New Light on the Siloam Tunnel Inscription

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Abstract: The literature relating to the discovery and recording of the Siloam Tunnel is reviewed and the most recent scientific dating analysis is described. A date of 700BC or before for the tunnel is now almost certain. A discussion of the technical terminology in the tunnel inscription leads to the conclusion that the workmen who excavated the tunnel probably used picks, or axe like implements, rather than chisels.

Recent physical analysis of materials has thrown new light on one of the best known ancient Hebrew inscriptions. The Siloam Inscription was located in a water tunnel which runs south-westwards from a spring ('Ain Sitti Maryam, known as the Virgin's Spring, probably the Gihon Spring mentioned in 2 Chronicles 32:30) at the northeast corner of the most ancient part, the Ophel Hill, of Jerusalem. The tunnel follows a somewhat irregular course from the spring to the southwest corner of Ophel Hill where it debouches into the Pool of Siloam (Figure 2).

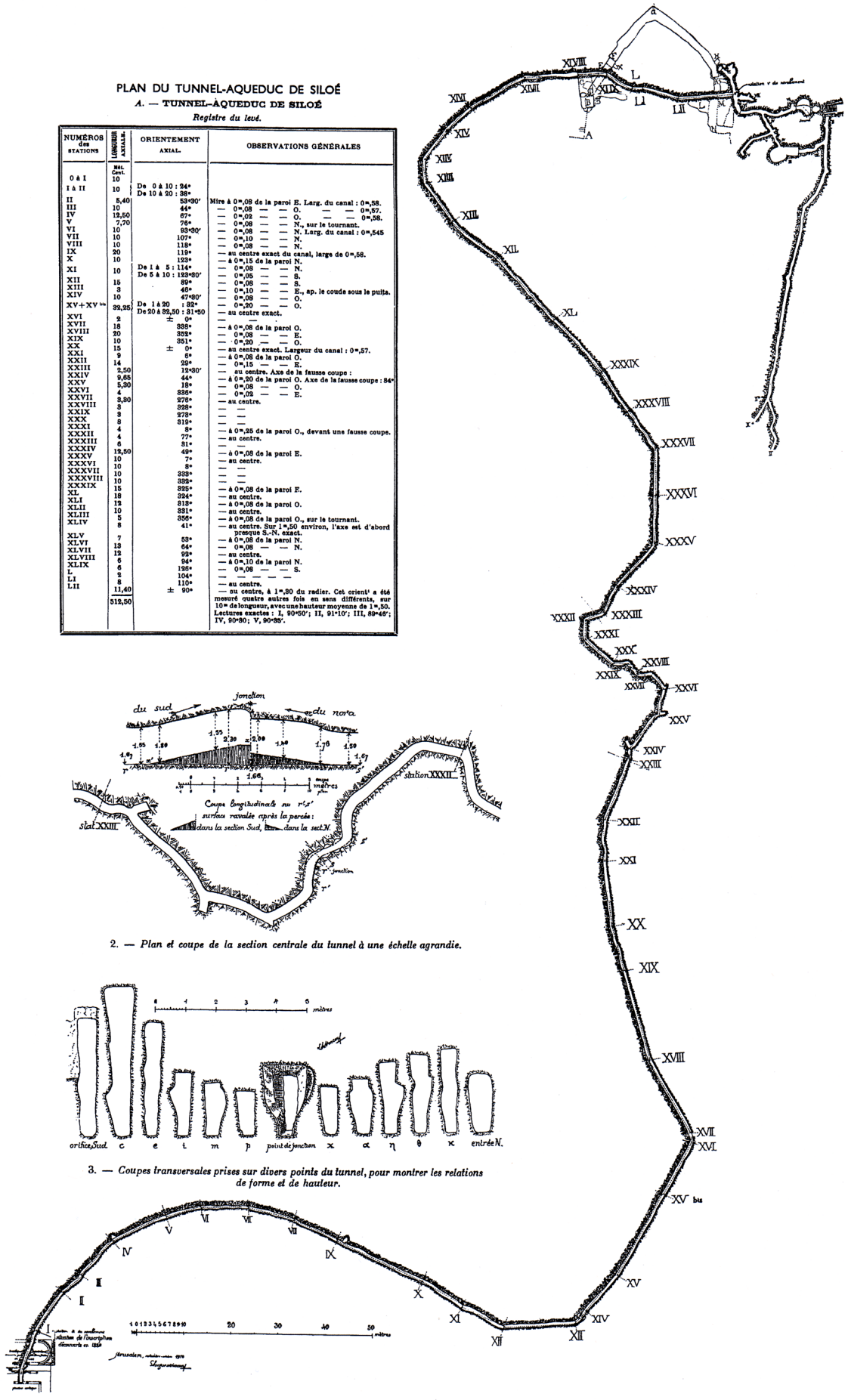
George Adam Smith gives a description of the water system in *The Topography, Economics and Historical Geography of Jerusalem* (1907: 87-98) and J. Wilkinson gives a convenient account of the pool in New Testament times with reference to its earlier history (1978: 104-108). A modern report on the tunnel is given by D. Gill (1996: 18-22) in the course of his more general article on the geology of the City of David and its ancient subterranean waterworks.

