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A WET AND COLD EL NIÑO: THE TAMBORA VOLCANO'S IMPACT IN THE AUSTRALIAN COLONIES

ABSTRACT

The cataclysmic Tambora volcanic explosion on an Indonesian island in April 1815 resulted in two or three years of cold and wet weather in much of the northern hemisphere which caused crop failure, famine, poverty and disease, among a range of repercussions. It also appears likely, through its impact on sea surface temperatures, to have triggered an El Niño event. This would normally result in hot and dry weather in the south-east of Australia, and potentially severe drought. However, the limited available proxy and documentary evidence indicates that in 1816 and 1817 the weather in NSW and VDL was wetter than average, especially in NSW, and quite cold in VDL. This climatic anomaly is not fully explained, but confirms that the repercussions from Tambora, while not as severe, were also experienced in the southern hemisphere.

THE TAMBORA VOLCANO AND THE WEATHER

From 1816 to 1818 large areas of the planet experienced unusually wet and cold weather, its cause mystifying scientific authorities and the general population alike and giving rise to far-fetched speculation – even in far-off British colony of New South Wales. Only in recent decades has science begun to understand the causes of this weather and the range of repercussions, one of which was an apparent intervention in the El Niño Southern Oscillation cycle.

We now understand that for several days from 5 April 1815 the Tambora volcano erupted on the Indonesian island of Sumbawa, which lies about 1000 kilometres north-west of the Dampier Peninsula in Western Australia and 330 kilometres to the east of Bali. This was no ordinary eruption. It culminated in a cataclysmic explosion on 10 April that was reportedly heard more than 2000 kilometres away, and which is estimated to be the largest in recorded history, rating seven out of eight on the Volcanic Explosivity Index. This makes it at least double the size of the much-vaunted Krakatoa eruption of 1883, ten times bigger than the 1991 Mount Pinatubo eruption and a hundred times more powerful than the 1981 Mount St. Helens blast.¹

Tambora devastated the islands and societies within its region, but its impact spread much wider. The resulting cloud of ash, sulphur and stratospheric volcanic aerosols of up to a million square kilometres spread across the skies of most of the planet, forming a layer that reduced and scattered incoming radiation from the sun and cooled the earth beneath. The effect was to transform weather patterns, notably bringing cooler temperatures and higher rainfall over vast regions during the three years that it took for the cloud to disperse.² This wintry effect in the northern hemisphere has been detailed by a number of authors, including Gillen Darcy Wood who outlined the impact, perhaps with some hyperbole: 'For three years following Tambora's explosion, to be alive, almost anywhere in the world, meant to be hungry. In New England, 1816 was nick-named 'the Year Without a Summer' or 'Eighteen-Hundred-and-Froze-to-Death.' Germans called 1817 'the Year of the Beggar.' Across the globe, harvests perished in frost and drought or were washed away by flooding rains. Villagers in Vermont survived on hedgehogs and boiled nettles, while the peasant of Yunnan in China sucked on white clay. Summer tourists traveling in France mistook beggars crowding the roads for armies on the march.'³

The assertion that the impact was felt ‘almost anywhere in the world’ needs some examination. Although the 2015 bicentenary of Tambora stimulated an increase of interest and research, Wood’s study and nearly all others have focussed mainly on the northern hemisphere. Relatively little scientific or historical research has been undertaken south of the Equator, and virtually none in Australia.

To deepen the Tambora mystery, in recent years evidence has been discovered that Tambora most likely compounded impacts from another major eruption that occurred in 1809. Despite significant research, the site of that volcano is unknown, but it is believed to have combined with Tambora to make the decade of the 1810s particularly cold and wet.⁴

The near-absence of recognition by scholars that Tambora may have impacted on the Australian colonies is largely explained by two phenomena. The first is the limited spread of British settlement in New South Wales (NSW) and Van Diemens Land (VDL, now Tasmania) to that point, and their small populations. The second is the consequential scarcity of documentary and scientific sources. However, there may be a third – the possibility that Tambora had much less climatic and weather effect in Australia than in the northern hemisphere.

What was the impact in the Australian colonies? That is what I set out to discover.

Perhaps superficially surprising, my research has found only one direct reference to the ‘Tomboro’ explosion in Australian colonial newspapers, an indirect account of an observation by a British vessel that was taken from Indian newspapers, reproduced in the *Java Government Gazette* and then in the *Sydney Gazette and New South Wales Advertiser* on 2 March 1816. Today, the lack of

reference to such a major volcanic event seems more than highly unusual, but is largely explained by the fact that Tambora was remote and apparently inconsequential except for those living near to it. More importantly, there was little scientific understanding prior to the 1960s of the connections between volcanic aerosols and the potential for impact on the planet's climate systems. Long winters, devastated food production, poverty, civil unrest and disease in Europe and North America in 1816-18 had no apparent connection with a volcano on a remote island in south-east Asia in April 1815.

