

# How Judaism was founded

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A chronology for the founding of Judaism is developed, based on two large volcanic eruptions. One eruption, in 1629–1628 BC, had climatic after-effects that induced the famine of Joseph. The other eruption, in 1162–1160 BC, prompted the expulsion of the Hyksos from Egypt. After the expulsion, the Hyksos encountered the Hebrews, whose Exodus was generations prior. The Hebrews and the Hyksos together formed the original Israelite population, which conquered Canaan. Although the Hebrews were far outnumbered by the Hyksos, they culturally subsumed the Hyksos—for reasons explained herein. Some other post-famine biblical events are also corroborated.

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## 1. Introduction

In 1983, a nineteenth-century debate on the chronology of ancient Egypt was reopened by D.M. Rohl and P. James [Rohl, 1995: p.400–404]. It was proposed that many events currently dated to *c.*1000 BC actually occurred about three centuries later. Egypt's chronology has been used to derive the chronologies of almost all other ancient civilizations around the eastern Mediterranean, via archaeo-historical synchronisms [James, 1991]. Further work indicated that the chronologies of those other civilizations could be compatibly redeveloped and that doing so would address several well-known chronological problems [James, 1991; Cryer, 1995]. The essential part of that redevelopment was to excise the Dark Age after 1000 BC—the lack of artefacts and human remains for that time are then explained by its non-existence rather than by a cultural collapse (with a rapid redevelopment to previous levels afterwards). The proposal led to much controversy {[Hassan, 1991; Scarre, 1991; James et al., 1992]}.

One issue that the controversy helped to clarify concerns the evidence that was originally used to develop a chronology for ancient Egypt: it became clear that that evidence is very weak [James et al., 1992; Rose, 1994; Rohl, 1995; Goldberg, 1995; Hagens, 1996; Keenan, 1999]. Indeed, the Egyptological data is so unreliable, incomplete, and contradictory that it does not appear feasible to develop a secure chronology from it alone (see further below).

There have been five main arguments against the proposed revised chronology: radiocarbon dating; Sothic dating of ancient Egypt; tree-ring dating of artefacts from Anatolia; texts recording ancient solar eclipses; Mesopotamian chronology. Regarding radiocarbon dating, Keenan [2002] has hypothesized that radiocarbon dates obtained downwind from the Eastern Mediterranean Sea are centuries too early, because the Sea was degassing <sup>14</sup>C-deficient carbon (see also Keenan [2010]). Regarding Sothic dating, this has been demonstrated to be fallacious [Keenan, 2012]. Regarding tree-ring dates from Anatolia, they are illusory [Keenan, 2006]. Regarding solar eclipses, see Excursus 1.

Regarding Mesopotamian chronology, this has been claimed to be a reliable independently-derived chronology, and if the claim is true, that would invalidate the proposed revised chronology. In the following, we assume that Mesopotamian chronology is in error by centuries. We make that assumption without consideration of the evidence that has been adduced for Mesopotamian chronology. And we acknowledge that this is a serious problem for the proposed revised chronology. {Consider the BICANE 4 conference?}

On the other hand, there is great evidence for the proposed chronology. The evidence includes these: ancient Egyptian texts; Egyptian archaeological records; non-Egyptian texts from the Ancient Near East; non-Egyptian archaeological records from the Ancient Near East; Chinese texts (which are linked to Egyptian records); Chinese archaeological records; paleobotanical records from in and around the Ancient Near East; paleobotanical records from many other locations in the Northern Hemisphere; marine sediments; polar ice cores; tree-ring records; speleothem records; computer simulations of the climate system; historical records of climatic events; genetic studies; biblical stories; and more. There is not one or two or three pieces of evidence that imply the proposed revised chronology. Rather, the evidence, collectively, seems to be immensely consilient.

The presentation of such a broad collection of evidence spans several papers. In the present paper, we focus on biblical stories about the founding of Judaism. In particular, we consider two biblical events: the conquest of Canaan and the famine of Joseph. We argue this: the conquest was prompted by a volcanic eruption in 1162–1160 BC and the famine was prompted by the climatic after-effects of a volcanic eruption in 1629–1628 BC. We also demonstrate that several aspects of related biblical stories are valid.

The conquest and the famine are synchronous with some events in Egypt. Understanding those Egyptian events is helpful for understanding the conquest and famine. For that reason, some Egyptian history is discussed below, but only to the extent that it is needed for understanding the biblical stories. The precise dates for the biblical stories, though, give precise dates for some events in Egyptian history. Those dates turn out to be similar to the dates proposed by Rohl and James. (For a more general discussion of Egyptian chronology, extending back to the third millennium BC, see Keenan [1999].)

One other issue is worth noting here. Some people view the biblical text as revealing religious truth. Some other people view the biblical text as mythical. Both those views are eschewed herein. Rather, we view the biblical text as containing descriptions of some events that might have occurred, and we consider how and why a description tells what it does. We have taken the same view of texts from ancient China: for example, we have argued that the Chinese notion of the Mandate of Heaven derived from real events, which are described in ancient texts [Keenan, 2021].

## 2. The biblical text

### Introduction

{This subsection needs more references.}

The Hebrew Bible acquired its present form in the second century AD. Prior to that, most stories in the Bible existed in multiple, differing, versions. Then, during the first two centuries AD, one version of each story was chosen to be “canonical” for Judaism. The process by which the canonization occurred is poorly understood.

Partial texts of some pre-canonical versions of the biblical stories are extant. Among the most important such texts are the Dead Sea Scrolls [Schiffman & VanderKam, 2000; Abegg et al., 2002]. The Scrolls were largely written during the last few centuries BC, and were preserved in caves near Qumran, Israel. They were discovered during the mid-20<sup>th</sup> century.

Most early Hebrew texts, such as the Dead Sea Scrolls, are written without vowels or punctuation, i.e. they are just sequences of consonants. That can sometimes make it difficult to interpret the texts, even when the texts are complete.

The earliest extant complete manuscripts of the Hebrew Bible were written in about the tenth century AD. Those manuscripts present what is known as the *Masoretic Text* of the Bible. Comparisons of those manuscripts with the Dead Sea Scrolls show that the Masoretic Text faithfully reproduces what is in some Scrolls. {...} In other words, it seems that the scribes who copied the texts of the biblical stories made almost no errors during over 1000 years.

Partly for that reason, the Masoretic Text is believed to faithfully reproduce the text that was canonized during the second century AD. Hence, the Masoretic Text is taken as containing the canonical text of the Hebrew Bible; so it is sacred in Judaism.

The Masoretic Text also includes annotations that specify vowels and additionally address other issues. The annotations are known as *qere*. The validity of the *qere*, however, is not always certain. {Elaborate; cite Tov [2001] and others.}

During the second and third centuries BC, the Hebrew Bible was translated into Greek. The translation is known as the *Septuagint*. The earliest extant manuscripts of the Septuagint date from the fourth century AD.

The versions of the biblical stories told in the Septuagint sometimes differ from the versions told in the Masoretic Text, in small but significant ways. Comparison of the Septuagint with the Dead Sea Scrolls indicates that the Septuagint faithfully reproduces versions of the stories recorded in some Scrolls. Thus, some of the pre-canonical versions of the stories that were reproduced by the Septuagint are different from the pre-canonical versions of the stories that were later canonized and reproduced by the Masoretic Text.

The canonization of the Masoretic Text has been accepted by most Christian churches in the West: those churches take the Masoretic Text as their text for the Old Testament. The canonization has not been accepted by Eastern Orthodox churches: instead, those churches take the Septuagint as their text for the Old Testament.

### Example 1: A divination

Below, we give an example of a quotation from the Bible. In giving such quotations, we cite two different English translations. The first translation is the *JPS Hebrew-English Tanakh* by the Jewish Publication Society [1999] (which is a small revision of a major edition from 1985); this is the de facto standard Jewish translation. The second translation is the *Hebrew Bible* by Alter [2018]; this is a recent original scholarly translation. In citing those translations, we sometimes make small clarifications, e.g. replacing a pronoun by its referent.

The quotation below describes the Israelite King Saul using divination: something that happened earlier went wrong, and Saul is asking the Israelite god to identify who is responsible. The divination is done by casting of lots (a practice known as *cleromancy*). The casting of lots results in either “Urim” or “Thummim” (also spelled “Thammim”); what those are is unknown to modern scholars. The quotation is from the First Book of Samuel, chapter 14, verse 41.

Saul then said to the LORD, the god of Israel, “Show Thammim.” Jonathan and Saul were indicated by lot, and the troops were cleared.

And Saul said, “LORD, god of Israel! Why did you not answer your servant today? If there is guilt in me or in Jonathan my son, O LORD god of Israel, show Urim, and if it is in your people Israel, show Thummim.” And the lot fell on Jonathan and Saul, and the troops came out clear.

1 Samuel  
14:41

The first translation, by JPS, is greatly different from the second translation, by Robert Alter; additionally, the JPS translation does not make sense. Why?

The JPS translation is an accurate translation of the Masoretic Text. The Alter translation is an accurate translation of the Septuagint. Thus, this example shows a biblical verse for which the Masoretic Text and the Septuagint greatly differ.

Alter generally relies on the Masoretic Text, but for this verse he relied on the Septuagint. The reason Alter gives is that the Septuagint makes greatly more sense, especially in the context of the chapter.

An additional reason for relying on the Septuagint is given by other biblical scholars (e.g. Toeg [1969], McCarter [1980], Minkoff [2012]). When a scribe was copying a text, he would sometimes make mistakes. One common mistake was to omit a phrase when his eye jumped from one word in the text he was copying to another appearance of the same word a little farther in the text (such a mistake is known as a *homoeoteleuton*). That mistake evidently occurred with this verse in the Masoretic Text: the scribe's eye skipped from one occurrence of the word "Israel" to the next and missed the words in between.

The Masoretic Text is clearly in error here. Possibly the error originated in a pre-canonical copy of the text. For determining the origin of the error, the Dead Sea Scrolls are not useful, because they do not include 1 Samuel 14:41 [Abegg et al., 2002].

### **Scholarliness and religious faith**

Although the error in the Masoretic Text is clear, JPS used the Masoretic Text anyway. There are other examples, too, of the Masoretic Text being clearly in error (see e.g. Tov [2001] and McCarthy [2016] {more references and discussion}). Yet JPS always uses the Masoretic Text: because the Masoretic Text is sacred in Judaism.

The underlying problem here is that some authors of biblical publications will sacrifice scholarliness due to their religious faith. The problem is common. That does not imply, however, that all Jewish publications sacrifice scholarliness; indeed, there are Jewish publications that are highly scholarly. Additionally, there are publications written by Christians who have sacrificed scholarliness due to their religious faith.

### **Example 2: Crossing the Jordan River**

Our second example of a biblical quotation pertains to when the Israelites first crossed the Jordan River, to conquer Canaan. According to the biblical story, the river was in full flow, but then temporarily stopped, thereby allowing the Israelites to cross. The quotation is given in the same format as above, from JPS and from Alter.

When the people set out from their encampment to cross the Jordan [river], the priests bearing the Ark of the Covenant were at the head of the people. Now the Jordan keeps flowing over its entire bed throughout the harvest season. But as soon as the bearers of the Ark reached the Jordan, and the feet of the priests bearing the Ark dipped into the water at its edge, the waters coming down from upstream piled up in a single heap a great way off, at Adam, the town next to Zarethan; and those flowing away downstream to the Sea of the Arabah (the Dead Sea) ran out completely. So the people crossed near Jericho.

