The Corrugated Iron Aesthetic

Dr Miles Lewis hardly needs introduction to Australian readers of Historic Environment. His understanding of and contribution to heritage preservation issues in this country is substantial. In this article he pursues that great Australian building material - corrugated iron. His evaluation should prove interesting not only to those interested in architectural history, but to those who find corrugated iron a useful modern design tool.

Historians of nineteenth century architecture have seized upon iron - or rather upon attitudes towards the use of iron in building - as a quick diagnostic of the innovativeness or backwardness, the pragmatism or the hypocrisy, the flexibility or the conservatism, and in general terms the relevance or otherwise of individual architects and theorists to the development of architecture. That development, of course, has been seen as leading by a process of natural law towards what we still rather uncomfortably know as the modern movement. We shake our heads at Ruskin's inability to come to terms with the material ("the moment that iron in the least degree takes the place of the stone" he bluntly stated, "that instant the building ceases ... to be true architecture"). We express surprise that so slight a man as Nash should sponsor significant advances in iron building technology (like his iron bridge patent and his skylights at Attingham Park). We are gratified when architects like M D Wyatt seem to grapple with the problem of producing a new architecture suitable to the new material; and we are quite bowled over by each successive example of a functional and modern looking structure produced by a non-architect - a gardener, bridge-builder, railway engineer, or a military man.

Although iron seems to be some sort of a litmus indicator of all sorts of nineteenth century architectural attitudes, it gives us no clear guidance on the question of morality. On the one hand a man like Pugin, moraliser par excellence, is happy to spurn the straightforward, logical, nineteenth century material in favour of keeping craftsmen fulfilled and happy and occupied with devout thoughts, buildings filled with true handiwork and radiant with the spirit in which it has been carried out and, least logically of all, the traditional forms of stone Gothic architecture unmolested by the embarrassing technological advances of his own time. Viollet-le-Duc was a gothicist who more successfully resolved this dilemma, for he took the view that the one of the great strengths of the Gothic was its structural rationality. He did not doubt that mediaeval builders would have used iron had it been available, and consequently he argued that nineteenth century architects should treat the Gothic as a starting point, introduce iron into their designs, and allow a truly nineteenth century architecture to evolve.
It is worth underscoring Viollet-le-Duc's special position. An architect like Butterfield (whom Viollet, incidentally, admired) might be prepared to slip in a concealed iron structural member where it suited him. A Pugin, or indeed a Ruskin, would not condone such a deceit - but rather than openly show such a member they would exclude it entirely, even though this might constrain the design. Viollet, on the other hand, would both use and show the member:

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\text{il faut ... que ces matériaux mis en œuvre indiquent leur fonction par la forme que vous leur donnez; que la pierre paraisse bien etre de la pierre; le fer, du fer; le bois, du bois} (\text{the materials used should reveal their function by the form which you give them, stone should appear clearly as stone, iron as iron, wood as wood})
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It may be superfluous to remind ourselves at this point that Viollet-le-Duc's actual buildings are mundane and disappointing in relation to his theoretical discussion, and display little if any of this dramatic exposed ironwork. On the other hand the effect of his writings should not be underestimated - as they have so far tended to be, simply because they were less received in England, the country which sets the pace in nineteenth century architectural history, than they were on the Continent and a little later in America and even Australia.

Some of these attitudes are paralleled in relation to the introduction of galvanised corrugated iron, however little this affects the work of serious architects and serious writers. Galvanising and corrugating are two quite separate developments, but from 1843 they tend to march hand in hand. There is an opening phase in which the new material seems to have boundless possibilities; then a phase of disenchantment when it is seen as less attractive, when buildings made of it prove to be extremely hot, and when it is frequently relegated to the backs of buildings faced in more imposing materials; thirdly, a phase of quite minor significance but very great interest, in which some builders in corrugated iron fight a desperate rear-guard action to establish its credibility as a respectable and even a picturesque material; fourthly a phase in which the material is quite discredited for serious use and it is relegated to the most utilitarian functions and the most remote locations; and last of all a phase in which corrugated iron - especially in these remote locations - has established its own vernacular character. I need only point out that the most conspicuous feature on the Australian cultural landscape is not the carved aboriginal boomerang or the Russell Drysdale in the living room: it is the corrugated iron rainwater tank behind the house.
To trace these phases in the use of corrugated iron, overlapping as they are, is difficult not only because it rarely enters the world of serious architecture or serious architectural writing, but also because it had none of the nostalgic associations of traditional vernacular forms, and was not seen as picturesque, so it escaped the net of another whole body of descriptive writing. Nevertheless it was accepted at the outset as an elegant structural innovation and it achieved its characteristic form as a result of deliberate effort, not a fluke. Solid cast iron roofing plates of zig-zag profile and with a slight curve along their length had already been produced for roofing purposes; on the other hand wavy corrugated sheets had been produced not long after the technique of rolling flat sheets from puddled iron was first introduced. But the idea of using the wavy sheets for building purposes had to await the patent of H R Palmer in 1829.3

