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The Earthquake Chronology of Palestine and Northwest Arabia from the 2nd through the Mid-8th Century A.D.

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This article addresses several issues relevant to a better understanding of why archaeologists have generally failed to reach a consensus on the dating, regional impact, or identification of earthquake destructions in the depositional records of Roman/Byzantine Palestine and the province of Arabia. An evaluation of earthquake destructions in these regions from the 2nd through the mid-8th century A.D. is based upon an analysis of both ancient textual accounts and contemporaneous archaeological data. Depositional processes affecting archaeoseismic destruction evidence as it appears in the archaeological record are also discussed.

INTRODUCTION

A more accurate understanding of the context of material remains in time and space enhances the empirical value of such data in archaeological analyses. Earthquakes, as temporally discrete events, result in the spatial deposition of contemporaneous material remains. Thus, an accurate temporal and spatial understanding of ancient earthquakes would substantially enhance the empirical value of associated archaeological data.

Depending upon the quality and nature of the historical and archaeological evidence, certain stratigraphic levels at individual sites could be dated to the actual year of their deposition, and in some instances to the hour, day, and month of that year. Further, since earthquakes tend to affect extensive regions, it should often be possible to chronologically articulate the depositional records of spatially discrete sites on the basis of comparative archaeoseismic evidence. Such temporal and spatial correlations would, in turn, allow for greater precision in the comparative regional analysis of material remains.

Realizing this potential, scholars working in the eastern Mediterranean have already advanced our understanding of the archaeological records of

Late Roman/Byzantine Cyprus (Soren and Lane 1981; Soren 1981) and the Galilee (Meyers 1982) through the identification and regional integration of archaeoseismic deposition. However, specific historical and archaeological problems continue to inhibit the wider application of this comparative archaeoseismic approach.

This situation is particularly striking in the archaeology of Late Roman/Byzantine Palestine and northwest Arabia (modern Israel and Jordan). Indeed, few archaeologists would seriously deny that these regions were afflicted in ancient times by destructive earthquakes. The entire length of the rift valley exhibits border faults, and numerous structural elements capable of generating earthquakes are found throughout these regions. Figure 1 presents the approximate locations of several such prominent tectonic structures. Seismic activity along these fault and structure lines, particularly where different systems intersect, has generated numerous earthquakes throughout recorded history. However, archaeologists have not been able to reach a general consensus on either the dating or the regional impact of such earthquakes, nor have they been able to generally agree upon the identification and nature of the archaeological evidence that would seem to document these events. While several factors have contrib-

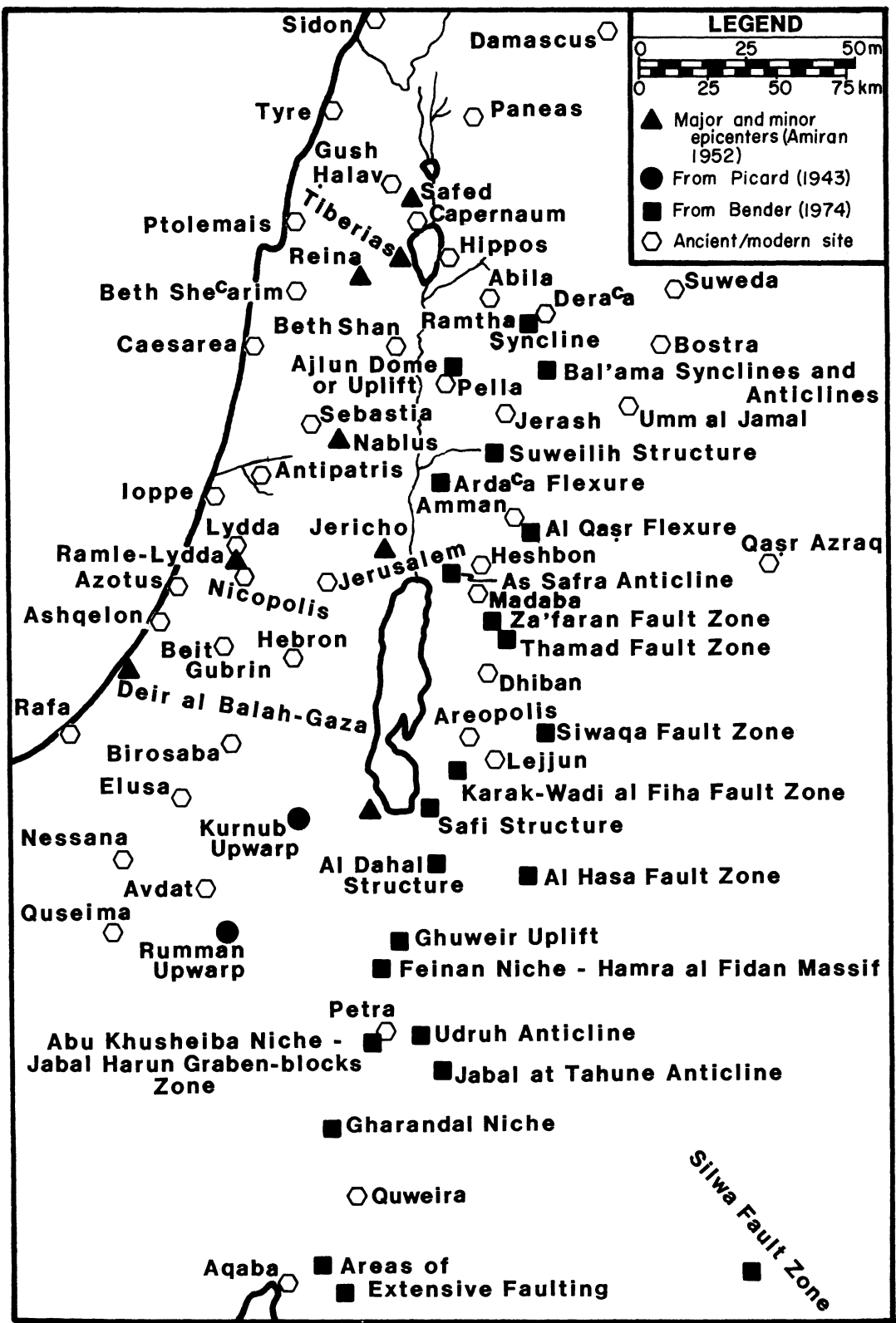


Fig. 1. Approximate locations of prominent tectonic structures in Late Roman/Byzantine Palestine (modern Israel and Jordan).