And it happened, when the people journeyed forth from its tents to cross the Jordan [river], with the priests, bearers of the Ark of the Covenant before the people, and when the bearers of the Ark reached the Jordan and the feet of the priests, bearers of the Ark, were immersed in the water's edge—the Jordan being full to all its banks throughout the harvest days—the water coming down from above stood still, rose up in a single mound, very far off from the town of Adam which is by Zanethan, and the water going down to the Arabah Sea, the Salt Sea, was completely cut off, and the people crossed over opposite Jericho.

Joshua  
3:14–16

The Alter translation says that the water was stopped “very far off from the town of Adam”. The JPS translation differs, saying that the water was stopped “a great way off, at Adam”. The JPS translation, though, includes a footnote: this explains that the consonant sequence of the Masoretic Text says “at” but that the *qere* says “from” (there is no punctuation). Thus, the Alter translation has used the *qere*. {Cite Tov [2001: p.58–63].} What should be concluded from all this?

Locations are normally specified as being *at* or *near* a place, rather than being *very far off from* a place. Hence the Alter translation is intrinsically odd here.

The Septuagint does not mention the town of Adam. It does, though, say that the waters formed “a single heap over a very wide area, as far as the outskirts of Kiryath-Jearim” [Holmes, 1914; Fretz, 1992]. Kiryath-Jearim is almost certainly a corruption of Zarethan [Holmes, 1914; {Stevenson, 1896; Albright, 1925} {later references}] {explain a little}.

The question of how to translate the text about the town of Adam has been studied since at least the 1890s (e.g. Stevenson [1895]). Since then, there have been many studies on the question. One of those studies is by the philologist-archaeologist William F. Albright, who is sometimes called the “father of biblical archaeology”; Albright [1925] argued that the original, pre-canonical, Hebrew text said, essentially, this: “the water coming down from above stood still, [and] rose up in a single heap as far from Adam as the outskirts of Zarethan”.

The Dead Sea Scrolls contain some of the quotation. The relevant parts, however, are fragmentary, and potential restorations are disputed [van der Meer, 2004]. Thus, the question on the text about the town of Adam has remained unresolved.

The town of Adam has been identified. The town is nowadays known by its Arabic name, which is transliterated into English as Damia, Damiya, Damiyeh, etc. [Albright, 1925; Glueck, 1951; Fretz, 1992; Avi-Yonah, 2007]. (Note that the consonant sequence for the transliterated name is the same as for Adam.) The town is by the east bank of the Jordan River (at 32.1°N, 35.6°E), 28 km north of Jericho.

We conclude here that the Alter translation seems at least dubious and that the original, pre-canonical, Hebrew text seems somewhat obscure. This issue might seem to be minor, but the quotation is important. The quotation is considered further below.

### **Divine attributions**

In the quotation above, the temporary stopping of the Jordan River seems to be unbelievable (or require a miracle, which we reject). The river stopping is one of many events in the biblical story that seem to be unbelievable. One of the purposes of the present work is to consider some of those events: do they have natural explanations or, if not, why were they fabricated? We demonstrate below that some of those events actually do have natural explanations and, moreover, can be shown to have likely occurred. For example, it is very likely that the Jordan River was in full flow and then temporarily stopped to allow the Israelites to cross.

Before discussing the biblical text further, we review some events that occurred in the South Pacific, on Easter Island. On Easter Island, many centuries ago, the people created nearly a thousand stone statues [Heyerdahl, 1989; Lipo et al., 2013]. The statues generally weigh tens of tonnes and are several meters high. Most statues are at locations several kilometers from the site where they were quarried. The largest statue weighs over 70 tonnes, is about 10 m high, and is over 5 km from the quarry.

How were the statues transported from the quarry to their locations? According to the Islanders' oral tradition, the statues walked to their locations with help from the Islanders' god [Heyerdahl, 1989: p.76,225].

The method by which the statues were transported was investigated by Heyerdahl [1989]. A later investigation was conducted by Lipo et al. [2013]. Lipo et al. determined that the Islanders had developed an ingenious method for transporting a statue, which needed only a small number of people; they also trialed the method successfully. The two investigations together make a conclusive case that the method was indeed used, by the Islanders centuries ago, to transport the statues.

Thus, the claim that the god helped the statues to walk is a falsification. Similar falsifications occur in many ancient historiographies: a historiography might attribute some result to a god, when in actuality the result was due to actions of the people. Such falsifications are in the biblical story: an example is with the stopping of the Jordan River—where the Ark of the Covenant is a manifestation of the Hebrew god.

Another way in which an event is attributed to a god occurs post facto. As a modern example, suppose that an earthquake happens in California; there will be some Christian preachers who claim that the earthquake was punishment, from their god, for people not adhering to the principles of their religion. Similar post facto attribution, to the Hebrew god, of bad events occurs many times in the biblical story. Relatedly, when something bad happens to a people, it is human nature for those people to ask “what did

we do to deserve this?’. There will commonly be someone—preacher, priest, shaman, etc.—who will then claim that the answer is disobedience to their deity.

{The biblical story was retold, over centuries, in part to advance an agenda: to support Judaism. Such retelling led to distortions in the story.}

### **3. Chronology of ancient Egypt**

#### **Overview**

The chronology of ancient Egypt is commonly divided into the following periods: Archaic Period; Old Kingdom; First Intermediate Period; Middle Kingdom; Second Intermediate Period; New Kingdom; Third Intermediate Period; Late Period (ending in 332 BC). The chronologies of the Archaic Period and the Old Kingdom (the pyramid age) are not relevant for the present work. The internal chronologies of the Middle Kingdom, New Kingdom, and Late Period are not significantly debated. That leaves the three intermediate periods—periods when Egyptian society broke down and there may have been times of anarchy. Extant records for those three periods are poor.

#### **Sources**

For constructing a chronology, we focus on written sources. Non-written, archaeological, sources are cited occasionally, but they cannot provide the detail that written sources can.

The most important written sources consist of lists of the pharaohs. There are two such lists of relevance for our work: one given by Manetho [Waddell, 1940]; one given by the Royal Canon of Turin [Gardiner, 1959; Kitchen, 1996a; Ryholt, 2006; Ilin-Tomich, 2016].

Manetho was an Egyptian priest who wrote an unreliable history book in the third century BC. There are no extant copies of the book; the book is known only through epitomes of later historians, which do not always agree.

The Turin Canon was a papyrus that listed the pharaohs and the pharaohs’ reign lengths. What remains are many damaged fragments. Those portions of the Turin Canon that have been restored, though, are generally believed to be reliable.

One problem with both Manetho and the Turin Canon is that they list pharaohs in a single sequence, as though all reigns were consecutive. In fact, some reigns, and some dynasties, were partly concurrent with others, and there have long been debates about which and for how long.

#### **The calendar of ancient Egypt**

The primary calendar used by the ancient Egyptians comprised three seasons. Each season comprised four months, and each month was 30 days long. The seasons were followed by five additional days known as *epagomenal days*. Thus, each calendar year was 365 days long. The seasons were called *Inundation* (when the Nile was in flood), *Emergence* (of land, as the Nile floodwaters retreated), and *Dryness* (when the Nile was at its lowest) [Rochberg-Halton, 1992].

The ancient Egyptians allowed their calendars to drift far out of alignment with the actual seasons—or so it is claimed by conventional Egyptology. The claim, however, is made with only negligible evidence. Furthermore, there is conclusive evidence against the claim, as shown by a companion paper [Keenan, 2012]. Although

the ancient calendars might have drifted by some weeks, it was almost certainly not more than that.

#### **4. The eruption of 1629–1628 BC**

##### **Extremely high Nile floods**

Each year, the Nile River overflows its banks and floods adjacent areas. The floods occur during summer and autumn. They provide water for irrigation; so they are vital for Egyptian agriculture, especially as Egypt receives only meagre rainfall.

There are a few extant records of Nile levels during ancient times. For the second millennium BC, there are records of one multi-year period of exceptionally high levels: the “ultra-high” floods, during the Egyptian Middle Kingdom. Flood levels were recorded as being roughly 7 m above usual, implying that flood volume was quadrupled [Bell, 1975; Rohl, 1995: ch.15].

(Bell [1975: p.238] proposed that at the time of the ancient ultra-high summer floods there were some extremely high winter Nile levels. The proposal is based on an inscription describing high water levels that Bell dated to January. The January dating, however, is derived via Sothic dating, which is fallacious [Keenan, 2012]. The context of the inscription makes it probable that it is a summer flood that is being described. Moreover, high floods during winter are extremely implausible on geophysical grounds [Keenan, 2012].)

The Cairo Nilometer (Roda Gauge) has been used to record Nile flood levels for many centuries [Irby & Mangles, 1868; Ball, 1939]. Many of those records are extant. They do not indicate any flood levels nearly as high as the ancient ultra-high floods [Jarvis, 1936; Popper, 1951; Hassan, 1981].

There are, however, textual reports of modern floods that had some similarity to the ancient ultra-high floods. In 1817, the Nile floods were so high that they destroyed many villages, ruined summer crops, and killed considerable numbers of people; in 1818, the floods were higher, the damages were worse, and the waters did not subside until the cultivation season was past [Ball, 1939; Belzoni, 1822: p.25–28, 152–154]. There are no records from the Nilometer for 1817–1818, because Nile floods were higher than the Nilometer’s top [Irby & Mangles, 1868; Ball, 1939].

Nilometer records for the other floods during 1800–1824 do not exist—1813 excepted, when the flood was average [Popper, 1951: p.98, 147–148]. (Clearly, though, the reconstruction of Nile levels given by Jarvis [1936] and Hassan [1981] is erroneous in claiming that floods after 1815 were ordinary.) Textual reports for 1816 and 1819–1824 have not been found.

For a review of the hydro-climatology of Nile floods, see Keenan [2012]. Here, we note that the ultra-high floods in ancient times, and the floods in and about 1817–1818, almost certainly could not have happened in isolation from the rest of the climate system: rather, such extreme floods must have been the result of a perturbation of the climate system. In other words, during the ultra-high floods and during the floods in and about 1817–1818, there were almost certainly other climatic events happening simultaneously in other parts of the world.

During 1816–1817, there were indeed severe climatic events happening in other parts of the world. The year 1816, in particular, is known as “the year without a summer”, due to widespread summertime cooling. The 1816–1817 climatic events

were induced by the greatest volcanic eruption of modern times: the eruption of Tambora, Indonesia, during 1815 (which was much larger than the eruption of Krakatau in 1884, by virtually every measure) {references}.

The above strongly indicates that the Nile floods in and about 1817–1818 were induced by the eruption of Tambora. That suggests that the ancient ultra-high floods were also induced by a volcanic eruption.

How could an eruption induce extremely high Nile floods? The climatic after-effects of a large eruption are generally due almost entirely to sulfur that the eruption injects into the stratosphere. (Volcanic ash/dust tends to fall out of the atmosphere within only several weeks and so it normally has little effect [Gerstell et al., 1995; Robock, 2000].) The sulfur forms an aerosol in the stratosphere, which reflects, refracts, and absorbs sunlight [Robock, 2000]. That leads to changes in heat distribution, winds, precipitation, etc. The way in which it could lead to extremely high Nile floods, however, is unknown.

The ancient ultra-high floods started during Dynasty XII, near the beginning of the reign of pharaoh Amenemhet III [Bell, 1975]. The conventional Egyptological date for the beginning of that reign is about 1818 BC [Hornung et al., 2006]. The date given by the proposed revised chronology is much later, although a priori imprecise.

If the ultra-high floods were induced by a volcanic eruption, then we might be able to precisely date the start of those floods: because climate-perturbing volcanic eruptions can often be precisely dated, via polar ice cores and tree rings. (For an introduction to eruption dating via ice cores and tree rings, see Keenan [2021].)

