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# Armageddon's Earthquakes

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## Abstract

Although the effects of earthquakes in destruction found in archaeological excavations have been recognized for decades, their importance remains controversial. New measurements of motions and analysis of earthquakes on active geological faults substantially improve the explanation of often-observed, but rarely understood, repeated destruction revealed by these excavations. Ancient Armageddon (Megiddo), the single most excavated archaeological site in Israel, is a fascinating example of this. It is situated next to the Mt. Carmel–Gilboa fault system, which, according to recent geophysical measurements, is seismically active. Its past activity: (a) has created, over time, the topography that made Megiddo strategically so important; and (b) through episodic earthquakes destroyed Megiddo's walls and buildings repeatedly.

The accumulated fault motion created the Nahal Iron Pass, which controlled ancient traffic between Syria and Egypt. Megiddo's strategic location at this pass led to some of the greatest ancient battles fought in this region and was the reason for the maintenance of its fortifications. The recurrence of damaging earthquakes, possibly 3 to 4 per millennium, however, explains the repeated destruction of Megiddo—sometimes attributed, for lack of a better explanation, to unproved battles: e.g., King David's often assumed conquest and mindless destruction of Megiddo was actually a destructive earthquake in northern Israel that occurred at ~1000 B.C. Another earthquake at ~1400 B.C., which damaged many parts of the country, also destroyed Megiddo at that earlier time. Finally, the earthquake during the battle of the Apocalypse at Armageddon (Revelations 17:8–18) may well be a simple retrospective prophecy.

*"And he gathered them . . . into a place called . . . Armageddon . . . and there was a great earthquake, such as was not since men were upon the earth."*

*The Revelation to John 16:8–16:18 ff.*

## Introduction

FOR MANY YEARS NOW we have been searching for ways to predict future earthquakes, especially large earthquakes. The task has turned out to be quite frustrating, as many schemes proposed by many researchers almost invariably have failed to date. One problem with the prediction of large earthquakes is finding an existing, sufficiently long historical record against which to test prediction schemes.

About 20 years ago we began to study what appeared to be the longest and perhaps the most continuous historical record of earthquakes on earth—in the Holy Land. This record consists of written descriptions, geological observations, and extensive archaeological evidence. The studies have revealed a rich list of details about past earthquakes inferred from archae-

ological evidence—fallen columns, collapsed walls, crushed skeletons, and slipped keystones (Table 1). These details, as rich as they are, did not add all that much to our understanding of the time-space distribution of large earthquakes, or their predictability. The results did yield another surprise, however: instead of learning about earthquakes from archaeology, we ended up learning about archaeology from earthquakes! As it turned out, it is our geological and geophysical knowledge of where and how earthquakes occur that provides important insights into the interpretation and reinterpretation of archaeological findings in many excavated sites in the Holy Land, especially ones for which historical writings are available.

Armageddon, or "Har Megiddo" in Hebrew, is perhaps the most fascinating of these sites.

Armageddon is not only one of the most excavated archaeological sites in Israel. Over the millennia, Megiddo's fame has fed a heated debate about its historicity, and also excited the interest of many archaeologists. Although Armageddon is the biblical symbol of the future Apocalypse, it is actually Armageddon's past that offers the most compelling evidence of recurring destruction, in a chilling way connecting excavated data with events described in the Revelation from John.

The reported debris uncovered in Megiddo's extensive excavations has been traditionally attributed by historians and archaeologists to the activities of invading armies (neighboring countries and cities have engaged in fierce battles over Megiddo for over five millennia). The reason for this interpretation lies in the difficulty of distinguishing between the destructive acts of conquering armies and the effects of other causes for sudden ends of populated areas.

Seismological and archaeological studies now reveal that earthquakes, not armies, must have been responsible for some of Megiddo's repeated devastation during the millennia of its thriving existence, therefore suggesting that the biblical prophecy of Apocalypse was a dramatized retrospective account. This hypothesis, however, may also be seen as a warning of future destructive earthquakes. Ironically, it replaces a religious metaphor with an educated guess. Such an inquiry also may serve as an example of consideration of the importance of earthquakes in the interpretation and reevaluation of the already existing, as well as future, excavated archaeological data.

