STATE PARTY RESPONSE TO THE SUPPLIMENTARY INFORMATION REQUESTED BY IUCN

FOR THE BARBERTON MAKHONJWA MOUNTAINS WORLD HERITAGE NOMINATION

21 FEBRUARY 2018

GOVERNMENT OF THE REPUBLIC OF SOUTH AFRICA

Barberton Makhonjwa Mountains is a site that South Africa submitted to Unesco for inscription as a World Heritage Site. An IUCN Evaluation Mission was successfully undertaken in September 2017. The aim of this Evaluation Mission was for IUCN to evaluate whether or not the property has Outstanding Universal Value, meet the conditions of integrity and (where relevant) of authenticity and meet the requirements of protection and management.

Following the Evaluation Mission, IUCN wrote a letter to South Africa dated 20 December 2017, requesting supplementary information before finalising its recommendations to the World Heritage Committee. South Africa was requested to address the following aspects and to submit responses by 28 February 2018:

What follows below are the responses by South Africa, addressing the above points in chronological order, together with relevant attachments where indicated.

1. Global Comparative analysis

As proposed by IUCN in terms of the Global Comparative Analysis, further review as requested has been submitted by Christoph Heubeck[1], Carl Anhaeusser[2] and Dion Brandt[3]. This new addendum has been integrated with the existing comparative analysis to provide a consolidated statement of the comparative values of the nominated property relative to other sites globally provided within the updated Nomination Dossier. Refer to Paragraph 3.2 on page 26 of the Nomination Dossier which is to be replaced by ***Annexure A*** attached.

[1] Prof. General and Historical Geology, Department of Geosciences, Jena University, Germany
[2] Prof. Economic Geology Research Unit, School of Geosciences, University of Witwatersrand, South Africa
[3] Dr. Consulting Geologist, Barberton, South Africa

2. Legal protection

In terms of the National Heritage Resources Act No.25 of 1999, section 27 (10) (NAHRA), all geosites listed shall be deemed to be protected as heritage sites for the period of six(6) months after the notification of intention to declare a site has been served. The notice was issued on 26 September 2017 which included all the geostites forming part of the proposed World Heritage Site. The final gazette notice to declare the geosites is due in March 2018. Find the notification attached as ***Annexure B***. In terms of the act, the notification stays enforceable until such time as the geo sites are declared to be heritage sites in a government gazette.

Therefore at present adequate protection of all the geosites as listed in the South African Heritage Resources Agency (SAHRA) Notification of intention to declare the geosites as national heritage sites is already in place and final declaration will be published in a government gazette, prior to UNESCO inscription.

3. Mining

Mining in the area has been in steady decline for many decades, moving from multiple operating mines (around 50) operating in the early 1900's to only a handful remaining at the turn of the century. All except three have now been closed down and their mining rights either cancelled, withdrawn or allowed to expire.

In terms of scale of remaining mining potentially affecting the property, the following are with regards to the two mines adjacent to the property.

Firstly, the one directly north of the property (Barberton Mines) is the only mine of any scale remaining. While it has also seen a decline since the heydays in the mid 1900's, it appears to be the only remaining viable mining operation in the district. In terms of threats to the property, the National Environmental Management: Protected Areas Act, 2003 (NEMPA) and Minerals and Petroleum Resources Development Act of 2003 (MPRDA) specifically prevents it from expanding into the Nature Reserve (recently confirmed by the highest court in the country, the Constitutional court) as well as into a World Heritage Site once it is also proclaimed as intended.There is thus no expectation that this mine can expand the area affected by its operations or can become a threat to the property.

Secondly, the one on the east (Vantage Goldfields) has also been through successive boom and bust cycles and has been in business rescue for going on two years now. It is not in operation at present and all indications are that it may never get back to operation again. Even if it did start up again it has no potential for mining at any scale and has always been a very small private mining operation employing some two hundred people at peak. Furthermore expansion of this mine to the property is also curtailed by NEMPA and the MPRDA as explained regarding Barberton Mines above.

As indicated elsewhere, the property already enjoys formal protection (under NEMPA and NAHRA acts as described elsewhere in response to comment number 2. Legal protection) and once inscribed it will gain additional final protection by being proclaimed a World Heritage Site in terms of the national World Heritage Convention Act No. 49 of 1999.

In terms of both NEMPA and the MPRDA no mining or related right may be awarded in a protected area (defined as a National Park, Nature Reserve or World Heritage Site). This prohibition was recently tested through the court system up to the country's Constitutional Court, who confirmed the prohibition on mining in protected areas and also that the Barberton Nature Reserve enjoys this protection (ie. the contact area between this mine and the proposed World Heritage Site on northern boundary of the property). This court case was brought by Barberton mines, the very mine sitting directly adjacent to the property. There is therefore no threat of expansion into the property.

It is established law in South Africa that mining rights, cadastral boundaries and protected areas boundaries extend below the surface of the earth, theoretically to the centre point of the earth. There is therefore also no risk of underground extension of mining under the property either now or in the future.

