



THE WITNESS

A QUARTERLY PUBLICATION BY THE BOOK OF MORMON FOUNDATION
Number 134 ■ Summer 2010



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*Cover photo courtesy of Dale Godfrey
Mayan Aztec calendar, Museo Nacional De Antropologia in Mexico City*

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— ❁ —

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Published quarterly by
The Book of Mormon Foundation
 210 West White Oak,
 Independence, MO 64050
 Tel: 816-461-3722
 Fax: 816-461-5850
 Foundation E-mail:
bmfoundation@live.com
 Interns E-mail: bmfinternship@yahoo.com
 Website: www.bomf.org

THE WITNESS



Book of Mormon “Years”

by Terry O’Leary

THE PROBLEM

Book of Mormon history and Biblical history coincide on three occasions: (1) Lehi in the Book of Mormon departed from Jerusalem during the reign of King Zedekiah; (2) Lehi’s descendants, the Nephites, were given a sign to indicate the time of Christ’s birth; (3) The Nephites were also given a sign to indicate the time of Christ’s death.

The dates of these events, according to Biblical scholars compared to the passage of time according to the Book of Mormon, appear to disagree with each other. The first year of the reign of King Zedekiah was 597 B.C. Herod, who figured prominently in the stories of Jesus’ birth, died in 4 B.C. That is a difference of 593 years. The Book of Mormon makes the repeated claim that 600 years passed between the time Lehi left Jerusalem and the birth of Christ.

To resolve this apparent conundrum, it has been alleged that Lehi made a mistake. It was suggested that the solution to this time scale problem is that Lehi actually left Jerusalem during the reign of Zedekiah’s predecessor, Jehoiakim. Jehoiakim was made king of Jerusalem by the pharaoh Necho II. He reigned for 11 years and was deposed by Nebuchadnezzar in 598-597 B.C. Jehoiakim was then replaced by Jehoiachin, who reigned for only three months. Nebuchadnezzar replaced him with his elder brother, Zedekiah. What is interesting at this point is that, prior to becoming king, Zedekiah went by the name of Mattaniah. He did not take the name of Zedekiah until he became king. If Lehi had left Jerusalem during the reign of Jehoiakim,

he could not have known the succession of kings to follow, nor would he have known that Mattaniah would take on the name of Zedekiah when he became king.

Another mystery in this timeline is that most Biblical scholars suggest Jesus was about 33 years old at the time of his death. The Book of Mormon suggests Jesus was 34 years old.

While trying to understand and decipher these mysteries, I found myself trying to connect the calendars of ancient Asian cultures with the calendars of Meso-america. At the same time, I tried connecting these calendars to what is known of the dates of those three critical events.

COMMON THREAD AMONG ANCIENT CALENDARS

Egyptian Calendar

It is estimated that Moses led the Israelites out of Egypt during the 15th century B.C. At that time, Egypt was using a 360-day calendar. (The Book of Calendars. Frank Parise, ed. Facts on File, New York. 1982. p 126) This is known as a vague year, since there would be a five-day change in the dates of the seasons each year. Annual events in the solar year were determined by observing the sun for solar equinoxes and solstices and by observing the star positions in the sky. Sirius was a very important star in Egyptian astronomy.

It appears that the original Egyptian calendar was a simplified lunar calendar. Each month consisted of three weeks of ten days each or 30 days.



When Moses, the author of Genesis, wrote about Noah’s flood, his calendar would have been the 360-day Egyptian calendar. Two scriptures from Genesis are of interest.

on “... the second month, the seventeenth day of the month” the great flood began. (Genesis 8:36 IV)
[Genesis 7:11 KJV]

“... after the end of the hundred and fifty days the waters were abated. And the ark rested in the seventh month, on the seventeenth day of the month, upon the mountains of Ararat.
(Genesis 8:49 IV)
[Genesis 8:3-4 KJV]

In this account, five months equaled 150 days or 30 days per month.

The Bible seems to consistently refer to a year as 12 months of 30 days each — from Genesis to the Book of Revelation. The Book of Revelation appears to equate 3½ years to 42 months and to 1,260 days. For that reason, the 360-day vague year also became known as the Biblical or prophetic year.

When Egypt adopted the 365-day calendar during the 8th century B.C. (The Book of Calendars. Frank Parise, ed. Facts on File, New York. 1982. p 126), it appears to have been done by simply adding five days at the beginning of their year. That calendar consisted of three seasons: Proyet (emergence), Shomu (summer) and Akhet (inundation). Each season was made up

of four months and, as before, each month consisted of three ten-day weeks. To this was added five days to make a 365-day year.

The change to a 360-day year was not likely to have been immediately universal throughout all of Egypt. The older 36-day calendar probably continued being used in outlying smaller towns and villages for many years to come.

