A PHOTOGRAMMETRIC STUDY OF THREE GUDEA STATUES*

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This study reveals the use of a consistent system of proportions in three life-size, standing statues in stone, attributed to the latest group of sculptures from the reign of Gudea of Lagash, datable to the last quarter of the third millennium B.C. This system of proportions is evidenced in a six-part division of the overall height of the body, expressed in six multiples of the length of the forearm (elbow to wrist). The correspondence between the division of the height of the image with bends in the body (roughly at the neck, waist, hips, knees and ankles) is suggested by measurement of the Gudea statues against Gudea's cubit of 24 divisions, and generally confirmed by ratios obtained with the aid of photogrammetry. These findings suggest that Gudea's statues were conceived as superimposed blocks in a six-tiered format that is most clearly and consistently expressed in stone sculpture attributed to the latest phase of Gudea's reign. During this period, when large blocks of imported diorite were exceptionally plentiful, the stone was readily cut to conform to the requirements of the prevailing artistic canon. However, earlier in the reign of Gudea, when stone was less plentiful, the sculptor sacrificed canonic proportions to material limitations. The earlier sculptor's reluctance to reduce the precious, uncut stone block to achieve a proportionally smaller image thus results in relatively short and squat statues in which the ideal six-tiered vertical format is reduced by one or two units. That standard proportions prevailed in sculpture from the classical or latest group of Gudea statuary, moreover, testifies to the implementation of artistic norms in the visual arts in an age that also sought to establish standards in other media of cultural expression.

A RECENT STUDY OF THE inscribed statues of Gudea by Horst Steible now offers definitive grounds for determination of the chronological sequence of the statues of Gudea based on formal and textual evidence.[1] The inscribed statues of Gudea, as his study shows, fall into three distinct chronological groups: early, intermediate and late. The oldest Gudea statues (statues M, N, O), which are linked by textual and formal features with antecedents from Lagash, are represented by images of relatively small dimensions,

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[1] Horst Steible's paper, "The Chronological Order of the Statues of Gudea of Lagash from the Point of View of a Sumerologist," is to appear in *JCS*. For a recent typological and statistical study of the Gudea statues, see Gudrun Colbow, *Zur Rundplastik des Gudea von Lagas* (München, 1987), which, because of its recent date, could not be consulted for the purposes of this paper or incorporated in the following bibliographical data. Colbow's book, which appeared in the series Münchener Vorderasiatische Studien (Band V), treats questions of authenticity, chronology, material of manufacture, workshop, proportions, style and sequential order. Colbow deserves high commendation for this thorough and comprehensive study. Although our projects were conducted independently of each other and followed different methods of approach, our conclusions on the sequential order of the statues and on their method of manufacture are in agreement. My method of approach differs from that adopted by Colbow in my use of metric photography toward the identification of a hypothetical

carved from heterogeneous stones, and bear dedications to the Sumerian goddess Geshtinanna, whose home was Sagub, in the outskirts of Lagash. The intermediate group (statues P, I, Q) is represented by small-scale statues carved in diorite and dolerite, and with dedication formulae that are connected with those of the earliest group, but now addressed to Gudea's tutelary god Ningishzida. The latest group is characterized by colossal and life-size diorite images inscribed with a fully developed dedication formula and addressed to Ningirsu and other leading gods of the city-state of Lagash/Girsu (statues D, A–C, E–H, K, in chronological order).

The inferences drawn from Steible's study are that the earliest inscribed statues date from a time when Gudea lacked access to the sources of Magan diorite, evidenced in the use of heterogeneous stones and small-scale statues (statues M, N, O). Then followed his initial and limited access to diorite sources, indicated by the small-scale diorite and dolerite statues of the intermediate group (statues P, I, Q). Gudea's subsequent triumphant statement on acquisition, transportation, manufacture and emplacement of diorite images, reflected in the exaggerated scale of the colossal seated statue D, is followed by the latest group of statues, produced when diorite was plentiful. The latter are represented by life-size diorite images that embody the classical form and style of the majority of Gudea's inscribed statues.

As a modest corollary to Horst Steible's brilliant and eloquent exposition, the present paper explores evidence for the use of a system of proportions in three life-size, diorite statues, two inscribed and one uninscribed, that are representative of the classical style associated with the latest phase of sculpture from the reign of Gudea. The three statues selected for the present analysis are also sufficiently similar to each other in dimension, gesture, and posture as to allow reconstruction of the missing heads, in the two inscribed examples, on the basis of their comparison with the uninscribed statue.

