‘The Atmosphere As Raw Material’:

The Sky Above Melbourne and the Russell and Mab Grimwade Collection

Liquid Oxygen Explosions at Truganina, Victoria 31/8/1933, Photo by Russell Grimwade

This paper was written on unceded Wurundjeri lands, and I would like to pay my respects to the traditional owners of this country, past and present, who have lived and breathed this country for generations.

Always was, always will be Aboriginal Land.

Thanks to the University of Melbourne staff for their knowledge and support, and to the Miegunyah Fund for enabling this project.

Thanks also to my colleagues and loved ones for creating a sustaining atmosphere conducive to thinking and working through these ideas.

In 1939, Russell Grimwade gave an address to the Chemistry section of the Australian and New Zealand Association for the Advancement of Science entitled 'The Atmosphere As Raw Material'.[1] In it he reflected expansively on the history of humanity's understanding of the air we breathe, on the quantities and qualities of different gases in the atmosphere and how humans have extracted and put them to use. It was a chemist's view of the sky, parcelled and measured. It made me question how the Grimwade art collection reflects this professional and scientific interest in the materiality of the atmosphere. How is the air, the sky, the atmosphere of this place depicted in this collection? *How does this collection breathe?*

Firstly, oxygen. Russell Grimwade was the first person in Australia to import machinery to distil liquid oxygen from the air.[2] The Linde processor,[3] a tall cylindrical tank with pipes running in and out of it at various angles, was installed at the back of the Felton & Grimwade premises in West Melbourne. Thus, the Australian Oxygen Company was born in 1910. They eventually moved to Latrobe St and in addition to liquid oxygen, the company produced liquid hydrogen, carbonic acid, nitrogen and nitrous oxide - all extracted from the air above their Melbourne factory.[4]

Though Australian Oxygen and Industrial Gases, as it later came to be known, was a small arm of the Grimwade business empire and by no means the most lucrative, the Grimwades did make money from selling liquified components of the atmosphere to the medical, industrial and construction industries here. These funds presumably went some way to help purchase the 19th century books and prints that Mab and Russell enthusiastically collected – hundreds of images made by Europeans, mostly in the 19th century, of the landscape and colonisation of Australia. Grimwade also took a few of his own photographs of the movement and chemistry of the air here.

I hope to draw attention to the quiet, invisible things of the air that are threaded through the Grimwade collection, highlighting the social and technological histories of our ways of seeing/not seeing, and the 'polytemporal, polyspacial knottings'[5] in this collection. It's thrilling to look at how entangled we are with the atmosphere, and what stories we tell ourselves about

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[1] Russell Grimwade. 'The Atmosphere as Raw Material', *Nature*, Vol 143, 8 Apr 1939, 610-611

[2] Paul Savage, *With enthusiasm burning: the story of welding and associated industries in Australia* (Brisbane: Paul Savage, 1974) https://www.cigweld.com.au/wp-content/uploads/2012/11/cigweld-with-enthusiasm-burning.pdf , 22

[3] Invented in Germany by Carl von Linde

[4] Savage, *Enthusiasm Burning*, 24 + *Sands & McDougall's directory of Victoria : 1930*. Melbourne: Sands & McDougall, 1930

[5] Donna J. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, Read by Laural Merlington. (Connecticut, USA: Tantor Audio, 2017) Audiobook ed.

this entanglement – what 'art/science worldings'[6] we partake in, how these change over time. "The question remains, where should we look, what depth of field should we focus on, in the midst of entanglements?"[7] I have chosen to focus on images depicting the skies and air above Melbourne out of many different images of Australian landscapes and colonies in the Grimwade Collection because I live and work here. So did the Grimwades and many of the artists. This shared view allowed me to look at the same skies, breathe the same air, and experiment with a more situated, embodied, reflective form of enquiry.

It is important to note that there are no Kulin images of the atmosphere or sky in the Grimwade collection and so I am not able to share their perspectives in this context. However, they and their lands are present in this collection, albeit through an invader's gaze. Many would say that the land and sky above Naarm have been out of balance ever since Europeans turned up with their fractured way of seeing and shaping the world.[8] The following is primarily an examination of that fractured view.