A companion paper analyses relevant data from polar ice cores and tree rings [Keenan, 2021]. The paper concludes that there was probably only one large climate-perturbing volcanic eruption during 1950–1450 BC and that the eruption occurred in 1629–1628 BC. This suggests that the eruption in 1629–1628 BC induced the ancient ultra-high floods. (The eruption was in Alaska: the volcano Aniakchak.)

The suggested date for the ultra-high floods leads to redating all prior Egyptian events, so as to be much later. In particular, the collapse of the Egyptian Old Kingdom (i.e. the pyramid age) would occur in about 2000 BC, rather than a couple centuries earlier. The collapse of the Old Kingdom would then become synchronous with a climatic upheaval evidenced by paleoceanographic, paleoecological, and archaeo-historical records from much of the world. Those records are surveyed in a companion paper [Keenan, 2000] (for China, see too Keenan [2021]). The companion paper also describes the main underlying mechanism of the climatic upheaval and suggests how the upheaval was triggered. The trigger explains, in particular, why the upheaval had two pulses—as evidenced by several records, including from Egypt. All of this gives strong support for dating the collapse of the Old Kingdom to about 2000 BC—and thus for our date of the ultra-high floods.

The ancient ultra-high floods seem to have lasted for decades; the high floods that followed the eruption of Tambora, however, lasted for only a few years. A possible explanation for that difference, and a brief discussion of possible mechanisms by which a sufficiently-large eruption might induce high Nile floods, is given in the Appendix.

### **Biblical famine of Joseph**

The ancient ultra-high floods caused the Egyptians considerable consternation {compare with Tambora’s effects, especially crop failure}. The Egyptians succeeded

in dealing with those floods by developing a waterway to drain away the extra waters (into the Fayum depression) [Rohl, 1995: ch.15; Bell, 1975]. The waterway is traditionally known as the *Waterway of Joseph* (Bahr Yusef). Joseph, though, is not an Egyptian name; Joseph is a Semitic name.

According to the biblical story, there was a seven-year famine in Egypt and in all the lands around Egypt (Genesis 41–47). Egypt was saved by the actions of the pharaoh’s vizier: a Hebrew named Joseph. The above suggests that the biblical Joseph was real and the biblical famine should be identified with the ancient ultra-high floods. Indeed, that is well supported by Egyptological evidence. The Egyptological evidence is voluminous: we refer the reader to [Rohl, 1995: ch.15].

The biblical story tells that Joseph’s extended family (parents, siblings and their children, etc.) originally lived in the region between ancient Egypt and Mesopotamia—a region known as the *Levant*. (Today, the region mainly comprises the countries of Syria, Lebanon, Jordan, and Israel.) The extended family moved from the Levant to Egypt, to escape the famine. In Egypt, the family settled in the region of Goshen.

Goshen has been identified in the Nile Delta [Rohl, 1995: p257–258].

Archaeological investigations in the region have concluded that the region was settled by Levantine people during Dynasty XII [Rohl, 1995: p.263–273; Bietak, 1996: ch.3; Bietak, 2010] {reword this}. Thus, the archaeological investigations give significant support for the biblical story.

Our identification of the ultra-high floods with the after-effects of a volcanic eruption effectively implies that the biblical famine must also have been one of the eruption’s after-effects. We can partially test that by examining Egypt and the Levant after the 1815 eruption of Tambora. In south-eastern Egypt, there was a drought during 1816–1818 (possibly longer) [Belzoni, 1822: p.43]. In Lebanon, there was a drought during 1816 (at least), with a famine through 1819 [Bruce, 1951]. Reliable reports for 1815–1820 are difficult to find, and the full extent of the regional drought and famine is unknown. Even so, this evidence is significant.

Modelling studies have suggested how the stratospheric aerosol produced by large eruptions could induce changes in mid-latitude storm tracks [Robock, 1996], which might cause a drought lasting a few years. A sufficiently-severe drought would tend to naturally persist for longer, since the region would likely be able to regain moisture only slowly [Bravar & Kavvas, 1991; Meehl, 1994].

The biblical story claims that the famine lasted seven years. That might refer to the duration of the regional drought. Alternatively, the number of years in the biblical story might have been changed to seven in order to fit with some ancient traditions [Sarna, 1989; Redford, 1970].

## **5. The eruption of 1162–1160 BC**

### **The setting**

Roughly two centuries after the ancient ultra-high Nile floods began, much of Egypt was forcibly occupied by the Hyksos—a people who originated in the Levant [Bietak, 2010; Stantis et al., 2020]. The Hyksos occupation continued for over a century. Then, the Egyptians fought the “wars of liberation” to expulse the Hyksos from Egypt.

The wars of liberation began either during or shortly after the reign of pharaoh Seqenenre Tao. Seqenenre Tao was brutally killed by the Hyksos [Saleem & Hawass, 2021]. It is unclear whether the killing occurred after the pharaoh was captured in a battle or if the pharaoh was somehow assassinated.

After Seqenenre Tao, the next pharaoh was Kamose. It was perhaps Kamose who launched the wars of liberation [Polz, 2001]. (If it was Kamose, then it might have been the killing of Seqenenre Tao that triggered the launch: we can only speculate, given the available records.) Kamose achieved some military successes [Bourriau, 2000: p.199–200; Polz, 2001; Vandersleyen, 2001]. He died after about three years, though, with the Hyksos still in Egypt.

After Kamose, the next pharaoh was Ahmose. When Ahmose succeeded to the throne, however, he was about ten years old [Romanosky, 2001]. Hence, there was a regency for several years, during which there was little military action against the Hyksos. After the regency ended, Ahmose continued the wars of liberation—with repeated successes. The Hyksos then retreated to their capital city: Avaris (30.8°N, 31.8°E), in the Nile Delta. Then the Egyptians laid siege to the city.

What happened next is described in an epitome of Manetho (Josephus, *Against Apion* 1:86–88 [Barclay, 2007]). According to the epitome, the Egyptians abandoned the siege and made a treaty with the Hyksos. Under the terms of the treaty, the Hyksos could leave Egypt and go, all of them unharmed, wherever they wanted.

Archaeological excavations have found that Avaris was abandoned by the Hyksos, and there is no evidence of destruction besides the looting of tombs [Bietak, 2010: p.164]. Thus, the excavations give some support to the epitome of Manetho.

### **The volcanic eruption**

On the Greek island of Thera (Santorini) there is a volcano (at 36.4°N, 25.4°E). The volcano had an eruption at roughly the time of Ahmose: that is known from archaeological synchronisms [references]. The eruption's explosivity was between that of Krakatau and Tambora [Sigurdsson et al., 1990; Decker, 1990]. Hence the eruption was a major event, and it would be expected that there would be some indications of it in archaeo-historical records.

Thera's eruption produced a large amount of pumice. Pumice is very useful as an abrasive, and it has been collected and traded since prehistoric times [Bichler et al., 2003]. Pumice from Thera's eruption has been found by archaeological excavations in the Nile Delta. The provenance of the pumice has been confirmed by checking the chemical composition of the glass fraction of the pumice (via neutron activation analysis) [Bichler et al., 2003]. Hundreds of the pumice samples have been excavated. The earliest stratigraphic levels of the samples correspond to just after the reign of Ahmose or perhaps in the last couple of years of the reign [Sterba et al., 2009]. {...}

### **Papyrus texts that suggest Thera's eruption**

For the expulsion of the Hyksos from Egypt, there is a near-contemporaneous text written on a document known as the *Rhind Mathematical Papyrus* [Chace & Manning, 1927]. The text is written in hieratic by an unknown author. It is not wholly coherent. Here, we present an English translation based on the proposal of Goedicke [1986], which emends the text.

Regnal year 10, second month of the Dryness season:  
Ahmose entered Heliopolis.  
Regnal year 11, first month of the Inundation season, day 23:  
Ahmose pushed the leader of the Hyksos toward Tjaru.  
Day 25: it was heard that Tjaru had been entered.  
Third epagomenal day: the majesty of the god Seth roared.  
Fourth epagomenal day: the sky made rain.

About the regnal years, whether they refer to the years of Ahmose or the years of the Hyksos king is debated, but they are usually taken to be the latter [El-Sabbahy, 1993; Bourriau, 2000: p.200; Spalinger, 2001; Schneider, 2006: p.194–195]. Tjaru was an Egyptian frontier town, roughly 50 km east of Avaris. The phrase “the majesty of the god Seth roared” was a way of saying that nature made a great noise [Goedicke, 1986].

Considering the papyrus text together with the epitome of Manetho leads to the following coherent interpretation—excluding the last two lines. During the second month of the Dryness season, Ahmose took the (Hyksos-held) city of Heliopolis; the next year, during the first month, day 23, the Hyksos expelled from Avaris, by Ahmose, and they left in the direction of Tjaru; two days later, it was heard that the Hyksos had arrived at Tjaru.

That interpretation, however, is not accepted by many Egyptologists, who have tended to disagree with some of the emendations proposed by Goedicke (e.g. El-Sabbahy [1993]). No Egyptologist, however, has proposed an alternative interpretation that is coherent (to our knowledge); yet the author of the papyrus text surely had a coherent message that he was intending to convey—so some emendations are surely needed. In any case, what is crucial for our purposes herein are the last two lines, which have no emendations, and whose translations are clear.

The last two lines tell of some seemingly-exceptional natural events that occurred during the time that Ahmose fought and expelled the Hyksos. Specifically, there was a day during which there was a great natural noise and, the next day, there was some seemingly-unusual rain. Both those days were epagomenal days; so those days were right before the Inundation season, i.e. during summer.

There is also another hieratic text that might be related (it is written on the Hearst Medical Papyrus). The text was written during the reign of the next pharaoh after Ahmose. It reminds the reader that the god Seth “had banned the Mediterranean Sea” [Goedicke, 1986].

It has been proposed that the two hieratic texts refer to the eruption of Thera [Goedicke, 1986]. For the first text, the context is very strange for a meteorological report and summer would be an abnormal time for a thunderstorm. Furthermore, if the text were describing a thunderstorm, then it would be unusual for the rain to occur the day after the thunder. For the second text, this seems to be a reference to a Mediterranean tsunami—potentially induced by Thera’s eruption. (For interpreting the hieratic papyrus texts, the assistance of R.B. Parkinson is gratefully acknowledged.)

The explosivity of Thera’s eruption was easily great enough for the sound to have been heard in the Nile Delta, about 850 km across the Mediterranean Sea. Thus, the sound is a credible explanation for “the majesty of the god Seth roared”.

The papyrus record of rain, the day after Seth roared, has been proposed to refer to volcanic ash/dust from the eruption of Thera [references]. The proposal is based

on the claim that volcanic ash/dust from the eruption has been found in the Nile Delta: a claim that originated with the analysis of Stanley & Sheng [1986]. The claim, however, has been shown to be invalid [Guichard et al., 1993; Liritzis et al., 1996; Eastwood et al., 1999]. Ergo the proposal is baseless. The record of rain might refer to water: Thera's eruption output to the atmosphere about 5 km<sup>3</sup> of water [Sigurdsson et al., 1990].

Regarding Seth banning the Mediterranean Sea, a Mediterranean tsunami would have been generated by Thera's eruption. Indeed, tsunami deposits from the eruption have been found on Crete [Bruins et al., 2008; Lespez et al., 2021]. Hence, it seems at least credible that the tsunami would have reached Egypt. (There have been several attempts to model the tsunami, which do generally show the tsunami reaching Egypt. Those attempts, however, are based on assumptions that are dubious or invalid. Hence they will not be cited here.)

An examination of the remains of insects on the island of Thera demonstrated that Thera's eruption occurred during the summer [Panagiotakopulu et al., 2013]. That is consistent with the eruption occurring on epagomenal days.

