

3.02 *Adobe or Clay Lump*

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a. distribution

The sun-dried brick or adobe is one of the oldest identifiable man-made building materials, and was widely spread across the Near and Middle East in various shapes and sizes, before being taken up as the principal building material of Rome. However a sharp distinction must be made between the hand-moulded lump and that cast in a wooden mould. The lump is far older, and an example from about 8,000 BC has been found at Jericho, though the material is probably even earlier than this. These bricks commonly have a flat base and curved top and look much like a loaf of bread, because they are similarly formed with the hands. A version which had emerged in the Middle East by the third millennium BC is known as the plano-convex brick, because of this typical shape. In North America the Pueblo Indians built in somewhat similar bricks which had evolved independently, but around the Mediterranean there is a continuum from ancient times. In Spain, where adobe has been identified from as early as the 10th century BC,¹ plano-convex mud bricks are known as *gleba*,² while bricks of a similar shape are known as far away as Czechoslovakia, and handmade bricks of other irregular forms elsewhere in Europe.

In Mesopotamia plano-convex bricks were sometimes laid in rows sloping against each other on an angle, but sloping in the opposite direction in alternate courses, in what is known as a herringbone pattern. In parts of Europe as late as the nineteenth century this herringbone walling was sometimes constructed as infill within a timber-framed structure, and in colonial America 'cates' made by rolling up clay with chopped straw, were sometimes used to infill frame walls, but concealed beneath a clapboard outer face and a wainscoted interior.³

¹ J F Arellano, 'Earthen Industrial Buildings in the Canal of Castilla: Eighteenth and Nineteenth Centuries', in Malcolm Dunkeld et al [eds], *Proceedings of the Second International Congress on Construction History* (3 vols, Cambridge 2006), I, p 243.

² J F Arellano, 'A Review of Historic Use of Earth in Construction in the Iberian Peninsula', *CHS Newsletter*, 74 (August 2006), p 15.

³ Hugh Morrison, *Early American Architecture from the First Colonial Settlements to the National Period* (New York 1952), pp 11, 30.

Generally the term 'adobe' is reserved for the rectangular mud brick, which is much more sophisticated because it is formed within a timber mould, and requires sawn timber. The rectangular adobe can be traced back to about 3000 BC in Mesopotamia, and was to be generally adopted by the Romans, though baked bricks were more common in the wetter parts of the empire, and although concrete was ultimately to become the primary structural material in Italy. But even in Britain a Roman building has been excavated, at Leicester, built of mud bricks measuring 430 x 280 x 75 mm.⁴ Whether there is any real connection between this Roman tradition and the later English 'clay lump' is doubtful, most of all because the flat plate proportions of the Roman brick, or *tegulum*, are quite different from the blocklike shapes of later adobe types, including clay lump. In France, François Cointereaux, better known for his work on *pisé* (discussed below) discussed a *nouveau pisé* in which the earth was rammed into moulds to produce blocks.⁵ It does not seem to have met with any general acceptance.

In Australia the adobe is amongst commonest and yet the least clearly documented vernacular building materials. Rachel Roxburgh was bold enough to state that 'sun-dried brick [was] in my opinion, a myth', on the grounds that clay cracks when dried, and that the drying bricks would have to spread out over a huge area of ground, susceptible to rain.⁶ Yet those problems would apply equally to baked bricks, which are dried in a similar way before they are burnt, and in any case the fact is that hundreds of mud brick structures still stand in Australia today.

Adobe is also found in New Zealand, where it is common in Central Otago, because of both a drier climate and a shortage of timber, but was not used in other parts.⁷ The first settlers at Wellington after 1839 had built in rough timber and sun-dried brick, but earthquake of 1848 destroyed these buildings.⁸ Peter Shaw refers to a surviving group of mud brick buildings at Otarehua,⁹ and in Central Otago Miles Allen cites the whole village of Matakanui (the former Tinkers), and the greater parts of Naseby, Stewartown and St Bathans,¹⁰ which are datable from 1863 to 1892.¹¹ Martin Hill illustrates farm workers quarters at Otago, dating from the 1870s, and built of sun-dried bricks measuring 450 x 225 x 225 mm.¹² Adobe was also used in South Africa,

⁴ L F Cave, *The Smaller English House: its History and Development* (London 1981), pp 24-5.

⁵ John McCann, 'Is Clay Lump a Traditional Building Material?', *Vernacular Architecture*, 18 (1987), pp 9-10, quoting François Cointereaux, *École d'Architecture Rurale*, 4th book.

⁶ Rachel Roxburgh & Douglass Baglin, *Colonial Farm Buildings of New South Wales* (Adelaide 1978), p 19.

⁷ G C Thornton, *New Zealand's Industrial Heritage* (Wellington 1982), p 11; Michael Fowler & Robert Van De Voort, *The New Zealand House* (Auckland 1983), p 164.

⁸ Fowler & Van De Voort, *The New Zealand House*, p 91.

⁹ Peter Shaw, *New Zealand Architecture* (Auckland 1991), p 16.

¹⁰ Allen identifies a number of individual buildings in the last three: M L D Allen, 'A Renaissance of Earth as a Building Material; in New Zealand' (MArch, University of Auckland, 1991), p 51.

¹¹ John Wilson, *AA Book of Historic New Zealand Places* (Auckland 1984), pp 216-8. Wilson names at St Bathans, the Vulcan Hotel of 1869, and the Roman Catholic Church of 1892; and at Naseby, the Briton Hotel of 1863, the former Welcome Inn, and St George's Anglican Church, of 1875.

¹² Martin Hill, *Restoring with Style* (Wellington 1985), p 9.

another area often relevant to Australian settlement, one instance being a building put up by J S Dobie near Queenstown in Natal in 1862.¹³

b. the Orient

The adobe tradition of the original flat plate form, though of varying sizes, persisted into Arab culture in Syria and elsewhere, whilst further north in Anatolia the more block-like proportions used in the Hittite and Urartu cultures persisted into modern times. Both forms had appeared in ancient Egypt and both survived. Independent cultures, such as those of China and India, always used more block-like proportions.

The adobe tradition of the India is a source of possible relevance to Australia because, although a connection cannot be positively demonstrated, a number of other Indian influences can be traced in Australia (and will be discussed). One account in 1810 claimed that most of the European bungalows in East India were of sun-dried bricks:

usually of a large size, eight of them making a cubic foot; each being a foot long, six inches broad, and three inches thick generally made in wooden moulds, which, being laid on some level spot, previously swept ... are filled with mud; the surface is then levelled, with the hand or with a strike, when the mould is raised, by means of handles, and washed in a large pan of water, and then placed on a flat spot.¹⁴

c. the Spanish tradition

'Adobe' is the Spanish-Mexican term and 'clay lump' the English for much the same thing, a sun-dried brick. Though it seems that this material which was quite extensively used after the 1850s it is, like other methods of earth construction, very short of contemporary documentation and difficult to identify in surviving examples. The sources relevant to Australia are England, Germany, Mexico/California, and the United States of the later nineteenth century. The Mexican tradition is in principle the most interesting, because it represents the fusion of Spanish practice with local traditions which, in the case of the Hohokam people, are believed to go back more than 2,200 years. The Spanish tradition was probably the dominant one, for the Spaniards used moulds, whereas the Hohokam and their successors had not done so prior to European contact.¹⁵

The Spanish-Mexican adobe may, like the technique of dry-blowing for gold, have been brought to use by diggers migrating from California, where Mexican influence remained strong. An interesting example of a direct Mexican connection is Samuel Birkbeck's house 'Glenmore', at Rockhampton, Queensland. The owner had himself been a mining engineer in Mexico, and had the house built in 1862 by two Mexican employees, using limestone for the walls, but with gables and internal partitions of

¹³ J S Dobie, quoted in John Hill [ed], *Settlers* (London 1950), pp 289-290.

