AFRICA

BARBERTON MAKHONJWA MOUNTAINS

SOUTH AFRICA

Overlook from the Barberton Makhonjwa Geotrail © IUCN / Guy Narbonne

WORLD HERITAGE NOMINATION – IUCN TECHNICAL EVALUATION

BARBERTON MAKHONJWA MOUNTAINS (SOUTH AFRICA) – ID N° 1575

IUCN RECOMMENDATION TO WORLD HERITAGE COMMITTEE: To refer the nominated property back to the State Party under natural criteria.

Key paragraphs of Operational Guidelines:
Paragraph 77: nominated property meets World Heritage criteria.
Paragraph 78: nominated property meets integrity requirements, but does not fully meet protection and management requirements.

1. DOCUMENTATION

a) Date nomination received by IUCN: March 2017

b) Additional information officially requested from and provided by the State Party: Following the IUCN World Heritage Panel a progress report was sent to the State Party on 20 December 2017. This letter advised on the status of the evaluation process and sought responses/clarifications on a range of issues including the further Comparative Analysis the State party submitted on 10 October 2017; legal protection of geosites outside the nominated area; mining rights for area adjacent to the northern edge of the nominated property; buffer zones; relocation of local communities; threats and private landowners. A response was received on 21 February 2018.

c) Additional literature consulted: Various sources, including: Bontognali, T.R.R., Fischer, W.W., Follmi, K.B. (2013). *Siliciclastic associated banded iron formation from the 3.2 Ga Moodies Group, Barberton Greenstone Belt, South Africa*. Precambrian Research, 226, pp. 116-124. de Ronde, C.E.J. and de Wit, M.J. (1994). *Tectonic history of the Barberton greenstone belt, South Africa: 490 million years of Archean crustal evolution*. Tectonics, 13(4), pp. 983-1005. Eriksson, K.A. and Simpson, E.L. (2000). *Quantifying the oldest tidal record: the 3.2 Ga Moodies Group, Barberton greenstone Belt, South Africa*. Geology, 28(9), pp. 831-834. Heubeck, C., Blasing, S., Grund, M., Drabon, N., Homann, M., Nabhan, S. (2016). *Geological constraints on Archean (3.22 Ga) coastal -zone processes from the Dycedale Syncline, Barberton Greenstone Belt*. South African Journal of Geology, 119(3). 495-518. Homann, M., Heubeck, C., Bontognali, T.R.R., Bouvier, A-S, Baumgartner, L.P., and Airo, A. (2014). *Evidence for cavity-dwelling microbial life in 3.22 Ga tidal deposits.* Geology 44(1), pp. 51-54. Homann, M., Heubeck, C., Airo, A., and Tice, M.M. (2015). *Morphological adaptations of 3.22 Ga-old tufted microbial mats to Archean coastal habitats (Moodies Group, Barberton Greenstone Belt, South Africa*). Precambrian Research, 266, pp. 47-64. Lowe, D.R. (1999). *Shallow-water sedimentation of accretionary lapilli-bearing strata of the Msauli Chert: Evidence of explosive hydromagmatic komatiitic volcanism*. In: Lowe, D.R. and Byerly, G.R. (Eds.), Geologic Evolution of the Barberton Greenstone Belt, South Africa. Geological Society of America Special Paper, 329, pp. 213-232. Lowe, D.R., Byerly, G.R., Kyte, F., Shukolyukov, A., Asaro, F. and Krull, A. (2003). *Spherule beds 3.47-3.24 billion years old in the Barberton Greenstone Belt, South Africa: a record of large meteorite impacts and their influence on early crustal and biological evolution.* Astrobiology, 3(1), pp. 7-48. Lowe, D.R., Byerly, G.R. and Kyte, F.T. (2014). *Recently discovered 3.42–3.23 Ga impact layers, Barberton Belt, South Africa: 3.8 Ga detrital zircons, Archean impact history, and tectonic implications*. Geology, 42(9), pp. 747-750. Parman, S.W., Dann, J.C Grove, T.L., and de Wit, M.J. (1997). *Emplacement conditions of komatiite magmas from the 3.49 Ga Komati Formation, Barberton Greenstone Belt, South Africa.* Earth and Planetary Science Letters, 150(3-4), pp. 303-323. Robins, B., Sandsta, NR., Furnes, H.,and de Wit, M. (2010). *Flow banding in basaltic pillow lavas from the Early Archean Hooggenoeg Formation, Barberton Greenstone Belt, South Africa*. Bulletin of Volcanology, 72(5), pp. 579-592. Sagan, C. and Mullen, G. (1972). *Earth and Mars: Evolution of Atmospheres and Surface Temperatures*, Science, 177 (4043), pp. 52-56. Van Kranendonk, M.J. (2011). *Cool greenstone drips and the role of partial convective overturn in Barberton greenstone belt evolution*. Journal of African Earth Sciences, 60(5), pp. 346-352;

