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# WHERE IS JUSTICE FOR THE YABURARA PEOPLE? FLAWED GOVERNMENT DECISIONS CONTINUE THE INTERGENERATIONAL TRAUMA FROM THE 1868 MASSACRES IN MURUJUGA, WESTERN AUSTRALIA

Robert G. Bednarik and John L. Black

**Abstract.** The Western Australian and Commonwealth governments approved in November 2024 – May 2025 the Woodside Energy North-West Shelf Project Extension Proposal to continue operations until 2070 on Murujuga in northwest Western Australia. The project will emit over four billion tonnes of carbon dioxide equivalents and around 10,000 tonnes of nitrogen dioxide annually. Murujuga is the site of the world's largest rock art gallery, showing the culture and spiritual beliefs of its inhabitants for potentially 50,000 years. The priceless and irreplaceable petroglyphs were created until the 1868 massacres of the Traditional Owners, the Yaburara people. Murujuga is sacred to the Original Australians. The government approvals were based partly on the second report from the industry-funded, government-administered Murujuga Rock Art Monitoring Program (MRAMP). The Western Australian government claimed, 'The research indicates that the current levels of the pollutants of most concern for the rock art are lower than the interim guideline levels'. An evaluation of the MRAMP report shows that current levels of pollutants have already damaged the outer ferromanganese rock varnish and weathering rind, both essential for the preservation of the petroglyphs. Six main findings confirm this. First, the MRAMP field studies identified elevated rock porosity in the areas immediately around contemporary industry. Second, the MRAMP climate chamber experiments show that nitrogen dioxide and sulphur dioxide gases create pores even in the base rock, which is more resistant than the outer rock coatings. Thirdly, the MRAMP claim that rainfall is now neutral to alkaline is contrary to previous studies and likely due to sea/dust contamination from the location of receptors. Fourthly, the MRAMP claim that rock surface pH has increased one unit is due to a change in methods. Fifthly, MRAMP microbial studies show that the Cyanobacteria and other microorganisms that created the rock varnish are depleted in the most polluted industrial areas, while the *Geodermatophilus* genus which is resilient to low pH and dissolves manganese and iron from rock varnish is concentrated near industry. Finally, recent independent research has suggested that the manganese content of the rock varnish is now half the concentration it was in 1994. These findings affirm that emissions are currently degrading the Murujuga petroglyphs beyond natural rates. With continuing government approvals, where is justice for the massacred Yaburara people?

## Introduction

In December 2024, the Western Australian government approved an application from the natural gas processing company Woodside Energy Ltd for the North-West Shelf Project Extension Proposal to continue operations until 2070 at the Karratha Gas Plant situated on Murujuga, in northwest Western Australia (Whitby 2024). Murujuga is part of the Dampier Archipelago, which contains the world's largest corpus of an estimated one million petroglyphs (McDonald and Veth 2011). The petroglyphs are globally unique, displaying continuously for potentially 20,000 to 50,000 years or more the activities, culture and spiritual beliefs of humankind until the 1868 massacres of the Traditional Owners of this country, the Yaburara people (Gara 1983; Lorblanchet 1983, 1992; Bednarik 2006; McDonald and Veth 2009; Mulvaney 2022). For the Original Australians, Murujuga is sacred. It is a place where the land, sky, sea, plants, animals, the lore and the spiritual world are all connected. The petroglyphs are believed to have been created by *Marrga*, the ancestral spirit, and retain the essential messages for teaching, ongoing responsibility and continuation of *Ngurra-ra Ngarli* Aboriginal culture (UNESCO 2020). The petroglyphs on Murujuga are priceless and irreplaceable, and once damaged, they can never be restored (Black 2024). No natural gas, oil or mineral resources are located in Murujuga; the government simply selected the site for the processing and shipment of resources sourced from hundreds of kilometres away.

The Western Australian government's decision to extend the operation of the Karratha Gas Plant until 2070 was made despite 727 formal appeals by the public against the proposal on the grounds of the huge greenhouse emissions and continued damage to the petroglyphs from the thousands of tonnes of acidic nitrogen dioxide released annually and which deposits on the rock surfaces (Whitby 2024). The total greenhouse gas emissions, including burning of the gas, over the life of the extended project are estimated to be 3.9 billion tonnes of $CO_{2\text{-equivalents}}$, which is 10 times the current annual Australian greenhouse gas emissions (Climate Analytics 2025).

The 'License to Operate' granted to Woodside Energy following the decision to approve the North-West Shelf Project Extension Proposal included clause 3 on Air Quality with Section 3-1 stating the Air Quality Outcome is: '*(1) to ensure that no air emissions from the proposal have an adverse impact accelerating the weathering of rock art within Murujuga beyond natural rates*'. The supporting documentation (Whitby 2024: 8–9) adds '*that it is expected that the MRAMP* (Murujuga Rock Art Monitoring Program) *will provide reliable information on changes and trends in the condition of the rock art and whether anthropogenic emissions are accelerating the natural weathering, alteration, or degradation of the rock art*'.

The Murujuga Rock Art Monitoring Program (MRAMP) is just the latest in a long history of attempts by the Western Australian government to commission research organisations to provide scientific evidence on the impacts of industrial emissions on the Murujuga petroglyphs. A proposal to develop the MRAMP originated in 2017, but after several false starts, a contract was allocated in 2021 for much of the research to be conducted by Curtin University in Western Australia. MRAMP is funded mainly by the major industries in Murujuga at more than $AUD 5 million per year for five years (B. Smith, pers. comm.). The Western Australian government administers the program in conjunction with the Murujuga Aboriginal Corporation. The report for the first year of MRAMP research was published in November 2023 (MRAMP 2023). The report for the second year of study was ready for release in early December 2024, but was not released by the Western Australian government at that time, despite requests from many organisations and a private 'Freedom of Information' request.

Final approval for the Woodside Energy North-West Shelf Project Extension Proposal relied on a decision from the Federal Government Minister for the Environment under the *Environmental Protection Biodiversity Conservation Act 1999* because most of the non-industrial sections of the Dampier Archipelago were declared National Heritage Listed in 2007. The Federal government also nominated the area for World Heritage listing in 2020 because of its universal heritage value (UNESCO 2020). However, a decision by the Federal Minister on the North-West-Shelf Proposal was delayed, ostensibly first because of the Western Australian election in March 2025 and then by the Federal election held on 3 May 2025.

The MRAMP (2024) report of around 800 pages was finally released by the Western Australian government on the afternoon of Friday, 23 May 2025. On the following Wednesday, 28 May, the Federal Minister for the Environment gave approval with undisclosed conditions for the Woodside North-West Shelf Proposal to proceed based partly on the MRAMP report. The Minister made this decision despite being informed on 24 May 2025 of the referral of the WH nomination to the government to address major concerns, including to: i) ensure the total removal of degrading acidic emissions currently impacting upon the petroglyphs of the Murujuga Cultural Landscape; and ii) prevent any further industrial development adjacent to, and within, the Murujuga Cultural Landscape (ICOMOS 2025).

Although most of the research reported by MRAMP (2024) is substantive and adds to knowledge on the impacts of industrial emissions on Murujuga petroglyphs, several methods employed are inappropriate and have resulted in controversial conclusions in the Executive Summary and subsequent press releases. This paper i) reviews the history of previous government-administered research projects into the impacts of industrial emissions on Murujuga petroglyphs; ii) why a Senate inquiry and a community-funded research project were established; iii) specific controversial issues with the MRAMP (2024) report; iv) current perspective on the impact of industrial emissions on Murujuga petroglyphs; v) recommendations on actions needed to preserve the petroglyphs for future generations, reduce generational trauma for the local custodians of the petroglyphs and to provide long-awaited justice for the Yaburara people and the wider Ngarda-Ngarli community.