Evidence within the Book of Mormon suggests Lehi and his family were merchants — carrying trade back and forth between Jerusalem and Egypt. The family was familiar with the language and customs of Egypt, along with the major caravan routes that connected Jerusalem with Egypt.

Mayan Calendars

The Mayans had three calendars: (1) 260-day Tzolk’in calendar, (2) a 365-day Haab calendar and (3) a Long Count Calendar. The first two calendars were combined to create a 52-year cycle. After 52 years, the cycle simply repeated. The number of cycles was not recorded. The Book of Mormon repeatedly refers to hundreds of years — either after Lehi left Jerusalem or in prophecies regarding the coming of Christ. Since the number of cycles was not recorded, the 52-year cycle would not have been used to record such long periods of time. Setting aside the first two calendars, I then turned to the Long Count Calendar. The Mayans could refer to the Long Count Calendar to measure the passage of time in thousands of years. This was done by counting the days beginning in some far distant past and could also be used to speak of time in the future. Within the Long Count calendar is the 360-day “tun” or Long Count year — a 360-day vague year.

In the Mayan Long Count Calendar

1 kin	=	1 day		
20 kin	=	20 days	= 1 uinal	
18 uinal	=	360 days	= 1 tun	= 1 vague year
20 tun	=	7,200 days	= 1 katun	= 20 vague years
20 Katun	=	144,000 days	= 1 baktun	= 400 vague years

It is interesting to note that the Egyptian 30-day months were divided into three ten-day cycles. The Long Count calendar consisted of 18 “months” of 20 days each or the equivalent of two ten-day cycles.

The Long Count Calendar of the Mayans indicates a preference for using multiples of twenty. The only exception is the 18 months of 20 days each to account for the 360-day vague year.

I then began to explore the idea that the Book of Mormon “years” were 360-day vague years. To test this idea, I had to carefully compare the estimated dates of those three Biblical events with the prophecies of the Book of Mormon.

THE REIGN OF KING ZEDEKIAH – LEHI’S DEPARTURE

Lehi’s son, Nephi, wrote of his father’s departure from Jerusalem.



For it came to pass, *in the commencement of the first year of the reign of Zedekiah, king of Judah, (my father Lehi having dwelt at Jerusalem in all his days); and in that same year there came many prophets, prophesying unto the people, that they must repent, or the great city Jerusalem must be destroyed.*

Wherefore it came to pass that my father Lehi, as he went forth, prayed unto the Lord, yea, even with all his heart, in behalf of his people.

... after the Lord had shewn so many marvelous things unto my father Lehi, yea, concerning the destruction of Jerusalem, behold *he went forth among the people, and began to prophesy and to declare unto them concerning the things which he had both seen and heard.*

And when the Jews heard these things, *they were angry with him; yea, even as with the prophets of old, whom they had cast out, and stoned, and slain; And they also sought his life, that they might take it away.*

And it came to pass that *the Lord commanded my father, even in a dream, that he should take his family and depart into the wilderness.*

And it came to pass that he was obedient unto the word of the Lord, wherefore he did as the Lord commanded him.

(1 Nephi 1:3-4; 18; 21-22; 26-27 RLDS)

[1 Nephi 1:4-5; 18; 20; 2:2-3 LDS]

(italics added)



Note that this sequence of events **started** during the first year of the reign of King Zedekiah. However, the preface to 3 Nephi is interesting. The author introduces himself as Nephi, the son of Nephi, who was the son of Helaman. *And Helaman was the son of Helaman, who was the son of Alma, who was the son of Alma, being a descendant of Nephi who was the son of Lehi, who came out of Jerusalem in the first year of the reign of Zedekiah, the king of Judah.* (Preface 3 Nephi RLDS/LDS) He is saying that Lehi left Jerusalem some time **during** the first year of the reign of King Zedekiah.



The Mayan Tzolk'in Calendar has a total of 260 days which is made up of 20 Mayan sun signs and 13 galactic tones. The 20 Mayan sun symbols combined with the 13 galactic tones equals the 260 days to the Tzolk'in calendar which repeats.

We know that Nebuchadnezzar conquered Israel and removed Jehoaichin from the throne. He then placed Zedekiah on the throne to do his bidding. It has been calculated that Nebuchadnezzar conquered Jerusalem in the spring of 597 B.C. By winter of 597 B.C., he took the rebellious King Jehoiachin, his family, servants and thousands of Jews back to Babylon. Presumably, Zedekiah became a puppet king starting sometime in mid-to-late 597 B.C. From mid-to-late 597 B.C. to mid-to-late 596 B.C. would have been the first year of the reign of King Zedekiah.