d) Consultations: 8 desk reviews received. The mission met with a wide range of stakeholders including representatives of local government, site managers, local community representatives and landowners.

e) Field Visit: Guy Narbonne, 1-7 September 2017

f) Date of IUCN approval of this report: April 2018

2. SUMMARY OF NATURAL VALUES

The nominated property, Barberton Makhonjwa Mountains (BMM), is a 113,137 ha (c.120 x 30 km) area of land located in north-eastern South Africa, and joining the Swaziland border on its eastern boundary. The nominated property comprises 40% of the Barberton Greenstone Belt, one of the oldest geological features on our planet. This ancient geology is core to the proposed Outstanding Universal Value (OUV) of this nominated property, and BMM

represents the best-preserved, thick and diverse succession of volcanic and sedimentary rocks dating back 3.6 to 3.25 billion years to the early part of the Archean Eon. After the planet first formed c.4.6 billion years ago, the early Archaean was the time when the first continents were starting to form on the primitive Earth. Features of the early Earth that are especially well-preserved in BMM include meteorite-impact fallback breccias dating to just after the end of The Great Bombardment (4.6 to 3.8 billion years ago) where massive meteorite impacts had repeatedly sterilized the surface of the new Earth, tidal bedding that formed when the newly formed Moon was less than half as far away from Earth as it is today, and komatiites that represent the hottest lavas to have ever flowed on Earth. This was the natural setting for the origin of the first reasonably confirmed evidence of cellular life forms. As in other greenstone belts worldwide, there is superb evidence at BMM of the distinctive early (vertical) tectonic processes that formed primitive crust before plate tectonics became the dominant surface process of Earth. BMM also shows the abundant evidence of liquid water on the Earth's surface, and distinctive banded iron formations attesting to the nearly completely anoxic oceans and atmosphere at that time.

Most early Archean sedimentary and volcanic rocks on Earth have eroded away over time, or have been extensively altered by structural deformation and metamorphism during later plate tectonic movement, but the rocks of BMM were protected from later deformation by plutons of granite beneath and from later erosion by a thick sequence of Proterozoic sedimentary and volcanic rocks. Metamorphic grades are very low (greenschist) and the rocks are not strongly deformed structurally, resulting in superb preservation of the original sedimentary and volcanic features. The area is rugged – this both provides excellent exposures of these strata and limits human impact through settlement or farming, thus maintaining the natural beauty and the exposure of the geological attributes of the nominated property.

Approximately 67% of the nominated property lies within protected nature reserves, hosting a range of wildlife that are considered typical for South Africa, with the remainder almost equally distributed between timber plantations (17%) and areas used for low-impact herding and subsistence farming. The unique geology of Barberton Greenstone Belt has also created distinctive soils that host a diversity of plant species. Endemic plant species include the Woolly Cycad (*Encephalartos heenanii*) which is listed as Critically Endangered on the IUCN Red List.

Fifty years of geological fieldwork in the Barberton Greenstone Belt have identified, described, and interpreted hundreds of geosites that collectively defined the following key features of the processes and products in the early stages in the development of supracrustal rocks on Earth. These are:

- Granite-greenstone belts that define the tectonic style of the early Earth that formed the planet's first supracrustal rocks;
- Spherule beds of molten rock droplets, generated by gigantic meteorite impacts on Earth dating back to the final stages of the Great (Late Heavy) Bombardment;
- the "Faint Young Sun Paradox", evidence of liquid water on the Earth's surface despite the fact that the Sun was a new star putting out only 75% of its modern energy level, a paradox that implies the Earth's earliest atmosphere consisted mainly of volcanic gases such as carbon dioxide;
- Chemical precipitates of iron-oxide minerals in banded-iron formation, implying that the early atmosphere and oceans were nearly completely anoxic;
- Pillow lavas, indicating widespread volcanic eruptions under water;
- Komatiite lavas, first described and named from the nominated property, that represent the hottest lavas to flow on Earth;
- Thick deposits of volcanic lapilli formed from explosive volcanic activity;
- Sediments that record river flows and wide sandy tide-dominated shorelines that reflect the near-Earth orbit of the Moon immediately after its formation 4 billion years ago;
- Microfossil evidence of early life on Earth, dispersed as abundant traces of organic material, as microscopic cells in black chert and as shallow-water biomats.