**History of the Murujuga rock art monitoring projects**

Robert Bednarik arrived in Dampier in 1967 as a project manager for an engineering company. He became fascinated by the extraordinary array and density of petroglyphs in the area. As well as photographing many, he studied at numerous places around the world, the chemistry and microstructure of the thin black/brown/red outer ferromanganese rock surface layer, termed patina or rock varnish. Robert understood the requirement of near-neutral rock surface pH for the varnish formation, and that, particularly, the manganese compounds in the varnish were dissolved under acidic conditions. In his seminal publication (Bednarik 2002), Robert predicted that the estimated 5800 tonnes of nitrogen dioxide and 120 tonnes of sulphur dioxide annually emitted from the natural gas processing facilities were already bleaching the ferromanganese patina and, by dissolving the manganese compounds, were making its internal structure more friable. He argued that the loss of the ferromanganese outer layer would eventually destroy the petroglyphs on Murujuga.

Bednarik's continual advocacy for the Murujuga petroglyphs contributed to the formation of the Australian Rock Art Research Association (AURA) in 1983 and the International Federation of Rock Art Organisations (IFRAO) in 1988. As a result of the evidence presented and persistent lobbying by Bednarik and the rock art organisations, the Western Australian Government announced on 25 July 2002 that it would conduct an independent study into the potential deterioration of the rock art. The State Development Minister of Western Australia, Clive Brown, announced on 13 February 2003 the terms of reference for the Burrup Rock Art Monitoring Management Committee (BRAMMC) and named an Environment Protection Authority board member, Associate Professor Frank Murray, as chair of this ten-member committee.

Tenders were announced for six rock art monitoring studies on the Burrup Peninsula on 16 July 2003: baseline assessment of microbial activity on rock surfaces; microclimate and deposition at rock art sites; monitoring of ambient concentrations of industrial emissions; artificial fumigation of rock surfaces; field studies of colour changes to rock art; and field studies of micro-topography changes to rock art. IFRAO presented a three-page submission to the Burrup Peninsula Conservation Reserve Planning Advisory Committee on 23 August 2003, criticising much of the plan and describing it as a waste of 'taxpayers' money. Finally, on 12 August 2004, the project to monitor air quality at Dampier, aimed at studying the survival of the petroglyphs, was commenced by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's national science agency. As stated by Black and Chapple (2024: 373), Bednarik (2004) was particularly critical of the colour measurement techniques and fumigation tests to be used by CSIRO. He warned the research would be '*four years of unfocused and purposeless gathering of probably meaningless data*' and '*I predict that the results of this project in 2008 will be inconclusive and unreliable, and that the main finding will be that CSIRO will require further funding to continue the work*'. '*Meanwhile, the government expects to continue its destruction of the Dampier rock art, bulldozing many more sites, and permitting the huge petrochemical industries to belch out ever more acidic emissions, at the rate of tens of thousands of tonnes per year*.'

The CSIRO 2009 Report, which evaluated colour changes on petroglyphs and background rock at eight sites on Murujuga, Gidley and Dolphin Islands (Lau et al. 2009: 19), states that '*Therefore the current indication is there was no consistent perceptible increase in colour change over the 2004–08 period.*' Colour measurements were continued until 2014, with the report (Markley et al. 2015: vii) concluding, '*The comparison of the colour and spectral data collected and processed for both the Northern (control sites) and Southern sites has shown no consistent trend in an increasing or decreasing direction. For the last 11 years, no observed accelerated colour contrast change was detected at the Southern test sites, when compared with the Northern control sites.*'

In the CSIRO study monitoring ambient concentrations of industrial emissions, the 'critical load' concept was used to assess the impacts of deposition of industrial pollutants on Murujuga rock art (Gillett 2008). Critical load is defined as the pollutant deposition flux expressed as milliequivalents per square metre per year, below which there are no significant effects on the environmental factors being assessed. Cinderby et al. (1988) listed five environmental sensitivity classes, from high to low sensitivity to pollutant deposition, as 25, 50, 100, 150 and 200 meq/m$^2$/y. Tables 19a and 19b in the Gillett (2008) report show pollutant deposition rates at five sites near the industrialised area of Murujuga to be 25 (meq/m$^2$/y) in 2004/05 and 32 (meq/m$^2$/y) in 2007/08. Gillett (2008) concludes that the critical load for pollutant impact on Murujuga is 200 (meq/m$^2$/y) based on world soil maps provided by Cinderby et al. (1988) and states (Gillett 2008: 3): '*…. acid deposition to the Burrup area is unlikely to cause any deleterious effects to rock or rock art on the Burrup Peninsula.*'

## A community-funded research project into the impacts of industrial emissions on the Murujuga rock art

*Evaluation of the CSIRO reports*

John Black, a former Assistant Chief and Acting Chief of the CSIRO Division of Animal Production, with others in July 2010 spent four days traversing much of the Murujuga non-industrial Natural Heritage Listed area with Wong-Goo-Tt-oo Elder, Wilfred Hicks, Ken Mulvaney, Robin Chapple and Garry Slee. The visiting group was overwhelmed by the extent, intricacy and continuous historical meaning of the petroglyph gallery, but was dismayed by the overbearing presence of the petrochemical industry and its highly visible air pollution. Black became aware of an application by Burrup Nitrates Limited to construct an ammonium nitrate facility adjacent to the existing fertiliser plant, and that a public response to the application had occurred. The Western Australian EPA responded to the public comments in their January 2011 Report 1379, advising that the project could proceed. The report (WA EPA 2011: 3) concluded that, based on the CSIRO reports (Lau et al. 2007; Gillett 2008), it was '*unlikely*' that emissions from the facility '*would have a significant impact on rock art in the surrounding areas*'.

Black, being a scientist with strict training in the Scientific Method (Black et al. 2017a), reviewed the Lau et al. (2009) report on colour changes and the Gillett (2008) report for the evidence used to conclude that emissions were unlikely to affect the colour or structure of the rock art. This review revealed either a serious lack of scientific integrity in the research methods or interpretation of the results obtained. For all the rock colour measurements, there was enormous variation between measurements at the same sites over the years; no consistency in the time-of-day measurements were taken, and conclusions made without rigorous statistical analyses—an anathema to the scientific method.

Although the research conducted by Gillett (2008) was sound, the conclusion that the critical load was 200 (meq/m$^2$/y) for pollutant deposition not to impact the Murujuga rock art was unsustainable. The Gillett conclusion was based on soil maps provided by Cinderby et al. (1988). Australia was included in the Cinderby et al. (1988) world soil maps, which had low resolution. The region for Western Australia used by Gillett covers the area from near Exmouth Gulf, east to the Great Sandy Desert and north to the Sandfire roadhouse. Cinderby et al. (1988) did not specifically mention the Burrup, which is an igneous rocky outcrop, in their paper. The critical load values proposed by Cinderby et al. (1988) are based on the buffering capacity of soil. The authors suggest that slow-weathering rocks tend to produce little soil, have low critical loads and are highly sensitive to acid-producing pollution, whereas fast-weathering rocks have high critical loads and are least sensitive to air pollutants. Murujuga rocks have extremely slow weathering rates and produce little soil (Pillans and Fifield 2013). Thus, based on Cinderby et al. (1988), rocks on Murujuga bearing rock art would have a critical load near the most sensitive of 25 meq/m$^2$/y, which was already exceeded by the Gillett 2007/08 measurements.

With these conclusions about the inadequacy of the CSIRO research, Black submitted his concerns in a response to the Western Australian EPA on Report 1379, with no response. Black continued to review the annual CSIRO reports on rock colour measurements and, in October 2012, met with the Burrup Rock Art Technical Working Group (BRATWG), which replaced BRAMMC in September 2010. He explained that, without full statistical analyses, it was impossible to conclude whether there had been a change or no change in the colour of the petroglyphs and background rock and the assumption that there was no change was untenable. Black, with members of Friends of Australian Rock Art (FARA), made submissions and met with many politicians, EPA and government department members, explaining that the conclusions being drawn from the CSIRO research were not justified. At the third meeting with the then Premier of Western Australia, Colin Barnett, he asked why don't you get the CSIRO results and conduct a statistical analysis yourself? The CSIRO data were the property of the Western Australian Government.