### **A stela text that suggests Thera's eruption**

There is a stela from the reign of Ahmose that records an extreme "tempest of rain" [Ritner & Moeller, 2014]. The tempest lasted for days, extended throughout Egypt, flooded territories, and caused great damage. There is no other similar record in extant ancient-Egyptian historiography. Several authors have suggested that the tempest is related to Thera's eruption, though without being clear, or realistic, on how (for references and discussion, see Wiener [2015]).

In fact, the tempest seems to be similar to the storm of late 1816 (following the eruption of Tambora). The storm is described in the following extract from a letter that was sent from Egypt, dated 28 December 1816 [*Times*, 1817].

At Cairo they had experienced a circumstance not remembered by the oldest Egyptian—four days of successive torrents of rain, which had nearly destroyed whole villages. The houses having been built of unbaked clay, scarcely a dwelling escaped without injury, and had the rain continued a few days longer, half the city of Cairo itself must inevitably have been washed away.

(Whether the 1816 storm extended throughout Egypt is unknown.)

Given the apparent uniqueness of the 1816 storm in modern times, it is reasonable to suspect that the storm resulted from some unique meteorological conditions: the obvious candidate being the after-effects of the eruption of Tambora. (The storm perhaps resulted from an eruption-induced change in mid-latitude storm tracks—see above.)

To recap, the Ahmose tempest record is unique for ancient Egypt and the 1816 storm record is unique for modern Egypt. Hence, it is reasonable to suspect that whatever conditions caused one were similar to the conditions that caused the other. This indicates, then, how the Ahmose tempest might be related to a large eruption.

The stratospheric sulfur output of Thera's eruption is unknown, but it is believed to have been greater than that of Krakatau [Sigurdsson et al., 1990]. Hence,

Thera's eruption would likely have had some climatic after-effects. That could potentially explain the Ahmose tempest.

### **Discussion**

The texts discussed in the prior two subsections can be reasonably interpreted as suggesting the eruption of Thera. Egyptian records for the first three pharaohs after Ahmose are sparse [reference?], but those that are extant contain nothing suggestive of Thera's eruption [Manning, 1988: p.46–47; Kuniholm, 1990; more]. Almost no historiographical records from the Hyksos period are extant, but it has been argued that archaeological synchronisms between Egypt and the Aegean make a Hyksos-period eruption date improbable [Bietak, 1996: ch.10; Bietak, 1997; Warren, 2000; Wiener, 2015; more]. An eruption date before or after Ahmose would leave the records from Ahmose's reign unaccounted for. Ergo, we provisionally accept a proposal made by several investigators: Thera erupted during the reign of Ahmose.

It is not known if there were exceptionally high Nile floods during, or around, the reign of Ahmose. If there were such high floods, though, we might not expect to have Egyptian records of them: because the Waterway of Joseph would presumably have still been operational; so the floods would not have caused severe problems.

The eruption of Thera would almost certainly have been interpreted, by both Egyptians and Hyksos, as a sign of gods' anger. That would have been profoundly so after the Hyksos killing of Seqenenre Tao, because pharaohs were essentially gods. Such justified gods' anger would have surely persuaded the Hyksos to abandon Avaris and Egypt. Ergo, the expulsion of the Hyksos occurred during the same year as the eruption of Thera. (The Hyksos left Avaris 25 days after the start of the eruption, under the interpretation of the papyrus text proposed by Goedicke [1986]: that seems to be a reasonable span of time.)

### **Date of Thera's eruption**

Thera's eruption would probably have resulted in a substantial rain of ash/dust falling on ancient China, due to the position of a jet stream during summer [Keenan, 2021]. A multi-day summertime rain of ash/dust is indeed recorded in ancient Chinese texts, dated to the late second millennium BC. Additionally, other ancient Chinese texts indicate that the rain of ash/dust was soon followed by a climatic perturbation. All those ancient texts have been argued to be due to the eruption of Thera, by a companion paper [Keenan, 2021].

Relevant data from polar ice cores and tree rings is analyzed in the companion paper. The paper concludes that there was probably only one large climate-perturbing eruption during 1600–900 BC, that this eruption occurred in 1162–1160 BC, and that it was this eruption that caused the events reported in the ancient Chinese texts. Thus, we propose dating the eruption of Thera to 1162–1160 BC.

The date of Thera's eruption has been debated for several decades, in hundreds of research publications. Radiocarbon measurements have indicated various dates in the range 1700–1500 BC [Wiener, 2009; Manning, 2014: §1.V.1; Kutschera, 2020]. Early-historical radiocarbon dates in and downwind from the Eastern Mediterranean Sea, though, tend to be centuries too early, due to degassing by the Sea—as discussed in a companion paper [Keenan, 2002]. (Radiocarbon scientists generally have not accepted the analysis in the paper, but they appear to have no valid counterarguments; for some related remarks, see Keenan [2010].)

Conventional archaeo-history gives a date for Thera's eruption of roughly 1500 BC [Bietak & Czerny, 2007; Wiener, 2015]. That date, however, is without any basis except for Mesopotamian chronology, as noted above. Moreover, any date near 1500 BC is in conflict with a great array of evidence, presented herein and in companion papers. (Among companion papers, perhaps the most notable evidence is from speleothems [Keenan, 2021].)

Our proposal dates the reign of Ahmose to over three centuries later than the date given by conventional Egyptology. That leads to redating all pharaohs prior to Ahmose, so as to also be much later. Such redating is consistent with the redating of Amenemhet III, proposed in §4. More discussion of this issue is in §7.

Our proposed date for the expulsion of the Hyksos is 1161±1 BC. The consistency of that expulsion date with pre-expulsion Egyptian records is considered herein. Post-expulsion Egyptian records are considered by Rohl [1995] (see too Goldberg [1995], Hagens [1996], and James et al. [1998]). The expulsion date proposed here is about 25 years later than the date that Rohl estimates and is consistent with Rohl's overall chronology (D.M. Rohl, private communication, October 1996).

## 6. Remarks about the Exodus

The proposed identification of the biblical famine with the climatic perturbation that began in 1629–1628 BC would make the famine the earliest dated biblical event. Previously, the earliest such event was the enthronement of Solomon, *c.*968 BC [Cogan, 1992]. Between the famine and the enthronement, the Hebrews supposedly became enslaved, were led to freedom by Moses in the Exodus, and conquered Canaan (a part of the Levant).

The biblical chronology for the events preceding Solomon's enthronement is confused [Cogan, 1992; Kitchen, 1992b; Hoffmeier, 2007] and gives essentially two Exodus dates. The first date is 477 years before the enthronement (*c.*1445 BC), with Moses claimed to be an aged fourth-generation descendant of someone who lived during the Joseph famine. The second date is 431 years after the start of the famine (so 1196±1 BC proposed herein), with a claimed eleven generations until the enthronement. The two different Exodus dates imply two different durations for the Hebrews' time in Egypt. The two durations are commonly referred to as "short sojourn" and "long sojourn". There has been debate about them for centuries [references].

It is sometimes claimed that the Exodus must be a myth because of the impossibility of the parting of the sea. The earliest extant Hebrew biblical texts, though, refer to a Reed Sea (not Red Sea) [Sarna, 1991: p.69; Kitchen, 1992b]. And there are reed-growing brackish lakes near where the Suez Canal is today, which did sometimes part naturally.

The reed-growing lakes were connected to the Gulf of Suez—essentially an extension of it. Although extremely rare, a combination of ebb tide and north-easterly gale was known, even in historic times, to push the waters back and force dry channels through some of the lakes [Boadt, 1984].

Plausible reconstructions of the Exodus route include a traversal of one of those lakes [Keller, 1991: p.120; Kitchen, 1992b; Rohl, 1995: p.287]. For an example of such a reconstruction, see Figure 1.

The foregoing—notably the requirement for a north-easterly gale—can be compared with the biblical story, which tells the following.

<p>... the LORD drove back the sea with a strong east wind all that night, and turned the sea into dry ground. The waters were split,</p>	<p>... the LORD led the sea with a mighty east wind all night, and He made the sea dry ground, and the waters were split apart.</p>	<p>Exodus 14:21</p>
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{Discuss the quotation more, including the wind direction (*kadim/qādîm*), and also seiches and additional evidence.} {Cite Moshier & Hoffmeier [2015].}

Most of the other miracles associated with the Exodus also have natural explanations. That includes, in particular, the first nine plagues [Hoffmeier, 1992; Humphreys, 2003: p.113–136,145–146], the tenth plague [Rohl, 1995: p.284], water from rock [Keller, 1991: p.135], and manna from heaven [Keller, 1991: p.124–126]. {Also discuss Hoffmeier [2005: ch.4] and possibly Propp [1999], e.g. p.550–554.}

{Note how unusual it would be for a people to fabricate a founding legend whereby their ancestors were slaves.}

There is evidence suggesting that the Hebrews left Egypt in a mass exodus and that this exodus occurred in the same year that the Hyksos took over Egypt [Rohl, 1995: ch.12–13]. {Elaborate on that. And mention how the Hebrews were brutally treated, per Exodus 1:11,13 and Numbers 20:15. Note Rohl’s evidence for Moses.} Thus, there might be another link between the biblical story and Egyptian history. Such links can be used to partially compare the biblical and Egyptian chronologies.

## 7. The Second Intermediate Period of Egypt

### Introduction

In this section, we consider the internal chronology of the Second Intermediate Period (SIP). The SIP began, and the Middle Kingdom ended, with the death of the last pharaoh of Dynasty XII—which is the dynasty of the ultra-high floods. The SIP ended, and the New Kingdom began, with the reign of pharaoh Ahmose.

### Manetho

The internal chronology of the SIP that is given by Manetho is not coherent, at least as understood through the epitomes. For a summary of the relevant portions of the main epitomes, see Table 1.

We next consider Dynasty XV, which is the main, or “Greater”, dynasty of Hyksos. The three main epitomes claim that Dynasty XV lasted for 250, 284, and 511 years, respectively [Redford, 1992: p.107–110; Waddell, 1940: p.82–93]. 250 might be a rounding of 284. 284 is given with a list of six kings whose reign lengths sum to 284. 511 is considered in Excursus 2. It too, though, is given with a list of six kings, five of whose names match those given with 284; five of the reign lengths also match and the six lengths sum to 260. Thus, it seems credible that one reign length (and one name, on a different line) has been mistranscribed in the epitome. The first of the six kings is said to have been appointed sometime after the Hyksos occupation began, and he was named Salitis [Waddell, 1940: p.78–81; Thackeray, 1926: p.192–193].

Manetho also claimed that the Hyksos occupation began immediately following some natural catastrophe [Waddell, 1940: p.78–79; Thackeray, 1926: p.192–193; Rohl, 1995: p.280–281]. The pharaoh who reigned at the time of the catastrophe appears to have been named Dudimose, though this is not certain [Redford, 1992: p.104; Kitchen, 1996b; Ward, 1984: n.59; Rohl, 1995: p.280–281]. Additionally, some epitomes claim that the biblical Exodus occurred during, or perhaps shortly after, the reign of pharaoh Ahmose [Waddell, 1940: p.111,115].

{Maybe discuss *Against Apion* 1:230.}

### **Royal Canon of Turin**

{The following discussion of the Turing Canon is seriously out-of-date, due especially to the work of Kim Ryholt. See Bennett [2006], Schneider [2006], Franke [2008], Allen [2010], Ilin-Tomich [2016], Shaw & Bloxam [2020: ch.30], and others. The required revisions do not affect any of the significant conclusions herein.}

The Turin Canon does not seem to separate the first two dynasties of the SIP. The number of monarchs listed for these two dynasties together appears approximately equal to the number given by Manetho for dynasties XIII + XIV; only the last 35 or so names, however, seem to be Hyksos, the rest being Egyptian [Redford, 1986: p.199–200,239–240]. No reign lengths are extant for those Hyksos, and there are very few for those Egyptians.

