a survey of building materials

Miles Lewis
COMMONWEALTH OF AUSTRALIA
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a hierarchy of use and survival
ephemeral materials
hut of the Okobambi people, south-west Africa, and as used in the Olduvai Gorge, 1,800,000 BP, according to M D Leakey
Mammoth bone hut excavated at Metzhiritch, Ukraine, undated, Ice Age, say 10,000 BC

mammoth bone house reconstruction
Lewis, Architectura, p 48
igloos under construction, on Igloolik Island, Nunapat, Canada

West Stow Anglo-Saxon village, Suffolk, C6th-7th: reconstruction

the thatching process

Cholderton, Hampshire, England:
rethatching a roof

Lewis, *Architectura*, p 257
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summer house of the Sauk and Fox Indians, photo c 1885, Smithsonian Institute, USA
'A View of a Hut in New South Wales'

Arthur Phillip, The Voyage of Governor Phillip to Botany Bay (London 1789)
Selector's hut of logs, slab and bark, using no nails, owned by Mr Stocks of Croajingalong, Gippsland: J N Caire photograph, c 1870
State Library of Victoria
a farm building, Hargraves, NSW: bark roof supported with wire

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T B Pearce's bark house, Aireys Inlet, 1850s
Miles Lewis
Sun-dried brick from Jericho, c 8000 BC

adobe manufacture, West Aswan village, Egypt

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Mohenjo-Daro, Pakistan, c 2500-2000 BC
Lewis, Architectura, p 39
pitched vault, Haft Teppah, Iran, c 1500 BC
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experimental adobes, Haft Teppah
Miles Lewis
the ziggurat, Choqa Zanbil, Iran, C13th BC: south flank
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second palace of Mallia, Crete, c 1700-1450 BC
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second palace of Mallia, detail of mud [cob] and rubble walling

Miles Lewis
thatched cob building, Somerset, UK

Lewis, *Architectura*, p 54
Bear's Castle, Yan Yean, near Melbourne, 1840s

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Bear's Castle, older view c 1970

Miles Lewis
sod house on the American prairies, 1886

King, *Homes for Home-Builders*, p 101
Frank Visek sod house, south-west Custer County, Nebraska
Sod house in Buffalo County, Nebraska: modern view of decayed wall

Turner, 'Sod Houses in Nebraska', p 34
the sod wall of the Ewins house, Blayney, NSW, c 1883: view and detail

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Banzhu Qiang, 'board formed earthen wall', or pisé, China
pisé illustrated by David Gilly, Germany, 1788-9

David Gilly, Handbuch der Landbaukunst (author, 2 vols, Berlin 1788-9)
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'Pompallier House, interior pisé wall surface
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pisé according to Rondelet, *Traité de l'Art de Bâtir* of 1812, based upon experience in 1764
Pompallier House

view of the formwork used in the restoration

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pisard detail from Rondelet

pisards used at Pompallier House

Rondelet, *Traité de l'Art de Bâtir*
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clamp from Rondelet clamps used at Pompallier House

Rondelet, *Traité de l'Art de Bâtir*
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bricks & tiles
enamelled brick from Nimrud (?c 880-730 BC), British Museum

Perrott & Chipiez, Assyria and Chaldea, II, pl xiii, facing p 294, after Layard
terra cotta decoration of an Etruscan temple,
Museo Archeologico, Arrezzo
Coarelli, *Etruscan Cities*, p 42
Roman brick and tile sizes

Campbell & Price, *Brick*, p 47
paving tiles with curved markings, Pammukale, Turkey
Miles Lewis
Roman brick stamp, Palatine Hill, Rome

Miles Lewis
Women’s Baths, Aquincum, Hungary

Miles Lewis
Women’s Baths, Aquincum
detail of ducting tiles
(reproductions in foreground)

Miles Lewis
San Vitale, exterior detail of brickwork
Byzantine brickwork at Resafe, North Syria, ?C6th
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brickmaker’s stool, 1850
(a) brick earth; (b) moulder’s sand; (c) clot-moulder’s sand; (d) stock; (e) water tub; (f) page; (g) pallets; (h) brick on pallet; (k) moulder’s place; (m) clot-moulder’s place; (o) cuckold – for cutting off the ground earth as it comes from the pugmill