Nevertheless, an examination of the two Australian colonial newspapers from the period, as well as the scarce and diverse other sources such as an explorer's journal, government records and proxy scientific data, indicates that there was a reasonably substantial impact in NSW and VDL from 1816 to 1817, particularly in mid-1816 and February 1817. This was principally a major increase in rainfall and, in VDL, also in low temperatures. Large areas of NSW became sodden, some arguably for a number of years, and resulted in short-term floods that devastated settlers on the Hawkesbury River which was Sydney's main food bowl. VDL experienced wet and cold years, but apparently the effect was not as serious as in NSW. Nevertheless, cropping and pastoralism briefly suffered, and the wet period appears likely to have contributed to the colonial expectation that there was an inland sea or major river system in the centre of the Australian continent.

A complication in understanding why there was such weather in 1816 and 1817 is associated with the phases of El Niño Southern Oscillation, which is one of the major influences on climate in south-eastern Australia. The two extremes of the oscillation, El Niño and La Niña, normally produce very different weather from each other, and from what is concurrently occurring in the eastern and western Pacific. In eastern Australia an El Niño event will 'normally' bring dry seasons and even drought while La Niña, by contrast, results in heavy rain and even floods.⁵ In recent

decades climatological research has established a chronology of El Niño oscillations going back decades and even centuries. A leading example is Gergis & Fowler's chronology which identifies oscillations since 1525, and which lists 1815 and 1816 as years of weak El Niño, and 1817 as a strong El Niño. It was not until 1819 and 1820 that they recorded a rain-bringing La Niña.⁶ It is now generally accepted that 1816 and 1817 were El Niño years, and therefore the Australian colonies could be expected to have experienced below average rainfall, with 1817 potentially in drought. However, both the limited proxy data and the only slightly more abundant documentary evidence clearly identify 1816 and 1817 as unusually wet and cold, with significant flooding in NSW. The almost unavoidable conclusion is that, while unproveable scientifically and nowhere near as severe as in the northern hemisphere, Tambora caused two years of anomalously wet and cold weather in south-eastern Australia and in doing so over-rode the normal consequences of an El Niño phase.

The mechanics of how this occurred are difficult to explain, even from the mounting volume of literature about the effects of volcanoes, and specifically Tambora, on climate and weather. Once more, nearly all studies have focussed on the northern hemisphere. As Predybaylo et al state, 'Over the past decade, the response of ENSO to volcanic forcing has received significant attention although consensus on the response mechanisms has not yet been reached.'⁷ Nevertheless, there is some apparent general agreement that volcanic eruption magnitude is responsible for the strength of ENSO response, and therefore a major volcano such as Tambora would have increased the likelihood of an El Niño, and amplified its repercussions.

In essence, the El Niño Southern Oscillation is closely associated with the rise and decline of sea surface temperatures in different parts of the Pacific Ocean. The dust cloud from Tambora caused a drop in land and sea temperatures across the middle band of the globe, but particularly in the

northern hemisphere. As oceans cool less quickly than land due to their greater heat capacity, it is speculated that there was relative warmth in the sea surface temperatures in the eastern Pacific following Tambora, and that this reflected or even triggered El Niño conditions.⁸ That may well explain partly why 1816 and 1817 were such cold and wet years in the northern hemisphere.

In Australasia, the explanation is even more complex and evasive. It has been postulated that the impact of Tambora was relatively not as severe in the southern hemisphere. A valuable summary and study of the climatic impact of Tambora is that of Raible et al:

While the proxies from the Northern Hemisphere land areas generally show substantial cooling in 1816, Tambora's temperature imprint in the Southern Hemisphere appears to be substantially weaker... As the Southern Hemisphere is mostly covered by oceans and its land masses are distributed more toward lower latitudes than their northern counterparts, a weaker and less immediate climatic response to volcanic eruptions is expected... the apparent absence of volcanic cooling in the Southern Hemisphere may be an artifact of the low number of records able to resolve short-term peaks of climatic anomalies. Alternatively (though not supported by ice cores), the amount of aerosols reaching the Southern Hemisphere might have been smaller than assumed in these models.⁹

Whatever the complex causes, and despite there being an El Niño event, in NSW and VDL the weather was not that of a typically hot and dry El Niño but was wet in both colonies, especially NSW, and quite cold in VDL. This anomaly remains an unexplained research challenge.

