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Mesoamerican Archaeological and Scientific Evidence Indicative of Chronological Events

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Chapter 5

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Following the method we employed in chapter 2, when looking at destructions in the Jaredite narrative in tandem with volcanic eruptions in Mesoamerica, we can correlate various other Jaredite events with incidents in the natural history of the region and the cultural history of the Olmec.

Opening the Land Southward for Game

Based on the approximate date of 1095 BC for Lib₁, from the chronological framework calculation (discussed later), and the founding of the great city by the narrow neck, which corresponds with the Olmec city of La Venta (also discussed later), there was an opening up of the land southward (at least in that area) for the principle purpose of preserving the land for hunting. There are no mentions of any previous migrations into the land southward since the time of Heth (ca. 1635 BC) and no indication there had been any (due to the proliferation of venomous serpents).

Ether 10:19, 21

19 And in the days of Lib the poisonous serpents were destroyed. Wherefore they did go into the land southward, to hunt food for the people of the land, for the land was covered with animals of the forest. And Lib also himself became a great hunter.

21 And they did preserve the land southward for a wilderness, to get game. And the whole face of the land northward was covered with inhabitants.

From a chronological and cultural standpoint, this practice is consistent in time with the Olmec chronology. A variety of studies cited by Christopher Pool (2007) indicate that by the end of the Early Formative Period (1000 BC), maize-based agriculture had been established through the Olmec culture area, augmented with other resources (64). The Olmec consumed a wide array of animal species including red brocket deer, white-tailed deer, rabbits, raccoon, peccary, duck, turkey, armadillo, boa constrictor, ocelot, and various types of fish (Vanderwarker 2006).

When sedentary agriculture becomes established, habitat and food for smaller game (insects) increase. While some larger mammals that browse (such as deer) can benefit from the new landscape partially devoid of forest, other large game becomes scarce. Several archaeological studies concentrated on the southwestern United States have shown that as people become more committed to farming, they actually increase their exploitation of larger prey (Speth et al. 1989, 76; Szuter and Bayham 1989, 89). These studies indicate that these groups selectively focused on larger species and suggest that when farmers were faced with a local depletion of large prey, they extended their hunting ranges and shifted from an individual-based to a communal-based hunting strategy. With the combined effort, they spent less time on long-distance hunts while procuring a higher return on preferred prey.

This approach is also consistent with other studies that show when a society becomes dependent on sedentary agriculture, it utilizes “trekking,” one strategy for dealing with fluctuations in productivity in which large segments of the population leave their permanent villages for extended periods to hunt and forage in distant areas. This practice has been documented in the Amazonian rainforest (Werner 1983).

A specific study regarding Olmec sustenance patterns revealed that, toward the end of the Early Formative Period and into the Middle Formative (ca. 1000 BC), people in the Tuxtlas became more sedentary and altered the faunal subsistence practices away from aquatic resources and toward terrestrial mammals (Vanderwarker 2006, 195).

The description provided in the Book of Ether for the “game preserve” in the land southward is completely consistent with the Olmec situation, both in time and in practice. The exact location of the “south wilderness” is discussed later.

Post-Jaredite Events and Commentary from the Book of Mormon

Tail End of the Jaredite Calendar

We do know that the last Jaredite king, Coriantumr₂, visited the people of Mulek and stayed for nine moons, so a look at the time constraints of the people of Mulek and at the end of the Jaredite culture is in order. Brant Gardner places the arrival of the people of Mulek in the New World at around 580 BC (based on the dates of King Zedekiah’s reign in Jerusalem) and the merger with Mosiah’s people at 162 BC. Gardner also places the end of the Jaredites at “around 200 BC” and the beginning of the Jaredites at “about 1100 BC” (Gardner 2015, 216, 390–92).

John Sorenson (2013) conjectured a date of 2500 to 2800 BC for the arrival of the Jaredites and around 570 BC for the end of Jaredite culture (27, 31), with the arrival of the people of Mulek around 575 BC. Sorenson (1990) indicates that a long period of overlap between the Jaredites and the people of Mulek was not likely. He also suggested that the final destruction of the ruling line could have occurred as early as 580 BC or as late as 400 BC (Sorenson 1985, 119).

If the chronology identified in the Caractors Document is correct, then the Nephites arrived in Zarahemla in 209 BC (Grover 2015, 205). It is clear that the discovery of Coriantumr₂ by the people of Zarahemla (Omni 1:21) and the “burial by them” (Ether 13:21) must have occurred sometime before 209 BC. This tail-end chronology is discussed in more detail later.