Black and statistical associate signed agreements with The State of Western Australia in November 2014 to obtain all the CSIRO colour measurements from 2004 to 2014 for statistical analysis on the basis that results remain confidential unless agreed by the Minister for Environmental Regulation. The statistical analysis of the CSIRO data showed that 70% of all measured spots on petroglyphs and adjacent rock had become significantly lighter over the period and were statistically redder and yellower. The colour changes were significant enough to be visible at all seven sites except one and tended to be greatest near the petrochemical facilities or shipping lanes. The results from the reanalysis of the CSIRO research were presented on 30 March 2016 to the BRATWG. The Minutes from this meeting stated '*that there was so much variability that it was too early to draw conclusions*', an observation that was not statistically correct. A manuscript on the reanalysis of the CSIRO results was drafted for publication in the journal *Australian Archaeology*, but submission of the manuscript was refused by the then Minister for the Environment. However, with a change in government in Western Australia in 2017, the report to the government (Black and Diffey 2016) was released online in 2018 by the department of the new Minister for Water and Environmental Regulation (DWER), as was permitted in the confidentiality agreement.

Following rejection by the Western Australian government to publish the results of the reanalysis of the CSIRO petroglyph colour measurements and knowing that the results obtained could be predicted through the application of electrochemical theory, Black worked with Dr Ian MacLeod, an erosion chemist and former Director of the Maritime Museum, and Benjamin Smith, Professor of Archaeology (World Rock Art) to confirm that increased acidity from industrial pollution on Murujuga would dissolve the darker manganese compounds and increase the red ferrous compounds to make the rock varnish thinner, lighter in colour, redder and more yellow over time (Black et al. 2017b). The authors concluded that pollution from industry was likely to destroy rock art over time. Dr MacLeod told the Australian Broadcasting Commission on 16 December 2016 that increased industrial nitrogen pollution, 'a*s sure as night follows day*', will accelerate decay at the world's largest rock art gallery (ABC 2016).

Black et al. (2017c) also detailed in a scientific publication the reasons for the inadequacies of the CSIRO research and why governments and industry could not use the reports to make credible decisions about the impacts of industrial emissions on the Murujuga rock art. These authors concluded (Black et al. 2017c: 145), '*The errors are so great that most of the results in the reports are worthless. The Western Australian Government remains in a state of knowledge deficit as if no study on colour change and mineralogy has been conducted, despite the large amount of time and money spent*'. The paper appeared together with an editorial suggesting that the complete removal of the industry from Dampier was inevitable in the long term.

*A Federal Government Senate inquiry*

Robin Chapple, Western Australian Legislative

Council for The Greens Party and a founding member of FARA, agitated strongly for the Yara Ammonium Nitrate facility to be located on the Maitland Industrial Estate, which had been established for heavy industry, and not on Murujuga adjacent to the rock art. This cause and protection of the rock art from industrial emissions was also strongly promoted by the Federal Greens Senator Rachel Siewert, a member of the Expert Panel on Constitutional Recognition of Indigenous Australians, and by Christine Milne, the former leader of The Greens in Federal parliament. These people, with evidence provided by John Black and others, persuaded the Federal Senate on 30 November 2016 to establish the Inquiry into *The Protection of the Aboriginal Rock Art of the Burrup Peninsula*, which was held on 17 February 2017.

The first presentation to the Senate Inquiry was a video link by Johan Kuylenstierna from the Stockholm Environment Institute. Johan was a coauthor on the Cinderby et al. (1988) paper and stated in his evidence: '*The use of the Cinderby et al. (1988) global sensitivity map and critical loads to say anything of relevance to the rock art in the Burrup Peninsula is just plain wrong—for many reasons and should not be used in evidence to the committee. It cannot be used by industry or governments to justify acid load emissions of 200 meq/m$^2$/year. Rather a careful analysis of the rock art and its sensitivity to acidic inputs is needed*'. Other presentations by Black, Mulvaney and Box all provided evidence of the inadequacies of the CSIRO research. Ken Mulvaney described the immense destruction of rocks bearing petroglyphs during the construction of the petrochemical industry facilities and the extent of industrial emissions on Murujuga. Discussion of the recent publication with Ian MacLeod (Black et al. 2017b) confirmed the findings of Robert G. Bednarik concerning the significant increase in acidity of both the rock surfaces and the rainwater. Subsequently, the CSIRO admitted to the *Sydney Morning Herald* newspaper '*that it had never undertaken any assessment of the capacity of the Burrup rocks to cope with acid deposition from industry*', failing to comply with its brief of assessing the risks of atmospheric acidification. In response to the information presented to the Senate Inquiry, CSIRO withdrew from the BRATWG research program, leaving no scientific conclusion about the impacts of industrial emissions on Murujuga rock art.

*Establishment of a community-funded research project*

Once it became clear that the CSIRO research was being used inappropriately by government and industry to promote additional industry on Murujuga, Black and FARA representatives met with the Board and Circle of Elders at the Murujuga Aboriginal Corporation in 2015 and 2016 to explain that the research to date was of no value for determining the impact of industrial emissions on the rock art and whether they support an independently funded research project. Black explained that the research needed to be independent of funds from industry or the government because there was pre-existing evidence that funders can influence research planning and interpretation (Golder and Loke 2008; Mandrioli et al. 2016). Consequently, with Murujuga Aboriginal Corporation approval, approximately $A300,000 was collected from the public to establish the Murujuga Rock Art Conservation Project, which was administered through the University of Western Australia under the supervision of Professor Benjamin Smith and John Black as an Honorary Research Fellow at the University. The funds were used for research activities aimed at understanding how emissions from the Murujuga industry would directly impact the Murujuga rock art and how nitrogenous emissions from industry change the bio-organism status of the rock surfaces and the consequent effects of their secreted organic acids. The research has involved comparisons of photographs taken pre-early industrialisation of petroglyphs on Murujuga with photographs taken in 2021; studies on the impacts of different molar concentrations of inorganic compounds emitted by Murujuga industries and of bio-organic secreted organic acids from rock surface organisms stimulated by the industry-emitted nitrogenous compounds on the release of mineral elements from rock varnish; accelerated weathering climate chamber experiments comparing Murujuga weather conditions when rain has a pH of 5 or 7; identification of microorganisms on rock surfaces, their metabolism and their likely impacts on the rock varnish.

**The Murujuga Rock Art Monitoring Project**

*Background to project*

Following the Senate Inquiry, the newly elected Labor government in Western Australia undertook to establish a new project to determine the impacts of industrial emissions on Murujuga rock art. On 8 September 2017, John Black was invited by the Minister for the Environment, Hon. Stephen Dawson, to join a new research oversight committee, the Burrup Rock Art Stakeholders Reference Group (BRATWG). On 21 September 2017, Black met with the Senior Policy Advisor to Minister Dawson to discuss the government's '*Draft Burrup Rock Art Strategy: a monitoring, analysis, and decision-making framework to protect Aboriginal rock art on Murujuga (Burrup Peninsula)*', which was to be released for public comments for two to three months until 1 December 2017. Following the discussion, major revisions were suggested to extend the proposed research program greatly and to commit annually for five years to $A500,000 collected from the Murujuga industries. More than 20 responses to the public invitation to comment on the proposed Strategy were received. These submissions were discussed at the first meeting of BRATWG on 10 September 2018, and the Strategy was finally released in February 2019. It was not until 13 February 2020 that a contract for the research was given to Puliyapang Pty Ltd, a joint venture between Calibre Ventures and Tocomwall.

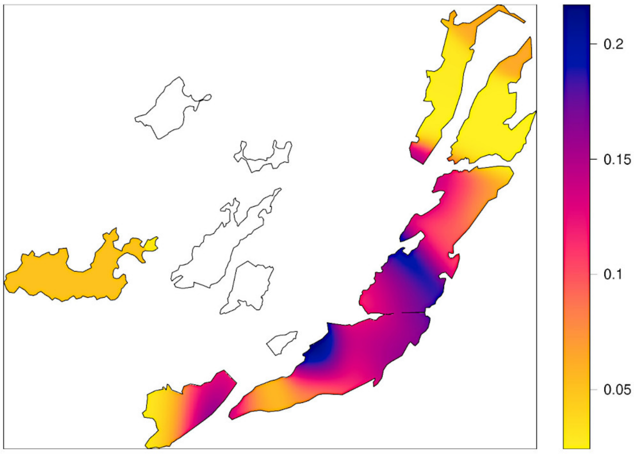


***Figure 1.*** *Reproduction of Figure 7.6-8 from MRAMP (2024) report showing the distribution of weathering rind porosity across the Dampier Archipelago. Average porosity (for depths from 0 to 3.1 mm) for morphological opening radius = 20 microns.*

However, on 30 April 2021, the agreement with Puliyapang Pty Ltd was withdrawn by the DWER for breach of contract. Again, the Department sought to secure a replacement with the contract going to Calibre Ventures, partnering with experts from Curtin University, Artcare and the ChemCentre, with most of the research objectives continuing from the initial contract. Research finally commenced in March 2022, almost five years after the initial government decision to establish a revised research program into the impacts of industrial emissions on the rock art. However, in the meantime, further industry expansion occurred, particularly the 73 ha Perdaman urea production facility was approved.

