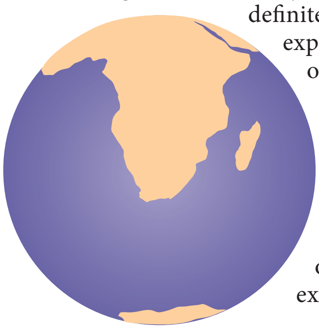
Recreating rocks

Nicole Posth and colleagues spent a month touring South African rock formations in their quest to understand the origin of ancient iron and silicate layers.

What was the objective of the work?
Initially we wanted to test the hypothesis that a specific type of bacteria — the anoxygenic phototrophic iron(II)-oxidizer — was involved in the deposition of South African banded iron formations more than 2.2 billion years ago. On a field trip to these formations we saw first hand the extent and character of these deposits. During hikes, long van rides and dinners of grilled Eland, Kudu or Boereworst, we discussed the many factors that may have influenced microbial activity in these settings. We came to the conclusion that anoxygenic phototrophs may not only have deposited these iron-rich layers, but, in a complex interplay with an array of abiotic factors, could have formed the enigmatic alternating silica–iron layers. Back home in the lab we set about testing both of these hypotheses by comparing the field samples we collected to biogenic minerals produced in the lab.

Did you encounter any dangerous animals?
We were in the very capable hands of Professor Nic Beukes, an experienced field geologist from the University of Johannesburg, who kept us safe from any South African wildlife while we were on our hikes. Back home in the lab, where the majority of our work was carried out, the closest thing to a wild animal is the late-night doctorate student crouched over a Bunsen burner, and they are usually quite harmless when approached with caution.

Did you encounter any difficulties during your experiments?
Although not a difficulty as such, I definitely had an experience that older colleagues have informed me is something of a rite of passage. I was carrying out a mineral extraction with



ALEXANDRA KAPPLER

Nicole Posth and Andreas Kappler sitting in between alternating layers of orange and black silica and iron minerals of the 2.5–2.6-billion-year-old Precambrian banded iron formation at Gamohaan Hill.

a new procedure. It had finally worked and I happily transferred the remnant mineral onto a filter for isotope analysis. As this filter was the harvest of five weeks of labour, I kept it safe from all harm in a covered glass dish. The next day I was particularly excited to show my advisor, who had just returned to work after the birth of his son. He came into the lab and I handed him the dish. He is normally an athletic person with good hand–eye coordination, but lack of sleep (not unusual in a new parent) had clearly affected his motor skills. I will never forget my precious filter, lying face-down on the lab floor in a heap of glass splinters, nor my advisor's face at that moment. I became more efficient with the extractions after that — and have enough fodder for jokes for a long time to come.

What was the highlight of the project?
Brainstorming the potential role that microbes may have played in the formation of these iron and silicate layers with experts in the field was very motivating. Later on, work with silica in batch cultures began as something of a side project. The process of trying something out, noticing an unexpected and interesting reaction, and then being able to pursue the questions stemming from that observation was very gratifying, and demonstrated to me, as a doctorate student, how creative and invigorating research can be.

Did you learn anything new about yourself or your team members?
In retrospect, I am very aware of how much the opportunity to go to the field and have a look at the natural systems (rocks/field sites) at the very start of my PhD really set the pace of my research, and helped me plan my subsequent laboratory experiments accordingly. The excitement that my colleagues showed for the topic of life on early Earth surpassed that which I had been accustomed to, and I found such vigour to 'want to know more' infectious and inspiring.

Did the work give you any ideas for future research projects?
If silica and iron layers formed in the way that we propose then the question remains as to how these bacterially deposited layers were transformed, through both long- and short-term processes, to produce the banded iron formations we see today. We recently started high pressure and temperature simulation experiments in order to understand the fate of iron mineral–biomass aggregates and the potential for biomarker preservation. In addition, together with one of the co-authors on this paper, Kurt Konhauser, we are now investigating the dependence of iron-precipitating bacteria on trace metals, and the fate of these metals in banded iron formations.

This is the Backstory to work by Nicole Posth and co-workers, published on page 703 of this issue.