

SERPENTINES

OF THE BARBERTON GREENSTONE BELT

Metal-rich rock outcrops and their associated vegetation.

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Dr Marla McIntosh, a botanist from the University of Maryland, U.S.A., told a colleague that she would be attending a conference on serpentine ecology. Her colleague inquired as to why she was going to a conference concerning snakes! Well, deceptive as the name may seem, serpentine ecology has very little to do with snakes, but much to do with a specific type of rock that is rich in metals, and its associated plantlife. The attractive, variegated shades of green, sometimes with streaks of red, of these rocks, as well as their greasy or soapy feel, resemble the skin of a serpent - hence the name.

What is serpentine ecology?

Serpentine ecology is a relatively new and not extensively explored field of study. Serpentine is 'ultramafic' rock, rich in metals such as nickel and chromium, and other elements, e.g. magnesium. The resulting toxicity of the soil creates an environment that is not particularly conducive to plant growth. Certain plant species are specifically adapted to grow on serpentine, and some accumulate the toxic elements in their leaves and stems. Numerous endemic species occur on serpentines all over the world, and the conservation of these sites is of utmost importance. An important plant that is endemic to South African serpentines is *Berkheya coddii*, a useful indicator of serpentine soil. 'Hyperaccumu-

lating plants' are currently receiving much attention, as their ability to accumulate heavy metals makes them useful for rehabilitating mine dumps, where the soil is too toxic to support much life. These plants can also be harvested, in a process known as phyto-

Potgietersrus to Duiwelskloof in the Northern Province. Smaller outcrops also occur on the Witwatersrand and in KwaZulu-Natal. Thirty-six serpentine sites have been identified in the Barberton Greenstone Belt, of which thirty have been mapped by geologists. The remaining six have been identified because of the presence of the nickel hyperaccumulating plants, *Berkheya coddii* and *B. rehmannii* var. *rogersiana*. The sites occur in an inverted equilateral triangle centred on Barberton, with sides approximately 100 km long, and show considerable variation in habitat, soil chemistry and species richness and diversity. The soils have concentrations of nickel and chromium high enough to be toxic to plants.

The Barberton Greenstone Belt serpentines

Approximately 620 serpentine-tolerant taxa (species level and below) of 298 genera and seventy-four plant families grow on serpentine in the Barberton Greenstone Belt. The Asteraceae has the most representatives and its largest genera are *Senecio*, *Helichrysum* and *Berkheya*. The Asteraceae contributes eleven

endemic species, the Acanthaceae and Anacardiaceae, three each, the Asclepiadaceae, Lamiaceae and Lobeliaceae, two each and the Adiantaceae, Celastraceae, Fabaceae, Iridaceae, Liliaceae, Proteaceae and Poaceae, one each. Eleven of the endemics are restricted to single sites. Three



Berkheya coddii, a South African serpentine endemic with the ability to accumulate nickel in its leaves and stem from toxic soil. Photo: K. Balkwill.

mining, during which metals are extracted from the plants themselves.

Where are serpentine areas in South Africa?

Major serpentine outcrops occur in two regions in South Africa, namely the Greenstone Belt of the Barberton mountains (Mpumalanga) and a band from



Dunbar Valley Serpentine. Note the sparsely vegetated slope on the left, as opposed to the dense tree growth on the right. The sparse vegetation is growing on serpentine, which contains heavy metals and limits plant growth. Photo: G. J. Campbell-Young.

endemic *Berkheya* taxa and two endemic *Senecio* taxa hyperaccumulate nickel, and *Berkheya coddii* has become the subject of intensive research because of its potential value for re-vegetation and other properties.

At the Agnes Mine site about 12 km south-west of Barberton fourteen endemics were identified, one that is unique to the site and three nickel hyperaccumulators. They include *Aloe thorncroftii*, *Asystasia subbiflora*, *Berkheya coddii* and *B. rehmannii* var. *rogersiana* (both hyperaccumulators), *Brachystelma dyeri*, a new species of *Cheilanthes*, *Cyphia elata*, *Indigofera crebra*, a new species of *Ocimum*, *Ozoroa barbertonensis*, a new species of *Rhus*, a new species of *Sartidia*, a *Senecio* hyperaccumulator that is similar to *S. coronatus*, and *Gladiolus serpenticola*. This site is relatively undisturbed, and two very small areas are conserved as the Cythna Letty and Harold Thorncroft Nature Reserves, but the main part has no formal conservation status. The owner, SAPPI, is interested in having it declared a

National Heritage Site.

