Nephi's Boat, by Joseph Brickey and Howard Lyon.

Ancient Voyages Across the Ocean to America

FROM "IMPOSSIBLE" TO "CERTAIN"

JOHN L. SORENSON

Book of Mormon history in the New World

begins with ocean voyages—by the Lehites, the Mulekites, and the Jaredites. For the first and last of those, the record pointedly states that the parties stocked their vessels with supplies both to use on their trip and to start life as agriculturists when they arrived in the new land (see Ether 6:4, 13; 1 Nephi 18:6, 24). Perhaps the Mulekites too brought certain natural resources.

Latter-day Saints may have wondered why virtually all secular scholars and scientists have rejected the idea that ancient sailors succeeded in voyaging from the Old World to the New. Their rejection is not just in reference to the Book of Mormon story but against all claims that seaborne migrants capable of having any significant effect breached the ocean barrier prior to Columbus, except for a few Vikings considered of no historical importance. Prevailing views by reputed experts have assumed that "primitive sailors" would have found it impossible to cross the "forbidding" oceans.[1] In the 1930s one scholar even spoke of the American continents as being "hermetically sealed by two oceans."[2] Such views were not so much scientific conclusions as echoes of the prevailing isolationist political doctrine of the times that refused to grant value to "foreign" people or ideas. Thus famous Maya archaeologist Sylvanus Morley opined in 1927 that there was "no vestige, no infinitesimal trace, of Old World influence . . . to detract from the [inventive] genius of our [*sic*] native American mind." "There is no room for foreign origins here," he went on to claim in his article entitled "Maya Civilization 100% American."[3] By the end of the 20th century this absolute view had eased only insignificantly.

There was, indeed, good reason to reject the voyaging explanation as usually presented. Numerous badly informed, or at least weakly argued, theories had been offered to explain the rise of civilization in the Americas. Josiah Priest, who published a popular book three years after publication of the Book of Mormon (i.e., 1833), supposed that not only East Asians in general but also "Polynesians, Malays, Australasians, Phoenicians, Egyptians, Greeks, Romans, Israelites, Tartars, Scandinavians, Danes, Norwegians, Welsh, and Scotch" people had colonized parts of the New World; but he gave no credible evidence for his speculations.[4] Ninety years later, somewhat better supported but still unconvincing evidence for similar ideas was being published in popular works like those by G. Eliot Smith.[5]

The small minority of scholars who continued to claim that meaningful ancient voyages were made argued for the idea mainly on the basis of cultural parallels.[6] They felt that close similarities of customs or beliefs that they pointed out could not be explained in any other way than that people carried those features with them across the waters. (However, much of the evidence that enthusiasts have cited has proven incautiously stated if not in error.) Orthodox scientists reacted against those notions with their own dogma holding that the issue

had already been adequately tested and should be rejected. For instance, Gordon R. Willey, a prominent Harvard archaeologist, said in 1985 that while no other subject in American archaeology had brought about such heated discussions as the role of Old World contacts, if no "concrete evidence" could be produced in the next 50 years, proponents ought to stop talking about the question.[7] Cultural parallels did not count as concrete evidence in the scholarship of people like him. The skeptics maintained that any cultural similarities between the New World and the Old were simply coincidences, explainable because, they claimed, the human mind works the same everywhere in the world, so it should not be surprising that people independently come up with similar inventions or ideas.

For years those who believed in the importance of ocean voyaging in human history ("diffusionists") tried to overwhelm this opposition by pointing out more and more, stronger and stronger, cultural parallels. A few years ago Martin H. Raish and I compiled a massive bibliography that made accessible the substance of over 5,000 books and articles concerning the diffusion issue—covering pretty much all published sources.[8] But the significance of this compilation has been generally ignored and has done virtually nothing to change the minds of the traditional isolationist majority of scholars. They have frequently countered with what they considered an absolute argument against voyaging: no food plant is common to the two hemispheres. That fact alone was supposed to be "enough to offset any number of petty puzzles in arts and myths [i.e., cultural similarities]."[9]

By the year 2000 I had concluded that the only way to break this particular intellectual logjam was to put forward hard scientific evidence that doubters could not explain away by offhanded reference to the inventiveness of the human mind. The approach I desired could best be pursued by demonstrating that the flora and fauna of the New World *had* been shared with the Old World. Some useful research had already established a limited body of such evidence. These concrete biological features would be important because no one can claim that the human mind had invented the same plant on opposite sides of the ocean.[10]

Floral Evidence for Diffusion

Over the last four years 98 species of plants have been identified that originated in either the Old World or the New yet were also grown in pre-Columbian times in the opposite hemisphere. That distribution cannot be explained the way cultural parallels have been by inventionist-minded scholars. A plant is an objective fact that demands a physical explanation for the presence of the same species on two sides of an ocean. Yet all purely naturalistic theories fail to account for plants thousands of miles from their natural home. For example, some have supposed that seeds were carried thousands of miles by birds, or evolutionary processes have been claimed as yielding identical species in multiple locations, but these notions are never more than nonempirical speculation.[11] The only rational explanation for multiple plant distributions is that people sailed across the oceans before Columbus, nurturing and transporting plants en route.