Dobson, *Bricks and Tiles*, II, p 16
EXTRUSION

'Archimidean Pipe, Brick and Tile Machine', patented by Alfred Cornwell of Brunswick, 1863, and a similar machine published in 1872

Victorian patent V646 (from the Commonwealth prints)
Town and Country Journal, 20 April 1872, p 492
Bulmer & Sharp's machine, 1861

wire cutters at Gulson's brickworks, Goulburn, NSW

Woodforde, *Bricks to Build a House*, p 113
Miles Lewis
detail of a brick press at Gulson's Brickworks, Goulburn NSW

Miles Lewis
brick markings

Gemmell, *And So We Graft*, p 27
hacking, parallel
hand moulding: base
pressing, screws holding kick

brick markings
Gemmell, *And So We Graft*, p 27

hacking: transverse, ?straw
hand moulding: skiving of top face
extrusion: wire cutters
circular brick clamp, India, 1869

W H M, 'Circular Brick Clamps', no CCXIX in *Professional Papers on Indian Engineering*, vol VI, pl viii
downdraught kiln, Gulson's Brickworks: breaking open

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fourteen chamber rectangular Hoffman kiln in plan

Cox, *Brickmaking*, p 43
the Upper Hawthorn Brick Company yards of Fritsch, Holzer & Co, c 1888
PGH City Brick kiln, Elizabeth Street, Malvern [demolished 1985]

Alexander Sutherland [ed], *Victoria and its Metropolis Past and Present* (2 vols, Melbourne 1888), II, p 638
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Jennings’s patent bonding bricks, 1858 & later
British cavity wall with wrought iron ties and asphalt damp-proof course, 1888
cast & wrought iron ties in use in Britain, 1901

*Notes on Building Construction, Part II* (London 1888), p 216
*Notes on Building Construction, Part II* (London 1901), p 9
Morse wire ties

cavity wall with Morse ties, USA, 1899

Morse tie from 878 High St Armadale, said to be about 1885

Wall ties, plain and drip type, by the Titan Nail & Wire Co, c 1930

a stoneware damp proof course made by Doultons, nine inches (230 mm) wide

the first Australian textbook illustration, by James Nangle, 1900

a cavity wall with Jennings's stepped-up bonding bricks and wrought or cast iron tie, stoneware damp-proof course

*Notes on Building Construction, Part III Materials* (1879), p 135
James Nangle, *Australian Building Practice, Part 1* (Sydney 1900), p 63
reconstructed minaret from Meskineh

Monumentum, XVII (1978), p 66
minaret at Meskineh, Syria: drum cut off for removal

Miles Lewis
minaret at Meskineh: drums being moved

Miles Lewis
reproductions of tiles from the Monastery Church of Brou, made in the late 19th century by Leon Parvillée for use at the Château of Chenonceau. Victoria & Albert Museum, London

Graves, *Tiles and Tilework*, p 60
Chateau of Chenonceau, France, C16th: detail of C19th ceramic floor tiles, showing wear

Miles Lewis
paving tiles of the 13th-14th centuries from the priory of St-Martin-des-Champs, France

St Giles, Cheadle, by A W N Pugin, 1844-6

floor tiling in the Blessed Sacrament Chapel, made by Mintons, c 1846

Atterbury & Wainwright, *Pugin*, p 146
tile making at Chamberlain’s works, Worcester, in 1843

*Penny Magazine*, February 1843
manufacture of an encaustic tile:
a) a layer of clay placed over a plaster mould; b) addition of body clay; c) clay slip poured in; d) scraping the surface; e) cutting and trimming

Alun Graves, *Tiles and Tilework of Europe* (London 2002), p 152
the Rookery, Chicago, by Burnham & Root, 1885-8

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underside of a floor in the Rookery, Chicago, by Burnham & Root, 1885-8
Miles Lewis
the Rookery: a fireproof partition