Fig.1. James Adamson, *Melbourne from the South Side of the Yarra Yarra, circa 1840s*

[6] Haraway*, Trouble'*, Audiobook ed.
[7] Eva Wilson, 'Exclusion Zones', in Krieman, Susanne. *Ge (ssenwiesse) K (anigberg)*, Spector Books: Leipzig, 2020, 124
[8] See Philip Clarke 'Space' in Fred Cahir, Ian Clark and Philip Clarke, *Aboriginal Biocultural Knowledge in South-Eastern Australia: Perspective of Early Colonists,* (Clayton South, Vic: CSIRO Publishing, 2028), 247-264, url: https://ebooks-publish-csiro-au.eu1.proxy.openathens.net/content/csirobk/9781486306121/9781486306121.body.pdf and

The earliest known printed image of the area now known as Melbourne is mostly sky. *Melbourne from the South Side of the Yarra Yarra* was etched by John Carmichael from a drawing by James Adamson circa 1839. It was criticised at the time for a diminished depiction of the size and scope of the colony, [9] but what is lost in details of activity on the land, is gained by a sense of the sky *from* the land. Melbourne's relatively flat topography does give these big sky views. But there is a spaciousness and metaphoric sense of possibility in this work that is drawn from the sky.

Landscapes are, of course, named for the land. They are rarely seen as documents of the air above it. However, the sky and its colours and clouds can set the tone of an artwork, implying metaphoric possibility and openness, or otherwise. A low and clear horizon can suggest empty space and unleash a desire to "lay claim to an apparently clear field". [10]

Many of the sky-dominant colonial images in the Grimwade collection depict the sky and land of Melbourne from a distance, from a higher vantage point, which at that time could only have been a hill. There are views from Collingwood and the top of the now-extinct Batman's Hill,[11] but many more were taken from the South side of the Birrarung, or Yarra as it has been incorrectly named, where the land rises to give the best view of the sky and growing city on the opposite bank.

Henry Burn's 'Melbourne from the south side of the Yarra' 1869 is one such image. The picnickers in the scene look across a landscape of long afternoon shadows to the dark promise of rain in the northeast. Shadows of passing clouds cross Burns' landscape too, providing what Alisa Bunbury called "soft and suffused atmospheric effects".[12] The high sunlit curves of cumulonimbus rise over the city from the horizon line, balancing the foregrounded figures and trees. Clouds here, and perhaps in many of the Grimwade collection images, have a compositional function. Clouds create balance.

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[9] Alisa Bunbury, 'Pride of Place: Exploring the Grimwade Collection', (Carlton: Miegunyah Press, 2020), 128

[10] Henry Lefebvre in Flint, *Victorian*, 286

[11] Batman's Hill was flattened to make way for the railway

[12] Bunbury, *Pride of Place,* 153

Fig.2 Henry Burn, *Melbourne from the south side of the Yarra*, 1869

For many artists the sky may simply have been an afterthought, something to be filled in later from memory, or seen as universal and unspecific to place - too changeable and impermanent to document closely. Certainly, different prints of the same image in the Grimwade collection show subtle changes in the depictions of the sky's colour, clouds, and smoke from version to version. Some skies aren't particularly convincing. De Gruchy and Leigh's 1863 panorama of Melbourne is a view from the roof of the newly built Parliament House. The clouds in this image have an unreal fixity and repetition to them - a pattern that bothers me, I think because there is no real movement in it, no openness to change.

Fig. 3 De Gruchy & Leigh, *Panoramic view of Melbourne, Victoria*, 1863

This image was likely etched from a series of photographs taken there, [13] which may account for this almost frozen effect in the sky, but similar cloud formations and chimney plumes are set at a similar distance above the horizon line in their earlier print 'View of the city of Melbourne,

[13] Alisa Bunbury, in conversation with curator, University of Melbourne, 7 May 2024

from the Observatory', 1858.[14] Clouds appear as firmly outlined objects, rather than mutable actions.