¹⁴ T Williamson, *The East India Vade Mecum* (2 vols 1810), pp 514-16, quoted in A D King, *The Bungalow* (London 1984), p 30.

¹⁵ Peter Nabokov & Robert Easton, *Native American Architecture* (New York 1989), pp 354, 367.

adobe.¹⁶ Most of the surviving examples reported in Australia do to some extent follow Mexican practice in that they lack the masonry base course normally used in England, though the reason in this case seems more likely to have been shortage of labour or of suitable materials. In France, too, unburnt bricks are said to have been widely used in Beaujolais and Maçonnais and have been known, in times of flood, to melt away.¹⁷

The Mexican adobe measured 610 x 300 x 150 mm, but in New Mexico in the 17th century a large flat form was reportedly used, measuring 450 x 250 x 130 mm.¹⁸ Settlers in the far west of the United States had adopted a more manageable size approximating to that of a normal brick, 270 x 130 x 60 mm, and made in the same way in a bottomless mould resting on a flat palette board; they were emptied on to the drying floor, turned on edge when partially dry, and after further drying, totalling about a week in summer, were placed in piles.¹⁹ Similarly, a small adobe, about the same as a baked brick, was used by the Moravian immigrant Joseph Hladky for his house in Nebraska in about 1884.²⁰

d. H L Ellsworth

Another American method, developed by Henry Leavitt Ellsworth²¹ and published in his *Plan for Cheap Cottages*, used lumps measuring 300 x 150 x 150 millimetres. An ordinary clay was trodden by cattle and mixed with straw chopped in 150 to 200 mm lengths, in the proportion of one bundle to every fifty bricks. The moulding was the same as for ordinary bricks, with a piece of wire or hoop iron being used to scrape the surplus clay from the top; the bricks were turned out to dry for two days, on the second of which they were turned on edge, and were then put in hack for ten or twelve days further to complete drying. The foundation wall was of stone or brick, rising 60 centimetres above the ground, but for cheap buildings on the prairies this might be replaced, if building stone was scarce, by a 300 to 360 mm wide timber sill laid on top of a pile of stones. It was desirable to lay a single course of slate on top of the foundation, for damp-proofing. The bricks were laid in a double thickness, preferably in English garden wall bond, making the wall 300 mm thick, but for internal partitions were laid in a single 150 mm thickness.

¹⁶ *Sketches of Old Rockhampton* [extract only sighted: publication details not established], p 17; Malcolm Fraser et al, *The Heritage of Australia* (South Melbourne 1981), p 4/52-3. The building is erroneously referred to as 'Strathmore' in Dennis Jeans, 'The Building Industry: Materials and Styles', in Judy Birmingham, Dennis Jeans & Ian Jack, *Industrial Archaeology in Australia: Rural Industry* (Richmond, Victoria, 1983), p 102.

¹⁷ C F Innocent, *The Development of English Building Construction* (Cambridge 1916), p 153.

¹⁸ Morrison, *Early American Architecture*, p 188.

¹⁹ D W King [ed], *Homes for Home-Builders* (New York 1886), pp 107-114.

²⁰ David Murphy, 'Building in Clay on the Central Plains', in Thomas Carter & B L Herman (eds), *Perspectives in Vernacular Architecture, III* (Columbia, Missouri, 1989), p 81.

²¹ Judge H L Ellsworth, Commissioner for Indians, has an indirect Victorian connection. He was the travelling companion of Washington Irving and C J La Trobe, later Lieutenant-Governor of Victoria, on a tour of the southwestern United States in 1832. Dianne Reilly, *Charles Joseph La Trobe: Landscapes and Sketches* (Melbourne 1999), pp 9-10, refers to journals of the party, including H L Ellsworth, *Washington Irving on the Prairie, or a Narrative of a Tour of the Southwest in the Year 1832* (New York 1937)..

Ellsworth's bricks were preferably laid in a mortar of lime and sand, but ordinary clay could be used, and a mixture of three parts of clay to two of ashes and one of sand was recommended both for this purpose and for internal plastering. The exterior wall surfaces were protected by an eave of at least 600 mm, and were plastered first with a coat of good lime mortar mixed with cattle hair or hog's bristles, and then with a coat of pebble dash.²² Another American size, which was actually published in Australia in a farm manual adapted for local use, was the same in plan as Ellsworth's, but shallower, 300 x 150 x 100 mm.²³ There is no evidence that it came into use here.

An undated house, 'Chudleigh' at Merrigum, Victoria, has bricks 300-3460 mm by 150 mm on the face, which is consistent with Ellsworth's system. But, as Anne Tyson has pointed out, it diverges from Ellsworth in other respects, such as the fact that it is built without foundations. In reality the vertical dimension has been selected to match that of two standard baked bricks, for the building has brick dressings and terra cotta ventilators, indicative of a twentieth century (or at least post-1890) date. The house is rumoured to have been built by a Norwegian, but there are about five other examples in the area, and no dominant ethnic association.²⁴

e. clay lump

In England houses of 'clay lump' or 'clay bat' are found in East Anglia and Emil Mercer cites an early nineteenth century Norfolk specification:

the clay to be raised on the farm within a quarter of a mile of the site, to be properly picked so as to leave no large stones and to be trodden with long hay or straw and made into lumps 1½ feet long, 1 foot wide and 6 ins. deep, and the lumps to be carefully dried and built up in a workmanlike manner jointed with a mixture of clay and mud, the lumps to be keyed on both sides while soft for plastering.²⁵

The origins of the method are debatable, and the precise date of this specification is not given. Cave claims that in the seventeenth and eighteenth centuries Lye, in Worcestershire, was referred to as 'mud town' because all of the miners' houses were of clay lump,²⁶ and in 1797 Robert Beatson reported that the Earl of Winchilsea† had built a house of unburnt bricks, but it soon tumbled down,²⁷ which suggests that it was not a familiar technique. The method must have been well enough known by 1804 when Edmund Bartell - without any sort of explanation - casually mentioned 'bats made with clay and cut straw' as a suitable material for a *cottage orné*.²⁸ Loudon

²² John Bullock, *The American Cottage Builder* (New York 1854), pp 39-41; Downing, *The Architecture of Country Houses*, pp 55-7.