As I dug into neglected books and journals, the number of plants reported to be shared across the oceans mounted. Victor H. Mair, a specialist in Chinese literature and language at the University of Pennsylvania, took an interest in the project and invited me to prepare a paper for a conference he was organizing on "Contact and Exchange in the Ancient World." I invited my friend and colleague Carl L. Johannessen, emeritus professor of geography at the University of Oregon, who had long worked on the topic, to collaborate. By the time of the conference in May 2001, we had identified over 35 plant

This 1,000-year-old bas-relief from a temple at Parambanan, Java, shows plant leaves, tassels, and ears characteristic only of maize. Photograph by Evelyn McConnaughey.

species for which there was what we considered conclusive proof that species had been transported between the hemispheres. By 2003, when we submitted our paper to Mair for publication in the report of the conference, the number of plant species on our conclusive list had grown to 85.[12] Since then we have found still more; today the total is 98 species.[13]

What evidence do we consider to be "conclusive" or "decisive"? In some cases it comes from archaeology. For example, in 1966–67 Australian archaeologist Ian Glover excavated in caves on the island of Timor in Indonesia, where he discovered


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plant remains that included three crops of American origin: *Annona* (custard apple), *Zea* (maize), and *Arachis* (peanut). These dated at the latest to AD 1000 and probably well before.[14] The peanuts were duplicated at two sites on the Chinese mainland that date by radiocarbon to as early as 2800 BC.[15]

In northern India archaeologists have recently found seeds of *Phaseolus vulgaris* (kidney bean), *Phaseolus lunatus* (lima bean), and *Macroptilium lathyroides* (phasey bean, a cousin of kidney and lima beans), in addition to *Argemone mexicana* (Mexican prickle poppy), all natives of America. The sites date from 1600 to 800 BC.[16]

For other American plants, decisive evidence consists of realistic depictions in art. For example, the chile pepper is clearly depicted in a sculpture at a temple that honors the Hindu god Shiva at Tiruchirapalli, India. Chiles are also mentioned


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1. Representation of maize at Cave Temple III, Badami, India. 2. A pottery effigy of a bird, with kernels intact after the surrounding clay was fired and the maize core burned away. From a Han Dynasty tomb (ca. AD 200) near Xinxiang, Henan, China. 3. A curl of maize silk on an unhusked maize ear in a medieval sculpture from India. Photos 1–3 by Carl Johannessen. 4. Carved chile pepper plants at the temple at Parambanan, Java. Photo by Evelyn McConnaughey. 5. Wall sculpture from the Halebid temple at Somnathpur, Karnataka state, India. The sacred gesture (*mudra*) made by the figure's hand underlines the sacred significance of the context and thus of maize. Photo by Carl Johannessen.

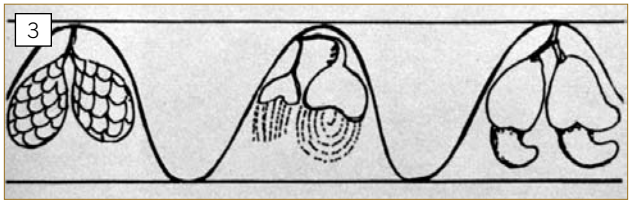
in traditional books of India dating to the sixth to eighth centuries.[17] The plants also appear on a sculpted wall panel at the ruined temple near the modern temple at Prambanan, Java, dating to about AD 1000.[18]

An especially striking case from art involves *Couroupita guianensis*, called the *naga lingam* tree in India. This native of South America or the West Indies has been cultivated in South India "from very early times," as illustrated in a temple carving of medieval age.[19] In India its unusually shaped blossom is thought to look like symbols sacred to a Hindu deity, Shiva; the flowers are still offered today

at temples to Shiva.[20] Interestingly, in Mesoamerica, where the tree is common, neither the blossoms nor the tree has any sacred significance. The only sensible scenario to explain these facts historically seems to be that a Hindu visitor to Mesoamerica was struck enough by the meaningful appearance (to him) of the bloom of the tree to decide to carry it to India, where it came to grow widely.

Hundreds of other India temple sculptures show voluptuous women holding upright in one hand an ear of corn (maize) while their fingers make a sacred gesture known as a *mudra*. Maize is, of course, an American crop plant.[21] Two other American plants, the pineapple[22] and the cashew nut,[23] are among additional species seen in Indian art.

1. An annona fruit in a goddess's hand at the Durga Complex temple, Aihole, India. Photo by Carl Johannessen. 2. A pineapple is depicted at a cave temple at Udaiguri, India, ca. fifth century AD. 3. Sketch of cashew nuts (far right) on the balustrade of the Bharhut Stupa in Madhya Pradesh, India, ca. second century BC. 4. Leaves of *Monstera deliciosa* appear on sculptures at Hindu and Jain temples in Gujarat and Rajasthan, India. The small personage on Vishnu's right holds a fruit of *M. deliciosa* on a plate. Photos 2–4 courtesy of the American Institute for Indian Studies.



References to imported American plants in Asian medical, botanical, and historical documents are a further source of evidence. A Chinese document written in the Jin dynasty (AD 290–307) by a minister of state who had served as a governor in southern China lists some 80 plants that were known to him there. In the list was the sweet potato, *Ipomoea batatas,* another American species.[24]

Right: At a temple at Halebid, Karnataka, India, a sculpture of Nandi, the mythological bull associated with Shiva, bears a sunflower between its ear and horn (shown here next to a live sunflower). Lower right: At the Pattadakal temple, Karnataka, a carving on a pillar shows a large sunflower seed head and a parrot eating the seeds. No other plant bears a seed head of this size or has a stalk this strong. Below: The annona fruit is shown at the Bharhut Stupa, dated to the second century BC. Photos by C. Johannessen.