Few meteorological records were kept in these small and primitive settlements in the early decades after British dispossession, and none that can be found for the period 1815-18. A small number of climatologists have looked for proxy data, but these generally lack a sufficiently high level of chronological specificity to enable identification of the weather in this three-year period.¹⁰

However, a partial insight is provided by Jonathan Palmer and John Ogden who examined the limited dendrochronological research (tree rings) in New Zealand and Tasmania. They found reduced growth in Tasmania from 1814 but particularly in 1816-17, and postulated that there was a cold winter in 1816 and that, more broadly, 'Dendroclimatic temperature reconstructions from Tasmania indicate below-average summer temperatures for the 1816-20 period.'¹¹ Further, they surmised that: 'The summer of 1817 shows marked ring-width reduction in many tree-ring chronologies from New Zealand, but not Tasmania. Temperature reconstructions imply it was a colder-than-average summer. Colder summers occurred in Tasmania also in the latter part of the 1810-20 decade.'¹²

Fenby and Gergis studied rainfall variations in south-eastern Australia 1788-1860 and identified 1816 and 1817 as a wet period but they also faced the problem of a dearth of scientific data and were essentially limited to contemporary newspaper reports.¹³

In the absence of clear scientific evidence, most research into the possible impact of Tambora on the Australian settlements is dependent essentially on observations in a limited range of documentary records. One of the problems with newspapers, diaries, correspondence and other documentary sources is that weather reports and personal observations lack objectivity. They were based upon the subjective nature of unreliable human memory and comparison and on individual personal responses. Besides, few colonists had been more than a few years in the settlement and this further restricted their capacity to judge comparative seasons; for most of them, their most familiar experiences would have been with the weather and climate in Britain.

One of the few settlers to leave a partial diary of the period was Reverend Robert Knopwood, an Anglican minister in Hobart from 1804 until he retired in 1823. Knopwood had a somewhat

dissolute past and was an ongoing bon vivant but, fortunately, in his erratic diary he frequently reported briefly on the state of the weather.¹⁴ This provides a useful guide, but the problem remains that it is difficult to interpret such observations as 'constant rain' or 'very wet day' or 'weather so bad could not leave the house'. Nevertheless, his entries confirm that 1816 and 1817 were frequently wet and cold, and especially in the heavy rainfall months indicated by newspaper reports.

In essence, the documentary records indicate that there was frequent rain, often punctuated in VDL by low temperatures and snowfalls in 1816 and 1817, but especially severe in a small number of intense periods. However, it was the rainfall and floods in NSW that stand out as being the main apparent repercussion from Tambora.

THE AUSTRALIAN COLONIES IN 1815

Both NSW and VDL were founded largely as convict settlements to relieve pressure on British gaols, while also planting British claims to possession (and dispossession of the Indigenous people) in the western Pacific region. In 1815 they were still tiny, the British population in NSW numbering only a little over 13,000, and in VDL a little under 2000.¹⁵ In 1815 most of the colonial invaders were concentrated in and around the capital settlements of Sydney and Hobart, and to a lesser extent in the even smaller settlements of Bathurst and Newcastle in NSW and Launceston in northern VDL. There was a slow spread of farming and pastoral properties into slightly more distant regions where food could be grown and sheep grazed in the hope of exporting wool to Britain. As colonial settlement expanded, Indigenous populations were displaced in what became a long and at times bloody invasion.

The Sydney coastal plain was hemmed in by the Blue Mountains, the adjacent section of the Great Dividing Range which runs parallel along most of the east coast of the continent. In 1813 the range was first crossed by a small party of Europeans and the vast, open and lightly forested plains (kept open by Indigenous burning) that lay beyond were spied and their agrarian potential evaluated. By 1815 the first, tentative steps to advance European settlement onto the plains were being made, and in the second half of April, just a few days after the Tambora cataclysm, Governor Lachlan Macquarie crossed the mountains and inspected the nearby country, choosing the site for the new town of Bathurst on the Macquarie River. Settlers with sheep soon followed, but in 1816-18 they were still few in number and further exploration was a necessary priority.¹⁶ Besides Sydney, the only settlement of note in NSW was at the site of the future city of Newcastle, on the coast about 150 kilometres north of Sydney, where a number of convicts were employed in mining coal.

On the island of VDL there were essentially only two small port settlements, at Hobart in the south and the tiny Launceston village in the north, both of which had been founded just over a decade before the Tambora explosion. Some inland exploration had been undertaken, largely in search of land that was suitable for farming, and there had been a tentative spread of farming and grazing around Hobart, especially to the north, and in the region of Launceston.¹⁷

1816

The earliest indications that 1816 might be an unusual year were seen in January and February (usually hot and generally dry summer months, especially during an El Niño) when the *Sydney Gazette and New South Wales Advertiser* (*Sydney Gazette*) reported that ongoing heavy rain was causing fears about potential damage to crops and the possibility of floods. It expressed particular concern about the Hawkesbury River, substantial distances along whose banks had been

converted to small farms where much of Sydney's grain and other food was produced.¹⁸ The Hawkesbury and adjacent streams effectively acted as the 'canary in the mine' for rainfall in the Sydney region, rising and falling in correlation with recent precipitation both locally and in the mountains further inland. There had been a number of floods causing severe destruction along the Hawkesbury since it was first settled, and there was mounting frustration in the government that the settlers persisted in building their homes on the vulnerable floodplains. Governor Macquarie had attempted to entice them to move their residences to safer ground, such as in the town of Windsor, and by establishing new townsites on higher land. However, most settlers preferred to live on their properties and were therefore vulnerable to periodic inundation.¹⁹