Chronological Information Provided by Recovery of the Jaredite Plates

Based on information in the Book of Mormon and the Caractors Document, we know that a large stone stela discussing Coriantumr₂ was recovered around 198 BC and that the Jaredite plates were recovered around 130 BC. A complete analysis of the chronology and geography of these events is discussed elsewhere.

“Dry Bones” as a Chronological Indicator

The Limhite expedition which recovered the Jaredite plates encountered “a land which was covered with dry bones” and was “covered with the bones of men, and of beasts.” Certain online publications have made the case for a chronological period of 100 years or less from the death of the Jaredites to the discovery of the bones in the neighborhood, based on bone decomposition rates (www.moriancumr2.blogspot.com 2016):

In a humid, wet, semi-tropical environment (*sic*) bones left on the surface of the ground tend to decompose rather quickly. If there are a lot of predators and scavengers, they tend to accelerate the process. If the soil is of volcanic origin, and therefore acidic, this also accelerates the decay. Many taphonomic studies (this is the science that studies biological decomposition) have been conducted to determine among other things the rate of decay of dead tissue. One of the experts in this field, Ann Behrensmeyer, has observed the disintegration of bones exposed on the surface in Kenya for at least 30 years. She has broken the process down into five stages: stage 1 (1–3 years) the bone exhibits fine cracking; stage 2 (3–5 years) the surface of the bone begins to flake off; stage 3 (5–10 years) the fibrous interior bone is exposed; stage 4 (10–15 years) deep cracks develop in the bone; stage 5 (15–30 years) the bone disintegrates into splintered fragments.

Once again, this is for bone lying on the surface and exposed to animals, bugs, and the elements. This was the case with the Jaredite bones that the Limhites found. Bone size is also a factor with smaller bones disintegrating first and larger bones lasting longer. But the thing to note is that within 30 years the bones are all decomposing. We can safely assume that within one hundred years all evidence of the Jaredite bones which had been on the surface would have disappeared.

The Behrensmeyer study referenced (Behrensmeyer 1978), however, was not done in a humid, wet, semitropical environment; it was completed in the Amboseli National Park, where the climate is actually hot and dry, positioned in the rain shadow of Mount Kilimanjaro. In fact, bone weathering in a tropical environment is much slower. Tappen (1994) conducted a study in 1994 in the Ituri rainforest in Zaire. That study observed 118 elephant bones with known or estimated death dates. After seven years of exposure, the bones were still at stage 0 (no weathering). A second site indicated bones still at stage 0 after 16 years (no weathering), while a third site with remains greater than 15 years old indicated stages 1 to 3 of weathering. The study indicated that heavy vegetation cover protects the bones and blocks the sun, significantly slowing the speed of bone weathering. Other subsequent studies have confirmed these findings and also determined that buried flesh or skeletal tissue takes roughly eight times longer to degrade (Ross et al., 2011).

While there is no discussion of burial, it is probable that for much of the final Jaredite war, which lasted at least eight “years” (six years under the Olmec Calendar Round calendar), battle casualties were buried. It was only in the very last stage of the war that bodies were mentioned to have remained on the surface (Ether 14:21–23). It is possible that after hundreds of years that some of these burials may have become exposed or scavenged.

In addition, it is curious that the Limhites described the land as also being covered with the bones of “beasts.” There is no mention of the final Jaredite war entailing the killing of beasts. It’s possible that some of the dry bones they observed may have been the result of the deaths of subsequent people and animals resulting from a volcanic eruption. There were two possible eruptions of the San Martín volcano within the potential intervening timeframe (400–130 BC) (Smithsonian 2016), which could have resulted in the deaths of both humans and beasts. After 200 years, fully preserved skeletons, covered by volcanic eruptive material, were excavated in 2008 from deposits of the 1811 eruption of the Tambora volcano (Johnston 2012). It is noteworthy that the early editions of the Book of Mormon, up until 1920, rendered this verse as “the bones of men, and of beasts, etc.” (Skousen 2005a, 574), so the likely interpretation of the “etc.” would be bones of other vertebrates (birds, reptiles, and fish), which would certainly be indicative of remains within a volcanic eruption.

If the dry bones observed on the surface were, in fact, from unburied bodies left in a wet, semitropical environment, one might expect dry bones (up to stage 5) to be present from at least a minimum of 150 years and perhaps several hundred years after death, based on extrapolations of the above-listed studies. If the bodies were initially buried by purposed burial or by volcanic material and then exposed to the surface, the time would be much longer. If one considers the Limhite expedition encountering dry bones at approximately 130 BC, the Jaredites’ demise at 350–400 BC is certainly very reasonable based on the “dry bones” chronological criteria.