TABLE 1. Earthquakes Presumed to Have Affected Palestine and Northwest Arabia, 2nd–Mid-8th Century A.D.

<i>Dating</i>	<i>Regions and/or Sites Affected</i>
c. 113–114?	Archaeologically attested from Caesarea through Ḥesbān, and from Jerash through Petra
306	Tyre, Sidon, and sites in the Galilee
May 19, 363	Paneas, Tiberius, Sepphoris, Baishan, Caesarea, Sebastia, Antipatris, Ioppe, Lydda, Gophna, Jerusalem, Hada, Nicopolis, Azotus, Ashqelon, Gaza, Beit Gubrin, ² Aina d-Gader (es-Salt?), Areopolis, Petra, and several other sites
419	Palestine and Jerusalem specifically mentioned. Probably far more extensive than texts indicate
August 22, 502	Tyre, Sidon, Beirut, Ptolemais, sites in Galilee
July 9, 551	NE Egypt (?), Palestine, Arabia, Phoenicia, Syria, and N Mesopotamia: Tyre, Sidon, Beirut, Tripoli, Byblos, Botryos, and villages in the Galilee
September, 633	Palestine: Extent unknown—evidence at Beth-shan?
June, 659	Palestine and Syria: extent unknown
659/60	Jordan Valley: Jericho and the Monasteries of St. John the Baptist and St. Euthymius
?672?	Presumably Ramle, Ashqelon, and Gaza
January, 748	NE Egypt, Palestine, Jordan Valley, Moab, Galilee, Syria, and N Mesopotamia (?): Damietta, Gaza, Mabbug, Tiberias, Dera ^c a, Bostra, Damascus, Ba ^c albek, and many other sites
March 9, 757	Palestine and Syria: extent unknown

uted to this situation, descriptive and analytic errors in modern earthquake catalogs have been particularly detrimental.

A CRITIQUE OF CURRENTLY AVAILABLE EARTHQUAKE CHRONOLOGIES

Several catalogs ostensibly list the earthquakes that affected ancient Palestine and northwest Arabia. The Abbé Alexis Perrey, a science professor at Dijon, compiled such a catalog for the eastern Mediterranean region in the mid-19th century (1848–50). G. L. Arvanitakis (1903: 178–79), a climatologist, compiled a chronological chart of ancient earthquakes in the Near East. B. Willis, a structural geologist, compiled an earthquake catalog specifically for ancient and modern Palestine (1928). Currently, the earthquake catalog that archaeologists tend to reference most often is that of D. H. K. Amiran (1950–51), which presents a revised and updated version of Willis' earlier work.

A critical examination of these catalogs, however, suggests that their respective authors based their accounts predominantly upon secondary rather than primary documentation without an adequate consideration of the nature and complexities of ancient historical texts. The use of

primary historical documentation for earthquakes is almost exclusively restricted to the 19th century work of the historian H. F. Clinton (1845). However, Clinton was compiling a civil and literary chronology, not an earthquake catalog, and he understandably failed to note several ancient seismic occurrences. Although such compilations are extremely useful, they are neither independently nor collectively sufficient to support valid geological, archaeological, or historical interpretations concerning earthquakes in the study region.

One example of these problems is the documentation presented for an earthquake in Palestine in A.D. 447.¹ According to Amiran (1950–51: 225), this earthquake affected “Asia Minor to Egypt,” and was “very strong” in Jerusalem. It subsequently appeared in Amiran's list of “major” earthquakes in ancient Palestine (1952: 51). To document this event, Amiran referred to the earlier earthquake compilations of Arvanitakis and Willis. Indeed, Arvanitakis (1903: 179) listed the regions affected by the 447 earthquake as Thrace, Asia Minor, Egypt, Syria, and Palestine; but he did not provide any supportive documentation. Willis subsequently (1928: 79) used the description of Arvanitakis, but apparently without further research.

Fortunately, both Perrey (1848: 8) and Clinton (1845: 634) also documented the 447 earthquake, notably by reference to primary historical texts. Evagrius Scholasticus (ca. 536–600) recorded that this earthquake caused extensive damage in Bithynia, the Hellespont, and both Phrygias, and that the destruction was especially severe in Constantinople (1964: 26–27). John, bishop of Nikiu (ca. 641–ca. 696), also mentioned that Constantinople was struck by this earthquake (1916: 95), while the entry for 447 in the *Marcellini Chronicon* (written ca. 534) noted damage and subsequent repairs to the city's walls as a result (1894: 82). Finally, John Malalas (ca. 491–578) documented the extensive damage at Nicomedia in Bithynia (1940: 84).²

The geographic consistency of all five accounts is readily apparent, and both Perrey and Clinton appropriately limited the regions affected in the 447 earthquake to Thrace, Bithynia, and the Hellespont. There is, however, no ancient textual support for the geographic description of Arvanitakis upon which both Willis and Amiran based their accounts. As such, the archaeological use of this date for earthquake destructions in either Palestine or northwest Arabia is unwarranted. The same observation has been previously noted for the use of a 365 date for an earthquake in the study region (Russell 1980: 53–54).

In the following analysis of the available textual and archaeological data relevant to earthquake destructions in the study region, it will be suggested that a further reduction in the number of earthquakes commonly perceived as affecting Palestine and northwest Arabia between the 2nd and the mid-8th century is in order.³

EARTHQUAKES IN PALESTINE AND NORTHWEST ARABIA FROM THE 2ND THROUGH THE MID-8TH CENTURY

An Earthquake in the Early 2nd Century

Both ancient textual documentation and archaeological evidence have been previously noted for an early 2nd century earthquake destruction in the study area. Unfortunately, the temporal and spatial dimensions of these separate bodies of data do not seem mutually supportive.

Textual Evidence. The principle ancient ac-

count used to document an early 2nd century earthquake in the study region is found within the *Chronicon* of Eusebius Pamphili (ca. 260–340). Unfortunately, the original form and contents of this work were not preserved, and it survived only through an Armenian translation and partly through a Latin adaptation by St. Jerome (Vasiliev 1958: 119). The relevant passage is rather terse, and may be translated as follows: “Nicomolis and Caesarea collapsed from an earthquake.”* Migne’s edition of the *Chronicon* (1844–64: 618) contains a marginal date of 130 for this event, although the narrative was placed at the end of the 226th Olympiad, which encompassed the years 125 through 128 (using a 776 B.C. base date; Bickerman 1974: 75–76).