After February 1816, there are no further reports of particularly wet weather until intense rain began in mid-May which flooded roads and destroyed bridges, seriously disrupting travel and communications. Macquarie recorded in his journal on 31 May: 'It having rained incessantly and very heavily for these last four days including the present Day, there is reason to apprehend that we shall have a Flood, and that there will be a serious inundation of the Rivers Hawkesbury and Nepean and South Creek; the Wind now blowing from the South East, which is the one that has generally blown during former Floods in this Colony. — It is now 5, O'Clock in the afternoon and it is raining and blowing most furiously and it has been a Continued Gale of Wind from the South East for the last three days.'²⁰

On 2 June he noted: 'At 2. P.M. this day I received an Express Dispatch from ... Windsor, reporting to me the distressing event of a Complete and awful Flood having taken place there on Friday the 31st. Ultimo, by the inundation of the River Hawkesbury and South Creek, both of which had overflowed their Banks and laid the whole of the Low Country under Water, to the great injury and

distress of the Settlers residing on the Banks of that River and Creek, who will lose their Houses and greatest part of the Grain both in and out of the Ground.’²¹

Through early June the Hawkesbury and Nepean Rivers were in flood and there was considerable damage to crops, although the *Sydney Gazette* noted with relief that the floods were not thought to be as bad as originally feared.²² The rain and floods temporarily subsided, but from the middle of the month there was another fortnight of rain which caused more flooding and loss of crops.²³ Estimates of the flood level in June 1816 place it at a little above or below 14 metres, which makes it a significant flood but not one of the highest experienced.²⁴

The only known visual record of the floods in 1816-17 is a watercolour held by the State Library of NSW, depicting the flood on the Hawkesbury in June 1816. It shows a very substantial, body of water that has spread far across the landscape near Windsor and people resorting to transport by boats.

ILLUSTRATION HERE

In July, frustrated once again that the Hawkesbury settlers had seen their homes as well as their crops destroyed, Macquarie issued an official admonishment and urged them once again to move to the new townships ‘out of reach of these inundations’.²⁵ Perhaps begrudgingly, he provided some government assistance to alleviate the impact on those with the most severe losses.

In VDL in 1816 the rainfall appears to have been more steady but perhaps not as severe as in NSW and while it seems to have been a very cold year, there are no reports of significant floods. The references to rainfall published in the *Hobart Town Gazette and Southern Reporter (Hobart*

Gazette) and the diary of Rev Robert Knopwood, indicate fairly consistent rain during the first half of the year, with the onset of a wetter and colder period as the winter months approached. From the start of May Knopwood regularly recorded heavy rain and observed that nearby Mount Wellington was covered in snow. It is hard to judge the accuracy of such impressions and judgements, or whether this was abnormal. However, the winter weather in June and July seems to have been extraordinary, especially in the second week of July when there were reports of extreme weather in both Sydney and Hobart. Knopwood's diary contained numerous reports in these days and on 13 July he remarked, 'We have had rain every day, more or less, for 28 days'.²⁶ This unusually wet and cold weather was also lamented in the *Hobart Gazette* on the same day:

The Winter has hitherto been as cold and wet as the Colony has experienced for some years past; for this last Week an almost incessant Rain has rendered the Streets nearly impassable, the ground being completely rotten, and full of water like a sponge... in addition to the difficulty of doing any work in such weather, Men badly clothed and lodged, and many unprovided with bedding, are little able to maintain their Health, against the depressing powers of wet and cold.²⁷

The infant settlements along the Coal River north of Hobart also suffered badly from damage to crops, gardens and infrastructure and the mortality of sheep. The *Hobart Gazette* reported on 20 July 1816 that, 'There has only been one season since the settling of the Colony, that has been so inclement as for the last Week-with the almost incessant Rains, there was a gale of wind from the S. West on Thursday night, attended with a very heavy fall of Snow, which covered all the surrounding Mountains on Friday morning, increasing the severity of the cold, and unpleasant weather; and what has added to the uncomfortableness of the Inhabitants, has been the difficulty of procuring Wood for firing, from the Roads being nearly impassable for Carts.'²⁸

Nothing is known about the situation further north on the island around Launceston, but a report in August indicated that the road through the middle of VDL between the two main townships was almost impassable because of the wet.²⁹

Nevertheless, while the coldness was often remarked, the volume of rain in VDL appears not to have been as great as in NSW. Indeed, when news of the June floods in NSW arrived in Hobart, the Hobart newspaper reflected upon how much more fortunate VDL had been:

The very unusual tempestuous and rainy Weather that we have experienced at Van Diemen's Land this Winter appears to have extended along the shores of New South Wales, beyond the limits of the British Settlements.—By private Letters, and also by the Sydney Gazettes we unhappily learn that two dreadful Inundations at the Hawkesbury... have swept away, rotted, and destroyed the feed Wheat committed to the ground; & the miserable impoverished Settlers are now utterly undone...