In India the chile pepper (*Capsicum annuum,* mentioned above) is cited in the traditional volume *Siva Purana* as part of a cure for tuberculosis.[25] The silk cotton, or kapok, tree (*Ceiba pentandra*) not only originated in America but also was deeply involved in the mythology of the Maya of Yucatan, yet it is referred to in the *Kurma Purana* (5th century AD) and the *Brahmanda Purana* (10th century).[26] Meanwhile, on Hainan Island, off the southern coast of China, the silk cotton tree was being cultivated and the fiber woven by local tribesmen during the Tang Dynasty (AD 600–900) according to a Chinese history.[27] The pumpkin and the squash are mentioned in India in the medical text of Al-Kindi in the ninth century AD.[28] At least a dozen more New World species are similarly documented historically in India and China.

Lexicons also serve to place plants on the map far from their areas of origin. This kind of data is especially abundant through study of the Sanskrit language in India. Sanskrit was the original language in which the earliest sacred Hindu texts were written in the first and second millennium BC. From around 500 BC to AD 1000, Sanskrit served as the key language of Indian sacred and civilized life in the same manner as Latin did in Europe. And like Latin in Europe for over a thousand years, Sanskrit was an inactive or "dead" language represented by the sacred texts but no longer reflecting contemporary life by adding new words. So when we find that a plant bore a Sanskrit name, we can be sure it was actually known in the country no later than AD 1000.[29]

For example, *Asclepias curassavica* (the milkweed), a species of American origin, was known in Sanskrit medicine as *kakatundi*.[30] Moreover, at least two species of hallucinogenic datura plants (in English "thorn apple" and "jimsonweed") were used in Asia as well as in the Americas; daturas were called by no less than eight Sanskrit names, as well as one in Persian.[31] *Tagetes erecta*, the large marigold, a Mexican native plant, bore four Sanskrit names,[32] and what our gardeners know as the four-o'clock flower (*Mirabilis jalapa*) had four names in India as well.[33] As a matter of fact, 38 different species of plants that originated in the Americas each had at least one name in Sanskrit. This observation alone demonstrates that a remarkably abundant flow of New World fauna took place into South Asia between perhaps 2000 BC and AD 1000.

The same naming phenomenon can be noted in other Old World languages. The black nightshade, *Solanum nigrum*, this too from the New World, was named not only in Sanskrit, Persian, and Chinese

but also in Arabic.[34] Elsewhere, a name for sweet potato among Chibchan speakers of Colombia and Panama precisely matches the Hawaiian name for the plant.[35] Karl H. Rensch's linguistic study of names for sweet potato resulted in his proposing "that the sweet potato reached Polynesia at least twice: once via a northern route through Hawaii under the guise of **kuara/*kuala*, and once via a southern route as **kumara*, with Easter Island as its point of entry."[36]

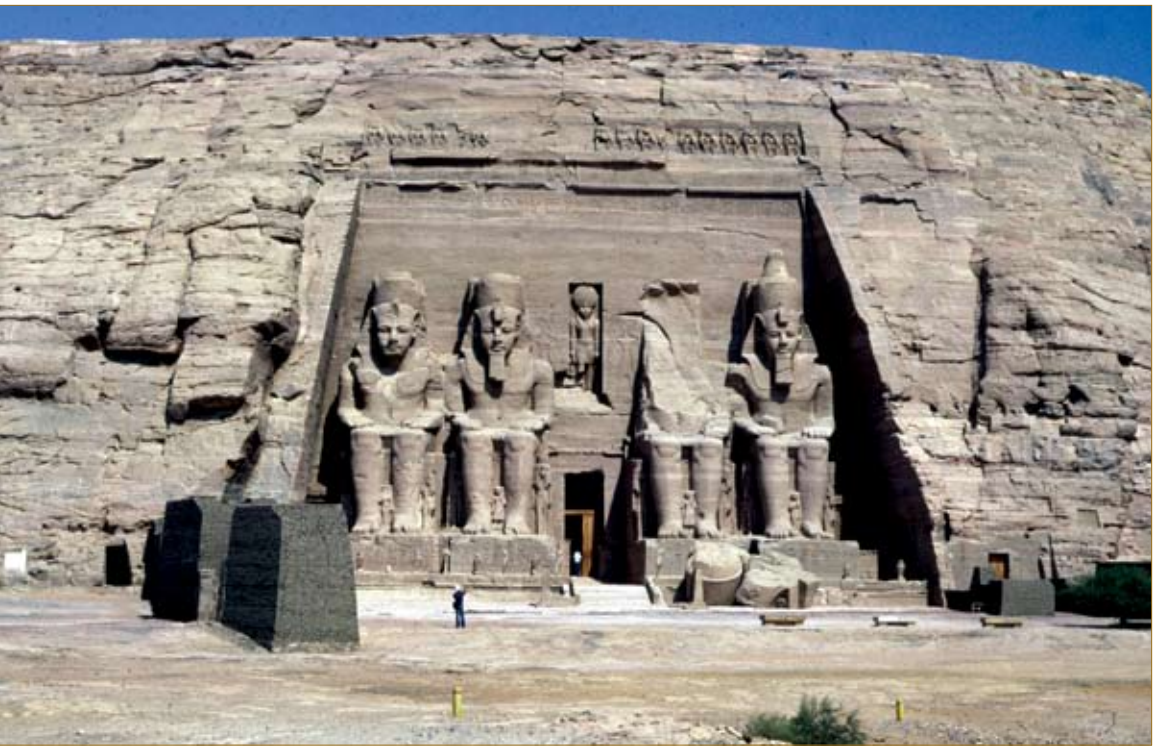
This teapot in the shape of a green *moschata* squash is in Zhejiang Provincial Museum, Hangzhou, Zhejiang, China, and is assigned to the Song Dynasty (AD 960–1279). Photo by C. Johannessen.

