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Dear Mr Irving and Dr Tyne,

I am writing in strong support for the recognition of the area within the Arkaroola Wilderness Sanctuary as one of the most significant arid zone mountain landscapes in the world. As such the management planning for this region should have as its first priority the protection of its environmental (and especially its geological) integrity. The region includes internationally significant geological and landscape features and hosts associated major geological research programs and training courses. The geological significance of this region has been recognised as early as the observations of eminent geologists such as Sir Douglas Mawson and the founder of Arkaroola Wilderness Sanctuary Reg Sprigg. As such, the region considered in the *Seeking A Balance* report (www.minerals.pir.sa.gov.au/public_notices/northern_flinders_ranges_project), especially the area of the Arkaroola Wilderness Sanctuary, would make an excellent nomination to be Australia's second Global Geopark and therefore recognised within UNESCO's World Heritage Centre and Man and the Biosphere (MAB) World Network of Biosphere Reserves.

My credentials for this response to the *Seeking a Balance* document is that I am employed as a Senior Lecturer in Geology at the University of Adelaide and have been conducting research and training students in the area of the Arkaroola Wilderness Sanctuary since 2006, and research in arid zone Australian landscapes across the country for over 15 years. My main area of expertise is in regolith geology and the associated history, geochemistry and biogeochemistry of the landscape. I have published numerous geological manuscripts on the geology, landscape history and flora and fauna biogeochemistry of the northern Flinders Ranges, and supervised 2 PhD students and 10 Honours students as well as conducted training courses for over 100 geology students and professionals in the area. An overview of some of this work has been recently published in the *MESA Journal* (Hill & Hore, 2009). I work very closely with mineral explorers, in particular both training their geologists but also developing new and environmentally sensitive exploration techniques, such as plant biogeochemistry, which have been successfully trialled in this area. Further details of my background and credentials can be seen at www.adelaide.edu.au/directory/steven.hill and an overview of my research program and publications at www.adelaide.edu.au/trax/research/landscape.

The need for citation of supporting data

My major criticism of the *Seeking A Balance* report is that it is low in substance and supporting detail and is completely without cross referencing to supporting data, such as previously published maps and reports. The findings of the report are presented without a supporting foundation and detailed scrutiny is therefore not possible. For instance, there is very poor or very little explanation of many of the criteria used in some of the maps of the region. The mineral prospectivity map, is without definition of the different rankings of prospectivity depicted and it is not shown what different minerals commodities (and therefore the environmental implications for their mining and exploration) are being expressed. The extent of mining shown in the area is misleading, with many of the mines depicted being historical, where many of which amount to little more than speculative or hopeful "scratchings", rather than ongoing mineral extraction activity in this landscape. Similarly legends for the maps of "Landscape Quality" and "Biodiversity Values" are without explanation and cross referencing to supporting data. Presented in this format and without context, many of these maps are at best meaningless and potentially misleading. At the very least they do not make a sound basis for major decision making processes and policy development.

The need for the development of further data and ongoing knowledge development

Without knowing the context and source of the data used in the *Seeking A Balance* report (because it is not provided) it is difficult to make an assessment of the quality of the proposals for different sites and areas. From my research experience in the area I am aware that the quality and age of data available are quite variable across the region. For instance, in the case of geological mapping, some areas have been extremely well mapped and recently updated by an ongoing geological survey program, whereas for many other areas the best geological mapping coverage remains Coats & Blisset's map published in the early 1970s but largely based on interpretations generated in the preceding years. Furthermore, regolith-landform maps (and post-Palaeozoic geological mapping) in sufficient detail to be of use in the development of a sound landscape management program are presently not available for the region. Ancient landscape remnants such as the Mawson Plateau, but also many other isolated and poorly recognised remnants of ancient landscape occur throughout the region and their significance and location does not appear to have been specifically recognised in the *Seeking A Balance* report. The development of these major management decisions based on variable and in some cases non-existent scientific data highlights the modest support that there has been for scientific research and mapping in this region in the previous several decades and continuing in the present day. I therefore plead with the government officers and decision makers to increase the level of support for high quality scientific research in the region within the *Seeking A Balance* report to better inform policy and decision making both at the present time and into the future.

