



## **Allegory, Alchemy, and Science**

### **The pillars in the Temple of King Solomon**

*When the Temple at Jerusalem was completed by King Solomon, its costliness and splendour became objects of admiration for the surrounding nations and its fame spread to the farthest parts of the then known world. There was nothing however in connection with this magnificent structure more remarkable or that more particularly struck the attention than the two great pillars that were placed at the porchway or entrance.... That on the left was called Boaz.... That on the right Jachin.... The height of those pillars was 17 cubits and a half each, their diameter 4....They were made of molten brass....*

Words we are all familiar with, but when I first delivered the early parts of the Second Degree Tracing Board, I started to wonder about those pillars and in particular how much brass went into their making.

If we assume a cubit to be about 52 centimetres, a few calculations show that the pillars would have been about 9 metres high and 2 metres in diameter with a shell thickness of 10 centimetres. On that basis each pillar would have weighed about 45 tonnes. The chapitres would have added another 2.6 metres and a couple of extra tonnes.

Records indicate that Solomon built the Temple at Jerusalem in the 10<sup>th</sup> century BC probably somewhere between 950 and 850BC. It stood for 300 to 400 years before it was destroyed by Nebuchadnezzar in 587BC after his successful siege of Jerusalem.

We're all very familiar with brass these days; it's in our plumbing, door furniture, name plates, church brasses, horse brasses, and holiday souvenirs picked up in souks and bazaars in the middle and far east – [show examples](#).

*But what about brass in those far-off days? Where did it all come from?*

It first gets a mention in the VSL in Exodus c25: v3 which states that it was to be used by Moses, along with gold and silver, as an offering to the Lord. Exodus c26: v11 states that brass was used to make *curtain rings* to hold together the veils of the Tabernacle. Exodus c39: v39 refers to a *brazen altar*.

Brass was supposed to have healing powers: Numbers c21: v9 tells us how Moses made a serpent of brass and set it on a pole. Anybody who had been bitten by a poisonous snake and then looked at the brass serpent would be cured. *A miraculous material indeed*. It is actually worth mentioning that the germicidal and antimicrobial properties attributed to brass (or at least the copper in it) were only proven as recently as the 1980s.

In Deuteronomy c8: v9 the Lord promises his people 'a land where the rocks are iron and there are hills from which they can dig brass'. Obviously brass was highly regarded and prized in those early days. A land flowing with milk and honey maybe, but one also with significant mineral wealth.



*As a bit of background* to the opening paragraphs of our Explanation of the Second Degree Tracing Board, I want to quote from a few biblical references that provide us with the detail.

*1 Kings c5: v5 – 11, 17 – 18* tell us that Solomon contracted Hiram King of Tyre to provide him with hewn timbers from fir trees and cedars of Lebanon in exchange for wheat and oil – an ancient trade agreement.

*1 Kings c6; v2 - 1* describe the dimensions of the Temple itself and the use of cedar and pre-hewn stone. *How they match those in the plan and elevation of the Temple in Jerusalem hanging in the stairwell up to the Scarbrough Temple, I haven't checked.*

*1 Kings c7: v13 – 15* describe how Solomon called on Hiram (Abif) the widow's son to assist in building the Temple. His father, from the tribe of Nephthali (familiar to some of us) was recorded as a skilled worker in brass.

*1 Kings c7: v16 – 22* describe the dimensions and ornamentation of the two brass pillars, Boaz and Jachin. Interestingly I couldn't find any mention of Celestial or Terrestrial globes surmounting the chapitres. Perhaps these are a Masonic inclusion.

*1 Kings c7: v45 – 47* describe the casting of vessels of bright brass for the Temple and refer to the clay ground between Succoth and *Zarthan*. There were apparently lots of these vessels, but they were never weighed, assayed, or catalogued.

*2 Kings c25: v13 - 17* this chapter is about the siege and sacking of Jerusalem by the Chaldeans. It quotes the dimensions of the pillars and describes how they and other brass objects were broken up and taken away to Babylon. The record states that the amount of brass plundered was 'without weight', suggesting large amounts.

*1 Chronicles c18: v3 – 8* tell how King David waged war against the Philistines and other neighbours and took several towns where he seized large quantities of brass. This was the brass that Solomon was to use later to build the pillars of the Temple and cast his holy vessels. It was because of the blood on his hands from these conquests that the Lord forbade David from building the Temple himself, but charged Solomon with the task.