Methods of research familiar to botanists who study the distribution of plants were also involved in our study. For example, turmeric, *Curcuma longa*, was originally Asiatic (it had names in Sanskrit, Chinese, Hebrew, and Arabic), and from there it spread eastward throughout many Pacific islands. So when we learn that turmeric was also grown by native people in the remote Amazon River drainage of eastern Peru, the conclusion seems inescapable—it was carried to South America, presumably from the islands, on some prehistoric voyage.[37]

Other evidence from distributions concerns the bottle gourd, *Lagenaria siceraria*. Some have proposed that it was capable of drifting across an ocean, although scientists are uncertain whether seeds would still grow after a months-long float to some American beach.[38] But the gourd was absent from western Polynesia, although it does appear in the islands of eastern Polynesia. Obviously, the gourd did not drift from island to island all the way across the Pacific to Peru or else the species would have grown in western Polynesia as well. Yet it appeared in an archaeological site on the coast of Peru almost 5,000 years ago. The only scenario that makes sense of these facts has Asian mariners carrying gourds in their vessels from Asia or the western Pacific directly to western South America thousands of years ago.[39] Later voyagers could have carried the plant to eastern Polynesia, but not farther west, from the mainland aboard vessels like the *Kon Tiki* raft.

Often several types of analysis, rather than a single method, combine to prove contact by sea. In our study we always demanded at least two lines of evidence before considering contact across the sea to be assured. For instance, for the peanut (see above), where the primary evidence comes from archaeology, added support comes from linguistics. Names for that nut among Native American peoples in interior South America, the area where botanists think the plant was first domesticated from the wild, compare to names for peanuts on the Indian subcontinent. South American names include (in the Tupí family of languages) *mandobi, manobi, mandowi, mundubi,* and *munui*; (in Pilagá) *mandovi*; (in Chiriguano) *manduvi*; and (in Guaraní) *manubi.*[40] Michael Black showed that those terms are strikingly like peanut names in India: in Sanskrit, *andapi*; in Hindi, *munghali*; and in Gujarati, *mandavi.*[41] These lexical parallels taken together with the actual plant specimens dug up by archaeologists in Asia make clear that transoceanic voyaging was the means by which the plant and its names reached Asia. Furthermore, plant scientist Edgar Anderson concluded that "the most primitive type of peanut, the same narrow little shoestrings which are found in the Peruvian tombs, are commonly grown today, not in Peru, but in South China."[42]

Proof for one complex of plants involved a particularly wide array of research methods. To the amazement of some scientists and the consternation of others, chemical evidence of tobacco has been found in ancient Egyptian mummies, although tobacco was supposed to be unknown in the Old World prior to Columbus. First, fragments of tobacco were found deep in the abdominal cavity of the 3200-year-old mummy of Pharaoh Ramses II while it was being studied in a European museum. Some skeptics immediately concluded that this had to be due to modern contamination in the museum. This American plant could not possibly have been known in Egypt, they insisted. In 1992 physical scientists in Germany used sophisticated laboratory instrumentation to test nine other Egyptian mummies. They found chemical residues of tobacco, coca (another American plant, the source of cocaine), and the Asian native hashish (the source of



In modern times this ancient monument to Ramses II was moved to a safer locale at Abu Simbel, Egypt. Tobacco fragments found in the abdominal cavity of the 3,200-year-old mummy of Pharaoh Ramses II suggest that this native American crop plant was transported to Egypt in ancient times.

marijuana) in the hair, soft tissues, skin, and bones of eight of the mummies. These traces included cotinine, a chemical whose presence means that the tobacco had been consumed and metabolized while the deceased person was alive. (The ninth mummy contained coca and hashish residues but not tobacco.) Dates of the corpses according to historical records from Egypt ranged from 1070 BC to AD 395,[43] indicating that these drugs were continuously available to some Egyptians for no less than 1,450 years. Investigators have since found evidence of the drugs in additional mummies from Egypt.[44]

Equally startling has been the discovery of the same drugs in Peruvian mummies that date back to at least AD 100. Chemical analysis revealed the use of tobacco and cocaine (not surprisingly, since the former was widely used in the Americas and the latter comes from the South American plant *Erythroxylon novagranatense*, commonly known as coca). But hashish was also used in Peru, although it is from Asian *Cannabis sativa*.[45] Furthermore, two species of beetles that infested Egyptian mummies—*Alphitobius diaperinus* and *Stegobium paniceum*—have also been found in mummies in Peru.[46] It is impossible to avoid the conclusion that intentional voyages across an ocean were involved in these transfers.