After Lehi and his family left Jerusalem, the Lord commanded Lehi to send his sons back to Jerusalem to obtain a set of brass plates, which contained a “record of the Jews” (1 Nephi 1:61 RLDS) [1 Nephi 3:3 LDS]. These plates were in the possession of a man named Laban. Eventually, after much tribulation, Nephi and his brothers returned to their camp in the wilderness with the brass plates. What Lehi found written in the brass plates is interesting.



And he beheld that *they did contain the five books of Moses, which gave an account of the creation of the world; And also of Adam and Eve, who were our first parents; And also a record of Jews from the beginning, even down to the commencement of the reign of Zedekiah, King of Judah; And also the prophecies of the Holy prophets, from the beginning, even down to the commencement of the reign of Zedekiah; And also many prophecies which have been spoken by the mouth of Jeremiah.*
 (1 Nephi 1:159-163 RLDS) [1 Nephi 5:11-13 LDS]
 (italics added)



There was a sequence of events that led up to Lehi's departure into the wilderness. *After Zedekiah became king:* (1) Lehi had a vision; (2) Lehi began to prophesy; (3) Lehi is persecuted; (4) Lehi escapes into the wilderness and (5) the brass plates were updated to include Zedekiah's accession to the throne. It is not likely that all of this was accomplished within the first month of Zedekiah's first year as king. Lehi probably left Jerusalem sometime in 596 B.C.



The Mayan Calendar depicted here was called "the Haab", the Mayan solar calendar of 365 days. It was divided into 18 months of 20 days each with a period of 5 days left over at the end of the year. This short 5 day month is called Uayeb, "the resting or sleep of the year".

BIRTH OF JESUS – BIBLE HISTORY

The date of Jesus' birth has been estimated by varying biblical authorities to have occurred anywhere from 6 B.C. to 7 A.D. One major factor that is often taken into account is the death of Herod the Great. Herod's name is integral in the traditional stories surrounding the birth of Christ. According to Josephus:

... But Herod deprived this Matthias of the high priesthood, and burnt the other Matthias, who had raised the sedition, with his companions,

alive. And that very night there was an eclipse of the moon. – Antiquities of the Jews Book 17:6:4

There was a partial eclipse on March 13, 4 B.C. The Jewish New Year starts with the new moon nearest to March 21 (Vernal equinox). That new moon would have been about March 28, 4 B.C. Passover during that year would have been on April 11, 4 B.C. According to Josephus, Herod died between the time of the eclipse and Passover — or between March 13 – April 11, 4 B.C. According to the Bible, Herod had children under the age of two put to death in an effort to kill the future King of the Jews. Taking all of this into account would suggest that the birth of Jesus probably took place between 6 B.C. and 4 B.C.

BIRTH OF JESUS – BOOK OF MORMON CLAIMS

Before the birth of Jesus, the tribe of people known as the Nephites had become wicked in the eyes of God. In the Book of Helaman of the Book of Mormon, Samuel the Lamanite came to the Nephites. Samuel prophesied of the coming of Christ.



And behold, he [Samuel] said unto them, Behold, *I give unto you a sign: for five years more cometh, and behold, then cometh the Son of God to redeem all those who shall believe on his name. And behold, this will I give unto you for a sign at the time of his coming; for behold, there shall be great lights in Heaven, insomuch that in the night before he cometh, there shall be no darkness, insomuch that it shall appear unto man as if it was day; Therefore there shall be one day and a night, and a day, as if it were one day, and there were no night; and this shall be unto you for a sign; for ye shall know of the rising of the sun, and also of its setting; Therefore they shall know of a surety that there shall be two days and a night; nevertheless the night shall not be darkened; and it shall be the night before he is born.*

(Helaman 5:55-58 RLDS)

[Helaman 14:2-4 LDS] (italics added)



Five years after Samuel's prophecy would also be 600 years from the time Lehi left Jerusalem. Nephi, a distant descendant of that Nephi who came out of Jerusalem, recorded the fulfillment of that prophecy.

Nephi had seen the wickedness of his own people. Some believed that the sign was overdue and, therefore, the sign had not and would not be given. They concluded that such prophets and prophecies were false. In their wickedness, they had chosen a day to kill all those who believed in Samuel's prophecy.



And it came to pass that he [Nephi] went out and bowed himself down upon the earth, and cried mightily to his God, in behalf of his people; yea, those which were about to be destroyed because of their faith in the traditions of their fathers.