4. Buffer zones

The Property does not have a buffer zone, but there are buffering mechanisms in place which should protect the OUVs. The Buffering Mechanisms in place include the legislative tools such as NEMPAA, NEMBA, MSA, NEMA, SPLUMA, NAHRA, EIA Regulations, IDP's these pieces of legislation are prescribed in detail in the document titled *"whs: relevant legislations"* forwarded as supplemental information shortly after the Evaluation Mission

Furthermore, the local municipality has given the assurance that developments in this area will be regulated so as not to have a negative impact on the OUVs of the property. The Strategy on Buffer Zones for National Parks also puts emphasis on municipal planning processes including Integrated Development Plans and Spatial Development Frameworks. In addition to the Strategy, the Ministers of Environmental Affairs and Mineral Resources have put in place the Mining and Biodiversity Guideline which guides how mining applications in sensitive areas should be handled. This Guideline take care of one of the biggest development challenges that the World Heritage Committee and Advisory Bodies are concerned about (that of mining)

The protection afforded by the existing mechanisms as described is therefore considered by South Africa to be sufficient for the purposes of protecting the OUV's of geology as intended.

5. Relocation of people

It is worth noting that, the relocation of people within the property is not due to the World Heritage nomination process. This is the process that has been ongoing for the last 30 years for the protection of biodiversity and to provide previously disadvantaged people with tenure upgrade. This process is well legislated and takes place strictly in accordance with the legal framework which deals with consultation with affected parties, their compensation and improved tenure security and livelihoods. Specifically the above process relates to land claims in terms of the Restitution of Land Rights Act No 22 of 1994. This legislation is an integral part of the country's attempts to address past social injustices and does not affect the proposed World Heritage Site.

6. Threats

Through the National Department of Environmental Affairs, MTPA has been allocated a R20 million grant over four years to fund the training and deployment of World Heritage village guides and rangers to, *inter alia*, address geosite protection and visitor management tasks. Focus is nominally on the Geotrail but plans exist for all high-grade geosites to be accessed by visitors via linked additional geotrails, most significantly those located along and close to existing public roads and the ones where damage occurred in the past. These will specifically be the target area for these village guides and rangers. A substantial emphasis in their training will be their community outreach function which will target local residents to support responsible visitor behaviour and geosite protection. By agreement with SAHRA, the MTPA has undertaken to mobilise its staff from the adjoining Songimvelo and Barberton Nature Reserves to patrol and protect these 51 geosites. A letter from the MTPA Chief Executive Officer dated 5 February 2018 is attached as ***Annexure C*** in evidence of this undertaking. Any damage and wrong-doing will be investigated and, with support if necessary from SAHRA, will be prosecuted.

In addition, the World Heritage Convention Act, Act No. 49 of 1999 requires that the Integrated Management Plan be developed and approved by the Minister six month after the appointment of the Management Authority. The integrated Management plan will integrate the conservation, promotion, management of the site and will further identify the potential threats as well as mitigation Measures in place including the Tourism management.

7. Private Landowners

All private landowners within the nominated property were consulted over an extended period of some years. Not only did they support the nomination but became a key driving force behind the nomination. They participated at all points along the process and have been and will in future by agreement be represented in all structures related to the nominated property, including in the future Management Authority of the site.

A resolution signed by all landowners evidencing their early support for the process can be found on Page 52 to 55 of Appendix J of the Nomination Dossier, titled *"Stakeholder Engagement Records and Signed Consent Forms"*.

As the process drew to a close the formal consent of the landowners was also required in terms of national legislation. As a result all landowners were required to sign formal consent forms which can be found from Page 56 of the same Appendix J of the Nomination Dossier.

For the sake of brevity the resolution and forms are not attached here. However, in the vent that these forms were omitted from the Nomination Dossier copies distributed then can be provided or found by downloading Appendix J on the project website at the below link:
http://www.bmmlworldheritage.org/docs/NominationDossier2017/Appendix%20J%20Stakeholder%20Engagement%20Report%20and%20Signed%20Consent%20Forms.pdf

8. Transboundary collaboration

South Africa had several engagements with Swaziland through different platforms including the Songimvelo-Malolotja Transfrontier Conservation Area (S-MTFCA) fora. The main purpose of these engagements was to inform Swaziland about South Africa's intention to nominate Barberton Makhonjwa Mountains as a World Heritage Site, to understand Swaziland's possible position on inclusion of potential geosites in Swaziland in the nomination process and later on to report on progress being made with the nomination. So far, there is no sufficient data available about potential geosites in Swaziland.

In future the possibility may exist to add potential geosites which may qualify to the Barberton Makhonjwa Mountains property, however, this would need more research to be conducted on the potential geosites. South Africa will be willing to accept extension should data become available.

END.

3.2 Comparative Analysis

Christoph Heubeck, Carl Anhaeusser and Dion Brandt

Volcano-sedimentary "greenstone belts" occur in the oldest basement regions of all continents. Having formed through the combined processes of sedimentation and volcanism, these ancient geologic terranes provide key evidence about the nature of the surface and environments of the early Earth. Nowhere on Earth do greenstone belts provide such a rich and detailed picture of conditions that prevailed on the very early Earth as in the Barberton Greenstone Belt (BGB). The *Outstanding Universal Value* of the BGB lies in (1) the extreme antiquity of BGB rocks, deposited 3.2 to 3.5 billion years ago, providing the most ancient known picture of the Earth; (2) the exceptional state of preservation (in most other areas, rocks of this age have been heated and deformed to a degree that their original context has been obscured; (3) their lithologic diversity, including strata recording rare events such as meteorite impacts and samples of biological remains; and (4) their record a history of life and surface environments spanning over 340 million years. These values are combined with excellent accessibility and a rich cultural context.

