



No. 21

HASTINGS

Nov. 7th 1938

Lecture delivered by Wor. Bro. J. Wray, P.M. of Lodge Napier, entitled

"BIBLICAL METALLURGY"

My object in preparing this lecture is not to open up a field for controversy, but in some measure to amplify the records in the V. of the S.L. on a subject which, I fear, is so little understood, and which, so far as I am aware, has rarely been associated with our Craft. Yet, Brethren, the Scriptural revelation is an important one from the Masonic point of view, and, to the trained mind, is so clear that it gives, in epitome, practically all that is known about modern metallurgy.

I am not, and do not profess to be, an engineer or an expert on metals; I am however, deeply interested in the subject, and, having investigated many and varied sources, and in particular the writings of one Andrew Buchanan, I can appreciate the truth and the technical accuracy of those portions of the V. of the S.L. which refer to or deal with metals.

Metallurgy is the science of dealing with and finding out all about metals. The subject is divided into three heads :

- (1) Precious metals—gold, silver, platinum.
- (2) Non-ferrous metals—brass, bronzes.
- (3) Ferrous metals—iron, steel.

Now the foundry and the forge both deal with the 2nd and 3th. The non-ferrous and the ferrous metals. The Volume of the Sacred Law clearly indicate the same classification. The image of Daniel shows this in a remarkable degree. But perhaps this image is outside Freemasonry. But the Tabernacle and Temple also show this classification of the metals. In fact, Biblical metallurgy goes back to very early times. We read in Genesis 2 of the land of Havilah, where there is gold, "and the gold of the land is good." In Genesis 4 we are introduced to Tubal-Cain as one who is an instructor of every artificer in brass and iron. Again Abram was very rich in silver and gold.

1 Kings 7 refers us to mighty castings in brass, and verse 46 to the foundry workshop. Isaiah 44 takes us into the forge and shows us "the smith with the tongs both worketh in the coals, and fashioneth it with hammers and worketh it with the strength of his arms." The Psalmist direct us to the tool room of modern engineering when he speaks of the "sharp razor." The science—as such—is not presented to us, but the finished product is given that an intimate knowledge is revealed of the fundamentals, because "heat treatment" is one of the fine arts of modern metallurgy, and the sharp razor edge could not be obtained except by heat treatment.

A similar instance is given by Isaiah when he says "he fitted it with planes" we all know before the plane will work the tool "fitted" must have a sharp edge.

IRON.

Pure iron—we use this phrase advisedly—does not exist in the earth's crust as such. True we have what is known in very ancient times as meteoritic iron, the use of which was known to the ancients. But this meteoritic iron is not sufficiently plentiful to be used commercially. Iron is reduced to a metallic state from

ore. We might be inclined to think that in the earlier stages of history, Adam to Exodus, some form of meteoritic iron was used, but for the fact that Moses tells us in Deut 4-20 "of the iron furnace." This furnace may have been for melting iron, such as a foundry Cupola or a blast furnace for reducing iron from iron ore. The value of an iron ore consists largely in the percentage of iron it contains. The ore may be mined from the hillside, and become expensive in many ways before it is transferred to the furnace.

Professor Turner states, "We can only conjecture as to the period in which iron was first introduced and extracted from its ore and applied to the use of man." Methinks, brethren, that Professor Turner is very much out of date. Because the Bible throws the light upon iron ores. In Dent 8.9 Moses informs Israel that God will bring them into a good land, "A land whose stones are iron, and out of whose hills thou mayest dig brass." Why should Moses differentiate between iron stones and brass out of the hills? Simply because Moses was a Metallurgist who knew the value of iron stones as ore, and could impart the science to Israel. Israel likewise must have been familiar with the use of iron ore and its extraction by the furnace, otherwise it would have been foolish for Moses to draw their attention to these stones and their late bondage unto an iron furnace. Otherwise the stones were of no earthly use to Israel. Brethren, Moses was not speaking in similitude or poetical imagery, but in hard matter of fact technical phrases. And we as Freemasons should marvel at this knowledge of Moses with regard to the stones of iron when we remember that famous Blackband Ironstone of Scotland was thrown aside on to the rubbish heap as useless and termed "wild coal," until David Musket in 1801 discovered in it a valuable iron ore.

One can only conjecture as to the size of the furnaces in ancient times, yet one is assured that the modern furnaces have nothing on the ancient ones for size, as I hope to prove. In attendance upon any furnace we have the air, the fuel, the charge, the molten metal, the slag, the tapping and ladle.

We have already seen that Moses speaks of the iron furnace and informs us about the iron ore. In the book of Job 28-1-2, we get further information regarding ore :—"Surely there is a vein for silver, and a place for gold whence they fine it, iron is taken out of the earth, and brass is molten out of stone." Well, brethren, I submit the blast furnace must have been in existence at the time of Moses.

In Judges 4-13 we are informed that Sisera had 900 carriages of iron. Then again we have David prepared iron in abundance. Then again, the Princes of Israel gave for the services of God "One hundred thousand talents of iron." Yet all this iron could only pass through the furnace to produce iron from iron ore.