The inscription, which was situated on the east wall of the tunnel about 19 feet in from the lower pool, was first noticed in 1880 when, according to Conrad Schick (known particularly for his model of the Temple in the time of Herod), one of his pupils fell into the water. Schick promptly entered the tunnel to inspect the inscription and found that the lower part was below the water line, so debris had to be cleared from the bottom to lower the level. He found also that, as he put it, "a deposit of silicate" had covered the inscription, making it very difficult to take a paper squeeze (*papier-mâché* impression). He published an announcement of the discovery in the *Quarterly Statement of the Palestine Exploration Fund* (1880: 238-39).

In the *Quarterly Statement* for the following year Lieutenant Claude Conder of the Royal Engineers, who was on detachment to the Palestine Exploration Fund to work on the Western Survey, reported that Hermann Güthe, of the German Palestine Society (Deutscher Palästina Verein), had succeeded in taking several paper squeezes and a gypsum cast of the inscription (1881: 197-99). In the same volume Archibald Henry Sayce, who was very prominent at the time in expounding discoveries of this kind, published a preliminary translation (1881: 282-85).

In 1890 the inscription was hacked out of the rock wall, and, since at that time Palestine formed part of the Ottoman Empire, it was taken to Istanbul where it is now held in the collections of The Museum of the Ancient Orient

Figure 1: *The Siloam Inscription now in the Istanbul Museum. Photo: the editor 1973*



PLAN DU TUNNEL-AQUEDUC DE SILOÉ

A. — TUNNEL-AQUEDUC DE SILOÉ

Registre du levé.