Table 1 lists all the sites presently inscribed under Criterion (viii) of UNESCO's selection criteria. No greenstone belts have yet, to-date been included in this list.

Table 1. WHSs which meet exclusively Criterion VIII of the selection criteria.

	WHS Name	***Significance***	***Age (Ma)***
1.	Mistaken Point, Canada	Fossil site	580-560
2.	Stevns Klint, Denmark	Fossil site	65
3.	Mount Etna, Italy	Volcanic activity	0.5
4.	Chengjiang Fossil site, China	Fossil site	530
5.	Lena Pillars Nature Park, Russia	Fossil site	570-530
6.	Joggins Fossil Cliffs, Canada	Fossil Site	300
7.	Swiss Tectonic Arena Sardona, Switzerland	Structural geology	300-0.034
8.	High Coast / Kvarken Archipelago, Finland and Sweden	Post-glacial rebound	0.020
9.	Vredefort dome, South Africa	Meteorite impact structure	2023
10.	Wadi Al-Hitan (Whale Valley), Egypt	Fossil site	0.049-0.036
11.	Monte San Giorgio, Italy and Switzerland	Fossil Site	237-247
12.	Dorset and East Devon Coast, UK	Well-preserved stratigraphic unit	252-0.660
13.	Ischigualasto / Talampaya Natural Parks, Argentina	Fossil site	245-208
14.	Isole Eolie (Aeolian Islands), Italy	Volcanic activity	1.3-present
15.	Miguasha National Park, Canada	Fossil site	382-372
16.	Caves of Aggtelek Karst and Slovak Karst, Hungary and Slovakia	Cave system	2-present
17.	Messel Pit Fossil Site, Germany	Fossil site	0.057-0.036
18.	Hawaii Volcanoes National Park, USA	Volcanic Activity	0.2-present

A comparative review of greenstone belts

Table 2 compares the BGB with all other significant greenstone belts worldwide, excepting the greenstone belts of the Eastern Pilbara Province in Northwest Australia; these will be discussed separately below.

Table 2. Significant greenstone belts (except Pilbara) compared to the BGB.

Comparable Greenstone Belts	Difference to the Barberton Greenstone Belt
Pietersburg and other southern African greenstone belts	Lower degree of lithologic variability, higher metamorphic grade, higher degree of stratal disruption, lower quality of outcrop
Lake Victoria and Zimbabwean greenstone belts, incl. Belingwe	Younger, fewer rock types. Heterogeneous degree of preservation
Superior province (Canada) greenstone belts, e.g. Abitibi greenstone belt	Much larger, low relief, moderate to poor accessibility, 500 Ma younger; fewer rock types.
Greenstone belts of the North Atlantic craton, including Nuvvuagittuq Greenstone belt (Quebec, Canada) and Isua Greenstone Belt (Greenland)	Nuvvuagittuq: Older, highly deformed, very small, poor accessibility, few rock types, low relief. Isua: Significantly older, almost inaccessible, very small, highly metamorphosed, fragmented and in parts poorly exposed; low number of rock types.
Greenstone belts of the North China craton	Ca. 400 Ma younger, highly metamorphosed and disrupted, poorly accessible, numerous but small, in part poorly exposed.
Yilgarn Craton, Australia	Younger, low relief, poorly exposed, deep weathering, moderate to poor accessibility.
Karelian (Finland, Russia) greenstone belts	Smaller, poorly exposed; more metamorphosed ; 400 Ma younger; restricted number of rock types

Greenstone belts can usefully be grouped in three cohorts:

At least two greenstone belts within the North Atlantic Craton (Isua and Nuvvuagittuq) have depositional ages around 3.8-3.9 and perhaps even 4.2 Ga. These are significantly older than the Kaapvaal and Pilbara greenstone belts where the oldest rocks are ca. 3.57 and 3.61 Ga old, respectively. However, the most significant greenstone belt in this province, the Isua Greenstone Belt, is quite small. Its strata are partially covered by the East Greenland ice sheet, are very highly disrupted at the m- and tens-of-m scale and have been metamorphosed to amphibolite-grade (ca. 550-650°C) so that many minerals and textures are recrystallized and deformed in a ductile manner. Inferences about early life and surface conditions derived from these rocks have proven controversial because of the difficulty in distinguishing them from later metamorphic effects. Insights on Archean surface conditions from the Isua (and similar belts in this region) will therefore only come from few, expensive and frequently ambiguous laboratory analyses of individual rock samples, and rarely from regional mapping of coherent and diverse stratigraphic sequences. Lastly, the Isua area is remote. Travel costs are prohibitively high even for many specialists, and access is possible only for about 2 months per year.

Because of their high degree of deformation and small size, sedimentary and volcanic strata of these oldest greenstone belts cannot yield substantial information regarding the conditions under which they formed,

such as volcanic eruption style, sedimentation transport conditions, composition or state of oceans and atmosphere, interaction with the biosphere etc. Consequently, geoscientists cannot estimate the lateral or temporal change of these environmental parameters. Even the degree to which these greenstone belts record original and representative information regularly creates debates in the scientific literature.

