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Native zinc from Brunswick, Victoria, Australia: The case for and against a type locality.

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Abstract

A specimen of native zinc was reported by Ludwig Becker to have been discovered in a basalt quarry near Brunswick, near Melbourne, in the colony of Victoria, in 1855. Despite quite detailed accounts of the discovery and the tests to confirm the specimen as zinc, and public display of a fragment in the London Exhibition in 1862, the occurrence has been generally discredited. Reports of nuggets of zinc metal in gold-bearing alluvial deposits in Victoria were also made during the late 1800s. Although several specimens of zinc in the Museum Victoria collections may be from the original discovery, there is no reliable evidence to confirm such a connection. This paper discusses the evidence for and against the discovery being a genuine one and concludes that, on balance, the record should be accepted .

INTRODUCTION

By the mid-1850s, Melbourne was only 20 years old, but the great gold rushes to central Victoria beginning in 1851 had sparked a population explosion. Interest was running high in any natural metal that glittered. Such a piece of metal was shown to Ludwig Becker by a Melbourne gold-broker, William Clarke, on 26 October 1855. Becker hurried to the reported site of the discovery, a basalt ('bluestone') quarry in an area known as Brunswick, a few kilometres north of the city. There he met the finder, a quarryman, who provided the following account, which was confirmed by a dozen of his workmates:

"Look here, Sir, the 'Bluestone' begins about four feet below the surface, and I bored a hole in a solid piece, 5 feet by 4, in order to blast it. As soon as this was done, I commenced breaking the large pieces of stone with a heavy hammer, and out of one of the pieces, a white mass fell to the ground, which I, out of curiosity, picked up. I found it rather heavy, and wishing to know what it was, I broke the mass, which presented then a blueish (sic) white and brilliant shining metallic surface. Thinking it to be silver, I requested one of my neighbours to show it to Mr Clarke, and the piece you hold in your hands is the identical piece I sent him. It splintered into several pieces upon my breaking it, some of which are on my mantelpiece, some in the hands of my neighbours. The piece, when unbroken, was flat, and about the size of a child's hand. It lay in the cavity of the bluestone block, and the sides of the cavity were covered with a similar substance, and of the same dirty white colour, as the coating or covering of the metal. I can swear to what I have here stated." (Becker, 1857a)

Becker could not find the block of basalt containing the cavity, nor did he find any more pieces of the metal during many subsequent visits to the quarry. His offer of a reward failed to produce more of the material.

At Becker's request, George Ulrich, a German-born mineralogist who became the foremost 19th century authority on Victorian mineral occurrences, examined the metal and its coating. Using standard methods of the time, Ulrich concluded that the metal was zinc and the coating was probably 'zincspar' (now known as the zinc carbonate, smithsonite), but possibly a mixture of zinc oxide and calcium carbonate. He noted tiny pale pink tufts in cracks in the coating, and concluded they were 'cobalt-bloom' (now known as the cobalt arsenate, erythrite). His tests for impurities in the metal revealed none of the elements likely to contaminate zinc, such as cadmium or cobalt.

At a meeting of the Philosophical Institute in 1856, Becker gave a full account of the discovery, together with a detailed description of Ulrich's tests on the material. He displayed pieces of the metal at this talk, which was subsequently published in the Institute's transactions (Becker, 1857a). In a letter he wrote to Professor Heinrich Bronn, editor of *Neues Jahrbuch für Mineralogie, Geognosie, Geologie und Petrefakten-Kunde* based in Heidelberg, Becker gave virtually the same account (Becker, 1857b). Ulrich gave a separate version of his investigations into the specimen (Ulrich, 1859). Both Becker and Ulrich were convinced that the discovery was the first recorded occurrence of native zinc.