### **Megiddo's Strategic Importance**

The strategic importance of Armageddon, in contrast with its unimposing appearance, stems from its unique topographic situation. The city controlled travel through the Holy Land because of its favorable position, causing wars between those who possessed it and those who wanted it.

Only a modest mound southeast of the Carmel Ridge in Israel, Megiddo rises 50 m above the surrounding Jezreel Plain and covers ~15 acres of land. This mound, with numerous layers of destruction, was first identified as the

legendary Armageddon (the Greek corruption of the Hebrew "Har Megiddo" or Mount Megiddo) by a Jewish writer of the early 14th century, Esthori Haparchi, then rediscovered by the British army officer H. H. Kitchener 500 years later. Extensive excavations were conducted at the site by C. Fisher, P. Guy, and G. Loud (Yadin, 1974). These archaeological studies revealed physical evidence of the existence and the historical development of Armageddon.

In about 500 B.C., the city of Armageddon (Megiddo) ceased to exist. But for more than five millennia it was a thriving city in Palestine (Finkelstein and Ussishkin, 1993), often fought over by the armies of Egypt, Assyria, Canaan, Israel, Judea, and others. Megiddo's history of defeat and glory is reflected in the papyri of Thutmose III and Seti I, Solomon's records, El-Amarna letters, Papyrus Anastasi (Rameses II), Assyrian records of the conquests of Tiglath-pileser III, and ultimately the Apocalypse of John in the Book of Revelations (16:12 ff.). Thutmose III of Egypt fought and defeated a Syrian army in 1468 B.C. (Nelson, 1913); Necho II of Egypt won a battle with King Josiah in ~1610 B.C.; and more recently General Allenby, later Viscount Allenby of Megiddo, crushed the Turks on September 18, 1918 (Wavell, 1943). The victory of Deborah and Barak over Sisera in the 13th century B.C. also took place here at Megiddo, as did Israelite battles and Pharaoh Shishak's invasion.

It was the location of Megiddo that made it an important strategic point in the ancient world. Thutmose III's expression, "the capture of Megiddo is the capture of 1000 towns," confirms that. Indeed, the mound stood at a topographic gap that became the focal point of several primary military and trade routes of antiquity (Fig. 1). By means of these routes, Megiddo controlled the course of trade and war. The determining factor for choosing traveling passages was topography: the low spots became the natural road-building factors before Rome introduced new technologies.

### **Megiddo's Topography and Active Faults**

The topography that made Megiddo strategically important resulted from movements on active faults (Fig. 2). These movements created