As to motives that impelled transoceanic travelers, the utilitarian, economic viewpoint that dominates so much of our thought today would lead us to suppose that a search for new sources of food and fiber would have been the obvious reason for ancient voyagers to undertake distant, dangerous explorations. But looking carefully at our entire list of plants, we are somewhat surprised to learn that utility seems to have been less important than we would suppose. While some of the American plants were indeed useful additions to the diet or made serviceable artifacts, virtually all the transported species served medicinal functions. Perhaps just as spices were a prime motivation for Europeans of the 15th and 16th centuries to undertake arduous travel to reach the islands of Southeast Asia, pre-Columbian voyagers may have sought after cures to relieve disease or nostrums that they hoped would lengthen their life span. Then again, a sufficient motive to impel long-distance sailors may simply have been curiosity—what Mary Helms has labeled "the Ulysses factor,"[47] the sheer desire to see "what is out there."

Table 1 does not necessarily represent a proper sample of the plant exchanges that actually took place. Because of the in-depth knowledge of Sanskrit that the India sources provide, connections of America with India may be appear disproportionately high. If we had equally detailed knowledge about other ancient languages, the count of species in other areas might be higher. Still, this inventory of plants exchanged is already impressive, as shown in table 1.

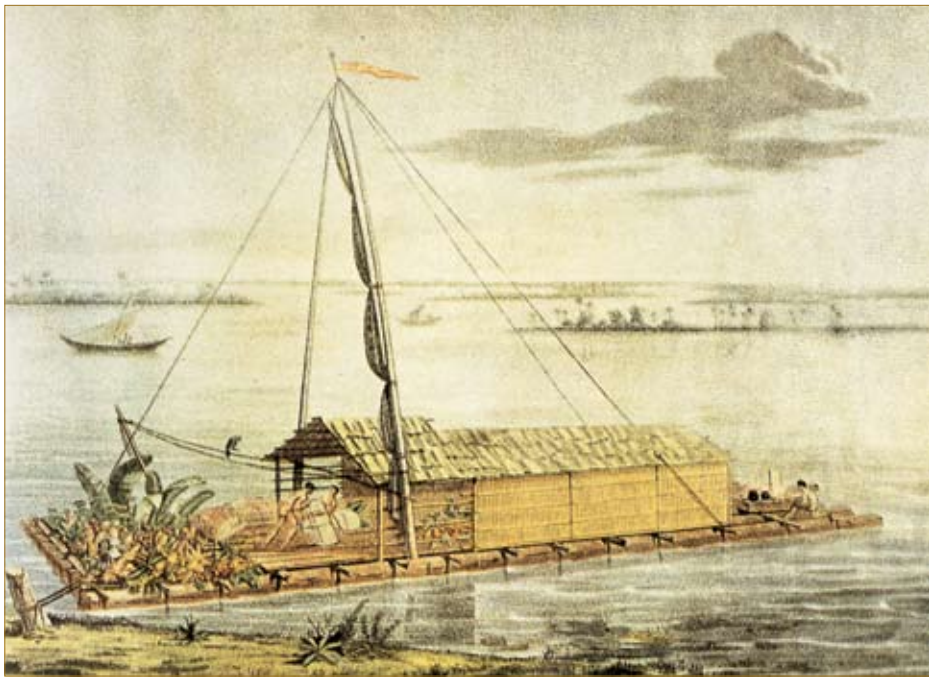
What is true of plants is paralleled by the transoceanic carriage of fauna. Let us look first at infectious organisms, because it was long believed that the New World constituted a virtual terrestrial paradise, free from the diseases known in the Old World, until the Spaniards brought in devastating Old World microorganisms. But in the last few years that naïve picture has changed considerably. It is true that many of the epidemic plagues of Eurasia and Africa did not exist in the Americas. (Generally speaking, New World people were protected from the spread of epidemics because they tended not to dwell in densely populated cities nor with large numbers of domestic animals close at hand, as much of the Old World population did.) Still, new research is demonstrating that New World peoples "were exposed to a wide variety of diseases," including "fungi and staphylococcal and streptococcal environmental pathogens."[48] At least 21 disease agents have been found to be located in both the Americas and the Old World before Columbus (see table 2), and up to 19 more may yet be shown to have been shared.

A prime example of the kind of evidence at hand to establish transoceanic transport for such organisms is the case of the hookworm, *Ancylostoma duodenale*. Its relative rarity in some tropical areas of the New World and its long-term prevalence in East and Southeast Asia make the latter area the place where epidemiologists think the organism originated. At first early historians of medicine assumed that *A. duodenale* had been introduced into the Americas by slaves brought from Africa. Early in the 20th century, O. da Fonseca discovered the parasite in an isolated Amerindian population in the Amazon basin.[49] Shortly afterward, microbiologist Samuel Darling weighed the evidence and concluded it was likely that the hookworm had reached native South American forest dwellers *before* Columbus arrived. If that could be proven, he observed, then the only plausible explanation for its presence in the New World would be that it arrived anciently via infected humans who had crossed the ocean.[50]

His confidence that the pest came by sea sprang from facts about the life cycle of this nematode worm. At a certain stage in its life cycle, it must inhabit warm, moist soil (in a climate no colder than North Carolina today). At a later point in the cycle the worms that have developed in the soil penetrate some human's body and settle in the digestive tract. Immigrants who came to the New World in slow stages via the Bering Strait would have arrived hookworm-free because the cold soil would have killed the parasite during the long trip,[51] while host humans crossing by ship (in a relatively short period of time) could still carry worms upon their arrival.