²³ Jonathan Periam [adapted by R W E MacIvor], *The Pictorial Home and Farm Manual* (Sydney 1885), p 376.

²⁴ Anne Tyson, *Australian Architecture B*, University of Melbourne, 1997.

²⁵ Specification for work at Fersfeld, Norfolk, quoted in Emil Mercer, *English Vernacular Houses* (London 1975), p 134.

²⁶ Cave, *The Smaller English House*, p 21.

²⁷ Robert Beatson, 'On Cottages' [*An Encyclopædia of Cottage, Farm, and Villa Architecture and Furniture* (London 1846 [1833]), §2342, p 1179.

²⁸ Edmund Bartell, *Hints for Picturesque Improvements in Ornamented Cottages, &c* (London 1804), pp 78, 140.

refers in his 1846 supplement to 'the mode of building walls of "clay lumps" practised in Suffolk' as durable and economical, and he seems to regard it as traditional, though he does not make this explicit.²⁹

Recently, however, it has been well argued by John McCann that clay lump was an invention of the late eighteenth century. In 1792 its use was reported in Errol, Pethshire, as an ingenious new technique, and in 1791 (at least as he told the Rev James Plumtree ten years later) the bricklayer James Austin built himself a cottage at Shelford, south of Cambridge, out of lumps 18 x 12 x 4 inches [450 x 300 x 100 mm]. It seemdss that the material had been used for dovecots for at least three decades, but not for conventional building.³⁰ McCann argues that the buildings cited by earlier writers as being two or three hundred years old are not so, and he has not been challenged. But his assertions about William Bartell are less convincing. He says that Bartell 'seemed not to have encountered the material at first hand', acknowledged Plumtree's report, and even used the same word, 'bats'. This is inaccurate and tendentious. Bartell does not acknowledge or even mention Plumtree (so far as I can see). Any fair reading of his text would suggest that he mentions clay bats without further comment because he regards them as completely familiar (and probably *had* come across them himself), while he used the words 'bats' because it was a generally accepted term. But it must be acknowledged that nobody has produced unequivocal evidence of clay lump of an earlier date, whereas McCann is able to cite a number of eaerly nineteenth century accounts, many of which cite Plumtree or mention Austin.³¹ Now an even more radical assertion has been made by Dirk Bouwens to the effect that walls of raw earth in general, not merely clay lump, were introduced to East Anglia only at the end of the eighteenth century, possibly from Spain, France or Portugal.³²

A barn built in Suffolk in about 1817 used bricks of about 600 by 300 by 225 mm [24 x 12 x 9 ins], and by the mid-century clay lump construction was quite common in Norfolk.³³ Whole Norfolk villages, such as Letton, near Shipdham, were built in clay lump in the first half of the century.³⁴ It is possible to get some impression of standard English methods of making and building with clay lump, and this will be our best guide to local practice, for such descriptions as were published locally seem themselves to be derived from such sources. English influence must, as usual, be assumed to be the one most significant here, and it would derive from East Anglia in particular.³⁵

²⁹ J C Loudon, *An Encyclopædia of Cottage, Farm, and Villa Architecture and Furniture* (London 1846 [1833]), §2342, p 1179.

³⁰ John McCann, 'Is Clay Lump a Traditional Building Material?', *Vernacular Architecture*, 18 (1987), pp 3-4. See also John McCann, 'The First Cottage of Clay Bat?', *Proceedings of the Cambridge Antiquarian Society*, LXXVI (1987), pp 113-121, abstracted in *Construction History*, VI (1990), pp 77-8; John McCann, *Clay and Cob Buildings* (Princes Risborough [Buckinghamshire] 2004 [1983]), pp 9-12, 16-19.

³¹ McCann, 'Is Clay Lump a Traditional Building Material?', pp 4-7.

³² Dirk Bouwens, 'East Anglia', in John Hurd & Ben Gourley [eds], *Terra Britannica* (London 2000), p 25.

³³ Wyatt Papworth [ed], *The Dictionary of Architecture* (London 1853-92), sv Clay-Walling, ref *Builder*, V, 330 (1847).

³⁴ Robin Lucas, 'The Tax on Bricks and Tiles, 1784-1850', *Construction History*, XIII (1997), p 46.

³⁵ Papworth, *Dictionary of Architecture*, sv Cob Walling.

The method of making clay lump was described in the 1846 supplement to Loudon, and substantially repeated in Allen's *Cottage Building*, the two works most likely to be used in the Australian colonies. The clay was freed of large stones and soaked it with as much water as it could absorb, then trod with horses while as much straw as possible was mixed in. The mixture was put into bottomless moulds of 460 x 300 x 150 mm, 'moulded in the same manner as a brick' - that is, on a palette - left in the sun to dry and subsequently laid in mortar in the usual way.³⁶ Mercer confirms the use of chopped straw in Norfolk clay lump.³⁷ In Essex clay lump or clay bats were still being made into the twentieth century, using wetted clay and straw prepared 'cob fashion' and formed in moulds measuring 300 x 150 x 150 mm.³⁸ Loudon also quotes a description of the clay lump as used in Cambridgeshire with the breadth of the brick varying from 230 to 300 mm, prescribes a foundation wall of a few courses of brick, and describes the mode of roughcasting the surface by throwing against it a mixture of lime, water and small stones.³⁹ According to Wilds these bricks were known in Cambridgeshire and nearby as 'clunch', and were laid either in mortar or moist clay.⁴⁰ In the supplement, Loudon further quotes an account by John Curtis of clay lump building in Norfolk.⁴¹

A more recent description of clay lump as used in East Anglia makes a similar requirement of a brick base between 460 x 610 mm high, and names the normal sizes of lumps as 460 x 300 x 150, or 460 x 230 x 150 mm, with 460 x 150 x 150 occasionally used for internal partitions or for backing conventional brick walls. A thin layer of clay slurry, with which lime was sometimes mixed, was used to besmear the walls and joints, and over this was sometimes painted a layer of coal tar, particularly where stock were kept and it was necessary to stop them licking the clay.⁴² Roughcasting was a rather more elaborate method, for the surface was first pricked up with a coat of lime and hair, which was allowed to set well, and then two workmen were needed: the first man would apply the second coat of lime as smoothly as possible, while the second followed him and immediately threw against the limed surface a roughcast consisting of fine washed gravel mixed to a semi-fluid consistency with lime and water. The completed surface was finally smoothed with a brush.⁴³

Adobe was quite widely used in the vicinity of York [Toronto] from at least 1816, and the sizes given by Rempel are 12 x 18 x 6 inches high [300 x 450 x 130 mm] for the external walls, and 12, or possibly 18, x 6 x 6 inches [300 or 450 x 150 x 150 mm] for

³⁶ J C Loudon, *An Encyclopaedia of Cottage, Farm, and Villa Architecture and Furniture* (London 1846 [1833]), §§ 2443-2445, pp 1248-9; C B Allen, *Cottage Building* (2nd ed, London 1854 [1849-50]), pp 33-4.

³⁷ Mercer, *English Vernacular Houses*, p 134.