In summary, this combination of a large and thick, compact package of superbly preserved and exposed strata dating to the early Archean is unknown anywhere else in the world, and provides our clearest view of sedimentary and volcanic conditions on the early Earth.

3. COMPARISONS WITH OTHER AREAS

BMM is nominated for World Heritage Site status under criterion (viii). In the original nomination document, the Global Comparative Analysis was split into three separate sections, none of which provided the rigorous comparisons and scientific discussion necessary to assess the importance of the nominated property on a global scale. Some of the comparisons were based on outdated information, resulting in unsubstantiated assertions and inadvertent factual errors. Following an initial request to the State Party by IUCN, an Addendum to Section 3.2 was submitted on October 10th 2017 to update the Comparative Analysis, although this supplement does not provide details on the palaeontology of these properties. IUCN requested further comparative information which was submitted as Annexure A in the supplementary information provided by the State Party. The updated analysis in the supplementary information is rigorous, factual, and succinctly conveys the key information needed for global comparison.

Taken as a whole these comparisons confirm that current geological sites included on the World Heritage List are not comparable, having been defined on values that are not applicable to BMM. Granite-greenstone belts are significant features that are not

represented among any properties currently inscribed on the World Heritage List under criterion (viii). The only valid comparisons of BMM are with other Archean greenstone belts worldwide, which can be divided into three main groups based on relative age (i.e. older than BMM, younger than BMM, and coeval with BMM).

Older Archean Greenstone Belts comprise Isua in Greenland, Nuvvuaqqitug in northern Quebec, and a newly reported site in Sagak in northern Labrador. All of these sites are older than BMM but each is a very small area of mainly structurally deformed and metamorphosed rocks, resulting in a record that is more limited, fragmented, and obscured that in BMM. Putative evidence of early life has been reported from all three of these older sites, but these reports are highly contentious and none are widely accepted. Further discoveries are possible, especially at Isua where melting of the Greenland Icecap is gradually exposing new outcrop, but at the present time none of these earlier sites could be regarded as comparable with the superb record of early Earth processes preserved in BMM. The global comparisons with granite-greenstone belts older than BMM conclude that they are smaller, more tectonized and fragmented, more altered through metamorphism, and contain a less diverse suite of rock types than BMM.

Younger Archean Granite-Greenstone Belts include Abitibi and Superior Province in Canada, and several African belts (Pietersburg, Lake Victoria, Zimbabwe, etc.) as listed in the dossier. These are on the same scale as BMM, but typically are more structurally deformed and metamorphosed so their record is more obscure. None of these properties is as rugged as BMM and the level of exposure is correspondingly poorer than in BMM, although to some degree this is compensated by the lack of weathering in the glacially-polished outcrops of the two Canadian properties. Putative microbial fossils have been reported from some of these sites. Global comparisons with granite-greenstone belts younger than BMM conclude that they are more weathered and exhibit fewer rock types recording the processes and products of the early Earth.

Regarding coeval Archean Greenstone Belts, analysis of a range of sites identifies Pilbara Greenstone Belt in Western Australia as the only site that represents a close comparison regarding the OUV proposed for BMM. Pilbara is closely comparable to BMM in its size and thickness, outcrop abundance, outcrop quality, and geological/rock type diversity. Both BMM and Pilbara contain all the key features and processes that formed the first supracrustal sequences on the early Earth, with komatiites and meteorite-impact fallback breccias better developed in BMM, and iron formation and carbonates better developed in Pilbara. Currently the fossil evidence for Earth's earliest microbial life is slightly older and more diverse at Pilbara, and this might provide one basis for a separate serial extension, with the part of Pilbara containing the key fossil occurrences (e.g. Marble Bar and Sellery Pool) sometime in the future. The updated analysis ranks the geological features of both BMM and Pilbara as essentially equal, but ranks BMM slightly higher than Pilbara overall because of secondary criteria regarding its greater accessibility and infrastructure. It should also be noted that BMM has been on the Tentative List for South Africa since 2009, whereas Pilbara does not appear on the Tentative List of Australia.