NUMÉROS des STATIONS	LONGUEUR AXIALE.	ORIENTEMENT AXIAL.	OBSERVATIONS GÉNÉRALES
	Mèt. Cent.		
0 à I	10		
I à II	10	De 0 à 10 : 24°	
		De 10 à 20 : 38°	
II	5,40	53°30′	Mire à 0m,08 de la paroi E. Larg. du canal : 0m,58.
III	10	44°	— 0m,08 — — O. — — 0m,57.
IV	12,50	67°	— 0m,02 — — O. — — 0m,58.
V	7,70	76°	— 0m,08 — — N., sur le tournant.
VI	10	93°30′	— 0m,08 — — N. Larg. du canal : 0m,545
VII	10	107°	— 0m,10 — — N.
VIII	10	118°	— 0m,08 — — N.
IX	20	119°	— au centre exact du canal, large de 0m,58.
X	10	123°	— à 0m,15 de la paroi N.
XI	10	De 1 à 5 : 114°	— 0m,08 — — N.
		De 5 à 10 : 123°30′	— 0m,05 — — S.
XII	15	89°	— 0m,08 — — S.
XIII	3	46°	— 0m,10 — — E., ap. le coude sous le puits.
XIV	10	47°30′	— 0m,08 — — O.
XV+XV bis	32,25	De 1 à 20 : 32°	— 0m,20 — — O.
		De 20 à 32,50 : 31°50	— au centre exact.
XVI	2	± 0°	— —
XVII	18	338°	— à 0m,08 de la paroi O.
XVIII	20	352°	— 0m,08 — — E.
XIX	10	351°	— 0m,20 — — O.
XX	15	± 0°	— au centre exact. Largeur du canal : 0m,57.
XXI	9	6°	— à 0m,08 de la paroi O.
XXII	14	29°	— 0m,15 — — E.
XXIII	2,50	12°30′	— au centre. Axe de la fausse coupe :
XXIV	9,65	44°	— à 0m,20 de la paroi O. Axe de la fausse coupe : 84°
XXV	5,30	18°	— 0m,08 — — O.
XXVI	4	336°	— 0m,02 — — E.
XXVII	3,80	276°	— au centre.
XXVIII	3	328°	— —
XXIX	3	278°	— —
XXX	3	315°	— —
XXXI	4	8°	— à 0m,25 de la paroi O., devant une fausse coupe.
XXXII	4	77°	— au centre.
XXXIII	6	31°	— —
XXXIV	12,50	49°	— à 0m,08 de la paroi E.
XXXV	10	7°	— au centre.
XXXVI	10	0°	— —
XXXVII	10	338°	— —
XXXVIII	10	332°	— —
XXXIX	15	325°	— à 0m,08 de la paroi E.
XL	18	324°	— au centre.
XLI	12	313°	— à 0m,08 de la paroi O.
XLII	10	331°	— au centre.
XLIII	5	356°	— à 0m,08 de la paroi O., sur le tournant.
XLIV	8	41°	— au centre. Sur 1m,50 environ, l'axe est d'abord presque S.-N. exact.
XLV	7	53°	— à 0m,08 de la paroi N.
XLVI	13	64°	— 0m,08 — — N.
XLVII	12	92°	— au centre.
XLVIII	6	94°	— à 0m,10 de la paroi N.
XLIX	6	126°	— 0m,08 — — S.
L	9	104°	— — — —
LI	8	110°	— au centre.
LII	11,40	± 90°	— au centre, à 1m,30 du radier. Cet orient[n] a été mesuré quatre autres fois en sens différents, sur 10m de longueur, avec une hauteur moyenne de 1m,50. Lectures exactes : I, 90°50′; II, 91°10′; III, 89°48′; IV, 90°30′; V, 90°35′.
	512,50		

2. — *Plan et coupe de la section centrale du tunnel à une échelle agrandie.*

3. — *Coupes transversales prises sur divers points du tunnel, pour montrer les relations de forme et de hauteur.*

Figure 2: *The plan from Vincent (1954:pl. LXV) based on a survey illustrating the sinuous path of the tunnel from the Gihon Spring (top right) to the Pool of Siloam (bottom left) where the inscription was found. The survey traverse data and sections are also given.*

Figure 3: *The start of the tunnel at the Gihon Spring. Photo: the editor 1974.*

(formerly Imperial Ottoman Museum) (Figure 1). Parts of the inscription are damaged, but, as a tracing made in 1881 by Lieutenants Conder and Mantell of what could be made out of the inscription *in situ* shows,[1] it was already in this damaged condition before it was removed. They had found it difficult to discern the details because of a layer of lime (calcite) which had formed over it, but they cleared some of this off with hydrochloric acid.

The language of the inscription was recognized as Hebrew by Sayce and others, and seen to be of great interest. It has been familiar to generations of English-speaking students of Hebrew since a copy and a transcription into the Square Hebrew script were included in the English edition published in 1910 of the Hebrew Grammar of the great German Hebraist Wilhelm Gesenius, for long the standard reference grammar (Kautzsch 1910: 9f) (Figure 4). It describes the inscription, provides a bibliography and includes the script of the inscription in a Table of Alphabets (Kautzsch 1910:xvif). Three years later a photograph, a transcription into the square Hebrew script, a translation together with philological notes on it were provided by S.R. Driver, with characteristic thoroughness, in his standard commentary on the Hebrew text of the books of Samuel (1913:viii-xi).[2] He noted that "The Hebrew is as idiomatic, and flowing, as a passage from the Old Testament"(Driver 1913: x), but while he commented that it had generally been assigned to the time of Hezekiah, he referred to other opinions put forward at the time that it was actually to be dated in the period of Simon son of Onias in about 220 B.C. or even by some to the time of Herod.