And it came to pass that he cried mightily unto the Lord, all that day; and behold, *the voice of the Lord came unto him, saying, Lift up your head and be of good cheer, for behold, the time is at hand, and on this night shall the sign be given, And on the morrow come I into the world, to shew unto the world that I will fulfill all that which I have caused to be spoken by the mouth of my Holy Prophets.*

Behold, I come unto my own, to fulfill all things which I have made known unto the children of men, from the foundation of the world, and to do the will, both of the Father, and of the Son of the Father, because of me, and of the Son, because of my flesh. And *behold, the time is at hand, and this night shall the sign be given.*

And it came to pass that the words which came unto Nephi were fulfilled, according as they had been spoken: For behold *at the going down of the sun, there was no darkness; and the people began to be astonished, because there was no darkness when the night came.*

(3 Nephi 1:11-17 RLDS) [3 Nephi 1:11-15 LDS]
(italics added)



According to the Book of Mormon prophecy, this coincided with the 600th year after Lehi left Jerusalem. The Book of Mormon repeatedly claimed that Jesus Christ would be born 600 years after Lehi departed from Jerusalem. (1 Nephi 3:4; 5:236; 2 Nephi 11:35 RLDS) [1 Nephi 10:4; 19:8, 2 Nephi 25:19 LDS].



Mayan Long Count Calendar: Long Count dates are written with Mesoamerican numerals, as shown on this table. A dot represents 1 while a bar equals 5. The shell glyph was used to represent the zero concept. The Long Count calendar required the use of zero as a placeholder, and presents one of the earliest uses of the zero concept in history.

CRUCIFIXION OF JESUS – BIBLE HISTORY

The estimated time of Jesus' death is partly limited by the times that varying people associated with the crucifixion were in office.

Caiaphas, the High Priest (18 A.D. to 37 A.D.)

Pilate, prefect of Judah (26 A.D. to 36 A.D.)

Herod Antipas, tetrarch of Galilee (4 B.C. to 39 A.D.)

A closer look at the history of Pilate indicates that his time in office ended after a battle with the Samaritans. This would suggest that the crucifixion of Jesus occurred before 36 A.D.

Passover had to occur on Nisan 14 or 15 of the Jewish calendar. If Jesus was crucified on a Friday and if Nisan 14 or 15 fell on a Friday and if the crucifixion occurred between 26 A.D. and 36 A.D., then the Jewish calendar would limit the possibilities to 27, 30, 33 or 36 A.D. Most scholars appear to be evenly divided between 30 and 33 A.D.



Varying theologians debate a multitude of ideas while sorting out all the conundrums and pointed arguments to arrive at a specific date of Christ's crucifixion. There are discussions surrounding the different calendars maintained by the Pharisees and Sadducees. There are questions of one calendar in which one group starts the new day at sunrise and the other group starts the new day at sunset. Some allege the coincidence of a lunar eclipse in April 33 A.D. to indicate the crucifixion date — in fulfillment of allegorical prophecies of the moon turning to blood.

For reasons that will become clear, I believe Christ was crucified on Nisan 14 or Nisan 15 in the year 30 A.D. This would equate to early April 30 A.D.

CRUCIFIXION OF JESUS – BOOK OF MORMON CLAIMS

The prophet, Samuel the Lamanite, had prophesied of a sign that would be given to them to signify the death of Jesus Christ.



But behold, as I said unto you *concerning another sign, a sign of his death,; behold, in that day that he shall suffer death, the sun shall be darkened and refuse to give his light unto you; and also the moon, and the stars; And there shall be no light upon the face of this land, even from the time that he shall suffer death, for the space of three days, to the time that he shall rise again from the dead; (Helaman 5:75-76 RLDS) [Helaman 14:20 LDS] (italics added)*



After the birth of Christ, the Nephites appear to have reckoned their time beginning with the sign given of Christ's birth. The same Nephi recorded the fulfillment of that prophecy given by Samuel the Lamanite regarding the birth of Christ also recorded the fulfillment of the sign given of His death. In the process, Nephi made note of the time lapse between the birth and death of Jesus.



And it came to pass *in the thirty and fourth year, in the first month, in the fourth day of the month, there arose a great storm, such an one as never had been known in all the land; And there was also a great and terrible tempest; and there was terrible thunder, insomuch that it did shake the whole earth as if it was about to divide asunder; and there was exceeding sharp lightnings,*

such as never had been known in all the land. (3 Nephi 4:6-7 RLDS) [3 Nephi 8:5-7 LDS] (italics added)



Nephi goes on to describe the ongoing destruction across the land in fulfillment of Samuel's prophecy. The extent of the destruction appears to imply combinations of a hurricane, earthquakes and apparent volcanic eruptions. The "darkness" referred to could be simply due to thick volcanic gases that would also prevent fires from being lit. The sun and stars would also be hidden from sight by these same volcanic gases.

The Book of Mormon claim is that the sign given for the death of Christ came 34 years and four days after the sign given for his birth.

PROBLEMS WITH THE BOOK OF MORMON YEARS AS SOLAR YEARS

In the Book of Mormon, the time span between Lehi leaving Jerusalem until the time of Christ's birth was given as 600 years. If Lehi left Jerusalem in 596 B.C., then the birth of Christ would have been 5 A.D. By 5 A.D., Herod had been dead for eight years. (For purposes of these calculations using the Julian calendar, it must be remembered that there is no year zero.)