A small specimen of native zinc from Brunswick was sent to the 1862 International Exhibition in London, included in a display of geological specimens from the Australian colonies. Alfred Selwyn, the Government Geologist, assembled the Victorian selection, which included minerals, rocks and fossils relating to the Geological Survey of Victoria, displayed in six cabinets. It is assumed that the piece on display came from the original find, although there is no way of confirming this. It must have been a specimen that Selwyn had obtained from Becker or another source, because the Geological Survey had not been involved in the discovery. The specimen was noticed by Dr. T. L. Phipson, who reported that it was encrusted in basalt (Phipson, 1862a & b); his observations were repeated in several journals (Anon. 1862a & b). Like Becker and Ulrich, Phipson claimed it was the first record of native zinc. After the exhibition, the rock, mineral and fossil specimens assembled by Selwyn were reported by a Melbourne newspaper to have been given to the British Museum (*The Argus*, 22 June 1863). The Natural History Museum's registers confirm that many specimens, principally igneous rocks from the colony of Victoria, presented to the Geological Society by Selwyn in 1863-4, were catalogued. However, there is no record of native zinc, or of basalt, from Brunswick (Alan Hart, *personal communication*, 2001).

Doubts about the validity of the discovery were first expressed by Smyth (1869). *"It is said that a piece of native zinc, weighing 19 ounces, was taken from a cavity in basalt at or near Northcote; but doubts as to its true character are entertained"*. No reasons for his suspicion were advanced. Foord (1874) reported that *"in one of the English scientific journals it was compared to the spurious nuggets stated as being so commonly manufactured on the Australian goldfields"*. Despite this, Foord himself was in no doubt that the features of the Becker specimen, which he had inspected, confirmed it to be *"a mineral, intact and in its native state"*. Dana (1888) also expressed doubts about the Melbourne discovery. Although providing details of the occurrence, Dana stated that the zinc *"was found by a quarryman and not by a qualified scientific observer, and that therefore there may be an error with regard to its actually having been taken from the basalt"*. Similar doubts were echoed by Krause (1896).

The Brunswick discovery was not the only record of native zinc in Victoria. In July 1857, *The Herald* newspaper in Melbourne published a letter from Becker in which he announced that two diggers had found a nugget of zinc in gold-bearing wash near Mitta Mitta, in north-eastern Victoria (Becker, 1857c). Gold had been found in this remote region in the early 1850s, mainly in the Mitta Mitta River and some of its tributaries (Flett, 1970). The nugget was found resting on slate at the bottom of the washdirt, three feet from the surface. Becker stated that an analysis had shown it to be zinc, with a small quantity of cadmium. He reported this occurrence in a second letter to Bronn in Heidelberg (Becker, 1857d). Ulrich (1866) supplied more details on the specimen, describing it as roundish and above a pound in weight. He also noted occurrences of small nodules of zinc, coated with 'carbonate of zinc and lime' in Pliocene gold drift at Creswick Creek and Daylesford. Those from Creswick had been found to contain about 1% cadmium. These localities appeared in subsequent records of minerals found on the various goldfields (Smyth, 1869, 1873). A prospector at 'Combyingbar' Creek (actually Combienbar River), in far eastern Victoria, was reported to have found metallic zinc, *"possibly native"* (Smyth, 1874). A list of Victorian mineral localities compiled by Nicholas (1876) gives Sandhurst (Bendigo) and Snowy River (Mountain Creek) as additional localities for zinc, but provides no references. Krause (1896) referred to waterworn pieces having been repeatedly discovered in refuse heaps on the sites of alluvial gold-workings in the Ovens district. Hart (1905) claimed he had a sample of zinc from Bamganie (near Bacchus Marsh, west of Melbourne), said to have been obtained in workings in the 80 ft level of one of the mines. Hart stated *"there was nothing in its circumstances under which I obtained it to suggest any doubt as to its genuineness"*.

Zinc isn't the only metal reported from basaltic rocks in Victoria. In 1874, George Foord discussed the discovery of a *"weighty mass"* of arborescent native copper amongst fragments of weathered basalt near the junction of the Yarra and Maribyrnong Rivers in Melbourne. He related this occurrence to the native copper deposits associated with basalts in the Lake Superior district, USA. In recent times, mineral collectors have found tiny native copper crystals associated with zeolites in a number of Victorian basalt flows, including those from Melbourne.

In the light of these records, this paper reviews the evidence for the discovery of zinc at the Brunswick locality. It explores in more detail the investigation by Vince (1980). A number of aspects require examination, including the nature of any surviving specimens, the weight of the original piece, the location, other possible sources of zinc, the geological origin of zinc, and even the reputation of Becker himself.