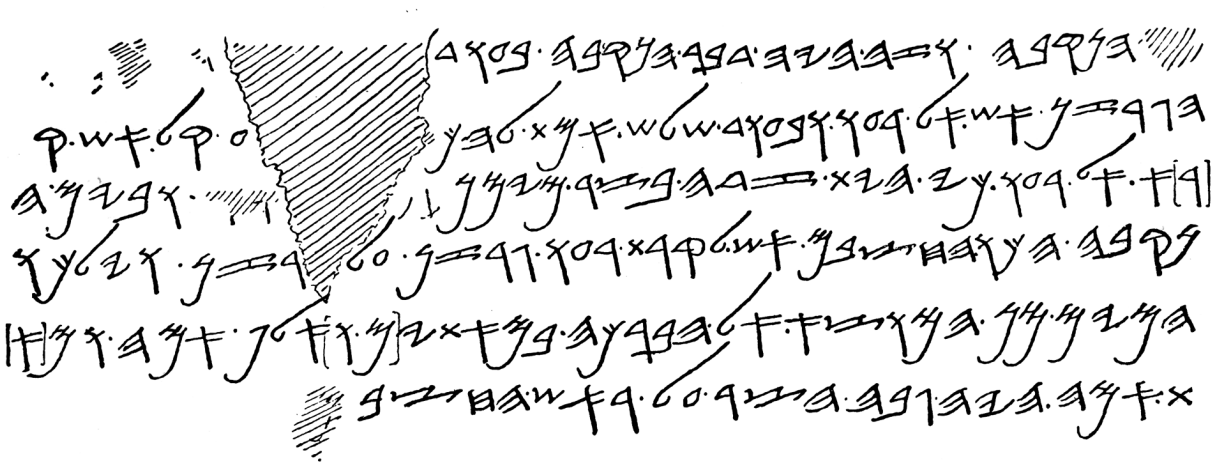
The inscription has been published frequently since, for example there are translations with introductory notes by W.F. Albright in Pritchard (1955: 321); N.H. Snaith in "the poor man's Pritchard" (Thomas 1958: 209-11); and the text is given conveniently with translation and philological notes in Gibson's *Syrian Semitic Inscriptions* (1971: 21-23); and recently with a thorough treatment by Renz (1995: 178-189).

The inscription describes the cutting of the tunnel, and since, unlike many monumental inscriptions of this type, it does not name any king,[3] its dating has depended on the palaeography of the script and on its presumed connection with references in the Old Testament to the cutting of a water channel in the time of Hezekiah (2 Kings 20:20; 2 Chronicles 32:3-4, 30). On these bases, it has been generally agreed that it should be dated to about 700 B.C. (Mitchell 1991: 356-359).

The new physical evidence makes use of two techniques, radiocarbon dating of organic material, and radioactive thorium and uranium dating of calcite speleothems formed by water seeping through the rock (Frumkin 2003:169-71; *Biblical Archaeology Review* Nov/Dec 2003:18). A speleothem is defined as "a naturally formed, unitary, coherent body of mineral matter which has been deposited within a cavern or cavern space subsequently to the development of such space, and at least a portion of the substance of which has been precipitated from solution ..." (Wyatt 1986: 294).

The organic matter, notably a fragment of wood and part of a plant, was found in borings into the floor of the tunnel, which had been plastered over in antiquity to counter the seepage away of water through fissures in the rock. Radiocarbon dating of these samples gave a figure of 2620 ± 35 years BP (Before the Present) = 822-796 B.C. for the wood, and 2505 ± 35 years BP = a range between 790-760 and 690-540 B.C. for the plant fragment.

Samples from the speleothems which had formed on the walls and ceiling of the tunnel as a result of water percolating through fissures in the limestone were tested for radioactive thorium and uranium, giving dates of 2317 ± 18 years BP = 332-286 B.C.