Slightly younger greenstone belts and greenstone belt remnants, generally between ca. 3.6 and 3.1 billion years old, exist in South Africa, Swaziland, northwest Australia, North China, India, and the US. Of these, only strata in two regions, the Pilbara region of Australia and the Barberton Greenstone Belt of South Africa and Swaziland are sufficiently well-preserved that they allow the interpretation of the sedimentary and volcanic processes by which they formed. This is for three reasons: (1) They have not undergone any deleterious thermal overprint by heating; (2) they have not been deformed to such a degree that it destroyed most primary information; and (3) they have seen some erosion of their cover strata in the comparably recent past, creating at least moderate topographic relief and thus, abundant outcrops, which earth scientists need to recover key sample material.

Lastly, a younger generation of greenstone belts, ca. 2,800-2,500 Ma old, forms part of the basements of Finland, northern Canada, Siberia, India, Brazil, Zimbabwe, southwestern Australia and Antarctica. Their considerable regional extent is somewhat compensated by low topographic relief and/or by deep weathering. In addition, aside from a few exceptions, this younger generation of greenstone belts has attracted less attention because thick, easily accessible, nearly flat-lying strata of the same age on the Kaapvaal Craton of South Africa and in the Hamersley Basin of northwest Australia provide more detailed information instead. Finally, this younger generation of greenstone belts is made up of rocks that reflects geological processes and events resembling those which occur at present on Earth. In contrast, the older greenstone belts, including the BGB, clearly record an early Earth quite unlike that which existed later.

Figure 1. BGB field photographs showing typical states of conservation of the area.

Comparative properties of the BGB

The BGB forms part of the Kaapvaal craton. This microcontinent is largely covered by more-or-less flat-lying and unmetamorphosed sedimentary and volcanic strata of great age, such as the Witwatersrand (3.0-2.8 Ga) and Transvaal Supergroups (ca. 2.7- 2.4 Ga), attesting to its early stabilization. In its basement, which is mostly exposed at the margins of this craton, numerous isolated greenstone belts are preserved among older, coeval and younger plutonic rocks. Most of those greenstone belts, however (e.g. Pietersburg GB, Table 4), are more highly metamorphosed, structurally highly disrupted, lithologically monotonous, and/or small.

The single exception to this rule is the Barberton Greenstone Belt of ca. 140 km length and 25-40 km width. This belt shows coherent stratigraphic sequences of significant lithological diversity and is between 3570 and 3210 Ma in age, mostly at a lower-greenschist grade of metamorphism (ca. 320-470°C). Because of the rifting of Madagascar from southern Africa, regional uplift due to gentle heating by the Southern African super-plume and resulting back-stepping erosion of the cover sequence (creating the "Great Escarpment" of eastern Mpumalanga) since the Miocene (ca. 15 Ma), the BGB has been uncovered in relatively recent geological times, resulting in a rugged topography between about 200 and 1900 m asl. The outcrop quality is thus generally good to very good, and regional geologic mapping is meaningful at a 1:25,000 or even 1:10,000 scale. Access is by paved roads to several towns nestled at the feet of the range (Barberton, Badplaas / eManzana, Piggs Peak, Malelane). The BGB can be reached from the Johannesburg-Pretoria metropolitan area within a 3.5 hours' drive.

The Pilbara Greenstone Belts, Western Australia

The only other place of great age that preserves greenstone belts in a similar contextual quality, that is, in a combination of size, age, geological coherence, and outcrop quality, lies in the greenstone belts of the East Pilbara Terrane, Western Australia. Because it forms the best comparison to the BGB, a more detailed description appears warranted.

The Pilbara region exposes a large number of greenstone belts in a hilly, semiarid tussock grass savannah, deep within the remote Australian outback. Their geometry is different compared to Barberton: The surrounding plutons are larger (there are at least five of ca. 60 x 80 km each, compared to the largest BGB pluton, the KVT, of ca. 40 x 20 km). The intervening greenstone belts show a spider-like geometry in map view while the BGB has a distinct linear component. The individual branches of the Pilbara region are thick and long, each almost the size of the entire BGB, with well-developed internal structures and stratigraphies; they have been given individual local names. Similar branches of the BGB, such as the Nelshoogte and Jamestown schist belts, are thin, highly disrupted and composed only of ultramafic lithologies. Because uplift / doming of the neighbouring plutons did not occur simultaneously (as in Barberton, where we know of the 3445 and the 3230 events) but individually over several 100 Ma, the branches of the Pilbara greenstone belts record different episodes of sagging, volcanism and basin fill. The thicknesses of the units which are common to all Pilbara GBs (that is, of the same age) are highly variable.