³⁸ Christopher Ketteridge & Spike Mays, *Five Miles from Bunkum* (London 1972), p 35.

³⁹ Loudon, *Cottage, Farm and Villa Architecture*, p 77, quoting Denson's *The Peasant's Voice* [1830], p 31. Green, op cit, p 49, quotes the statement by J McCann, *Clay and Cob Building* (1983), p 18, that this was a reprint of an article by John Denson in the *Cambridge Chronicle* of 1821.

⁴⁰ *** Wilds, *Cottages and Houses*, p xii.

⁴¹ Loudon, *Cottage, Farm and Villa Architecture*, p 1248.

⁴² Williams-Ellis, *Building in Cob, Pise, and Stabilised Earth*, quoting the description of a Mr Skipper of Norwich.

⁴³ Allen, *Cottage Building*, pp 38-9.

the internal ones,⁴⁴ which perhaps tends to suggest an East Anglian origin. Only one description of clay lump was published in Australia, in the *Town and Country Journal* of 1873. It was said that three loads of 'soft tender clay' would make a hundred lumps. It was to be put in a heap, and all the larger stones picked out, then soaked with as much water as it could absorb, trodden by horses, and mixed with as much straw as practicable. It was then placed in a mould 18 x 12 x 6 inches - exactly as at York - which was lifted off the block and wetted before being used again.⁴⁵

f. English variants

On these basic methods there were some variants, and another recent account describes chalk marl (a chalk-clay mixture), which occurs naturally in Cambridgeshire, as having been likewise mixed with straw and trodden and dried into large bricks, but having been finished with a coating of plaster.⁴⁶ One old bricklayer recalled a clay lump barn in Suffolk which he had built in about 1815, where the lumps were 610 x 300 x 230 mm and were built on to a rubble base, though he thought brickwork was preferable if carried up high enough to keep out rats and mice; the mortar joints in this case were about 2 centimetres thick and the finished wall, which was well protected by a projecting gable and eaves, was also coated in limewash.⁴⁷ An Essex writer recommended another non-standard size, 510 x 250 x 180 mm high, using a mortar of the same material and raising the work only about three courses a day.⁴⁸

The Norfolk rustic, with even greater freedom, used clay lumps of any size which he might find convenient but conformed to a distinct local tradition when it came to erecting the walls, which

were carried up in a rather rough manner to ensure a good key to the plastering either inside or externally; the angles are protected by angle beads, and the plaster consists of good clay mixed with road-sand, or silt, as it is there called. But more frequently the plaster is composed of old clay and loam or mudgen, well-kneaded with old straw to a proper consistency before horse-treading it. These cottages are raised about 2 feet above the surface of the earth on flint walls, or pinnings, the remaining walls above being clay; the eaves of the roof generally project from nine inches to one foot beyond the walls. The windows and door frames should all of them have a drip-board projecting about five inches beyond the walls to carry off the rain.⁴⁹

In theory, one might attempt to trace these provincial variations in Australian examples of clay lump construction, but in practice mud buildings of any sort are difficult enough to find, and usually impossible to analyse in detail. When they are

⁴⁴ J I Rempel, *Building with Wood and other aspects of Nineteenth-Century Building in Central Canada* (Toronto 1980 [1967]), p 275.

⁴⁵ *Town and Country Journal*, 10 May 1873, p 587.

⁴⁶ Olive Cook, *English Cottages and Farmhouses* (London 1954), plates 36, 39, 41; at Linton the blocks appear to be about 20 x 30 centimetres on the face.

⁴⁷ *Builder*, V, 234 (21 July 1847), p 364.

⁴⁸ *Builder*, VII, 310 (13 January 1849), p 21.

⁴⁹ *Builder*, V, 236 (14 August 1847), p 388.

in good repair they are usually concealed between coats of roughcast, slurry or whitewash, and when they are allowed to fall into disrepair they soon decay completely. One clue may be found in the size of the bricks. An indirect indication is gained from the fact that the term 'mud bat' was used in Western Australia, suggesting a connection with the clay bat used in Norfolk and Essex, though unlike the that material it was characteristically made without straw.⁵⁰ Archdeacon Wollaston refers to the fact that he and his son William put up a clay lump building at Dardanup, Western Australia, in the 1840s. Wollaston had previously been a curate in Cambridgeshire, and was probably familiar with the technique.⁵¹

g. Australian examples

In Australia the oldest surviving example may be the schoolhouse at Wilberforce, New South Wales, built (according to Ian Jack) in 1819-20 of sun-dried bricks with stone quoins.⁵² While I have not been able to corroborate this, it is not impossible given that other examples of adobe are found in the district a year or two later. It has been said that 'Cad-Die' at Cattai, of 1821, is of adobe,⁵³ and likewise a house at 49-51 Bosworth Street, Richmond, of 1825-7, which Graham Edds reports to be of sun-dried bricks which are of normal baked brick dimensions.⁵⁴ However, it has not so far been possible to confirm this, and it seems improbable. Another putative local example is the King William Inn at what is now Kelso, on the fringes of Bathurst, built by G B Mills in 1831, which now forms part of the Evans Shire offices at 7 Lee Street, Kelso. The structure, which is not accessible to inspection, is said to be of mud brick, but it seems more likely to be of the sods or the cob which were so common in the area. Because of these doubts we cannot be sure that any mud brick was used in Australia before the gold rushes, and we therefore do not know whether it reached us only through the influence of California.

The first local description is one of doubtful origin, but supposed to date from 1849, as advice to intending settlers.

It will not always occur that the young beginner will have either the time or the money at his disposal for burning bricks - if he has, he is well off. Sun-dried bricks, if mixed with chopped straw, and carefully made, are an excellent substitute for the burned brick, and as they may be made very large, say, nine inches wide and eighteen-and-a-half inches long, they are very quickly laid. In Victoria there is, in general, a scarcity of lime; it can be always had in Melbourne though but seldom in the country a mortar made of sandy clay or loam must, therefore, be substituted for it.⁵⁵

⁵⁰ G F Middleton, *Earth-Wall Construction* [Bulletin no 5 of the Commonwealth Experimental Building Station] (Sydney 1952), pp 1, 29.

⁵¹ J R Wollaston [ed C A Burton & H U Penn], *Wollaston's Albany Journals (1848-1856)* (Perth 1954), p 239.

⁵² R I Jack, *Exploring the Hawkesbury* (2nd ed, Kenthurst, NSW, 1990 [1986]), pp 82-3.

⁵³ Information from Graham Edds of Richmond, 1991, quoting Barry Cooper.

⁵⁴ Information from Graham Edds, 1991.

⁵⁵ E Dianiska et al, 'Backgrounds of Melbourne Brick' (BArch research report, University of Melbourne 1959), p 3, quote this passage and ascribe it, apparently incorrectly, to Clutterbuck, *Port Phillip in 1849*.