Geological research and teaching access

Geological teaching and research have long been important activities in the region and continue to the present day. A national Honours geoscience fieldcourse sponsored within the Mineral Council of Australia's Minerals Tertiary Education Council (MTEC) program is conducted in the region. This course entitled *Mineral Exploration Under Cover* includes the largest enrolment of all courses within

this program (over 50 participants a year from universities across Australia) and provides skill and knowledge relating to new approaches for mineral exploration. One of the main highlights of this course features the stunning landscape and unsurpassed geological field teaching opportunities that Arkaroola offers. Following the vision of Reg Sprigg, the landscape of this region (and in particular Arkaroola Wilderness Sanctuary) is one of the best field teaching laboratories imaginable. This would be severely compromised if parts of the ranges at Arkaroola were actively mined and the associated mining infrastructure developed in these areas. Already access to some sites has been made more difficult due to recently increased mineral exploration traffic (eg. vehicles accessing drilling rigs in the Mt Gee area) and disturbed and unstable ground in parts of the Ridgetop Track and near the Hodgkinson Prospect. Arkaroola Wilderness Sanctuary will also be the host to the first national *Australian Regolith Geology Association* (ARGA) conference in February 2010 (<http://regolith.org.au>), in further recognition of the scientific significance of the region's landscape and its geological substrates. Although the *Seeking the Balance* report does recognise the significance of the region for geological teaching and research, however the details of exactly how this will be conducted both in the context of areas with greater environmental protection and for areas potentially hosting greater exploration and mining activity and the potential for bureaucratic impediments with any future management changes are not clear.

Utilise new advances in low impact mineral exploration approaches

Within the *Seeking A Balance* report a number of mineral exploration strategies are recommended for different zones in the region. I can understand that it may not be possible to fully account in great detail the types and procedures for mineral exploration programs operating in these different zones, however, some inclusion of the leading edge techniques specifically developed in the Arkaroola region are not included. I am disappointed that some of the recent advances in environmentally and culturally sensitive mineral exploration techniques, such as plant biogeochemistry are not specifically encouraged within some of the zones (e.g. Zones 2a and 2b). These techniques have a proven ability to provide an expression at the landsurface of otherwise buried geochemical characteristics and their sampling has a minimal impact on the landscape, requiring only a once-off, small amount of regenerative sample. This would be an ideal technique to encourage in environmentally sensitive areas where mineral exploration programs could still be active. It has already been successfully tested overlying different styles of mineralisation in the northern Flinders Ranges and has even been able to detect deeply buried U mineralisation at Four Mile immediately to the east of the area considered in this report (see www.adelaide.edu.au/trax/research/landscape to download manuscripts and reports relating to this).

Global Geopark Recognition for Arkaroola?

The Arkaroola Wilderness Sanctuary would be an excellent candidate for recognition within the global network of national Geoparks. The first (and only) Global Geopark in Australia is Kanawinka in SW Victoria and SE South Australia. Geoparks provide an international framework of geoconservation to enhance the value of the heritage of the Earth. They seek

to safeguard and sustainably manage landscapes and geological formations that contain key evidence for the history of life on Earth, thereby stimulating regional economic and cultural development. The Geopark Programme operates in synergy with UNESCO's World Heritage Centre and Man and the Biosphere (MAB) World Network of Biosphere Reserves. As outlined on UNESCO's website, a Global Geopark:

- is a territory encompassing one or more sites of scientific importance, not only for geological reasons but also by virtue of its archaeological, ecological or cultural value;
- Will have a management plan designed to foster socio-economic development that is sustainable (most likely to be based on geotourism);
- Will demonstrate methods for conserving and enhancing geological heritage and provide means for teaching geoscientific disciplines and broader environmental issues;
- Will be proposed by public authorities, local communities and private interests acting together;
- Will be part of a global network, which will demonstrate and share best practices with respect to Earth heritage conservation and its integration into sustainable development strategies.

For further information on Global Geoparks see: <http://www.unesco.org/science/earth>

References

Hill, S.M. & Hore, S.B., 2009. Northern Flinders Ranges – Lake Frome Plains uranium exploration under cover: new geological insights through collaboration. *MESA Journal* 53, 28-31.