CHAPTER XVII

The Problem of Iron, Steel and Other Metals

The Book of Mormon speaks of iron eighteen times; one of the references is an allusion to Micah 4:13 (3 Nephi 20:19), and another occurs in a quotation from Isaiah 48:4 (1 Nephi 20:4). Of the eighteen references to iron in the text, only two are found in the Book of Ether (10:23); there the Jaredite acquisition of the metal is mentioned. Steel is mentioned five times in the sacred text; the sole mention in the Book of Ether (7:9) has reference to the manufacture of steel swords by a rebellious Jaredite. Copper is mentioned eight times in the Book of Mormon, of which one appearance occurs in Ether 10:23 in reference to Jaredite use of the metal. On the other hand, brass, an alloy of copper and zinc, is mentioned about thirty-seven times, one of these being in the inevitable Ether 10:23. Silver is mentioned about fifty times, four of these occurring in the Book of Ether. Gold is spoken of about sixty times, five occurrences being in the Book of Ether. Reference is made in Mosiah 11:3, 8, to a metal which the prophet Joseph Smith transliterates as "ziff." One suspects that this unknown metal was zinc (or tin?) but why the prophet would have to transliterate the name of such a common metal makes the identification somewhat uncertain. The word "ziff" may possibly come from a Hebrew root meaning "bright," which could apply to zinc; the Nephites and Jaredites must have known it (zinc) well because it was a necessary ingredient in the manufacture of brass. If one wonders why zinc is never mentioned in the Book of Mormon, other than as possibly indicated by "ziff," it should be pointed out that the word never occurs in the Bible either.

Let us introduce at this point two passages of scripture which illustrate well the Jaredite use of metals:

> Wherefore, he [Shule] came to the hill Ephraim, and he did molten out of the hill, and made swords out of steel for those whom he had drawn away with him; . . . (Ether 7:9)

> And they did work in all manner of ore, and they did make [produce] gold, and silver, and iron, and brass, and all manner of metals; and they did dig it out of the earth; wherefore they did cast up mighty heaps of earth to get ore, of gold, and of silver, and of iron, and of copper. And they did work all manner of fine work. (Ether 10:23)

The Nephite use of metals, "ziff" excepted, is fairly represented by this passage:

> And we multiplied exceedingly, and spread upon the face of the land, and became exceeding rich in gold, and in silver, and in precious things, and in fine workmanship of wood, in buildings, and in machinery, and also in iron and copper, and brass and steel, making all manner of tools of every kind to till the ground, and weapons of war—yea, the sharp pointed arrow, and the quiver, and the dart, and the javelin, and all preparations for war. (Jarom 8)

The use of gold, silver, and copper by Book of Mormon peoples presents no particular difficulties to us, for the use of these metals is attested from earliest times. And many of the largest and best museums in the world will be found to house examples of ancient American objects made of these metals, especially gold. Silver and copper are much more active, chemically speaking, than gold; hence objects made of these metals are harder to come by.[1] And because objects made of iron (including steel) so readily oxidize, disintegrate, and disappear in damp climates, the use of them by Book of Mormon peoples is now somewhat difficult to prove. Indeed, the problem of the Book of Mormon re-

specting metals is that of proving the use of iron and steel by peoples living roughly between the years 2,000 B. C. 400 A. D. The problem seems to us to resolve itself into two parts: (1) Could Book of Mormon peoples have brought to this (the American) continent a knowledge of the production of iron and steel? And (2) is there material evidence surviving which bears out the Book of Mormon account of the use of iron and steel by the ancient inhabitants of this continent? The presumption in favor of a positive answer to the first question is very high in view of our present scientific knowledge. As a reflection of this fact, we may note these remarks taken from the current (1963) *Encyclopedia Britannica*:

> Few implements of iron or steel survive for many years before they rust away, consequently there is little direct evidence to prove the point; nevertheless the antiquity of iron smelting is great. It doubtless has been discovered and rediscovered many times; explorers reaching primitive peoples in many parts of the world find the native blacksmith using methods very similar to those known to other tribes at far distant times and places. An iron blade, probably 5,000 years old, has been found in one of the Egyptian pyramids. Even without this discovery one could plausibly maintain that the ancient Egyptians must have had skilled steel workers in order to have built the great pyramids and other monumental architecture, to say nothing of the statuary and hieroglyphics cut into the hardest rocks. Steel working and hardening, an advanced stage in the art which doubtless required centuries to reach was common 3,000 years ago in Greece, and is mentioned in Homer.[2]