*Second-year Report Summary*

The first annual report from the MRAMP was released in November 2023, and the second annual report on 23 May 2025. The latter report claims again that the Dampier rock art is not adversely affected by the massive acidic emissions from the industry. The summary of the research *Murujuga Rock Art Monitoring Program: Research Summary Year 2* released by (DWER 2025: 3) makes the following claims: i) '*The acid rain/deposition theory proposed by earlier researchers is not supported by the data from this program*'; ii) '*Measurements of rainfall and deposition over the past two years are neutral or slightly alkaline*'; iii) '*Rock surface pH is not a reliable indicator of rock degradation*'. The first claim is based on the second claim that rainfall and depositions across Murujuga are neutral to alkaline, which is outside previous measurements of rainfall pH on Murujuga sites and is a result of the location of the rainfall receptors. Nevertheless, regarding the first claim, there is an abundance of world literature that shows the ferromanganese rock varnish in desert environments such as Murujuga is highly sensitive to rock surface acidity, with the manganese compounds being dissolved when pH falls below neutral (Dorn 2020; Black 2024). For the third claim, there is clear evidence to show that the pH of rock surfaces can vary. The rock surface pH measured will change with chloride from sea water, the washing of dissolved acids and dissolved minerals, particularly manganese compounds, from the rock varnish during rain, the release of ammonia into the atmosphere, structure of the rock surface, time to equilibrium during rock surface measurements, ambient temperature and operator techniques (MacLeod 2005; MacLeod and Fish 2021; MRAMP 2023).

Nevertheless, when rock surface pH is below 6–6.5, there is strong evidence that the ferromanganese rock surface layer starts to be dissolved (Bednarik 2007; Dorn 2020; Black 2024). For example, Lefkowitz et al. (2013) showed that the lattice structure of the magnesium-rich birnessite in rock varnish breaks down when the rock surface pH is less than 7. Furthermore, Bednarik (1979, 2002) observed that rock varnish was not present on Murujuga rocks where birds perch and where the mean pH was 5.9 across 30 of these sites. Bednarik (2007) also states that the ferromanganese rock coating does not occur in areas with high rainfall because the rock surface pH is below 5.6. It is essential to note Ford et al.'s (1994) finding that, in the Kimberley region north of the Pilbara, a reduction of 2.2 pH points increased the solubility of the rock by 230%. This illustrates the dramatic effects of pH reduction, which result from the logarithmic nature of the pH scale. It is also noteworthy that there are no significant rock varnish accretions on the rocks of the Kimberley due to the wetter climate than the Pilbara (Chaddha et al. 2024).

**Critique of MRAMP 2024 report in relation to rock art**

Despite the DWER summary document claims and certain media reporting, the MRAMP 2024 report contains evidence that industrial emissions are damaging the rocks on Murujuga and the rock art. There are five specific areas of the MRAMP (2024) report discussed in detail.

*Elevated porosity of the weathering rind*

The MRAMP (2024) report shows substantial porosity of the weathering rind of Murujuga rocks and that it varies with the location of the rocks (Fig. 1) (MRAMP 2024: Fig. 7.6-8). The location for the greatest porosity of the rock weathering rind is near the industrial areas and the Dampier township and the iron ore transport and port facilities. The authors show that the variation in porosity is most closely related to $NO_x$ concentration across the Dampier Archipelago (MRAMP 2024: Fig. 7.11-14). As an example, Figure 2 shows the distribution of measured $NO_x$ for December 2022, with the highest concentration over the industrial area.

The authors (Aubrey et al. 2025: iv, 285–295) observe that the association of weathering rind porosity and distribution of $NO_x$ '*may represent anthropogenic impact*'. However, they attribute the increased porosity to the former Dampier power station. This attribution to an earlier industry is not sustainable because the power station operated from 1966 to 1986 with heavy fuel oil and increasing output over those years to approximately 8000 tonnes $NO_x$ annually (MRAMP 2024: 633). From 1986 to 2010, the power station used natural gas with a total $NO_x$ output of a little over 2000 tonnes annually. Secondly, porosity of the weathering rind is also high close to the current petrochemical industrial complex, well away from the old Dampier power station. Industry-provided information to the National Pollution Inventory shows $NO_x$ emissions ranging from approximately 8000 to 16,000 tonnes annually from 2001/02 to 2021/22, where the Karratha Onshore Gas Plant refers to the Woodside North-West Shelf gas processing facility (Fig. 3). The substantial drop in $NO_x$ emissions shown by the Karratha Onshore Gas Plant in 2013/14 was due to a change in the methods Woodside used for the Pollution Inventory entry. In the Karratha Gas Plant Annual Environmental Report – July 2018 to June 2019, Woodside states that '*If the new method was applied retrospectively, the data points prior to the 2013/14 period in Fig 4.1 would decrease by approximately 40%*'. The information contained in the National Pollutant Inventory is provided voluntarily and is not validated by any authority. The following historical occurrence illustrates this anomaly well. Two days before a conference of international air quality scientists and rock art conservators was to be held in Dampier, Woodside announced on 26 March 2003 that it had for many years made a major error in calculating the emissions of $NO_x$ at its Karratha Onshore Gas Plant and conceded $NO_x$ emissions were about twice as great as listed in the National Pollutant Inventory.

The MRAMP (2024) report provides clear evidence that the porosity developed in the Murujuga rock weathering rind is closely associated with the emissions of industrial acidic gases. Each time the rock surface is soaked by rainwater containing acidic emissions, acids from the dry deposits and the rain penetrate the pores on the ferromanganese rock surface into the existing weathering rind pores and gradually increase their size. Ultimately, this process leads to the physical disintegration of the weathering rind zone and, with it, the loss of the surface rock varnish and the petroglyphs.

*Degradation of base rock by $NO_2$ and $SO_2$ in climate chambers*

The MRAMP climate chamber studies were conducted with the base rocks found on Murujuga and not with the ferromanganese rock varnish or with the weathering rind, which are more sensitive to acidic

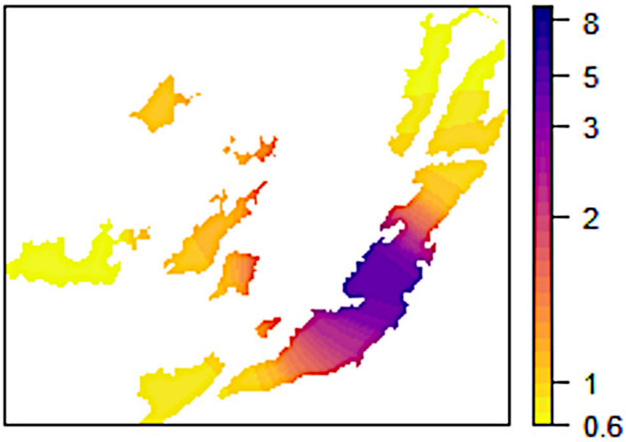


***Figure 2.*** *Reproduction of the December 2022 measurement of $NO_x$ distribution (µg/m³); from MRAMP (2024: Fig. 7.11-14).*

dissolution. Significantly, the base rocks, when exposed to increasing concentrations of $SO_2$ and $NO_2$, developed observable pores in the rock structure. The MRAMP (2024: 439) report concludes, '*The chamber studies have confirmed a mechanism by which rock surfaces exposed to air pollution could undergo an increase in porosity, as observed in field samples. This has been confirmed chemically (through analysis of leachate) and physically (through high-resolution pre- and postexposure analysis of minerals via imaging*).' Thus, the chamber studies provide further evidence that industrial pollutants on Murujuga are capable of seriously damaging the rocks and, therefore, rock art on Murujuga.