In the view of IUCN, BMM fulfils the claim of being the best-preserved example of the oldest and most diverse sequence of volcanic and sedimentary rocks on Earth. For the reasons discussed above the older and younger sites available are less able to demonstrate the full range of attributes associated to the early history of the Earth. The approximately coeval succession at Pilbara is closely comparable to BMM and of essentially an equivalent value, although secondary considerations such as access distinguish BMM. IUCN therefore concludes that comparative analysis supports the case that BMM meets criterion (viii).

4. INTEGRITY, PROTECTION AND MANAGEMENT

4.1. Protection

South Africa has enshrined environmental rights in its constitution, and this is reflected in the strength and diversity of environmental laws protecting its lands. The State Party provided the field mission with a list of all national, provincial, and municipal laws relevant to the legal protection and management of the nominated property. The five reserves that collectively constitute 67% of the nominated property are effectively protected by the National Environmental Management: Protected Areas Act, No. 57 of 2003 (NEMPAA) and the Mpumalanga Tourism and Parks Agency Act, No. 5 of 2005 (MTPAA). Issuing of any new mining and mineral exploration rights in these areas is specifically prohibited under the Mineral and Petroleum Resources Development Act, No. 28 of 2002 (MPRDA). Inscription of the nominated property would provide additional protection under the World Heritage Convention Act, No. 49 of 1999 (WHCA).

Approximately one-third of the nominated property lies outside formal Protected Areas. These areas are privately owned by timber plantations (16.5% of the nominated property) and farming/tourism (16.5% of the nominated property), and thus require different approaches to protection and management. These areas were chosen to include key geosites with essential attributes that are not well represented inside any of the five formal Protected Areas.

Geosites inside the nominated property but outside the protected areas currently have limited or no legal protection. This is being actively addressed by the South African Heritage Resources Agency (SAHRA), who have completed an inventory all of these geosites and are in the process of applying for protection for them under the National Heritage Resources Act, No. 25 of 1999 (NHRA). This process may require public consultations and, although it seems likely to proceed successfully, informal estimates for its completion given to the field mission ranged from a few months to more than a year among the different

experts interviewed. Inscription of the nominated property on the World Heritage List would provide immediate additional protection under the World Heritage Convention Act, No. 49 of 1999 (WHCA). The State Party supplementary information conveyed that notification of intention to declare geosites outside the boundaries of the reserves as protected heritage sites was issued on 26 September 2017 and that these geosites will be formally published in a government gazette in March 2018. If enacted this would appear to provide adequate protection for these geosites under South African environmental law. Protection of geosites outside the reserves was a key concern throughout the Evaluation mission, and, whilst the State Party has responded quickly and definitively in this regard, at the statutory date of finalization of the IUCN evaluation, the formal protection of the geosites was not able to be confirmed. As these sites are crucial in conveying the attributes of the nominated property, the confirmation of protection appears to IUCN to be of a fundamental importance, before the site could be recommended for inscription on the World Heritage List.

Land use outside the protected areas but inside the nominated property is sympathetic with the protection of the property's proposed OUV and nearly all land use immediately bordering the Reserve is similarly sympathetic. One additional major benefit of World Heritage inscription would be the immediate establishment of a 10 km zone around the nominated property subject to the National Environmental Management: Protected Areas Act, No. 57 of 2003 (NEMPAA), which requires that any proposal for new activities or rezoning in this area undergo an environmental review.

IUCN considers that the protection status of the nominated property does not fully meet the requirements of the Operational Guidelines, as there is a need for the geosites located outside the protected areas to have received statutory protection.