The hookworm's pre-Columbian presence in America was finally established by Marvin Allison and colleagues, who in 1973 found traces of hookworms in a Peruvian mummy dated AD 700.[52] In 1988 Brazilian scientists identified the same species from human remains excavated in eastern Brazil. A series of radiocarbon dates at that site placed the remains at about 7,300 years ago,[53] although, given the inland remoteness of the place, the human carriers who introduced the pest from overseas must have arrived on some American coast centuries earlier than that.

This find establishes conclusively that humans crossed the ocean at a startlingly early time, for only in that way can the presence of the hookworms be explained. Scientists continue to assure us that there is no alternative explanation. L. F. Ferreira



This 1810 drawing by Alexander von Humboldt depicts a raft from Ecuador with a garden at one end and cooking facilities at the other. Nearly identical rafts were used in southern China and Vietnam for thousands of years and were likewise steerable and safe.

Table 1. Plants for Which There Is Decisive Evidence of Transoceanic Carriage				
Species	**Common Name**	**From**	**To**	**By**
Adenostemma viscosum	—	American origin	Hawaii, India	AD 1500
Agave sp.	agave	American origin	E. Mediterranean	300 BC
Agave americana	agave	American origin	India	AD 1000
Agave angustifolia	agave	American origin	India	AD 1000
Agave cantala	agave	American origin	India	AD 1000
Ageratum conyzoides	goat weed	American origin	Hawaii, India	AD 1500
Alternanthera sp.	—	American origin	India	BC
Amaranthus caudatus	love-lies-bleeding	American origin	Asia	BC
Amaranthus cruentus	amaranth	American origin	Asia	BC
A. hypochondriacus	amaranth	American origin	Asia	BC
Amaranthus spinosus	spiked amaranth	American origin	India	BC
Anacardium occidentale	cashew	American origin	India	100 BC
Ananas comosus	pineapple	American origin	Middle East, India	600 BC
Annona cherimolia	custard apple	American origin	India	AD 1200
Annona reticulata	annona	American origin	India	100 BC
Annona squamosa	sweetsop	American origin	India	2500 BC
Arachis hypogaea	peanut	American origin	China, Indonesia	2800 BC
Argemone mexicana	prickle poppy	American origin	India	1100 BC
Aristida subspicata	—	American origin	Polynesia	AD 1500
Artemisia vulgaris	mugwort	Asian origin	Mexico	AD 1500
Asclepias curassavica	milkweed	American origin	India, Polynesia	AD 1000
Aster divaricates	—	American origin	Hawaii	AD 1500
Bixa orellana	achiote, annatto	American origin	Oceania, Asia	AD 1000
Canavalia ensiformis	jack bean	American origin	India	1600 BC
Canna edulis	Indian shot	American origin	India, China	AD 300
Canna indica	Indian shot, achira	Peru	India, China	AD 300
Cannabis sativa	hashish	Asian origin	Peru	AD 100
Capsicum annuum	chile pepper	American origin	India, Indonesia	AD 800
Capsicum frutescens	chile pepper	American origin	India	AD 800
Carica papaya	papaya	American origin	Polynesia	AD 1500
Ceiba pentandra	silk cotton tree	American origin	Southeast Asia, India	AD 900
Chenopodium ambrosioides	Mexican tea	Asian origin	Mexico	AD 1000
Cocos nucifera	coconut	Asian origin	Central America	AD 400
Couroupita guianensis	cannonball tree	American origin	India	AD 1000
Cucurbita ficifolia	chilacayote	American origin	South Asia	AD 1500
Cucurbita maxima	Hubbard squash	American origin	India, China	AD 900
Cucurbita moschata	butternut squash	American origin	India, China	AD 900
Cucurbita pepo	pumpkin	American origin	India, China	AD 500
Curcuma longa	turmeric	Asian origin	South America	AD 1500
Cyperus esculentus	edible bulb. sedge	Peru, No. America	Middle East, India	BC?
Cyperus vegetus	edible sedge	American origin	India, Easter Island	AD 1000
Datura metel	datura	American origin	Asia, Europe	BC
Datura stramonium	datura	American origin	Asia, Europe	BC
Diospyros ebenaster	black sapote	American origin	South, East Asia	AD 1500
Erigeron canadensis	—	American origin	India	AD 1000
Erythroxylon novagranatense	coca	So. American origin	Egypt	1200 BC
Garcinia mangostana	mangosteen	Asian origin	Peru	BC?
Gossypium arboreum (or *G. herbaceum*)	cotton	Asian origin	So. and No. America	3000? BC