A phenomenon reported several times (e.g. Bednarik 2006, 2007) provides a natural form of 'chamber study'. It occurs in an area extending up to ~100 km from Murujuga but has not been observed elsewhere. Where patinated rock surfaces are subjected to 'through-fall' (Löfvendahl and Magnusson 2000), rainwater seeping through plant foliage above the rock absorbs accumulated airborne matter before falling on the rock below. In such locations, the ferromanganese accretions have been wholly or partly dissolved by the solution's higher acidity relative to the direct

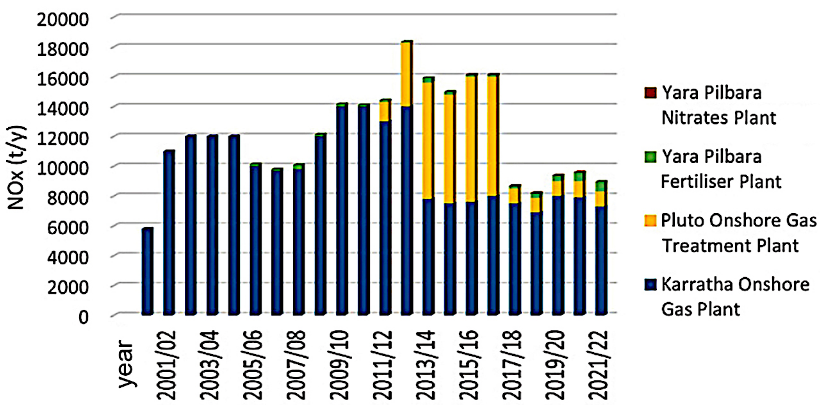


***Figure 3.*** *$NO_x$ emissions as reported annually by industry on Murujuga, obtained from the National Pollution Inventory in March 2023. Reproduced from Black (2024).*

***Figure 4.*** *The loss of the ferromanganese veneer under the foliage of a tree is shown by placing an unaffected patinated clast (centre) among the 'bleached' rocks.*

rainwater, exposing the light-coloured weathering rind (Fig. 4). Therefore, these rocks beneath trees and dense shrubs provide an accelerated or 'fast-forward' version of the effects of acidic precipitation. It would, therefore, be worthwhile establishing the pH of through-fall water at Murujuga.

*Reason for measured rainwater and dust deposition pH being neutral to alkaline*

The MRAMP (2024) report alleges that the pH of rainfall and dust deposition was neutral to alkaline, ranging from pH 7 to 8.7 at different sites (Fig. 5; MRAMP 2024: Fig. 7.10-25, 344). Clean, unpolluted rain has a pH of 5.6 due to carbon dioxide from air being dissolved in the rain to form carbonic acid, whereas acid rain has a pH of 4.5 or below (US EPA 2025). There are other measurements of rain pH on Murujuga and Dampier that do not correspond with the MRAMP results. First, as part of the Murujuga Rock Art Conservation Project at the University of Western Australia, a Dampier resident collected rain while falling into sterile glass containers in seven rainfall events near Dampier between April and September 2022. The average pH of the collected rain was 5.89, with a range from pH 5.43 to 6.46. These rain samples were collected within about 1 km of the iron ore train line and port facility and may have included small amounts of iron ore dust. Secondly, the rain measuring system used by MRAMP (2024) was a static collection over approximately four weeks using a three-bucket system that prevented evaporation. A similar static single bucket system was used by Gillett (2008) to measure rain constituents, including pH, over 'about' 30 days in 2004/05 for 20 measurements at five sites and in 2007/08 for 24 measurements at six sites previously used by CSIRO on the Murujuga industrial area and close to industry. Only one site, at Parker Point, was close to the sea. The mean acid-base value for rain measured by Gillett in 2002/05 was pH 5.04 (range pH 4.34–6.78), and for rain measured in 2007/08 was pH 5.29 (range pH 4.77–6.60). The two highest values recorded were at the Parker Point location close to the sea. The rain pH measures obtained by Gillett in 2004/05 are similar to those reported for 2004 by Bednarik (2007) at pH ~4.6 and those reported by MacLeod (2005).

These previous rain pH measurements can explain why the MRAMP (2024) measured values were unusually high for natural rain. The seven sites used by MRAMP (2024) to measure rain and dust deposition are shown as red circles in the map of Murujuga (Fig. 6). All sites are located close to the sea. Sites AQ-09, AQ-02 and AQ-14 were a little further from the coast and had the lower rain pH values of all sites measured at pH 7.0–7.4.

The MRAMP (2024: 344) report provides a clear explanation for the reason their rain pH values were high by stating, '*Rainfall pH above 7 is usually considered to be due to salt/sea spray or alkaline dust/clay*'. The pH of seawater is between 7.7 and 8.3, with an average of 8.1 (US EPA 2025), while the pH of moist iron ore dust is 7.1–8.5 (Soltani et al. 2021). The MRAMP (2024) results suggest that the method of rain collection and the locations of the collection sites are the primary reasons for the high pH values recorded because they allowed the deposition of sea

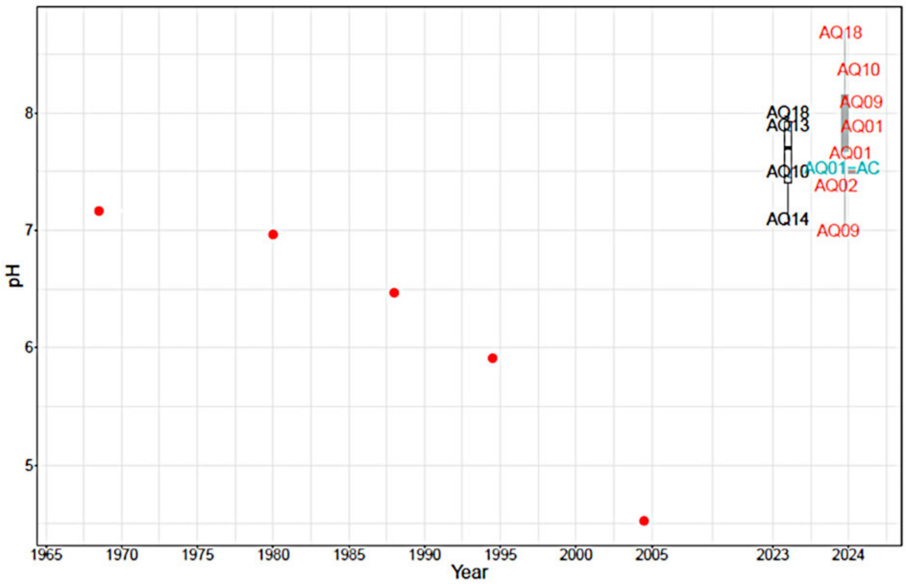


***Figure 5.*** *Historical measurements of rain pH on the Dampier Archipelago. Red dots from Bednarik (2007) and numbered sites from the MRAMP (2024) report, p. 344.*

salt and dust on the collecting system. Although this explanation was clearly stated in the MRAMP (2024) report, the authors unjustifiably use these high rain pH measurements to claim that the 'acidification' hypothesis of Bednarik (2007) and Smith et al. (2022; Smith 2024) that the rock varnish and weathering rind on Murujuga is being degraded by low pH rock surfaces is not supported by the MRAMP studies.