The time between Christ's birth and death was given as 34 years and 4 days. When added to the 600 years already given, this would be 634 years and 4 days between the time that Lehi left Jerusalem and the sign given to indicate the death of Christ. If Lehi left Jerusalem in 596 B.C., a calculation based on solar years would place the crucifixion of Jesus Christ in 39 A.D. By 39 A.D., Pilate had not been a prefect of Judah for three years. Caiaphas had been removed from the office of high priest in 37 A.D. — two years earlier.

Thus, there is a problem if the Book of Mormon years are equated to 365.25-day solar years.

POSSIBLE SOLUTION – THE 360-DAY VAGUE YEAR

Birth of Christ

The Book of Mormon claims that 34 years and 4 days had passed away between the signs given to indicate the birth and death of Jesus. If these years are 360-day vague years, it would need to be converted to solar years for this comparison. The resulting 33.5 solar years approximates the age of Christ at the time of his crucifixion according to many Biblical scholars.

$$\frac{360 \text{ days/vague year} \times 34 \text{ vague years} + 4 \text{ days}}{365.25 \text{ days/solar year}} = 33.5 \text{ solar years}$$

Calculating backward 33.5 solar years from Christ's supposed date of crucifixion (early April 30 A.D.) would place the birth of Christ in the Fall of 5 B.C. Again, note that there is no year zero in the Julian calendar for this calculation. The fall of 5 B.C. would be about six months before the death of Herod. So far, the idea of the Book of Mormon years being 360-day vague years is supported.

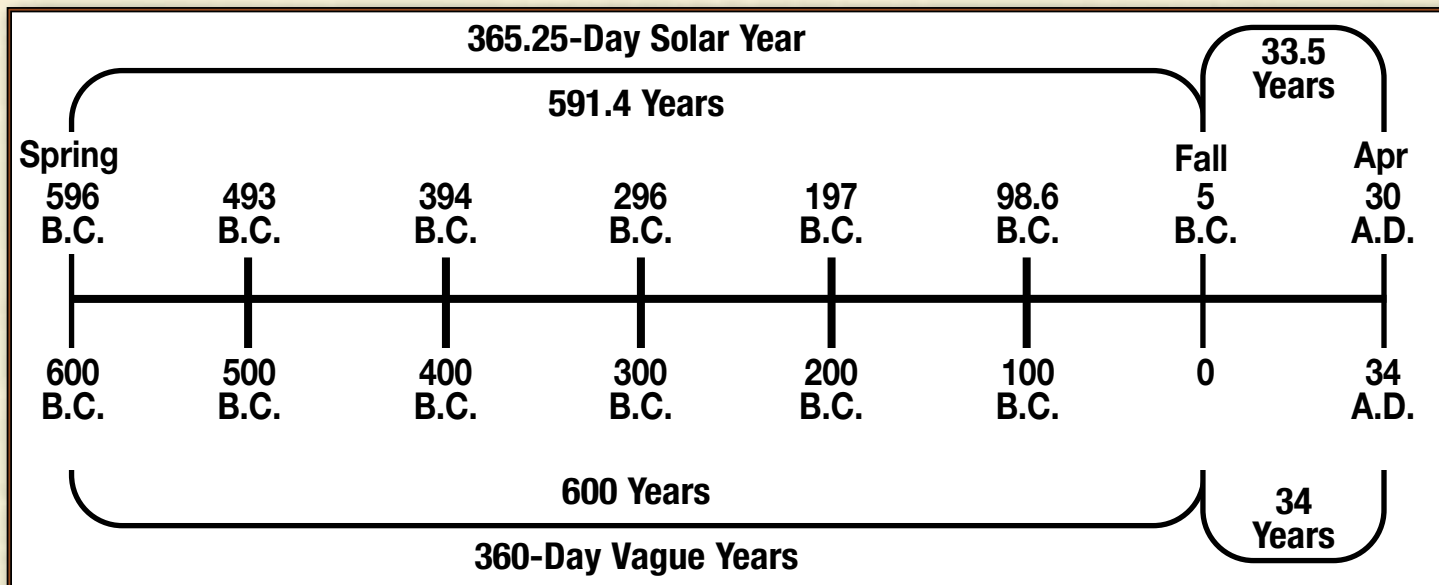
Lehi Departed Jerusalem

The Book of Mormon claims that 600 years passed away between the time Lehi left Jerusalem and the birth of Jesus. If these are 360-day vague years, it would need to be converted to solar years for this comparison.

