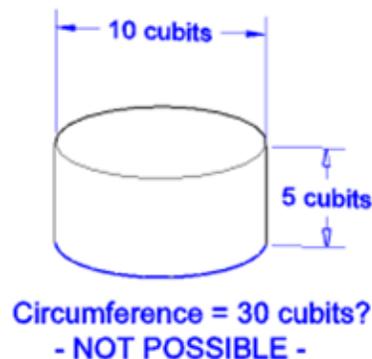


An Investigation into Solomon's Sea Dieter Schlaepfer

Common objections to the veracity of the Bible often mention the description concerning a massive bowl that was likely cast out of bronze¹ called *Solomon's Sea*, which was located within the Temple grounds.

Now he made the sea of cast metal ten cubits from brim to brim, circular in form, and its height was five cubits, and thirty cubits in circumference. Under its brim gourds went around encircling it ten to a cubit, completely surrounding the sea; the gourds were in two rows, cast with the rest. It stood on twelve oxen, three facing north, three facing west, three facing south, and three facing east; and the sea was set on top of them, and all their rear parts turned inward. - 1 Kings 7:23-25 (NASB)

According to skeptics, the Bible asserts an inaccurate value for Pi, undermining the belief that this passage could have been inspired by God. Here's what they imagine:



As one learns in school, the circumference of a circle is equal to Pi times the diameter. Thus, 3.14159 . . . times 10 cubits would equal more than 31.4 cubits, not 30 cubits as is stated in the scriptures.

But the biblical text holds a clue for those who simply continued reading to the next verse.

It was a handbreadth thick, and its brim was made like the brim of a cup, as a lily blossom; it could hold two thousand baths.

However, Solomon's Sea wasn't a straight cylinder but its rim was flared out. The diameter was measured brim to brim, but the circumference was likely measured under the brim. What could this have looked like? Notice the flared brim of the Jewish *Kiddush* cup. Next to it is a shekel from the second temple period.

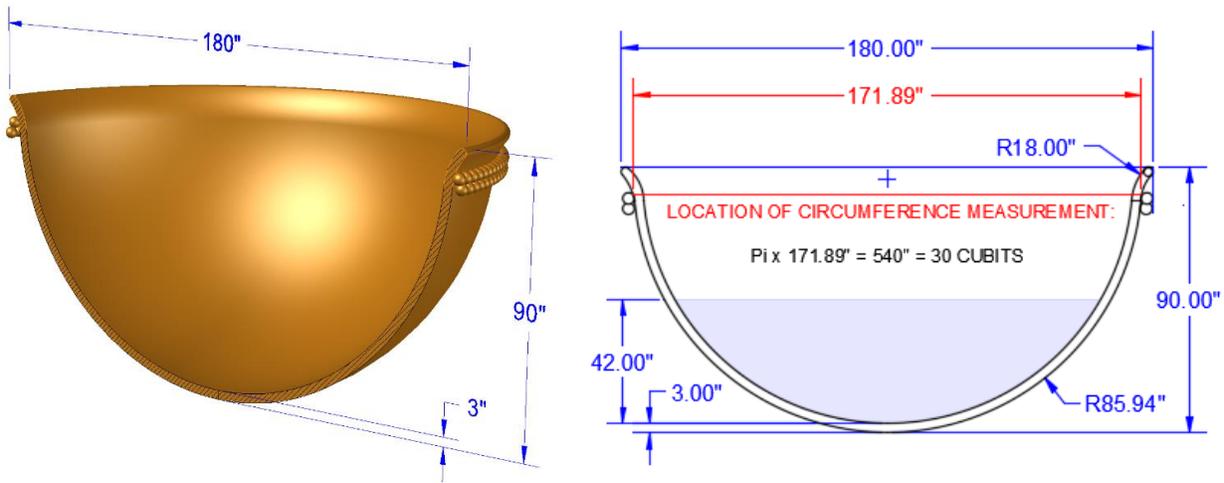


¹ Bronze is an alloy of copper and tin, while brass is an alloy of copper and zinc. Brass first appeared in the first millennium BCE, much later than bronze, due to the extreme difficulty in combining copper with zinc, which vaporizes at the temperature required to melt copper. Also of interest is that the noun, *bronze*, was only introduced into English in 1721, later than the King James Version. In Middle English, both brass and bronze were known as *bras*. See <https://www.etymonline.com/word/bronze>.

There's a further, extra-biblical clue that could have been considered. During the time of the Emperor Nero, the commander of the Jewish insurgents at Joppa surrendered to the Romans. He later became the historian known as Josephus Flavius. In his book, *The Antiquities of the Jews*, Book VII, Chapter 3, Josephus wrote:

Solomon also cast a brazen sea, whose figure was that of a hemisphere: this brazen vessel was called a sea for its largeness: for the laver was ten cubits in diameter, and cast of the thickness of a palm.