... Happily for the Settlers of Van Diemen's Land although they have had uncommon severe winterly Weather, yet little damage has been sustained, or losses suffered by Individuals at the various Settlements throughout the land: And we have the satisfaction to look forward to a most abundant Harvest, which we trust through the blessing of Providence will not only enable us to afford consumption for almost any accession of population, but also supply the wants of the Settlements at Port Jackson.³⁰

Both Knopwood and the *Hobart Gazette* continued to report frequent very wet and cold weather in VDL through until the end of August 1816, and of other episodes in September. However, as the *Hobart Gazette* had observed, cropping was not badly impacted in VDL and in November the

newspapers in both colonies commented that despite the earlier rains the crop returns were looking very promising.³¹

1817

The repercussions from Tambora were greater in 1817, especially in the first two and a half months, despite these being summer months and the year being identified as one of strong El Niño conditions. January was unusually wet in both colonies. NSW experienced a week of 'incessant rain' in the middle of the month, including two days which were 'as heavy and as unintermitting as any that have been experienced for many years'.³² The situation was much the same in VDL where heavy rain and some flooding did damage to crops and infrastructure in the Coal River region. This resulted in observations in the *Hobart Gazette* that were notably similar to those in the *Sydney Gazette*: 'There has only been one season since the settling of the Colony, that has been so inclement as for the last Week-with the almost incessant Rains... attended with a very heavy fall of Snow, which covered all the surrounding Mountains..., increasing the severity of the cold, and unpleasant weather ...'.³³ Knopwood also recorded several days of rain, 'bad weather' and lightning in January.³⁴ However, while the 'unusual & rainy weather' in VDL delayed harvesting until about the middle of March, it appears not to have been sufficient to impact greatly on harvest returns.³⁵

Heavy rain continued intermittently in both colonies through February, although seemingly much more severe in NSW where a further deluge in the last week of the month brought on another disastrous Hawkesbury flood that reached its peak on 26th. This flood has been estimated as a little over 14 metres, making it slightly higher than that in June 1816.³⁶ It was described as 'one of

the most serious disasters (the flood of March 1806 excepted), that has ever befallen the Colony'. At least one person drowned.³⁷

In April Macquarie reported to his superiors in England that: 'Harvest considerably Checked by no less than three successive Inundations of the Rivers Hawkesbury and Nepean and South Creek, by which the Country has been much distressed within the last Nine Months; the last took place in the Month of February of the present Year, Overflowing the Country along the Banks of the Hawkesbury to a great Extent, and sweeping away Farm Houses, Offices, Grain of every kind in Stacks, and on the foot, Horned Cattle, Sheep, Pigs, Poultry, and various other Property to a very great Amount; so much so that many Settlers, formerly Opulent, have been completely ruined...'³⁸

Macquarie was so frustrated that he again admonished the settlers for residing in flood-prone zones and urged them to move to the townsites that had been established on higher ground.³⁹

Many settlers and their families were left without homes or income, living in distress and in need of public and government support. By July there were 150 people who were considered destitute and were being fed and supported by charitable funds that had been collected by a committee that had been established in Windsor.⁴⁰

In VDL, although Knopwood made diary entries about the wet, cold, winds and snow in Hobart, the weather was seemingly not as severe as in NSW in February and March. There was no major flooding and the conditions delayed rather than damaged the harvest. That produced some self-congratulation at the superiority of the VDL climate, and the opportunity it offered to sell crops into the northern colony.⁴¹ Indeed, 20,000 bushels of wheat were exported from VDL to Sydney in 1817, a figure that appears to encapsulate the different impacts of the weather on the two

colonies.⁴² As well, a rapid expansion of land grants in VDL in 1817 suggests that the Tambora weather had not been sufficiently challenging to be a deterrent.⁴³

June and July continued to be wet in both colonies, and NSW was said to be cold in August, but there were no further reports of flood or major damage. However, in 1877 NSW Government Astronomer H.C. Russell, as part of his climatological research, identified four floods in 1817, in January, February, March and May. This study has not found evidence for the latter two, and it is unclear on what basis Russell came to his conclusion.⁴⁴

The weather from the second half of 1817 appears to have been generally benign, and the effects of Tambora in decline. By early in 1818 there were even complaints about the preceding dry months and the need for rain.⁴⁵