By adding 591.4 solar years to the Fall 5 B.C., the supposed date of Christ's birth, the time of Lehi's departure from Jerusalem would be in the Spring of 596 B.C. Covering such a large span of time, the idea of the Book of Mormon years being vague years or 360-day years is now very strongly supported.

$$\frac{360 \text{ days/vague year} \times 600 \text{ vague years}}{365.25 \text{ days/solar year}} = 591.4 \text{ solar years}$$

THE SOLUTION



I do not presume to suggest that these are the exact dates for these occurrences. I do suggest that the years, as mentioned in the Book of Mormon, are most likely 360-day vague years that coincide with the Biblical/Prophetic years, early Egyptian years and the Mayan Long Count years. The solution is frighteningly simple. It is a perfect fit for both the estimated Biblical time frames and Book of Mormon claims. Within this context, the Bible and Book of Mormon validate each other. The coincidence of times and dates underscores the historical accuracy of the Book of Mormon. If one then accepts the historical accuracy of the Book of Mormon, one must also accept Joseph Smith as a prophet, the authenticity of the ancient authors of the Book of Mormon and, most importantly, the reality of Jesus Christ.

We've a Story to Tell to the Nations

by Rich Rowland

Recently, I have been reading the memoirs of the great RLDS missionary, Charles Derry. Brother Derry was certainly a faithful servant of God and a powerful preacher of the Gospel restored. Sometimes when I read about the early missionaries, I marvel at their personal sacrifice and persistence in the face of adversity. I think about how God used their gifts and talents... and even their shortcomings, to further His great and marvelous work. While reading about Brother Derry and his missionary journeys, I couldn't help but also think of the many people around him who contributed greatly to his success. His family and the Saints of the early Reorganization played a pivotal role in the success of his ministry. Like pieces of a God-inspired puzzle, the saints of old did their best to find their place in assisting the missionary efforts of Brother Derry. His young wife, Eliza, was a woman of faith and a wonderful helpmeet. In fact, it was her support and encouragement that gave Charles the fortitude to move out in his calling to the English mission field. In his memoirs, Brother Derry records this touching moment as he and his family were preparing for his journey to England:

"...it was hard to see my wife quietly, and some would have thought almost cheerfully, preparing my things for my departure, as she strove to keep back the tears that would force themselves into her eyes, while my children clung around me with all the loving tenacity of loved and loving babes; and to know that both wife and children realized the terrible uncertainty of our ever meeting again in this life. But she had consecrated me as her heart's best gift to the service of God, and though the separation might be for years instead of months, yet she murmured not... I prayed God to accept the sacrifice, and committed her and the children to His care. For I realized that as hard as the lot of the missionary may be,

the heaviest part of the burden falls upon the faithful wife and loving children. I committed them into our Heavenly Father's hands, and sadly wended my way toward the rising sun."

Surely the long nights spent away from home would have seemed like a lifetime to Charles without the loving support of his wife and children. Their commitment to his missionary calling, as well as their prayers and letters of encouragement, lifted his spirits when he thought he could not go on.

Wherever the Derry family made their home, the local Saints would welcome them. When Brother Charles was in the mission field, the local Saints would look after his wife and children. During his English mission, the William Brittain family kindly provided Eliza and the children a place to stay. Although the log cabin was small, only 12 feet square on the outside, it was truly a home. Several of the local families pledged themselves to assist in providing for the needs of the family. What a comfort it must have been for Charles to know that, while he was away preaching the Gospel, his family would not suffer.

The Saints Charles met along the way were of great assistance as well. Brother Derry records testimony after testimony of how, traveling without purse or scrip, he would receive money, food, clothing and even shoes at a time when he needed them most. One entry in his journal reveals not only the generosity of the Saints, but the thankfulness of a true servant of God.

"On the 28th, I paid my farewell visit to Blakeley (England), and trust I shall never forget the kindness of John Heywood and his wife. She kindly gave up her bed for me and gave me two shillings and sixpence of her own earnings. John gave me one shilling and sixpence. These people are poor,



but they determined to deny themselves for a poor servant of Christ, and the Master will note every act of kindness shown to the least of his servants.”

I suppose most great missionary endeavors really are a group effort. We tend to remember the names of the missionaries, as we should, but let's not forget about the families and the many Saints whose contributions were just as important. Their willingness to sacrifice and share in the work was truly a blessing to Brother Derry and the missionary effort. Through it all, God's hand was ever-present guiding, protecting and blessing his faithful servants in this great and marvelous work.

I like to think, in some ways, the Book of Mormon Foundation resembles the old missionaries. Each year, we set out on a missionary journey and do our best to follow the leadings of our Lord and Savior. The publications and programs we produce are aimed at proclaiming the truthfulness of the Book of Mormon and its testimony of Jesus Christ. Like the missionaries of old, we set out without purse or scrip, relying completely on the blessings of God and the generosity of the Saints. And, like the missionaries of old, we have yet to be disappointed. At every turn, we have received what we have needed most. Whether the need has been financial or volunteers or supplies or articles for The Witness, the Lord and the Saints have been there for us. For this we are eternally grateful. We look forward to the days ahead and joyously proclaim “We've a story to tell to the nations that will turn their hearts to the right!”