*2 Chronicles c2: v7, 14* describe Solomon's request for a skilled artificer and labourers to build the Temple in exchange for wheat, barley, oil and wine – another trade deal. Hiram King of Tyre's response was to send Hiram Abif whose many skills were listed as working in metals including gold, silver, brass and iron, working in stone, in timber, in dyes and dying, and engraving. *This has significance for one of the Masonic side orders.*

*2 Chronicles c3: v15 – 17* describe the veils of the Temple as being in colours of blue, purple, and crimson. *We are all familiar with these as the colours of Royal Arch.* Here, however, the dimensions of the pillars are quoted as 35 cubits high, nearly double the 18 cubits in *1 Kings c7*. But they are named as Boaz and Jachin

*2 chronicles c4: v17* describes casting the pillars in the clay ground between Succoth and *Zeredathah* (cf *1 Kings c7*).



**Jeremiah c52; v21 -23** describe the sacking of Jerusalem by the Babylonians and describes how they took away immense amounts of gold, silver, and brass including the pillars of the Temple. Here, for the first time, it mentions that the pillars were hollow.

So, I suggest that these biblical records and our own interpretation of them in Masonic Ritual form the *allegorical* part of my title. The historical accounts were often written well after the event and certainly rarely first-hand as the matched highlighted text shows. The *historical truth* was probably treated both *emblematically and symbolically* to illustrate the prowess, power and splendour of Nation States and their rulers, much as they are today.

Researching a little farther, it appears that the names of our two pillars, *Boaz and Jachin*, probably refer to *Kings David and Solomon*. In his book *Secrets of Solomon's Pillars* the author (Tony Badillo [www.templesecrets.info](http://www.templesecrets.info)) gives the plausible explanation that Boaz, which can be translated as 'strength' or 'force' might be linked to David as a warrior king – a man of strength. Jachin means 'to establish' and can be linked through translation and association to the name Solomon.

Perhaps then, in this context, 'in strength I will establish this mine house to stand firm forever' doesn't mean the *physical temple* would stand forever (which it didn't) *but the nation it represents allegorically* which was built upon the prowess of its warrior king David and which is still with us today. Boaz may not only be an allusion to *physical battle, but also to spiritual battle* against the dark forces. Certainly those Israelites who, in their relief at escaping from Egypt, succumbed to all sorts of idolatry, immorality, debauchery, and unbelief, never made it to the Promised Land. It was left to Joshua to accomplish that battle.

The text I have just quoted from suggests that the *Tanakh*, the canon (a sort of technical appendix and source document for interpreting the Hebrew Bible) uses many *physical metaphors to illustrate spiritual truths - in other words allegory*.

*Moving on to the alchemy and science of my title*, I come to the question *what is brass?* It is an alloy of copper and zinc. It is worth noting that the colour brass formed from these two metals will vary according to their relative proportions and to the presence of any contaminants present in the ores used. Copper is found widely in its native state – [show examples](#) - whereas zinc is only ever found naturally as an ore – your zinc oxide ointment is a refined version. The discovery of brass was most probably the happy result of heating up copper with various types of rock of no particular significance to look at.

Copper had also been traded for thousands of years and was used for making all sorts of artifacts.

*So where did the hundreds of tonnes of brass come from* to make the pillars of the Temple, its vessels and trappings? David pillaged a lot from his wars of conquest and likewise large quantities were pillaged in their turn on the destruction of the Temple by Nebuchadnezzar.

Scholars generally accept that as late as the first century BC brass was only made in sufficient quantity to make coins. In the 4<sup>th</sup> century BC Plato described something he called *aurichalcum* – golden copper or brass – saying that it was as rare and as valuable as gold; remember, this was



400 years after the sacking of the Temple. Even then the brass would have been of variable quality and mechanical properties because zinc vapour is volatile and will escape from the smelting mix as noxious fume. One of the properties of brass is that it will take a high polish, hence the expression burnished brass.

Here we need to turn our attention to *bronze*. This is an alloy of copper and tin with added arsenic, phosphorus, aluminium, manganese, and silicon (as contaminants from the crude tin ores). It had been made and converted into vessels, weapons, adornments and so on from as far back as 3000BC. Like brass, bronze will also take a polish. The tin miners of Cornwall were known to export tin ore to Phoenicia, so the ingredients needed to make bronze would have been available to the builders of Solomon's Temple.

The records state that the Temple was built of hewn stone and cedar of Lebanon. These were described in biblical references as being overlaid with gold. But perhaps it could equally have been overlaid with thin sheets of beaten bronze or brass that would have also shone brightly with very little tarnish.

*When trying to decide what brass was* as far as the ancients were concerned, we have to consider the difficulties of translation from Hebraic and other middle eastern scripts, Even in Shakespearean English brass equated to bronze as a copper alloy. *So, my conjecture is* that bronze and brass would have been interchangeable terms for the early translators. In any case they were both highly prized and sought after and would appear to have had similar value to that of gold.