In reality, when we look up at the sky, "Even the stillest seeming cloud is in a restless turmoil of vaporous exchange".[15] As Richard Hamblyn wrote of our perception of the mutability of clouds "Every cloud is a small catastrophe, a world of vapour that dies before our eyes. So how [...] might it be registered as anything other than a cursory sign in the sky?".[16] I would argue that even if the sky and air is considered as secondary to topography or grounded objects in an artwork, that tells us something about what we choose to see or not see.

The 19th century brought new ways of seeing to the Western world. Imaging technologies vastly increased people's understanding of physical space. Distant places were brought close through the rapid dissemination of the printed image.[17] Science also fundamentally altered people's visual perceptions of the natural environment, and while many resisted the so called 'unweaving of the rainbow' many more were enchanted by the possibilities of the microscope and telescope, and what might come from seeing the previously impossible to see, including in something so ethereal as air and clouds. [18]

Luke Howard's scientific cloud classification system of 1805 was well established by the time many of the images in the Grimwade collection were drawn and circulated. In the 19th century an ability to read clouds and their atmospheric signals was crucial to predicting the weather for commercial or subsistence agriculture and seafaring navigation – the tools of colony. Whether most people subscribed to Howard's Latin nomenclature - Cumulus, Nimbus, Stratus, Cirrus and all their variations - is debatable. The first rudimentary meteorological network wasn't established in Australia until 1838 and it wasn't until much later in the 19th century that Howard's terms were modified and widely adopted.[19]

Melbourne is known for its changeable weather, and its cloud. It is situated at the meeting point between warm air from the continent and cold air from the Southern Ocean.

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[14] 'The view of the city of Melbourne, from the Observatory', 1858 (George Rowe, Lithographer; De Gruchy & Leigh, Printers) The University of Melbourne Art Collection. The Russell and Mab Grimwade Bequests, 1973. 1973.0017.000.000

[15] Hamblyn, 121

[16] Richard Hamblyn. *The Invention of Clouds* (London: Picador, 2001), 91

[17] Kate Flint, "The Victorian and The Visual Imagination", (Cambridge: Cambridge University Press, 2000), 6-7

[18] Flint, *Victorian,* 6-8

[19] See Claire Fenby, 'Seven Lean Years, Seven Fat Years': Climate Theory in Australia, 1820–1830', *History of Meteorology, (*7, 2015*)* 26 and Richard Hamblyn, *Clouds*

“There’s an intimate relationship between the Antarctic storms and the cold fronts we see in Melbourne – virtually all of these fronts are connected to a low-pressure system near Antarctica.” [20] Intimate with Antarctica, Melbourne holds onto its cool air and clouds because the city is surrounded by low mountains which the air struggles to cross. Cool weather hangs here. We breathe the Antarctic.

Fig 4. Wilbrahim Liardet, *View of Melbourne, Port Phillip, with index plate*, 1851

Melbourne’s grey sky – what I often call its ‘lid’ – is a flat layer of cloud that hangs over the city, sometimes for days. If low and heavy it is stratocumulus, if high and thin it is altostratus - a mid-altitude grey cloud that can appear to those of us on the ground as though it covers the whole sky. We see a combination of these in Wilbrahim Liardet’s work, where a central cumulus cloud hangs above Melbourne. Mount Macedon, seen in the original drawing, is swallowed up in the aquatinted streaks of grey cloud crossing the entire sky in the print. Despite the unreality of much of Liardet’s art, often painted from memory and imagination, the sky feels right – it threatens rain.

There is little rain (nimbus) or fog (low lying stratus), in the depictions of Melbourne in the Grimwade collection. Even John Prout’s depiction of Elizabeth Street, notorious at the time for its floods and effluent, appears dry, open and sunlit. But look at Prout’s skies a little more closely and despite the wash of blue tint across the coloured prints, the skies are almost always clouded. Cumulus clouds balloon high and the blue sky above is shaded with grey stratus. Hints of cirrus are discernible above that.