Solomon's Sea was not a cylinder as is assumed by skeptics. The following illustration is a half-section of a 3D solid model created in AutoCAD that conforms precisely, though not necessarily uniquely, to the biblical account. Using a value of 18 inches to a cubit, the outer diameter is 180 inches, the circumference measured below the flared rim is 540 inches, the height is 90 inches, the thickness is 3 inches, and the value of Pi is still 3.14159 . . .



The weight of Solomon's Sea using these values is about 24.2 US short tons of bronze, assuming the composition was typically 90% copper and 10% tin alloy. However, the lengths of cubits and the other measures used in the Ancient Near East were not universally standardized. Also, the shape of Solomon's Sea was likely not a perfect hemisphere—the change in curvature to create the flared lip in the model was located just above the two rows of decorations that were distributed 10 to a cubit. If they touched each other, these would have been about the size of chicken eggs or gourds such as the squirting cucumber, *Ecballium elaterium*. The placement of the two rows of decorations in the model is approximate.

Other possible solutions to the dimensions of Solomon's Sea have been suggested over the years. For example

- Measuring the outer circumference at its widest bulge as one might measure a cauldron.
- Measuring the *inner* circumference by measuring the core used in casting the sea. (*Talmud, Erubin 14a*)
- Applying the numerological ratio from the Hebrew *Gematria* to the spelling variant of the Hebrew word "circumference." This yields a slightly larger circumference of 31.415 cubits, a value that deviates from Pi by only about 1 part in 38,000.

In any case, we can see that the assertion, "This is not possible," made by skeptics is incorrect and there are several mathematically reasonable possibilities for the shape of Solomon's Sea.

Even Sir Isaac Newton studied the cubit and Solomon's Sea, which he described in *De magnitudine cubiti sacri*, a draft paper he wrote in the 1680s.²

“Some compute the Cubit from Solomon's brazen sea. Lest any objection should be raised from thence, I shall briefly remark, that the bottom of that sea ought not to be represented spherical, as it generally is, but flat, in such a manner that all the water might run out for the use of the priests, and the vessel might stand commodiously upon the backs of the oxen . . .” – translated from Latin by the Newton Project

But let's dig deeper. What about the differences between the accounts in 1 Kings and 2 Chronicles?

Calculating Volumes

The maximum volume of the illustrated 3D model with the dimensions given is about 5,750 US gallons. The Bible reports the volume as 2,000 baths in 1 Kings, and 3,000 baths in 2 Chronicles. A bath or *bat* is a Jewish liquid measure of about 5.75 US gallons or 22 liters according to some authoritative sources.³ Thus, the reported volumes of Solomon's Sea by this measure are 11,500 and 17,250 US gallons respectively. These volumes of water are two or three times as much as Solomon's Sea could possibly hold. Even if it were cylindrical, it could have held a maximum of only about 8,200 US gallons, which still would have insufficient capacity.

However, there is still a reasonable answer, although it requires a little research. The Septuagint is a translation of the Hebrew scriptures to common Greek by 70 or 72 Jewish scholars that was completed about 130 BCE. Let's see whether this earlier translation can get us to a reasonable volume for Solomon's Sea.⁴

The 1 Kings passage in the Septuagint uses the Greek word *chous* (pronounced coos) as the unit of liquid volume rather than *bat*. A *chous* is a Greek liquid measure of about 0.81 US gallons or 3.1 liters. The Jewish scholars who translated the Septuagint likely chose the Greek *chous* as the Greek *equivalent measure* because its volume was nearly identical to the common Jewish liquid measure, the *hin*. Thus, it can be argued that if the original Hebrew word were *bat*, then the translators of the Septuagint would likely have chosen the Greek *keramion* at 6.9 US gallons in 1 Kings, which would be significantly closer to the *bat* at 5.75 US gallons than a *chous* of 0.81 gallons. In 2 Chronicles 4:5, the Septuagint reports 3000 “measures.” But what's a measure?

Two types of measures are used in the Bible, liquid and dry. Liquid measures include the *log*, the *hin*, the *bat*, and the *homer*. The *hin* is mentioned most often in the Bible, but none these liquid measures times 3,000 come close to the maximum volume of Solomon's Sea, which should be about 5,750 US gallons.

Hebrew Liquid Measure	Closest Greek Units	Approx. US Units	Approx. Metric Units
<i>log</i>	1.3 <i>xestēs</i>	3 cups or 1.5 US pints	0.71 liters
<i>hin</i>	0.98 <i>chous</i>	0.81 US gallons	3.1 liters
<i>bat</i>	0.83 <i>keramion</i>	5.75 US gallons	22 liters
<i>homer</i>	5.5 <i>metrētēs</i>	57.5 US gallons	220 liters

² See *Isaac Newton and the Temple of Solomon* by Tessa Morrison, 1954

³ Estimates of the volume of a *bat* are based on archaeological evidence—labeled jars and shards found at Tell Beit Mirsim, Tell ed-Duweir (Lachish), and Tell en-Nasbeh. Published estimates typically vary between 5 and 6 US gallons, including 5.5, 5.75, 5.8, and 6.0 US gallons or 21-23 liters.