Bones scattered in the land northward were noted by Amaleki (Omni 1:22), who it seems obtained that knowledge when a large stone (presumably from the land northward) containing information about Coriantumr₂ was brought to Mosiah₁ (Omni 1:20). This event would have had to occur after the Zeniff party left Zarahemla (Limhi had no knowledge of these bones, thinking they were from the people of Zarahemla, who he thought had been destroyed). The bringing of the large stone would have had to have been sometime prior to Mosiah’s death and so would have been approximately 430 years after Lehi left Jerusalem, or 170 BC. Amaleki does not mention that the bones were “dry,” but they may have been (Limhi didn’t mention that the bones were “dry” on his first recounting of the bones either [Mosiah 8:8]). The time period between the large stone being brought to Mosiah₁ and the Limhite expedition is approximately 40 years, and bones were observed by both groups, which is fair proof that the decomposition of

the bones was much slower than some have asserted. Trying to place the Jaredites' demise after 280 BC would be suspect, since the remaining bones would not have reached a dry state in the semitropical climate.

Timber Deforestation Chronological Criteria

The chronological correlation of the post-Jaredite era is further corroborated in statements made by Mormon regarding the repopulation of the land northward over time.

Helaman 3:3–11

3 And it came to pass in the forty and sixth, yea, there was much contention and many dissensions; in the which there were an exceedingly great many who departed out of the land of Zarahemla, and went forth unto the land northward to inherit the land.

4 And they did travel to an exceedingly great distance, insomuch that they came to large bodies of water and many rivers.

5 Yea, and even they did spread forth into all parts of the land, into whatever parts it had not been rendered desolate and without timber, because of the many inhabitants who had before inherited the land.

6 And now no part of the land was desolate, save it were for timber; but because of the greatness of the destruction of the people who had before inhabited the land it was called desolate.

7 And there being but little timber upon the face of the land, nevertheless the people who went forth became exceedingly expert in the working of cement; therefore they did build houses of cement, in the which they did dwell.

8 And it came to pass that they did multiply and spread, and did go forth from the land southward to the land northward, and did spread insomuch that they began to cover the face of the whole earth, from the sea south to the sea north, from the sea west to the sea east.

9 And the people who were in the land northward did dwell in tents, and in houses of cement, and they did suffer whatsoever tree should spring up upon the face of the land that it should grow up, that in time they might have timber to build their houses, yea, their cities, and their temples, and their synagogues, and their sanctuaries, and all manner of their buildings.

10 And it came to pass as timber was exceedingly scarce in the land northward, they did send forth much by the way of shipping.

11 And thus they did enable the people in the land northward that they might build many cities, both of wood and of cement.

Verses 3 and 4 discuss an initial specific migration and settlement to a land that was at “an exceeding great distance,” where there were “large bodies of water and many rivers.” This location has been postulated by others to be the Valley of Mexico, which is the only place that reasonably meets the description given (Gardner 2015). Also provided in the above passage of scriptures is a more general discussion of the spreading of the population from the land southward into the land northward (verses 5–11). The text does not indicate that all of this migration and population spreading into the land northward occurred in the 46th year—it is just an indication of the initial migration and the general population expansion that occurred, presumably, up until Mormon's day.

Verse 6 does indicate that, at least initially, portions of the land northward were not settled and that portions were “without timber, because of the many inhabitants who had before inherited the land.” The first migration occurred in the 46th year of the reign of the judges, which is equivalent to 48 BC. The word *timber* has no official definition, but it is indicated that houses of wood could not be built without it and that “tents” and “houses of cement” were able to be built even though timber was lacking. In addition to wooden houses, “their cities, and their temples, and their synagogues, and their sanctuaries, and all manner of their buildings” were unable to be built without timber.

Because of the timber deficiency, a special forest-preservation program had to be implemented (verse 9) to guarantee that the trees to be used for timber reached maturity. In addition to the tree-preservation program, it was necessary to import timber from the land southward (verse 10).

Mormon’s Statements on Structural Timber and Cement in the Land Northward

The statement that tents and some small cement houses could be built without timber squares with Mesoamerican practices. Although the preferential practice for manufacturing cement in Mesoamerica involves the burning (at high temperatures) of lumber (typically softwood pine), other sources of fuel (e.g., bound brush limb faggots) could have been used to manufacture cement. A “tent” in the Book of Mormon context would be assumed to be some sort of thatched lean-to (Sorenson 2013, 322–23).