Adobe was not quite so popular in New South Wales as in the adjoining colonies, at least until the 1870s, but there were some early examples, including the Menindie Hotel, of Burke & Wills fame.⁵⁶ In 1870 the *Sydney Morning Herald* published an article devoted mainly to pisé construction, but making reference to what it called 'adobie'. This was said to be used largely in South America, in some of the South Sea Islands, and to a lesser extent in the colonies neighbouring New South Wales. However the recommended size for the adobes was 18 x 12 x 6 inches [460 x 300 x 150 mm], which was the standard for East Anglia.⁵⁷ In 1873 the journal published, under the Loudonesque title of 'Cottage, Farm, and Villa Architecture'⁵⁸ a design for a farmhouse which might be built in cob, clay lumps or pisé, betraying its English origins by the very use of the term 'clay lump'. In the same year a more detailed account of the method was actually entitled 'On Building with Clay Lumps': it recommended the same size as in the 1870 article, and quoted the cost of doing the work in England.⁵⁹

One of the oldest surviving examples in Victoria, if the claims made for it are correct, is Charles Souter's house at Eltham, built of mud brick in about 1860⁶⁰ and hence perhaps the progenitor of all the earth buildings which have sprung up in the neighbourhood in the twentieth century. A house of about this date (it may be the same one) is reported to be of blocks measuring about 300 x 175 x 200 mm thick.⁶¹ A house on the Bulban Road, Werribee, is thought to have been built for William Ison in 1858-60: here there are blocks of the order of 230 x 460 mm on the face, preserved with the aid of later rendering and an added verandah.⁶² As Ison was a native of Cambridgeshire⁶³ his house should probably be seen as an outcome of the clay lump tradition rather than of adobe proper. At Badaginnie near Violet Town is the ruin of a stable said to date before 1870, and built of adobes measuring about 720 x 200 x 360 mm thick, and mud brick buildings are fairly common in the Bendigo area of Victoria.

Another example, but in an advanced state of deterioration, is to be found on the Sandy Creek Road near Maldon; it consists partly of what may be either cob or pisé, and partly of some sort of mud brick or clay lump, this being most clearly seen in one of the gables.⁶⁴ The gable was one section which was particularly difficult to build in

⁵⁶ Dugald Cameron, *Bush Life in Australia and New Zealand* (4th ed, London 1900), p 53.

⁵⁷ *Sydney Morning Herald*, 8 April 1870, quoted in A L Green, 'Unfired Earth Walls. The Promotion and Use of Sod, Sun-Dried Brick, Cob and Pisé Walling in New South Wales from 1788 to 1960' (MBltEnv, University of New South Wales, 1989), pp 191-2.

⁵⁸ *Town and Country Journal*, 10 May 1873, quoted by Peter Freeman, *The Homestead: a Riverina Anthology* (Melbourne 1982), p 57.

⁵⁹ *Town and Country Journal*, 10 May 1873, pp 587-8, quoted in Green, 'Unfired Earth Walls', pp 198-9.

⁶⁰ Alistair Knox, *We Are What We Stand On* (Eltham [Victoria] 1980), p 33; Marguerite Marshall, *Eltham Shire* (no place or date), p 16.

⁶¹ Information in 1992 from the owner, Bill Corker, who was not prepared to identify the building.

⁶² Information supplied to the National Trust by Miss M N Stewart. A title search is said to show that the land was owned by one Jones in 1857. Jones let the land to William Ison, who built the house: the evidence for this is Ison's recollections as published in the *Werribee Express* in September 1903.

⁶³ K N James, *Werribee: the First One Hundred Years* (Werribee [Victoria] 1985), p 34.

⁶⁴ Warwick Hatton et al, 'Maldon' (5 vols, BArch, University of Melbourne, 1964), I, p 103.

wet mud, not only because of its height from the ground but because it had to be finished to the angle of the roof pitch and because the diminishing wall length on which the mud was placed (combined with the fact that the work could be raised only about 60 centimetres at a time) made it possible to build up only small sections at a time.

Clay lump would also be particularly suitable where a gable or any other part was to be infilled in an existing structure where wet mud would cause damage. Thus William Kelly found a house in St Kilda the gables of which were adobe,⁶⁵ and Thomas Ham's engraving of 'A Store at the Diggings' shows the external wall nogged between posts with some sort of clay lump in blocks which look to be about sixty centimetres long by fifteen high. In prefabricated buildings heat insulation was often a major problem, and it was not uncommon for English manufacturers to recommend the use of a mud brick nogging concealed within the external walls. The mud building at Maldon is thought to date from the early sixties, but it seems likely that clay lump continued in use among selectors for some time afterwards.

A surviving adobe house of 1881 has been reported at 'Caromboon' near Deniliquin,⁶⁶ and Annette Green has identified number of other adobe buildings in New South Wales. In some cases she has inspected and researched them, but in others the data must be treated with some reserve because the information has been obtained by correspondence with a local council, and the construction may be wrongly identified. One of the earliest is 'Edin Glassie' at Penrith, possibly dating from about 1855,⁶⁷ and another is a house at Annangrove of about 1878.⁶⁸ 'Abbieglassie', south of Mitchell, is believed to have been built in 1896, using earth from a bend in the creek half a kilometre away, wheeled to the site in barrows by Aboriginal labourers. It is now much altered, but in its original form had a steep pitched roof and a surrounding bullnose verandah protecting the earth walls. The detached kitchen block is also of adobe. The external walls of the house are about 500 mm thick and the internal ones about 300 mm, and the blocks measure about 450 x 300 x 300 or 450 x 300 x 225 mm. There is no sign of any grass in the mixture.⁶⁹ In Queensland, apart from the Mexican-built house which has been mentioned, there is allegedly a mud brick house at Canterbury of about 1872, though this is improbable,⁷⁰ and a number of adobe houses were built in South Brisbane by Joseph

⁶⁵ William Kelly, *Life in Victoria in 1853, and Victoria in 1858* (2 vols, London 1860), II, p 24. Kelly had been familiar with adobe construction in California, and there is no reason to doubt that he uses the term accurately. Most other writers are extremely imprecise in their choice of words to describe mud construction.

⁶⁶ Extract of typescript tour notes of 1991, kindly supplied by Graeme Prisk.

⁶⁷ A L Green, 'Unfired Earth Walls. The Promotion and Use of Sod, Sun-Dried Brick, Cob and Pisé Walling in New South Wales from 1788 to 1960' (MBltEnv, University of New South Wales, 1989), p 215 & appendix H.

⁶⁸ Green, 'Unfired Earth Walls', p 201.

⁶⁹ Information 1994 from Mrs Helen McLean of Abbieglassie, whose grandfather, Harry Loughnan, bought the property from the Winton family in 1906.

⁷⁰ Ted Howard, 'Earth Building in Australia - a Vista', *Owner Building and Earth Architecture* (Melbourne 1984), p 58: this is probably the 'J.C. Hotel', now a ruin, which my informants unanimously describe as being of pisé.

and James Lihou in about the 1880s.⁷¹ In Queensland a variation known as 'Egyptian brick', as discussed below, seems to have been especially popular.