Within the colonies there was little introspection or analysis about the cause of the apparently extreme weather of 1816 and 1817. Colonial experience was sufficient for it to be recognised that the weather was unusual or even extreme, but only one reference has been found to link the conditions to events in the northern hemisphere and to speculate upon wider climatic connections. This was a letter to the editor of the *Sydney Gazette* on 12 April 1817 from 'Civis', in response to the arrival of news from Europe of the calamitous cold and rain in 1816. 'Civis' was intrigued by scientific speculation about the cause of the extreme weather, especially the discussion about an observed increase in sunspots that had led to conjecture about whether this might be the cause of the cold and wet. He challenged that theory and argued that the explanation was likely to be the break-away of massive polar icebergs.⁴⁶

1818 was not nearly as wet as the two preceding years, although there were periods of rainfall that produced some nervousness. Whether these were normal weather fluctuations or were the result of ongoing repercussions from Tambora is impossible to say. However, it is likely that accumulated water from the heavy rainfall of 1816 and 1817 had produced an accumulation of major bodies of water which would generate speculation about the nature of the country further west in NSW.

TWO ASPECTS WORTH FURTHER EXAMINATION

There are two other relevant phenomena in the 1815-17 period that may have been influenced by the climatic effects of Tambora, one each in the northern and southern hemispheres.

The bleak weather in the northern hemisphere inevitably took its toll on the British Isles where crops failed and famine, poverty and disease impacted on the working poor, resulting in a scattering of food riots, vandalism and protest marches that were quickly put down by the military. The worst of these were the 'Bread or blood' riots at Littleport near Ely in May 1816 when a large crowd was dispersed leaving two killed, five later hanged and nine transported.⁴⁷ In Ireland, as was so often the case, the distress was even greater, but made worse by an associated outbreak of typhus.⁴⁸ An increase in crime is an expected product of such conditions and, as in Littleport, this would have led to more people being drawn into the convict system and being sentenced to transportation. There was a significant rise in the number of convicts sent to the Australian colonies after the 1815 end of the Napoleonic wars, which has traditionally been explained by the backlog of prisoners waiting to be transported, and a rise in unemployment as the economy returned to peacetime conditions. The extent to which post-Tambora conditions

may have swollen transported numbers might be established by extensive research in the convict records, but that is beyond the parameters of this study.

Another imponderable deserving further research is the impact of Tambora weather on the Indigenous populations of NSW and VDL. Those near British settlements were already under pressure prior to 1815 from loss of hunting and other food resources, the spread of disease and mounting conflict with the colonists. The cold and wet of 1816 and 1817 may have involved a further disruption to traditional economies and food gathering and placed even greater pressure on communities under stress. Further extensive research is required on this subject, but it is notable that the cold and wet summer and autumn of 1816 coincided with increased conflict between the Indigenous population and colonists in NSW, notably in March and April. Governor Macquarie sent troops who violently suppressed any resistance they encountered. Most tragic was the Appin massacre on 17 April 1816 when at least 14 Aborigines were killed.⁴⁹ On 1 May 1816 Macquarie issued an emotive proclamation in which he announced that because of the mounting violence he was:

... lately reluctantly compelled to resort to coercive and strong Measures to prevent the Recurrence of such Crimes and Barbarities, and to bring to condign Punishment such of the Perpetrators of them as could be found and apprehended; and with this View sent out a Military Force to drive away these hostile Tribes from the British Settlements in the remote Parts of the Country, and to take as many of them Prisoners as possible; in executing which Service several Natives have been unavoidably killed and wounded, in Consequence of their not having surrendered themselves on being called on so to do...⁵⁰

Violent conflict continued well into the year.

AN INLAND SEA OR MAJOR RIVER?

In the early decades of British exploration and colonial expansion there was much inquisitiveness about the nature of the centre of the continent, and speculation about the possibility that it contained an inland sea or a major river or two that emptied the continent's rainfall into the ocean. This expectation was based on the understood nature of the other continents and the resulting belief that such a large area of land as Australia would of necessity contain mountains and regions of good rainfall, and therefore possess significant rivers and bodies of water. Where else would the rain go? Once the Blue Mountains had been crossed this notion was enhanced by the encounter with sections of two rivers: the Macquarie River on which Bathurst was founded and which flowed essentially northwards; and the Lachlan River which was 'discovered' in 1815 and which runs from the Bathurst region mainly west-south-west towards the interior. Where did their waters flow?

How significant this expectation of finding inland water was in the early decades is a matter of some debate among historians. J.H.L. Cumpston and others see it as a major preoccupation of early colonists and explorers; others see it as an exaggerated undercurrent. For example, Michael Cathcart argues that the 'myth' of the inland sea was inflated and cultivated by later writers and historians, and was not as strong in the nineteenth century as has been assumed or argued.⁵¹ Certainly the possibility of substantial water was in the mind of Governor Macquarie after the Blue Mountains were crossed in 1813, and was one of the motivations for his encouragement of further exploration. It was his desire to have the country and rivers beyond the Blue Mountains and Bathurst explored that resulted in the sighting in 1815 of the Lachlan River. In March 1817 he instructed NSW Surveyor General John Oxley to follow the Lachlan to trace its course and identify the nature of the country through which it passed.