Gossypium barbadense	cotton	American origin	Polynesia	AD 1500
Gossypium gossypioides	cotton	(genes from) Africa	Mexico	AD 1500
Gossypium hirsutum	cotton	American origin	West Africa	AD 1475
Gossypium tomentosum	cotton	American origin	Hawaii	AD 1500
Helianthus annuus	sunflower	American origin	India	AD 400
Heliconia bihai	balisier	American origin	Oceania, Asia	AD 1500
Hibiscus tiliaceus	linden hibiscus	Tropical America	Polynesia	AD 1500
Ipomoea batatas	sweet potato	American origin	Polynesia, Asia	AD 300
Lagenaria siceraria	bottle gourd	American origin	E. Polynesia	AD 1500
Luffa acutangula	ribbed gourd	India	America	BC?
Luffa cylindrica	vegetable sponge	Asia	Mesoamerica	1200 BC
Lycium carolinianum	—	American origin	Easter Island	AD 1500
Macroptilium lathyroides	phasey bean	American origin	India	1600 BC
Manihot sp.	manioc	American origin	E. Polynesia, India	AD 1500
Maranta arundinacea	arrowroot	American origin	Easter Island, India	AD 1000
Mimosa pudica	sensitive plant	American origin	India	BC?
Mirabilis jalapa	four-o'clock	American origin	India	BC?
Mollugo verticillata	carpetweed	Eurasia	Americas	BC?
Monstera deliciosa	ceriman	American origin	India	AD 1100
Morus sp.	mulberry	Asian origin	Middle America	AD 1500
Mucuna pruriens	cowhage	American origin	India, Polynesia	BC?
Musa x paradisiaca	banana, plantain	South Asia	Middle Amer.	BC?
Myrica gale	bog myrtle	No. Europe	North America	AD 1000
Nicotiana tabacum	tobacco	American origin	Egypt	1100 BC
Ocimum sp.	basil	India	America	AD 1500
Opuntia dillenii	prickly pear cactus	American origin	India	BC?
Osteomeles anthyllidifolia	—	American origin	Oceania	AD 1500
Pachyrhizus erosus	jicama, yam bean	American origin	India	AD 1000
Pachyrhizus tuberosus	jicama, yam bean	American origin	East Asia, Oceania	AD 1500
Pharbitis hederacea	ivy-leaf morn glory	American origin	India, China	AD 1000
Phaseolus lunatus	lima bean	American origin	India, China	1600 BC
Phaseolus vulgaris	kidney bean	American origin	India, Middle East	1600 BC
Physalis lanceifolia	ground cherry	American origin	India, Marquesas	BC?
Physalis peruviana	husk tomato	American origin	India, Polynesia	AD 1000
Polygonum acuminatum	—	American origin	Easter Island	AD 1500
Portulaca oleracea	purslane	American origin	India, China	BC?
Psidium guajava	guava	American origin	India, Middle East	BC?
Sapindus saponaria	soapberry	American origin	Asia, E. Polynesia	BC?
Schoenoplectus californicus	bulrush	American origin	Easter Island	AD 1300
Sisyrhynchium acre	a "grass"	American origin	Hawaii	AD 1500
Sisyrhynchium angustifolium	blue-eyed "grass"	Greenland	Newfoundland	AD 1000
Solanum candidum/ S. lasiocarpum	naranjillo	American origin	Oceania, SE Asia	AD 1500
Solanum nigrum	black nightshade	American origin	Eurasia	BC?
Solanum repandum/ S. sessiliforum	—	American origin	Oceania	AD 1500
Solanum tuberosum	potato	American origin	Easter Island	AD 1500
Sonchus oleraceus	sow thistle	Asia	Middle America	AD 1500
Sophora toromiro	toromiro tree	American origin	Easter Island	AD 1300
Tagetes erecta	large marigold	American origin	India	BC?
Tagetes patula	dwarf marigold	American origin	India	AD 1000
Zea mays	maize, corn	American origin	Eurasia, Africa?	2500 BC?

Table 2. Faunal Sources of Disease Shared in Both Hemispheres	
Alphitobius diaperinus	lesser mealworm
Ancylostoma duodenale	a hookworm
Ascaris lumbricoides	roundworm
Bordetella pertussis	whooping cough bacterium
Borrelia recurrentis	relapsing fever spirochete
Entamoeba hystolytica	amoeba that causes dysentery
Human (alpha) herpes virus 3	cause of shingles, chicken pox, etc.
Human (gamma) herpes virus 4	cause of mononucleosis, etc.
Microsporum spp.	causes of ringworm of the body
Mycobacterium tuberculosis	bacterium causing tuberculosis
Necator americanus	a hookworm
Pediculus humanus capitis	head louse
Pediculus humanus corporis	body louse
Piedreaia hortai.	a fungus that infests the hair
Rickettsia prowazekii	bacterium that causes typhus
Rickettsia rickettsii	bacterium that causes spotted fever
Strongyloides sp.	threadworm nematode
T cell lymphotropic (retro)virus (HTLV-I)	lymphotropic virus
Trichosporon ovoides	a fungus infesting scalp or beard hair
Trichuris trichiura	whipworm
Yersinia pestis	the plague bacillus

and colleagues say that "transpacific migrants from Asia by sea *must be* one component of the ancient American population."[54] Fonseca agrees: "Shared species of parasites . . . *make it inescapable* that voyagers reached South America directly from Oceania or Southeast Asia."[55] Ferreira and colleagues conclude the same: "We *must suppose* that [the human hosts for the parasite] arrived by sea."[56] And A. Araújo insists, "*The evidence points only* to maritime contacts" for the introduction of hookworms (emphases added).[57]

Two key facts arise from this situation. First, *A. duodenale* could have arrived in America only in the bodies of humans (Asians presumably) who arrived by sea. Since all humans bear a culture, it was not just a source of illness that arrived in South America on that boat or raft, but also features of some particular Asian culture, as well as a set of genes. Second, by the sixth or fifth millennium BC, whether we can describe or conceive of them or not, ships were then available in at least one region on the western side of the Pacific that were capable of crossing or skirting the ocean, for at least one did so.