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[20] Sam Burt, ‘Explaining Melbourne’s Crazy But Predictable Weather’ *Pursuit* ¸ University of Melbourne: Dec 2019, https://pursuit.unimelb.edu.au/articles/explaining-melbourne-s-crazy-but-predictable-weather

Fig. 5. John Skinner Prout, Elizabeth St, Melbourne, 1847

All clouds are formed from the gathering of particulate matter (dust, smoke, volcanic ash, sea salt) around air that has cooled to dewpoint, or crystalised to ice. This exchange is pictured quite literally in several images of Melbourne in the Grimwade Collection that feature eddying dark grey streaks or steamy clouds billowing from industrial and domestic chimneys

Fig.6 Edmund Thomas, *View from below Princes Bridge south side*, 1853

Edmund Thomas' lithographs from the 1850s are particularly notable for their smoke. *In View from below Princes Bridge*, 1853 there is a slight breeze from the south that stirs multiple dark plumes, bending their path upwards into *cumulus homogenitus* - the scientific name given to human-made cloud formed of rising thermals and particulates from smokestacks.

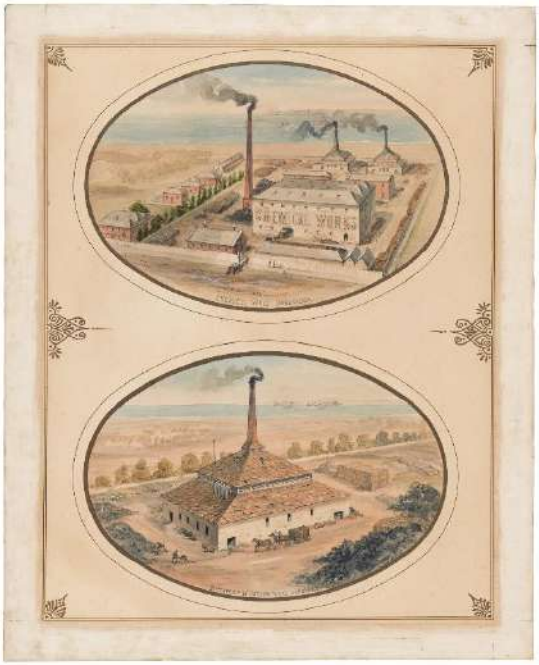

Fig. 7 Unknown, *Chemical works, Sandridge; Be-sulphide of carbon works*, Sandridge, c. 1884

Russell Grimwade's ancestors contributed their own share of particulates to the atmosphere. In a series of images produced for a Felton & Grimwade advertisement in the 1880s, the towering chimneys of their various business concerns, including their glassworks and chemical plant in Sandridge are depicted industriously spewing forth smoke. Tall chimneys like this were built to pump bad air up and away from the ground where people live and work, but of course that smoky air still travels, sinks in the cold, and forms its own little weather systems.

There is a separate image of what appears to be the Colonial Sugar Refinery in the Grimwade collection, drawn in a similar fashion and framed neatly in an oval. They burned bones in that refinery to create charcoal for filtering sugar, but they also burned coal in the drying house. Both, but particularly the bones, would have had a strong smell. Melbourne's west had a reputation for foul odour and bad air from industry. Dust and smoke in Victorian times were associated with uncleanliness, ill health, poverty and pollution.[21] The chimneys in these artworks were symbols of progress though, the exhalations of a modern industrial city. Images like these communicated this industrial reality back to Europe.

[21] Flint, *Victorian*, 56

According to Russell Grimwade's 1939 address on the atmosphere, a person exhales 3lb of carbon dioxide in a day,[22] a third of which can be taken up and turned back into oxygen by a single 200-foot mountain ash tree.[23] From this, and numerous other examples of chemical exchange he cites in the essay, Russell concludes that "the balance of nature is the only basis of man's existence. It will demand control over vegetation which has been lacking ever since the inception of the industrial period."[24]

Russell was an early advocate of a sustainable Australian forestry and loved eucalypts especially, for their oil and the different qualities of their timber.[25] As an industrialist with a longstanding interest in commercial gas production Grimwade could also see how eucalypts led quite directly to the production of oxygen. This could be cycled back to us in breath or distilled into a saleable bright blue liquid, 'rather like brilliantly sunlit water'[26] used to rehabilitate hospital patients and weld steel.