Further documentation of this earthquake exists in the *Chronographia* of Elias of Nisibis, composed in Syriac ca. 1019: “There was an earthquake, and Nicopolis and Caesarea were overthrown” (1954: 42). This account forms part of the entry for A.G. 438, thus dating the event to 126/7.⁴

These narratives would seem to document an earthquake during the reign of Hadrian that affected the Palestinian littoral. However, N. N. Ambraseys (1985, personal communication) has alternatively suggested that these narratives document an earthquake in northeastern Anatolia in the province of Pontus. As such, the sites affected would have been [Neo]Caesarea (= Niksar) and Nikopolis (= Susehri), both important frontier centers in the early 2nd century. If correct, the use of these narratives to document an early 2nd century earthquake in the study area would be unwarranted.

Indeed, some support for Ambraseys’ suggestion exists in the archaeological evidence of early 2nd century structural damage or rebuilding in the study area, for this evidence would seem to indicate both a greater spatial extent of damage, and an earlier date of occurrence.

Archaeological Data. Early 2nd century evidence of structural damage or rebuilding has been noted at Caesarea (Fritsch and Ben-Dor 1961: 55; Karcz and Kafri 1978: 45; Toombs 1978: 228, 230), Jerash (Kraeling 1938: 47–48; Illife 1944: 1–3), Heshbon/Hesbân (Mitchel 1980: 95–100), the Roman garrison at Masada (Yadin 1965: 30, 118; 1967: 45), Khirbet Tannur (Glueck 1965: 138), Avdat (Negev 1961: 123, 125), Mampsis (Negev 1971: 166), Moje ʿAwad and Mezad Shaʿar Ramon

on the Petra–Gaza road (Cohen 1982: 243–44), and Petra (Kirkbride 1960: 118–19; Parr 1960: 128–29; Hammond 1965: 33–35; 1977–78: 81–84). Coins of the last Nabataean king, Rabbel II (71–106), have been noted in association with this destruction evidence at Petra (Kirkbride 1960: 118–19; Parr 1960: 129), Moje ʿAwad (Cohen 1982: 243), and Meʿad Shaʿar Ramon (Cohen 1982: 244). At Masada, a coin ostensibly struck at Tiberias in 99/100 was recovered from beneath the collapse debris of the bath house, while the latest coin in a horde found beneath the collapse debris of building VII ostensibly dated to 110/111 (Yadin 1965: 118–19; 1967: 45). At Avdat, an imperial coin struck at Alexandria and tentatively identified as Trajanic was apparently found in association with the collapse of the potter’s workshop (Negev 1974: 24).

Further, during the 1976 excavations at Petra, a brass *sestertius* commemorating Trajan’s *alimenta italiae* endowment was uncovered on a floor-slab next to several crushed unguentaria in a storage room of a collapsed house of the early 2nd century. The description of this *sestertius* is as follows:

OBV.: —TRAIANO AVG GER DAC—. Laureated bust, facing right, slight drapery on left shoulder.
REV.: S P Q R OPTIMO PRINCIPI. S C (left and right in field). ALIM ITAL in exergue. Annona (or Alimentatio?), draped, standing front, head left, holding two corn-ears downwards, and cornucopiae outwards. On left, below corn-ears, small male figure, togate, standing front, head right, holding roll.

SIZE: 31 mm

Sestertii of this type were minted between 103 and 117 (Robertson 1971: 57–59, and pl. 13, nos. 344, 350, 354). Unfortunately, the consulship was illegible in the obverse inscription; this would have allowed for a more precise dating.

Thus, while the early 2nd century destruction evidence archaeologically attested at Caesarea would seem to match the textual documentation contained in the *Chronicon* of Eusebius, the cumulative evidence of apparently contemporaneous structural damage or rebuilding in the study area stretches from Caesarea through Ḥesbân, and from Jerash through Petra. Further, no coins of Hadrian have yet been reported in association with these destructions.

Analysis and Synthesis. If, as proposed here, this archaeological evidence of early 2nd century structural damage and rebuilding indeed relates to a single catastrophic event, the most parsimonious explanation is that it reflects extensive earthquake damage. The evidence is simply too widespread to support an alternative explanation on the basis of civil turmoil or invasion (e.g., Negev 1966: 95, 1976a: 62, 1976b: 229–30). There is also sufficient evidence to suspect that Trajan himself may have provided funds for the reconstruction of at least some of the cities damaged at this time.

At Petra, a monumental commemorative arch was dedicated to Trajan by the city late in 114 (Kirkbride 1960: 120), but the sections of the inscription that would have documented the reason for this dedication were not recovered. However, at Jerash, a similar civic dedication to Trajan was installed when a new north gate was constructed early in 115 (Kraeling 1938: 47–48; Welles 1938: 401); here Trajan is termed the “savior and founder” of the city.⁵ These civic dedications to Trajan may well reflect the imperial aid he supplied for reconstruction after a disastrous earthquake in 113 or 114.

The current lack of historical documentation for this proposed event may be primarily credited to Cassius Dio Cocceianus (ca. 155–post-229). Dio (1925: 392–465) failed to record either the earthquake ca. 106 in the province of Asia which damaged Elaea, Myrina, Cyme, and Pytanæ (Eusebius *Chronicon* 1844–64: 606), or the earthquake ca. 122 in the province of Bithynia that damaged Nicomedia, Nicaea, and several other cities (Eusebius *Chronicon* 1844–64: 613). In fact, the only earthquake Dio did record during the reigns of Trajan and Hadrian was that of 115 in Antioch (1925: 404–9), apparently because Trajan himself was nearly killed in it.

Eusebius, writing his *Chronicon* in the early 4th century, was probably well aware that his native Caesarea had been severely damaged by an earthquake some 200 years earlier, but had to base his account of this event on the only texts available to him which seemingly documented an earthquake in Palestine at approximately the right time.⁶

*This and subsequent translations are the author’s, except as noted.

The Earthquake of 306

The principle (and only?) ancient text in which this event was recorded is again the *Chronicon* of Eusebius. The relevant passage states, "A terrible earthquake at Tyre and Sidon threw down many buildings, and innumerable people were crushed" (1844–64: 664). Migne's edition provides a marginal date of 306 for this event, although once again the exact source (or sources) of this date must be questioned. A date ca. 303 may be more nearly correct (N. N. Ambraseys 1985, personal communication).