4.2 Boundaries

The nominated property is a single, contiguous entity with its boundaries carefully chosen to represent the key attributes of OUV within the context of land use compatible with World Heritage designation. The nominated property is of sufficient size, comprising 113,137 ha that accounts for 40% of the total area of the Barberton Greenstone Belt. Care has been taken to include all key attributes and as many of the key geosites (outcrops) as possible, as justified in the nomination dossier. An international team of four eminent geoscientists, chosen for their extensive published research on the Barberton Greenstone Belt and their familiarity with comparable regions elsewhere in the world, selected the 380 most important geosites in the Barberton Greenstone Belt and graded them as "essential" (Grade 1) or "important" (Grade 2). This map was then integrated with present and anticipated land use to produce a nominated property that exhibits as many key geosites as possible within a contiguous nominated property. The nominated property encompasses 51% of the 380 geosites identified in Barberton Greenstone Belt, but more importantly contains 75% (71 of 95) of the Grade 1 geosites in the area. The IUCN field mission verified that all of the key features of early Earth crustal evolution listed in the dossier are represented by world-class geosites that are reasonably undeformed and only very slightly metamorphosed. Some of the localities from which putative fossils of early life were first reported from the Barberton Greenstone Belt lie within active mining areas that could not be included in the nominated property, but lateral equivalents of these units are well represented in the nominated property. Most attributes are illustrated at more than one geosite within the nominated property. Carbonaceous fabrics that are reasonably interpreted as ancient microbial mats are readily available for public viewing on the Barberton Makhonjwa Geotrail and can be examined for research purposes elsewhere in the nominated property.

Areas with land use incompatible with World Heritage designation were specifically excluded from the nominated property. These areas include urban and semi-urban centres such as Barberton, which in any case are mostly situated on flat alluvium that lacks the geological features that might constitute OUV. Lawfully held mining rights adjacent to the northern edge of the nominated property resulted in a northern boundary that is strictly defined on land use irrespective of the geological attributes in this region. One community specifically requested that it not be included within the nominated property so it could negotiate exploration rights with a mining company, but may seek to be included at a later date if mineral exploration is unsuccessful.

No buffer zone is proposed on the basis that the State Party considers a buffer zone is unnecessary. The State Party informed the field mission (with supporting maps provided), that with the exception of the area of mining rights in the north discussed below and a very small built-up area on the southern boundary, most land adjacent to the boundaries of the nominated property is zoned as "Agricultural" with smaller amounts zoned "Forestry" or "Open Space". These land use restrictions are reported to be strictly implemented by municipalities under the MSA. The State Party indicated that all of the individual geosites protected in the privately held areas of the nominated property will in future have a 20-50 m buffer zone that is protected under the South African World Heritage Convention Act No 49 of 1999. The State Party also indicated that any proposed activity or rezoning within 10 km of an inscribed World Heritage nominated property in South Africa requires environmental review under the National Environmental Management: Protected Areas Act, No. 57 of 2003 (NEMPAA).

IUCN acknowledges that the complicated land use that has evolved in and around the nominated property is such that it may not be possible to establish a viable buffer zone that completely encloses the entire nominated property. However the need for a buffer zone for protection is most critical for geosites outside of the reserves, and the confirmation of these buffers should be part of the confirmation of protection for the geosites as discussed above. The need for a wider

buffer zone is reduced for the heavily fenced reserves, most of which have boundaries that in part correspond to the sharp interface between the flat and arable land outside the reserves and the mountainous land inside the reserves. The fact that any proposed activity or rezoning within 10 km of an inscribed World Heritage nominated property in South Africa would require strict environmental review, if the site was inscribed, also represents a *de facto* buffer for the proposed World Heritage nominated property.

IUCN considers that the boundaries of the nominated property meet the requirements of the Operational Guidelines, provided that the confirmed protection of the geosites outside the protected areas includes appropriate wider protection for each geosite. However strengthened buffer zone arrangements are desirable for the nominated property as a whole.

4.3 Management

The dossier proposes that Mpumalanga Tourism and Parks Agency (MTPA), the agency currently overseeing the five protected areas that comprise 67% of the nominated property, have its role expanded to act as the Management Authority for BMM. There is considerable logic in this proposal in that MTPA has been successfully overseeing protected areas in the nominated property for decades, is one of the main bodies spearheading the World Heritage nomination, and has the infrastructure and much of the staff and expertise to assume its new role and carry out its additional mandate.