POSSIBLE SURVIVING SPECIMENS

Five small fragments of coarsely crystalline zinc are in the Museum Victoria collection, catalogue number M5272 (Figure 1). The specimens were first registered in the mineral catalogue of the National Museum of Victoria in May 1909, but there is no record of how or when the Museum obtained them. The catalogue entry and the old label, probably written at the time of registration, states *"(?) Native zinc. Basalt quarries. Brunswick and Mitta Mitta, Victoria"*. There are several ambiguities in this label information as written, with the punctuation shown. The placement of the question mark suggests doubt over the naturalness of the zinc, rather than over the locality information. It is possible that the pieces came from two localities, Brunswick and Mitta Mitta, however, there were basalt quarries only at Brunswick.

The mixed locality information does suggest the fragments may have come from Becker, since he wrote notes describing pieces from both places. In financial difficulty,

Figure 1: The pieces of zinc metal, possibly from Ludwig Becker. Photo: B. Birch. Specimen: Museum Victoria Collection, M5772.

he attempted to sell part of his natural history collection to the National Museum of Victoria in 1857 (Darragh, 1994). A list supplied with his letters to Professor McCoy, the Museum's Director, includes three specimens of 'metal' representing three 'species', but no further detail. While it is possible that zinc specimens were included in the offer, there is no direct confirmation that the Museum actually obtained the collection. Records of acquisitions for this very early period of the Museum's history are sketchy. From 1856 until 1899 the collections were housed at the University of Melbourne, but no original acquisition registers for the 1850s, if there were any, survive.

The combined weight of the fragments in M5272 is about 6 grams. The largest piece is a roughly rectangular plate about 2.5 x 1 cm in outline and 5-6 mm thick (Figure 1). Both flattened surfaces are partly coated with a cream, powdery material, in places overlain with a very thin, more compact crust with a crystalline appearance. Bright silver-white metal is revealed along one broken edge, and shows coarse cleavage surfaces with striations. The fragment appears to be from close to the edge of a larger flattened piece. The other four pieces are irregular crystal fragments between 5 and 12 mm across, and with all but one carrying patches of alteration similar to the main piece.

CHEMICAL COMPOSITION

Several techniques were applied to the fragments for this review. Firstly, in four samples of zinc metal from the Museum Victoria collections, minor metal contents were determined using Inductive Coupled Plasma (ICP) analysis. The samples included one of the supposed Becker pieces, fragments from a late 19th century zinc ingot, a small pellet found in 1994 by a prospector using a metal detector on the Inglewood goldfield in central Victoria, and a slug from the Teetulpa goldfield in the Olary district of South Australia. Other pieces from the Teetulpa sample contain small charcoal fragments, so it is reasonable to conclude these are not of natural origin. The analytical results are shown in Table 1. While there is little overall distinction between the analyses, the zinc ingot contains the lowest amounts of Cd, Pb, Co and Cu, whereas the Inglewood and Teetulpa specimens contain high Pb values, exceeding 1 wt %. Similar Pb values to these (1.22 % and 1.15 % respectively) have been reported for slab zinc produced by furnace smelting of lead-zinc sulphide ore from Broken Hill, Australia (Woodward, 1965) and by the horizontal retort process in Avonmouth, England (Johnstone and Johnstone, 1961). However, it is difficult to draw any definite conclusions from the data for the possible Becker sample, in the absence of more analyses for zinc from both natural and man-made sources.