While this account only specified earthquake damage along the southern Lebanese littoral, earthquakes in this region do appear to be historically correlated with simultaneous activity at the Safed epicenter in Upper Galilee (see fig. 1). The earthquake of January 1, 1837, illustrates this seismic correlation (Robinson 1841: 324). Thus, while Eusebius did not document contemporaneous damage in northern Palestine, it is reasonable to expect that sites in the Galilee would have been affected as well.⁷

The 306 earthquake has been used to date the collapse of Synagogue 1 and the subsequent construction of Synagogue 2 at Khirbet Shema^c (Meyers, Kraabel, and Strange 1976: 33–38; Meyers 1982: 122–23). At Gush Halav, the earthquake of 306 has been used to date a second phase of Late Roman occupation (Meyers, Strange, and Meyers 1979: 36–37; E. M. Meyers 1984, personal communication). At en-Nabratein, this earthquake has been used to date a partial collapse and subsequent repair in Synagogue 2 (Meyers, Strange, and Meyers 1982: 36, 43).

The Earthquake of May 19, 363

An extended account of this earthquake and the sites it affected appears in a previous article (Russell 1980). Although this earthquake was recorded in numerous ancient texts (Levenson 1979; Russell 1980), the most extensive and accurate account is that contained in Harvard Syriac 99, a late 4th or early 5th century letter attributed to Cyril of Jerusalem (Brock 1977). The following is Brock's translation of the relevant sections of the text (minus explanatory insertions in Greek):

Now we should like to write down for you the names of the towns which were overthrown: Beit

Gubrin—more than half of it; part of Baishan, the whole of Sebastia and its territory, the whole of Nikopolis and its territory; more than half Lydda and its territory; about half of Ashqelon, the whole of Antipatris and its territory; part of Caesarea, more than half Samaria; part of *NSL*², a third of Paneas, half of Azotus, part of Gophna, more than half Petra (RQM); Hada, a suburb of the city (Jerusalem)—more than half; more than half Jerusalem, . . . Part of Tiberias too, and its territory, more than half *RDQLY*², the whole of Sepphoris (*SWPRYN*) and its territory, ²Aina d-Gader; Haifa (?; *HLP*) flowed with blood for three days; the whole of Japho (*YWPY*) perished, (and) part of ²*D²NWS*.

This event took place on Monday at the third hour, and partly at the ninth hour of the night. There was great loss of life here. (It was) on 19 *Iyyar* of the year 674 of the kingdom of Alexander the Greek (Brock 1977: 276).

It would seem that this part of the manuscript was primarily written to document the extent of destruction in the various administrative districts of what were then the two provinces of Palestine (excluding Paneas in the province of Phoenicia). The date of this event was May 19, 363 (Brock 1977: 268). Additional ancient texts record contemporaneous destructions at both Gaza (Brock 1977: 279) and Areopolis (Russell 1980: 53–54).

The destruction caused by this earthquake stretched from Paneas in the north through Petra in the south, and from the coastal littoral through the Jordan Valley and beyond. The extensive archaeological evidence associated with it should be reviewed for information on the nature of archaeoseismic deposits as they appear in the archaeological record.

The Earthquake of 419

Several brief historical accounts have been noted for this earthquake. The entry for 419 in the *Marcellini Chronicon* records the event: "Many cities and towns in Palestine were thrown down by an earthquake" (1894: 74). Idatius, the bishop of Chaves (5th century) also provided an account in his *Chronicon* within the entry for 419: "A severe earthquake violently shook the holy places in Jerusalem and other localities" (1894: 19). Saint Augustine mentioned this earthquake in his undated *Sermon 19*: "News has been brought of a great earthquake in the East. Several great cities

suddenly collapsed. All of the terrified Jews, pagans, and neophytes wandering Jerusalem were baptized" (1961: 258).⁸

While only Jerusalem is specifically mentioned in these accounts, it is apparent that many sites in Palestine were affected. Whether the Negev, the Jordan Valley, or the regions east of the rift were affected as well cannot be established from these texts.

The earthquake of 419 has been used to date the collapse of Synagogue 2 at Khirbet Shema^c (Meyers, Kraabel, and Strange 1976: 36–38). It has also been suggested that the early 5th century destruction evidence at Khorazin relates to this earthquake (Yeivin 1973: 157; Russell 1980: 61, n. 5). The effect of this earthquake on Gush Ḥalav is unknown (Meyers 1982: 124), although the Geological Survey of Israel has suggested that the site is highly prone to earthquake damage because of its topographic setting (E. M. Meyers 1984, personal communication). A 419 destruction has ostensibly been identified at Antipatris (Kochavi 1976: 52, 1981: 84; Karcz and Kafri 1978: 245).

The Earthquake of September 498: Inappropriate for the Study Area

While this event was briefly noted in the *Chronicle of Eddesa*, an extended account of this earthquake exists in the *Chronicle* of Joshua the Stylite, composed in Syriac in 507. The following passage is from the English edition of the text by William Wright (minus explanatory insertions in Greek):

In the month of *ḥlūl* (September) there was a violent earthquake, and a great sound was heard from heaven over the land, so that the earth trembled from its foundations at the sound; and all the villages and towns heard that sound and felt the earthquake. Alarming rumors and evil reports came to us from all quarters; and, as some said, a marvelous sign was seen in the river Euphrates and at the hot spring of Abarnê, in that the water which flowed from their fountains was dried up this day. . . . There came too in the course of this month a letter, which was read in church before the whole congregation, stating that Nicopolis had fallen to the ground of a sudden at midnight and overwhelmed all its inhabitants. Some strangers too who were there, and certain brethren from our schools who were traveling thither and happened to be on the spot, were buried (in the ruins). Their companions who came

(back from thence) told us (this). The whole wall of the city all round, and everything that was within it, was overturned in that night, and not one person of them remained alive, save the bishop of the town and two other men, who were sleeping behind the apse of the altar of the church (1882: 23–24).

Joshua further noted that the church of Arsamosata also collapsed at that time, crushing most of the people assembled there (1882: 25–26). The year of this event was given as A.G. 810 (1882: 23), thereby dating the earthquake to September 498.