Should the nominated property be inscribed, there will need to be a significant expansion from an apparent biologically oriented management approach to one which gives strong standing to geology. Among the three Integrated Action Plans provided in the nomination, the Nkomazi Integrated Management Plan (Appendix F) mentioned geology only once in the introduction. Songimvelo Integrated Management Plan (Appendix D) mentioned “geology” only in the chapter on “Background” and listed “paleontological” features once in section 7.4.1 on Cultural Resource Management. Geology plays a bigger role in the Mountainlands Integrated Management Plan (Appendix E), where an action item to construct a geological database is included in all five years of operations. The dossier proposes that the new geological opportunities and responsibilities inherent in World Heritage status can be tacked onto the existing plan with little new resources or changes in direction.

This limited approach is repeated in the proposed Barberton Makhonjwa Mountains Integrated Management Plan (Appendix N), included in the nomination dossier as the future management plan for the World Heritage Site, which states that “normal biodiversity management will be more than adequate to protect and manage their geological heritage”. IUCN considers this is not adequate to the management requirements for a geological site, even if the proposed new plan sees a more significant role for geology than in the previous management plans for the individual reserves and a greater integration of geology into a regional framework. The nominated property requires high-level geological expertise necessary to manage the increased attention, pressures, and opportunities that World Heritage would entail. There is a specific need to improve capacity in the areas of engagement with the Scientific Advisory Committee, responding to directed requests from the World Heritage Committee (and UNESCO and IUCN), designing proactive and retroactive programs to protect the outstanding geological attributes of the nominated property, training the interpretive staff in geology and geoheritage, encouraging and facilitating national and international geological research and education programmes, designing new interpretive displays based on recent discoveries, and popularizing the geology of BMM both locally and worldwide to generate increased geotourism.

MTPA has committed to hiring four or five new staff to assume the extra duties inherent with World Heritage. The budget for these new positions indicated in the nomination seems appropriate. Only minor extra funding is promised in the dossier for the wider increased responsibilities inherent in World Heritage designation, however the supplementary information from the State Party reports that the National Department of Environmental Affairs has been allocated a ZAR 20 million (c. USD 1.6 million) grant to MTPA 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. IUCN considers that these additional resources represent a minimum requirement to meet the future management needs of the nominated property in relation to its geological values, whilst noting the need to maintain at least the current levels of expertise and effort regarding biodiversity conservation.

The nominated property is accessible, being relatively close to O.R. Tambo Airport in Johannesburg which is the busiest airport in Africa, and even closer to the world-class game reserve at Kruger National Park. The potential of the nominated property to enhance global earth science education is heightened by Barberton Makhonjwa Geotrail, a 37 km-long paved public highway through a geological cross-section of the Barberton Greenstone Belt from Barberton to the Swaziland border. Each roadside overlook has high quality interpretive displays that illustrate the geological evolution of the early. There is a clear need for more signage at key BMM boundary access points and additional training of the staff in geology and geological stewardship, but all other essential management mechanisms are already in place and appear likely to be enhanced by inscription.

IUCN considers that, in view of the lack of geological capacity currently in place in the proposed management body and the fact that the Integrated Management Plan remains a proposal, the management of the nominated property does not fully meet the requirements of the Operational Guidelines.

4.4 Community

The landscape is rugged and sparsely populated, with less than 500 permanent inhabitants and no medium- or large-scale settlements, nor industrial uses within the nominated property. Approximately 250,000 people live on the flatter and more arable lands that surround the site. There are multiple land uses and ownership throughout the Barberton Mountains and a complex mosaic of land uses including barren rock ridges, small subsistence farms, managed forest plantations, tourist resorts, and isolated small communities. Land ownership is similarly complex, and includes protected areas governed under Mpumalanga Tourism and Parks Agency (MTPA), private companies operating timber plantations (SAAPI Manufacturing and York timbers), private land owners, and communally held land with some simple dwellings. Other land uses and ownership outside the boundaries of the property include medium-sized communities with commercial activities such as stores, restaurants, and mining, and have also been included as stakeholders in all negotiations.

Barberton Tourism and Biodiversity Corridor (BATOBIC) has held public meetings with all of these groups, and additional meetings were held as part of the IUCN Evaluation field mission. These meetings verified very strong support for the World Heritage initiative from all of the local land owners and dwellers. An open, outdoor meeting of local inhabitants in the village of Avontuur on September 5th (held in Siswati with English translation) was attended by 77 people from Avontuur with an additional 28 people attending from the community of Mbhejeka, ended with a unanimous show of hands supporting the initiative. A meeting of land owners, principally managers of the Nature Reserves and timber plantations along with some local landholders, held in English in Barberton the next day, also produced a unanimous show of support for the initiative. Support for the World Heritage initiative is widespread among all types of landowners throughout the nominated property, and the efforts of BATOBIC in meeting openly with all potential stakeholders to discuss their concerns are to be commended.