The beauty of corrugated iron is of course the high strength which the corrugation gives to what would otherwise be a flexible flat sheet of metal, and in addition to this its simplicity and almost natural-looking form, approximating that of a sine curve. When a sheet is also given a slight curve in the longitudinal direction (which can be done by a simple adjustment of the rollers) a truly elegant structural solution results. It was Palmer who first appreciated this and built a curved corrugated iron roof at the London Docks at about the time of his patent. The corrugated iron sheets were not very long, but they could be rivetted together length-wise, and in this form would produce an arch capable of spanning perhaps seven or eight metres with no substructure whatever except a narrow tie rod - while with a more elaborate system of ties they could span even further.

The elegance of this system was better appreciated at the time than it has been at any later date. A correspondent of the London Builder wrote of 'the most beautiful roof of the Eastern Countries Railway, Shoreditch, excelled nowhere in elegance, lightness and simplicity'.4 It appears that the material even reached Adelaide, where some corrugated iron stores were put up in 1839,5 but it did not achieve general acceptance principally because Richard Walker, who had acquired the patent, attempted to sell the iron at exorbitant prices. The fourteen year term of the patent expired in 1843, and the same writer in the Builder took the occasion to argue that 'such a beautiful and useful method of using sheet iron' should be revived, more especially as it could now be galvanised and would, it was believed, be everlasting.

Early reactions to galvanising were generally just as enthusiastic as was the acceptance of corrugated iron, though its appearance was less sudden. The process had its roots in the eighteenth century work of Paul-Jaques Malouin.
After the Chinese method of extracting zinc was introduced to Europe in 1770 it became more viable, but zinc coatings were still applied only on a small scale until the French patent of Stanislas Sorel in 1836 and its extension to England by Commander H W Craufurd in 1837. Even then disputes over patent rights delayed production in Britain until the Patent Galvanised Works began operation in 1843. In the meantime an alternative process, in which the iron was first coated in tin and then in zinc, was introduced to America in 1838 and patented in Britain 1841, 1843 and later by Morewood and Rogers. Morewood and Rogers successfully defended an action for patent infringement in 1845, and the large scale manufacture of their 'zinked tinned iron' seems to date from this time.

The Builder enthused over galvanised iron as 'this grand revolutionizing agent in the matter of style in architecture:

A new world and new people will spring up under the new regime.

Talk of the transmutation of metals and the ages of alchemy!
We have surpassed the expectation of both, or rather we are in the advent of that which shall surpass them ...

The same journal wrote of the Morewood and Rogers iron as being 'very beautiful, presenting a bright crystalline surface'. The conventional galvanised iron was used in 1845 by no less an architect than Charles Barry in roofing the Houses of Parliament at Westminster, but an even clearer indication of its prestige was its adoption for the palace of King Eymo of the Calabar River, West Africa. His neighbour, King Eyo, had imported a prefabricated wooden house from Liverpool, and Eymo, not to be upstaged, ordered a timber framed house clad in galvanised iron. It was raised above ground level to allow his 320 wives to be accommodated in the sub-floor space, and the main rooms included an audience hall measuring nine metres by sixteen 'ornamented throughout in a style of the most gorgeous magnificence'. The walls and ceiling were decorated by a Mr Dodd, there were a number of 'splendid pictures, in papier mache' by Jennens and Bettridge of Birmingham, and the complete furnishings of a large English house.

It was nearly ten years before galvanising lost its glitter. A galvanised iron store designed by the Liverpool engineer John Grantham, and sent to San Francisco in 1849, was a utilitarian enough design but the galvanising was sufficiently novel to be described as 'nearly white' in colour and of 'a singular appearance'.

The iron police lock-ups at Beechworth and Bendigo were each known as the 'camp oven' and the latter referred to as the 'iron hot house for baking unfortunate prisoners in.' The Royal Municipal and Charitable Institutions Commission in 1862 expressed surprise at finding such a structure housing the police themselves at Maldon, and the chairman, Captain Sturt, said he had 'at first thought the constables' quarters were a sort of patent oven.'