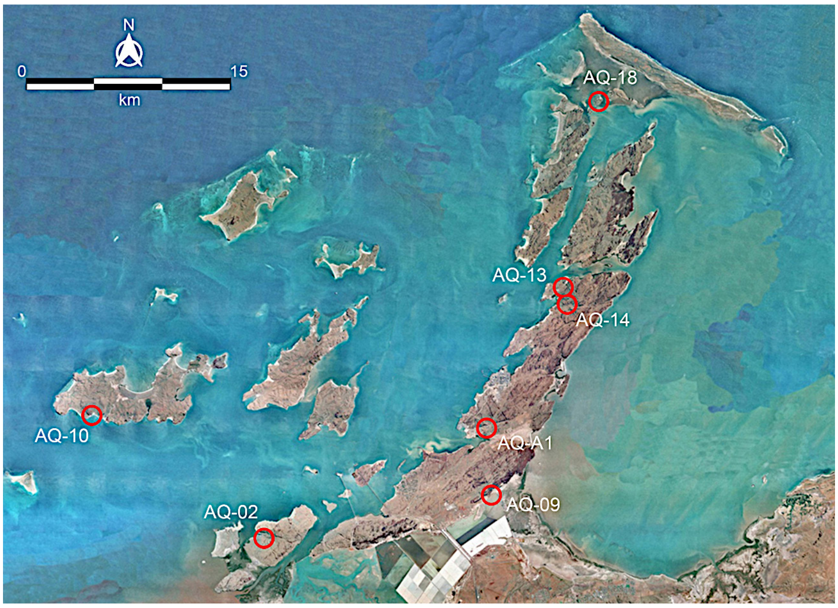


***Figure 6.*** *Sites used by MRAMP (2024) to measure rain pH and dust deposition. Source B. W. Smith.*

*Reason for measured rock surface pH being high in measurement campaigns 6 and 7*

MRAMP (2024) measured rock surface pH on seven occasions, with mean values being above 6 in campaign 1, between pH 4 and 5 for campaigns 2, 3, 4 and 5 and rising again to around pH 6 in campaigns 6 and 7 as shown (Fig. 7). MRAMP disregard the results from campaign 1 because of technical reasons. There was a major difference in the experimental technique used for campaigns 6 and 7 compared with earlier measurement campaigns, where an ionic strength adjuster (ISA) was used while making pH measurements. The MRAMP (2024) report did not include a comparison of the rock surface pH values obtained with or without the ISA. This failure was a significant technical oversight in the experimental procedures, particularly when a comparison with and without ISA was made for chlorine measurements. There is ample evidence that shows the addition of ISA will substantially increase the pH of measured high ionic solutions by as much as 1 pH unit (Wiesner et al. 2006). This increase in measured pH with ISA occurs because $H^+$ ions that were attached to other compounds, particularly $Na^+$ and $SiO^-$, are released into solution, increasing $H^+$ concentration and the measured pH value. Thus, the reason that the pH values from rock surfaces in the MRAMP campaigns 6 and 7 show less acidic readings is likely to be due to the change in experimental technique and not due to environmental changes.

*Absence of Cyanobacteria and increase in* Geodermatophilus *near the gas treatment areas*

MRAMP (2024) reports their findings on the presence of microbial species on rocks and an investigation into an association between organism density and the observed increase in porosity of the weathering rind of rocks near the industrial area (MRAMP 2024: Fig. 8.2-3). The analysis showed that the *Geodermatophilus* genus was more abundant in areas of high rock porosity, and the *Chroococcidiopsidaceae* genus, which contains the phylum Cyanobacteria, was more abundant in regions with low porosity. These observations about the relative abundance of microbial species are highly significant when considering the effects of industrial emissions on the long-term preservation of the Murujuga petroglyphs.

Cyanobacteria showed low abundance near the industrial areas on Murujuga (Fig. 8). The photosynthetic *Chroococcidiopsis cyanobacteria* organisms, *Rubrobacter*, as well as other microorganisms, are critical for the formation of rock varnish in desert environments

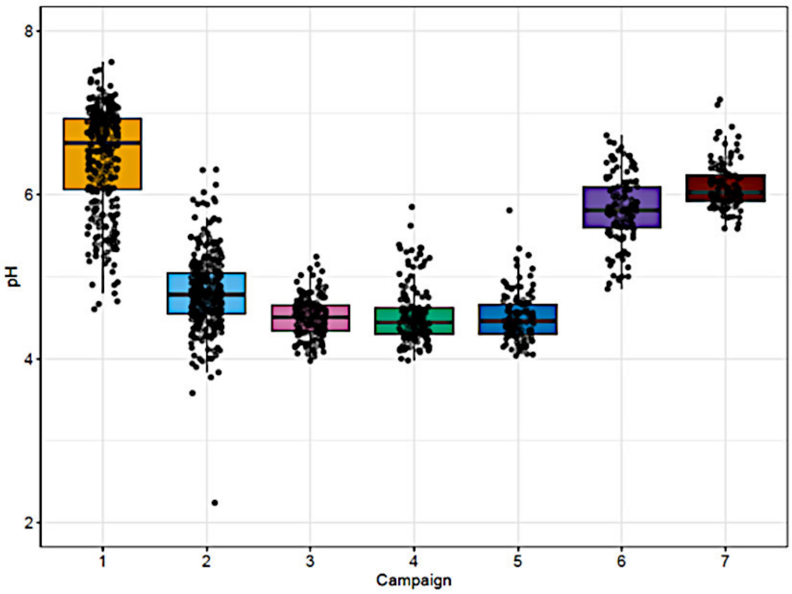


***Figure 7.*** *Measurements of rock surface pH by MRAMP for the seven campaigns. From MRAMP (2024: Fig. 7.4-1, p. 254).*

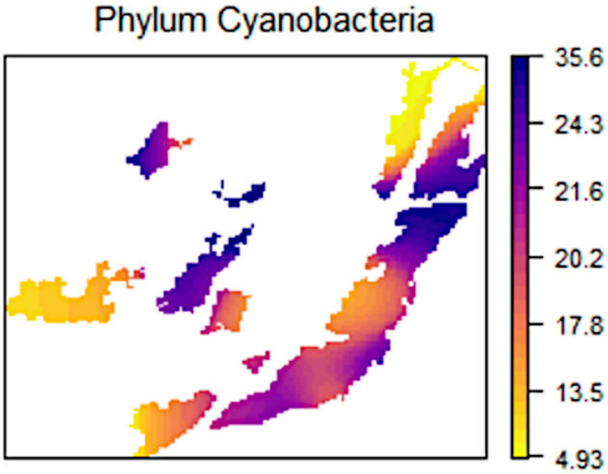


***Figure 8.*** *Reproduction of MRAMP (2024: Fig. 7-8-2) showing the relative abundance (%) of the microbial phylum* Cyanobacteria*, which is predominantly responsible for rock varnish formation.*

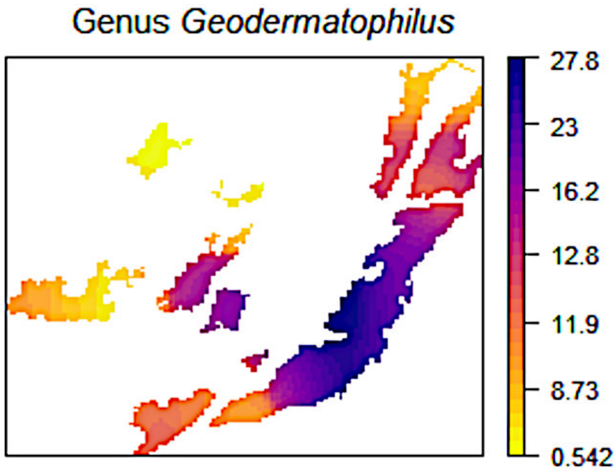


***Figure 9.*** *Reproduction of MRAMP (2024: Fig. 7-8-2) showing the relative abundance (%) of the microbial genus* Geodermatophilus*, which is acid tolerant and mobilises manganese and iron from rock varnish.*

(Culotta and Wildeman 2021; Lingappa et al. 2021; Chaddha et al. 2024; but cf. Dorn 2024). These organisms are crucial for concentrating manganese and iron from the environment by up to 100-fold to form a protective sheath, allowing them to survive the harsh desert conditions. The protective outer sheath of the Cyanobacteria disintegrates when the organisms die to form rock varnish at the extraordinarily slow rate of 1–40 μm in 1000 years (Liu and Broecker 2000; Dorn 2020). The Cyanobacteria evolved in an extremely low-nutrient desert environment and obtained the nitrogen they needed for metabolism directly from the air and their carbohydrates through photosynthesis. The rock varnish-forming Cyanobacteria are highly resistant to desiccation, ultraviolet radiation, high salt concentrations and high temperatures (Bothe 2019). The distribution of Cyanobacteria in regions away from industry suggests that rock varnish is still being formed at these sites, but not in the industrial areas. Furthermore, the MRAMP (2024) redundancy analysis (Fig. 8.2-3, 416) shows higher concentrations of manganese, iron and aluminium (all essential compounds in rock varnish) to be closely associated with high presence of Cyanobacteria and inversely related to porosity in the weathering rind. This observation is further evidence that emissions from the industry have ceased the formation of rock varnish, increased porosity and will be accelerating the rate of varnish and weathering rind degradation and, therefore, the longevity of the petroglyphs.