Since both Arsamosata (= Arsameia) and the hot spring of Abarnê were located in the region of Commagene, the Nikopolis referred to in these texts would seem to be Nikopolis of Euphratensis (Hierocles' *Synecdemus* 1939: 40), not Nikopolis of Palestine or Nikopolis of Pontus. This earthquake would therefore have affected the provinces of Euphratensis, Osrhoena, and Mesopotamia, and thus the use of this account to document an earthquake in the study area is unwarranted.

The Earthquake of August 22, 502

Ancient documentation of this event is again found within the *Chronicle* of Joshua the Stylite. After noting a rare display of the *aurora borealis* across the northern quarter of the sky during the night of 22 *Ab*, A.G. 813 (= August 22, 502), the following earthquake account was presented:

We received, however, a letter from some acquaintances of ours, who were traveling to Jerusalem, in which it was stated that, on the same night in which that great blazing fire appeared, the city of Ptolemais or ʔAkkô was overturned, and nothing in it left standing. Again, a few days after, there came unto us some Tyrians and Sidonians, and told us that, on the very same day on which the fire appeared and Ptolemais was overturned, the half of their cities fell, namely of Tyre and Sidon. In Bêrýtus (Beirût) only the synagogue of the Jews fell down on the day when ʔAkkô was overturned (1882: 37).

Unfortunately, only the occurrence of the *aurora borealis* was recorded in the *Chronicle of Edessa*, although the date given was again the 22nd of August, 502 (1955: 8; 1864: 36).

As with the earthquake of 306, that of 502 specifically affected the southern Lebanese littoral.

However, the 502 earthquake also affected regions as far south as Ptolemais, which would strongly suggest simultaneous seismic activity at both the Safed and Reina epicenters of the Galilee. The 502 earthquake could have been responsible for the deposition associated with the Gush Halav coin hoard (Meyers, Strange, and Meyers 1979: 52–55). The latest and most frequent coins identified in this hoard were struck during the reign of Anastasius I (491–518).

The Earthquake of July 9, 551

The most extensive ancient account of this earthquake is that given in the *Chronographia* of Theophanes (ca. 758–817), the principle ancient source for Byzantine chronology in the 7th and 8th centuries (Ostrogorsky 1934: 2130; Vasiliev 1958: 291–92), who wrote:

Indeed, on the 9th day of July, a great and terrible earthquake occurred throughout the regions of Palestine, Arabia, Mesopotamia, Syria, and Phoenicia, to such an extent that it caused Tyre, Sidon, Beirut, Tripoli, and Biblos to receive great damage, and many thousands of people perished. Further, at the city of Bostra, a large part of the mountain adjacent to the sea, which is called Lithoprosopus, was separated and displaced into the sea. And it produced a suitable port for receiving many large ships which the former port of that city would not hold. The Emperor sent, however, great sums of money for the ruins of those cities to be repaired. The water also withdrew for a mile out to sea, by reason of which many ships were sunk to the deep, and thereafter, by command, it drew itself back into its permanent hollow (1839: 353).⁹

The erroneous reference to Bostra, capital of the province of Arabia, appears in the 10th century Paris Codex Gr. 1710, and Classen noted that the 12th century Vatican Codex 154 referred instead to Botryos (Classen 1839: vii, 352). This earthquake was said by Theophanes to have occurred in A.M. 6043, which dates it to July 9, 551, according to the era he employed.¹⁰

Theophanes' account was closely followed by the Byzantine chronicler Georgius Cedrenus (fl. ca. 1081 to 1118):

On the 9th day of July, a terrible earthquake occurred throughout Palestine, Arabia, Mesopo-

tamia, Syria, and Phoenicia which leveled many cities and destroyed many mortal men. In the city which is called Botryos, which means "clusters of grapes," a large part of the mountain adjacent to the sea, called Lithoprosopus, was displaced and fell into the sea and produced a great port suitable for receiving many large ships which that city's port would formerly have been without. The water also withdrew for a mile out to sea, and thereafter, by command, flowed back (1838: 659).

Cedrenus placed this event in the 24th year of Justinian's reign (= August, 550 through July, 551).

The destruction of Tripoli, Byblos, Tyre, Beirut, and Sidon by this earthquake was also recorded in the *Antonine Itinerary* (written ca. 560–70). Unfortunately, this event was simply dated within the reign of Justinian (*Antonine Itinerary* 1896: 2–3).

Agathius Scholasticus (ca. 531–80), a lawyer who lived in Constantinople, also recorded this earthquake, and described the extensive damage Beirut had suffered (1967: 59–60). His emphasis apparently reflects the fact that Beirut was at this time one of only three centers for legal studies in the empire, and was well known for its magnificent buildings and numerous works of art (Gibbon 1907: 295; Robinson 1841: 442–43; Vasiliev 1958: 147). Agathius, however, did not provide an exact date for this event. Further, he postponed his account of it until after he had completed his description of the final events of the Ostrogothic war in 554 (Gibbon 1907: 295, n. 126). His earthquake narrative was therefore introduced with the temporally vague statement "At [or 'about'] this time . . ." (1967: 59).

Agathius prefaced his description of the damage and subsequent reconstruction efforts at Beirut with the statement that Byzantium (Constantinople) and many other places in the provinces—including cities on islands—where shaken by this earthquake (1967: 59). Given the withdrawal of the sea from the Lebanese coast as noted by Theophanes and reiterated by Cedrenus, it would seem likely that a downward displacement of the sea floor in the eastern Mediterranean had accompanied this earthquake, and was responsible for tremors throughout the region. A similar displacement of apparently greater magnitude had attended an earthquake in the eastern Mediterranean on July 21, 365, creating a tidal wave of immense

proportions (Russell 1980: 53). If correct, archaeological damage from 551 should be found on Cyprus.

Finally, Agathius also stated that this earthquake was felt in Alexandria. He wrote, in a poorly-expressed narrative, "Then in great Alexandria, which is situated on the Nile River—and it is notable that that land does not customarily experience earthquakes—there was a common perception of the crowd, albeit very slight and weak and not at all conspicuous, but nevertheless, it happened" (1967: 60).¹¹ It therefore appears that Alexandria did not receive damage during the 551 earthquake. However, as can be documented for an equivalent earthquake in 748 (below), sites in the eastern delta may have been damaged, particularly Damietta.