Thank you for your faithful support,
Rich Rowland

The Power of Giving is in Your Hands

The Book of Mormon Foundation (BMF), previously Foundation for Research on Ancient America (FRAA), has been providing ministry, research, resources and service to the Saints for the past 44 years. The power for us to continue as an effective organization rests totally with the Lord and the continued generosity of the saints.

We are currently facing a deficit of \$12,000 this year.

As a Book of Mormon organization, we are excited to promote its unique and inspired message and know it holds a special place in your heart and is a part of your family heritage. We share this common bond together.

Our prayer is the Spirit of the Lord will prompt your desire to send a financial gift. Just as the early saints sacrificed to send out missionaries and build the Kirtland Temple, please consider a personal sacrifice to help The Book of Mormon Foundation meet its financial needs. If just 120 individuals, Sunday school classes, youth groups or branches each give \$100, we will be able to eliminate our deficit.

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Mesoamerican people perfected rubber processing more than 3,000 years ago, MIT study suggests

by David L. Chandler, MIT News Office
originally published June 3, 2010
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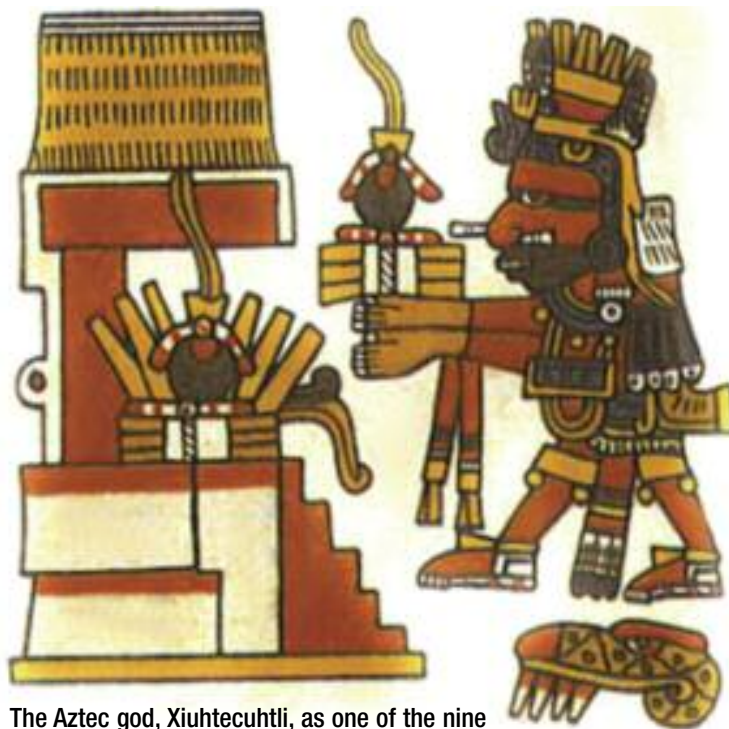
Spanish explorers encountering an advanced civilization in Mesoamerica in the 16th century had plenty of things to be astonished about, but one type of object in particular was unlike anything they had ever seen before: rubber balls. No such stretchy, bouncy material existed in the Old World, and they had to struggle to find words to describe it.

New research from MIT indicates that not only did these pre-Columbian peoples know how to process the sap of the local rubber trees along with juice from a vine to make rubber, but they had perfected a system of chemical processing that could fine-tune the properties of the rubber depending on its intended use. For the soles of their sandals, they made a strong, wear-resistant version. For the rubber balls used in the games that were a central part of their religious ceremonies, they processed it for maximum bounciness. And for rubber bands and adhesives used for ornamental wear and for attaching blades to shafts, they produced rubber optimized for resilience and strength.

All of these, according to the research by Professor Dorothy Hosler and Technical Instructor Michael Tarkanian of MIT's Department of Materials Science and Engineering, were most likely achieved by varying the proportions of the two basic ingredients, latex from rubber trees and juice from morning-glory vines, which were cooked together. A paper describing the findings will be published soon in the journal *Latin American Antiquity*.

The research builds on a paper that Hosler, Tarkanian and Sandra Burkett, then an assistant professor at MIT, published in *Science* in 1999 that showed for the first time that the Mesoamerican people could have used the combination of two ingredients to produce rubber. The new work, which draws on a combination of laboratory experiments, recovered artifacts and the descriptions left by early explorers, demonstrates how varying the formula could fine-tune the rubber's properties.