I

The present paper is a follow-up on an earlier study by this writer on the systems of proportions used for the depiction of the human form in the art of the ancient Near East. That study had argued that the ancient Near Eastern system of proportions in Achaemenid art, specifically that datable to the reign of Darius I (521–486 B.C.), is evidenced in the grid pattern of standard bricks used in decorated wall panels from Susa. The Achaemenid system of proportions in art, moreover, was shown to have been influenced by proportional ratios found in the Achaemenid system of linear measure. That paper concluded that, like the dimensions of the Achaemenid standard brick, proportional ratios in Achaemenid art were derived from an older Mesopotamian tradition. Although uncontested, the assumption of Mesopotamian

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standard of six head lengths. Although Colbow also sees a mathematical basis in the proportions of Gudea statues (p. 38, passim), she does not arrive at a six-part break-down of their vertical proportions. Instead, she uses a comparative study of large, rough units, i.e., the vertical lengths of torso, robe and feet, to arrive at her sequential groupings (tables 1–2). The "conspicuously plump massiveness" (quoted from Moortgat, see below) of the proportions of the small Gudea images are attributed by Colbow to the sculptors' concern for the preservation of the mass of the stone block (p. 30). On the other hand, she sees in the more realistic proportions of life-size Gudea images the sculptors' willingness to sacrifice the stone to achieve ideal, mathematically determined proportions, points with which my findings are in agreement.

For reference to a distinctive canon of proportions in the statues of Gudea, see B. L. Schlossman, "Portraiture in Mesopotamia in the Late Third and Early Second Millennium B.C.," *Archiv für Orientforschung* 26 (1978/79): 57, 60. Schlossman has noted the insistence, in statues of Gudea, on harmonically related surface patterns that are treated as a leitmotif, applied to modular referents of an underlying geometric structure. She found consistency in the relative proportions of head to shoulders, and of the modular width of the eye, nose and mouth, to the width of the face. For brief comments on the proportions of Gudea statues, see E. Strommenger, "Das Menschenbild in der altmesopotamischen Rundplastik," *Baghdader Mitteilungen* 1 (1960): 85, who attributes the exact relationship she sees between the measurements of limbs and body to the use of stone as the medium of manufacture. For a similar view, see A. Spycket, *La Statuaire du proche-orient ancien* (Leiden, 1981), 190. A. Moortgat, *The Art of Ancient Mesopotamia* (London, 1969), 62f., alludes to the evolution of an artistic canon in the art of the time of Gudea's father-in-law, Ur-Baba. He finds an element of portraiture in Gudea's statuary, with which Schlossman (op. cit., 57) and Spycket (op. cit., 190f., 194f.) are in agreement. Against the use, in ancient Near Eastern art, of portraiture, in the modern sense of a lifelike and realistic delineation of an individual, see I. Winter's review of Spycket's book, in *JCS* 36 (1984): 170f. For an early effort toward the identification of the canon of proportions in the art of the ancient Near East, see P. Albenda, "An Investigation of the Working Methods of the Ancient Near Eastern Sculptor" (M.A. thesis, Columbia Univ., 1962).

priority in the use of standard proportions in art has remained illusive.[2]

This paper seeks to test the assumption of the priority of the ancient Mesopotamian canon of proportions in art, through quantification of proportional ratios with the aid of the technique of photogrammetry. Analytical photogrammetry offers objectively verifiable measurements of proportional ratios through calculation of coordinates in an arbitrary coordinate system. This method of measurement is especially appropriate for determination of proportional ratios in monumental stone sculpture in the round, which lacks obvious proportional guidelines, such as those provided by the grid pattern of decorated brick panels.[3] Test samples for this study have been selected from the latest group of Neo-Sumerian stone sculpture from the reign of Gudea of Lagash, datable to the last quarter of the third millennium B.C. The aim of the present study is to determine proportional ratios in three diagnostic statues that, as *pars pro toto*, may be expected to represent the standards that prevailed in the visual arts of the age. The samples selected for study are three standing statues of Gudea, two inscribed statues, statues A and E, in the Louvre Museum, and one uninscribed statue, BM 122910, in the British Museum.[4] These statues are distinguished by the use of diorite and dolomite as media of manufacture, and by their life-size dimensions and standing postures. Statues A and E are also linked by their dedicatory formulae and Sumerian phraseology which, according to Horst Steible's study, place them firmly within the last group of inscribed statues from the reign of Gudea.[5] Although uninscribed, BM 122910 is included in the present study because of its close similarity to statues A and E in terms of scale, posture, and style, and because it remains the only statue with these particulars that has been assembled with a matching head. BM 122910 is thus used here to aid in a tentative reconstruction of the heads on the two inscribed, headless statues under study.[6]