Textual documentation thus suggests that a disastrous earthquake on July 9, 551, wrought a path of destruction from the three provinces of Palestine through at least the province of Syria II. Since destruction was also mentioned in the province of Mesopotamia, the province of Osrhoena, between Syria II and Mesopotamia, probably was also affected. Northeastern Egypt may have suffered damage as well. However, there is no textual evidence to suggest that Syria I (with its capital at Antioch) was damaged at this time. The emphasis on describing the destruction along the Lebanese coast—a bias of many ancient accounts of this event—undoubtedly reflects the disastrous effects which this earthquake had on these commercial and social centers of Justinian's empire.

Crowfoot (1938: 233) suggested that at Jerash the mid-6th century construction of the Propylae Church occurred after the 551 earthquake had caused the collapse and abandonment of the bridge whose approach had been blocked by this church. This earthquake also appears to have been responsible for the destruction and subsequent abandonment of the Town of Nebo (Saller and Bagatti 1949: 217, n. 2). Parker (1982: 7–8, 10, 1983: 230) has recently uncovered mid-6th century destruction evidence in the *principia* and barracks of the Lejjun fortress, which he attributes to the 551 earthquake. The extensive mid-6th century destruction of Petra is also attributed to the 551 earthquake (P. C. Hammond 1983, personal communication).¹²

While Justinian is said to have supplied funds

for the reconstruction of ruined cities, such aid was apparently limited to the major cities of the Lebanese coast. For example, Petra, the capital of *Palaestina tertia*, was never rebuilt after the 551 earthquake, and by the end of the 6th century, its ruins had become a quarry for liming and smelting operations.

Both the dating and geographic extent of this earthquake became confused in later earthquake accounts and catalogs. The confusion appears to have occurred because there were several earthquakes in the eastern Mediterranean during the later reign of Justinian.

In the autumn of 551, another earthquake caused extensive damage in Greece around the Corinthian Gulf and in Boetia and Achaia; a consequent tidal wave destroyed two cities at the upper end of the Maliac Gulf. The historian Procopius (ca. 500–ca. 562) documented this latter earthquake but totally excluded that of July 9th (1928: 322–23), as did Evagrius Scholasticus (1964: 170–71).

On August 15, 554, yet another earthquake occurred in the regions of Byzantium and Bithynia. Aftershocks were felt for 40 days, and the event left such an impression on the affected populations that it was remembered annually in a festival held, appropriately, in an open field. This event is documented in Theophanes' *Chronographia* (1839: 354–55) and in the *Anastasio Bibliothecarii Historia Ecclesiastica*, an abridged Latin version of Theophanes' *Chronographia* made by the papal librarian Anastasius in the second half of the 9th century (1841: 105).

Finally, an earthquake in 561 severely damaged Anazarbus, the capitol of Cilicia II, as well as Antioch and Seleucia in the province of Syria I (Cedrenus 1838: 678–79; Procopius 1954: 224–27; Theophanes 1839: 364).

Cedrenus, writing in the early 12th century, also provided an account of the earthquake of August 15, 554. However, while most of his account reiterated the earlier narrative of Theophanes, he further stated that Antioch was also damaged at this time, along with cities in Arabia, Palestine, and Mesopotamia (1838: 674). Apparently, Cedrenus, or later editors of his work, conflated accounts of the July 9, 551 earthquake with those of 554 and 561.

A similar conflation of mid-6th century earthquakes appears in the *Chronicle* of Michael the Syrian (1901), written in Syriac in the mid- to late

12th century. Michael also recorded the earthquake of July 9, 551, noting damage to the cities of the Phoenician coast as well as villages in the Galilee (1901: 244). However, his subsequent account of the August 554 earthquake is apparently split in two, and one narrative appears at the end of his account of events in 551, while the other was placed within his account of events for 558 (1901: 245–46). Further, his description of the collapse of Mount Lithoprosopus at Botrys and the damage incurred at Beirut during the 551 earthquake was conflated with the 554 earthquake narrative erroneously placed among the events of 558 (1901: 246–47).

When Clinton compiled the tables for his *Fasti Romani* (1845), he apparently correlated the account of the July 9, 551 earthquake given by Agathius with the corrupt account of the 554 earthquake presented by Cedrenus. Both these accounts, along with Theophanes' narrative for 554, were then collectively used to document a 554 earthquake that ostensibly caused damage from Constantinople through Palestine (Clinton 1845: 802). However, Clinton did not record any earthquakes for the year 551 (1845: 792–96).

This temporal and geographic confusion has subsequently appeared in modern earthquake catalogs. Avranitakis noted (1903: 179) a 554 earthquake in Thrace, Asia Minor, Egypt, Syria, and Palestine while Willis (1928: 79) apparently added the account of Procopius for the 551 earthquake in Greece to document a 554 earthquake in "Greece, Syria, Mesopotamia, etc." Amiran (1950–51: 226) subsequently included a 554 earthquake in his catalog by reference to Clinton, Arvanitakis, and Willis, stating that "Cedrenus mentions Palestine, Agathius Beirut."

To reiterate, only the earthquake of July 9, 551 specifically affected the regions of Palestine and northwest Arabia.¹³

The Earthquake of September 633

By 630, the Byzantine empire had lost southern Jordan, with its abandoned capital of Petra, to the emergent power of early Islam. In the subsequent Arab assault on southern Palestine, a military force from Caesarea under the command of the patrician Sergius apparently suffered annihilation. After noting this defeat, Theophanes recorded an earthquake, saying, "Also in the same year an earthquake affected Palestine, and a sign

was seen in the direction of the southern sky exhibiting the shape they call the 'Celestial Cross,' which was fortelling the Arab Empire. And it lasted for 30 days, stretching everywhere from the South to the North, and it assumed the shape of a sword that was striking" (1839: 516). Theophanes placed these events in A.M. 6124 (= September, 632 through August, 633).¹⁴ Cedrenus (1838: 745) ignored the occurrence of this earthquake, and instead recorded only the comet, an account of which was placed at the end of his condensed narrative of events during the years 631 through 633.