Miles Lewis
fireproof construction: porous tile around columns, partition blocks

International Library, ‘Masonry Continued’ pp 114, 116
steel construction of a Chicago building, c 1903

terra cotta lumber

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terra cotta lumber

Lynne Dore
Oratory of Gallerus, Dingle, Ireland, C7th or later

Miles Lewis
Building C, Troy VI (c1800-1200 BC)

Robertson, *Greek and Roman Architecture*, p 24
method of extracting limestone blocks from a quarry in Egypt

Lloyd, 'Building in Brick and Stone', p 478
Jebel Khalid quarry

view from north end

undercutting on west face

Miles Lewis
Jebel Khalid: quarrymen’s grooves

Miles Lewis
splitting a blocks of stone from the quarry

Thierry Hatot, *Batisseurs au Moyen Age* (Clermont-Ferrand 1999), p 59
an Assyrian relief showing masons with tools

Reade, Assyrian Sculpture, p 18
nineteenth century stone sawyer

*The Useful Arts Employed in the Construction of Dwelling Houses* (2nd ed, London 1851), p 23
partially sawn column drum from Jerash, Jordan, C6th

partially sawn column drum from Jerash
Seigne & Morin, 'Une Scierie Hydraulique', p 250
the sawmill at Ephesus: a technical reconstruction by Mangartz

Mangartz, 'The Stone Cutting Machine of Ephesos', p 238
the sawmill at Ephesus: a fuller reconstruction by Mangartz

Mangartz, 'The Stone Cutting Machine of Ephesos', p 239
stone saw at the
Thomas Brown
Monumental Works,
High St, West
Maitland, NSW

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British slating practice

slater's tools

Bennett & Pinion, *Roof Slating and Tiling*, p 26
Lighthouse Cottage, Wilson's Promontory, 1880s
view from above during re-roofing, October 2000

Miles Lewis
Wilson’s Promontory lighthouse cottage
close view of battens and slating, here fixed with three silicon clouts

Miles Lewis
Wilson’s Promontory lighthouse cottage: roof showing the 8 mm slates and the timber roll at the ridge to take the lead capping

Miles Lewis
ridge rolls for shingle and slate roofing

reconstruction of a typical long house, Neolithic village of Köln-Lindenthal (near Cologne), Germany, c 4000 BC

palisade construction, Denmark

Gorm Benzon, *Gammelt Danske Bindingsværk* (Copenhagen 1984), p 19
posts or studs, with and without a ground sill

West, *The Timber-Frame House*, p. 21
interpretation of a structure from Valkenburg, Netherlands, of the Roman period framing and wattling in trenches

E M Jope [ed], *Studies in Building History* (London 1961), p 21
interpretation of a structure from Valkenburg, Netherlands, of the Roman period framing and wattling in trenches

E M Jope [ed], *Studies in Building History* (London 1961), p 21
excavation of a structure at Valkenburg, Netherlands, of the Roman period, indicating framing and wattling on sole plates

Jope, *Studies in Building History*, p 21
reconstruction of a structure at Valkenburg, with framing and wattling on sole plates

Jope, *Studies in Building History*, p 21
Gulf Station, Yarra Glen post showing hitching peg and rotting base

Helen Watters
Gulf Station: decayed post
Helen Watters
Gulf Station: cutting the bottom off the post

Miles Lewis
Gulf Station: new base for post
Helen Watters
Gulf Station
restored post with new spliced base
Miles Lewis
King Midas tomb, Gordion, c 696 BC: view of the tumulus

Miles Lewis
Midas tomb, Gordion: section

Akurgal, Ancient Civilizations, p 277
Midas tomb: interior view

Miles Lewis
Midas tomb

detail of roof
axonometric diagram

Miles Lewis
Lloyd, Early Highland Peoples of Anatolia, p 131
Midas tomb: access hole cut through the wall

Miles Lewis
winegrower's house from Sachsenflur, Germany, 1562, now in the Hohenlohe Freilandmuseum

Miles Lewis
house from Sachsenflur, view of a lehmwickel floor
Miles Lewis
house from Sachsenflur, lehmwickel details