In Western Australia there seems to be a more explicitly English connection than in the eastern colonies, reflected in the common use of the term 'bat', as opposed to adobe. E J Hammond wrote of pioneering buildings in Perth being made of 'clay brickbats' made by women, and 'knew of one woman who made enough brickbats to build a five-roomed house.'⁷² Clay lump or adobe was used for W S Hall's hut at Roebourne in 1865, as well as for later buildings in the township.⁷³ At 'Berkshire Valley' near Moora there were apparently a number of structures wholly or partly of adobe, including stables which were built in 1867 with a stone foundation, on top of this 1.8 metres of cob in formwork, then the rest in adobe.⁷⁴ The Barron family's homestead of 'Minnijin', in the rural shire of Narrojan, is reported to be an adobe building of the 1860s or 1870s,⁷⁵ and Joseph Stirk used adobe for his cottage at Kalamunda in 1881.⁷⁶

The West Australian tradition was probably reinforced by Queensland experience when Patrick Durack and his wife Mary [Costello] migrated to the Kimberleys from Queensland after being ruined in the bank crash. In 1892 they built an adobe house at Argyle, on the Behn River, where he died the following year.⁷⁷ Similarly, some of the buildings put up at Hall's Creek in the 1890s were of an adobe made from antbed and spinifex.⁷⁸ A number of examples of adobe survived until recent years in the Pinjarra area of Western Australia,⁷⁹ and Kingsley Fairbridge continued the local tradition when he used adobe for the Pinjarra Farm School in the early 1920s.⁸⁰

h. German connections

Adobe was one of the main building materials used by the German settlers of Klemzig, near Adelaide, in the 1830s,⁸¹ and there is evidence of the use of adobe by German settlers elsewhere in South Australia.⁸² The term 'German brick' was used in the Cornish mining areas in South Australia for a brick mixed from wet earth, limestone rubble and straw or long grass, in a mould 9 by 15 inches [230 x 380

⁷¹ Information from Don Watson, 1991: his own house at 39 Brook Street was built by Joseph Lihou in 1883.

⁷² J E [?or E J] Hammond, *Western Pioneers* (Perth 1980), p 159, quoted in John Archer, *Building a Nation* (Sydney 1987), p 42.

⁷³ N E W Taylor, *A Saga of the North West: Yeera-Muk-A-Doo* (Fremantle 1987 [1980]), pp 49, 99, 101.

⁷⁴ Ray Oldham, 'Berkshire Valley, Western Australia', in J McClemens et al, *Historic Homesteads of Australia* (North Melbourne 1967), p 161.

⁷⁵ Information from Paul Tvermoes, 1996.

⁷⁶ Malcolm Fraser et al, *The Heritage of Australia* (South Melbourne 1981), p 6/24.

⁷⁷ Eve Pownall, *Mary of Maranoa* (2nd ed, Sydney 1959 [1959]), p 174.

⁷⁸ Ray & John Oldham, *George Temple-Poole* (Nedlands [WA] 1980), p 163, quoting *National Trust News*, no 80.

⁷⁹ Information from Ingrid van Bremen, 1991.

⁸⁰ Illustration in W A Shum, *Concrete, Mud, Stone, and How to Use Them* (Melbourne, no date [c 1950]), reproduced from Ruby Fairbridge, *Pinjarra*.

⁸¹ *South Australian*, 1 May 1839, quoted in John Archer, *Building a Nation* (Sydney 1887), p 53.

⁸² Gordon Young, 'Early German Settlements in South Australia', *Australian Journal of Historical Archaeology*, III (October 1985), p 50.

mm].⁸³ Similarly, Jeans reports that the mud brick houses which survive at Newcastle, New South Wales, were known as 'German brick' houses.⁸⁴

Near Hamilton in Victoria, an area with considerable German settlement, the original Engelfield homestead is a mud brick building erected some time after the run was taken up in 1841, but apparently no later than 1861, and it still survives behind the brick house put up at the beginning of this century.⁸⁵ At the Moravian Kopperamanna Mission, established in 1867, in the Stony Desert, 145 km north of Maree, the buildings formed a hamlet called Bethesda, and were built of mud brick made from clay and rushes. From 1869 the mission was run jointly with the Lutheran mission at Killalpaninna as a single station,⁸⁶ and as many as twenty-two buildings of mud brick and thatch were built by the Lutherans in 1877-8.⁸⁷ A number of other buildings in the area used adobe, including the Afghan settlement at Marree, known as 'Ghan Town'.⁸⁸

In western Victoria the tradition established by the Germans became endemic. The *Leader* reported in 1874 that mud brick houses were the commonest type on the plains:

The surface soil without any other ingredient whatever, is puddled by means of a horse walking round in a gutter dug for the purpose, water being added until a proper consistency is obtained. When thoroughly puddled the bricks are cast in a mould one foot long by six inches deep and eight inches broad, after which exposure to the sun for a couple of days serves to bake them almost as hard as stone; the cost of making these bricks is about 7s. 6d. per thousand, and they make a neat and most comfortable house. Mr. Brabender's house, a high and roomy dwelling thirty-six feet by eighteen contains two thousand bricks, and was constructed entirely by himself ...⁸⁹

In this same area a preserved adobe from a house at Jung is of exactly these nominal dimensions 12 x 8 x 6 inches [300 x 200 x 150 mm],⁹⁰ and at the Bolangum Inn, to the north of Stawell, the size is similar, 11 x 8¹/₂ x 5¹/₂ inches [275 x 215 x 140 mm].

Peter Freeman illustrates an adobe building at Wattle Park station, Buchargingah (or Buckargingah) Creek, in the Riverina, where the adobe is in panels set within a timber structural frame.⁹¹ It is difficult to know when combinations of this sort have some specific ethnic origin, and when they are simply ad hoc. In the English and

⁸³ Oswald Pryor, *Australia's Little Cornwall* (Adelaide 1969 [1962]), p 66.

⁸⁴ Dennis Jeans, 'The Building Industry: Materials and Styles', in Judy Birmingham, Dennis Jeans & Ian Jack, *Industrial Archaeology in Australia: Rural Industry* (Richmond, Victoria, 1983), p 102.

⁸⁵ Information supplied to the National Trust by Mr C A Hindaugh. The property is mentioned in Bell to La Trobe, 12 August and 15 September 1853, in Bride, *Letters from Victorian Pioneers*, pp 290, 295, 197.

⁸⁶ Helen Ferber, *Stagecoach to Birdsville* (Kenthurst [NW] 1995), pp 31-2.

⁸⁷ Howard Pearce, *Homesteads of the Stony Desert* (Adelaide 1978), p 53.

⁸⁸ Pearce, *Homesteads of the Stony Desert*, p 40.

⁸⁹ *Leader*, 28 January 1874, quoted in Y S Palmer, *The Track of the Years* (3rd ed, St Arnaud 1980 [Melbourne 1955]), pp 238-9.

⁹⁰ Actually 290/310 x 190/200 x 145/155. The adobe is from the Baker house at Jung and is in the Murtoa Water Tower Museum.