After the two apparently-adjointed dynasties, the Turin Canon lists a dynasty explicitly recorded as being Hyksos, presumed to be Manetho’s Dynasty XV. Although the Turin Canon explicitly states that this dynasty comprised six kings [Redford, 1986: p.12], it appears to actually list seven [Kitchen, 1996a; Redford, 1967]—in current restorations. Only the last of the seven names is readable, and it does not match any of the names given by Manetho [Redford, 1992: p.108]. The sum of the reign lengths is given as “100 + ...” years—very probably to be read as “108” years [Redford, 1992: p.107; Ryholt, 2006; Bietak, 2021: p.302].

The sum of reign lengths is followed by a list of about 31 monarchs. The 31 is approximately the same as the number of monarchs in Manetho’s Dynasty XVI (primary epitome—see Table 1), but the few names that are (partially) readable appear to be Egyptian. In the middle of the list of 31 is a summing-up statement, “[Total of] five monarchs”; this seems to indicate that the immediately-preceding five monarchs belong to a distinct dynasty—perhaps the five of Manetho’s Dynasty XVI (secondary epitomes); none of the five names are readable. The Canon ends with the list of 31.

The extant fragments of the Turin Canon do not certainly list pharaoh Dudimose, but there are at least three partially-readable names that could match [Ward, 1984]. Those three names appear to be listed among the Egyptian names at the beginning of the SIP part of the Canon; the last of the three immediately precedes the 35 or so Hyksos names.

### **A genealogy**

There is also a purported genealogy covering the SIP: that of the high priests of Memphis [Rohl, 1995: app.B; Borchardt, 1917; Redford, 1986: p.62–64; Kitchen, 1992a; Goldberg, 1995]. For many priests, this also names one of the monarchs under whom they served. The part where Dudimose likely belongs is missing. The pharaoh that is listed after Dudimose in the Turin Canon, however, is shown (though it is possible that this is a different pharaoh with the same name). He is named ninth before

Ahmoose and eighth before the last Hyksos king given by Manetho [Redford, 1992: p.107–108]. It has also been suggested that the monarch named immediately before the last Hyksos king is Salitis [Redford, 1992: p.108; Bietak, 1996: p.65; Ward, 1984]. No monarchs are named for the last five priests before the suggested Salitis.

### **Archaeology**

{This subsection needs substantial updating.}

Overviews of archaeological records from the SIP are given by Weinstein [1992a], Bietak [1997], and O'Connor [1997]. The records of most relevance here come from excavations at the site of the Hyksos capital, Avaris; we briefly summarize those. Non-Egyptian people of Levantine culture lived at the site for several generations from about the time of Amenemhet III. Those people apparently lived in fair harmony with the Egyptians, at least initially. There was then some catastrophe, cause unknown, which resulted in many deaths. Next came occupation by another Levantine people, lasting for some generations. That evolved into the time of the main Hyksos occupation. The Hyksos did not occupy all of Egypt; in southern Egypt, the Egyptians had their own capital, from which the pharaoh continued to reign.

It seems very likely that the people occupying the site of the Hyksos capital immediately after the catastrophe should be identified as Hyksos [O'Connor, 1997]. Rohl [1995: ch.12–14] supports that and, citing Manetho, has proposed that the Hyksos occupation began at the time of the catastrophe.

### **Discussion**

To summarize, the data for the chronology of the SIP is confusing. And it is plainly not possible to derive a secure SIP chronology from that data alone. (Similar problems pertain to data from the Third Intermediate Period. With the chronological proposal of Rohl [1995], a major aspect is that one of the dynasties of the Third Intermediate Period, Dynasty XXII, is wholly concurrent with other dynasties. Such concurrency is in contradiction to conventional Egyptological chronology.)

In conventional Egyptological chronology, the span of the SIP is about 1790–1540 BC [Kitchen, 2006] or 1760–1540 BC [Hornung et al., 2006] (but note that this is substantially reliant on Sothic dating). The first dynasty of the SIP, Dynasty XIII, is immediately followed by Dynasty XV, which lasts 108 years, after which the SIP ends. Dynasties XIV, XVI, and XVII are taken to have been concurrent with other dynasties. Dynasty XVI and/or Dynasty XVII are usually taken to have been Egyptian, based in southern Egypt.

The span of the SIP under our proposed volcanism-based chronology is as follows. The ancient ultra-high floods started near the beginning of the reign of pharaoh Amenemhet III (as noted above); 58 years after the beginning of that reign, Dynasty XII ended [Kitchen, 1996b; Hornung et al., 2006]; so, the SIP began in approximately 1570 BC. The expulsion of the Hyksos, in 1161±1 BC, was sometime during the reign of pharaoh Ahmoose, but not during the first five years (the likely minimum duration of the regency); the reign of Ahmoose lasted 24 years [Hornung et al., 2006]; so, the SIP ended in 1171±10 BC. If the year of the reign of Ahmoose during which the Hyksos were expelled could be determined precisely—as some investigators have claimed—then so could the end year of the SIP.

Considering the data for the SIP chronology, we further propose that the Hyksos occupation spanned 284 years, beginning with the catastrophe and ending with

the fall of the 108-year-long Dynasty XV. The other details of the SIP chronology are not important here. We tentatively suggest, though, that Dynasty XIV lasted for  $284 - 108 = 176$  years, rather than 76 reigns (per Table 1) and that its claimed duration of 184 or 484 years should be 284 and refers to the whole occupation.

The proposed chronology plainly fits the data better than the conventional chronology, though both chronologies ignore some data. If the proposed chronology is correct, then the Hyksos occupation began in  $1161 \pm 1 \text{ BC} - 284 = 1445 \pm 1 \text{ BC}$ . That date is essentially the same as the date proposed by Rohl [1995], which is based on apparent synchronism with the Exodus and the first of the two Exodus dates given by the biblical chronology. The agreement of the two wholly different dating approaches is notable.

## **8. Merger of the Hebrews and the Hyksos**

### **Expulsion and merger**

The difference between the second of the two Exodus dates and our date for the expulsion of the Hyksos is  $1196 \pm 1 \text{ BC} - 1159 \pm 3 \text{ BC} = 37 \pm 4$  years. We propose that the second Exodus date actually refers to the expulsion. The apparent error of  $37 \pm 4$  years might be essentially from using the round 250 years for the span of the Hyksos occupation, instead of 284 years; any additional years could be from other rounding, i.e. using whole years as summands.

We further propose that, after the expulsion, the Hyksos merged with the Hebrews, who had stayed in the Sinai since the Exodus; i.e. the Hebrews and the Hyksos together constituted the original Jewish population. Under the proposal, the historiographies of the Hebrews and the Hyksos were conflated by the biblical story. The conflation explains the internal inconsistencies in the biblical story, such as the two different dates for the Exodus (noted in §6).

### **Genetic data**

The proposed conflation of the historiographies of Hebrews and Hyksos conflicts with the modern belief that Jewish people are largely descended from the original Hebrews—one man and four women (some of whom were alive during the famine of Joseph), according to the biblical story. The modern belief, however, is invalidated by genetic studies.

Consider mitochondrial DNA, which is essentially inherited only from the mother. Its rate of evolution (i.e. mutation) is negligible over four millennia; so if individuals have measurably-different mitochondrial DNA, then their lines of female ancestors (mother, mother's mother, etc.) do not meet within the last four millennia (and very probably not within the last ten) [Ritte et al., 1993a]. Mitochondrial DNA appears to have the same amount of diversity (heterozygosity) among Jews today as among all Caucasians [Ritte et al., 1993a]. Thus, the belief that Jewish people are largely descended from four women is invalid.

Consider too DNA in the Y-specific segment of the Y chromosome, which is inherited only from the father. Its rate of evolution is less than that of mitochondrial DNA. Yet Y-specific DNA has greater diversity among Jews than mitochondrial DNA [Ritte et al., 1993b]. Thus, the belief that Jewish people are largely descended from one man is invalid.

Nonetheless, Jewish populations do seem to have a (small) set of genes that uniquely distinguishes them from non-Jewish populations. That very strongly indicates

that Jewish populations have a common origin with little introgression of non-Jewish genes since then [Livshits et al., 1991; Relethford, 1996]. If the introgression of non-Jewish genes has been little, then most of the diversity in mitochondrial DNA and Y-specific DNA must have been present at the common origin. Thus, the genetic data is consistent with the proposed merger of Hebrews and Hyksos.

### **Josephus and related**

The proposal that Jews are largely descended from the Hyksos is not new. Rather, there are authors from the first two centuries AD who stated or indicated the same proposal.

Josephus was a Jewish priest and historian who lived during the first century AD [Feldman, 1992; Schalit, 2007; Chapman & Rodgers, 2016]. Josephus repeatedly stated that the Hyksos were ancestors of the Jews (*Against Apion* 1:91–92, 103, 228 [Barclay, 2007]). Moreover, Josephus stated that simply, i.e. in a way that gives the impression that Hyksos being ancestors of the Jews was accepted in his time, at least among Jews. For some related remarks, see Excursus 2.

{Discuss what Josephus said happened to the Hyksos.}

Tatian was an Assyrian Christian theologian who lived during the second century AD [Whittaker, 1982; Edwards, 1992; Hunt, 2003]. Tatian apparently had access to translations of Egyptian chronological records. He stated that those records told that the Jews' journey from Egypt occurred during the time of pharaoh Ahmose (*Address to the Greeks* ch.38 [Whittaker, 1982]).

Several authors have argued against what Tatian and especially Josephus said. All such arguments that we have seen, though, are really against the Hyksos being the sole ancestors of the Jews. We have seen no arguments that could be made against the proposal herein: the Hyksos and Hebrews are jointly ancestors of the Jews.

### **Remarks**

The post-famine biblical story now appears generally coherent. In particular, as is often noted, the conquest of Canaan could not have been made by the pastoralistic Hebrews, who likely numbered in the thousands {elaborate}; indeed, shortly before the Exodus, the Hebrews apparently had just two midwives (Exodus 1:15)—and that was during an age when there was little birth control. The militaristic Hyksos, however, would likely have been capable of the conquest: they had been able to forcibly occupy much of Egypt. (For discussion of the size of the Hyksos population, see Excursus 3.)

Hebrew is a West Semitic language. We do not know what language was native for the Hyksos, but it too seems to have been West Semitic: because all known personal Hyksos names derive from West Semitic languages, when their etymology can be established [Bourriau, 2000: p.175]. That would have eased a merger.

{Discuss the terms “captive shepherds” and “shepherd kings”, which Josephus used for Hyksos; relatedly, see Bronn [2006: §4.1] and Geobey [*JBL*, 2017].}

## **9. How the Hebrews subsumed the Hyksos**

### **Introduction**

The proposed merger of Hyksos and Hebrews seems to be well supported, but there is a conundrum. The Hyksos were militaristic and numerous; the Hebrews were pastoralistic and few. Ergo, when the Hyksos and the Hebrews merged, it would be

expected that the Hyksos would subsume the Hebrews. Yet, the record shows that the Hebrews subsumed the Hyksos—culturally at least. Why did that happen?

### A cloud with “fire”

The biblical story tells how the Hebrews, after their Exodus from Egypt, wandered in the Sinai desert for many years. During their wanderings, they built a large tent. The tent was called the “Tent of Meeting” or the “Tent of the Covenant” or, most commonly, the “Tabernacle”. According to the biblical story, on top of the Tabernacle there was sometimes a cloud with “fire” in it. A relevant quotation is below.

