The Weighty Issue of a Gold Bible

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The whole story of the gold plates needs to be examined. Since all involved believed that they could heft the gold plates, it is clear that no one really had any idea how heavy gold is. The table below reviews the options, with different metals. The accounts of hefting the plates need to be evaluated in the light of the weighty facts: if they were gold, they would weigh 135 pounds, calculated with a very generous estimate that the air between the plates could account for one third of the volume. In fact, 10% is more likely. On the other hand, the plates may have been only 60% gold, and 40% copper, an alloy called tumbaga actually used in South America in Book of Mormon times. Tumbaga plates would weigh 105 pounds, again with the same generous allowance for air between them. It seems clear that very few witnesses would be able to heft 105 pounds. The testimonies would read more in the vein of attempts: "I tried to heft them, but could not lift them."

Weight of Each Option Adjusted for the Percent Air

Solid block is 6"x8"x6" or 288 cubic inches

Plate option by substance of the plates	Weight gold per cubic inch	Weight copper per cubic inch	Weight brass* per cubic inch	Weight lead per cubic inch	Volume: G gold C copper B brass L lead	Weight per solid block	% air	Total (67% of a solid block)
Gold plates	.7 pounds					201.6 pounds	33	135 pounds
Copper plates		.31 pounds				89.28 pounds	33	59.8 pounds
Brass plates			.2876 Pounds			84.64 pounds	33	55.5 pounds
Lead plates				.41 pounds		118 pounds	33	79 pounds
Tumbaga plates	.42	.124			G 60% C 49%	156.67 pounds	33	105 pounds
Brass-lead combo			.2876 pounds	.41 pounds	B 49.5 L 193.5	B 56.97 L 38.75	33	76.9 pounds

1. The tumbaga is rated here as being 60% gold & 40% copper. So the weight of copper per cubic inch is.31x .4=.124, and the weight of gold is .7x.6=.42, and therefore:
[(288x.42)+(288x.124)]x.67=105 pounds of tumbaga.

2. The weights per cubic inch of gold, copper, brass and lead are multiplied by 288 to get the weight of a solid block. The weight of the plates for each is this time .67.

3. The weight of brass varies. Common brass for cold working applications is 65% copper and 35% tin (.246 pounds per cubic inch), and the weight of the two combined is given here:
(.31x.65)+(.246x.35)=.2876.

4. The brass lead combo assumes that half (3 inches, i.e., the sealed plates) were hollowed out, with a margin of one inch on the side where the rings would have passed, like a three-ring notebook, and a margin of ½ inch at the top, bottom and right-hand sides. This yields a volume of solid lead (6-1-.5)x(8-.5-.5)x3=4.5x7x3= 94.5, so that the weight is 94.5x.41=38.745 pounds of lead in the combo. The brass volume of the margins of the bottom (sealed) three inches is 16.5 (area of the margins) times 3 (height of this portion of the plates), equaling 49.5 cubic inches of brass in the bottom section. The top uncut plates have a volume of 6x8x3=144 cubic inches. The total volume of the brass is therefore 49.5+144=193.5. The block weight is 193.5x.2876=55.65 and two thirds of this is 37.286 pounds. The brass portion (37.286) plus the lead portion (38.745) equals 76 pounds. Wider margins and a shorter sealed portion would reduce this.

So bearing in mind that even tumbaga plates would weigh 105 pounds, we read his mother's account of how he got them out of hiding in a log in the woods and home: "Joseph .. wrapping them in his linen frock, placed them under his arm and started for home.. travelling some distance after he left the road, he came to a large windfall, and as he was jumping over a log, a man sprang up from behind it, and gave him a heavy blow with a gun. Joseph turned around and knocked him down, then ran at the top of his speed. About half a mile further he was attacked again in the same manner as before; he knocked the man down in like manner as the former and ran on again; and before he reached home he was assaulted the third time. In striking the last one he dislocated his thumb, .. he threw himself down in the corner of the fence in order to recover his breath."