In comparison, the main geological observations include:

- The stratigraphic sequence involved in crustal stabilization in the East Pilbara is thicker (total 21 "shingled" km) and spans a longer duration (~3580 to ~2830 Ma). Lithologies are nearly as diverse as in Barberton but include very thick volcanic sequences.
- Because stripping of the cover rocks began earlier in the Pilbara region than in the Kaapvaal (in the Cretaceous, about 100 Ma ago) and occurred under more humid subtropical conditions, the Pilbara region is generally deeply weathered. Its topographic relief is only ca. 100-350 m, in contrast to the 1700 m in the BGB. This results in overall poorer outcrop conditions, especially of the volcanic rocks. The plutons generally occupy vast outcrop-poor plains.
- Regional mapping is most meaningful at a scale of 1:100,000, which has been accomplished by a long-term effort of the West Australian Geological Survey. Mapping at a more detailed scale of 1:50 000 or 1:25 000 would likely be done only on those sheets that had interesting geology and good outcrop. In the BGB, much mapping at this and higher resolution has been done but not published.
- Many individual sites of the Pilbara GBs have a preservation quality identical to those of the BGB but they are separated by large and poorly exposed areas.
- At some sites, the metamorphic grade is lower than in the BGB (ca. 250°C). Archean kaolinite is possibly preserved.
- The strain (viscous-plastic deformation of the rocks) is more diverse and ranges from nil to "enormous". There are mappable regions of subvertical stretching strain that culminate in vertical rodding of all involved lithologies. In contrast, the degree of lateral shortening of the Pilbara GBs is generally less than in the BGB; Pilbara belts almost completely lack the "fold-and-thrust-belt" geometry that appears well developed in parts of the BGB.
- The Pilbara GBs preserve several Archean environments with early stromatolites which are, as yet, poorly documented from the BGB. Some of them may have been calcareous but they are now mostly silicified. In contrast, the BGB features km-long units of microbial-mat-bearing sandstones which are many hundreds of m thick; nothing comparable exists in the Pilbara.
- The record of early life in Barberton is more diverse, better preserved, better exposed and spans alonger time span than in the Pilbara greenstone belts.
- Most volcanism in the Pilbara belts is basaltic; they lack the thick units of Mg-rich (ultramafic) lavas exemplified by the thick Komati, Hooggenoeg, Mendon and Weltevreden Formations of the BGB.
- Several thick chert units in the Pilbara greenstone belts preserve impressive evidence for very active and extensive submarine hydrothermal environments and their association with early life. Thick chert units of the BGB, in contrast, such as the Buck Reef Chert, appear unrelated to hydrothermal activity.
- In contrast to Barberton, the plutons surrounding the Pilbara GB branches record repeated and increasingly chemically differentiated intrusions in their cores, resulting in "onion-" structures and doming ("ballooning"). This doming (and concomitant sagging of the sedimentary-volcanic cover sequence between these domes) can be documented over a far longer period than in the BGB (3300-2830 Ma).
- Quartzose shallow-water sandstones comparable to the Moodies Group of the BGB, exist in the several km thick Gorge Creek and Fortescue Groups in the PGB. They record the deformation of the underlying basement through tilting and thickness changes and are perhaps tectonically equivalent to the Moodies Group of the BGB but 500 Ma younger. Only a single quartzose sandstone unit at the base of the Strelley Pool Formation is older (ca. 3.4 Ga) but discontinuous.
- The contact zones resemble those found along the margins of the BGB; they are structurally overprinted (extensionally thinned?) shear zones that originally were intrusive and had contact-metamorphic relationships.

Other observations in relevant categories of comparison:

- The WA Geological Survey had a long-term dedicated geological mapping, geochronological dating and geochemical sampling program that resulted in an excellent series of 1:100,000 sheets, while the mapping of the BGB has not received substantial government attention in the past twenty years. Most mapping progress in the BGB was done by academic groups that are not in the core business of producing regional geological map sheets.
- The Pilbara is not as accessible as and significantly more remote than the BGB. A single tar road of 240 km from the nearest major airport, Port Hedland, ends at Marble Bar, within the greenstone belt terrain. From there, access to outcrops is by a few well-maintained sand roads and through many rough tracks on former sheep stations. A four-wheel-drive vehicle, significant driving and long days are required to visit virtually any of the geological attractions. In contrast, a large part of the BGB is excellently accessible by paved public roads and many well-maintained forest roads.
- Marble Bar is the only significant settlement in the Pilbara GBs; it has a population of about 200 and provides only basic amenities. Its petrol station is the only one in a radius of ca. 160 km. In contrast, Barberton is a rural hub with a population of about 20000 and 30000 in adjacent Emjindini. Hotels, shops, petrol stations, tourism services etc. all exist. Nelspruit /Mbombela Municipality, an urban district of 470,000 with many regularly scheduled flights at its airport, is 45 km from Barberton.
- Perhaps most relevant is that the small population of Marble Bar, the only settlement in this vast region, is not interested and appears inactive in placing the region under a protective status.
- Pilbara can be visited only part of the year because it is too hot and cyclone-prone for 5 months over the summer. In contrast, due to its climate, accessibility and good infrastructure, Barberton can be studied nearly year-round.

Summary

Greenstone belts are potentially valuable recorders of early earth history. Among the world's GBs, the BGB and the greenstone belts of Australia's Pilbara region both possess unique universal values understandable and attractive to laypeople. Both regions excel in "geological variety per unit area" and in "quality of outcrop". Non-geological attributes, such as accessibility, socioeconomic characteristics, climate, and public support favour the BGB when ranking for WHS purpose.

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Table 3: Main attributes of the other greenstone belts referred to in the nomination dossier.