... the cloud covered the Tabernacle ...; and in the evening it rested over the Tabernacle in the likeness of fire until morning. It was always so: the cloud covered it, appearing as fire by night.	... the cloud covered the Tabernacle ..., and in the evening the cloud would be over the Tabernacle like a semblance of fire until morning. Thus it would be perpetually: the cloud would cover the Tabernacle, and a semblance of fire at night.	Numbers 9:15–16
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A related quotation is the following.

For over the Tabernacle a cloud of the LORD rested by day, and fire would appear in the cloud by night....	For the LORD’s cloud was over the Tabernacle by day, and fire by night was in it....	Exodus 40:38
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Those two quotations partially explain why the people believed that they had a god with them. Ergo, those quotations are crucial for the founding of Judaism. We next argue that those quotations are describing real events: there actually was a cloud with “fire” in it.

The first quotation seems to tell that the “fire” resembled genuine fire, but might not have been genuine fire. Additionally, both quotations seem to tell that although the cloud was over the Tabernacle during both the day and the night, the “fire” appeared in the cloud only during the night. Some biblical commentaries say that the “fire” was presumably inside the cloud during both day and night, but was only visible during night because of the contrast with nighttime darkness—e.g. Milgrom [1990: p.70] and Levine [1993: p.298].

Instructions for constructing the Tabernacle and surrounding courtyard are in Exodus 25–40. The instructions are detailed, but sometimes unclear. Measurements are specified in cubits: a cubit is about half a meter [Sarna, 1991: p.159; Powell, 1992].

The Tabernacle was rectangular. The length and width are often claimed to have been 30 cubits and 10 cubits, but those measurements might be slightly inaccurate [Homan, 2002; Propp, 2006: p.502–506; Hrobon, 2013]. The height was 10 cubits. The entrance to the Tabernacle was at one end—considered to be the front.

Access to the Tabernacle and the area in front of the Tabernacle was prohibited, except for a small group of designated people. Anyone who breached the prohibition would be put to death (Numbers 3:10,38, 18:7).

Over the Tabernacle was another tent. The tent is described in Exodus 26:7–13 and again in Exodus 36:14–18. Those two descriptions are essentially the same. The first description is quoted below.

You shall then make cloths of goats' hair for a tent over the Tabernacle; make the cloths eleven in number. The length of each cloth shall be thirty cubits, and the width of each cloth shall be four cubits, the eleven cloths to have the same measurements. Join five of the cloths by themselves, and the other six cloths by themselves; and fold over the sixth cloth at the front of the tent. Make fifty loops on the edge of the outermost cloth of the one set, and fifty loops on the edge of the cloth of the other set. Make fifty copper clasps, and fit the clasps into the loops, and couple the tent together so that it becomes one whole. As for the overlapping excess of the cloths of the tent, the extra half-cloth shall overlap the back of the Tabernacle, while the extra cubit at either end of each length of tent cloth shall hang down to the bottom of the two sides of the Tabernacle and cover it.

And you shall make goat-hair panels for a tent over the Tabernacle, eleven panels you shall make them. The length of the one panel, thirty cubits, and a width of four cubits to the panel, a single measure for the eleven panels. And you shall join five of the panels by themselves and six of the panels by themselves, and you shall double over the sixth panel at the front of the tent. And you shall make fifty loops along the edge of the outermost panel in the one set, and fifty loops along the edge of the outermost panel in the other set. And you shall make fifty bronze clasps and bring the clasps through the loops, and you shall join the tent, that it become one whole. And the overhang left over in the tent panels, half of the leftover panel you shall let hang over the back of the Tabernacle. And the cubit on one side and the cubit on the other in what is left over in the length of the tent panels shall hang over both sides of the Tabernacle to cover it.

Exodus  
26:7–13

The description of the tent is detailed but unclear—like the description of the Tabernacle. The description of the tent, though, clearly specifies that the tent was *over* the Tabernacle. That indicates that the cloud with “fire”, which covered the top of the Tabernacle, was underneath the tent.

The above quotation also states that the tent was made of goats’ hair. We assume that the tent was constructed so that much of the goats’ hair was loosely hanging down into the space between the tent and the top of the Tabernacle. The Tabernacle and tent were in the desert: it was dry, usually warm, and the winds were sometimes strong. Thus, when the winds blew over the goats’ hair, the hair would often acquire a charge of static electricity.

In front of the Tabernacle was an altar. The altar was 5 cubits long and 5 cubits wide. It was used to make offerings to the Hebrew god: each offering was burned on the altar. Offerings mainly consisted of animals—oxen, rams, goats, etc.—and grain/meal. Note that some of those offerings would have burned for many hours. Offerings were made at least twice per day (Exodus 29:38–42; Numbers 28–29).

The quotation below points to what was really happening.

<p>You shall season your every offering of meal with salt; you shall not omit from your meal offering the salt of your covenant with god; with all your offerings you must offer salt.</p>	<p>And every offering of your grain you shall season with salt. You shall not leave out the salt of the covenant of your god from your grain offering. With each of your offerings you shall offer salt.</p>	<p>Leviticus 2:13</p>
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The last clause has been taken to mean that both animal and grain/meal offerings probably required salt [Milgrom, 1991: p.211; Berlin & Brettler, 2004: p.210].

“Salt” is the common name for sodium chloride. When salt is burned, it dissociates into sodium and chlorine. The sodium is what is relevant here.

Sodium gas has a special property: when it comes into contact with electricity, it lights up. The reader will have seen sodium lamps: such lamps have a yellowish glow, and are sometimes used in streetlights and in car headlights. The bulbs of those lamps have sodium gas inside them; an electric current is passed through the gas, and so the gas lights up.

When salt was burned on the altar, it would produce sodium gas. The sodium gas would sometimes be blown, by wind, over the Tabernacle (lengthwise) and underneath the tent. Thus, the gas would come into contact with static electricity, and so light up. Hence, there would indeed be a cloud with “fire”—here, yellowish light from sodium gas—over the Tabernacle.

The people did not have a term for such a light; so they used the closest term that they had, “fire”. This explains why the first quotation above (Numbers 9:15–16) indicates that the “fire” in the cloud merely resembled genuine fire. The “fire” being sodium light explains too why the “fire” was clearly visible during the night, and not during the day. It also explains why the “fire” did not burn the Tabernacle or tent.

The technology for the sodium light was presumably discovered accidentally by pastoralists who lived near the desert. This issue is discussed further in a companion paper (in preparation).

{Discuss wind direction and prevailing winds at plausible locations after the Exodus (Figure 1: 8–10). The biblical story claims that the Tabernacle faced eastward, but eastward was the cardinal direction in ancient times (not northward); so the claim might have been added later. It seems possible that the facing direction varied too.}

{Discuss Numbers 9:17–23 and related.}

To summarize, the Tabernacle, with tent and altar, functioned as a large primitive sodium lamp. The Hebrew priests told the people that the light from the lamp was a manifestation of their god—and the people believed them. This was crucial for the origination of the god of Judaism.

### **Other electrical aspects**

{The poles of the Tabernacle were made of gold; so presumably they would have acquired an induced charge from the goats' hair.}

{The Ark of the Covenant was a box made of wood; inside and outside were covered with gold. Discuss that: two conductors separated by an insulator ... could a charge have been obtained by connecting to the gold poles?}

{Speculate about the burning bush: not flames, but sparks; not the leader of the Hebrews (Moses), but the leader of the Hyksos.}

### **Strict monolatry**

Although the people generally were convinced that the Hebrews' god was real, the people still believed that there were other gods. The biblical story tells that the people were prohibited from worshiping those other gods, under penalty of death. The prohibition is given repeatedly in the story; an example is below.

If your brother ... or your son or daughter, or the wife of your bosom, or your closest friend entices you in secret, saying, "Come let us worship other gods" ...: do not assent or give heed to him. Show him no pity or compassion ...; but take his life. Let your hand be the first against him to put him to death, and the hand of the rest of the people thereafter. Stone him to death, for he sought to make you stray from the LORD your god.... Thus all Israel will hear and be afraid, and such evil things will not be done again in your midst.

Should your brother ... or your son or your daughter or the wife of your bosom or your companion who is like your own self incite you in secret, saying, "Let us go and worship other gods" ..., you shall not assent to him and you shall not heed him and your eye shall not spare him and you shall not pity ... him. But you shall surely kill him. Your hand shall be against him first to put him to death and the hand of all the people last. And you shall stone him and he shall die, for he sought to thrust you away from the LORD your god.... And all Israel will hear and see, and they will not do this evil thing again in your midst.

Deuteronomy  
13:7–12

Some people, however, still worshipped other gods. Such violation of the prohibition was claimed, by the Hebrew priests, to account for disasters that befell the people. For example, a plague caused the deaths of thousands of Israelites; the Hebrew priests claimed that the plague was punishment, from their god: due because some Israelites had worshipped the god of the Moabite people (Numbers 25:1–9). Such post facto attribution of disasters to a god is noted in §2.

{Relatedly, consider Leviticus 24:16, on blasphemy.}

### Discussion

When the Hyksos first encountered the Hebrews, they had just been expelled from their home. Moreover, they believed that they had been expelled by a volcano god, in part for killing a pharaoh god. The Hyksos would have felt ashamed and trepidatious, and perhaps been in shock as well. When the Hyksos first met the Hebrews, the Hebrews appeared to have a god of their own with them, as evidenced by the cloud with "fire" {and the Ark of the Covenant}. In those circumstances, the Hyksos would surely be extremely averse to doing anything that would offend the Hebrews' god.

The Hebrews had a strong motivation for making the Hyksos believe that they had a god with them. The Hebrews had earlier fled from their home in Egypt because the Hyksos there had brutally enslaved them; now they were met by the Hyksos, who greatly outnumbered them and were far more militaristic. The Hebrews must have been afraid that the Hyksos would kill or re-enslave them. The Hebrews saved themselves by taking advantage of the shame and trepidation of the Hyksos: via their apparent god.

If the Hyksos were to worship other gods, though, there would be an existential danger for the Hebrews. That would have motivated the strict monolatry.

In conclusion, the Hyksos being culturally subsumed by the Hebrews is credible. The subsumption also facilitated hiding the shame of the Hyksos. That would presumably have motivated the biblical story's conflation of the Hebrew Exodus with the Hyksos expulsion.

## 10. Conquest of Canaan

### Motivation for the conquest

The expelled Hyksos population probably comprised over 100 000 people: see Excursus 3. Such a large population could not survive for long in the Sinai desert. The biblical story tells that, when the Israelites were wandering around in the desert, they repeatedly complained about scarcity of food and even water. Two examples are quoted below.

<p>and the people spoke against god ... , “Why did you make us leave Egypt to die in the wilderness? There is no bread and no water, and we have come to loathe this miserable [manna].”</p>	<p>And the people spoke against god ... : “Why did you bring us up from Egypt to die in the wilderness? For there is no bread and there is no water, and we loathe the wretched [manna].”</p>	<p>Numbers 21:5</p>
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<p>... the Israelites wept and said, “If only we had meat to eat! We remember the fish that we used to eat free in Egypt, the cucumbers, the melons, the leeks, the onions, and the garlic. Now our gullets are shriveled. There is nothing at all! Nothing but this manna to look to!”</p>	<p>... the Israelites ... wept and said, “Who will feed us meat? We remember the fish we used to eat in Egypt for free, the cucumbers and the melons and the leeks and the onions and the garlic. And now our throats are dry. There is nothing save the manna before our eyes.”</p>	<p>Numbers 11:4–6</p>
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The Hyksos effectively had a choice: either occupy some habitable territory or die. A reasonable territory for them to occupy would have been some part of the Levant: it was nearby and it was their ancestral homeland. And indeed they seemingly went on to occupy a part of the Levant—the part anciently known as *Canaan*.