⁹¹ Peter Freeman, *The Homestead: a Riverina Anthology* (Melbourne 1982), p 82.

other half-timbering traditions, including the German *fachwerk*, unbaked brick was a regular infill material for the panels, but this is rather different from filling a complete wall bay between main posts. One German immigrant house in Nebraska used adobe in combination with timber verticals but, rather than being principal columns, these were corner strips and trimmers at the sides of openings, designed to provide for nailing on cladding.⁹²

An undated homestead at Woorak West, in Lowan Shire, is partly of adobe and partly of palisade and pug. Susan Priestley, writing on Warracknabeal, Victoria, refers to the thick blocks of sun dried mud used to build dwellings in the eighties in areas where suitable 'pug' or clay could be found,⁹³ and at Brim, in the same shire, interesting examples were built in the early twentieth century. Percy Lamshed had an American mud brick-making machine and used his bricks to build the Brim public hall and at least two other structures, one of them a house dating from after 1915.⁹⁴

i. Egyptian brick

The term 'Egyptian brick' for adobe is a mysterious one, and appears to be a local usage originating from the later nineteenth century. It had been foreshadowed in Britain, where a Sudbury bricklayer wrote in 1847 of a building he had worked on thirty years earlier, made of clay lump 'composed of clay and chopped straw, well worked together, and dried after the Egyptian method, in the sun.'⁹⁵ This is a reasonable description of Egyptian methods which are still in use today, but the Australian use of the term 'Egyptian brick' relates to the biblical reference to the Israelites having to make bricks *without* straw,⁹⁶ for this is its distinctive characteristic. It was doubtless coined by somebody familiar with the bible, but this does not explain its rapid dissemination in the eastern colonies.

A house of 1856 at Muddy Creek, east of Melbourne, was described as being of Egyptian brick, though probably only at a later date,⁹⁷ but the term was certainly used in 1875 of a substantial house or homestead in the Melbourne suburb of Balwyn.⁹⁸ The term was also used in the town of St Arnaud, where it is reported that most of the mud brick houses date from after 1870 and can be traced in the rate books of the 1880s. One miner's cottage which still survives in the town is shown on a Lands Department plan of 1898 as an 'E.B. Dwelling'.⁹⁹ Nearby the 1880 rate books for the

⁹² David Murphy, 'Building in Clay on the Central Plains', in Thomas Carter & B L Herman (eds), *Perspectives in Vernacular Architecture, III* (Columbia, Missouri, 1989), p 82.

⁹³ Susan Priestley, *Warracknabeal: A Wimmera Centenary* (Brisbane 1967), p 39.

⁹⁴ Historic Buildings Council, Victoria, file no 82/1221, data compiled by Timothy Hubbard, 1983.

⁹⁵ A J Green, in a letter to the *Builder*, V, 234 (31 July 1847), p 364.

⁹⁶ *Exodus*, V, 5-19.

⁹⁷ N E Beaumont, *Early Days of Berwick* (Berwick [Victoria] 1979 [1948]), p 96.

⁹⁸ *Argus*, 15 February 1875, p 2.

⁹⁹ Celestina Sagazio, 'Research into the Miner's Cottage, St. Arnaud' [typescript report for the National Trust, Victoria, 24 July 1986], p 4, quoting letter and research notes by Allan Stewart, 4 June 1986, p 3, who reproduces the map from Land Selection and Correspondence Files 1856-1980 [PRO, Victoria].

West Riding of Avoca Shire is also reported to contain many references to E.B. cottages or huts,¹⁰⁰

In the outback of Queensland Constance Ellis also referred in 1888-9 to a number of structures of what she likewise called 'Egyptian brick'. As Ellis described it, this was a form of adobe made of pure clay without any straw or grass added.¹⁰¹ The buildings to which she referred were the house of a cocky farmer called Shene, a number of buildings on the Tullys' property, presumably 'Ray', the homestead at 'Kyabra', and the shearers' and rouseabouts' huts at 'Narine'. The evidence suggests that she was wrong about 'Ray', and probably about 'Kyabra', but there is no doubt that the material was used in the area and that it was known as Egyptian brick. A surviving example of adobe is 'Cowley', in the Charleville area, which seems to have been built in 1888 after a slightly earlier house was destroyed by flooding. The bricks measure about 600 by 300 to 350 mm on the face, and the soil was dug from the site, creating a cellar: it does not appear that they contain grass, but nothing is known of how they were made.¹⁰²

j. the twentieth century

It seems likely that adobe construction generally had ceased in most parts of Australia by the time of the Great War. Until that time it had been the leading form of vernacular construction. The Australian census of 1911 indicated that there were 6,333 sun-dried brick dwellings: although this was only 0.69% of the total, it was greater than the number in bark, pisé, wattle and daub, and other such materials.¹⁰³ In Victoria in the twentieth century Italian settlers made some use of mud brick, and G M Henriksen of Natya in the Victorian Mallee in 1929 noted outbuildings of 'large, red-mud bricks' which 'wasn't an Australian practice' on the farm of an Italian settler, Mazzocci.¹⁰⁴ However, the number of twentieth century adobe buildings in New South Wales is quite surprising, and probably due in part to official promotion of the technique. In 1911 the official New South Wales *Farmers Handbook* gave directions for buildings constructed of sun dried bricks:¹⁰⁵

For buildings of this character, material like clay, which is unsuitable for Pise-work, can be used. The bricks are made in a wooden mould, and are 16 in. long, 8 in. wide, and 6 in thick. A man can made about 100 per day. They are laid in a similar manner to other bricks, the mortar used being wet loam, or even the material of which the bricks are made.

¹⁰⁰ Diana Western to Lorraine Huddle, 7 April 2003.

¹⁰¹ Constance Ellis, *I Seek Adventure* (Sydney 1981), pp 8, 9, 11, 29,

¹⁰² Information 1994 from Mr Philip Manns, Manager, and Mr Henry Harkin, one of the owners, who has supplied an extract from M J Fox, *History of Queensland* (***) ? publication details). Fox, pp 388-9, refers to the house as being built of pisé in 1887. Mr Manns, however, describes the bricks exposed where plaster has come off, and refers to a more modern letter on the station files which refers to the original house of 1886 being destroyed by flooding of the [Cowley] Creek, and the present one built in 1888, higher and on a stone foundation.

¹⁰³ Green, 'Unfired Earth Walls', p 28.

¹⁰⁴ G M Henriksen, *Red Dust Country* (Newtown [Victoria] 1984), p 96.

¹⁰⁵ Williams-Ellis, *Cottage Building*, p 59.