The powdery portion of the coating on the largest of the possible Becker samples was tested using X-ray powder diffraction and found to consist of zinc oxide (zincite). The more compact crust on another fragment is also zincite. On part of this fragment there is a colourless grain which appears to be partly enclosed by the crust. Examination of this grain by scanning electron microscopy with energy

Table 1: ICP analyses of zinc samples

Sample No.	wt % (error ± 0.01)				
	S	Cd	Pb	Co	Cu
M5772	0.16	0.01	0.33	<0.01	0.38
M1669	0.09	<0.01	0.06	<0.01	0.12
M25698	0.07	0.05	1.1	<0.01	0.07
M43614	0.11	0.07	1.2	<0.01	0.38

M5772: "Brunswick or Mitta Mitta", Victoria
M1669: Ingot, source unknown
M25698: Teetulpa, South Australia
M43614: Inglewood, Victoria

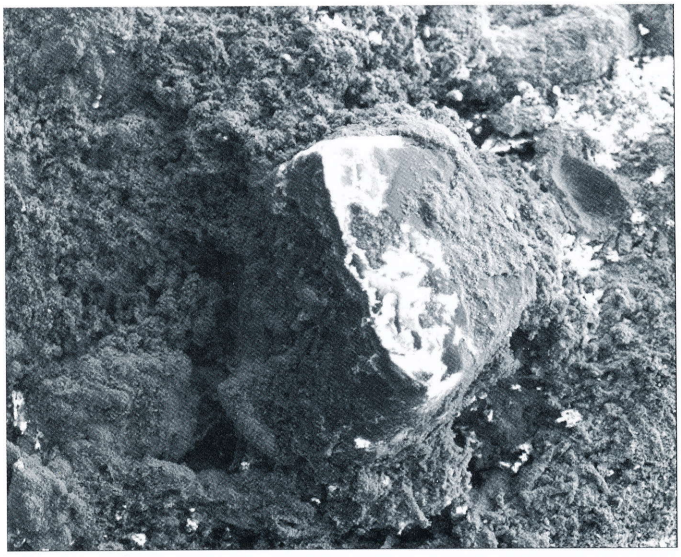

Figure 2: SEM of coating on one specimen in Figure 1, showing an embedded quartz crystal in zincite.

dispersive analysis facilities showed it to be quartz, in the form of a rounded, broken crystal (Figure 2). This indicates that the zinc fragment to which it is attached could not have come from a basalt quarry, but could have come from an alluvial deposit, such as the Mitta Mitta occurrence described by Becker.

DISCUSSION

SPECIMEN WEIGHT

The weight of the original specimen is not mentioned directly by Becker in his initial account. However, he quotes the quarryman who found the specimen as saying it was *"rather heavy"* and *"flat and about the size of a child's hand"*. The first reference to a total weight was by Ulrich (1866), who stated the piece was about 19 ounces. Krause (1896) gave a figure of about a pound and a half. While Krause did not reveal how he obtained this weight, it was probably based on Ulrich's estimate. In order to roughly recreate the size and shape of the specimen, some quantitative estimate is required. If the child's hand included the extended fingers, dimensions of about 8 x 12 cm may be a reasonable approximation, making an area of about 100 cm^2. On this basis, the original specimen would need to have averaged between 7 and 8 mm in thickness in order to achieve a weight of about 540 g (or 19 ounces), taking the density of zinc as 7.1 g/cm^3. This would fit the description of it being flat.

Some secondary references (e.g., Dana, 1888) have given the weight of the original specimen as 4.5 ounces. This is surprising in the light of the finder's description of the specimen as being *"rather heavy"*. However, the figure of 4.5 ounces is a misreading of Becker's original description provided to the meeting of the Philosophical Institute. Becker stated that *"the specimens before you were in one piece which, when complete, weighed circa four ounces and a half"*. This 'one piece' was clearly not the original specimen, since Becker quoted the quarryman telling him he had broken the specimen into several pieces before his visit to the quarry. It is possible that it was the piece that William Clarke had brought to show to Becker, who may have broken it into fragments to examine the properties of the metal. This action is suggested by a footnote describing the fracture, added to Becker's paper.

That pieces from the original specimen were widely distributed can be gained from the quarryman's account (*"some (pieces) are on my mantlepiece, some in the hands of neighbours"*). The specimen exhibited in the International Exhibition in London in 1862 was estimated by Phipson (1862a) to be about 12 grains, or 750-800 mg, in weight. This must be questioned, as such a piece would be only about pea-size. There is no other published description to confirm this figure.