II

The use of Gudea statuary as a test case for determination of the system of proportions used for the depiction of the human form in the art of the ancient Near East is appropriate for the following reasons. The statues of Gudea, which are known in remarkably large numbers, remain in a relatively good state of preservation and come largely from a known archaeological context.[7] All the inscribed Gudea stat-

[2] G. Azarpay, W. G. Lambert, A. D. Kilmer, W. J. Heimpel, "Proportional Guidelines in Ancient Near Eastern Art," *JNES* 46 (1987): 183–213.

[3] On the use of photogrammetry for measurement of sculpture, see E. Guralnick, "The Proportions of Kouroi," *AJA* 82 (1978): 470f.; idem, "The Proportions of Korai," *AJA* 85 (1981): 463f.; idem, "Profiles of Kouroi," *AJA* 89 (1985): 409; Shinji Fukai et al., *Taq-i Bustan* III: *Photogrammetric Elevations*, The Tokyo University Iran-Iraq Archaeological Expedition, Report 19 (Tokyo, 1983); J. Davis-Kimball, "The Canon of Proportions in Achaemenid Art" (Ph.D. diss., Univ. of California, 1988).

[4] For *statue A* (Louvre AO 8, "petite statue debout"), see Flemming Johansen, *Statues of Gudea: Ancient and Modern*, Mesopotamia, Copenhagen Studies in Assyriology 6 (Copenhagen, 1978), 7–8; E. Strommenger, "Gudea (B. Archäologisch)," *RLA* (1971): 681. For *statue E* (Louvre AO 6, "statue aux larges épaules"), see Strommenger, "Gudea," 681; Johansen, *Statues of Gudea*, 9. For *BM 122910*, see Johansen, *Statues of Gudea*, 22, nn. 63f.; Schlossman, "Portraiture in Mesopotamia," 56–60.

[5] Steible, "The Chronological Order of the Statue of Gudea," op. cit.

[6] *BMQ* 6.2 (1931): 31f.; Schlossman, "Portraiture in Mesopotamia," 56–60; Johansen, *The Statues of Gudea*, 22, erroneously associates BM 122910 with another Gudea torso, bearing the inscription BM 92988, in the British Museum. The imprecise joining of the surface of the head and torso of BM 122910, commented upon by Johansen (op. cit., 22), may be expected to have resulted from chipping of the surface along the sharp edges of the fracture after separation of the head from the torso. The only Gudea head that has been joined to a matching body from controlled excavations is the small-scale statue I, which belongs to the intermediate group of inscribed Gudea statues, and, hence would be inappropriate for use toward reconstruction of the head in the statues A and E, datable to the latest group of Gudea sculptures. The head of statue I (Louvre AO 41091), "petite statue assise, complète") from Tell V, Tello, was uncovered by de Sarzec in 1898, the body by Cros in 1903, see L. Heuzy, *Catalogue des antiquités chaldéennes* (Paris, 1902), no. 56; Strommenger, "Gudea," 682; Johansen, *Statues of Gudea*, 11.