The expedition was undertaken after the main rainfall periods of 1816 and early 1817, when the accumulated effects of the rain were apparent and seemed to confirm the speculation that there would be a substantial body of water in the hinterland.

Oxley would be somewhat confounded by what he found. To start with, he and other colonists presumably had little understanding of how most Australian inland rivers behave. Rather than following a single main channel that runs in a substantially curving line along declining contours, most of the Australian landscape is relatively flat and drops in altitude are very minor. As a result, streams generally meander very slowly, frequently cutting back on themselves as they loop across the landscape. Another unusual characteristic is that most streams are intermittent, rising and falling with rainfall that might be local but often is in hills a considerable distance away. This results in periodic and rapid flooding when streams break their banks and flow across the countryside to create temporary wetlands, or accumulate in pools or billabongs. The Lachlan River rises in the western slopes of the Blue Mountains and meanders in an essentially west-south-west direction until it reaches the Murrumbidgee River in western NSW, which in turn flows into the Murray River which gathers in a coastal lake system in South Australia that intermittently overflows into the ocean. The Lachlan is notable for the fact that it has adjacent intermittent wetlands for much of its length, and these presumably contained considerable water when Oxley's expedition saw them, as a result of the dramatic rainfall in 1816 and 1817. The wetlands proved a barrier to Oxley's expedition and he was disappointed and frustrated in his attempts to understand the nature of the river and the country through which it passed.⁵²

Oxley and his party set off in April 1817 and the early weeks were relatively easy. The Lachlan was reached on 25 April and it was 'evidently much higher than usual'. The party pushed on slowly to the west, some of the men rowing boats with supplies while Oxley and others proceeded on

horseback or foot. From 5 May they began to encounter wetlands which made progress more difficult. Oxley was unimpressed, commenting on 6 May that it 'is impossible to fancy a worse country than the one we were now travelling over, intersected by swamps and small lagoons in every direction; the soil a poor clay, and covered with stunted useless timber.'

In summary, the expedition followed branches of the Lachlan until, finding their progress barred by impassable wetlands, they were forced to backtrack. On May 12 he complained: 'We ascended the hill, and had the mortification to perceive the termination of our research, at least down this branch of the river: the whole country from the west north-west round to north was either a complete marsh or lay under water, and this for a distance of twenty-five or thirty miles, in those directions; to the south and south-west the country appeared more elevated, but low marshy grounds lay between us and it, which rendered it impossible for us to proceed thither from our present situation. I therefore determined to return back.' By contrast, when they left the river to strike towards the coast, they ran into such arid land that they were forced back to the river.

Oxley's diaries are redolent with such terms as swamps, lagoons, morasses, marshy flats and bogged, and these encapsulated his greatest challenge. At times he 'was sanguine in my expectations of soon entering the long sought for Australian sea, [but] it all at once eluded our farther pursuit by spreading on every point from north-west to north-east, among the ocean of reeds which surrounded us...'⁵³

It was clear that much of the landscape was at times flooded and as he travelled Oxley speculated on three somewhat contradictory possibilities. One was the notion of an inland sea:

To assert positively that we were on the margin of the lake or sea into which this great body of water is discharged, might reasonably be deemed a conclusion which has nothing but conjecture for its basis; but if an opinion may be permitted to be hazarded from actual

appearances, mine is decidedly in favour of our being in the immediate vicinity of an inland sea, or lake, most probably a shoal one, and gradually filling up by immense depositions from the higher lands, left by the waters which flow into it. It is most singular, that the highlands on this continent seem to be confined to the sea-coast, or not to extend to any great distance from it.⁵⁴

Secondly, he conjectured on the likelihood that a significant river would re-emerge on the other side of the wetlands and fall into the sea but, as he became more doubtful and disillusioned, he conceded that: 'It is impossible to arrive at any certain opinion as to what finally becomes of these waters, but I think it probable, from the appearance of the country, and its being nearly on a level with the sea, that they are partly absorbed by the soil, and the remainder lost by evaporation.'⁵⁵ Finally, on July 7 he 'was forced to come to the conclusion that the interior of this vast country is a marsh and uninhabitable', and the party began their long trudge back to Bathurst.

After a brief respite in Sydney, in 1818 Oxley was appointed by Macquarie to lead a similar expedition, this time to follow the Macquarie River which flowed north from Bathurst and thereby suggested the possibility of forming part of a major inland waterway. In several respects this expedition was similar to his previous one. Initial high expectations became bogged down in an impenetrable wetland into which the river dispersed, the Macquarie Marshes.⁵⁶ It is likely that the Marshes were particularly extensive and sodden in 1818 following the heavy Tambora rains of the previous two years.