THE LOCALITY

The location of the discovery was said by Becker to be a basalt quarry near Brunswick, at the back of the Collingwood Stockade (later reports gave Northcote and Collingwood as the quarry location, indicative of the lack of any named settlement to provide a reference point at the time). The stockade opened early in 1853 as a low-level prison, in what was bushland at the time, approximately 3 km north of the centre of Melbourne (Figure 4a). It closed in 1866. The site was chosen because the availability of basalt, or 'bluestone', provided a ready source of hard labour for convict chain gangs. The most direct route to the quarry site would have been north along Nicholson Street, from its intersection with Spring Street on the city's eastern edge. The boundaries of the reserve containing the stockade appear to coincide with present-day Rathdowne, Newry, Canning and Princes Streets in the suburb of North Carlton (Pratt, 1981). The North Carlton Primary School now occupies the site of the early stockade buildings and the basalt quarries worked by the prisoners were on the present site of Curtain Square. Early maps show additional basalt quarries on allotments close to the eastern boundary of the stockade reserve (Figure 4a). These were known as the Corporation Quarries (not to be confused with the Corporation Quarries several kilometres to the east in the suburb of Clifton Hill) and by 1854 were being worked to within a very short distance of the stockade buildings. In March 1855, the stockade reserve was enlarged by extension of its northern edge to the approximate position of present-day Fenwick Street. Further north on Nicholson Street there were small basalt quarries on allotments along the south side of future Park Street, west of its intersection with Nicholson. These and the Corporation Quarries have now been filled and built over by housing (Figure 4b).

Becker's statement that the quarry yielding the specimen was *"at the back of"* the stockade suggests it was one of the Corporation Quarries just outside the reserve's eastern boundary. This conclusion is strongly reinforced by Becker being able to gain immediate access to the quarry and speak directly to a quarryman. Any quarryman who was also a prisoner would have neither a mantlepiece to show off his zinc specimens, nor neighbours to give them to.

GEOLOGICAL EXPLANATION

The basalt in which the zinc specimen was supposedly found belongs to the Werribee Plains phase of the so-called Newer Volcanics. In the Melbourne region, these are mainly alkaline olivine basalts with ages between 0.8 and 2.2 million years. The basalts are widely known in the building trade as 'bluestone'. Lava erupted from volcanoes north and west of Melbourne flowed down the ancestral valleys of the Merri and Darebin Creeks, as far as the Yarra River. The 'Brunswick' quarries were situated on the western edge of the Merri Creek flow where it spilled over the valley sides onto the surrounding country (Figure 4a). The thickness at the site is unknown but unlikely to be more than about 5-10 metres. The only references to thickness in relation to the discovery site are the quarryman's statement that the 'bluestone' begins at a depth of four feet below the surface and the comment by Ulrich (1866) that the specimen was found at a depth of about 20 feet.

If the occurrence is assumed to be genuine, a mechanism has to be found to explain it. Zinc metal melts at 419°C and

boils at 907°C. Therefore any zinc enclosed in basaltic magma, at temperatures of the order of 1000°C, would at least be molten. Perhaps the only plausible way for a globule of zinc to have formed in this way would be by the inclusion of a mass of zinc sulphide in the magma. ZnS melts at 1850°C, so it would not melt under magmatic conditions, but perhaps be gradually reduced, leading to the formation of metallic zinc and the evolution of sulphur. Assuming the magma was under sufficient pressure to prevent the zinc sublimating, and that eruption was rapid, then a globule of metallic zinc may have survived. The coarse-grained nature of the Museum specimens is consistent with slow cooling, as might be expected in a lava flow. Even so, it is hard to envisage the circumstances under which this situation might arise, particularly in Victoria. While zinc sulphide was found in small amounts in some of the gold-bearing quartz reefs, such as at Bendigo, no massive sulphide deposits are known.

The most common product of the corrosion of metallic zinc under atmospheric conditions is hydrozincite (Williams, 1990). The occurrence of zincite on the samples therefore suggests lower than normal partial pressures of carbon dioxide, perhaps due to burial.