[7] E. de Sarzec et al., *Découvertes en Chaldée* I–II (Paris, 1884). A. Parrot, *Tello, vingt campagnes de fouilles (1877–1933)* (Paris, 1948); A. Falkenstein, *Die Inschriften Gudeas von Lagaš*, Analecta Orientalia 30 (Rome, 1966): 177–88; idem, "Gudea," *RLA* (1971): 676–79; Strommenger, "Das Menschenbild," 103; idem, "Gudea," 680–87; Schlossman, "Portraiture in Mesopotamia," 56–65; Spycket, *La Statuaire du proche-orient ancien*, 184–94.

ues found in supervised excavations are of diorite, the hard and valued "stone of Magan," of generally dark color.[8] The majority are life-size statues, generally over one meter in height, with a few that are a little less than half that size.[9] The dedication formulae inscribed on the statues indicate that they were originally destined for emplacement in the numerous temples built, refurbished, or renovated by Gudea for some 19 gods of the Sumerian pantheon.[10] The statues date to a period of at least eleven years when Gudea ruled as *ensi* of the Second Dynasty of Lagash, founded by Ur-Bau, Gudea's predecessor and father-in-law. Gudea, whose reign perhaps preceded and overlapped with that of Ur-Nammu, of Ur (2111–2098 B.C.), was succeeded by his son and grandson, Ur-Ningirsu and Pirigme, whose dynasty ended with the defeat of its last ruler Nammahni by Ur-Nammu.[11]

III

The quantification of the Neo-Sumerian system of linear measure is graphically illustrated on two well-known statues of Gudea, from Tello, in the Louvre. Statues F and B, known as "Architect à la règle," and "Architect au plan," respectively, depict the seated ruler with a tablet on his lap with a stylus for right-handed use, and a graduated rule placed on the upper edge of the tablet (broken in statue B).[12] Whereas the blank tablet on Gudea's lap in statue F is thought to express the ruler's expectation of inspiration and divine instruction, the completed plan displayed on the tablet in statue B may attest to the realization of the plan and construction of a temple that, according to the statue's inscription, was dedicated to the goddess Gatumdug.[13] The rule, depicted on the tablets in statues F and B, records Gudea's cubit of 24 fingers. The scale of the rule shows 16 nominally equal divisions, or fingers, with a total length of 269mm, and an average length of 16.6mm (.66″) for each division. Five of the divisions on Gudea's rule are further subdivided into fifths, fourths, thirds and halves. The rule of 16 fingers corresponds with the Sumerian two-thirds (of a cubit) measure, which may be reckoned by means of 6 hands placed next to each other (exclusive of thumbs).[14]

Measured against Gudea's cubit of 24 fingers, a composite of the three standing statues of Gudea under study (fig. 1) shows that the overall height of the figure may be expressed in six multiples of the length of the forearm (here measured from the inside of the elbow to wrist).[15] The similarity in proportional ratios between the three statues under study permits tentative reconstruction of the head in the inscribed statues A and E, by reference to the assembled head and torso of the uninscribed statue in the British Museum. The breakdown of the six divisions of the body, suggested by the major subdivisions of Gudea's cubit is as follows. The *head* (crown to chin/neckline), *upper torso* (chin/neckline to elbow, marked by the tip of the line of the inner elbow, or the lowest line of the fanned pleats on the draped arm), *upper legs* (buttocks to knees, measured vertically), *lower legs* (knees to hemline), and *hemline to baseline*. Since the knees are not visible under the garment, their position is here arbitrarily assigned to a point midway between buttocks and hemline. The six divisions of the body noted here correspond with the bends in the body, roughly at the neck, waist, hips, knees, and ankles. Photogrammetric measurements obtained, where possible, for the same six divisions, in the three statues

[8] Johansen, *Statues of Gudea*, 16, 33. For the identification Magan, of Ur III sources, with Oman, see W. J. Heimpel, "Das Untere Meer," *ZA* 77 (1987): 22–49, 60, 69f.

[9] Johansen, *Statues of Gudea*, 33. There is discrepancy between measurements of the height of statues A and E, given by Johansen (*Statues of Gudea*, 7, 9), and those obtained through photogrammetry. The height of statues A and E are reported by Johansen as 1.24m and 1.42m, respectively, and photogrammetrically determined as 1.14m and 1.32m.

[10] Falkenstein, *Die Inschriften Gudeas*, 174–77; Strommenger, "Gudea," 681f.