Fig.8. & Fig.9. Grimwade, Wilfrid Russell, *Eucalyptus Regnans* (c.1918), [UMA-ITE-2009003000158] & Grimwade, Wilfrid Russell, Eucalyptus Regnans (c.1918), [UMA-ITE-2009003000143]. University of Melbourne Archives

Taken as a whole, Russell Grimwade's archive of photographs, now held by the University of Melbourne, do not show an especially close attention to the weather, the sky, or

[22] Contemporary sources generally cite the figure as being more like 1kg, 2.3lb or 500 litres. We also exhale other gases, like nitrous oxide and methane.
[23] Grimwade, Russell. 'The Atmosphere as Raw Material', *Nature*, Vol 143, 8 Apr 1939, 610
[24] Grimwade, Russell. 'Atmosphere as Raw Material', 611
[25] Bosisto's Eucalyptus Oil is part of the Felton & Grimwade medical business empire. Russell was also a keen woodworker.
[26] 'It's In The Air' , *The Herald* (*Melbourne, Vic. : 1861 - 1954), 10 Feb* 1940, 30. url: http://nla.gov.au/nla.news-article246537216

the air. However, his ode to eucalypts, 'An Anthology of the Eucalypts' (1930), features two photographs of the leaves, flowers and fruit of the mountain ash, or *Eucalyptus regnans*. They are airy and spacious photographs, more like loving portraits than scientific illustrations. The leaves curve like lungs either side of the stem, exhaling that 1lb (or a little less) of oxygen. Though of course they're done with all that breathing now. They are 'atmosphere, condensed' through Russell's lens. [27]

By the early 20th century, when Russell was writing his essay on the atmosphere and photographing eucalypt cuttings, matter and space were generally viewed as continuous, porous, and 'exuberantly chemical'.[28] Russell was certainly excited by the chemical possibilities in the world, and in the air and the mixture of gases it contains – he saw a sustainable and sustaining business in it. He'd been liquifying and selling gases commercially for years and continued to research applications for these distillations.

Fig.10., Fig.11. Grimwade, Wilfrid Russell, *Liquid oxygen explosions at Truganina, Victoria, 31/8/1933*

One such application for liquid oxygen appears to have been high powered explosives, used primarily in mining. There are several photographs in Russell's archive of the preparation and explosion of test cartridges being filled or dipped in liquid oxygen[29]. These photographs

[27] Umberto Boccioni 1911, quoted in Christian, Margareta Ingrid, "Objects in Air: Artworks and Their Outside Around 1900", Chicago and London: The University of Chicago Press, 2021, 15
[28] Haraway, *Staying with the Trouble,* 2017 audiobook ed.
[29] Liquid oxygen reacts violently with carboniferous material, which would cause the explosion. Grimwade's personal papers feature research into this process. See Grimwade, Wilfrid Russell, *[1975.0089] Consolidated Papers of Wilfrid Russell Grimwade* (1901-1966), [UMA-ACE-19750089]. University of Melbourne Archives

were taken by the seaside at what is likely Truganina Explosives Reserve, near the Altona foreshore where Laverton Creek flows into the bay in Melbourne's west. Men in suits and hats tinker with dewar flasks and explosives on a grey beach - white sky, grey cloud and the still sea behind them. Then the explosion - sand and smoke forming a brief, already dissipating cloud that Russell captures on film.

Fig12. Grimwade, Wilfrid Russell, *Liquid oxygen explosions at Truganina, Victoria, 31/8/1933*

The Grimwade collection is the perfect lens to show 'art/science' worlding in action. It is a chemist's art collection after all, filled with images documenting the colonisation of water, land and air, the increase of industrialisation, the violence and turbulence of the 19th century and early 20th, but above all that, the sky and its changing clouds; through all that, the landscape with its remnant trees, still breathing. These artworks and images, in their current context, show Russell Grimwade's way of thinking through things. They are documents of past weather, romantic idealisations of a country that the artists, Russell himself, and even we are trying to understand, are trying to live in, are trying to breathe.