Site	*Size*	*Significance and State of preservation*	*Age*	*Metamorphic Grade*	*Lithologies*	*Reference*
Barberton Greenstone Belt	~120 km x ~50 km	One of the best preserved GSBs; diverse lithologies	~3.57-3.21 Ga	Mostly greenschist facies	Predominantly ultramafic and mafic volcanic rocks, including felsic pyroclastic and volcaniclastic rocks and chert (Onverwacht Group); deep- to shallow-marine environment with graywacke, shale, banded iron formation, chert, basaltic lava, and ash-fall tuffs (Fig Tree Group) Sandstones and conglomerates; minor shale, siltstone, volcanic units, and BIF.	1
Pilbara Greenstone belts (Western Australia)	~60,000 km^2	World's oldest microbial life? Well preserved. Particular tectonic style	~3.61-2.94 Ga	Mostly greenschist facies	Dominantly tholeiitic basalts, subordinate ultramafic volcanic and intrusive rocks, but also felsic volcanic formations, and a variety of sediments	2, 3
Isua Greenstone Belt (Greenland)	~20 km x ~2 km	Tectonized; metamorphosed; earliest stromatolites	~3.8-3.7 Ga	Upper greenschist- to amphibolite-facies	Protoliths were basaltic and high-Mg basaltic pillow lava breccias, cherty BIF, minor greywacke	4, 5, 6, 15, 16
Nuvvuagittuq Greenstone belt (Quebec, Canada)	~10 km^2	Possibly oldest greenstone rocks, questionable traces of life	~ 4.3 to 3.8 Ga	upper amphibolite or higher	Mafic Cummingtonite-Amphibolite (Major component); Ultramafic and Mafic sills; and chemical sediments (BIF & Silica formation)	7, 8, 17
Abitibi Greenstone belt (Canada)	800 km x 200 km	largest greenstone belt; evidence for lateral accretion (plate tectonics)	~2.75-2.68 Ga	sub-greenschist to lower amphibolite	komatiitic, tholeiitic, and calcalkaline volcanic rocks; litharenites, schists; some chert	12, 13, 14
Pietersburg	~125 km	Strongly tectonized	~2.95-	Greenschist to amphibolite	massive to pillowed metabasalts, metagabbros and metaperidotites; BIF, fine-grained mafic tuffs and some	18, 19

greenstone belt	x 20km		~2.7 Ga	facies	terrestrial clastic sediments	
Murchison greenstone belt	~140 km x 15-20 km		3.09-2.97 Ga	Greenschist to amphibolite facies	felsic schists, ultramafic to mafic volcanic and siliciclastic schists; local actinolitic pillow lavas, interbedded with BIF and aluminous quartzites; micaschists; metatuffs and breccias; some conglomerates; amphibolites	20
Giyani greenstone belt	~70 km x15 km	Poorly exposed	~3.2 Ga	Greenschist to upper-amphibolite facies	Ultramafic volcanics; rare BIF, felsic rocks, metasediments	21, 19
Belingwe greenstone belt		"best preserved late Archean greenstone belt"	2.9-2.65 Ga	Greenschist facies	Sandstones (in places quartzose), komatiites and basalts, BIF, conglomerates; stromatolitic carbonates	22, 23, 24

Table 4: Attribute matrix, comparing the world's major greenstone belts.

SITE	Geological/ Facies Diversity	Outcrop Abundance	Ouctrop Quality	Size and Thickness	Chrono-stratigraphic Continuity	Age	Accessibility	Site Infrastructure		Score	Overall Rank
Barberton Greenstone Belt	1	1	1	1	1	2	1	1		9	**1**
Pilbara Greenstone belts (W. Australia)	1	1	1	1	1	1	3	3		12	**2**
Abitibi Greenstone belt (Quebec/Ontario, Canada)	4	3	3	1	1	3	2	3		20	**3**
Pietersburg; other Southern African Greenstone belts	3	3	4	3	3	2	2	2		22	**4**
Lake Victoria and Zimbabwean Greenstone belts	3	3	2	3	2	3	3	4		23	**5**
Isua Greenstone Belt (Greenland)	3	1	2	4	3	1	5	5		24	**6**
Nuvuaqqituq Greenstone belt (Quebec, Canada)	4	3	3	5	3	1	4	4		27	**7**

Scores: 1 = excellent / high / relevant; 5 = poor / low / less relevant

References cited in Table 3

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Our Ref No: 9/2/203/49
SAHRIS Case Id: 9801; 9802; 9803 & 9804
Enquiries: hweldon@sahra.org.za

26 September 2017

Mr. L. Loock
Manager: Wildlife Economy and Wildlife Services
Mpumalanga Tourism and Parks Agency
Private Bag X 11338
Nelspruit
1200

Dear Sir,

NOTIFICATION OF INTENTION TO DECLARE A NUMBER OF GEOSITES AS PART OF THE BARBERTON MAKHONJWA MOUNTAIN; BARBERTON; MPUMALANGA AS NATIONAL HERITAGE SITES IN TERMS OF SECTION 27 OF THE NATIONAL HERITAGE RESOURCES ACT NO. 25 OF 1999

This letter serves to confirm that the South African Heritage Resources Agency (SAHRA) intends to declare a number of geosites as part of the Barberton Makhonjwa Mountain; Barberton; Mpumalanga in terms of Sections 27 (1) of the National Heritage Resources Act No 25 of 1999 ("the NHRA").

Please see attached a table of the affected geosites and properties.

South African Heritage Resources Agency has identified these geosites as having qualities so exceptional that they are of special national significance and warrant the declaration as National Heritage Sites.