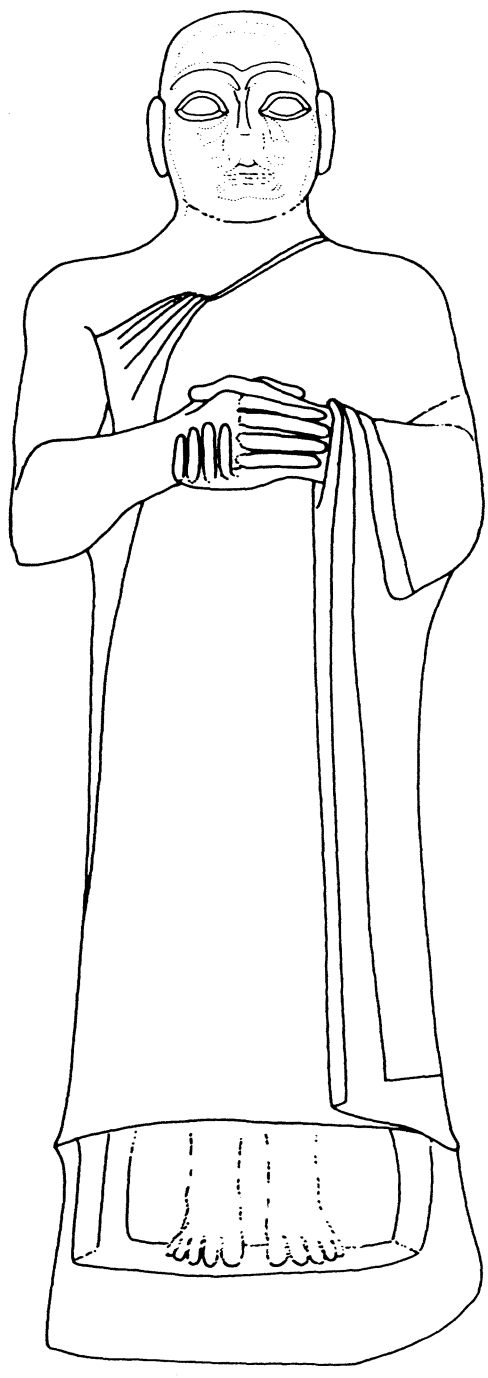
[11] P. Steinkeller, "The Date of Gudea and his Dynasty," *JCS* (1988).

[12] Parrot, *Tello*, 161, 163; Strommenger, "Gudea," 682; Johansen, *The Statues of Gudea*, 10–11.

[13] Parrot, *Tello*, 161, 163.

[14] De Sarzec et al., *Découvertes en Chaldée* II, 192, pl. 15; M. A. Powell, "Sumerian Numeration" (Ph.D. diss., University of Minnesota, 1971), 128; idem, "Ancient Mesopotamian Weight Metrology," in *Alter Orient und Altes Testament* 203: *Studies in Honor of Tom B. Jones* (Neukirchen-Vluyn, 1979), 77f.

[15] On the cubit of Gudea, see Powell, "Ancient Mesopotamian Weight Metrology," 77f. The elbow to wrist measure, comparable to the Egyptian canonic two-thirds of a cubit measure, may have been used in the Gudea sculpture as a metaphor for, rather than a literal expression of, the cubital forearm (the distance from elbow to the tip of the medius); cf. E. Iversen, *Canon of Proportions in Egyptian Art*, 2nd ed. (Warminster, 1975), 29.



Crown to Chin/Neckline:
BM 122910 22.1 cm

Chin/Neckline to Base of Block:
Average 123.0 cm
Statue A 114.0 cm
Statue E 132.0 cm

Chin/Neckline to Inner Elbow Line:
Average 20.9 cm
BM 122910 23.1 cm
Statue A 19.0 cm
Statue E 20.6 cm

Chin/Neckline to Base of Left Hand:
Average 26.2 cm
BM 122910 26.5 cm
Statue A 23.4 cm
Statue E 28.8 cm

Outer Elbow to Wrist:
Average 25.6 cm
BM 122910 23.5 cm
Statue A 23.7 cm
Statue E 29.7 cm

Base of Left Hand to Buttocks:
Average 23.8 cm
Statue A 21.8 cm
Statue E 25.9 cm

Base of Left Hand to Hemline:
Average 71.5 cm
Statue A 65.4 cm
Statue E 77.6 cm

Buttocks to Knees:
Average 23.8 cm
Statue A 21.8 cm
Statue E 25.9 cm

Knees to Hemline:
Average 23.8 cm
Statue A 21.8 cm
Statue E 25.9 cm

Hemline to Baseline:
Average 25.4 cm
Statue A 24.9 cm
Statue E 25.9 cm

Fig. 1. A composite drawing of statues A and E, in the Louvre, and BM 122910, in the British Museum, measured against Gudea's cubit of 24 divisions. Measurements of modular units, obtained through photogrammetry, are indicated in corresponding sections of the image. Drawn by Jane Becker after photographs prepared by David de Vries.