Ezekiel 22.12 also speaks of the furnace for melting brass. So one could quote indefinitely from the scriptures examples of tremendous furnaces. Take Nebuchadnezzar's furnace, it transcends and excels anything of the size of the modern type. Where we read four men walked about in the fiery furnace. We know wood was largely used for fuel in the scriptures. Yet we also know that Isaiah refers to the smith "who worketh in coals." Lest Brethren, we should misconstrue the word coals, Lamentations 4-8 informs us that "their visage is blacker than coal." So we see that coal was used and known in ancient times as a means of fuel.

Now there are six verses in scripture containing in a condensed form, practically all that is known about metallurgy. Ezekiel 22.17-22 where it says "The house of Israel is to become dross." That means slag. When we watch the making of jam, the scum rises, it is the impurities of the fruit, the same with metal, it must be skimmed off. This is dross or slag. Then the scripture applies "the charge" ; it says "all they are brass, and tin, and iron, and lead, in the midst of the furnace." As they gather silver, and brass, and iron, and lead and tin, into the midst of the furnace." Now in the blast furnace we have a charge of Ore. In the cupola a charge of pig iron, and scrap. In the reverberatory furnace the charge is such as is given in the two passages of scripture I have quoted. Such a charge goes to make up the composition of brass castings. In the 20th verse it says "To blow the fire upon it"; the 21st verse "And blow upon you in the fire of my wrath." Now according to diagrams of modern furnaces, the blown air is a "forced draught." How wonderful these scriptures are, brethren.

The 21st verse also says "To melt it." This refers to the silver, brass, iron, lead, and tin at the beginning of the verse. Verse 22 says "And ye shall know that I the Lord have poured out my fury upon you." All metals are poured out into a mould known as tapping and the ladle system.

But what I wish to emphasise, Brethren, by quoting this condemnation of Israel, is the accuracy of symbolic phrases used of the manufacture of iron, that it is impossible to pass lightly over they knowledge the prophet

possessed about furnaces etc. Now in making castings it is necessary to have a foundry and suitable soil for making the moulds. This soil must be of sufficient depth to enable the moulds to be formed for large castings. We find the description of the foundry and its soil is given in 1 Kings and 2 Chronicles. 1 Kings 8. 41, "In the plains of Jordan did the King cast them ; in the clay ground between Succoth and Zarthan."

The Hebrew meaning as given in the Margin uses the phrase "in the thickness of the ground." When we consider that the hole of the "Great Sea" (used in the Temple) a hole over 10 feet in depth was required, we see the strict technical accuracy of the Hebrew rendering.

And I say, Brethren, that to me it is simply marvellous that so much is revealed in six words. The massive castings belonging to Solomon's Temple are described in 1 Kings, 2 Chronicles and Jeremiah, and according to measurements, the weight can be summarised as follows—2 Pillars 55 tons each, 2 Chapiters 20 ton each, one Great Sea 72 ton, 10 Lavers of 1½ ton each.

I do not intend to deal with the computation of weights, and as to how they are derived at, suffice it so say that I have the authority of an engineer and a mathematician of high calling for the weights given.

But there is one item I should like to dwell upon. The description of the Pillars in Kings and Chronicles is not complete. Jeremiah, however, gives the full specifications. This passage of Scripture indicates quite clearly that each Pillar was cast in one piece. It says "the height of one Pillar was eighteen cubits ; and a fillet of 12 cubits did compass it, and the thickness thereof was four fingers ; it was hollow." We are informed that it was "bright brass," the margin says "scoured brass." Now, brethren, any engineer will tell you to secure bright or scoured brass, such metals require to be melted at one time, and in one furnace. Such castings would require to be melted in the largest furnace known to man of the Liemens type, otherwise the Pillars and the Great Sea could not be cast in bright brass.

In 2 Chronicles, the height of the two Pillars is given as 35 Cubits or 17 Cubits each. Jeremiah says "they were eighteen cubits each. This has led to some criticism as to the inaccuracies contained in the Volume of the Sacred Law. But, brethren, if we study the situation properly and rationally we find that inaccuracies are non-existent. In verse 16 of 1 Kings it says the chapiters were made "to set upon the tops of the pillars." This statement at once appeals and is particularly logical, the words are "to set upon the tops of the pillars." Therefore it will be seen that the Chapiters are let down to the depth of half a cubit on the pillars for safety and strength. This would be sound engineering practice, and at the same time preserve the architectural feature necessary in forming the projection, separating the Chapiters from the Pillar. Therefore the Pillar's full height is 18 cubits, but as seen from the outside, 17½ cubits. Now, brethren, Masonry is interested in the captivity of the Jews when conquered by Nebuchadnezzar, because he took away with him all the valuables of the Temple. The total weight of the Pillars, chapitars, Great Sea, 10 Lavers would weigh at least 235 tons of brass, there were also castings of 12 Bulls, 10 bases for lavers, 40 wheels for bases, of which we can not estimate because of unknown size. But what a record ! What an achievement ! 235 tons of brass after having been broken up. It would take a long trail of over four months duration from Jerusalem to Babylon, and were those mighty castings made in our day, the leading newspapers and engineering papers would devote special articles to their description and manufacture. Yet the Scriptures pass them over in such an unassuming manner that even Freemasons fail to see the wonderful revelation given of Israel's ancient glory !