Joseph runs more than a mile with a weight of at least 105 pounds. He carries it under his arm, like a school book. With it, he jumps over a log. And during this whole time with it, lugging it from place to place, there is no mention that he can hardly even lift it.

Martin Harris had spent his life working on his farm, and was no stranger to hefting heavy objects. He claimed to have hefted the plates, and said that they weighed about fifty pounds, and certainly no less than forty.

In summary, whether we consider the many who hefted the book, even Mother Smith, Martin Harris' estimate of their weight, or the adventures of Joseph running through the woods, the bottom line is that the sheer weight of even tumbaga plates cannot be reconciled with the story. And the weight of these hypothetical tumbaga plates was generously underestimated.

How about Brass Plates?

It is instructive to have a knowledge of metallurgy in the early Americas, as well as in early nineteenth-century New England. Smelting gold, silver and copper began in the Andes, where alloying also emerged. Well before BCE, bronze and tumbaga were produced. The Moche culture was especially advanced, and South American trading ships carried on an active trade with Mesoamerica, resulting in local metallurgy among the Mayas in their classic period (c. 400-900 BCE). Tumbaga is especially interesting. It is a copper-gold alloy, its ration can range from 10:90 to 90:10, and it has higher tensile strength and a lower melting point than either metal alone. It can be gilded by rubbing it with a mild acid; citric acid will do. This dissolves away the surface copper, leaving a glistening pure gold surface, and the process can be repeated when wear occurs.

In colonial America, the British tried to prevent the local development of the metal industries. Still, one of the largest deposits of lead in the world is in Missouri, and it was being mined as early as 1720. Frontiersmen needed it to cast balls for their muskets. Prior to 1800, brass was mostly used in the button industry. Buttons were formed from sheet brass, and these craftsmen got their brass rolled in early steel rolling mills. The center of the New England brass industry was in Waterbury, Connecticut, self-dubbed "Brass Town." Aaron Benedict began rolling sheet brass in 1824, and quickly found a market for his product.

Joseph Smith was thinking brass plates from the beginning, as is evidenced in the story of Laban's brass plates, in the first few pages of the Book of Mormon. As we have seen, he also produced a "reformed Egyptian" character set also very early. He came from a cooper family. His grandfather and father had been coopers, he was a cooper's son, and his family had a cooper shop. It is interesting to observe that this shop was one of the first places where he claimed he was hiding the plates.

Plates could be weighted with a lead insert. In my tiny village in Wyoming, by age eleven, I was melting lead on my mother's kitchen stove to cast small toys. By thirteen I was making hiking gear out of sheet aluminum (cases for matches and a compass to wear on my belt). And in my teens, I spontaneously cut out rectangular centers from the pages of an old half-leather book, glued the page frames that remained together and the back cover to them, to produce a book box, the front cover acting as its lid. This was a sort of "purse" befitting a studious guy. Such a cavity could have been made in the sealed portion of the plates. But was this necessary? We see from the table *supra* that the weight of unweighted brass plates would be at least 55.5 pounds, more than the upper end of Martin Harris' estimate for the weight of the gold plates. The unsealed portion of brass plates could have been easily inscribed with Smith's character set using an awl, or even an ice pick. But does this mean that the Smiths had actually produced this sort of prop for their project? Not necessarily. Everyone who claimed to have hefted or otherwise examined the plates may have been a confederate. But having a brass-plate prop would have been effective, even just for feeling it through a cloth and hefting it. After all, we do not know that all those who had this privilege got their experience into print.

Conclusions

1. The weight of the plates, if gold, is completely incompatible with the stories told about their being carrie3d and hefted.

2. Tumbaga plates could look like gold, but are still too heave.

3. It was possible in the mid 1820's for a cooper's son to fabricate a brass-plate prop, although there is no need to assume that this happened.