[תם .] הנקבה . וזה . היה . דבר . הנקבה . בעוד . . . .
הגרזן . אש . אל . רעו . ובעוד . שלש . אמת . להנ[קב] . . קל . אש . ק
רא . אל . רעו . כי . היתּ . זדה . בצר . מימן . . . . . ובים . ה
נקבה . הכו . החצבם . אש . לקרת . רעו . גרזן . על . גרזן . וילכו
המים . מן . חמוצא . אל . הברכה . במאתים . ואלף . אמה . ומ(א)
ת . אמה . היה . גבה . הצר . על . ראש . החצב[ם]

Figure 4: *A hand copy of the Siloam Inscription and a transliteration into the square Hebrew script. From Kautzsch (1910:xvif)*

The radiocarbon date of about 800 B.C. for the fragment of wood might show only that the tunnel had been cut at some time after that date, but, as the authors of the article point out, trees more than a hundred years old are rare in Palestine, so a date a little before or around 700 B.C. is likely, and this conclusion is supported by the broad range of dates between 790 and 540 B.C. for the plant fragment. The formation of speleothems would probably have taken many years after the cutting of the tunnel so the range of thorium-uranium dates in about 332-286 B.C. would not clash with a date around 700 B.C.

With this confirmation of what has long been assumed to be the actual date of the inscription, it is worth having a look at some points in it. It indicates that two teams of workmen cut their way through the rock from opposite ends, finally meeting more or less in the middle. In the last stages, when, as the inscription says, they were three cubits (שלש אמת: *šlš. 'mt*) apart, the voice of each calling to his fellow (רעו אל קל אש קרא: *ql. 'š.qr'. 'l.r'w*)[literally "voice of (*ql*) man (*'š*) calling (*qr'*) to (*'l*) his companion (*r'w*)"] could be heard and when they finally met it was implement against implement (גרזן על גרזן: *grzn. 'l.grzn*) and the water flowed from the source (מוצא: *mws'*) to the pool (ברכה: *brkh*), 1200 cubits (במאתים ואלף אמה: *bm'tym.w'lp. 'mh* [literally "in" (*b-*) + "hundred" (*m't*) + "two" (*-ym* (dual termination)) "and" (*w*) + "thousand" (*'lp*) "cubits" (*'mh*)].

This last detail provides a useful clue to the value of the cubit in ancient Israel. The word *'mh* is found many times in the Old Testament (vocalised as *'ammāh*) with the meaning "cubit", mostly in descriptions of the making of the tabernacle, the temple, and Ezekiel's temple in Exodus 25-38, 1 Kings 6-7, 2 Chronicles 3-4 and Ezekiel 40-43. This is the only rendering of *'ammāh* in most English versions, but usage in other languages makes it clear that it's primary meaning was "forearm"(Dhorme 1963: 143) and it has been suggested that an instance of this meaning is found in Psalm 91:4, where the consonants אמתו: *'mtw* could be read with the vowels *'ammātō*, "his arm", instead of *'ămittō* "his truth" (Authorised Version) and "faithfulness" (New International Version) which appears in the Masoretic text. This remains a speculation, but it is reasonable, and has been adopted for instance in *The Revised Psalter* (London, 1964) although there are other suggestions (Dahood 1968: 331).

Hebrew *'ammāh* has a clear cognate in Akkadian (Babylonian-Assyrian) *ammatu* which had the meaning "cubit" in most contexts. In a limited number of instances it is clear that the correct rendering is "forearm"(Oppenheim 1968: 70-75) and, further, in Ugaritic there is a rare occurrence of *'amt* in a context where it is reasonable to translate it "forearm". For example, in a passage in the Epic of Keret the hero is told by the god El to wash his hands to the *'amt*, probably the elbow (Gibson, 1978: 83, line 63). The English word "cubit" is itself appropriate for this unit of measurement, since it derives from Latin *cubitum*, "arm; distance from the elbow to the middle finger".

