ABPL90085 CULTURE OF BUILDING

concrete & stucco
COMMONWEALTH OF AUSTRALIA
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lime
1. CALCINATION

\[ \text{calcium carbonate} + \text{heat} \rightarrow \text{calcium oxide} + \text{carbon dioxide} \]

\[ CaCO_3 \quad \rightarrow \quad CaO \quad \text{(quicklime)} \quad CO_2 \]

2. HYDRATION

\[ \text{calcium oxide} + \text{water} \rightarrow \text{calcium hydroxide} + \text{heat} \]

\[ CaO \quad H_2O \quad \rightarrow \quad Ca(OH)_2 \quad \text{(slaked or hydrated lime)} \]

3. CARBONATION

\[ \text{calcium hydroxide} + \text{carbon dioxide} \rightarrow \text{calcium carbonate} + \text{hydrogen} \]

\[ Ca(OH)_2 \quad CO_2 \quad \rightarrow \quad CaCO_3 \quad 2H \]
the lime cycle
shell lime mortar, former inn, 31-33 North Street Windsor, NSW, 1840s
Donald Ellsmore
traditional lime kiln at Phoca, Campania, Italy

Jean-Pierre Adam [translated Anthony Matthews], Roman Building Materials and Techniques (Indiana UP, Bloomington [Indiana] 1994), p 68
lime kiln described in Cato’s *De Agricultura*, XLIV, *De Fornace Calcaria*

Adam, *Roman Building*, p 70
‘D’ lime kiln, King's Dale, NSW
Miles Lewis
conical lime kiln, Portsea, Victoria

Miles Lewis
lime kiln types according to Michael Pearson
perpetual kilns, USA

lime kiln,
Guarda,
Switzerland,
closed 1933

Miles Lewis
slaking pit, Sarah Island, Macquarie Harbour, Tasmania, ?1830s
Miles Lewis
cement and concrete in antiquity
lime plaster floor, Ayn Ghazal, Jordan, c 8100 BC

floor surface mix of baked red limestone, sand and gravel at Lepenski Vir, Serbia, c 5000 BC

wall plaster was at Catal Hoyuk, Turkey, c 5000 BC

Mud-bound concrete in tombs at Ur, Mesopotamia, c 3300 BC

concrete floor of sand, stone, broken pottery and bones, China, 3000 BC

stones bonded with gypsum mortar in Egypt, 3rd millennium BC

paving slabs set in red gypsum mortar, Phaestos, Crete, c 1600 BC
western room of a two-room house, c 8100 BC, at 'Ayn Ghazal in Jordan
Burton, *Archaeology of Jordan* p 74
paving of the later palace at Phaestos, Crete, c 1700-1450 BC, consisting of gypsum slabs set in red plaster

Miles Lewis
cocciopesto floor from the Domus Romana, Rabat, Malta
Miles Lewis
earthen floors, Europe / Australia

loam
clay
sand
gravel
quicklime
slaked lime
brick dust
anvil dust
cupola ashes
ox blood
egg white
manure
fat
yellow ochre
kopi or infusorial earth
antbed
chunam, India

shell lime
jaghery water
egg white
ghee
gypsum ribs
cross ribbed vault, Qasr Harane [Kharana], Jordan, c 710

Ignacio Arce, 'Umayyad Arches', p 197
arch with precast gypsum ribs, Ukhaidir, Iraq, 774-5
O Reuther, Ocheïdir [Leipzig 1912]
precast gypsum ribs at the Umayyad Palace of the citadel, Amman, Jordan

Arce, 'Diaphragm Arches', p 230
caravanserai near Anar, Iran: a gypsum rib

Sandy Robb
gypsum rib at a caravanserai near Anar, Iran
Miles Lewis
modern use of gypsum ribs at Meybod, Iran
the creation of gypsum ribs

Mohammad Reza Bazldjou (modified Miles Lewis)
the use of gypsum ribs

Mohammad Reza Bazldjou (modified Miles Lewis)
Roman concrete
Roman concrete at Tiddis, Algeria
Miles Lewis
Roman rubble concrete
Tomb 20 South, on the Via dei Sepolcri, Rome; Central Baths; apodyterium; wall at Terracina, c 100-90 BC with facings of *opus incertum* and rubble core

Adam, *Roman Building*, p 77
Roman theatre, Timgad, Algeria: concrete vault of the vomitorium

Miles Lewis
Porticus Aemilia, Rome, C2nd BC, detail of the opus caementicium vault

L C Lancaster, Concrete Vaulted Construction in Imperial Rome (CUP, Cambridge 2005), pl 2
pozzolana
(*pulvis puteolanus* in Latin)

a fine, sandy volcanic ash, which gives hydraulic properties to lime concrete
Baths of Trajan, AD 104-9, detail of the vault concrete

L C Lancaster, Concrete Vaulted Construction in Imperial Rome (CUP, Cambridge 2005), pl 2
Baths of Trajan, AD 104-9, components of the vault concrete

- mortar containing pozzolana rosa
- Vesuvian scoria
- tufa giallo della via Tiberina
example of *opus incertum*, Italy