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APPENDIX - List of Figures

Cover Image. Grimwade, Wilfrid Russell, *Liquid oxygen explosions at Truganina, Victoria, 31/8/1933* (31/08/1933), [UMA-ITE-2002000300153]. University of Melbourne Archives, accessed 23/06/2024, https://archives.library.unimelb.edu.au/nodes/view/281381

Figure 1. James Hazell Adamson (Scottish / Australian, artist) **,**John Carmichael (Scottish / Australian, engraver) , Raphael Clint (English / Australian, publisher)
Melbourne from the south side of the Yarra Yarra, [c. 1840s]
engraving
20.3 x 35.6 cm (sight), 24.1 x 39.1 cm (frame)
The University of Melbourne Art Collection. The Russell and Mab Grimwade Bequests, 1973
1973.0032.000.000

Figure 2. Henry Burn (English / Australian)
[Melbourne from the south side of the Yarra], 1869
watercolour and tempera on paper
40.3 x 64.1 cm (sheet), 55.6 x 79.9 cm (frame)
The University of Melbourne Art Collection. The Russell and Mab Grimwade Bequests, 1973
1973.0009.000.000

Figure 3 De Gruchy and Leigh (Australian)
Panoramic view of Melbourne, Victoria, 1863
lithograph and watercolour
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The University of Melbourne Art Collection. The Russell and Mab Grimwade Bequests, 1973
1973.0257.000.000

Figure 4. Wilbraham Frederick Evelyn Liardet (Australian, artist), Joseph Wilson Lowry (British, engraver)
View of Melbourne, Port Phillip, with index plate, 1851
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49.2 x 54.7 cm (composition), 64.3 x 72.0 cm (frame)
The University of Melbourne Art Collection. The Russell and Mab Grimwade Bequests, 1973
1973.0226.000.A.000.B

Figure 5. John Skinner Prout (English)
Elizabeth Street, Melbourne, 1847
lithograph and watercolour
22.5 x 35.6 cm (sight)
26.9 x 39.8 cm (sheet)
The University of Melbourne Art Collection. The Russell and Mab Grimwade Bequests, 1973
1973.0377.000.000

Figure 6. Edmund Thomas (Australian, artist) , Edward Gilks (English / Australian, lithographer)
Township Printing Office Huxtable & Co. (Australian, printer)
View from below Princes Bridge south side, [1853]
colour lithograph
20.0 x 33.6 cm (sight)
27.6 x 42.7 cm (sheet)
The University of Melbourne Art Collection. The Russell and Mab Grimwade Bequests, 1973
1973.0457.000.000

Figure 7. Unknown
Chemical works, Sandridge; Be-sulphide of carbon works, Sandridge, c. 1884
watercolour and gold ink on paper
39.7 x 30.6 cm (sight)
The University of Melbourne Art Collection. The Russell and Mab Grimwade Miegunyah Fund, 1994
1994.0033.000.A.000.B

Figure 8. Grimwade, Wilfrid Russell, *Eucalyptus Regnans* (c.1918), [UMA-ITE-2009003000158]. University of Melbourne Archives, accessed 23/06/2024, https://archives.library.unimelb.edu.au/nodes/view/315762

Figure 9. Grimwade, Wilfrid Russell, *Eucalyptus Regnans* (c.1918), [UMA-ITE-2009003000143]. University of Melbourne Archives, accessed 23/06/2024, https://archives.library.unimelb.edu.au/nodes/view/315746

Figure10. Grimwade, Wilfrid Russell, *Liquid oxygen explosions at Truganina, Victoria, 31/8/1933* (31/08/1933), [UMA-ITE-2002000300054]. University of Melbourne Archives, accessed 23/06/2024, https://archives.library.unimelb.edu.au/nodes/view/281283

Figure11. Grimwade, Wilfrid Russell, *Liquid oxygen explosions at Truganina, Victoria, 31/8/1933* (31/08/1933), [UMA-ITE-2002000300167]. University of Melbourne Archives, accessed 17/08/2024, https://archives.library.unimelb.edu.au/nodes/view/281394

Figure 12. Grimwade, Wilfrid Russell, *Liquid oxygen explosions at Truganina, Victoria, 31/8/1933* (31/08/1933), [UMA-ITE-2002000300153]. University of Melbourne Archives, accessed 23/06/2024, https://archives.library.unimelb.edu.au/nodes/view/281381