R. J. Forbes, one of the foremost experts on the subject, claims that man had learned the secret of making wrought iron as early as 2500 B.C.[3] And G. A. Wainwright points out that "while Mesopotamia had known meteoric iron from before 3000 B.C. it also knew [though rarely] smelted

iron as early as some time before 2800 B. C."[4] Moreover, those of us who still believe in the essential integrity of the books traditionally ascribed to Moses can't help but remember that our Hebrew version of Genesis 4:22 tells us that very early in man's history Tubal-Cain was "a hammerer of every [kind of] engraving instrument of bronze and iron." T. K. Derry and Trevor I. Williams advise us that "a few pieces of man-made iron were in circulation before 2500 B. C., and iron ornaments and ceremonial weapons soon after 2000 B. C."[5] Forbes further informs us that the secret of making wrought iron spread into prehistoric Europe, but that a proper solution for the best use of the metal was probably achieved about 1400 B. C. among peoples in the Armenian mountains and the districts along the southeast corner of the Black Sea. "Here," says he, "dwelt the tribe of the Chalybes who according to Greek tradition gave their name to steel (Greek *chalybs),* and who were celebrated ironsmiths. They discovered that wrought iron, reheated frequently in a charcoal fire and then hammered, would become much harder than any bronze and keep its hardness after long use."[6]

Ancient historians seem more or less to agree that the workers in the new metallurgy of iron and steel were subjects of the Hittite Empire of Asia Minor and Syria. Among the precious objects found (1922) in the tomb of king Tutankhamon (1350 B. C.) was a steel dagger which the young king's father had obtained from the Hittites. It is generally agreed that Balkan tribes invaded Asia Minor and brought about the end of the Hittite Empire, thus scattering the ironsmiths.

> Among the dispossessed were ironsmiths, who now spread rapidly over the Near East. They were the ancestors of the Kenites of Midian, one of whose daughters married the great Hebrew prophet and lawgiver Moses, and of the groups of smiths that up to the present day forge the weapons of the desert tribes of Arabia.[7]

"Cuneiform Hittite texts," says R. K. Harrison, "have shown that they [the Hittites] monopolized the smelting and manufacture of iron for all trading purposes up to the time when Hittite power was broken about 1200 B.C."[8]

In some ancient cuneiform tablets found about 190 miles south of Cairo, Egypt, by an old peasant woman about 1887, there is a list of presents from Tusratta to Amenophis III, (1412-1375 B. C.) when he gave to him his daughter Taduhita to wife. Here are two entries:

> [One] dagger whose blade is of steel.
> One mittu [divine weapon] of iron[9]

Because of its inherent interest, let us read into our record this extended statement by the very competent G. A. Wainwright, who uses well-attested sources:

> With people [Hittites] from the homeland of ironworking roaming all over Syria, it is not surprising that this is the period at which iron became common in Palestine. At Gezer in central Palestine two large pieces of iron, measuring about four inches in width and one in thickness, were found together in a water passage which had been sealed up about 1500 or 1400 B.C. By the time of the 19th Egyptian Dynasty, c. 1300-1200 B.C., iron had become the regular metal at Gerar in south Palestine, of which were manufactured knives, dagger-knives, spearheads, lanceheads, chisels, borers, hooks and sickles. A little later, say between 1200 and 1100 B.C., there were a number of very large iron implements, consisting of an iron pick originally weighing some six pounds, two large hoes, two plough irons, and a large adze. The furnaces were also found, showing that the iron was worked on the spot. The two earliest ones were datable to about 1175 and 1100 B. C. respectively. At Megiddo in northern Palestine an iron foundry was discovered with quantities of iron ore, ash, scoriae, and numbers of manufactured iron implements, including plough shares, hoes of various sorts, spearheads, a small chisel, a sickle, knives, rings, and many

nails, etc. The date of this is uncertain but in any case it is probably before 926 B. C.[10]

We may briefly summarize our present scientific knowledge of the use of iron and steel in this way:

1. Meteoric iron was known in Mesopotamia 3000 B.C. or earlier.

2. The secret of producing wrought iron was known as early as 2800-2500 B. C.

3. The making of steel seems to have developed after 2000 B. C.; at any rate, archaeological evidence indicates that the slagging of iron ore, the handling of the hot metal, and the techniques of carburizing, quenching, and tempering necessary for the making of steel, had been accomplished by c. 1400 B. C.,[11] more especially by peoples in the Hittite Empire.

4. Knowledge of the production of iron and steel spread into Palestine and Arabia at an early period, especially after the dissolution of the Hittite Empire about 1200 B.C.

