

THE USE OF THE METAL LEAD IN THE BIBLE

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INTRODUCTION

The books of the Bible are a good source for examining the level of technical knowledge in ancient Jewish society. This article will focus on what Jews in ancient times knew about the metal lead and its compounds. Besides recognition of the uses of lead, I have also considered some lead compounds referred to in biblical literature and whether literature of the period betokens an awareness of lead toxicity.

The metal lead (Pb) is relatively easy to extract from its ores. Signs of its mining have been found dating as far back as 6400 BCE in Anatolia, part of modern Turkey. Lead is usually found in ores together with zinc, silver, and copper. Metallic lead was produced by heat treating the ore in furnaces.¹ When lead ore was heated, the waste might still contain copper, zinc, cadmium, silver, gold, and bismuth. Later, the silver and gold could easily be removed. In the Bronze Age, lead was used together with antimony (Sb) and arsenic (As). The largest utilization of lead was documented in the period of the Roman Empire. More than 60,000 tons were produced as a byproduct of silver smelting. In physical properties, lead is malleable (hardness = 1.5 on the Moh's scale), has a high density (11.4 grams/cc), and is easy to smelt (melting point, 327.46 C°).² Since its melting point is considerably lower than that of iron (1535 C°), it is easier to shape using ancient technology. In Roman society, lead was used to produce water pipes, pins to secure large limestone blocks, and in the manufacture of dishes. Until the 17th century, the name for lead was often confused with that of tin. Lead was defined as *Plumbum nigrum* (black lead) and tin as *Plumbum candidum* (bright lead). This ambivalence shows up in the biblical text as well.³

LEAD IN THE BIBLE

The Israelites regarded lead one of the materials worth taking as booty after they defeated the Midianites (Num. 31:9-21), but ritual cleansing was need-

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ed: *Gold and silver, copper, iron, tin, and lead* [oferet] – *any article that can withstand fire – these you shall pass through fire and they shall be clean* (Num. 31:22-23). Ezekiel the prophet recalls that lead was traded with merchants from distant Tarshish along with silver, iron, and tin: *Tarshish traded with you because of your wealth of all kinds of goods; they bartered silver, iron, tin, and lead for your wares* (Ezek. 27:12; cf. Jer. 10:9).

Lead may have been obtained from the mines of Gebel Rusas near the Red Sea.⁴ There were several functioning mines in the Sinai Peninsula. A remarkably detailed description of mining for ores is given in the Book of Job (28:1-18), where the difficulties of mining are portrayed together with a compassionate account of the harsh lives of the miners.

We also gather from an extra-biblical source, the Black Obelisk of Shalmaneser III, that in 841 BCE the Assyrian monarch received precious tribute from Jehu King of Israel, including gold, silver, and lead.⁵

PROPERTIES AND USES OF LEAD

The Bible refers specifically to the physical properties of lead. In the Song of the Sea, for example, it is said of the drowning Egyptian charioteers that *they sank like lead in the majestic waters* (Ex. 15:10), emphasizing the high specific gravity of lead. There is a similar allusion to this metal's weight in the Apocrypha: *What is heavier than lead?* (Ben Sira 22:14).

We also find specific uses for lead. The prophet Zechariah notes the use of a lead disk as the heavy cover for a tub: *The disk of lead was lifted, revealing a woman seated in a tub . . . and he pressed the leaden weight into its mouth* (Zech. 5:7-8). Job, on the other hand, would have liked his words to be written down, *incised on a rock forever with iron stylus and lead* (Job 19:23-24).

The most frequent use of lead in the Bible, however, is in a plumb line. A plummet or plumb line consists of a vertically held cord which has a lead weight at one end to determine precise vertical direction. This has been the typical use of lead in construction work and the Book of Kings describes its function: *I will stretch over Jerusalem the measuring line of Samaria and the plummet of the House of Ahab* (II Kgs. 21:13). In a fascinating passage, the prophet Amos has a vision in which God showed him a plumb line: *The Lord . . . was standing on a wall checked with a plumb line with a plumb line in His hand. And the Lord asked me, 'Amos, what do you see?' 'A plumb line,' I*

replied. Then the Lord said, 'Behold, I am setting a plumb line in the midst of My people Israel' (Amos 7:7-8). Isaiah expresses the use of the plummet's function in a similar way: *I will apply judgment as a measuring line and retribution as a plummet (Isa. 28:17).*

Zechariah tells of the plummet held by Zerubbabel: *For whoever despised the day of small beginnings shall see with joy the plummet [even ha-bedil] in the hand of Zerubbabel (Zech. 4:10).* The word *bedil* employed here usually means "tin", but the phrase only makes scientific sense if it refers to lead. There is no evidence in other biblical texts for the use of tin as a plummet.