Statement of Significance:

The Barberton Makhonjwa Mountain Land (BMML) contains the oldest well-preserved sequence of volcanic and sedimentary rocks on Earth. These highly accessible Archaean outcrops present a continuous 350 million year geological sequence, from 3 600 million years ago. The physical and chemical characteristics of these rocks are so remarkably well preserved that they provide a globally unparalleled history of the early Earth. In particular, they provide unique evidence of the formation of the earliest oceanic and continental crusts and of the initial phase of the evolution of our biosphere. The Barberton Makhonjwa Geotrail is the principal geoheritage product within the BMML. It was planned and developed in 2012/13, and opened on 30 April 2014. With its attractive and informative roadside panels, built into vehicle lay bys on the 37km road between Barberton and the Swazi border at Bulembu, it is the only geotourism product of its kind in South Africa and probably similarly unique to the continent as a whole.

In terms of Section 27 (10) of the NHRA, the geosites shall be deemed to be protected as heritage sites for six (6) months from the date of service of this notice or until the notice is withdrawn or the geosites are declared to be heritage sites by notice of a Government Gazette, whichever is the shorter period.

Implications of Declaration:

SAHRA is responsible for the protection of all National Heritage Sites and will, therefore, be the responsible heritage resources authority to ensure the protection of the geosites according to section 27 (15) of the NHRA. The declaration of the geosites will have the following implications for you as a landowner:

1. In terms of section 27 (17) of the NHRA, all heritage sites must be marked with a badge indicating their status, except in cases where SAHRA considers it inappropriate;

2. In terms of section 27 (18) of the NHRA, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site declared a National Heritage Resource without a permit from SAHRA;

3. In terms of section 27 (19) of the NHRA, SAHRA may make regulations pertaining to the site with the consent of the owner that (a) safeguards the site from destruction, damage, disfigurement, excavation or alteration, (b) regulates the conditions of use or development of the site, (c) regulate the admission of members of the public to the site and fees payable for such admission;

4. In terms of section 27 (20) of the NHRA, the owner must maintain the site according to minimum standard and procedure prescribed by SAHRA;

5. In terms of section 27 (21) of the NHRA, SAHRA may by agreement with the owner (a) conserve or improve the site, (b) construct fences, walls or gates around or on the site, (c) acquire or construct and maintain an access road to the site over any land and construct upon such land fences, walls or gates or (d) erect signs on or near the site; and

6. In terms of section 27 (22) of the NHRA, no person may damage any fence, wall or gate constructed or sign erected by SAHRA in terms of subsection (21).

As the owners of properties on which one or more of the geosites are located; you are hereby given sixty (60) calendar days from the date hereof to make representations or written submissions regarding the proposed declaration and to propose, if any, conditions under which the declaration will be acceptable to you, in accordance to Section 27 (8) (a) of the NHRA.

an agency of the
Department of Arts and Culture

Please make written submissions to the following postal address: **SAHRA, P.O. Box 4637, Cape Town, 8001**.Alternatively you may submit via email to the following email addresses: hweldon@sahra.org.za or nmachete@sahra.org.za.

Should you have any queries with regards to the above, please contact Ms Heidi Weldon or Ms Nkosazana Machete at 012-941-4960.

We look forward to your response.

Sincerely

Ms. M. Nkhasi-Lesaoana
ACTING CHIEF EXECUTIVE OFFICER

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Department of Arts and Culture

PROPERTIES AND GEOSITES AFFECTED BY PROPOSED DECLARATION AS NATIONAL HERITAGE SITES:

Property	WHS ref	Geosite Description	Central Coordinates of Geosite	
			Longitude	Latitude
Barberton Townlands 8/369 JU	206	GT site 1 "Greenstone View & BGB Boundary"	31.06576	-25.770914
		Rifle Range View		
Dycedale 368 JU		Sheba Fault & May Mine		
	172	View of Saddleback & Barbrook faults	31.08342	-25.786875
	207	GT site 2 "De Kaap Valley View"	31.08204	-25.787769
	148	Moodies sedimentary sequence & paleosols	31.08369	-25.793417
	208	GT site 3 "Tidal Sandstone"	31.08394	-25.7945
	149	Dycedale Syncline	31.08729	-25.794131
	209	GT site 4 "Eureka View" "Alluvial Conglomerate"	31.08928	-25.795528
	168	GT site 5 "Dycedale Syncline" & "Biomats"	31.09491	-25.794142
Oosterbeek 371 JU	210	Oosterbeek ridge (extensive biomat exposures)	31.07521	-25.842861
Heemsteede 378 JU	182	Biomats	31.063	-25.860167
	212	View of Shokolwa Mountain	31.05945	-25.872336
Schoonoord 380 JU	181	GT site 6 "Painted Quarry" & "Baryte"	31.08808	-25.877722
	215	Baryte Sample pits	31.10426	-25.882844
	278	Meteorite Spherule Layer	31.09883	-25.880743
	279	GT site 7 "Makhonjwa/Lebombo View"	31.10402	-25.883033
Schoonoord 1/380 JU	216	Puddingstone Quarry	31.10426	-25.882844
Loenen 381 JU	217	GT site 8 "Tsunami Conglomerate"	31.09128	-25.905722
	178	GT site 9 "Banded Ironstone"	31.10125	-25.906222
	179	Deformed banded chert	31.10508	-25.9125
Josefsdal 382 JU	218	Overturned Onverwacht / Fig Tree Contact	31.10481	-25.940922
	177	GT site 10 "Volcanic Lapilli" & "Black Chert"	31.10842	-25.945667
	176	GT site 11 "Pillow Lavas" & "Msauli-Bulembu" View	31.11072	-25.946083
Batavia 5/151 IT	5	Large exposure of Migmatites & Greenstone (chert,bif,amphibolites, serpentinite-talc schist)	30.66241	-26.003892