Now applying our knowledge to the problem in the Book of Mormon, we can say with certainty that the Nephite people could have known about the production of iron and steel before they left Palestine about 600 B. C. And as for the Jaredites who left Asia about 2000 B.C., it can be said that they could readily have known about the production of wrought iron. But an expert in the history of the use of iron and steel, intent on being critical, might object somewhat if we say they could have known about the production of steel as early as 2000 B. C. And we are going to say it, for, after all, the methods of making steel were in use by 1400 B. C. by the Hittites, and what scholar is in a position to say that some groups of people in the whole of Asia were not in a position to produce it as early as 2000 B. C.? Let us remember what the Encyclopaedia Britannica article we quoted earlier tells us and note the

possibility that the manufacture of iron and steel could have been discovered and rediscovered many times by different peoples, including the Jaredites, in Asia. Granted that wrought iron was produced before 2000 B. C., as we have shown, it seems to us that any competent metallurgist would grant the very strong possibility that the process of making steel could easily be discovered. It is a well known fact that if objects made of wrought iron, such as sword blades, are heated repeatedly in a charcoal fire and hammered out, they become very hard on the outside. In fact, the outside layer becomes steel. What happens is that the iron absorbs carbon in the heating process and develops a steel structure as a result. And if hot steel is plunged into cold water, an even harder steel may result. Once the technology of producing wrought iron is understood, it is easy to see how steel could be discovered. But even if the ancient Jaredites didn't know how to make steel on leaving Asia, they could well have discovered the process on coming to this continent. The one reference to the making of steel in the Book of Ether (7:9) indicates that the process was in use some time after the Jaredites had arrived in Middle America.

Coming now to the second part of our problem, we want to inquire if there are any survivals of iron and steel objects among ancient American peoples. Iron and steel, as we have already pointed out, oxidize and disintegrate so rapidly that it is very difficult to prove that a given culture used the metals even when the probabilities of such use are very high. Our problem is made clear in a letter very graciously sent to one of our students by Professor Earle R. Caley, Acting Chairman of the Department of Chemistry of Ohio State University, as of July 10, 1963:

> As far as I am aware nothing new has turned up lately in regard to the possible use of iron by the Indian peoples of the Americas. Except for a few North American implements definitely shown to have been

> made from meteoric iron, I know of no use of iron tools by the inhabitants of the Americas prior to the entry of Europeans. No Pre-Columbian iron object or remains of such an object has ever been found in either Central or South America, as far as I know. On the other hand, a large number of tools composed of hard copper alloys have been found. These fall into two classes in respect to composition. The majority are composed of tin bronze, and the others of arsenical copper. I hope I have answered your enquiry satisfactorily.

Professor Caley's letter clearly indicates that we do not at present have the profusion of scientific evidence proving the use of iron and steel in the ancient Americas that we have for their use in ancient Egypt, Palestine, and Asia. But we need not be too disturbed. Not too many years ago there was a similar dearth of good scientific evidence for the use of these metals in the ancient Near East and Asia. Only vigorous archaeological activity and investigation has made the difference.

It may be of interest, however, to notice some reports of the finding of iron and steel in ancient American ruins without attempting in any way to assess their real scientific value, if any. In the 1920's A. Hyatt Verrill was carrying on some investigations in Panama in the interests of the Museum of the American Indian, Heye Foundation, of New York. Among other things, he says these words about the ancient people he was investigating:

> I am thoroughly convinced that this people, as well as many other prehistoric races, possessed iron or steel tools, and I do not know of a single argument or fact to disprove this. The fact that no iron or steel tools have ever been found proves nothing. Iron is the most perishable of metals, and, except under most unusual or peculiar conditions, all traces of small iron or steel tools would disappear completely in a few centuries....
>
> Indeed, less than two years ago, I was scoffed at for

> suggesting that an entirely new and unknown culture of great antiquity had existed in Panama, but we now have undeniable proofs of the fact. Moreover, at a depth of five and one half feet below the surface, at the temple site, among broken pottery and embedded in charcoal, I found a steel or hardened iron implement. The greater portion is almost completely destroyed by corrosion, but the chisel-shaped end is in good condition. It is so hard that it is scarcely touched by a file and will scratch glass, and with such an implement it would be a simple matter to cut and carve the hardest stone.
>
> No doubt many will discredit this, or will claim that the implement is modern and found its way beneath the surface via some hole or crevice, or will claim that some junk-collecting snake or centipede carried the object to its resting place in a compact mass of semi-fossilized carbon packed in the midst of broken prehistoric pottery. But how can they explain the evidence of tool marks on much of the stone work? Not the irregular indentations which might, and very likely were, made by pecking with a stone hammer, but clearly cut delicate lines and chisel marks.[12]

Under date of July 19, 1819, a certain Dr. Hildreth reports the finding of some metal objects near a body in an ancient mound in Marietta, Ohio:

> Lying immediately over or on the forehead of the body were found three large circular bosses, or ornaments for a sword-belt or buckler; they are composed of copper, overlaid with a thick plate of silver.... Near the side of the body was found a plate of silver which appears to have been the upper part of a sword scabbard; it is six inches in length and two inches in breadth, and weighs an ounce; . . . Two or three broken pieces of a copper tube were also found, filled with iron rust. These pieces from their appearance, composed the lower end of the scabbard near the point of the sword. No signs of the sword itself were discovered except the appearance of the rust above mentioned....