THE PUBLICIST

Ludwig Becker (1808-1861) was a German artist and naturalist who arrived in Tasmania in 1851, then moved to Melbourne early in 1854 (Figure 3). He earned a living as an artist, and dabbled in natural history, mainly zoology, during his travels. He joined the newly founded Philosophical Institute (the forerunner of the Royal Society of Victoria) and contributed several papers to its journal. These were mainly short, fairly superficial notes on zoological topics, and the 1857 note describing the zinc specimen was something of an exception for its geological nature. In 1857 Becker offered to write letters and notes on the natural history of Australia for the *Jahrbuch*, then being edited by Professor Bronn in Heidelberg. His first two letters reported on the zinc discoveries at Brunswick and Mitta Mitta and on various other minerals from the goldfields. In 1860, Becker was appointed as artist, naturalist and ethnographer to the ill-fated Victorian Exploring Expedition, led by Robert Burke and William Wills. He made geographical sketches and observations and collected specimens, but became ill with scurvy and died at Booloo Creek, near Menindee, New South Wales, in April 1861. Foord (1874) lauded Becker for his *"zeal and attainments"*, yet Becker's contributions to science have received mixed reviews. Darragh (1994) concluded that while he could not be compared favourably with the few scientists in Melbourne at the time, he could be regarded as an enthusiastic and competent naturalist.

Becker had no formal geological training. Few men did at that time, yet many of the diggers working on the goldfields during the 1850s must have acquired considerable amateur geological knowledge. Becker restricted his notes on the two discoveries of zinc to the specimens and the localities; he did not proffer any geological explanations. Nor however did Ulrich, who was a qualified geologist.

Figure 3: Ludwig Becker.

CONCLUSIONS

Several key questions must be asked in order to reach a conclusion on the validity of the Brunswick native zinc occurrence. Firstly, was the discovery a hoax? For the discovery to be fabricated would have required a cast of characters involved in the plot, from the quarryman and his fellow workers, to Clarke, Becker and Ulrich. Why would they bother? While there was considerable interest at the time in valuable metals, especially gold, in Victoria, planting a piece of zinc in a basalt quarry hardly seems a logical way to make a fortune. Even if only the quarrymen were involved, why would the finder seek the opinion of a gold broker to have identified a piece of metal that he knew to be a fake? Becker stated that he offered a reward to the discoverer for another piece. Whether he would have been able to pay one is a moot point, given his financial straits, but the fact is no more specimens came to the light. If the piece had been manufactured and the finder were motivated by greed, then it's logical to conclude he would have 'found' more material for Becker, in order to claim a reward. On this basis, it appears genuine curiosity rather than profit motivated the finder.

If the Brunswick specimen was not naturally formed but was man-made, where did it come from? During the 1850s, the inner northern suburbs of Melbourne were still largely unsettled. Fitzroy, to the east of Nicholson Street, was only just being established as Melbourne's first suburb. Only a couple of foundries had been established by this time in the Melbourne area, in response to the growing demands from the goldfields and new industries (Weickhardt, 1984), but none was near Brunswick and none appeared to be set up to process zinc. In Britain at about this time, the zinc industry was beginning to develop rapidly, following the invention of the galvanising process in 1836 (Cocks and Walters, 1968). Exports of galvanised iron sheeting to the