Figure 5: *The Pool of Siloam. The tunnel exit is under the right side of the arch behind the standing figure. Photo: the editor 1974.*

While a cubit was the length of a man's forearm, men come in various sizes so this can indicate only a general not a precise value. The length of a Babylonian cubit (*ammatu*) in about 2000 B.C., at that time Sumerian *kùš* (Borger 1978: sign no.38; 2003: sign no.490) is known from a statue of the ruler Gudea who is shown seated with a flat space on his knees prepared for the plan of a building, but with a graduated builder's rule already carved on it measuring a total of 27cm (10.64 inches), or 26.5 cm (10.44 inches) to the last marked graduation (de Sarzec 1884-1912: 136-38, II, pl.15.2 and 3; Parrot 1948: 163 no.6; pl.XIV.b and d lower). This presumably represents half a cubit of 54 or 53 cm (21.28 or 20.88 inches), and this value of the cubit is also evident in the cuneiform texts during the second millennium B.C. In the Neo-Babylonian period (mid- to late first millennium B.C.) the length of the *ammatu* stood at only about 40 cm (15.76 inches), the longer standard being referred to at that time as *ammatu rabītu*, "great cubit" (Oppenheim 1968: 75; Borger 1978: 342).

There is good evidence for the value of the cubit in Egypt from actual builders' rules, an average measurement of which gives a length of 52.3 cm (20.6 inches). Carter refers to graduated rules measured by him (1917: 130-58). But Arnold argues, on the basis of measurements of actual buildings, that 52.5 cm is a more correct figure for the Egyptian cubit (1991: 10; 251-52; 2003: 61).[4] Another interesting indication is found in a papyrus giving details, including dimensions, of a royal tomb which was almost certainly that of Ramesses IV. Matching the dimensions on the papyrus with the corresponding measurements in the actual tomb of Ramesses IV gives a value of 52.3 or 52.31 cm (20.60 or 20.61 inches). (The actual measurements made by Carter are arranged in columns opposite the papyrus measurements, Carter and Gardiner 1917: 149-156).[5] The Egyptian cubit (*mh*)[6] was reckoned to consist of seven palms (or handbreadths) (Faulkner 1962: 113; Gardiner 1957: 199, §266.2).

The measured length of the Siloam tunnel is 533 meters, (Gill 1996: 18-19)[7] so 53300 ÷ 1200 = 44.41 cm (17.50 inches). This is rather smaller than the lengths mentioned above from Babylonia and Egypt, but, bearing in mind the likelihood that 1200 is an approximation rather than an exact figure and that it would have been difficult to obtain an accurate measurement through the twisting course of the tunnel, precise accuracy is not to be expected. The difference between the Siloam cubit and the Babylonian and Egyptian dimensions amounts, however, to something like 1/6 of the lesser figure, that is to say 44.41 ÷ 6 = 7.4, while 7.4 x 7 = 51.8, a figure not far from those of the Babylonian and Egyptian cubits. This numerical relationship corresponds to that found in Babylonia in Neo-Babylonian times, and there may be reference to it in Ezekiel's vision of a new temple, where a measuring rod is referred to as, literally, "of six cubits in the cubit and the handbreadth" (*šēš-'ammôt bā 'ammāh wāṭōpaḥ*), i.e. indicating a cubit longer by one handbreadth, or palm, (*ṭōpaḥ*) than the standard (Ezekiel 40:5), a passage rendered by the NIV, "six long cubits, each of which was a cubit and a handbreadth." That is to say, if the Babylonian and Egyptian dimensions suggest a common international standard of seven handbreadths, the cubit used to measure the Siloam tunnel may represent a cubit of six, i.e. shorter by one handbreadth, and the one referred to by Ezekiel the longer international standard.