Michael the Syrian also recorded this earthquake in his *Chronicle*. Chabot's French translation of the relevant passage reads: "*En l'an 945 des Grecs, il y eut un violent tremblement de terre, aus mois d'îloul, et après le tremblement, il y eut un signe dans le ciel; il se présenta sous la forme d'un glaive s'étendant du sud au nord, et demeura pendant 30 jours. Il sembla à plusieurs qu'il signifiait la venue des Taiyayê*" (1901: 414). According to Michael's account, this earthquake occurred in September of 633. His dating has been adopted here for convenience.¹⁵

While further supportive historical documentation has not yet been located, it seems that an earthquake did occur in the region of Palestine at the time of the initial Islamic assaults. However, it is suspected from the general tone of these accounts that this earthquake was less destructive than others which were anciently recorded, and that the region it affected may have been circumscribed in actual extent within Palestine.

At Beth-shan, Fitzgerald (1931: 7) uncovered three Byzantine houses that had collapsed and burned in the early 7th century, sealing coins of Anastasius I, Justin II, Maurice Tiberius, and Phocas beneath their destruction debris, a temporal span ca. 491–610. In the Byzantine monastery at Beth-shan, gold coins of Heraclius (610–641) were sealed beneath similar collapse debris (Fitzgerald 1939: 4). This destruction was likely a result of the 633 earthquake.

The Earthquake of June 659 and a Subsequent Earthquake in the Jordan Valley

As a result of internal Arab discord in 658/9, the Islamic governor of Syria, Mu^cawiyah (who later founded the Omayyad Caliphate), entered a brief truce with the Byzantine empire (Hitti 1951:

427). After documenting these events for the year A.M. 6150 (= September, 658 through August, 659), Theophanes further noted an earthquake, writing, "... in the month of Daesio in the second indication, a great earthquake throughout Palestine and Syria had given cause for an extensive collapse of the buildings of the East" (1839: 531). The second indication would have occurred between September 1, 658 and August 31, 659 (Ware 1976: 227; Ostrogorsky 1934: 2130). Further, Daesio was the Macedonian month corresponding to the Attic Thargelion (= May/June; Hamilton 1969: 39), dating this event to May/June 659.

This earthquake was also recorded in the 11th century *Chronographia* of Elias of Nisibis: "And in the month of ḥazirān there was an earthquake and it overthrew a major portion of Palestine and many neighboring regions" (1954: 68). Elias placed this event in A.G. 970, thus dating it to June 659.

Further documentation of this earthquake is found in the *Maronite Chronicle* (1899: 323; 1955: 54), written in Syriac shortly after 664: "In the year 970, the 17th of Constans, in the month of ḥazirān, on a Friday at the second hour, there was a violent earthquake in the region of Palestine: many places were overthrown by that." Again, the date was June 659. Further, since Constans II was proclaimed emperor in the autumn of the ancient year 641/2 (as derived from Theophanes 1839: 523; see also Vasiliev 1958: 193), the 17th year of his reign would have been from the autumn of 658 through the summer of 659.

Apparently this earthquake affected the region of Palestine, with damage extending north through Syria. That the Jordan Valley and regions east of the rift were not immediately affected is suggested by the subsequent occurrence of an earthquake in the Jordan Valley, recorded in the *Maronite Chronicle*. According to this document, a very large crowd of Arabs had gathered in Jerusalem to proclaim Mu^cawiyah as Caliph. Mu^cawiyah, with a crowd following him, had gone to pray on Mount Golgatha, and subsequently at the Sepulchre of Mary in Gethsemane. The continuing narrative reads:

At that moment, while the Arabs were gathered there with Mu^cawiyah, there was a foreshock and a violent earthquake, by which it overthrew the greater part of Jericho and all of its churches. And the Church of St. John, built next to the Jordan in honor of our Savior's baptism, was

destroyed to its foundations, along with the entire monastery. The Monastery of St. Euthymius, along with many habitations of monks and hermits and many villages, were also overthrown in this quake (1955: 55; also 1899: 324).

This event was dated to both A.G. 971 (= September, 659 through August, 660), and the 18th year of Constans II (= autumn 659 through summer 660).

It seems plausible that the June 659 earthquake had created stress along the tectonic structures of the Jordan Valley, which triggered an earthquake the following year. Chitty (1928: 176; 1932: 196) correlated evidence of extensive 7th century reconstruction in the Monastery of St. Euthymius with the 659/60 earthquake in the Jordan Valley. Regions east of the rift may also have been affected at this time.

An Earthquake in 672 (Textually Undocumented)

According to Amiran (1950–51: 226), an earthquake in 672 damaged Gaza, Ashqelon, and Ramle. This is the same description given by Robinson for this event (1865: 325–26). Both scholars referred to volume 16 of Karl Ritter's *Erdkunde* (1852) for documentary support. But Ritter did not explicitly note ancient documentation for this event (1852: 64, 70), and none has yet been located. Since there is sufficient reason to doubt that a localized earthquake would have occurred in the vicinity of the Ramle/Lydda or Balah/Gaza epicenters at this time, the future use of this date will have to be supported by explicit reference to the ancient text or texts that, presumably, document this event. There is currently insufficient evidence to adequately evaluate its occurrence.

The Earthquake of January 748

An account of this earthquake in Theophanes' *Chronographia*, reads: "This year, on the 18th day of the month of January at the 4th hour, a great earthquake occurred in Palestine, around the Jordan, and in all of Syria, to such an extent that many innumerable and countless people perished in its power, and churches and monasteries collapsed, and all around the greatest of holy places there were deserted cities" (1839: 651). The date given was A.M. 6238, dating this earthquake to January 18, 747. However, Theophanes noted the

initial Abbasid revolt against Marwan prior to presenting his earthquake narrative, dating the revolt to 745/6 (A.M. 6237; 1838: 650). The commonly accepted date is June 747 as derived from Arabic sources (Hitti 1951: 530), which suggests the possibility of an error in Theophanes' dating.

Cedrenus also recorded this earthquake, largely replicating the previous account and dating of Theophanes. "In the 6th year," he wrote, "there was a great earthquake in Palestine, and towards the Jordan, and throughout all of Syria, on the 18th day of January at the 4th hour. Many thousands of people perished, and churches and monasteries collapsed, from the greatest of holy places through deserted cities" (1839: 7). The sixth year of the reign of Constantine V would have been from June, 746 through May, 747, but this dating is ultimately derived from Theophanes (1839: 635).