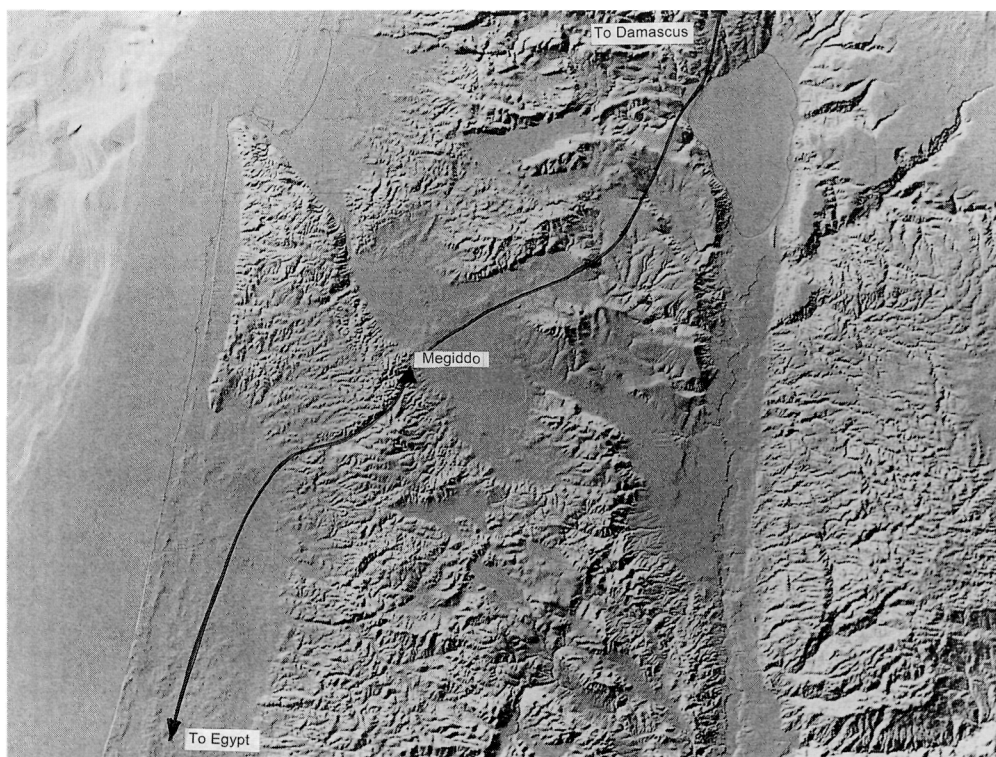


FIG. 1. Location of Megiddo (Armageddon) at the narrow passage connecting ancient Syria and Egypt.

the prominent Carmel-Gilboa Mountain Range, which obliquely cuts across northern Israel and still inhibits N-S transport. The easiest passage through this chain was through the gap where Megiddo was located. It was this gap that provided the transport routes for the armies and caravans traveling through the Holy Land in ancient times.

The Carmel-Gilboa Range and the Megiddo gap were the results of accumulated movements over geological time. The mix of horizontal and vertical motions on some of these faults was responsible for the uplifted blocks of Mt. Carmel and Mt. Gilboa and the low elevations in the Megiddo region. The movement on these faults was, and still is, explained at least in part by episodic earthquakes.

The seismicity of Israel (Fig. 3)—recorded between 1981 and 1988 by the Institute of Petroleum Research and Geophysics in Holon, Israel—consists of tremors that clearly delineate these active faults. This activity implies that larger earthquakes must have occurred in the past. One such event—a widely felt M5.2 earth-

quake—occurred on the Carmel fault only 10 miles northwest of Megiddo in 1984 (Fig. 4). Also from seismology, based on the length of an active fault, we can estimate the magnitude that its earthquakes can attain: for the Carmel-Gilboa system, this is 6 to 6.5 on the Richter scale, comparable to the 1994 Northridge, California earthquake.

The Carmel-Gilboa system is only a branch of the longer and, with respect to fault motion, much more significant Dead Sea fault system (Fig. 3). This system, like the San Andreas in California, causes motion between plates—the northward-moving Arabian plate to the east and the southward-moving Mediterranean plate to the west. Because there is a minor component of separation between the plates (in contrast to the Carmel-Gilboa faults), the motion created a valley—the Jordan Valley and the Dead Sea depression. At the same time, the Dead Sea fault results in a larger slip than the Carmel-Gilboa system, generating earthquakes more frequently. Because of the fault's length, these earthquakes reach larger magnitudes, 7.5 or