Although Hosler and Tarkanian's research demonstrates that the Mesoamericans had the raw materials



The Aztec god, Xiuhtecuhtli, as one of the nine Lords of the Night, offers up rubber balls in this drawing.
Photo - Image: Wikimedia commons

and the basic knowledge to make these different formulations, proving that's what they actually did would require further evidence, either from contemporaneous accounts or from chemical analysis of samples used for different purposes.

Long before Goodyear

Charles Goodyear is credited with having invented vulcanization — a chemical process for converting rubber or related polymers into more durable materials — while experimenting with rubber and sulfur in the mid-19th century. But it has long been known that the Aztecs, Olmecs and Maya — the civilizations that, over a span of more than three millennia, dominated the region that is now Mexico and parts of Central America — were adept at making rubber, and that the material was used to produce the large, heavy balls used for the ceremonial games played on stone-walled ball courts. A few such balls have been found in archeological digs in the region — the oldest dating back to 1600 B.C., or more than 3,000 years before Goodyear's contributions — and though they have become hard and brittle with age, their nature is unmistakable. "They were really spectacular, really

enormous,” Hosler says of the Mesoamerican rubber balls, which ranged in size from a few inches to a foot across — the size of a beach ball.

Until the new research, nobody had shown that it was possible to obtain the different properties needed for other uses of rubber, simply by varying the recipe’s proportions. Unlike the rubber balls, Mesoamerican rubber-soled sandals have never been found. But they are described in the diaries of the Spanish explorers and missionaries, and their existence is clear from linguistic evidence: The Aztecs used a compound word that clearly blends the words for “rubber” and “sandals.”

The ancient rubber material that has survived tends to be so degraded that it can’t be tested for its mechanical properties. So Tarkanian and Hosler set up their own processing facility at MIT, using raw materials collected in field trips to Mexico. They made batches of rubber with varying proportions of the two plant substances, and then subjected the product to a suite of tests to measure wear resistance, elasticity, toughness and other properties.

Sure enough, varying the proportions produced different properties. A 50-50 blend of the latex and morning glory produced maximum elasticity, or bounciness, perfect for the rubber balls. Rubber used as an adhesive or for joining other materials (such as ceramic and wood) needs different properties — strength and damping ability — and for that, pure latex seems to work best. For sandals, where wear resistance is the most important quality, a three-to-one mix of latex to morning glory provides the most durable material.

The Mesoamericans had plenty of time to work out these properties through trial and error. By the time the Spanish arrived, Tarkanian says, “there was a large rubber industry” in the region, producing 16,000 rubber balls each year, and large numbers of rubber statues, sandals, bands and other products. Most of those were produced in villages in outlying areas, and were shipped to the capital city as a form of tax payment.

Hosler has also studied these ancient civilizations’ advanced work in metallurgy, and suggests that they were likely also accomplished practitioners of other kinds of materials

processing that have yet to be studied, such as formulating mortars, plasters and paints.

Frances Berdan, professor of anthropology at California State University at San Bernardino, says Hosler and Tarkanian’s latest work has implications well beyond rubber. “There are other areas of production where the pre-Hispanic peoples cleverly combined materials to achieve enhanced products. The Tarkanian-Hosler research on ancient rubber should have the effect of directing our attention to the methods used by these peoples, and recognizing that they developed sophisticated answers to their everyday (and also not-so everyday) problems.”

John McCloy, a senior research scientist at Pacific Northwest National Laboratory, says that “Tarkanian and Hosler have compiled a compelling case that ancient Mesoamerican peoples were the first polymer scientists, exerting substantial control over the mechanical properties of rubber for various applications.” He adds that “what remains to be done is to find archaeological evidence of rubber footwear in ancient Mesoamerica, and to study the production methods for Mesoamerican rubber as an adhesive and as footwear. It would also be interesting to do chemical analyses on rubber balls, adhesive rubbers, and sandals (if they are found) to see if quantification of morning-glory additives corroborates the laboratory study of the mechanical properties.”

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THE Book OF Mormon

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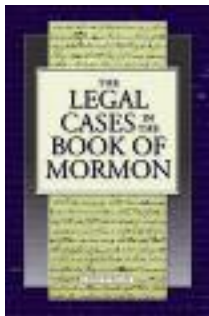


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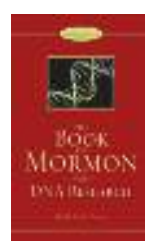
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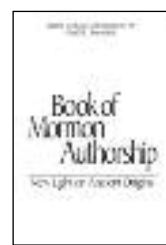
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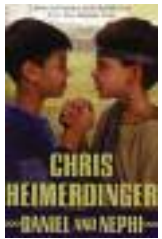
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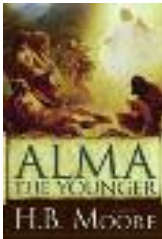


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