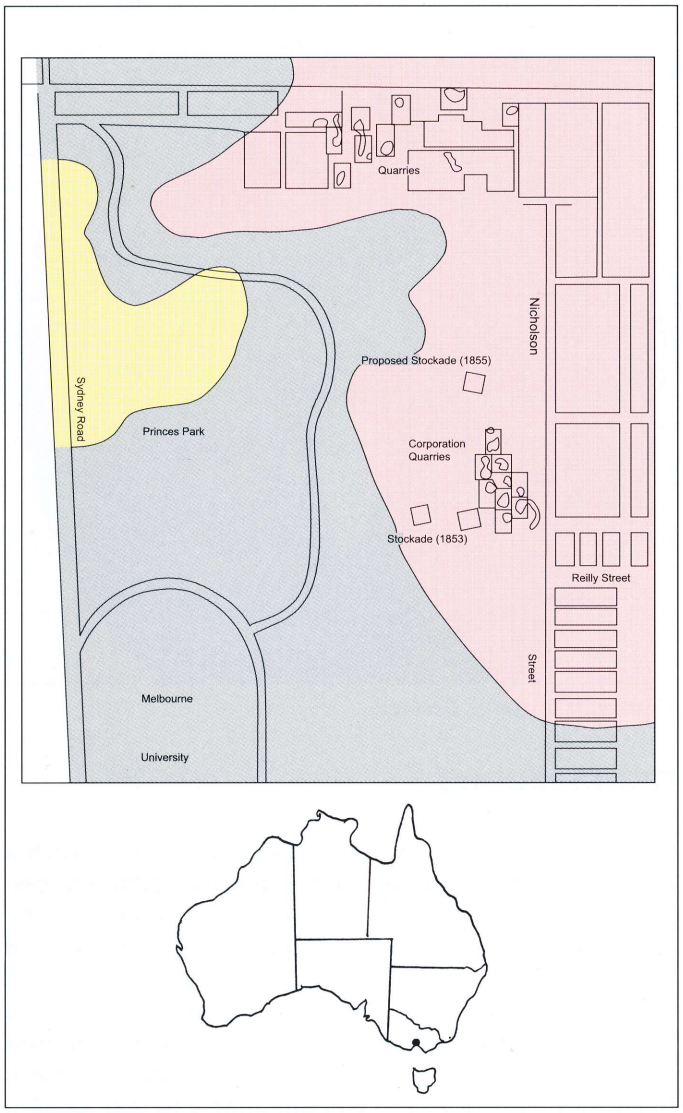

Figure 4 a (top) Locality map of the 'Brunswick' area in the early 1850s showing the position of the Collingwood Stockade and the Corporation Quarries. The quarry leases and pit outlines are from Department of Crown Lands and Survey plan Q5 (1852). Details of the streets and stockade buildings are from Kearney (1855).

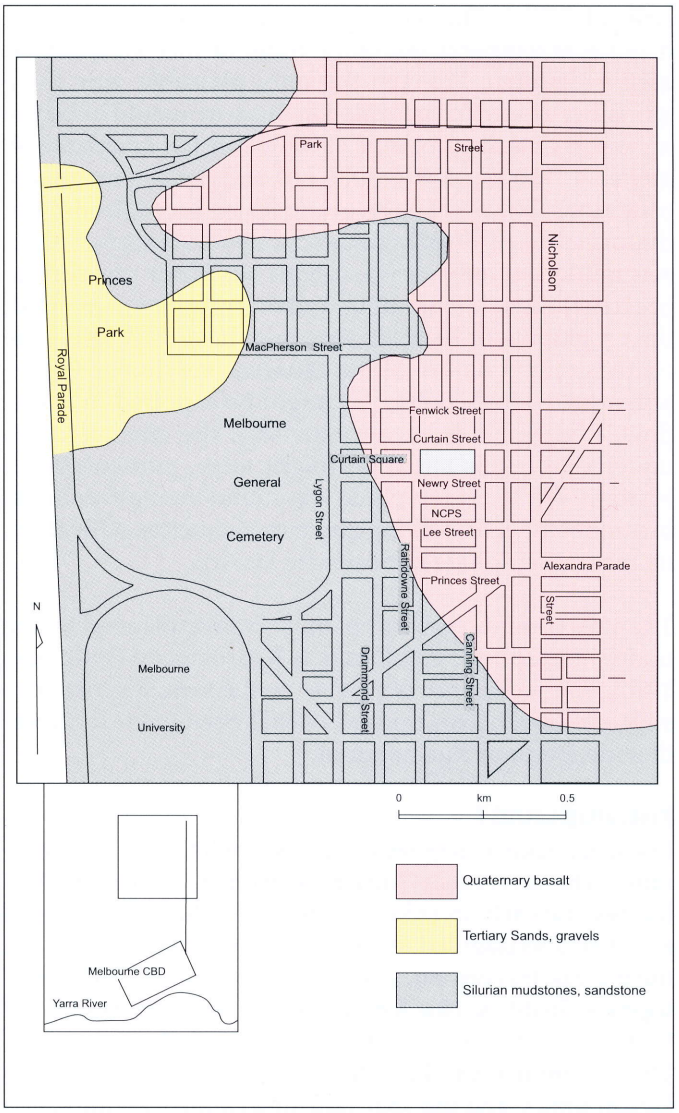

Figure 4b: Locality map of the same area as in (a), at the present day (NCPS is North Carlton Primary School). The geology of the area is shown in both maps and is taken from Thomas (1967).

rapidly developing Australian colonies were increasing significantly, but the uses of massive zinc were more limited. Under these circumstances, it is hard to imagine how a quarryman would have come by a lump of zinc.