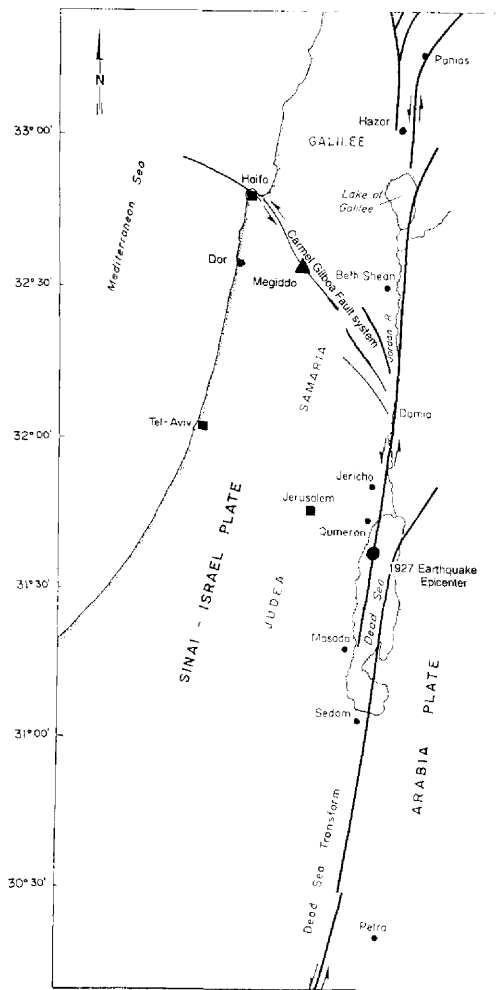


FIG. 2. Location of active faults in Israel.

greater on the Richter scale. Given the accumulated data, we may infer that topography, although giving Megiddo its favorable location, also has been partly responsible for its destruction.

### Historical Earthquakes in the Holy Land

It is beyond doubt that, because of its geological situation, Megiddo, along with the neighboring territories, must have experienced earthquakes strong enough to cause significant or total destruction during its history. In fact, we have archaeological evidence that since 1500 B.C. the Holy Land has suffered at least 10 severe earthquakes (Table 1) that caused destruction over wide areas. Typically, the

effects of an earthquake on the Carmel-Gilboa faults and the Dead Sea fault system were not limited to Megiddo, but were imprinted in archaeological strata of the same age throughout the entire region. In fact, the territorial extent of the destruction could be used to estimate earthquakes' magnitudes and epicenters. In some cases, when there are historical writings or witnesses' accounts that describe such an event, it also is possible to fix the time of its occurrence.

Such historical writings, along with archaeological excavations, provide irrefutable evidence of destruction by earthquakes—collapsed walls, parallel alignment of the fallen columns, and attending conflagrations over large territories. Aggregation of this data gives us some idea about the numbers of these events, their intensities, and the damage they caused.

One of the most characteristic examples of such aggregated data concerns the great earthquake in Kourion, Cyprus (not far from the Holy Land) in 370 A.D. It was substantiated in abundance both by archaeological discoveries and in writings. At this site, archaeologists found a skeleton of a couple with their baby, crushed under their collapsed house while asleep (Soren and James, 1985, p. 4). What happened here also was described by the eyewitness record of Ammanus Marcellirus:

For a little after daybreak . . . the whole of the firm . . . earth . . . trembled, the sea . . . was driven back . . . from the land, so that in the abyss . . . thus revealed, men saw . . . sea creatures stuck in the slime; and vast mountains and deep valleys, which nature, the creator, had hidden in the unplumbed depth, then, as one might believe, first saw the beams of the sun. . . . For the great mass of waters, returning when it was least expected, killed many thousands of men by drowning; and by swift recoil of the eddying tides of a number of ships . . . have been destroyed, and the lifeless bodies of the shipwrecked persons lay floating on their backs or on their faces. Other great ships . . . landed on the tops of buildings (as happened in Alexandria), and some were driven almost miles inland. . . .

Such accounts of the effects of earthquakes were somewhat dramatized *post factum*, but they