St Peter's Church at Leeton dates from 1913.¹⁰⁶ There is a concentration of buildings at Walla Walla, and reference to the technique being used there in about 1920; and there is a school building with adobe infill panels of about 1935 at 'Sunnybank' 20 km from Kelso.¹⁰⁷

The material seems to have effectively gone out of use in Queensland for more than four decades, but an adobe house was built at 'Wammadoo' in the Morella district in about 1921, and survived until the 1950s.¹⁰⁸ It was in 1921 that Arthur Morry, of the Department of Agriculture, published an article on 'Building a Pise House and Farm Buildings of all kinds in Country Districts'. In a bizarre aberration, the Town Planning Association met in Brisbane in 1929 to discuss 'Western Housing', and in particular the possibility that adobe or pisé housing might be suitable for use in western Queensland. Reference was made to precedents in France, England, Victoria, and even Townsville, but the planners seemed quite unconscious of the fact that both techniques had long been used in western Queensland itself.¹⁰⁹

j. the adobe revival

At Eltham, near Melbourne, where the Souter house had been built in adobe in about 1860, the artist Justus Jorgensen and his followers built a mud brick studio (with an upper storey of what is said to have been wattle and daub) in about 1935. Other buildings followed to create Jorgensen's artists' colony, 'Monsalvat'. Nearby John D Harcourt built a large house of stone and mud brick, and the Jelbart family had also built in mud brick by the mid-1940s. It is wrong to see this (as some have) as an autochthonous movement. The same thing was happening in the United States, and a Californian publication of 1946, *Build Your Own Adobe*, describes the whole process in considerable detail.¹¹⁰ At Eltham the builder and designer Alistair Knox, who had for years been interested in Monsalvat, built the Frank English house of mud brick in 1947 with the help of Sonia Skipper, who had gained her experience on Jorgensen's projects,¹¹¹ and this was followed in 1948 with a house for Professor W McMahon Ball, again designed by Knox and executed by Skipper.¹¹² A number of mud brick houses by Knox and others were subsequently built in the area.¹¹³ In about 1950 Knox built an extensive adobe farmhouse at 'Sunningdale', between Tarnagulla and Moliagul, Victoria.¹¹⁴

The landscaper Edna Walling wrote favourably about both adobe and pisé in 1947, and was probably main influence in the popularisation of adobe in Victoria at this

¹⁰⁶ Green, 'Unfired Earth Walls', appendix H, ref A E Bowmaker, *A Brief History of Leeton*, 1968. Illustrated in G F Middleton, *Build Your House of Earth* (Sydney 1953), facing p 50.

¹⁰⁷ Green, 'Unfired Earth Walls', pp 206, 207.

¹⁰⁸ J M Mims [ed], *Morella Memories* (Morella [Queensland] 1992), p 36.

¹⁰⁹ *Architectural & Building Journal of Queensland*, VIII, 87 (10 September 1929), pp 27-32.

¹¹⁰ Paul & Doris Aller, Peter Cuffley, *Build Your Own Adobe* (Stanford [California] 1946).

¹¹¹ Alistair Knox, *We Are What We Stand On* (Eltham [Victoria] 1980), pp 11, 29-31; Peter Cuffley, *Australian Houses of the Forties and Fifties* (Knoxfield [Victoria] 1993), pp 129-130.

¹¹² Alistair Knox, 'Building with Mud Bricks', in W A Shum, *Concrete, Mud, Stone, and How to Use Them* (Melbourne, no date [c 1950]), p 40.

¹¹³ One is the Bateman house, 85 Sweeney's Lane: *Age*, 13 February 2002, Domain p 14.

¹¹⁴ *Australian Home Beautiful*, February 1955, pp 23-5.

stage (for pisé had other supporters as well). She treated it in a very practical manner, discussing the use of straw (generally a 100 lb [45 kg] bale to a thousand bricks), and recommending thicknesses of at least twelve inches [300 mm] for bearing walls up to 3.6 m high, and sixteen inches [400 mm] for two storey construction. She recommended a mud plaster, but with sand added if the clay content was high. Three coats of 'linseed oil paint' was the best finish, though expensive, whereas whitewash was cheap and easy but neither durable nor waterproof. A stucco of lime putty and sand was fairly durable and would adhere better than cement, especially if thrown on with a broom or brush rather than applied with a trowel. If cement stucco was used it should be on a metal lath.¹¹⁵ Walling illustrated a seaside cottage design, said to be suited either to stone or adobe.¹¹⁶

Knox had been able to get a council permit in 1947 only because he was able to get in the nick of time copies of a pamphlet by G E F Middleton of the Commonwealth Experimental Building Station, *Earth-Wall Construction*,¹¹⁷ and bombard the shire councillors with them. Middleton's experience doubtless derived from the more continuous mud brick tradition in New South Wales, but he came also to draw upon the experience of Victorian earth builders, including the Elthamites, and, for pisé, the McKnights in the Riverina. He built an adobe pavilion at the Experimental Building Station, North Ryde, in about 1950,¹¹⁸ and in 1952 the Building Station issued an expanded version of *Earth-Wall Construction*.¹¹⁹

By 1950 the Queensland Housing Commission had recognised the material by publishing a standard house design for execution either in adobe or in pisé. The house was absolutely undistinguished in plan and elevation, but had footings and foundation walls described as being of stabilised earth, cypress pine stumps with stabilized earth around their bases, cypress pine bearers, and main exterior and interior earth walls of twelve and nine inches [300 & 225 mm] thickness respectively.¹²⁰ It must have been shortly after this that the Commission published its book *Homes of Earth*, which describes construction in both adobe and pisé.¹²¹ It is unremarkable in technical terms, except that reinforced concrete is used for a ring beam at the top of the walls, for lintels and, optimally, for footings. Moreover the recommended block dimensions are 18 x 12 x 4 inches [450 x 300 x 100 mm) which amounts to a flat rectangular plate, unlike any other adobe reported in Australia.

¹¹⁵ Edna Walling, *Cottage and Garden in Australia* (Melbourne 1947), pp 83-5.

¹¹⁶ Walling, *Cottage and Garden*, pp 6-8.

¹¹⁷ Cuffley, *Australian Houses of the Forties and Fifties*, p 130. Cuffley cites this as G E F Middleton, *Earth Wall Construction* [Commonwealth Experimental Building Station Bulletin no 5] (North Ryde [NSW] 1946), but in his bibliography he gives the date as 1947. As best I can establish the original publication was in 1947, and it was issued as a 'duplicated document', and only later expanded to become a bulletin, as cited below. This is presumably the Station's Document No 28, referred to by Knox in about 1950: Knox, 'Building with Mud Bricks', p 47.

¹¹⁸ Middleton, 1956, p 12, quoted Green, p 215.

¹¹⁹ G E F Middleton, *Earth-Wall Construction* [Commonwealth Experimental Building Station Bulletin no 5] (Sydney 1952). This is stated to supersede Duplicated Study No 28/Technical Study No 28 on the topic, which had run into three editions, which seems to cast doubt on the supposed Bulletin no 5 of 1946.

¹²⁰ Queensland Housing Commission, drawing no S3574, 6 September 1952, 'Adobe Block and/or Pisé de Terre'.

¹²¹ Queensland Housing Commission, *Homes of Earth* (Brisbane, no date).

Between 1951 and 1954 the Native Affairs Board of the Northern Territory Government built a number of adobe structures at the Phillip Creek Aboriginal settlement (which has since been abandoned),¹²² and in 1953 Middleton published his *Build Your House of Earth*, which remains the bible today.

¹²² Fraser, *Heritage of Australia*, p 8/36.