It is possible but difficult to dismiss all the reports of nodules of native zinc in alluvial deposits in Victoria. Some localities were remote, well away from any potential contamination. There would be little point prospectors sending metallic samples in for assay if it was known that they had been manufactured, although at least one record of possible zinc was dismissed in this way because it contained pieces of charcoal (Newbery, 1870). Zinc items on the early goldfields included linings to washing equipment such as long-toms and cradles, as well as mirrors (Robyn Annear, personal communication, 2001), so the odd bushfire or campfire could well have resulted in pieces of melted zinc. Unfortunately, no reliably sourced specimens from the alluvial deposits have survived to be examined. If these and the Brunswick zinc sample were formed naturally then a possible link between all specimens is the Cainozoic basaltic rocks which are widespread in Victoria. Weathering of these lavas has contributed heavy minerals such as sapphires and zircons to several generations of alluvial deposits, including those in deep leads mined for alluvial gold. Through the same process, small masses of zinc included in the basalts could eventually find their way into alluvial deposits.

For the time in Victoria, the description of the Brunswick discovery of native zinc is unusually detailed. There was a first-hand account of the circumstances of the find, given to a 'competent naturalist', who engaged the colony's leading mineralogist to investigate the specimen. The discovery was reported to a scientific organisation in a formal lecture, followed by several publications, both local and international. No recognised geological identity at the time questioned the occurrence and it was thought sufficiently significant for a sample to be included in the London International Exhibition of 1862. The piece of the jigsaw puzzle clearly missing is a sample that can be reliably attributed to the discovery.

The first doubts raised about the discovery appear to be based on the fact that a qualified scientist had not made it. General application of this criterion would preclude a considerable body of discoveries from being considered genuine. These days, professional mineralogists acknowledge the important role played by inquisitive and keen-eyed collectors, who are not necessarily scientists, in finding new minerals. Given the thorough way in which the alleged find was reported, the grounds for doubt on the basis of the lack of qualifications of the finder are unconvincing.

The geological explanation for native zinc in basalt is perhaps the weakest link in the chain. Elsewhere in the world, native zinc has been recorded in only a handful of localities associated with a variety of environments, including sulphide orebodies, in concentrates derived from platinum-bearing ultramafic rocks, and in one case, as a volcanic sublimate (Anthony *et al.*, 1990). The Victorian occurrences, if genuine, would rate as a highly unusual geological phenomenon.

On balance, there is no valid reason to question the process by which the Brunswick zinc find was reported. While some doubt must inevitably exist about the naturalness of the specimen, especially in the absence of reliable type material, and considerable doubt about the geological origin, the occurrence cannot be simply waved away. For the present, the status of the former basalt quarry in the inner northern suburbs of Melbourne as the type locality of native zinc should be preserved until new evidence arises which would discredit it.

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The spur to undertake this study was David Vince's re-investigation of the native zinc occurrence for his 1980 paper on the minerals occurring in the basalts of the Melbourne district. Tom Darragh (Museum Victoria) provided historical information on Ludwig Becker, guided the author to significant references and commented on the penultimate draft of the manuscript. Sources of information on the Collingwood Stockade were provided by Gary Presland (Museum Victoria), on the early use of zinc in Victoria by Robyn Annear (Castlemaine, Victoria) and on the zinc industry by Allan Pring (South Australian Museum). Alan Hart (Mineralogy Department, Natural History Museum, London) searched the registers and collections for the zinc specimen displayed in London in 1862. The ICP analyses were conducted by Affinity Laboratories, Dandenong, Victoria. The scanning electron microscopy was undertaken at Geotrack International with the assistance of Pat Kelly.

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