⁴ The Masoretes “corrected” (their term) variations in the Hebrew scriptures between the 6th and 10th centuries CE and might have consolidated the use of the word *bat* in both these passages. This is why the Dead Sea scrolls, the Septuagint, and the Syriac Peshitta are valuable tools for checking variations. Unfortunately, the Dead Sea Scrolls are missing 1 Kings 7:22-24 and nearly all of 2 Chronicles. The Syriac Peshitta, an Aramaic translation from about the 2nd – 4th century AD, uses “bath” in both references.

So, let's turn to dry measures.⁵ The most common reference to a dry measure is the *se'ah*, which in ancient times was defined as a third of a *bat*, or about 1.92 US gallons.

Hebrew Dry Measure	Closest Greek Unit	Approx. US Unit	Approx. Metric Unit
<i>se'ah</i>	0.83 <i>hekteus</i>	0.96 Pecks or 1.92 US gal.	7.3 liters

But how can referencing a dry measure be justified? For one thing, the *Targum Jonathan*, an Aramaic paraphrase of the Hebrew text from the first or second century CE, supports the idea of liquid and dry measures in this context. "It received three thousand baths of dry measure, and held two thousand of liquid measure."

2 Chronicles 4:17 indicates that Solomon's Sea was cast in the clay ground between Succoth and Zeredah. Casting a huge bronze bowl is similar to casting a bell. The inner core of the mold can be measured out precisely during construction using a dry volume. The volume of the illustrated 3D model of Solomon's Sea is 2918 *se'ahs*, which is a just little less than the stated 3,000 measures of *se'ahs*. The 2.7% difference between these volumes can be reconciled with a slightly larger radius for the flared brim, a slightly smaller *se'ah*, or a slightly larger *cubit*.

The first mention of the *se'ah* in the Bible is in Genesis chapter 18. In the account, Abraham met three angelic beings and he asked his wife Sarah to prepare an offering of bread using three measures (*se'ah*) of fine flour.⁶ Thus, Solomon might have been making a statement of devotion by specifying that the dry volume of the brazen sea should be 1,000 times as much as what Abraham and Sarah offered. The concept of 1,000 times an offering is not completely speculative. The description of Solomon's devotion at the very beginning of his reign states

[And Solomon went up there before the Lord to the bronze altar which was at the tent of meeting, and offered a thousand burnt offerings on it. – 2 Chronicles 1:6 \(NASB\)](#)

The 2,000 *chous* reported in 1 Kings suggests that the normal liquid volume in Solomon's Sea was about 1,620 US gallons of water. The function of Solomon's Sea was apparently for ritual immersion by the priests.

[He also made ten basins in which to wash, and he set five on the right side and five on the left to rinse things for the burnt offering; but the Sea was for the priests to wash in. – 2 Chronicles 4:6 \(NASB\)](#)

What would be the depth of this quantity of water at the center of Solomon's Sea? The answer is about 3'6" deep (107 cm). This is about half the maximum depth of Solomon's Sea or about waist deep for an average male at that time.

In addition to the other possible solutions for the shape of Solomon's Sea mentioned previously, the variations in ancient units of measurement are also a factor in the total volume.⁷

However, it should be clear that objections to biblical accuracy such as the one presented can often be resolved with the application of archaeological, linguistic, or analytical research.

⁶ After this event, stories about Gideon and also Hannah included prepared offerings of fine flour in the same amount. One of the parables of Jesus of Nazareth also refers to three *se'ahs* (transliterated to the Greek word, *saton*) of fine flour that was corrupted with a small amount of leaven.

⁷ For example, the royal cubit dates back to the Egyptian Old Kingdom and was used in the construction of the Step Pyramid of Djoser about 2700 BCE. If a 20.6" royal cubit was used in the construction of Solomon's Sea, it would result in a maximum volume of 8,479 US gallons or 4,423 *se'ahs*, however, the increased capacity would still be insufficient to hold 17,250 US gallons maximum as required by 3,000 baths at 5.75 US gallons per bath.

Further Reading

Solomon's Sea and Pi

Andrew J. Simoson

The College Mathematics Journal, Vol. 40, No. 1 (Jan., 2009), pp. 22-32

On the Capacity of Solomon's Molten Sea

John Byl

Vetus Testamentum

Vol. 48, Fasc. 3 (Jul., 1998), pp. 309-314

<https://www.jstor.org/stable/1585234>

King Solomon's Molten Sea and Pi

Albert Zuidhof

The Biblical Archaeologist, Vol. 45, No. 3 (Summer, 1982), pp. 179-184