under study, yield ratios that approximate 1:1:1:1:1:1, for, head : upper torso : lower torso : upper legs : lower legs : hemline to baseline.[16]

These findings suggest that the human form in stone sculpture from the latest phase of Gudea statuary, exemplified by the images measured in this study, was conceived as tiers of six superimposed units, or building blocks, with a 1:6 ratio of head to total height. This proportional ratio, however, was subject to modification in small-scale statues, from the early and intermediate groups of Gudea statuary, where a 1:4 and a 1:5 ratio of head to body is seen to prevail. It would be superfluous to give detailed and precise measurements of these boldly segmented statues, which are made of units clearly divided at the bends of the neck, waist, hips, knees and ankles. The explanation for the peculiar proportions of these awkwardly short and squat statues must be sought in the Neo-Sumerian sculptor's reverence for stone, especially for the noble diorite absent among the stones used in the earliest group of Gudea statues. Diorite was initially imported to Lagash in small quantities during the intermediate phase of sculpture from Gudea's reign. The reluctance to reduce the integrity of the imported, uncut stone block on the part of the sculptors of the intermediate group may thus account for the elimination, in the small-scale Gudea statues, of one or two vertical units from the standard six-tiered format. Moreover, if, as suggested by Heimpel, diorite was collected and shipped to Lagash in the form of boulders, rather than cut to precise specifications in quarries, then the natural shape of the boulder may have influenced the format of the image carved from it.[17] Rather than reduce the width of the boulder to produce proportionally smaller statues of canonic six head-lengths, the carvers of the early and intermediate phases appear to have modified standard proportions to preserve the integrity of the stone boulder.

The point to be made is that the rarity and value of stone, especially of diorite, as material of manufacture during the early and intermediate phases of sculpture in the reign of Gudea led the Neo-Sumerian artist to subordinate the ratios of the prevailing artistic canon to the priorities of the stone medium. That standard proportions prevailed in the majority of sculptures in the classical, or late group of Gudea statues, moreover, testifies not only to the increasing abundance of diorite in Gudea's later years, but also to the implementation of artistic norms in the visual arts in an age that also sought to establish standards in other media of cultural expression.

[16] Since the statue and its base were carved from the same block of stone, the height of the base, or platform, was evidently reckoned in the overall height of the image and in calculation of height/width ratios; cf. the divisions of height of the image, inclusive of base, in ancient Egypt, as evidenced in representations of divisions of scaffolds built during the process of the carving of statues, recorded in a painting from the tomb of Rekhmire, Western Thebes, ca. 1430 B.C. See Norman de Garis Davies, *The Tomb of Rekh-mi-Rē'* I, The Metropolitan Museum of Art Egyptian Expedition (New York, 1943; repr. Arno Press, 1973), pl. 60. On the importance of the base/throne in Gudea's imagery, cf. specific references to the building, by Gudea, of thrones for cult images in inscriptions on statues A and E (see Barton, *The Royal Inscriptions of Sumer and Akkad*, 181, 193f.). For measurements of modular units, obtained through photogrammetry for the three statues of Gudea under study, see fig. 1. Photogrammetric measurements of fractions of the modular "cubit," used for the proportions of details of the head and bodies, were also obtained by the photogrammetric firm of Hammon, Wallen, Jensen, and Associates, Inc. However, the smaller ratios have been omitted from the set of measurements given in fig. 1. The latter treat only large modular units.

[17] W. J. Heimpel, "Das untere Meer," *ZA* 77 (1987): 22–49, 60, 69f., appendix. The precision of proportional ratios, notable in even small details of Neo-Sumerian sculpture in the round, may indicate the use of area measures, in square cubits, reached by multiplication of length and width/breadth distances; cf. reference to the use of area measures in Neo-Assyrian statues that were covered with gold leaf, S. Dalley, J. N. Postgate, "The Tablets from Fort Shalmaneser," *Cuneiform Texts from Nimrud* III, The British School of Archaeology in Iraq (Oxford, 1984), 158–63. I wish to thank Professor Wolfgang Heimpel for this reference.