lifting the curtain...

Continents are a planetary oddity, when you think about it. We know of no other planet that sports any similar features. The same applies to life. Can these two peculiarities be related, so vastly different in scales of both time and space? The search for answers takes us to the origin of both processes, deep within the basement of the Earth's first continent: the Kaapvaal craton, as exposed in the Barberton Mountain Land.

Continents, those semi-permanent platforms floating in the Earth's crust, require the separation of an originally homogenous mass, into lighter and denser materials. This can only be achieved through steady and repeated partial melting of huge volumes of rock by a reliable long-term heat source, such as found in the Earth's mantle. Subduction and convection combine to force cooler solid material into deeper, hotter zones. Subduction zones are recognized as the continent factories. Lighter material rises within the magma chambers above subduction zones, and is eventually exposed to the gases and liquids at the surface, while denser material sinks back into the mantle. Once exposed, the gradients achieved in the 'solid' surface materials (mountains) ensure that weathered continental rocks are transported to the oceans in both particulate and dissolved form, giving rise to immense clastic and chemical sedimentary deposits, along with endless pore spaces, dissolved nutrients and shallow-water (wet and dry) tidal environments. Simply add sunlight and wait 3 billion years (3 Ga).

There is, however, no need to invoke *plate* (or lateral) tectonics for this process. If the planet's interior was too hot, subduction would not succeed because the surface material will be too hot and too buoyant to sink. Nevertheless, the earliest continents may have formed through the vertical rise of hot mantle material in discrete cells with the corresponding sagging of material in between, a process not unlike that in a lava lamp – an old idea that has recently come back into fashion. The Barberton Greenstone Belt (BGB) is one of the few regions worldwide that shows evidence of this particular style of *vertical* tectonics, a relic of a younger, hotter Earth.

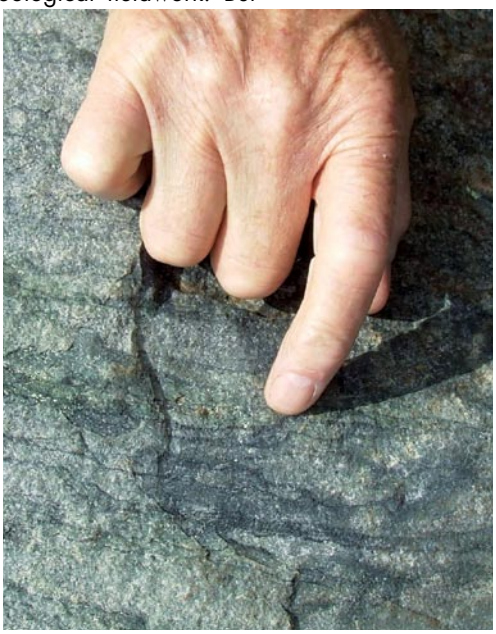
Faurea growing in the high hill-slopes of the Barberton Mountain Land.

Northward view toward the Lebombo mountains

Recognising these attributes, the BGB was proposed as deserving World Heritage Site (WHS) status by Carl Anhaeusser in the 1980s, a relatively lonely voice until about a decade ago. Slowly, even until today, awareness of the value of geoheritage is growing. Official planning for WHS recognition began around 2006, and in WHS status followed in 2009, but after one year of work, the project ran out of funds and was placed on hold. Planning is now back on track and the Barberton Mountain Land is first in the queue of South Africa's upcoming WHS applications. The plan is to have the Nomination Dossier tabled at UNESCO during the current year's cycle of acceptance.

Credit for staying in touch with the process must go to the Barberton Chamber of Business whose belief in the merits of the case has never faltered. They created a project management agency named BATOBIC (Barberton Tourism and Biodiversity Corridor) responsible for funding and managing the project. BATOBIC also oversaw the planning and construction of the Barberton Makhonjwa Geotrail, now two years old and warmly reviewed by geologists and tourists alike. The team of professionals doing the WHS work is basically the same as in 2009, brought together by geologist, Dr. Dion Brandt.

The area to be included within the WHS has been the subject of much debate. The Tentative Listed site included only nature reserves; but important geosites extend way beyond their boundaries. Outcrops in overgrazed cattle country are not necessarily at greater risk of damage than those in nature reserves, and are often easier to find. Trackless mountain wilderness, with long grass, thorny thickets and forested river lines, makes for delightful geological fieldwork. But biodiversity protection is not a pre-requisite for geosite protection, although in some circumstances it helps at a landscape scale. Having little commercial value, these outcrops are low-risk, low-maintenance assets. So where should the WHS boundaries be located?



1st signs of life visible to the naked eye

Current planning indicates that a multi-owner, multi-land-use core area will be proposed. Management and administrative complexities will result, but they will be offset by the relative simplicity of protecting *geodiversity*, as compared to protecting *biodiversity*. Scientifically important (rare) geosites can be conserved easily because rocks are largely self-protecting. There is not much to be asked of a land-owner with an important geosite on his land: "Please don't damage, excavate or bury the rocks," and, "Please allow visitors to examine them". Registered

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Zebra stripes near the Lochiel T-junction

outcrops, and there are about 300 of them, are not likely to wander off or get shot like rhinos do.

As a matter of fact, the biggest threat to these valuable outcrops, both within nature reserves and outside, is the ill-discipline of rock collectors: including, geologists, students and researchers, with their ever-ready geopicks and core drills. With WHS proclamation this 'entitled' behaviour will have to become more disciplined and considerate.

If museums could display continents and microbes side by side, confined by walls and glass, the significance of the link would probably be lost to visitors as they walk out the door. To really gain insight about the continent factory, and why singled-celled organisms had to make a 2.5 Ga investment to make the planet clean enough to support multi-cellular life, you have to get into those impossibly ancient green hills of the Makhonjwa Mountain Range. These most ancient strata, never subducted, have lain lightly and coolly buried and protected for 3.3 billion years. Their study lifts the curtain on the Earth's earliest beginnings and shows the vital link between continents, and the evolution of life as we know it.

At the side of a tarred road along the Geotrail you can see, by simply stepping out of your car, the earliest signs of life visible to the naked eye. A few graceful curves further, and you will see all sorts of evidence of our planet's first proto-continent. The relationships are there, clearly explained for all to see. In truth, the Barberton Mountains stand as the planet's pre-eminent natural monument to Earth's early history. There is nowhere else quite like it anywhere on Earth – nor on any other planet.

Tony Ferrar, Barberton;
with unreasonable amounts of help from his wife Sandy, and Christoph Heubeck in Jena, Germany.

Tidal foresets