The *Geodermatophilus* genus, which was abundant near industry (Fig. 9), is highly resilient to acidic conditions and was shown by Neumann (2025) to multiply on gabbro rocks in climate chambers with rain pH 5. *Geodermatophilus* genus is known to mobilise manganese and iron from rock varnish surfaces (Hungate et al. 1987).

## Impact of industrial emissions on Murujuga petroglyphs

The MRAMP (2024) report confirms that both the ferromanganese rock varnish layer, through decreased presence of the varnish-forming Cyanobacteria and an increase in varnish-mobilising *Geodermatophilus*, and the weathering rind, through increased porosity, are currently being degraded in areas that are in proximity to the petrochemical industries on Murujuga. Accelerated degradation of the rock varnish and increased porosity of the weathering rind will inevitably lead to the destruction of the Murujuga petroglyphs. The evidence presented in the MRAMP report shows clearly that Clause 3, Section 3-1 (1) on Air Quality, '*to ensure that no air emissions from the proposal have an adverse impact accelerating the weathering of rock art within Murujuga beyond natural rates*' of the Woodside Energy Licence to Operate the North-West Shelf facility has been contravened and that acidic emissions are currently degrading the Murujuga petroglyphs beyond natural rates.

A major failure of the MRAMP was the lack of comparison between rock samples collected before the industrialisation of the area and the samples collected in 2022. By contrast, Neumann (2025), as part of the Western Australian University Murujuga Rock Art Conservation Project, obtained a sample of granophyre rock collected by Bednarik in 1994 from near the Woodside North-West Shelf gas treatment facility for comparison with rocks collected in 2022 from a similar area. Neumann (2025) examined a section of the rock varnish with differing colours for manganese content. Analysis of black, manganese-rich varnish sections of a sample collected in 1994 showed that its MnO contents ranged from 12 to 20 wt % and were substantially higher than the amounts of only 3.01 to 7.97 wt % in the samples collected in 2022 (Neumann 2025: 55). Similarly, for the orange lower manganese-rich varnish regions, the MnO content of rock collected in

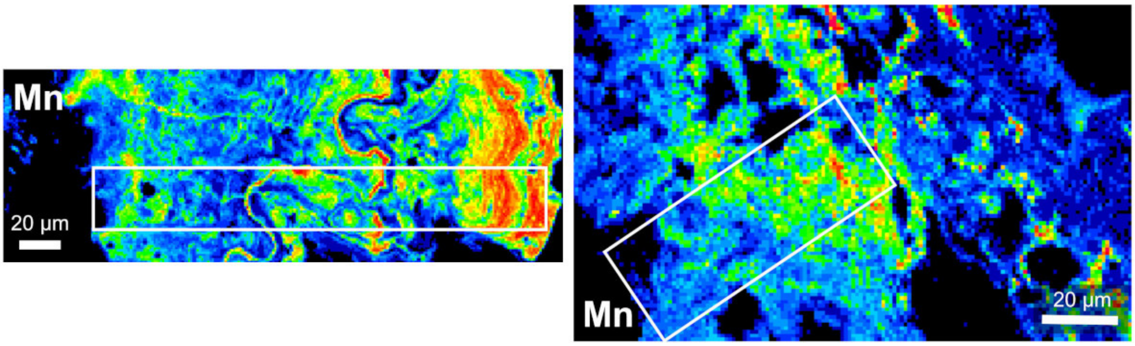


***Figure 10.*** *The hyperspectral Raman image for manganese is superimposed on the electron microscope image, and a rectangle in the element distribution images marks its location. Colour coding of the element distribution images varies from red for high to blue for low abundances. The left picture shows the cross-section of the 1994 granophyre sample with the rock surface to the right, and the right panel shows a 2022 gabbro sample with no clear lamination, little manganese remaining and a substantial area free of matter. From Neumann (2025).*

1994 was 10–11 wt %, while the corresponding 2022 samples yielded concentrations as low as 0.48 wt %. The $Fe_2O_3$ content was only slightly higher in the 1994 sample than on the surface of the 2022 samples. However, the Fe-Mn ratios were substantially lower in the 1994 sample than for all measurements on the recently collected samples, suggesting a significant loss of manganese from the rock varnish of Murujuga rocks over the last 28 years. It would be desirable to test this observation by securing further older samples.

Neumann (2025) also superimposed hyperspectral Raman images for manganese on electron micrographs on images of thin cross-sections of the rock sample collected in 1994 with those of granophyre rock collected in 2022 (Fig. 10). The 1994 sample to the left of Figure 10 showed clear lamination of manganese compounds, a depth of varnish of about 12 µm, with only one obvious dark porous spot. In contrast, the 2022 granophyre sample to the right of Figure 10 showed no obvious lamination with very few manganese compounds present. The depth of the 2022 sample varnish was similar to the 1994 sample, but there were many dark porous areas. The Neumann (2025) results show that the manganese content of Murujuga rock surfaces may have been significantly depleted due to increased dissolution rates since 1994. Neumann's proposition that Murujuga rock varnish weathering rates have most likely already been accelerated due to the lower pH of the rainwater for several decades fits with the MRAMP observations of reduced varnish-forming Cyanobacteria and increased weathering rind porosity in areas adjacent to the Murujuga industrial area.

The findings of Neumann (2025) reinforce the evidence that has been available for many years from the research conducted by MacLeod (2005) that manganese and iron are leached from the surface of Murujuga rocks at a logarithmic rate (ten times per unit pH change) as pH falls from the measured values of pH 5.4 to pH 4.2 (Fig. 11). The pH range observed by MacLeod was similar to that measured by MRAMP (2024) before the addition of the ionic strength adjuster to their measurements.

The summary report of MRAMP (2024) research prepared by the Western Australian DWER (2025: 5) states that: '*The research indicates that the current levels of the pollutants of most concern for the rock art are lower than the interim guideline levels*'. This statement is not supported by the evidence presented from a comprehensive evaluation of the MRAMP (2024) report. The chief statistician for the project, Adrian Baddeley, wrote to DWER outlining his concerns about the way one of the graphs in the scientific paper had been handled. In the report delivered to DWER, the graph included a green line (representing an early warning threshold) that was deleted from the published summary version of the report against Baddeley's wishes (Shine 2025). The summary of the 800-page report grossly misrepresented the main findings of the MRAMP research by not concluding, as the report shows, that the rock varnish and the weathering rind of Murujuga rocks bearing petroglyphs within the industrial area are already being degraded beyond natural rates. The longevity of the petroglyphs is being reduced now.

**Actions required to preserve Murujuga petroglyphs for future generations**

The scientific evidence is strong that restoration of the ferromanganese rock varnish cannot occur unless the rock surface pH is at 6.5 or above, as summarised by Black (2024), because the manganese compounds are dissolved once pH falls below 6.5. Furthermore, the Cyanobacteria primarily responsible for the creation of the rock varnish do so at the rate of 1–40 µm in 1000 years. The only solution to prevent further damage to the rock varnish and weathering rind, and therefore the petroglyphs on Murujuga, is to reduce acidic gas emissions to zero. Technologies are available to achieve such an outcome.