A typical Maya house (which is assumed to be representative of other Mesoamerican wood houses) requires a lashed timber skeleton frame that is then covered with a thatched roof and wattle walls (see figure 13).

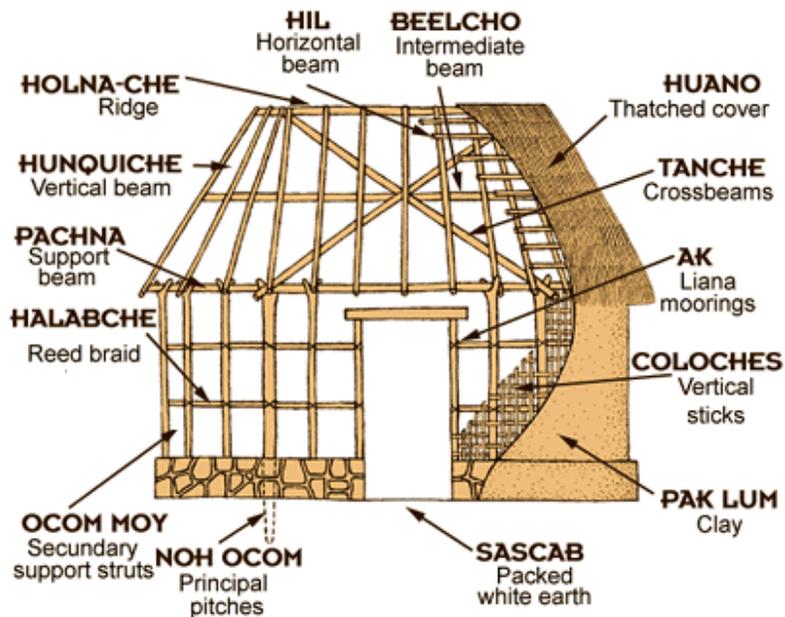


Figure 13. Typical Maya house and structure. (clio.missouristate.edu 2015)

The use of cement has been documented in Central Mexico and corroborates the date provided by Mormon (Sorenson 2013, 322 and references cited there). Charcoal found in mounds at Teotihuacan radiocarbon dates between 50 BC and 110 AD (Millon et al. 1961). This same date range was reconfirmed by radiocarbon dating of charcoal that was found under concrete slabs under the Temple of the Sun (Sload 2007). Maya builders were knowledgeable of the process for fabricating hydraulic cement prior to 300 BC and were using it in building projects (O’Kon 2012, 139). The term for cement in the Book of Mormon could also reasonably be interpreted to include structural mortar, plaster, and stucco.

The statement by Mormon that “their cities, and their temples, and their synagogues, and their sanctuaries, and all manner of their buildings” were unable to be built without timber also squares with Mesoamerican practice. High-strength structural timber from tropical hardwoods were used in the construction of larger buildings where high-tensile strength was needed in features such as lintels and beams.

Specifically, the Maya arch was a basic building tool used in the construction of large building projects because it had multifaceted capabilities and could span between supports to create interior spaces in buildings, span a gateway, create large vault-like interior spaces, or be vertically positioned to form multistory vaulted buildings. As a structural mechanical element, the Maya arch is not a true structural arch, in that it requires additional structural, tensile truss elements in order to be self-supporting. It was necessary for the Maya to use high-strength timber trusses in their arches to make them self-supporting.



Figure 14. Maya arch structure showing cross-timber structures in Ti'kal, Guatemala. (www.maya.nmai.si.edu 2015)

High-strength timber was used in other structural applications that would certainly qualify as “cities, and their temples, and their synagogues, and their sanctuaries, and all manner of their buildings”:

High strength tropical timber was used by Maya engineers for spanning bridges, roofs, and floors. Examples of these structures include the bridge at Pusilha, the palace tower at Palenque, and the sweat house at Piedras Negros. In several cases, the timber beams were used with a concrete topping. This system then became a composite structural material, and the total strength exceeded the sum of parts. (O’Kon 2012, 163)

It is interesting that temple structures placed on top of solid Mesoamerican pyramid piles (made from mass fill of rubble encased with precast concrete) do not require timber. It is thought that the principle use of the word *tower* in the Book of Mormon is the word used for these pyramids, so Mormon's failure to mention the word *tower* supports this interpretation, since Mesoamerican pyramids, or "towers," do not require timber.