ALLOYS.

The chemist to-day is taxed to the uttermost supplying alloys, for the Diesel engines, aeroplanes, motor cars etc., which demand a special metal. Yet the Scriptures give us these special metals. I will quote two of them only. Ezekiel 22-18, "All they are brass, and tin, and iron, and lead, in the midst of the furnace." The second formula is given as follows, "As they gather silver, and brass, and iron, and lead, and tin, in the midst of the furnace." This is known as a brass alloy in which several metals go to its make up.

Now iron does not usually occur in the composition of brass. But some years ago Messieurs M. Williams and Longmur show compositions in which iron is present and speak of its effect upon the alloy.

Is it not remarkable that the Bible of thousands of years old should contain iron in one of its alloys. Silver is also used in the alloys. We should not, however, be surprised at this, in the time of Solomon, silver was accounted as nothing (1 Kings 10). In making up alloys the chemist must know the effect of each individual constituent upon the metal as a whole, adding or taking from the metal completely alters its structure. But

again, brethren, I do want to draw your attention to this wonderful metallurgical science given by the Great Chemist. We have scoffers who assert that there is nothing in Masonry, that the craft has nothing and never did have anything to offer mankind, that we base our authority on a race of prehistoric savages under the title of Israel, led by a man of unknown or doubtful birth of the name of Moses.

Let us for a moment look into the ability of this man Moses. When Israel came out of Egypt there were 605-550 men of twenty years old and upwards. This number was exclusive of the Levites. This number of fighting men would, on a fair ratio, be equivalent to three million souls. It was essential that they should be fully employed. They were put under training by Moses for military and educational pursuits, both in worship, organisation, health, workmanship and law. Now we will take only one aspect of this genius Moses. "The Tabernacle," "with Cherubims of cunning work made by them." This undoubtedly suggests intricate work of a very high order. I ask you! Whence came the training? Then again, we are told that 100 talents of silver were set aside for 100 silver sockets and that each socket contained exactly one talent (Ex. 38.2). This in plain language means that the sockets had to be designed to contain no less and no more than one talent. How did these people under Moses accomplish this? Any modern engineer knows, and confesses, that it takes utmost care and very skilled labour, highly involved in designing any piece of machinery which will not exceed or fall below any given weight. Again, here is another example of the implied science of scriptural revelation. "And all the women that were wise hearted did spin with their hands, and brought that which they had spun, and of fine linen."

THE TEACHERS OF ISRAEL.

Exodus 35-30, "And Moses said unto the, children of Israel, see the Lord hath called by name Bezaliel the son of Uri, the son of Hur, of the tribe of Judah, and He hath filled him with the Spirit of God, in wisdom, in understanding, and in knowledge, and in all manner of workmanship, and to devise curious works, to work in gold, and in silver, and in brass. And in cutting of stones to set them, and in carving wood, to make any manner of cunning work, and He hath put in his heart that he may teach, both he, and Aholiab, the son of Ahisamach, of the tribe of Dan. Them hath he filled with wisdom of heart, to work all manners of work, of the engraver, and of the cunning workman, and of the embroideur, in blue, and in purple, and in scarlet, and in fine linen, and of the weaver, even of them that do any work, and of those that devise cunning work.

What a wealth of information is contained in these six verses I have read to you ! Taking them in their order we find that - It was the Lord that taught Bezaliel, hence Israel's education did not come from Egypt. Bezaliel's education included metallurgy, also any manner of cunning work.

The teachers appointed were Bezaliel and Aholiab. The wisdom given the teachers covered all the arts and crafts. Further, this training included the making of castings, "And thou shalt cast five sockets of brass for them; and he cast for them four sockets of silver." It will be observed that the two teachers were of the tribe of Dan and Judah. When Hiram, the chief organiser (at a later date) and metallurgist of the Temple, was "the son of a woman of the daughters of Dan." Connecting up Aholiab, Hiram, Tyre and Solomons navy, we can trace the Tribe of Dan to a seafaring people, who brought tin and other metals for the building of the Temple from other lands, which makes Hiram's mighty works stand out against anything before or since as a man of wisdom, and understanding and cunning to work all work of brass. The point I want to impress on you is this: That the earliest period given by any expert in the history of iron etc., is about 1,000 B.C. Yet we find that Freemasonry teaches that Moses taught and built with all metals 1,500 B.C.; 500 years earlier than any known data given by authorities outside the scriptural authority.

It therefore looks as if Masons in the original were the pioneers through Israel in Metallurgy, and then to the world in general.

In closing, permit me to state that to-day's value of gold and silver alone used in the Temple would amount to the enormous, even stupendous, sum of 1,201,739,102 pounds.

This amount would not include the brass, iron, wood; stone, workers etc., or even the precious stones (which must have been tremendous) marble and other costly furnishings. Brethren, it was the most costly, grandest structure ever erected to God or man in known history. Its principal artificers were the stock of Abraham and are known as Gods chosen people, through whom they received their wisdom and knowledge.