A second species, *Necator americanus*, is also known as hookworm and has the same life cycle. It has been found in Brazil in human remains similar in date to that of *A. duodenale*.[58] By the same reasoning, it too arrived by a sea voyage.

Not only is the louse that infests the heads of humans (*Pediculus humanus corporis*) precisely the same species in mainland America and the Pacific islands,[59] but the names also virtually match, at least in two languages of the Solomon Islands and the Maya of Mesoamerica.[60]

Some of the other diseases whose agents have recently been shown to have been in America in the pre-Columbian era include other intestinal parasites—the roundworm and the threadworm; the amoeba that causes dysentery; viruses responsible for shingles, chicken pox, and mononucleosis; a fungus that causes ringworm on the body and two others that infest human hair; disease bacteria for whooping cough, typhus fever, and the plague; and the T cell lymphotropic (retro)virus (HTLV-I).

In addition, some larger fauna made the trip directly across the ocean, surely with humans. For example, the native American turkey was known in medieval central Europe. Bones have been excavated from archaeological ruins dated to the 14th and 15th centuries (in Switzerland and Hungary), and jewelry

that bears engravings of the fowl's distinctive head and the characteristic neck wattle has come from south-central Europe, dated as early as the 10th century. Moreover, two years before Columbus's first voyage, a letter was sent from Budapest to an Italian nobleman, asking him to supply a pair of the birds along with a man skilled in their care.[61]

In addition to the organisms for which we have decisive proof of transoceanic distribution, for another 80 species of flora and fauna there is some evidence that they too may have crossed the oceans with boat travelers. More research is needed to determine which of those, if any, to add to our "decisive evidence" list. (For tables listing the additional candidate fauna and flora, along with full documentation and data supporting the historicity of these movements across the oceans, see the publications cited in notes 12 and 13.)

Ancient Seafaring Technology

A question naturally arises as to whether vessels and nautical skills were available to account for the early voyages. Contrary to the picture we were once taught about "primitive" sailors timidly avoiding the open sea until an intrepid Columbus made a breakthrough, evidence now clearly establishes that sailors long ago ventured widely. As long ago as 50,000 BP (before the present), Australia's first settlers reached that continent across as much as 95 miles (150 km) of open sea, and the Solomon Islands were populated from 105 miles (170 km) away by 29,000 years ago.[62] Balsa-log rafts (functionally they were steerable "ships," not what we think of under the term *rafts*) like the *Kon Tiki* vessel of Thor Heyerdahl were preceded by early Ecuadoran craft that sailed up and down the Pacific coast of South and Middle America apparently from 2000 BC on.[63] However, they, in turn, were modeled on rafts of unknown age from China and Southeast Asia.[64] Three modern replicas of pre-Columbian rafts constructed in Ecuador in the traditional form were sailed in 1974 as a fleet over 9,000 miles to Australia.[65] Many other craft, some of them remarkably small and "primitive,"[66] have been sailed in modern times across various ocean routes; one veteran small-craft sailor reports that "it takes a damned fool to sink a boat on the high seas."[67]

A Changing Paradigm

We have seen that the old view of completely separate natural and cultural histories for the Old World and the New can no longer be maintained. New research has turned that reactionary idea on its head. The historical paradigm has changed. Hereafter, students of history must start from the position that voyaging across oceans was within the capability of adventurous folks in many times and places. Numerous voyages across the oceans were completed that had substantial consequences on both sides of the world.

That being the case, historians, archaeologists, geographers, and others must not fail to look anew at the massive evidence from *cultural* similarities that they have long considered mere coincidental inventions easily made by the human mind.

How can those who have been considered the authoritative experts have got this aspect of history so utterly wrong? Much of the "new" evidence has actually been around in published form for quite a long time (see note 8). It has been largely ignored because dogmatically opinionated experts have so blindly defended the notion that the histories of the two hemispheres were independent, denying that there was any possibility of meaningful ocean travel.

Yet we should not be disappointed with secular scholars for lacking curiosity and open minds in regard to this topic. We Latter-day Saint students of antiquity too have allowed ourselves to be unnecessarily limited in approaching the Nephite record's account of transoceanic voyaging. Most of us have been too long stuck with the traditional notion that the scriptural account allowed only Lehites, Mulekites, and Jaredites to sail across the oceans (that is equivalent to assuming that Mormon pioneers were the only ones who crossed the plains of western North America to the Rocky Mountains and beyond). If we want fuller answers about Book of Mormon history, we ourselves need to ask potentially richer questions of the record.

Research so far has not confirmed that ships did carry Jaredites, Lehites, or Mulek and his party from Eurasia to America. But now, for the first time, we have the clear backing of biological history that those voyages fit within a long-standing historical pattern.