> A piece of red-ochre or paint, and a piece of iron ore, which has the appearance of having been partially vitrifiled, or melted, were also found. The ore is about the specific gravity of pure iron[13]

Professor Cyrus Thomas reports the finding in a burial mound of eastern Tennessee "one *iron chisel,* which was by a skeleton."[14] He also reports the finding in a triangular pit in Caldwell County, North Carolina, of a group of skeletons in one place, the principal personage of which had

> A piece of copper . . . under his breast; around each wrist were the remains of a bracelet composed of copper and shell beads alternating; at his right hand lay four iron implements, one a roughly hammered celt; another, part of a blade; another, part of a punch or awl, with a deer-horn handle.[15]

In a book dealing with the story of iron-age civilization in America, Arlington H. Mallery tells in an enthusiastic manner about the finding of iron slag and heavy pieces of iron, not to mention blast furnaces for the making of iron implements in Virginia and Ohio. Many of these furnaces he attributes to the activities of pre-Columbian Vikings, but at least one, the Deer Creek furnace, which was exposed by floods, he says seems to have been built thousands of years ago.[16] Mallery strongly supports the view that there was an Iron Age in pre-Columbian America; indeed, he holds that a highly civilized Iron Age people lived here with a history of great accomplishment. Not only that, but he also thinks such an age was preceded by an even greater civilization which was possibly equal to or greater in certain respects than the contemporary civilizations in the Old World.[17]

We could multiply such citations, but enough have been given to acquaint the reader with the nature of them.

It is not at all improbable that at some future time iron and steel implements may be found in some dry con-

tainers in or about some of the great stone buildings which stand as a monument to ancient Middle American cultures. Just as many years ago people "could plausibly maintain that the ancient Egyptians must have had skilled steel workers in order to have built the great pyramids and other monumental architecture," so we can do the same in respect to the great monumental architecture of the ancient Americans. The problem is more difficult than in the dry climate of Egypt, but we can afford to wait. And when the finds are made, we hope they are made under competent scientific direction.

Notes:

[1] Gordon R. Willey, Harvard University says, "Occasional copper and gold Ends come from contexts which are Classic and, perhaps, even earlier (Sorenson 1954). Continued research in west Mexico may reveal a deeper tradition of metallurgy than has heretofore been admitted for Middle America." See his article, "The Prehistoric Civilizations of Nuclear America," *American Anthropologist,* Vol. 57, No. 3, Part 1, p. 585 (June, 1955). See the article by my colleague, John L. Sorenson (which Willey seems to cite with approval, "Indications of Early Metal in Mesoamerica," *Bulletin of the University Archaeological Society* Brigham Young University, No. 5, pp. 1-15. Provo, Utah.

[2] No. 12, p. 649. Encyclopaedia Britannica, Inc., William Benton, Publisher, 1963.

[3] *Man the Maker*, p. 54. Abelard-Schuman Ltd. New York, 1958.

[4] "The Coming of Iron," *Antiquity, X,* 23.

[5] *A Short History of Technology*, pp. 120-121. Oxford University Press, 1961.

[6] *Op. cit*.

[7] Forbes, *op. cit.,* pp. 55-56.

[8] *A History of Old Testament Times*, p. 69. Zondervan, 1957.

[9] See S.A.B. Mercer, *The Tell El-Amarna Tablets, I,* 81, lines 32 and 38. Toronto, Macmillan Co., 1949. Cf. Knudtzon, *Die-el-Amarna-Tafeln, 1,159,* line 38, and p. 163, line 16.

[10] *Op cit*., pp. 19-20.

[11] On these last points R. J. Forbes may again be consulted, with profit. See *A History of Technology, I,* 572. Oxford, Clarendon Press, 1954.

[12] The Pompeii of Ancient America," *The World's Work,* LIII, No. 3, pp. 268-287 (Jan. 1927).

[13] Barnard Shipp, *The Indian and Antiquities of America,* pp. 244-245, Philadelphia, 1897.

[14] Introduction to the Study of North American Archaeology, p. 63. Cincinnati, 1898.

[15] *Ibid*., p. 81. The find is assumed not to be of "any great age." P. 83. See account of other finds of iron ore on p. 142.

[16] *Lost America*, p. 194a. Introduction by Matthew W. Stirling, Director of the Bureau of American Ethnology, Smithsonian Institution. Overlook Co., Columbus, Ohio, 1951.

[17] *Ibid*, pp. 214, 215. It is a pity that Mallery with a great opportunity didn't present his material in a strict, scientific manner. See review of his book in *The Ohio State Arch-ecological and Historical Quarterly,* Vol. 62, No. 3, pp. 285- 293. (July, 1953)