### Evidence of the conquest

The biblical story tells that the Israelites left the Sinai desert and then conquered Canaan (Joshua 1–12). Archaeological excavations show that most of the cities of Canaan were abandoned or destroyed at roughly the time of the Hyksos expulsion [Bietak, 1991: p.57–62; Redford, 1992: p.138–139; Na’aman, 1994]. Moreover, the list of those cities well matches the list given in the biblical story [Rohl, 1995: ch.14].

The biblical story includes several details of the conquest of one city: Jericho. Specifically, according to the story, the conquest occurred at harvest time (Joshua 3:15, 5:10), it involved the city wall falling down (Joshua 6:20), and it ended with a massive conflagration (Joshua 6:24). Those details have been confirmed by archaeological excavations [ {references} ].

The story about the walls of Jericho falling/tumbling down is a part of Western culture. According to the Bible, the Israelite army marched around the city for seven days, and then the city wall fell down. The story does not explain what caused the wall to fall down. There is, though, a straightforward explanation.

It was a well-known military tactic for a besieging army to dig tunnels under a city's wall: to undermine the wall and force the wall to collapse. Digging such tunnels is called *sapping*. A city's defenders would sometimes attack the tunnels. For example, when the Romans besieged the city of Themiscyra, the city's defenders dug openings in the Roman tunnels—into which they thrust swarms of bees and wild animals, including bears (Appian, *Mithridatic Wars* [Roman History 12] §78 [White, 1962]).

For a city's defenders to attack a tunnel, they had to know where the tunnel was being dug. That location could be found by listening. Such listening would not have worked, however, if a large army were stomping around just outside the city. Presumably, then, the wall of Jericho fell down due to sapping and the purpose of marching around the city was to make attacks on the tunnels unworkable.

### **Stopping the Jordan River**

The Israelites apparently entered Canaan by crossing the Jordan River. The biblical story tells that the crossing occurred during harvest season, and while the river was in full flow—as quoted in §2. During harvest season (March–April), the river is indeed in full flow [Watson, 1895]. And there is archaeological evidence that the crossing occurred during the harvest season: the first city conquered after the crossing, according to the biblical story, was Jericho. Additionally, Jericho would indeed probably be the first major target in a conquest of Canaan, due to its location.

When the Jordan River is in full flow, it cannot be forded [Watson, 1895]. Thus, the only way the Israelites could have crossed the river is by temporarily stopping the flow. In other words, the story's claim about temporarily stopping the river almost certainly must be true: because there seems to be no other way to explain how the Israelites crossed the river. How, then, was the river temporarily stopped?

At Damiya/Adam, the river is narrow and has a bank tens of meters high. The bank is largely made of loose marl. Hence, the bank is unstable. The bank is especially unstable when the river flow is strong, because a strong flow tends undermine the marl—so much that it is then dangerous to be on the bank [Watson, 1895].

The bank occasionally collapses, due to earthquakes. Sometimes a collapse is severe enough that the marl fully blocks the flow of the river. Water is then backed up, behind the blockage. The blockage lasts for about a day or two. Then the backed-up water becomes massive enough to overwhelm the marl and push the marl aside—and so the river flow resumes. Such river blocking has occurred at Damiya/Adam, and nearby sites, following earthquakes in 1927, 1906, 1834, 1546, 1534, 1267, and 1160 [Humphreys, 2003: ch.2]—and probably in other unrecorded years.

The above description of river blocking matches the biblical story well. A river-blocking earthquake occurring just as the Israelites were about to enter Canaan, though,

is not credible—due to the rarity of such earthquakes. Presumably, then, the river bank was forced to collapse by the Israelite army. Having the capability to do that is suggested by the army’s seeming skill with sapping.

### **Forty years?**

The biblical story claims that the time span from the Exodus to the conquest was 40 years. Under our proposed chronology, the time span actually refers to either the span from the Hebrew exodus to the conquest (many times 40 years) or the span from the Hyksos expulsion to the conquest (a tiny fraction of 40 years). In either case, then, the biblical claim seems to contradict our proposed chronology.

The biblical claim of 40 years, though, need not be an accurate measure of anything. Indeed, the *Encyclopaedia Judaica* notes that “Biblical numbers are not always intended to be taken at their face value” and that such numbers are sometimes used “rhetorically” [Abrahams, 2007]. That would seem to be especially true for the number 40, because 40 was considered to be symbolic and sacred [Pope, 1962]. For an illustration, consider the Torah (which comprises the first five books of the Bible): in the Torah, there are exactly 40 occurrences of the word “forty”.

### **Massacres**

The conquest of Canaan was, in broad terms, understandable and arguably even normal for the times. The conquest, though, did have an extremely unusual aspect to it: the inhabitants of Canaan were massacred. What is especially remarkable about the massacres is that they included the women. The massacres have been described by many commentators as genocidal.

The biblical story repeatedly tells that the Israelites massacred the Canaanites because they were commanded to do so by the Hebrew god. The justification for the command was that if some Canaanites were left alive, then those Canaanites might lead some Israelites into worshipping other, Canaanite, gods. Indeed, the biblical story tells of several instances of foreigners—{almost} always women—who led Israelites to abandon monolatry. An example is cited above: it was Moabite women who led Israelite men into worshipping the Moabite god.

The command to massacre and the justification are illustrated below.

... you shall not let a soul remain alive ... as the LORD your god has commanded you, lest they lead you into doing all the abhorrent things that they have done for their gods....	... you shall let no breathing creature live ... as the LORD your god has charged you. So that they will not teach you to do like all the abhorrent things that they did for their gods....	Deuteronomy 20:16–18
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The biblical story repeatedly claims that the Hebrew god gave commands, as in the above quotation. The Hebrew god, though, did not speak directly to the people. Rather, the Hebrew god supposedly spoke to the Hebrew priests, who then told the people what their god had commanded. In reality, then, it must have been the Hebrew priests who gave the commands. In particular, it must have been the Hebrew priests

who gave the command to massacre the Canaanites. The priests' motivation, presumably, was the justification given in the biblical story: to ensure monolatry.

Relatedly, Albright [1940] said that the massacres of the Canaanites

prevented the complete fusion of the [Canaanites and Israelites] which would almost inevitably have depressed [Hebrew religious] standards to a point where recovery was impossible. Thus the Canaanites, with their orgiastic nature-worship, their cult of fertility in the form of serpent symbols and sensuous nudity, and their gross mythology, were replaced by Israel....

We hypothesize the following scenario. The Hyksos realized that they could not remain in the Sinai desert, and they then concluded that they should conquer Canaan. Before doing so, they asked the Hebrew priests what the Hebrew god would think of such a conquest. The Hebrew priests recognized that the Hyksos could not remain in the desert; so they agreed with undertaking the conquest. The priests realized, though, that if the Hyksos intermingled/fused with the Canaanites, then the Hyksos would eventually abandon the monolatrous worship of the Hebrew god—which would probably lead to the Hebrews being killed or re-enslaved.

To prevent being killed or re-enslaved, the Hebrew priests concocted the following story. The Hebrew god supported going ahead with the conquest; moreover, the Hebrew god promised to give the land of Canaan to the Israelites (e.g. Deuteronomy 1:8,21). The god would favor the Israelites, with the land of Canaan and with other things, because the Israelites were the god's chosen people. There was a *covenant*: (i) the god would favor the Israelites as his chosen people and (ii) the Israelites would practice monolatry and always obey the god's commands. One of the god's commands, the priests said, was to kill every Canaanite.

The biblical story repeatedly tells that the Hebrew god chose the Israelites as his special people. An example is in the quotation below. In the quotation, the god is telling the Israelites something; the god spoke directly to Moses, according to the story, who later communicated the god's words to the Israelites.

“... if you will obey me faithfully and keep my covenant, you shall be my treasured possession among all the peoples.”

“... if you will truly heed my voice and keep my covenant, you will become for me a treasure among all the peoples....”

Exodus  
19:5

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### **Excursus 1: Chronologies relying on solar eclipses**

The difficulties in using solar eclipses for ancient chronologies have often been seriously underestimated. For general discussions of those difficulties, see Stephenson

[1997], Steele [2003], and Stephenson [2008]. Herein, we consider two claims to construct a chronology using a solar eclipse.

There is a record of a solar eclipse that was seemingly observed during the reign of the Hittite king Muršili II [van den Hout, 1998]. For some analysis of the record, see Huber [2011]. The record is probably reliable, but not certainly so. It might well be a record of a large partial eclipse, though, and such eclipses occur often. The date of the record has been approximately determined via archaeo-historical synchronisms with Egypt: to 1350–1300 BC. During 1350–1300 BC, there were four eclipses that could potentially account for the record [Huber, 2011: tbl.8]. If conventional Egyptological chronology is not assumed to be valid, however, then the span of 1350–1300 BC should obviously not be relied upon. In that case, the oftenness of large partial eclipses implies that the record has negligible value for chronology.

Rohl [1995: ch.11] attempted to develop a chronology of ancient Egypt by using a record of a solar eclipse and records of the movements of Venus. Rohl's supposed record of an eclipse, however, is due to a mistranslation: the record is not actually of an eclipse [Pardee & Swerdlow, 1993]. Moreover, Rohl's retrocalculation of the eclipse date makes unwarranted assumptions about Earth's past rates of rotation (per general references above). (As for Rohl's argument regarding Venus, it is only probabilistic; moreover, it relies on an archaeo-historical synchronism with Mesopotamia—involving pharaoh Neferhotep I—that is uncertain [Ward, 1992].)

## **Excursus 2: Claim of 511 years of Hyksos occupation**

One epitome of Manetho's works claims that the Hyksos occupation lasted for 511 years. The claim is definitely wrong. Conventional Egyptological chronologies assume that the claim is just a mistake. Perhaps that is true, but such a mistake seems peculiar. A speculative explanation for the claim is as follows.

The claim is made in the epitome that was written by Josephus (*Against Apion* 1:84 [Barclay, 2007]). Josephus regarded both Hyksos and Hebrews as ancestors of the Jews, and he did not distinguish between the two (*Against Apion* 1:91–92, 103, 228 [Barclay, 2007]). Indeed, he refers to the first Hebrew to reside in Egypt, Joseph, as being Hyksos. Thus, it seems that, in the conception of Josephus, Joseph was the first Hyksos to reside in Egypt.

Joseph began residing in Egypt about 20 years before the start of the famine, according to the biblical story ({citations}). Thus, according to the chronology proposed herein, Joseph began residing in Egypt in about 1648–1647 BC.

Some of Manetho's time spans in and around the Hyksos period have long been thought to be overstated by 60 years—based on internal inconsistencies within Manetho's book [Thackeray, 1926: p.205; Waddell, 1940: p.121; {Barclay, 2007: n.1:356}]. If both the apparent 60-year overstatement and the 37-year error noted above (in §8) were incorporated into Josephus' epitome, then the revised duration of the Hyksos occupation would be  $511 - 60 + 37 = 488$  years.

The Hyksos occupation ended in  $1161 \pm 1$  BC, by the chronology proposed herein. Hence, with the above revised duration, the occupation would have begun in  $1161 \pm 1$  BC  $- 488 = 1649 \pm 1$  BC, i.e. about when Joseph began residing in Egypt.

In conclusion, we speculate this: Josephus' claim of 511 years includes two numerical errors and actually refers to the total number of years during which the

ancestors of the Jews resided in Egypt. Given that Josephus did not distinguish between the Hyksos and the Hebrews, the confusion is somewhat understandable.

### Excursus 3: How many Hyksos were there?

The biblical story repeatedly claims that the Israelites had about 600 000 men. For example, Exodus 12:37 says that while the Israelites were in Egypt, just before the Exodus, the Israelites had about 600 000 men.