Frank Sear
opus incertum,
Terracina, Italy

Frank Sear
opus reticulatum, house 21.6.6, Via del Terme, Pompeii

Frank Sear
opus reticulatum, Italy
MUAS 25,363
opus reticulatum, Italy

Hugh O’Neill
opus reticulatum in the Forum, Pompeii

Miles Lewis
Roman concrete facings

opus testaceum in a house at Timgad, Algeria

Miles Lewis
House of the Soothsayer, Nunnery complex, Uxmal, Mexico
arch bonded into rubble concrete

Miles Lewis
the rubble
concrete vault
annular vault in the pump room of the sanctuary of Aesculapius, Pergamon, Turkey, after AD 140

Miles Lewis; E Boehringer, Neue Deutsche Ausgrabungen im Mittelmeergebiet ..., 1959,
Ardashir’s Palace, Firuzabad, Iran, late AD C3rd
comparison
Firuzabad: dome detail
Palace of Diocletian,
Split, Croatia, c AD 300
North Baths, Bosra, Syria: view of the cloister vault
Miles Lewis
chamber in the Southern Baths, Bosra

J W Crowfoot, *Churches at Bosra and Samaria-Sebaste* [British School of Archaeology in Jerusalem Supplementary Paper 4] (London 1937), pl 11
Church 1, Binbirkilisse, Turkey, late 6th: north side of the nave

Miles Lewis
possible Jacobite shrine, Binbirkilisse, Turkey, late C6th: detail showing stone facing over opus coementricium
Miles Lewis
barrel vaulted building forms on Santorini

MUAS 14,664
Santorini

vaulted chamber
at Pyrgos

vaulted room at
Akrotiri

Miles Lewis
vault construction, Santorini
MUAS 14,666,14,667
erection of vaults on Capri, Italy, 1953
Fitchen, *Construction of Gothic Cathedrals*, pl 11
the homogeneous concrete vault
vaulted temple base, Terracina, Italy
Frank Sear
hypothetical process of constructing a large span Roman barrel vault

E E Viollet-le-Duc, *Dictionnaire Raisonné*
timber formwork and brick lining for concrete barrel vaults

L C Lancaster, *Concrete Vaulted Construction in Imperial Rome* (CUP, Cambridge 2005), pp 23, 29
Hunting Baths, Lepcis Magna, Libya, AD mid-C3rd

Elizabeth Feltham
Minerva Medica, Rome, c AD 260: drawing by F I Kobell (1780) before the dome fell in 1838 & isometric reconstruction

Lynne C Lancaster, Concrete Vaulted Construction in Imperial Rome (CUP, Cambridge 2005), p 163, frontispiece
Minerva Medica, vault plan showing the rib pattern [shaded parts extant]

Minerva Medica, materials in the vault
L C Lancaster, Concrete Vaulted Construction in Imperial Rome (CUP, Cambridge 2005), p 78
the Pantheon
Lewis, Architectura, p 159
the Pantheon
Lewis, Architectura, p 224
Pantheon: section with suggested centering

Adam, Roman Building, p 185
Pantheon: suggested revolving centering

E L Tarbuck [ed], *Encyclopædia of Practical Carpentry and Joinery* (2 vols, A H Payne, Leipzig, no date), pl 49
Pantheon dome from below
Frank Sear
the Pantheon: details of the dome

MacDonald, *The Pantheon*, pl 84; Frank Sear
Pantheon, detail showing dome coffering with the surface stripped.

Pantheon, showing the distribution of materials

L C Lancaster, *Concrete Vaulted Construction in Imperial Rome* (CUP, Cambridge 2005), p 65
stucco
remains of white stucco at the Temple of the Dioscuri, Agrigento, Sicily, late C5th BC

Miles Lewis; Adam, *Roman Building*, p 216
internal plaster in a Roman tomb at Palmyra, Syria

Miles Lewis
plastered vault of the basilica at the Porta Maggiore, Rome

Miles Lewis
column shaft of artificial polychrome marble: fragments of different types were placed in cavities and fixed with iron cramps sealed in lead.; from the marble depot, Ostia

Adam, *Roman Building*, p 118
30 Neiβstraße, Görlitz Germany

Miles Lewis
30 Neißstraße, Görlitz Germany: doorway

Miles Lewis
30 Neißstraße, Görlitz Germany: detail of marbling

Miles Lewis
28 Neißstraße, Görlitz
Germany:
Deteriorated stucco

Miles Lewis
No 1
Loretánská
Uličká, Prague,
early C13th

Miles Lewis
No 1 Loretánská Uličká, Prague: detail of stucco with sgraffito

Miles Lewis
Schwarzenburg Palace, Heradčany Square, Prague, C16th onwards
Miles Lewis
Schwarzenburg Palace, detail of stucco

Miles Lewis
Mereworth Castle, Kent., England, by Colen Campbell, 1723
Country Life
septaria cement nodule

Lewis, *Architectura*, p 75

MUAS 11,507
some Australian stucco surfaces
barracks building, Willow Court, New Norfolk, Tasmania, probably 1850s
'Pontville', 629-651 Blackburn Road, Doncaster, 1840s
Volunteer Arms, 51 William Street, Port Fairy, licensed 1868

Miles Lewis
Castle Howard, England, by John Vanbrugh, the hall and scagliola chimneypiece, c 1703-6

George Howard, *Castle Howard* (Castle Howard Estate Ltd, Castle Howard [Yorkshire] 1972 [1958]), pls 18, 16
the court chapel, Würzburg, Germany, by Balthasar Neumann, completed 1743

Miles Lewis