the middle and the proximal facies of the Lomati Delta Complex of the Saddleback Syncline; the third rig will likely complete a 350 m section through a lithologically highly variable terrestrial–tidal transition with common microbial mats in the Dycedale Syncline. Drilling operations are set to end in mid-May after drilling sections in the Stolzburg and Eureka Synclines.

A central objective in this drilling project is to investigate the evolutionary development of oxygenic photosynthesis because it was and is responsible for the profound transformation of surface environments; it allowed the rise of eukaryotic and complex multicellular life. Various geochemical clues suggest that there were at least temporary variations in the overall very low level of atmospheric oxygen by ~3 Ga. This is consistent with results of recent molecular clock analyses that suggest the onset of oxygenic photosynthesis prior to that time, probably via microbial consortia including highly productive benthic cyanobacteria that colonised early shorelines. Other research objectives will address the setting of the thin BIFs and jaspilites found in the fine-grained sections, the weathering conditions inferred from palaeosols and lava flows, and Moon–Earth dynamics, represented in sandstone tidal bundles and siltstone-shale prodelta rhythmites.

The project is about eight years in the making and is partially based on geological mapping and studies by Christoph Heubeck, Friedrich-Schiller of the University Jena, Germany, and his students. ICDP initially funded a field workshop in 2017 during which ca. 50 international participants inspected potential sections and formed working groups. ICDP funding, covering about 50% of the



Site 3 (foreground) of the BASE (Barberton Archean Surface Environments) drilling project recovered 340 m core from steeply dipping, overturned strata of the Saddleback Syncline, central Barberton Greenstone Belt. This included ca. 200 m of microbially laminated sandstones of tidal-flat facies.

total costs of ca. ZAR 25 million, was successfully obtained in 2019. Co-funding came in from the US, Belgium, Germany, South Africa, Japan, Norway, Switzerland and DSI-NRF CIMERA; research proposals aiming to contribute to drilling and follow-up expenses from several other countries are still pending. The project is administered in South Africa by DSI-NRF CIMERA at the University of Johannesburg. After the end of the drilling campaign, the archive half of the cores will be stored at the National Core Library at Donkerhoek near Pretoria; the working half of the cores will be shipped to ICDP core analysis and storage facilities in Spandau, near Berlin, Germany. A "sampling party" is tentatively scheduled for the end of this year.

Core processing is currently taking place in the BIAS Hall next to the Barberton Museum in downtown Barberton. Our setup is open to the public and includes an exhibition on the geology of the BGB, polished rock samples, geologic maps, and posters illustrating the value of geologic research in general and for the recently (2018) declared Barberton-Makhonjwa Mountains UNESCO World Heritage Site, which encompasses a large part of the central BGB. A core point of the exhibition is to demonstrate that the value of the World Heritage Site was created and will be maintained by continuous and unhindered geological research.

Follow our daily updates and biweekly newsletter at the ICDP project link or the Moodies-BASE Project Facebook page.

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***Christoph Heubeck**, **Nic Beukes** and the BASE Onsite Geoscience Team (**Dora Paprika, Phumelele Mashele, Chris Rippon, Ryan Tucker, Rodney Tucker, Tony Ferrar, Astrid Christianson**)*