

COMMENTS

J. Jean Ajdler, Comments on Daniel Michelson's Article, "The Shape of the Menorah," (*B.D.D.* 23, July 2010, pp.29-54)

Daniel Michelson's paper is an important contribution to the understanding of the shape of the Menorah. However, it deserves some additions and remarks.

1. In the rabbinical literature, the *shekel* of 17gr., championed by the *geonim* and Rambam, was adopted by R. Joseph Caro in his *Shulhan Arukh*: Hoshen Mishpat 88:1 and Even ha-Ezer 27:10; 294:6 and 305:1. On this basis and according to the Talmudic tradition, the *shekel* of Moses weighed about 14.167 gr. and the weight of the Menorah was 42.5 kg. However, no *shekel* of 17 gr. was ever found. By contrast, the *shekels* that were found support Rashi's theory of a Talmudic *shekel* of about 14.16 gr., and a *shekel* of Moses of 11.80 gr. The weight of the Menorah would then be only 35.4 kg.
2. Michelson's paper was written on the assumption that a *shekel* of Moses weighed 17 gr. and a Menorah weighed 51 kg. It appears that the proposed solution is close to the limit as the stress at the point of the embedding of the external branches under only the action of their own weight reaches 44 MPa. The author mentions a yield point of 70 Mpa for annealed 24 carat gold but, on the site [www.utilisegold.com/jewelry technology/colours/colour alloys](http://www.utilisegold.com/jewelry_technology/colours/colour_alloys) I found a yield point of 45 MPa. A deflection calculation should also have been performed, but I did not find any indication about the elasticity modulus. The author is obliged to assume that the cross sections are a regular convex dodecagon, inscribed in a circle of diameter 2 cm. Furthermore, because of the lack of gold, the author is obliged to replace the generally accepted base resting on three feet by three straight legs; this solution was never considered before.
3. The author's assumption of a *shekel* of 17 gr. in the time of Moses is supported by personal considerations and by a reference in Josephus, *Jewish Antiquities* 3.8. We must always be very cautious with evidence derived from Josephus: possible internal contradictions, later interpolations and corrupted text. However, in the present reference, it is not likely that Josephus referred to the ancient Attic *drachma*, he referred probably to the Greek Provincial *drachma* of his time, which had about the same weight as the Imperial silver *drachma*. This would correspond to a *shekel* of about 14.16 gr.

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Similarly, Josephus writes in *Jewish Antiquities* 3. 6. 7 that the candlestick was of cast gold, hollow within and weighed 100 pounds or $9600 \times \sim 3.5 \text{ gr.} = 33.60 \text{ kg}$ or $10000 \times \sim 3.5 \text{ gr.} = 35 \text{ kg.}$, if we consider that Josephus did not make the difference – as it is often the case in the Talmud and the rabbinic literature – between the denomination of the *libra*, weighing 96 *denarius* and the *mina* weighing 100 *denarius*. This statement of Josephus supports the theory of Rashi giving the menorah a weight of about 35 kg. This theory is also supported by the numismatic evidence.

Furthermore, it seems that Josephus was not aware of a re-evaluation of the *shekel* at a certain moment of history.

4. The author mentions in his introduction the bulky Menorah on the Arch of Titus. The assumption adopted in the paper leads to a much leaner Menorah. But, on the contrary, the bulky shape of the Menorah on the Arch of Titus should give us some hint about the true shape of the Menorah.
5. Ibn Ezra on Ex. 25: 18, in contrast with all the other commentators, understands *mishka* as equal and not beaten. *Zahav mishka* would then mean “overlaid with an equal layer of gold.” Profs. Grinfeld and Aviezer, in their article about the cubit,¹ accounted for the amount of gold used in the Tabernacle according to Ibn Ezra’s assumption. We find the same expression in Ex. 25: 36, 37: 8 and 37: 17. It can then be argued that, according to Ibn Ezra, the Menorah could have been a wooden or even a copper Menorah overlaid with an equal layer of gold.
6. The author considered a cross section in the shape of a dodecagon inscribed in a circle of radius 1 cm and having a section of 3 cm^2 . If we consider a circular section of 2.5 cm and a 0.7 mm. layer of gold, the section will be 1.08 cm^2 . This will allow us to consider a base with three feet and we will have enough gold to cover it with gold. This would solve many problems related to the Menorah. The latter assumption of a bulky copper Menorah overlaid with gold would explain why it was a heavy piece that required four bearers on the Arch of Titus.
7. The statement at the bottom of p. 31 that according to Rashi one *log* of water weighs 25 Talmudic (?) *shekels* is important, but the reference is missing. If it concerns the Talmudic *shekel*, it would give a *revi'it* of 88.56 cm^3 , an *etzba* of 2.017 cm and a cubit of 48.397 cm.

1 See *B.D.D.* 1 (Summer 1995), where they considered 0.7% of the *kikar* of gold for the covering of the cherubins (layer of 0.7 mm of thickness).

Conclusion

Daniel Michelson's paper is an important contribution to the solution of the conundrum of the Menorah. The paper was written in order to demonstrate that the classical (Talmud, Targum Onkelos, Rashi and other commentators) understanding of a massive Menorah of gold, entirely hammered out of single piece of gold, without any casting, is possible. However this understanding is not without difficulties and it rests on assumptions that are not necessarily acceptable. I am afraid that the conundrum remains unsolved.

Daniel Michelson, Reply to J. Jean Ajdler's comments

J. Jean Ajdler raised several questions regarding my paper "The Shape of the Menorah" published in *B.D.D.* 23. His main objection is the weight of the *shekel* of the Torah of 17.28 gr, on which I based the calculations of the volume of the Menorah. Because of lack of space, the issue of the weight of the shekel was not discussed in detail in the paper. As mentioned in Section 2 of the paper, I posted a lengthy article "The cubit and shekel of Torah" on the site www.truthofland.co.il on that subject. This is a very profound and complicated issue. I would be happy to discuss it with the readers of the article.

As for the yield strength of annealed gold of 70 MPa, I took it from a technical encyclopedia. The yield point of gold is not clearly defined (in the source quoted by Ajdler they mistakenly call it "tensile strength" which, for annealed gold, is not 45 MPa but 130 MPa). The yield strength of cold worked gold is much higher, about 200 MPa – much in excess of the maximal required strength of 44 MPa. Even if the manufactured Menorah was heated in a furnace, the crucial joints could have been pressed once again to reach additional strength.

J. Jean Ajdler suggests that the Menorah was hollow. Yet, according to the Talmud in Menachot 28b, *miksha* means a single piece of metal. This is also stated in Rambam, Hilchot Beit Habhira 3, 4. It is hard to imagine that one can manufacture a Menorah with hollow branches and cups of oil at their upper ends from one piece of gold. Yet, Rambam adds there that if the Menorah is made from other metals, not from gold, it could be hollow. Thus, in principle, the Menorah in the Second Temple and the one exhibited on the Arch of Titus, could have been made not from gold of only overlaid by gold and hollow. However, the Menorah of Moses made of pure gold with all the fixtures, could not be hollow.

As for the opinion of Rashi on the weight of the *shekel* and its relation to the unit of volume, one is advised to read section 12 in the above-mentioned article.