The word גרזן: *grzn* in the inscription, tentatively translated "implement" above, raises some questions. It occurs four times (vocalised *garzen*) in the Old Testament (Deuteronomy 19:5; 20:19; 1 Kings 6:7; Isaiah 10:15). It has a clear Semitic etymology in the verb *grz*, "to cut",[8] and the references in Deuteronomy show that it could be used to cut down trees, while the passage in Kings, like the inscription, refers to working stone. The passage in Isaiah does not add further to the definition. It is probable that the noun is found as a Semitic loanword *qrḏn* (in which *ḏ* = *dj*) in Egyptian (Hoch 1994: 303f no.438), where one reference indicates that it was a tool used in making a tomb, presumably indicating again that it could work stone.[9] The Old Testament references and the extra-Biblical sources thus show that it was a chopping or hacking implement which could be used for working either wood or stone. This may indicate that it was a generic rather than a specific

term. Artefacts from Palestinian excavations show that by the 8th century B.C. iron weapons and implements were outnumbering bronze, and this situation is reflected in references in the Old Testament (Mitchell 1982: 449-50). Two instances relating to the 9th (2 Kings 6:5-6) and 8th (Isaiah 10:34) centuries refer to an implement or implements described only by the word "iron" (*barzel*), used for cutting down trees, and therefore usually translated "axe".

The question arises therefore, whether the implements used for the tunnel were of bronze or iron. A possible indication may be found in a reference to the making of the tunnel in the apocryphal book of Ecclesiasticus (Sirach) (48:17), where one Hebrew manuscript mentions the use of a bronze tool (*nḥšt),* while the Greek version refers to one of iron (*sidērion*), in each case the word for the kind of tool being understood but not stated.[10] The Hebrew text of this book was probably written in the early second century B.C., so it cannot be counted as a reliable source concerning the time of Hezekiah, but it could be that it points to a tradition that the tools were bronze, and that the scribe who made the Greek translation altered the material to that most likely in his own time, either inadvertently or because he assumed it to be correct. This, of course, is only speculation. Limestone, though it occurs in different forms, measures only about 3 on the Mohs scale of hardness and could probably have been worked with bronze implements. Bronze can be a very tough material, especially when hammered, and as the working edges wore down they could have been reground or replaced. This is described by Tylecote who cites work-hardened examples of bronze from Egypt (1976: 167, 9).

Representations of Egyptian woodworking axes in tomb paintings show that for that purpose the blade, probably of bronze, mounted on a wooden shaft, was shaped like a half-circle, the cutting edge being curved.[11] It seems clear, however, that when it came to detailed work on a stone statue, a chisel was used with a club-shaped mallet (Bierbrier 1982: fig.28; Scheel 1989: 53, figs 43, 44, 57; Lucas 1962: 63-68). However as Arnold and Davey have noted, the chisel types used for quarry and underground excavation in Egypt do not at this stage appear in the archaeological record (Arnold 1991: 33; Davey 2001: 23).

Evidence also comes from Assyria, where a representation on the bronze gates from Balawat depicting a man carving a relief of Shalmaneser III celebrating his campaign to the source of the Tigris in 853 B.C., shows the sculptor using a chisel and a club-shaped mallet (King 1915: 30f, pl.LIX). This evidence applies to the carving of statues or reliefs, the mallet and chisel being appropriate to this kind of work,[12] but the references to the use of the *garzen* in the texts make it unlikely that it was a chisel, and since it was apparently used to cut down trees (Is. 10:15), it is likely that it was some kind of axe rather than an adze.

Axes are depicted in the Assyrian bas-reliefs but they are shown in scenes of war or ceremonial (Hrouda 1965: 88, pls.18.14, 15, 16; 26.3), and do not give much indication of the activities of everyday life.

Figure 6: *A view inside the tunnel. The regular shape of the tunnel and the smoothness of the walls displays careful workmanship. Photo: the editor 1974.*

It is often instructive to examine the semantic field of a word in a language, bearing in mind that the evidence is limited. In the Old Testament there are three other words, *qardōm*, *kaššīl*, and *magzērâ*, which appear to refer to similar implements. Q*ardōm* occurs five times in contexts which show that it was used mainly for cutting trees (Jer. 46:22; Ps. 74:5) or branches from trees (Judg. 9:48), indicating some kind of axe, and there is an interesting passage making clear that it needed to be sharpened (1 Sam 13:19-21) (McCarter 1980: 238). The other two words occur each only once: *kaššīl* in Ps 74:6 where it is represented (together with another implement of uncertain meaning) as suitable for destroying carvings in a sanctuary, suggesting some kind of pick; and *magzērâ* in 2 Sam 12:31 where it is defined as made of iron and the context seems to indicate an agricultural implement of some kind. McCarter discusses the general sense, but questions the inclusion of "*mgzrh* of iron" in the original text (1984: 311). The Old Testament only uses vocabulary of this kind incidentally, and none of these words are found in the inscriptions, so this evidence is too limited to help to define *garzen.*