Where does all this get us? *Alloy making was an alchemical subject*, shrouded in mystery and myth. Because of the variability in quality and quantity of the ores used in making alloys, the alloy itself could vary widely in composition and properties. Its makers - the alchemists - would have been regarded with awe, if not a little suspicion and fear. As the early history of chemistry reveals they used arcane language to describe their materials and processes to make sure they maintained that mystique and reverence. It is not surprising then to read that Hiram Abif was described as '*a cunning man endued with understanding*' - *an alchemist perhaps*.

If we accept that brass and bronze are broad terms that describe a bright gold-like alloy, we finally come to *the science* of casting the enormous pillars. That science is *metallurgy*.

Although I have had experience during my days as an inspector of seeing metal cast in foundries, I wanted to get some idea of what it might be like to do it in my own back garden. I found a useful practical reference at [www.backyardmetalcasting.com](http://www.backyardmetalcasting.com). In its sections on *Flowerpot Furnaces*, *How to Cast Metal in Sand*, and *Casting Brass and Bronze* the author (B. Terry Aspin) gives an insight into the difficulties of casting metals even on a small scale.

Mould design is critical for casting even fairly basic shapes, so making the moulds for something as intricate as the chapitres would have required skills of the highest order, even by today's standards – *a short clip about casting iron and steel shows a little of how it is done* - <http://m.youtube.com/watch?v=hRsYliUxZeQ>



The temperature required to melt brasses and bronze is about 900 – 950°C something that is difficult to achieve using charcoal; the only fuel available to the ancients. Progress with high temperature smelting was slow until the time of the Industrial Revolution when coke and then later coal-gas were first prepared and used in quantity. As you can see from the film clip, large items have to be continually cast to avoid flaws, faults, cracks, and similar defects. Casting a small amount of molten metal and then later adding another portion and hoping they will join is not an option.

What this implies is that enormous furnaces and crucibles holding tonne quantities of molten metal would have been needed to cast even modest columns. Added to the scale of the crucibles would be the extreme dangers of lifting, tilting, and pouring such large amounts of liquid metal into the moulds. Today man and molten metal are kept apart wherever possible. Modern crucibles are heated in large induction furnaces and are tilted by cranes to pour the melt. Heat protecting clothing is essential.

It is, of course, possible to cast smaller sections and then fit them together with rivets or using woodworking joints. This was the technique that Thomas Telford used when he built the cast iron bridge that straddles Ironbridge Gorge. Thin sheet can be nailed to a substrate.

Even if these technological and metallurgical challenges had been met, at least in part, by Hiram Abif, *where is the evidence that the Temple existed?* As I stated at the beginning, King Solomon built his Temple in 10<sup>th</sup> century BC. It stood for about 400 years before being destroyed by King Nebuchadnezzar in 587 BC. No traces of it have yet been found.

In fact archaeologists have found very few ancient artefacts of bronze or brass in the Middle East; those that they have found are usually small and decorative like brooches and pins. An interesting article entitled '*Of brass and bronze in prehistoric south-west Asia*', the author (Christopher P. Thornton) describes the metallurgy of the pieces that have been found and how they differ widely in composition. He suggests that brass may have been confused with tin-bronze by local consumers ignorant about the very different mechanical properties of the two. He also points out that many of the samples that have been found may have been re-worked from other items, rather than being original pieces.

### *So what is my conclusion?*

I can offer no explanation as to how and of what the pillars of Solomon's Temple were made, or why there is no evidence of them available to us today. I only suggest that making the pillars as described, seems improbable given that we have no hard evidence of their existence.

However both King David and King Nebuchadnezzar, as well as being warrior kings, were also part-time scrap metal merchants - *who knows where and in what form the spoils of war might have ended up.*

As a final observation, we have a tendency to look back at ancient civilisations and say 'they shouldn't have been able to do that, they didn't have the technology' A good example is the



Pyramids of ancient Egypt. How did the Egyptians manage such incredible accuracy in cutting and moving huge stones, aligning them with the stars? The fact is that they did and we have the tangible evidence.

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*As a footnote to W Bro Karan's talk:* sometimes referred to the eight wonder of the world is the 1000m long tunnel that was built by Eupalinus through a mountain on the island of Samos in 6<sup>th</sup> century BC to supply water to what is now called Pythagorion. This was cut through solid rock with teams starting on both sides of the mountain. The two sections met with only a couple of centimeters vertical deviation and very little horizontally. How did Eupalinus achieve this remarkable accuracy before the days of Euclid's 47<sup>th</sup> Proposition? The fact is that he did; we still have the evidence.

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