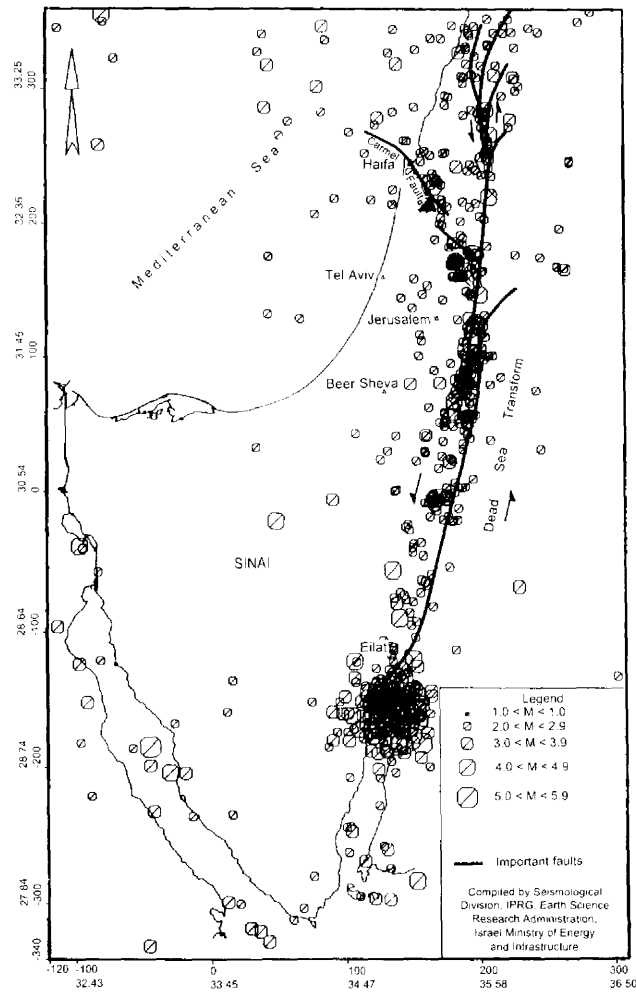


FIG. 3. Present-day seismicity in Israel.

did nevertheless convey many of the real facts (Nur, 1991; Nur and MacAskill, 1991).

One of the earliest records of earthquake devastation in the Holy Land, on the Dead Sea fault at ancient Jericho, dates from ~1400 B.C. (Kenyon, 1957). In addition to fallen walls, skeletons of two people who were crushed by rocks were unearthed. Furthermore, it has been suggested by some that Joshua's conquest of the city (Kenyon, 1957) was made possible by this or a similar earthquake.

Hazor is another archaeological site where, in the 7th century B.C., massive damage was caused by a biblical earthquake. The evidence uncovered (Yadin, 1972, p. 211) includes broken jars, fallen walls, and a collapsed roof.

The excavated ruins of Beth Shean also present physical evidence confirmed independently in historical documents: a double destruction by two earthquakes, one in 363 and another in 749 A.D. After the latter, Beth Shean never regained its historical importance.

The pattern of observed and documented destruction continues up to recent times: on July 11, 1927, many towns and villages in the Holy Land—including Jericho, Nablus, and Jerusalem—suffered great damage from a magnitude 6.3 earthquake, with an epicenter near Jericho. The *New York Times* (July 13, 1927) reported 1000 people killed and a similar number of houses destroyed. Although the quake was moderate in magnitude, the damage to

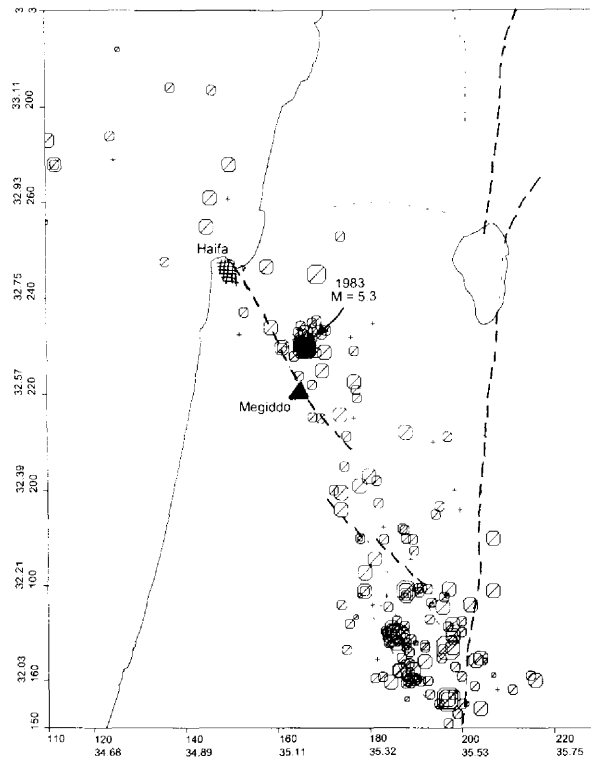


FIG. 4. The magnitude 5.2 earthquake of 1984, on the Carmel fault ~10 km northwest of Tel Megiddo.