The land-owners within the nominated property have signed a resolution (included as Appendix J in the nomination) committing themselves and their properties to support the proposed World Heritage Site on condition that they are afforded formal representation on all decision-making structures and that their land ownership rights are protected. Most of these land owners have also signed individual agreements for their identified properties to be included within the proposed World Heritage Site.

IUCN sought information from the State Party regarding a reference to relocation of people in the nomination. The State Party confirms in reply that relocation of people within the property is part of a process that has been ongoing for the last 30 years and which 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 and an integral part of the country's attempts to address past social injustices. No direct concerns have been raised about this process with IUCN.

4.5 Threats

Barberton was established during the 1884 Barberton Gold Rush, and gold has been mined in Barberton nearly continuously since that time. There is limited evidence of historic mining activity in the nominated property, but this has not resulted in lasting damage to the features of the proposed OUV. Two companies, Barberton Mines and Vantage Goldfields, lawfully hold mining rights adjacent to the northern edge of the nominated property and there is active mining at a depth of approximately 1000-1200 m below the surface immediately to the north of the nominated property.

The rights of these companies to legally extract minerals from their existing mineral properties and to explore for new mineral resources in areas outside protected areas is not disputed. However a century of mining is depleting the known reserves of gold ore in these mineral claims, and Barberton Mines expressed concern that World Heritage status would further restrict them from prospecting for further mineral deposits, particularly in the protected areas immediately south of the existing mining properties. The National Environmental Management: Protected Areas Act (2003) already ensures that no mining, agricultural tillage and timber growing can take place within protected areas, and mining in protected areas is also specifically prohibited by the MPRDA (Minerals and Petroleum Resources Development Act, 2003). The interpretation of these acts as banning mineral exploration and mining in the protected areas immediately south of the active mines was challenged in two recent court cases (Supreme Court of South Africa Case No. 216/2016 and Constitutional Court of South Africa Case CCT-84/17), and both judgements confirmed that prospecting or mining may not proceed in the protected areas.

For perspective, greenstone belts host a huge percentage of the world’s mineral resources, and mining will be a threat in any greenstone belt worldwide except the most remote. The level of threat in the nominated property is not high by comparison with other greenstone belts worldwide and is now largely under control due to the relatively high standards of South African environmental law. At least for the moment the matter seems to be settled on the side of conservation, but continued diligence is necessary.

Outcrops in the reserves are well protected, with enforcement officers and protocols already in place, and require only an additional focus on the geological attributes proposed for OUV rather than the biological attributes for which the reserves originally were established. Most of the rock outcrops that are the key attributes of the proposed OUV of the nominated

property are in excellent condition, but despite the assurances given in the dossier it became obvious during the IUCN field mission that there has been major uncontrolled collecting from the komatiite outcrops outside the current protected areas to a level that threatens their long-term existence. The wildlife managers who run the protected areas have considerable knowledge and experience dealing with poachers of biological resources but are less sensitized to illegal collecting of geological material. The increased exposure that World Heritage designation could bring to these komatiites would also increase the pressure on these key geosites. Adequate laws to protect the outcrops already exist however, will only come into effect if the nominated property is inscribed on the World Heritage List. Successful application of these laws will require in-house geological expertise and local community support to deal with geosite protection both proactively and retroactively. Supplementary information confirms that the MTPA has undertaken to mobilise its staff from the adjoining Songimvelo and Barberton Nature Reserves to patrol and protect the geosites located outside the reserves. Thus it appears a range of measures are in train to combat threats to the geosites.

Broader threats to the proposed OUV appear relatively minor. The region is seismically stable. Threats to the biodiversity of the region (such as the spread of alien invasive species and increased erosion) do not diminish its geological attributes. There is a small population of traditional owners living through sustainable agriculture on the nominated property, and any expansion of the population would probably take place mainly on flat lands covered in alluvium that do not contain key geosites. Educational and some logistical facilities for increased geotourism as a result of World Heritage designation are already active, and the procedures are currently being honed on the modest number of current visitors. The Barberton-Makhonjwa Geotrail was designed for present and future needs and is more than adequate for the likely increase in visitation that inscription on the World Heritage List would bring. The Geotrail is a well-maintained, paved trail with superb interpretive overviews, and as such will focus visitation into a defined area that is easy to manage and patrol.

