



ĀHAK II. EARLY USE OF LIME MORTARS

The earliest use of lime mortar in Iran is difficult to document because archeologists have not always made the distinction between lime mortar and gypsum (calcium sulfate) mortar (gač). Furthermore, both types of mortar may be tempered with a variety of organic and inorganic materials which affect their appearance as well as their setting time and adhesive qualities. Lime mortar may be divided into two main categories, hydraulic (able to set under water) and non-hydraulic, and these in turn may be further subdivided (for a summary of mortar types see Architectural Publication Society, *The Dictionary of Architecture*, London, 1849, IV, pp. 89-90). Roman engineers captured by the Sasanian king Šāpūr I (A.D. 242-72) apparently introduced hydraulic lime into Iran, particularly for the construction of bridges.

Non-hydraulic lime mortars appear earlier at the late Parthian (2nd-3rd cents. A.D.) sites of Qāl'a-ye Yazdegerd in Kurdistan (E. Keall, "Qal'eh-e Yazdigird: A Question of Its Date," *Iran* 15, 1977, pp. 1-2; idem, M. A. Leveque, and N. Wilson, "Qal'eh-i Yazdigird: Its Architectural Decorations," *Iran* 18, 1980, pp. 1-2, 8, fig. 5 ; and pl. IIIc), Qal'a-ye Zaḥḥāk in Azarbaijan (W. Kleiss, "Qal'eh Zohak in Azerbaidjan," *AMI* 6, 1973, p. 168), and possibly at Neh in Sīstān (U. W. Hallier, "Neh—eine parthische Stadt in Ostpersien," *AMI* 7, 1974, pp. 182-83 and pl. 39.3). The appearance of lime mortar at the Seleucid (3rd-2nd cent. B.C.) site of Āy Kānom in Afghanistan (P. Bernard, "Campagne de fouilles 1974 à Aï Khanoum (Afghanistan)," *Comptes rendus de l'Academie d'Inscriptions et*



Belles Lettres 1974, pp. 175-80, and figs. 4-8) and its reported occurrence at Seleucid Susa in Kūzestān (M. A. R. Colledge, *Parthian Art*, Ithaca, 1977, p. 28) suggest that the use of lime mortar began before the Parthian period. The discovery of slabs and bricks of a concrete-like substance in the Jemdet Nasr levels (late 4th millennium B.C.) at Uruk in southern Mesopotamia demonstrates that at least some craftsmen in a neighboring region were experimenting with a sort of lime mortar even earlier (S. Lloyd, "Building in Brick and Stone," in C. Singer, et al. eds., *A History of Technology I*, Oxford, 1958, p. 462, and H. J. Lenzen, "Nachtrag zu dem Steinstiftstempel," in "XXIII. vorläufiger Bericht über die . . . Ausgrabungen in UrukWarka, Winter, 1965," *Abhandlungen der Deutschen Orient-Gesellschaft* 12, 1967, p. 35 and pl. 21 a & b).