Yara International has developed Selective Catalytic Reduction (SCR) systems that reduce nitrogen oxide emissions from individual industrial outlets by 98% (Yara International 2025). Placing several of the SCR systems in series for each nitrogen dioxide venting outlet from all industries on Murujuga would

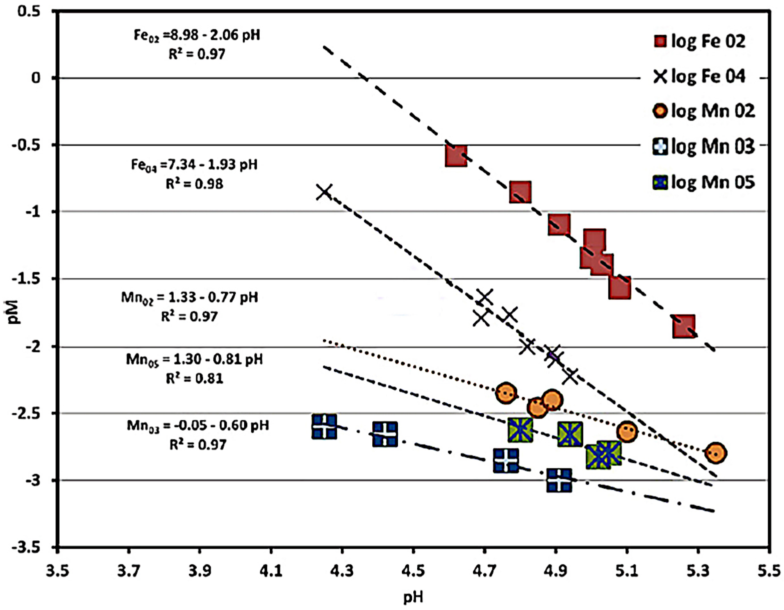


***Figure 11.*** *Relationship between rock surface pH and concentration (PM, $log_{10}$ ppm) of iron and manganese minerals in the washings from rocks on Murujuga in 2004. The slope of the relationships indicates the increase in solubility of rock varnish compounds as acidity increases. From Black et al. (2017b).*

reduce nitrogen dioxide emissions to zero. According to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA 2025) report, accepting the Scarborough offshore gas environmental plan, Woodside Energy considered the use of the SCR system and a wet scrubber system to reduce $NO_x$ emissions but rejected their use on the basis that '*the cost of implementation grossly outweighed the environmental benefits at this point in time*' (NOPSEMA 2025: 8). This is an astonishing revelation by Woodside Energy; does this statement imply that the profits for the company are more important than saving the world's unique heritage in Murujuga petroglyphs from certain destruction?

All nitrogen dioxide in Murujuga is produced by burning natural gas at high temperatures in air that contains nitrogen. The heat produced is used for a wide range of industrial processes, including the liquefaction of natural gas for export. However, the heat required for these industrial processes could also be produced from electricity, which can be generated away from Murujuga and prevent the emissions of nitrogen dioxide in the vicinity of the petroglyphs. Surely, the electrification of these heat-producing processes should be a condition imposed by governments on the Murujuga industries to prevent further damage to the petroglyphs. Although this suggestion has been made in many submissions to governments, it has not yet been made a requirement in new Licenses or Works Approvals.

## Injustice for the Yaburara people continues

By their refusal to acknowledge the evidence presented in the MRAMP (2024) report that the Murujuga petroglyphs are currently being degraded and allowing industrial acidic emissions to continue until 2070, the Western Australian and Federal governments are knowingly approving the continual demise of potentially 50,000 years of human heritage of world significance. The true significance of the site was recognised in July 2025 when the Dampier Archipelago was given World Heritage Listing by UNESCO. However, the ICOMOS-recommended restrictions on acidic emissions by industry were not included.

The 1868 massacres of the Yaburara Traditional Owners and custodians of the petroglyphs and their connection to Murujuga are deeply embedded in the memories of the Aboriginal custodians of the land today. Government mistreatment began within a few years of the first settlement of the nearby mainland by the British in 1863, encouraged by offers of land by Western Australian Governor John Stephen Hampton (Bednarik 2006). The settlements of Roebourne and Tien Tsin (Cossack) were established and grew rapidly. As more settlers took up leases around the Harding River during 1865, a two-year drought developed. Conditions became so severe that the arrivals relied heavily on fish and game provided by the Indigenous landowners. Indeed, Frederick Stow, who later became the first to mention the Dampier petroglyphs in print, observed in 1865 that the friendliness of the Murujuga Indigenes '*almost amounted to affection and they were obedient to our requests*' (Stow 1881). The discovery in 1866 of substantial beds of pearl shells in Nickol Bay provided an alternative source of support for the new community, developing quickly into a thriving industry. It was so successful that it soon became a curse for the Indigenous people. Recruited initially as shell gatherers, men, women and children found themselves forced to dive for shells once the easily accessible beds were exhausted. As the industry gathered momentum, becoming one of the largest pearling centres in the world, the demand for divers increased. Hundreds became forced labour, especially after a smallpox epidemic decimated the Indigenous population. Aboriginal people were 'recruited' (i.e. kidnapped and transported in chains) from neighbouring tribes.

On 6 February 1868, police officer Constable W. Griffis raped a Yaburara woman and then arrested her husband, Coolyerberri. Camping at night, he chained Coolyerberri to a tree by the neck. During the night, a large mob of Yaburara attempted to free the prisoner; a melee ensued, and Griffis and two companions died. The Roebourne Government Resident, Robert J. Sholl, examined the site, established the identities of the nine 'ringleaders', and returned to Roebourne. He swore in two parties of special constables, totalling about 20 men (contradictory numbers were reported). The first posse, led by Alex McRae (a slave trader who had other encounters with Indigenous people that were fatal for them), travelled on horseback across the mudflats to Murujuga; the second, under John Withnell, was to reach Murujuga on the cutter *Albert* (Gara 1983; Bednarik 2006). Withnell once beat the female shepherd Talarong to death with a stick, but Magistrate Sholl acquitted him as '*he had been provoked*'.

On 16 February, the two posses met up in Hearson Cove as arranged. Seeing tracks leading west, they decided McRae's party would follow them and meet up with the boat in King Bay. That evening, they saw the fires of a large camp but deferred the attack to the morning. With the first daylight, they crept close to the camp and killed about sixty Yaburara people, as reported by David Carly, who examined the skulls of fifteen victims. William Taylor (1869) confirms that '*the most diabolical acts both on women and children*' were perpetrated. Pearler John Watson reports that '*they were shot down while others took to the water only to be finished off by the boat party*'. The massacres continued on 19 February with two incidents in the vicinity of the Flying Foam Passage. There appears to have been major carnage on the small Conzinc Island, where large quantities of human remains were found subsequently (Bednarik 2006). Finally, a '*sharp skirmish*' with fugitives occurred on 20 February 1868 at an unnamed island.

The idiom of the reports of both Withnell and McRae suggests that they were written or dictated by the same person, and Withnell was almost illiterate. The reports are unreliable, self-contradictory and self-serving. There are no numbers or estimates of individuals killed or wounded, and no prisoners were brought to Roebourne. Three were taken but escaped due to a lack of equipment to secure them. A newly arrived police officer, Constable Francisco, was then instructed by Sholl to continue combing the islands for survivors for the next months and reported shooting dead three Yaburara men in late March. In May, four men were apprehended on the furthest island, Legendre Island, two of whom were sent to Rottnest Island prison. At this point, the search for survivors was called off, as there did not appear to be any. Yet a year after the massacres began, the two remaining wanted men, Poodegin and Pulthalgarry, walked into Roebourne voluntarily and begged for clemency. Sholl granted them an amnesty, even though Poodegin was the man who probably killed Griffis. Perhaps it had become apparent to Sholl that he had instigated the near-complete genocide of an entire tribe, which does not look good on anyone's CV.

The very small surviving community of the Traditional Custodians of Dampier rock art, Australia's greatest cultural monument, has never been compensated by the responsible agency, the State Government of Western Australia. Instead, many streets and landmarks remain named after the main culprits of the series of massacres, while the local communities have to fight for the survival of their massive cultural heritage, the thousands of stone arrangements and the rock art of the archipelago.

The lack of current government action to apply conditions on acidic emissions by the industries on Murujuga, essential for the preservation of the Murujuga petroglyphs, continues the awful wrongness perpetrated by non-Aboriginal people on the local Indigenous population. The intergenerational trauma through so many generations continues today.

Where is the justice for the Yaburara people and the wider Ngarda-Ngarli community?

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