structures extended from the Negev in the south to the coastal plain, lower Galilee, and the Sea of Galilee in the north—a distance of 100 km or so. An earthquake of greater magnitude would cause destruction over a much larger area because the energy released by an earthquake increases logarithmically with magnitude. For example, the 363 A.D. earthquake in the Holy Land caused massive devastation throughout the entire country (Russell, 1985), from Petra in the south to Banias in the north—a distance of over 250 km. This would correspond to a modern-day Richter magnitude of 7.5 or 7.8—similar, for example, to the Armenian earthquake of December 7, 1988 in which 25,000 people were killed.

#### **Destruction in Megiddo and Earthquakes**

Megiddo, of course, was not immune from the same historical earthquakes that destroyed neighboring cities of the country. There are several destruction-debris levels (at least four,

in fact) at Megiddo, some of which have remained inexplicable for decades (Fig. 5). They most likely resulted from earthquakes, which occurred every few hundred years. Because of poor construction practices in ancient (as well as modern) times, these earthquakes must have destroyed or severely damaged Megiddo time and time again.

In Megiddo, the tradition of blaming the invading armies for the debris has led to serious discrepancies. The conquest of the city by the Egyptian Pharaoh Thutmose III (~1479 B.C.), for example, has left no remains. On the other hand, four distinct destructive episodes in the Late Bronze and Iron ages have not been explained.

The first destruction level separates the Late Bronze Age strata VII B (older) and VII A (younger) sometime between 1550 and 1130 B.C. (Table 2), perhaps when the Israelites first entered the Holy Land. However, the Bible (unreliable as a historical source, but often the only one available) gives no indication that

TABLE 1. Historical Earthquakes in the Holy Land

| Year      | Period             | Affected sites  |
|-----------|--------------------|---|
| B.C.      |                    |   |
| 1400–1200 | Late Bronze        | Beth Shean, Hazor, Haror, Tel Michal, Jericho                                       |
| 1200–900  | Iron               | Hazor, Dor, Cabul   |
| 900–600   | Iron               | Hazor, Tel Keisan, Tel Sera   |
| 600–400   | Babylonian/Persian | Kadesh Barnea   |
| 31–37     | Early Roman        | Kirbet El Qumran, Jericho, Tel Bira   |
| A.D.      |                    |   |
| 306       | Late Roman         | Gush Halav, Nabratein, Kirbet Shema   |
| 363       | Byzantine          | Petra, Beth Shean, Beth Shearim, Tiberias, Jerusalem                                |
| 551       | Byzantine          | Jerash, Gush Halav, En-Nashut   |
| 614–749   | Byzantine/Arab     | Jericho, Jerash, Sussita, Pella, Tiberias, Beth Shean, Capernaum                    |
| 1033      | Arab               | Tiberias, Jericho, Jerusalem  |
| 1534      | Ottoman            | Jerusalem—the tower of the Holy Sepulchre collapsed                                 |
| 1546      | Ottoman            | Jordan River cut off for two days, Jerusalem, Nablus, Hebron, Ramle, Gaza, Damascus |
| 1834      | Ottoman            | Jerusalem, Bethlehem, Mar Saba  |
| 1837      | Ottoman            | Atlit, Banias, Safed  |
| 1859      | Ottoman            | Jerusalem, Jericho  |
| 1903      | Ottoman            | Jenin, Bethlehem, Nablus  |
| 1927      |                    | 15 km north of Jericho  |



FIG. 5. Overlying foundations of older and younger rebuilt structures in Megiddo (after Davies, 1986). This could be the result of earthquakes.