In conclusion, IUCN considers that the integrity requirements of the nominated property meet the requirements of the Operational Guidelines, but that the protection and management requirements in the Operational Guidelines are not yet fully met.

5. ADDITIONAL COMMENTS

5.1 Transboundary collaboration

IUCN noted the importance of possible transboundary collaboration in the management of the property, in view of its location at the national border with Swaziland, and the fact that the features of potential OUV extend over this border. IUCN sought information from South Africa about their view on transboundary collaboration, and in their supplementary information it is confirmed that 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.

South Africa states that, at present, there is insufficient data available about potential geosites in Swaziland, and acknowledges that the possibility may exist to add potential geosites that would complement those of the nominated property. In the event this is shown to be the case, South Africa confirms that it will be willing to accept extension should data become available.

IUCN recommends that this aspect of possible future extension is actively supported, and notes that inscription of the nominated property in South Africa would enhance scientific research throughout the whole of the Barberton-Greenstone Belt, including whether there are Swaziland geosites that could contribute to the potential OUV of BMM.

6. APPLICATION OF CRITERIA

Barberton Makhonjwa Mountains has been nominated under natural criterion (viii).

Criterion (viii): Earth's history and geological features

Barberton Makhonjwa Mountains represents the best-preserved, thick and diverse succession of volcanic and sedimentary rocks dating back 3.6 to 3.25 billion years to the early part of the Archean Eon when the first continents were starting to form on the primitive Earth. Features of the early Earth that are especially well-preserved in Barberton Makhonjwa Mountains include meteorite-impact fallback breccias dating to just after the end of The Great Bombardment (4.6 to 3.8 billion years ago) that had repeatedly sterilized the surface of the new Earth, tidal bedding that formed when the newly formed Moon was less than half as far away from Earth as it is today, and komatiites that represent the hottest lavas to have ever flowed on Earth. This was the natural setting for the origin of the first reasonably confirmed cellular life forms.

IUCN considers that the nominated property meets this criterion.

7. RECOMMENDATIONS

IUCN recommends that the World Heritage Committee adopts the following draft decision:

The World Heritage Committee,

1. Having examined Documents WHC/18/42.COM/8B and WHC/18/42.COM/INF.8B2;

2. Refers the nomination of **Barberton Makhonjwa Mountains (South Africa)** to the World Heritage List back to the State Party, noting the clear potential of the nominated property to meet criterion (viii), in order to allow the State Party to:

a) Complete the current process of legal protection of the geosites located outside of the nationally protected areas, including an appropriate wider zone of protection around each of these geosites;
b) Commence the recruitment of the necessary geological staff, including at least one position at senior level, in order to ensure the necessary qualified capacity to assure the management of the geological values of the nominated property, and the protection of all of the geosites from illegal collection.
c) Expedite the implementation of the proposed Barberton Makhonjwa Mountains Integrated Management Plan as an agreed joint management framework for the nominated property in anticipation of its legal adoption should the property be inscribed.

3. Requests the State Party to:

a) Ensure that all the proposed additional financial commitments to the nominated property are expedited, and that ongoing additional resources are provided to assure adequate staffing, including specific geological expertise, in the management bodies for the property;
b) Maintain and enhance vigilance regarding threats to the property, and ensure that the nominated property as a whole, and all of the individual geosites, are effectively protected, conserved and presented;
c) Evaluate the opportunities to further strengthen the buffer zone arrangements for the nominated property, and to give consideration to the specific creation of a World Heritage buffer zone, in collaboration with the relevant stakeholders.

4. Invites the States Parties of South Africa and Swaziland to continue their collaboration regarding protection, management and research on the key geosites in the greenstone belt that extends into Swaziland, and to evaluate further the possibility to include additional sites in Swaziland in a transboundary extension of the nominated property, should further research indicate this potential;

5. Commends the State Party, and the local stakeholders, for the participative process that has led to the creation of this nomination, and requests the State Party to ensure that this strong community collaboration remains at the heart of management of the nominated property in the future.

Map 1: Nominated property