At Mundt's Concession, about 5 km north-east of Barberton in true lowveld vegetation, six endemics, three unique taxa and one hyperaccumulator have been identified. Endemics include the hyperaccumulator *Berkheya nivea*, a new species of *Gymnosporia*, *Protea curvata* which is restricted to this site, a *Rhus*, *Sclerochiton triacanthus* and *Gladiolus serpenticola*.

Diepgezet serpentine, 25 km south south-east of Barberton, is the most intensively sampled portion of the larger Msauli Mine serpentine. Endemics include *Berkheya coddii*, *B. rehmannii* var. *rogersiana*, a species of *Brachystelma* (close to *B. franksiae*), a new species of *Ocimum* and *Salpinctium hirsutum*. The Msauli site is the most disturbed area because of the activities of the asbestos mine, but the mine is reaching the end of its productive life and will be rehabilitated and closed. The site is owned by the Mpumalanga Parks Board, but is excluded from the Songimvelo Game Reserve. It is

part of land that forms a link with Malolotja Nature Reserve in Swaziland.

The Dunbar Valley occurs within Songimvelo Game Reserve and has the highest number of taxa recorded so far, with a total of 227 identified, including the four endemics *Berkheya coddii*, a new species of *Helichrysum*, an *Ocimum* species and a new species of *Sartidia*. This is one of the least disturbed sites because of its location within the Game Reserve, although grazing by herbivores (such as zebra and rhino) and cattle (at one end of the site) takes place.

Groenvally is the largest serpentine site in the Greenstone Belt, situated near Badplaas in high altitude grassland. Endemics include a new species of *Athrixia*, *Berkheya coddii*, *B. rehmannii* var. *rogersiana*, a new species of *Dicoma* (which is similar to *D. anomala*), a new species of *Inezia* (similar to *I. speciosa*) and a new species of *Sartidia*. The *Athrixia* and *Inezia* were discovered on a field trip with Sarah Smith from Kew. On the whole, this site is undisturbed,

although part of it has been planted with pines. Most of this land is owned by SAPPI, who is interested in declaring this site a National Heritage Site too.

Of the five sites, initially only Dunbar Valley was formally conserved. However, with Mpumalanga Parks Board assuming responsibility for, and consolidating much land into the Barberton Nature Reserve (including Mundt's Concession), a much improved conservation status for serpentine in the Barberton Greenstone Belt has been achieved. Despite this, the number of endemics at Agnes Mine and Groenvaly make it urgent for us to collaborate with SAPPI to have these two sites declared National Heritage Sites, and thus guarantee their conservation.

Third International Conference on Serpentine Ecology

This conference was hosted by Prof. Kevin Balkwill, an organizing committee of international delegates and an action team from the C.E. Moss Herbarium, and took

place at Berg-en-Dal restcamp in the Kruger National Park, in March 1999. Countries represented included Australia, Belgium, Brazil, Canada, Cuba, England, France, Italy, Mozambique, the Netherlands, New Caledonia, New Zealand, Portugal, Scotland, South Africa, Spain, Sri Lanka, Sweden, Turkey and the United States of America. Many aspects of serpentine ecology were addressed at the conference, and applied studies led to stimulating discussions, including such issues as re-vegetation and phytomining. Delegates visited all the serpentine sites mentioned above, and a highlight of the post-conference tour was a visit to the beautiful Dunbar Valley - a real African adventure as delegates were driven there in four-wheel-drive vehicles, through thick bush and rivers.

The next conference (2003) is likely to be held in Cuba, which boasts the world's richest source of nickel hyperaccumulating plants.

The conference left researchers feeling inspired about their work and encouraged to press on in their

struggle for the conservation of serpentine areas. Priorities are to gather as much information as possible regarding serpentines around the globe and to present such information to authorities able to ensure the survival of serpentine sites. ♡

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Conference delegates approaching Dunbar Valley on four-wheel-drive vehicles. Photo: G. J. Campbell-Young.