More distant evidence from the classical world may give some idea of what a tool used for cutting into rock might

have been like in Palestine. Painted scenes of the 6th century B.C. from Corinth show miners hacking into what is probably rock with what look like picks (Healy 1978: 84, pls.8, 17), and actual examples of a type which would have been mounted on a wooden handle include a Greek miner's pick of the 4th-3rd century B.C. from Corinth, and a Roman example of the Roman period from the area of Rio Tinto in southern Spain (Healy 1978: 84, 100, pls 16a and 30).

Many examples of axes are known from throughout the ancient Near East,[13] and it may be that among them there is a type appropriate to the present text, but the context does not give sufficient evidence for a clear choice. This is an instance of a common situation in the study of antiquity, that many questions remain open.

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Endnotes

1 *PEFQS* 13 (1881), pp.285-87, the tracing following p.286. Sayce (1883) reproduced this tracing in his popular book *Fresh Light from the Ancient Monuments* facing p.87, with accompanying text, pp.82-91; the copy also appears embossed in gold on the front cover.

2 S.R. Driver played a major part in the translation of the RV Old Testament, just as his son G.R. Driver was greatly involved in the preparation of the NEB.

3 The inscription occupied the lower part of a rectangular space measuring a little over 2 feet square which had been smoothed and polished to receive it. The upper part, which was blank, may have been intended for an historical introduction naming the king in question, but warlike conditions at the time perhaps prevented its completion.

4 I am indebted to Mr E.P. Uphill for drawing my attention to this reference.

5 This tomb was used as a billet by Champollion (the decipherer of Egyptian hieroglyphics) and his colleagues when they were examining the tombs in the Valley of the Kings in 1829 (popular account of this in L. and R. Adkins, *The Keys of Egypt. The Race to Read the Hieroglyphs* (London, 2000), 265-68).

6 *Mh* also had the meaning "forearm", the hieroglyph being a picture of a human forearm.

7 Adam Smith (1907:93) cites measurements made before his time varying between 518 and 535 meters. According to Sayce (1883:84), Conder measured the length of the tunnel at 1708 yards, actually 1708 feet — a mistake corrected in his well-known book *The* "*Higher Criticism*" *and the Verdict of the Monuments* (London, 1893), p.377 — giving a cubit of 520.94 ÷ 1200 = 0.4341 meters, i.e. 43.41cm.

8 Found also in the metathesised form *gzr*, "to cut".

9 J. Černy, *Journal of Egyptian Archaeology* 15 (1929), pp.245 (referring to recto page 2, line 9 of a papyrus) and 249, nn.31 and 32 (where *qrḏn* is given as the equivalent of "hoe", suggesting that the two words have been reversed).

10 The Hebrew, and Greek texts are given conveniently in Vattioni, (1968:262-63) and see Skehan & di Lella (1987:537-38).

11 Killen (1994:fig. 6) felling a tree, early 2nd millennium; Scheel, (1989:fig. 52) cutting a tree.

12 A useful account of the tools and methods used for stone working in the Achaemenian period in Iran is given by Nylander (1970:22-30) with bibliography concerning the classical world, Egypt and other areas nn.46-47; see also on ancient Greece, with some reference to Egypt Casson 1933:168-222).

13 A large selection of early bronze examples is included in Deshayes (1960); and some selected examples can be seen, e.g. from Palestine in Barrois (1939:374-78, fig.134) (an old book but giving a useful though limited selection); and from Egypt, Scheel, (1989:48, 53, fig.51) and Killen (1994:fig. 50) (actual tools, late 2nd millennium B.C.).