It was not clear at the time whether Oxley's experiences supported the possibility of an inland sea or confirmed fears that there would be vast wetlands but not much else.⁵⁷ As a consequence, the myth or expectation or hope of an inland sea or an Australian Mississippi continued to be at the back (and occasionally the front) of explorers' minds in the following years. Finally, any expectation was effectively deflated by the explorations of Charles Sturt whose trials and

tribulations during expeditions to arid inland Australia between 1828 and 1844 demonstrated that no large body of water existed.⁵⁸

LAKE GEORGE AND LAKE BATHURST

Another piece of evidence that supports the incidence of high rainfall in 1816 and 1817 is the state of two intermittent lakes, Lake George and the rather smaller Lake Bathurst. Both lie a short distance north-east of the Australian Capital Territory, and are about 16 kilometres apart 'as the crow flies'. Both are shallow depressions that are fed by small streams from surrounding hills, and do not have an outlet but lose water by evaporation. Therefore the volume they contain is a reflection of rainfall and temperatures over recent months and years, and over time they can vary from substantial lakes to dry beds.

The first European to see Lake Bathurst was NSW Deputy Surveyor James Meehan, on 3 April 1818. He described it as 'a large lake exceeding ten miles in circuit... On the NW side are several trees growing in the water which makes me conclude that the lake extends its former limits.'⁵⁹ This estimate of circumference may be an exaggeration but the extent of water and the fact that there were trees growing in the water both suggest that the lake was full or near full because of rainfall during the previous two years. Others who viewed the lake in the next few years described it as a fine body of water.

Lake George is equally interesting and there is more evidence of its historic rise and fall, although it was not observed by a Briton until August 1820 by Joseph Wild, who was much impressed with what he found. Reports of these two substantial bodies of water piqued interest in Sydney and in October Governor Macquarie undertook the long journey to inspect them, reaching Lake Bathurst

first where he observed: 'The first view we had of the Lake was really magnificently fine, from the Heights to the Northwest of it – appearing quite a little Sea, covered with innumerable Flocks of Wild Ducks – and a great many Black Swans – which last looked most beautiful floating on the surface of this grand Piece of Water which is perfectly fresh and good. — The Lake appears to be about Six miles in length by 4 miles in Breadth – and has considerably increased in Size since Mr. Meehan first discovered it in April 1818.'⁶⁰

In the following days Macquarie and his party trekked to the shores of the larger lake where on 27 October he noted: 'At this Point however we were all most highly gratified and delighted with this noble expanse of Water, and the Surrounding Scenery... from every succeeding Hill our admiration of the magnificence and size of this noble Sheet of Water encreased [sic].'⁶¹

Macquarie's admiration for the size of the lake is illustrated by his decision to name it after the most important man in the empire: 'We sat down to Dinner today at ½ past 5, and after Dinner we drank a Bumper Toast to the Success of the Future Settlers of the Shores of "Lake George" – which name I have given to this grand and magnificent Sheet of Water in Honor of His present Majesty.'⁶²

The variability of the two lakes has been the source of much subsequent fascination, led scientifically in the nineteenth century by H.C. Russell. In 1886 he presented a paper to the Royal Society of NSW in which he demonstrated a calculation of the levels in Lake George over the preceding 66 years, based on a mixture of observations and measurements: '... heavy floods in the [Hawkesbury] river coincide in time with heavy floods in the lake... from it we may reasonably infer the state of Lake George from the state of the Hawkesbury during the years 1816, 1817 and 1818. In the autumn of 1816 there were three great floods in the Hawkesbury, while the three preceding

years had been very dry, and there seems to be no doubt that in 1816 the lake suddenly rose...for when found... it was: "full of water".⁶³ Twenty-first century recalculations of lake levels have essentially confirmed his conclusions.⁶⁴

CONCLUSION

The cataclysmic Tambora volcanic explosion in April 1815 resulted in two or three years of exceptionally cold and wet weather in much of the northern hemisphere which caused crop failure, famine, poverty and disease. These conditions in Britain potentially contributed to social disruption and criminal activity that inflated convict number being transported to the Australian colonies. It also appears likely, through its impact on sea surface temperatures, to have triggered an El Niño event which would normally result in hot and dry weather in the south-east of Australia, and potentially severe drought. However, both the limited scientific and documentary evidence indicate that this was not the case and that in 1816 and 1817 the weather in NSW and VDL was wetter than average, especially in NSW, and quite cold in VDL.

Nevertheless, the weather conditions were not so extreme that they caused a long-term disruption in either colony. Exploratory expeditions in these years encountered substantial volumes of water which contributed to exaggerated expectations and visions about the nature of the inland of the continent. The most significant impact of Tambora appears to have been the series of Hawkesbury River floods which resulted in considerable stress for the farmers on its banks and disrupted food production in NSW in 1816 and 1817. Tambora temporarily challenged but did not impede British settlement in Australia.

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