Miles Lewis
reconstructing a lehmwickel ceiling
Szentendre Museum
Hungary

Sajbán Tibor, 1994
GLASS

crown glass

sheet (or cylinder glass)

plate glass
crown glass: (left) a pane or table from Jerash, (centre) a plaster frame with the edges of two panes, and (right) modern glass from Hebron, c 1930

crown glass from Jerash, Hebron, and (right) Sudan, C12th

Harden, 'Domestic Window Glass', p 40
crown glass manufacture, C18th France: step A

Diderot, *Encyclopédie*, sv 'Verrerie', pl 13
crown glass manufacture, C18th France: step B
Diderot, *Encyclopédie*, sv 'Verrerie', pl 13
crown glass manufacture, C18th France: step C

Diderot, *Encyclopédie*, sv 'Verrerie', pl 13
manufacture of crown glass:

the table on the end of the punty

two ways of dividing a table of crown glass

the manufacture of sheet glass by Chance Brothers, c 1850

Jackdaw no 43, The Great Exhibition 1851
sheet glass being reheated and flattened

Harden, 'Domestic Window Glass', pp 41, 42
bronze bound doors
reconstruction of the Balawat gates from the palace of Shalmaneser III (858-824 BC) British Museum
reconstructed door with bronze door plating from Assur, Shalmaneser III period (c 840 BC),
Archaeological Museum, Istanbul

Miles Lewis
the Balawat Gates, detail of the bronze plating British Museum ANE 121652-121653
Miles Lewis
the use of dovetail cramps

Temple of Haroeris & Sobek at Kom Ombo, early C2nd BC onwards.

Sanctuary of Athena, Pergamum, Asia Minor, c 300 BC: Hellenistic dovetail cramp recesses

Miles Lewis; Fatih Cimok, *Pergamum* (Istanbul 2001 [1993]), p 25
dovetail cramp trace at Persepolis, Iran

Miles Lewis
Achaemenid cramps, Persepolis, c 490-460 BC

broad dovetail cramp with iron bar and lead, platform

cutting for a narrow hook cramp, Hall of a Hundred Columns

Nylander, Ionians at Pasargadae, p 42, 43
Achaemenid cramps, as indicated by the cuttings in the stone

Nylander, *Ionians at Pasargadae*, p 43
Roman masonry with molten lead poured around metal dowels and cramps

Durm, *Baukunst der Griechen*, p 94
Roman lead pipe with inscription
Musée Rolin, Autun, France
Miles Lewis
Roman lead pipe fabrication

Roman lead pipes, Archaeological Museum, Palermo, Italy. junction with spigots; end view of a pipe showing the seamed joint

Miles Lewis
bronze stopcock, Humayma, Jordan

Burton MacDonald, Russell Adams & Piotr Bienkowski [eds], The Archaeology of Jordan (Sheffield, Sheffield Academic Press, 2001), p 610
Roman bronze double action pump from Bolsena, Italy, probably AD C3rd
British Museum GR 1892-5-17.1 BM Cat Bronzes 2573: Miles Lewis
cast iron

• impure: up to 4% carbon, up to 10% other elements
• poured into a mould
• crystalline texture
• good in compression
• poor in tension
• poor in bending
• brittle under change in temperature
wrought iron

- pure (to commercial standards)
- hammered or rolled
- fibrous texture
- good in tension
- good in bending
- subject to rust
steel
(a less precise term)

• pure (maximum 0.25% carbon)
• hammered or rolled
• good in tension
• good in bending
• stronger than wrought iron
• even more subject to rust
Derby Cotton Mill
by William Strutt,
1792-3
plan & section

MUAS16,682
Derby Cotton Mill by William Strutt, 1792-3
detail of construction, 1792, based partly on Milford and Belper West

MUAS 13,022
sections of cast iron beams, 1801-1837

- Philips & Lee by Boulton & Watt [1799-] 1801
- Benyon's mill, by J Farey, 1816.
- Thomas Tredgold, 1824
- Mill in Bradford, Fairbairn, 1827
- 'Ideal' by Eaton Hodgkinson, 1830.
- No 70, Old St, EC1, 1837

209-11
Langridge St,
Collingwood,
?1880s
view & detail of
bressummer

Miles Lewis
209-11 Langridge St, Collingwood, details of bressummer, east & south sides