Megiddo actually was conquered by the Israelites at that time (Finkelstein and Ussishkin, 1993). Kenyon (1979) mentions the presence

of a thick destruction layer, but ascribes it to the work of Thutmose III. *The New Encyclopedia of Archaeological Excavations in the Holy Land* (Aharoni, 1993; Shilo, 1993) places this devastation somewhere between the second half of the 15th century B.C. and the first half of the 14th century B.C. Evidence of a catastrophe also is mentioned by Davies (1986, p. 62): “both the courtyard and the room . . . were filled with debris from fallen walls. . . .” Davies, in fact, suggests an earthquake as the cause, on the basis of excavated ruins of roughly the same age throughout the entire Holy Land.

The second “enormous destruction level . . . with debris . . . as much as 4 feet deep” was found on top of stratum VIIA and under stratum VIB (Table 2), as noted in Finkelstein and Ussishkin (1994, p. 40).

. . . the settlement of stratum VIIA was brought to an end by a sudden and total destruction. This is shown not only by the fact that the following stratum (VIB) is totally unlike stratum VIIA, but by the signs



TABLE 2. Major Widespread Destruction Episodes That May Have Resulted from Earthquakes

| Date of strata | Period              | Stratum                        | Date of destruction | Evidence of destruction   | Other affected sites                                 |
|----------------|---------------------|--------------------------------|---------------------|---|--|
| 1500-1400 B.C. | Late Bronze Age I   | IX-VIIB (BB)                   | 1400 B.C.           | Thick destruction layer, fallen walls   | Tel Deir, Alla, Tel Michal, Beth Shean, Haror, Hazor |
| 1400-1300 B.C. | Late Bronze Age IIA | VIII (AA + DD), VIIB (AA + DD) |                     |   | Jericho  |
| 1300-1200 B.C. | Late Bronze Age IIB | VIIA (AA + DD)                 | 1300-1200 B.C.      | Sudden and total destruction, which brought settlement to an end                      |  |
| 1200-900 B.C.  | Iron Age IA         | VIIB-VIA IVB                   | 1000 B.C.           | Enormous burned debris, disarranged smashed pottery, destruction over the entire site | Timna, Dor, Cabul, Tel Keisan, Tel Masos, Capernaum  |
| 900-600 B.C.   | Iron Age II         | IVA-II                         | 760 B.C.            |   | Lachish, Tel Keisan, Tel Sera                        |

of the devastation wrought upon the VIIA buildings and by numerous objects . . . found over the floors of this level.

Furthermore, the settlement on top of this destruction is unwallled and of poor construction (Yadin, 1993). This sequence of sudden devastation followed by poor rebuilding is typical of earthquake-prone regions in less-developed areas of the world even today.

A third level of violent destruction was found in stratum VIA, dated as Iron Age I (1130-1000 B.C.). This destruction is attributed by many to the conquest of Megiddo by King David's army, but without support by any independent evidence. Kempinsky (1993), however, suggests an earthquake as the cause. Perhaps the earthquake that occurred was that described in the book of 1 Samuel during the battle between King Saul and the Philistines at Michmash (1 Samuel 14:13-15) in 1020 B.C. Vivid proof of the destruction, including enormous burned debris, disarranged smashed pottery, etc., was found by Yadin and was given approximately the same date (Yadin, 1974). The most compelling evidence in support of the earthquake theory is the contemporaneous devastation excavated in many other sites in northern Israel, including the city of Dor.

The fourth Megiddo destruction occurred sometime after Shishak, King of Egypt, conquered it in 925 B.C. It is difficult to decide whether this destruction was caused by the

earthquake in King Uzziah's time (~760 B.C.; Amos 1:1) or by another earlier earthquake.

