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Hon. Stephen Noel Dawson
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

Dear Sir,

Industrial emissions are destroying Burrup Peninsula rock art

I am astonished to learn of the recent decision by the Government of Western Australia to encourage further industrial development in the Murujuga (Burrup Peninsula). For years, concerns have been raised internationally about how excessive industrialisation on this small peninsula was destroying rock art sites that, irrefutably, count among the world's most valuable shared heritage. Continuing industrialisation and lack of emissions control are deliberate acts by Government, which unfortunately makes the Burrup rock art one of the most famous archaeological site in the world to be knowingly destroyed. The huge increase in surface acidity and dissolution of the mineral crust through industrial emissions has been known since MacLeod published his paper in 2005. Ignoring this science, I consider is comparable to the deliberate destruction of the Buddhas of Bamiyan in Afghanistan by the Taliban. Endorsement of actions that will further damage to the petroglyphs on the Burrup Peninsula is outrageous.

I am a chemical engineer and materials scientist. I have been studying the preservation of rock art for the last 20 years and have gained a deep understanding of the mechanisms associated with the impacts of pollutants on rock surfaces. I have studied the chemical processes affecting rock art decay in the Lascaux caves in France for the International Scientific Committee for the Conservation of Lascaux. I have also studies decay of open-air rock art sites in South Africa and other parts of the world.

It is indisputable that the emission limits granted in the recent licence for Yara Pilbara to operate the new Ammonium Nitrate plant will result in an increased level of nitrogen compounds in the surrounding atmosphere. Compounds such as nitrogen dioxide, nitrous oxide and nitric oxide are known to increase acidity levels in the environment and are responsible for acid rains that devastated forests in Europe and North America. There is irrefutable scientific evidence that acidification of rock surfaces on the Burrup Peninsula is increasing. Dr Ian MacLeod, the internationally renowned chemist and former Director of the Western Australia Maritime Museum, has recently measured pH on surfaces of the same rocks he examined in 2005. The lowest pH observed in 2005 was 4.2, whereas the pH now has fallen to 3.81 at two sites near the Woodside plant flares. The same study shows that the acidity of these rock surface has increased 1000-fold since introduction of industry on the peninsula.

Manganese and iron oxides in rock surface patina will dissolve in such an acidic environment. It is difficult to predict the rate of dissolution, but principles of thermodynamics dictate that these oxides are being dissolved right now. This is truly a serious threat to survival of the rock engravings. Manganese and iron oxides form an important structural component of rock patina and, importantly for rock engravings, give the rocks its characteristic dark colour. Once the patina is dissolved, the engravings will irremediably disappear.

An important point to consider when examining acid deposition and its impact on rock art conservation is the cumulative and irreversible effects. Changes to the patina or its colour through mineral dissolution may not initially be visible to the naked eye. However, the cumulative increase in acidic compounds within the rock surface will definitely dissolve the patina and destroy the rock art over time. There is no doubt that the delicate chemical balance within the rock patina has already been upset by the industrial pollution and acidification on the Burrup Peninsula through the cumulative impact of more than 40 years of industrialisation and shipping. Ignoring this cumulative effect of increasing acidity and the progressive damage to the rock art is comparable to how emissions of greenhouse gases have been dismissed by many for years because global warming had then no visible impact. Waiting for visible impacts also means waiting for damage and here the comparison with global warming becomes incorrect: global warming may still be reversible, damage to rock art never will.

The rock art in the Burrup Peninsula is one of our most valuable shared heritage treasures of the world, with maybe the oldest representation of human faces. It can still be saved if courageous decisions are taken now to limit industrial emissions to virtually zero.

Yours sincerely,

Stéphane Hoerlé

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