Miles Lewis
built-up girders

details of the construction of an iron-framed house, by Viollet-le-Duc, 1872

rivets: types: cap ended; pan headed; hammered; countersunk; Forth of Firth Bridge, Scotland, by John Fowler and Benjamin Baker, 1882-90, detail of rivetted members

welding at the Empire State Building, New York, 1930

Lewis Wickes Hine photo
'Coriyule', Drysdale, 1849-50: iron tile with inscription

Miles Lewis
corrugated curving machine, Victorian patent no 9 to Edmund Morewood & George Rogers, 18 March 1857, from the original drawings
corrugated curving machine, Launceston Railway Workshops
Miles Lewis
GOSPEL OAK
G [anchor] O
FIRST QUALITY
GALVANIZED TINNED IRON

Gospel Oak iron from the stables at ‘Killeen’, Victoria
Miles Lewis
WOLVERHAMPTON
CORRUGATED [IRON]
MANUFACTURERS

[convex arc: TRADE MARK ]
[circle containing:
[upward arc, illegible: ? ... JO ...... ]
[horizontal: IRON ]
[concave arc: STAFFORDSHIRE ]
[underneath, manually painted: '5/3']

Wolverhampton iron from the stables at ‘Killeen’, Victoria

Miles Lewis
Pinson & Evans Wolverhampton iron from a fence, Brunswick Road, Brunswick

Miles Lewis
corrugated iron sizes manufactured by Frederick Braby & Co, c 1910

galvanised iron dates and sizes

Morewood & Rogers iron tiles 1850-60, but very occasionally as late as the 1880s

Tupper & Co two inch corrugated tiles c 1855-65

five inch [125 mm] ‘Scotch iron’ 1852-1860, later very rare except in special applications

three inch [75 mm] 1853 to the present

Traegerwellblech iron in 4, 2 and 2 inch corrugations from 1883, replaced by British versions during the 1890s

ripple iron, one inch [25 mm] c 1890-1930

finely striated iron mainly for ceilings c 1900-1930
iron house at ‘The Weatherboard’, Inverleigh, one of a batch designed by Henry Ginn, Colonial Architect, c 1852-3, fabricated by John Walker, erected from 1854 onwards

Miles Lewis
house at the Weatherboard

junction of panels at the window line maker’s plate

Miles Lewis
detail of the John Kelly house, Beveridge

Miles Lewis
corrugated iron lapping

Cercle Française de Tientsin [French Club], 29 Jie Fang Bei Rd (cnr Bin Jang Rd), Tianjin, China, 1931-2: entrance

Miles Lewis
8-10 Jie Fang Bei Rd (cnr Bin Jang Rd), Tianjin, China
detail at the entrance

Miles Lewis
'Wunderbright'; and similar glazing systems
glass from the former Sydney County Council Offices and Showroom, 1935,
Powerhouse Museum, Sydney; flats, 57 Ramsay St, Haberfield, NSW;
Criterion Hotel, Pitt & Park Sts, Sydney, by Copeman, Lemont & Keesing, 1936

Van Daele & Lumby, *A Spirit of Progress*, pp 100, 139, 177
door handle,
Midlands Hotel,
Castlemaine

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Monel Metal advertisement

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And, Monel is easy to keep clean and bright—a rub over with a damp cloth is all that is usually required to keep Monel always clean and attractive. Monel sinks and draining boards also blend with any colour scheme, their resiliency reduces crockery breakages and they are guaranteed not to rust.

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Buckley & Nunn, 294-6 Bourke St, Melbourne, by Bates, Smart & McCutcheon, 1933
Julie Willis; Van Daele & Lumby, A Spirit of Progress, p 97
McPherson's Building, 546 Collins St, Melbourne, by S P Keith Reid & John A Pearson; Stuart Calder, architects in association, 1935: corner detail

Van Daele & Lumby, A Spirit of Progress, p 96
Mural Hall, Myer Emporium, 314-336 Bourke St, Melbourne, by H W & F B Tompkins, 1933, ‘Staybrite’ balustrade of the Mannequin Staircase

Van Daele & Lumby, A Spirit of Progress, p 95