Facades of solid cast iron had been developed in Britain in the 1840s, but United States manufacturers, led by James Bogardus, carried them to greater heights and treated them in every variety of Renaissance and even Gothic detail. It was of these buildings that a correspondent of the Melbourne Argus wrote (promoting the proposed City of Melbourne Iron Building Company) in 1852:

*Having seen the splendid iron houses erected in New York, and other cities in the United States (the writer) is enabled to state, from personal observation, that as a building material, iron is, in all respects, most desirable, and he confidently adds, very peculiarly suitable for this climate.*
When John Walker (son of Richard Walker) in 1853 despatched a large house to Chagres, Panama, for the Royal Mail Steam Packet Company, it was reported that it would present to the eye the appearance of a perfect, permanently built private residence, within and without, in all the details of paper, paint, etc.

The Builder had by 1849 qualified its first enthusiasm for galvanising, but it was still possible for Papworth in 1851 to speak of it in the Dictionary of Architecture as making iron totally incorrodible. In the 1850s Victoria imported large quantities of corrugated iron, both galvanised and ungalvanised, of iron roofing tiles and other components. Galvanised iron was used, allegedly for the first time in the Port Phillip District, by the architect George Wharton for a store in Elizabeth Street, Melbourne, in 1850. H W Mason, the store keeper, had imported quantities for sale and it was said to be 'pleasing in appearance, very durable, not affected by lightning or rust, admits ventilation, and ... an admirable covering for verandahs, or for flat roofs.' There is no indication that this iron was corrugated, and one of the most ubiquitous forms of galvanised iron in the 1850s is the flat iron tile with rolls down the long sides, which creates a roof of an appearance similar in appearance to sheet lead. Surviving examples may still be seen in Victoria, South Australia and Tasmania.

The prefabricated iron buildings which became a major British export were by no means universally regarded as ugly: amongst them, indeed, are to be found some of the ironmonger's finest flights of architectural fancy. E T Bellhouse of Manchester begun in a simple enough way, using flat iron cladding, but gradually evolved his patent system of corrugated sheets running horizontally, with the corrugations fitting into specially shaped structural members. Of the houses which Bellhouse sent to California in 1849 it was said: 'their appearance altogether is extremely pleasing, - picturesque in fact, and they will doubtless cause some surprise amongst the denizens of the "diggins". Others were favourably noticed even in the Viennese Allgemeine Bauzeitung, and then when he displayed his emigrants' cottages at the Great Exhibition of 1851 Prince Albert was sufficiently impressed to commission from him an iron ballroom on the same system, for erection at Balmoral. In 1854 he despatched a store and a custom house in Payta in Peru, and the latter was favourably described as having 'a picturesque and somewhat imposing appearance'.
The cast iron buildings and facades which actually reached Melbourne were nevertheless of only one or two storeys, and not from America but from Britain. One of the most prominent firms was Robertson & Lister of Glasgow, soon to be taken over by C D Young & Co., and it remains a characteristic of their buildings that the rear parts are often of corrugated iron.

In some respects it took longer for corrugated iron to be discredited in England than in Australia. Iron columns and other iron members had been used in many churches, and had even acquired a degree of respectability in the works of Thomas Rickman. This makes it a little less surprising that the Ecclesiological Society in 1853 commissioned R C Carpenter, described by Hitchcock as their most 'correct' architect, to design a model iron church. Carpenter became ill and died in 1855, and the English bishops refused to consecrate iron structures as either parish or district churches. Carpenter was succeeded by William Slater, whose project for a cast iron church was published in *Instruments Ecclesiastica* in 1856. Slater's church was not built, but an iron church designed for Rangoon by Matthew Digby Wyatt was actually constructed by Tupper & Co and despatched, and seems to have been generally regarded as a success.
Apart from Wyatt's building, wrote a correspondent of the Building News in 1858, he knew of no good iron church or schoolhouse in existence: 'those that have been erected display such consummate bad taste, that it positively makes one shudder to look at (them).'. All the same, though, he conceded the possibility that iron could be made to look elegant. Soon another anonymous writer (or perhaps the same one, as the whole correspondence has the air of being fictitious) took up the cudgels in support of the view that architects should be employed to design these buildings, and expressed confidence 'that much may be worked out, both in Italian and Gothic, to produce very satisfactory results in iron church building.' Specific criticisms were levelled at the 'iron abortions' at Islington, Barnsbury, Bow and Kingsland (the first by Tuppers and the rest probably by Hemming). Tuppers defended themselves and stated that they had arranged with the architect G A Burn to produce a series of designs for churches. Finally one of the earlier correspondents returned to point out that corrugated iron was difficult to deal with architecturally, and 'certainly we can never hope that it will become in itself a very great beautifier.' Even Slater's design had been externally ugly and it had been estimated to cost from £8 to £9 a sitting, at which price a church of conventional materials could be built. The problem was that customers were looking for buildings at too cheap a rate for architectural pretensions to be possible:

Well, then, the conclusion of the whole matter is just this — while parties ordering iron churches will only pay for a shed, a shed is all that they can have. 15

Whether or not as a result of these strictures Hemming's firm, (under the management of his son Samuel Charles Hemming from about 1858) by 1862 had produced a fully Gothic iron church much more closely related to Slater's design than to his shed-like earlier buildings. This response can be seen as one of the more spirited blows struck in a rearguard battle by manufacturers to preserve the iron building market and to rehabilitate iron as a legitimate architectural medium. A more bizarre attempt is made at this time by Francis Morton of Liverpool, who illustrated two of his iron buildings at the International Exhibition of 1862: one is an arch-roofed building with walls of vertical corrugated iron, typical of the 'iron boiler' type which received such hostile criticism in the 1850s, but here converted into a cottage ornee. The gable end has been enriched by a looped barge board around the edge of the curved roof; from the centre of this wall projects a small porch with sides of corrugated iron and its own miniature arched roof and smaller version of the same barge board; flanking the porch are two twelve-paned sash windows. From the middle of the roof projects a chimney stack with two pots, and at the back of the building placed with deliberate asymmetry is an outhouse which must accommodate the water or earth closet, and the roof of which is continuous with the main one but with reverse curvature (previously encountered in John Walker's Californian buildings of 1840). The building is represented as flanked by trees in a rustic setting, with a windmill in the distance, and country folk in the foreground are about their simple labours: the whole effect is totally incongruous.

Morton's second building attempts the same sort of thing with much more success in a style best described as ironmonger's gothic. There is a steep gabled roof with both sides concave (in the same way as one of Bellhouse's Californian buildings of 1849 and the iron house now preserved at Moe, Victoria). It is ornamented with the same barge board, looking much more appropriate on the concave curve, with large finials, a fleur-de-lis ridge capping, and the same central chimney stack carrying two spirally ornamented conical chimney pots. Each window, including a small attic window in the gable end, has a crude gothic arched top, and is furnished most inappropriately with folding shutters. In general the building is a much more successful essay in the picturesque, and is shown appropriately placed in a sylvan landscape with a gothic church visible in the background. He was still advertising this building, as an 'ornamental shooting lodge and country house' in 1869, by which time he had developed his speciality in iron church building, which need not concern us here, and had constructed for Turk's Head Island in the West Indies a two storeyed house surrounded by a verandah and balcony, which was alleged to have withstood the fearful tornado of 1866. This last was a two-storeyed building surrounded by verandah and balcony, and is perhaps relevant to similar forms which developed in Australia.
(State Library of Victoria).
Victoria surpassed even California as the greatest importer of English iron buildings, to a value of £111,380 in 1853 alone, and it was the Victorian market which brought into the field Samuel Hemming of Bristol, the greatest exponent of the art. Hemming began by constructing a cottage for a son who was emigrating to Australia, and by 1853 he had patented improvements in construction which allowed for 'a greater boldness of style' as well as improved ventilation. He was soon building in his Bristol yard each week the equivalent of a complete town of shops, stores and houses, which would then be dismantled and packed for despatch to Melbourne. Amongst the more ambitious structures were his churches, of which he sent at least three to the Anglicans in Victoria, and one in 1855 for the Congregationalists of Surry Hills, Sydney. Other denominations followed suit, notably the Wesleyans, who imported Morewood and Rogers iron components for a number of small buildings, and planned a large iron church for the present Wesley Church site in Lonsdale Street, Melbourne. It was designed by Wharton, the Melbourne architect, in the Decorated Gothic style, and was to be manufactured under the supervision of an English architect, Jenkins; however the cost of iron had risen as a result of the Crimean War, and the project did not proceed.11

Corrugated iron seems to have reached its peak of acceptance in Victoria in 1853, but even now many of the more substantial imported buildings had facades of cast iron or other materials, while the corrugated iron was relegated to the sides and back, and even now the plainer buildings were attracting criticism. William Howitt, the peripatetic journalist, commented on the arch-roofed iron stores:

They are what they call corrugated iron - sheets of iron, fluted or channelled. These have been brought out from England, and look like huge caravans, the roofs being arched like them; or like great steam-engine boilers, or gasometers. These houses seem to have a vast demand, because they are rapidly put together; but they should send out iron constitutions with them, for the people who are doomed to inhabit them; for they will be very cold in winter, and in summer will just roast their tenants alive. They will prove admirable houses - for the doctors.