Most books of the Bible that mention lead point to the refining of metals by pyrotechnology. For example, as stated earlier, Moses commanded the Israelite warriors to cleanse the metal objects they had acquired by passing them through fire (Num. 31:22-23). The frequent use of metallurgical imagery to illustrate moral issues or ethical principles indicates that people were familiar with the processes and so understood the allusions and metaphors. Metal refining is most often used symbolically to illustrate the purification of Israel: *The bellows blow fiercely; the lead is consumed by fire. Yet the smelter labors in vain, for the wicked are not removed (Jer. 6:29).* Similarly, Ezekiel warns: *The House of Israel has become dross; they are all copper, tin, iron, and lead in the midst of the furnace . . . Just as fire is blown to melt them, so will I blow upon you the fire of My wrath and you shall be melted in a crucible (Ezek. 22:18-21).*

LEAD COMPOUNDS IN THE BIBLE

Lead ores occur in several mineral forms. Minium (Pb_3O_4) is a naturally occurring lead ore which has a beautiful wine red color. Its name was acquired in the Imperial Roman era. Some forms of cinnabar (Mercury sulfide, HgS) are coated with minium, and could therefore be misidentified in the text, but they are totally different minerals. While minium occurs in lead deposits, it can also be prepared from lead in oxidizing conditions. These pigments were used in ancient manuscripts, for decorating walls, and as cosmetic materials.⁶

Ezekiel and Jeremiah vividly describe luxurious Babylonian palaces where one can see *men portrayed upon the walls, figures of Chaldeans drawn in vermilion [shashar] (Ezek. 23:14); spacious upper chambers provided with*

windows, paneled in cedar, painted with vermilion [shashar] (Jer. 22:14). The red pigment used could have been iron ochre (Fe_2O_3) or cinnabar (HgS), but was more probably minium. The word *shashar* used in these texts is related to the Akkadian term for minium (*šašu*).⁷ The most commonly found lead ore is the bluish gray mineral galena (PbS), which was used as a cosmetic. Eye makeup was well known in the Bible (II Kgs. 9:30; Jer. 4:30; Ezek. 23:40) and in the Mishnah (*Berakhot* 7:3; *Kelim* 13:2, 16:8; *Makkot* 3:6; *Shabbat* 8:3, 10:6).

LEAD POISONING IN THE BIBLE

The Bible demonstrates that lead was mined, traded, and used for many different purposes in ancient Israel. Lead compounds were also utilized in art and cosmetics. Lead water pipes were later installed in King Herod's palace, and the Jordan river bed near Jerusalem was lined with lead.⁸ Thus, in biblical times, lead poisoning may well have occurred in Judea, but there is scant evidence that people were aware of lead toxicity.

However, I have found one biblical reference to symptoms that could be attributed to lead poisoning: It is related that King Asa *in his old age suffered from a foot ailment* (I Kgs. 15:23) and that Asa, *in the thirty-ninth year of his reign, suffered from a foot ailment which became severe* (II Chron. 16:12). This illness may have been gout and the result of lead toxicity.⁹

There is evidently knowledge of this affliction in the Talmud (TJ *Shabbat* 14.14, *Avodah Zarah* 2.40). When R. Joshua ben Levi fell ill with *kolos* (a type of colic), R. Hanina bar Hama prescribed treating it with grated cress soaked in old wine.¹⁰ This potion was an accepted antidote for lead poisoning. Pliny also referred to the same type of colic during the reign of Tiberius (14-37 CE).

I consulted Professor Aren Maeir (Bar Ilan University) regarding the possible lead content of bones or food unearthed in his recent excavation of an ancient Philistine site in Israel. No trace of lead content was found in the bones. I also consulted Mrs. Vera Kestenberg, who was a member of the research team studying lead disease at Johns Hopkins University (Baltimore). The earliest evidence for lead content in food and body parts that they found was in samples from the excavations at Pompeii. On the basis of my own

research, I conclude that our ancestors perhaps recognized the symptoms of lead disease, but did not connect them to lead consumption.

Clarifying this matter is a task that future archaeologists could undertake. If ancient bones in today's Judea could be tested for lead content, the data obtained might tell us if lead poisoning seriously affected our ancestors or if it was just a rare occurrence. Such data could also ascertain whether class distinction in Jewish society had any effect on the level of lead toxicity.¹¹

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NOTES

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