There was a partial census of the Israelites shortly after the Exodus, according to the Bible (Numbers 1–2). The census was of the men who were eligible for military service: men age 20 and over and able to bear arms. A count was conducted for each of the Israelite tribes, e.g. the tribe of Gad had 45 650 eligible men. The total number of eligible men, in all tribes, was 603 550. That total is repeated in Exodus 38:26.

Later on, there was a second census of the eligible men (Numbers 26). A count was conducted for each of the tribes, as with the first census. For each tribe, significant details are presented by the biblical story; an example, for the tribe of Benjamin, is in the quotation below. The total number of eligible men was 601 730.

The descendants of Benjamin by their clans: Of Bela, the clan of the Belaites; of Ashbel, the clan of the Ashbelites; of Ahiram, the clan of the Ahiramites; of Shephupham, the clan of the Shuphamites; of Hupham, the clan of the Huphamites. The sons of Bela were Ard and Naaman: [Of Ard,] the clan of the Ardites; of Naaman, the clan of the Naamanites. Those are the descendants of Benjamin by their clans; persons enrolled: 45,600.	The sons of Benjamin by their clans. For Bela, the clan of the Belaite. For Ashbel, the clan of the Ashbelite. For Ahiram, the clan of the Ahiramite. For Shuphupham, the clan of the Shuphumamite. For Hupham, the clan of the Huphamite. And Bela's sons were Ard and Naaman. The clan of the Ardite. For Naaman, the clan of the Naamanite. These are the sons of Benjamin by their clans, and their reckonings were forty-five thousand and six hundred.	Numbers 26:38–41
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{The Book of Numbers also presents a census of all first-born males age one month and over (Numbers 3:39–43). But... Also see Levine [1993: p.161] and Budd [1984: p.28]. Conclude that the census of first-born males should probably be ignored.}

Despite the above, 600 000 military men seems too large to be credible. That is agreed upon by almost all biblical commentaries. Additionally, during the battle for the city of Jericho, the Israelites supposedly deployed 40 000 soldiers (Joshua 4:13): that is very small for the biggest and most important battle of the conquest of Canaan—if there actually were 600 000 soldiers available. It also seems notable that all the numbers are multiples of ten.

Yet, there is a large amount of boring detail, such as in the quotation above. This might suggest that the two census stories are not wholly fabricated.

In the Hyksos expulsion, the number of people who were forced out of Egypt is specified by Manetho—according to Josephus, who wrote a substantial epitome of Manetho’s book. The epitome says that there were 240 000 people (*Against Apion* 1:86–89 [Waddell, 1940: p.86–89; Barclay, 2007]).

Archaeological investigations in Egypt have estimated the Hyksos population to be about 100 000 people [references]. We note, however, that the population of Egypt generations prior to the Hyksos occupation has been conservatively estimated as two million [Butzer, 1976]. Thus, according to conventional Egyptology, the Hyksos were able to forcibly occupy much of Egypt even though they were outnumbered 20-to-1. We infer that either the estimate of the Hyksos population is much too low or the estimate of the Egyptian population is much too high—perhaps both.

{Discuss Hassan [1997]?}

In conclusion, the data seems to be difficult to interpret. We have been unable to find an interpretation that can be supported with confidence. We do, though, tentatively speculate this: the population size from Manetho is accurate and each of the census numbers was recorded as tenfold its true value.

## **Appendix: Mechanisms for high Nile floods**

{Revise and update this appendix.}

The river Nile has two distinct catchment areas. One is in the East African Equatorial Lake Plateau, which typically contributes about 30–40% of annual Nile flows [Shahin, 1985; Conway & Hulme, 1993]. Its precipitation comes almost entirely from moist winds that originate over the Indian Ocean, and its Nile input is roughly constant year-round. The other catchment area is in and around the Ethiopian highlands. Its precipitation comes almost entirely from summer monsoons that originate over the South Atlantic. These monsoons are drawn northward by the low-pressure area over North Africa. Some winds are also drawn eastward by the low-pressure area over the Arabian Peninsula; those that reach the highlands rise and precipitate their moisture—leading to the Nile’s summer floods. (All the winds precipitate some of their moisture as they blow over land—the heavy summer rains throughout much of tropical North Africa. The precipitation that Egypt itself receives is sourced in the Mediterranean Sea; it is meagre and has little relation to the precipitation over the Nile catchment areas.) For further discussion, see Keenan [2012].

The meteorologies of the two Nile catchment areas thus appear distinct. This is supported by their uncorrelated precipitation [Hulme, 1994; Evans, 1994; Conway & Hulme, 1993]. The highland precipitation naturally correlates with African precipitation at a similar latitude, particularly with precipitation around the catchment area of Lake Chad [Camberlin, 1995]. Lake Chad has no outlets; so it is expected that its levels correlate well with those of Nile floods, as a study of the years 1850–1920 confirmed [Hassan, 1981]. Throughout the early 1800s, though, Chad’s levels dropped substantially [Nicholson, 1978; Maley, 1973]. Also, precipitation near the Niger Bend, to the west-north-west, was exceptionally low around 1815–1825 [Nicholson, 1978]. Thus it appears that Tambora’s eruption, in 1815, did not intensify the whole North

African monsoon system. Indeed, a very large eruption is expected to weaken monsoons [Keenan, 2021; {other/better references}].

There remain two possible explanations for the high post-eruption floods, and further research is needed to determine which was operative. First, additional moisture might have been sourced from somewhere other than the Atlantic Ocean: the only other feasible source would be the Indian Ocean. Second, there might have been a large increase in the amount of (Atlantic-sourced) moisture that was actually precipitated: that could occur due to an enhancement either of moisture recycling or of the efficiency of precipitation mechanisms {(both of which are affected by the jet streams, which Robock [1996] indicates are, in turn, affected by stratospheric aerosols)}.

The ancient ultra-high floods appear to have lasted for decades. The high floods that followed Tambora's eruption, however, lasted for only a few years. A possible explanation for this difference might be had by comparison with a recent event around Lake Victoria. For some months around late 1961, there was extremely heavy precipitation over the catchment area of Lake Victoria. This brief event caused precipitation over the catchment area to be much increased during the next 35 years, tapering off unevenly over that time [Sene & Plinston, 1994; Evans, 1994; Conway & Hulme, 1993]. The extended precipitation increase was due to local factors, such as enhanced vegetation, soil alterations, and increased lake surface area. {...}

## Manetho's Second Intermediate Period

Dynasty	XIII	XIV	XV	XVI	XVII
Years	453	184(or 484)	<i>see text</i>	518(or 190)	151(or 103)
Monarchs	60	76	6	32(or 5)	43(or 4)
Egyptian/Hyksos	E	H	H	H(or E)	?(or H)

TABLE 1. Parenthesized entries indicate where records from different epitomes differ; the parenthesized entry is considered less likely. Manetho also names the six monarchs of Dynasty XV—see main text. (Manetho additionally names the monarchs of Dynasty XVII in those epitomes claiming that Dynasty XVII comprised 4 Hyksos kings; the four names, however, are among the six of Dynasty XV and are considered to be erroneous.)

{Rework this per Barclay [2007: p.54].}

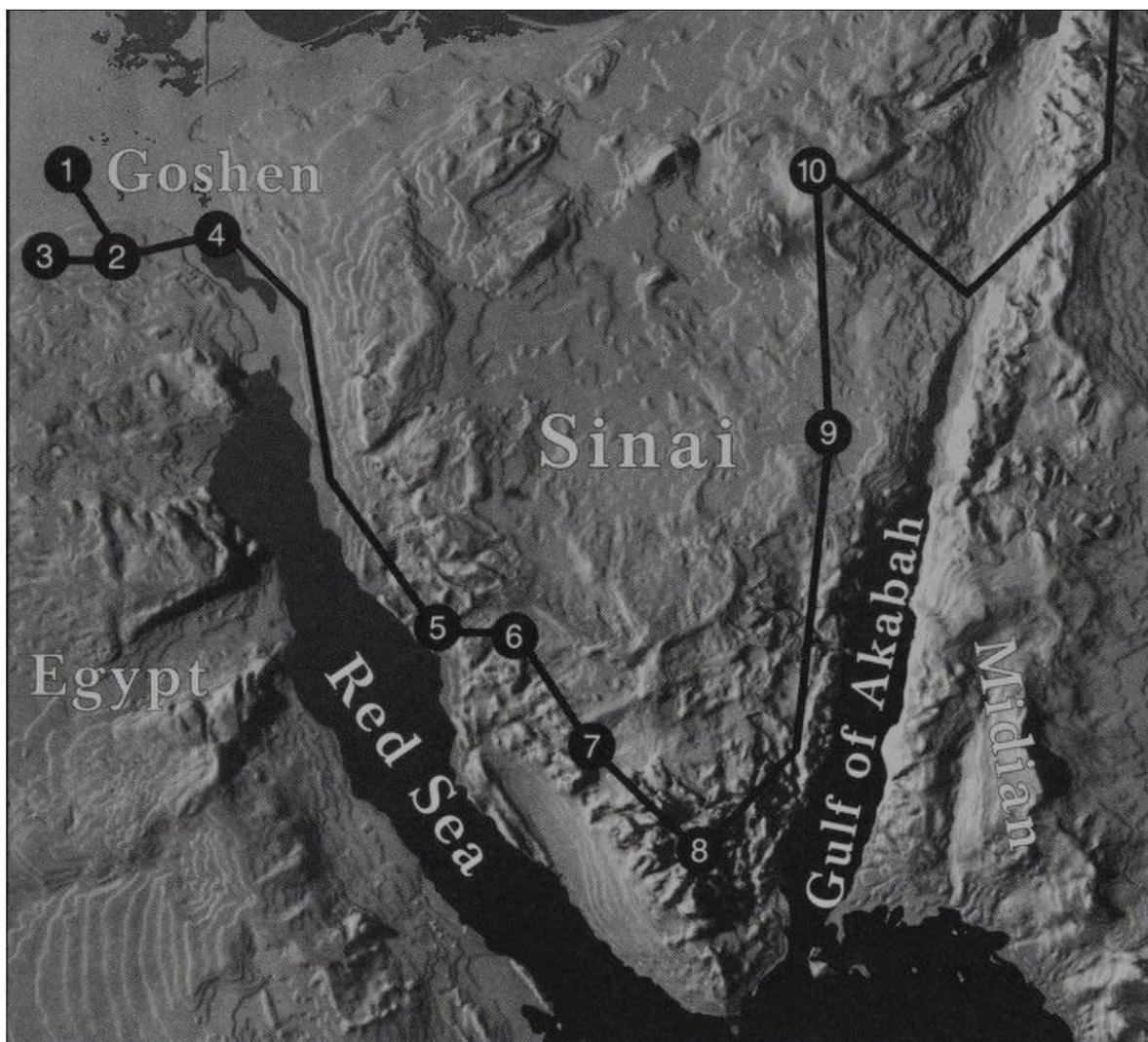


FIGURE 1. Plausible route of the Exodus (adapted from Rohl [1995: fig.319]). Moses led the Hebrews from Goshen (1), which the biblical story refers to by its later name Raamses. From Goshen, Moses went to Succoth (2), and then to Pithom (3), to gather more Hebrews there. The Sea of Reeds (4) is where the parting of the sea occurred. After that, the Hebrews went to Elim (5), and then to Rephidim (6). The locations Gebel Serbal (7) and Gebel Mousa (8) are not mentioned in the biblical story, but they are considered probable en route to Paran (9). Kadesh-barnea (10) is the location from which the Israelites set off for Canaan. For more details and caveats, see Rohl [1995: p.287].

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