### Earthquake Skeletons

The tectonic situation of Megiddo astride an active fault, its closeness to the Dead Sea fault system, and the archaeological findings provide strong evidence in support of the likelihood of earthquake destruction. But the most compelling evidence at Megiddo, as elsewhere, is provided by crushed skeletons of people trapped under the collapsed rubble. This type of evidence often is accepted even by those archaeologists who otherwise dismiss earthquakes as an important cause for destruction.

In 1992 the smashed skeleton of a woman (archaeologists who found it called the victim Doreen) was unearthed during the excavation of Dor, 25 km west of Megiddo. The event was dated at approximately 1050 B.C.: ". . . on the floor of the Phoenician city that David conquered: amid the other evidence of destruction was the complete skeleton of a woman whose head had been crushed by a stone, apparently a casualty of battle . . ." (Stern, 1993, p. 20). Stewart (1993), however, suggested that the cause was an earthquake, not a battle. He based his argument on the results of an analysis by Dr. Patricia Smith at Hadassah Medical Center in Jerusalem, which reveals bone fracture by massive and sudden load on the victim. Most

convincing is the widespread devastation contemporaneous with that of Dor. It is remarkably typical of the results of earthquakes in this region—in Akhziv, Tel Keisan, Tel Abu Hawam, Tel Michal, Yokneam, Afula, and Beth Shean. Most probably, these sites were destroyed together within seconds by a magnitude 5.5 to 6.5 earthquake on the nearby Carmel fault, or a magnitude 6.3 to 7.0 event on the more distant Dead Sea fault.

Skeletons crushed by falling structures during earthquakes were found in many other sites—Jericho (~1400 B.C.), Hisham (749 A.D.), Kourion in Cyprus (370 A.D.), Beth Shearim, Pella, and Petra in Jordan (363 A.D.), Beth Shean (749 A.D.), Crete (~1700 B.C.)—and, of course, in recent times. Broken skeletons of people who most probably perished in an earthquake also have been uncovered in excavations at Megiddo. Much as in Dor, they were found next to smashed jars. It is even possible that the death at Megiddo was caused by the same earthquake that killed Doreen at Dor (~1050 B.C.).

### From Earthquakes to the Apocalypse

Many historians and archaeologists have attempted to use archaeological evidence to better understand earthquakes. Because the evidence often is inconclusive, it has led to only modest advances. At Megiddo, the opposite is possible: geological and earthquake evidence can be used to better understand archaeology. Because seismic data now provide extensive, accurate, and reliable information about the locations of active faults and about earthquake occurrences and magnitudes, the Megiddo case illustrates how in the future this evidence could significantly improve the ability of archaeologists to look afresh at their findings in tectonically active areas of the earth by paying attention to natural as much as to human factors. In Megiddo, it appears that its geological position has been responsible for both the historical rise and the fall of the city.

Megiddo's past earthquakes are a vivid reminder of the hazards posed by future earthquakes in the Holy Land. Although appreciated by seismologists and engineers, earthquake risk has been widely overlooked and even ignored in Israel. Thus, archaeology is a key to understanding the future.

Science, history, archaeology, and mysticism are entangled in a bizarre way at Megiddo. This entanglement yields lessons not only to geologists, archaeologists, and historians, but also to architects, engineers, government planning agencies, biblical scholars, earthquake forecasters, prophets, and mystics. In Armageddon, the role of earthquakes, however, seems to transcend the usual boundaries of a mere local catastrophe.

The description of the earthquake in Apocalypse of the Book of Revelations follows:

... And he gathered them ... into a place called Armageddon ... and there was a great earthquake such as was not since men were upon the earth, so mighty an earthquake, and so great. And the great city was divided into three parts, and the cities of the nation fell. ... And every island fled away, and the mountains were not (Revelations 16).

This account of a future event, which is so reminiscent of the actual devastation described by Ammanus Marcellinus in Kourion, suggests that the apocalypse is in fact a dramatized historical account, perhaps even of a past Megiddo earthquake, a retrospective prophecy widely found in *post factum* warning of the ancient literature.

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