Before long Louisa Meredith was to remark on the ugliness of the same buildings, 'having no eaves, and, with their slightly elliptical roofs, looking very much like steam-boilers, with doors and windows cut in the; - and at home I have often seen boilers of bigger dimensions'. During the 1850s pejorative terms like 'iron pot' come to be regularly used for everything from Coppin's Royal Olympic Theatre (an elaborate building by Bellhouse) down to the iron school buildings made by Morton of Liverpool and Porter of Birmingham.
By 1865 the *Dictionary of Architecture* in England had become less than enthusiastic about galvanised iron, and even before this the Philosophical Institute in Victoria had referred to 'the most objectionable use of galvanised iron', which it hoped to see superseded as a roofing material by locally produced slates. Both in England and in Australia corrugated iron was to continue to appear in quite substantial buildings, arching between iron joists and filled with concrete above to produce a fireproof floor. With this exception the material now ceased to be used in significant buildings or by major architects, and Australia now, with the material restricted to humble uses and remote locations, as tradesmen became accustomed to it and as architects ceased to meddle in it, that a vernacular use of corrugated iron could develop.

The fundamental expression of the corrugated iron vernacular is of course the verandah. While the verandah declined in importance in Britain after the Regency it burgeoned in the more tropical British colonies and in Australia especially, but it tended to retain its Regency form, as an awning, often concave in profile and decorated in stripes. Shop verandahs in particular were initially, especially in the case of the 'shades', provided in the gold towns, still made of canvas or of American duck, and were replaced by corrugated iron as a result of the joint march of sophistication, permanence, and local government by-laws. But it is this provenance which explains how often the Australian verandah was striped, typically in red and white, even in later examples where a convex bull-nose profile totally negated the awning concept.

A less stylish vernacular element is the corrugated iron rainwater tank. It is difficult to know when or where it was invented, but the first local patent was that of John Carter, of Little Bourke Street, Melbourne, in 1857, and he exhibited specimens of his tanks in 1858. In doing so he flew in the face of the authoritative opinion of Professor John Smith of Sydney University, who had established by experiment in 1856 that galvanised iron formed zinc carbonate, which it would be imprudent to continuously consume in drinking water: therefore, he concluded, galvanised iron was unsuitable for water cisterns.

As galvanised iron penetrated remoter areas, where buildings were required in a hurry and where pressing utilitarian considerations prevailed, it naturally showed few stylistic flourishes. The Holtermann photographs show some charmingly bald specimens on the Hill End and Gulgong diggings, and examples of the same character remain today. Later, buildings of the same character appear in the mining towns of Queensland, and it is striking at Atherton to find all the exotic associations of a Chinese joss house grafted onto a rather ordinary-looking huddle of tin sheds.
Only gradually did the special requirements of the local climate and the mellowing effects of time foster the growth of a special Queensland vernacular. Surprisingly, this transition is accompanied by the extensive importation from England, not of buildings but of components like iron gates and fence posts — and these from none other than Francis Morton of Liverpool.

The beauties of the new corrugated iron vernacular were not appreciated by contemporaries, such as Michael Davitt, who visited Charters Towers in 1897, and commented:

_The houses are all roofed with corrugated iron — as most Queensland dwellings are — and this imparts anything but a pleasing appearance to the place when seen from an elevation._

Nevertheless it is at Charters Towers as much as anywhere that the new vernacular characteristics are to be found. The windows are provided with galvanised iron hoods, the roof ridge with a ventilator which is a gem of the tinsmith's art, and most characteristically of all the whole house is surrounded by a broad verandah from which, in some cases, cantilevers a further level of iron awning. These vernacular Queensland characteristics are properly to be appreciated only in conjunction with the local exposed timber stud construction, and this has now developed into a whole domain of earnest research into which no southerner would dare intrude.

The more stylish uses of corrugated iron seem to peter out by the time of the Great War. The wartime Nissen Hut is certainly a logical and ingenious use of the material in the best tradition of the early arched roofs, but it somehow fails to strike a chord in the heart of the ferrophile. It is only in the humblest locations, where fancy is allowed to play free of sophisticated inhibitions, that some few sparks remain in the corrugated iron aesthetic today.
NOTES:


3. For details of the technical history of corrugation and galvanizing see my 'Tradition and Innovation in Victorian Building' (3 vols Ph. D., University of Melbourne 1972), vol. II, pp. 376-395; also H W Dickinson, 'A Study of Galvanized and Corrugated Sheet Metal' (paper read at the James Watt Memorial Institute, Birmingham, 16 December 1943).


8. *Argus* (Melbourne), 21 August 1850.