Aside from the structural support provided by high-strength timber, the ability to build larger cement/stone projects would also be inhibited if cement production was scarce due to lack of timber, a fact that also supports Mormon's description.

Mormon's Statements on Prior Deforestation in the Land Northward

Since the primary purpose of this particular discussion is to better tie in the chronological tail end of the Jaredite era, and one of Mormon's statements potentially pertains to the Jaredite era, namely, Mormon's assertion that "the many inhabitants who had before inherited the land" had rendered parts of the land "desolate and without timber." Mormon clarifies what was meant by "desolate" here, namely that the land had vegetation but lacked timber. Mormon further indicates that the name for the land itself was called "desolate" because of "the destruction of the people who had before inhabited the land." The land is referred to elsewhere in the Book of Mormon as the land of "Desolation," so the description here is consistent. There is no specific reference to the Jaredites here, so the reference to prior inhabitants may include others besides (and perhaps after) the Jaredites.

There are scientific techniques to determine events of ancient deforestation. The primary method involves obtaining cores of sediment from historically stable soils (ones that would reliably accumulate soil layers as opposed to ones that sporadically accumulate or experience periods of soil loss). These locations would typically be sediment columns in stable lakes or marshlands. Once the cores are obtained, layers are then evaluated for the presence and types of pollen present. Also of interest are any layers of charcoal that may indicate forest burning (typical of the slash-and-burn agriculture that was practiced anciently) or layers of volcanic ash indicative of volcanic eruptions, which could, of course, have caused deforestation within the range of the eruption.

There are two studies of this sort that have taken place within what would reliably be considered to have occurred within the land northward. The first study took place in 1998, core studies were completed from the lake sediments of Laguna Pompal, which is a small lake four miles east of Lake Catemaco on the western flank of the Volcan Santa Marta in the Tuxtla Mountains. This study is also corroborated by an earlier 1989 study of cores taken from Lake Catemaco.

These studies showed that circa 650 BC, arboreal (tree-derived) pollen started to drastically decrease and by 500 BC (+/- 70 years), pollen from individual-measured species of trees (*Ulmus*, *Alchornea*, and *Liquidambar*) were nearly nonexistent (Goman et al. 1998; Byrne et al. 1989). These studies showed that arboreal pollen stayed low until circa 650 AD and that the largest driver of the deforestation was agriculture, evidenced by the increase in agriculturally based pollen and charcoal. Based on later data, following a decrease or cessation in agriculture, the tropical forest recovery was fairly rapid, with arboreal pollen peaking within 300 years. The studies also indicated a large increase in grass and weed pollen during the timeframe when the forest pollen was low.

In 2006, an additional pollen core study, of the area north on the Veracruz coastal plain, north of the city of Veracruz, was published. It showed a similar drop in arboreal pollen that started circa 800 BC (Sluyter et al. 2006).



Figure 15. Location of pollen core studies.

With three data points, more research is still needed to establish certainty about deforestation in the complete region, since pollen counts may reflect only the condition of a more localized region. Although tree pollen has been measured to travel hundreds and even thousands of miles, the majority of pollen is deposited closer to the pollen source. In light of the data so far, Mormon's statement is entirely accurate with respect to the existence of deforestation in 48 BC that continued up through his time in portions of the land northward. He is also accurate in stating that the land was "desolate" with respect to trees but not "desolate" in regard to other vegetation; in fact, the other types of vegetation increased.

Gardner (2015) makes a case that Mormon is primarily talking about Teotihuacan in the passages cited above, based on historical recitation technique (328–33). Part of the error made in this approach is that it appears to be based on the widely held beliefs that the use of cement in Teotihuacan must have caused the deforestation, since wood would have been needed as fuel, and that deforestation in Teotihuacan at the time of Mormon is all that has apparently been documented on the matter. While the use of cement for large-scale structures in the land northward may have been contributing factor later in time closer to Mormon's time, the pollen core studies indicate that the deforestation started much earlier and was primarily caused by agricultural practice and populations, although cement/plaster manufacture may have also played a role.

The large Jaredite populations that were clearly in the land northward prior to their demise rendered a reasonable explanation for the deforestation, which is consistent with an extended civil war, which may have contributed to the conflict by creating competition for limited resources.

The Book of Mormon text indicates that the location of the Jaredites' initial migration is the Valley of Mexico, but the rest of the passage is a summary of the continued growth and migrations from the land southward into the land northward that occurred up and through Mormon's time.