Property	WHS ref	Geosite Description	Central Coordinates of Geosite	
			Longitude	Latitude
Batavia 5/151 IT	6	Migmatitie pavements exposure	30.66272	-26.006964
	7	Inyoni Shear Zone	30.64878	-26.004825
	9	Tholeiitic dyke in trondhejmitic gneiss on whaleback granitic platform	30.64413	-26.034942
Theeboom 729 JT	277	Theeboom River migmatite exposure	30.74355	-26.021964
Nederland 2/152 IT	14	Boesmanskop Pluton: medium grained syenite	30.69918	-26.048536
	18	Greenstone Xenolith showing cross bedding in Sandspruit Formation metasandstones	30.71729	-26.038989
	19	Greenstone Xenolith granite-greenstone migmatite exposures	30.71638	-26.029358
Nederland 152 IT	13	Boesmanskop Pluton: coarse grained syenite exposures	30.67886	-26.020653
	17	Greenstone Xenolith showing metamorphosed calc-silicate rocks	30.7125	-26.029206
Vergelegen 2/728 JT	4	Barite prospect shafts in felsic schists	30.65685	-25.966347
Hooggenoeg 1/731 JT	126	Komati Formation: Type locality Several geosites of komatiite flows, pillow lavas & related outcrops (Southern point)	30,83666	-25,973142
	127	Komati Formation: Type locality Several geosites of komatiite flows, pillow lavas & related outcrops (Northern point)	30,84203	-25,968914
	283	"spinifex texture in Komatiitic rocks", showing long bladed pyroxene spinifex-textured komatiitic basalts.	30,84075	-25,968719
	128	Middle Marker (Komati Formation with silicified ash and carbonaceous sediment)	30,83721	-25,961128
Theespruit 1/156 IT	130	Komati Formation: Type Locality, (South of section).	30,85149	-25,99505

Property	WHS ref	Geosite Description	Central Coordinates of Geosite	
			Longitude	Latitude
Theespruit 1/156 IT	131	Komati Formation: Type Locality, (North of Section).	30,86167	-25,985917
Geluk 732 JT	132	Hooggenoeg Formation: Pillowed tholeiitic basalts with spherules and ocelli structures	30,87994	-25,967139
	139	Spherule Beds (Spherule Bed S1) meteorite impact spherules	30,88233	-25,94
	242	Middle Marker (Komati Formation: unmetamorphosed sedimentary unit)	30,89861	-25,974497
	246	Type section of chert in the Hooggenoeg Formation with abundant carbonate minerals.	30,88479	-25,944053
Schoongezicht 713 JT	234	Ironstone pods and large landslide features	30,91537	-25,925717
	254	Buck Reef Chert showing microbial life	30,91885	-25,928206
	255	Buck Reef Chert evaporite section	30,91449	-25,929814
Uitgevonden 170 IT	102	exposed Migmatites	30,85258	-26,081056
	107	Shear Zone gneisses	30,86618	-26,080011
	103	Granitic and gneissic/migmatitic exposure.	30,85499	-26,081025
	104	Migmatite platform in Sandspruit River: gneiss and migmatite intrusion	30,86438	-26,060969
Roodewal 169 IT	110	Kromberg Formation: Felsic agglomerates and dacitic tuffs and lavas.	30,90475	-26,067706

Property	WHS ref	Geosite Description	Central Coordinates of Geosite	
			Longitude	Latitude
Brandybal 1/171 IT	94	Spinifex texture in komatiite ultramafic flow units (also small quarries mined for poor quality talcoseserpentinite)	30,83623	-26,066403
	97	Contact of Sandspruit Formation and porphyritic trondhjemitic gneisses	30,84176	-26,083711

Mpumalanga
TOURISM AND PARKS AGENCY

OUR REF: BMM-WHS

Enquiries: louis@mtpa.co.za

IUCN Evaluation Panel: Proposed Barberton Makhonjwa Mountain World Heritage Site

To whom it may concern,

SUBJECT: PROTECTED AREA SUPPORT TO PATROLLING AND POLICING GEOSITES OUTSIDE PROTECTED AREAS AS PART OF THE BARBERTON MAKHONJWA MOUNTAIN WORLD HERITAGE SITE (BMM-WHS)

With reference to the IUCN letter, dated 20 December 2017 on supplementary information, item 6 THREATS, this office undertake to patrol and police the 51 geosites outside protected areas through the support of the two reserve managers and their field rangers based at Barberton and Songimvelo Nature Reserves respectively.

Should any damage to these geosites be noted or be reported, the South African Heritage Resource Council will immediately be informed and action will be taken that may lead to prosecution of those offenders.

Note that these geosites have been afforded legal protection in terms of the National Heritage Resource Act, no 25 of 1999, under Section 27 (10).

Trust that you find the above in good order.

Kind Regards,

MR. B J NOBUNGA
CHIEF EXECUTIVE OFFICER
DATE: 05.02.2018

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