Another account of this earthquake exists in a 10th century Arabic manuscript on the history of the patriarchs of the Coptic Church of Alexandria by Severus ibn al-Muqaffa, bishop of Ashmunein (fl. ca. 955–987). Evett translates the relevant passage:

And that night there came great wrath from God, for there was a great earthquake in the land, and many houses were ruined in all the cities; and none was saved from them, not a single soul; and likewise on the sea many ships were sunk on that night. This happened all over the East, from the city of Gaza to the furthest extremity of Persia. And they counted the cities that were wrecked that night, and they were six hundred cities and villages, with a vast destruction of men and beasts. But the land of Egypt was uninjured, except only Damietta. And at Miṣr there was only great fear, without any death or ruin of houses; for though the beams in the doorways and walls were moved out of their places, they went back again to their places after two hours (Severus ibn-al-Muqaffa 1910: 139–40).

Al-Muqaffa presented this narrative while recounting events in the life of the patriarch Michael I (744–768). However, according to his account, this earthquake occurred on the 21st of *Tuba* (1910: 139), the Arabic name for the Egyptian month of *Tybi*. Since this month began on the 27th of December (see Bickerman 1974: 50), the 21st of *Tuba* would have been the 16th of January. Al-Muqaffa also noted the initial Abbasid revolt against Marwan (1910: 134) prior to his presenta-

tion of the earthquake narrative, thereby suggesting that this earthquake occurred on January 16, 748 according to the accepted date of the initial Abbasid revolt.

Two other accounts further support a 748 date. The first is given in the *Chronicle* of Michael the Syrian. This is also the most regionally detailed account of this earthquake. Chabot's French translation of the relevant Syriac text reads:

Au milieu de ces choses, il y eut à Damas un tremblement de terre qui dura des jours et qui la secoua comme la feuille des arbres. Il y avait à Beit Qoubayê (?), une forteresse qui avait été bâtie par Ḥadjdjadj, fils de Yousef, et pour laquelle il avait fait de grandes dépenses. Elle fut renversée de fond en comble et plus de 80 personnes y furent suffoquées; dans la ville même, beaucoup périrent. Dans la Ghauthah et à Dâreiya plusieurs myriades de gens périrent. Bogra, Nawa, Der'at, Ba'albek furent totalement englouties.

Dans la région de Balqa, c'est-à-dire de Mo'ab, il y avait une forteresse située sur le rivage de la mer, dans la-quelle habitaient des Taiyayê yéménites: quand les flots de la mer se heurtèrent contre elle, ils l'arrachèrent de ses fondements, et la projetèrent à trois milles.

Ce tremblement de terre détruisit la ville de Tibériade, à l'exception de la maison d'un homme nommé 'Isa. Il y renversa trente synagogues des Juifs, et de merveilleuses choses naturelles. Les thermes, édifice admirable, bâti par Salomon, fils de David, furent renversés et s'écroulèrent.

Près du mont Thabor, un village se déplaça de quatre milles, avec ses maisons et ses constructions, sans qu'une pierre ou un peu de pisé tombât de ses bâtisses; et pas un homme n'y périt, ni aucun animal, pas même une poule.

La source d'eau qui était à côté de Jéricho s'éloigna de sa place de six milles.

A Mabboug, le tremblement survint au moment de l'oblation; les hommes et les bêtes furent tués, car les grandes églises furent renversées ainsi que les murs (1901: 509–10).

Since Michael recorded these events for the year A.G. 1059, a date between September 747 and August 748 is suggested.

The second supportive account comes from the 11th century *Chronographia* of Elias of Nisibis:

Further, there were many earthquakes and many regions gave way. And miraculously, a village adjacent to Mount Thabor was displaced four miles away from its own location along with

houses and their possessions, and not one piece of wall plaster fell from those houses, and not a single person perished in it, nor animal nor cock. And further, the church of the Jacobites in the city of Mabbug collapsed on Sunday at the time of the Eucharist, and many people perished in it (1954: 82).

The date of A.G. 1059 given in Elias' text would again place the occurrence of this earthquake between September 747 and August 748.

Finally, a 748 date agrees with that given by the 16th century Egyptian polygrapher As-Soyuti for a severe earthquake in Damascus (A.H. 130 = September 747 through August 748; Ambrassey 1962: 78), as well as the "quake in the sabbatical year" apparently recorded in Talmudic literature (Ben-Dov 1976: 101; Mazar 1975: 269).

While a final resolution of this temporal problem cannot yet be offered, a 748 date is probable and has been adopted here. However, regardless of whether a 747 or 748 date is ultimately determined to be correct, only one earthquake occurred in the study area during this period.

As suggested for the earthquake of July 9, 551, the region affected by that of 748 apparently stretched from northeastern Egypt through northern Mesopotamia. The 748 earthquake has been correlated with destruction evidence at Khirbet al-Mefjer (Baramki 1942), Pella (Smith 1973: 166), and Jerusalem (Ben-Dov 1976: 101; Mazar 1975: 269). The final destruction of the basilica at Mt. Nebo also appears to correlate with this earthquake (Schneider 1950: 2–3), as do the collapsed Omayyad structures uncovered in 1949 on the Amman citadel (Harding 1951). At Jerash, this earthquake apparently brought an end to the impoverished "squatter" occupation in the Church of St. Theodore (Crowfoot 1929: 25, 1938: 221) and parts of the churches of St. John the Baptist, St. George, and SS. Cosmas and Damianus (Crowfoot 1938: 242, 244). Finally, Umm al-Jamal apparently suffered damage at this time and was subsequently abandoned (de Vries 1981: 65, 71).

The Earthquake of March 9, 757

The earthquake of 757 completes the present analysis of earthquakes in Palestine and Arabia through the mid-8th century. Theophanes wrote of this earthquake, "In this year, an earthquake, by no means mild, affected Palestine and Syria on

the 9th day of the month of March" (1839: 662–63). The year referred to was A.M. 6248, which dates the event to March 9, 757.

Further textual documentation of this earthquake has not been found. Cedrenus, for example, did not record any events at all between June 754 and June 759 (1839: 10–11). Even so, the temporal proximity of this earthquake to Theophanes' own lifetime (ca. 758–817), coupled with his general accuracy and consistency in documenting earlier earthquakes, suggests that sections of ancient Palestine and Syria were indeed affected by an earthquake on March 9, 757, provided that his dating is correct. Whether the Negev, the Jordan Valley, or the regions east of the rift were affected as well cannot be established from this text. No archaeological evidence has yet been correlated with this earthquake.¹⁶

Summary of Earthquake Data

Ten earthquakes are textually documented that would have affected the regions of Palestine and northwest Arabia between the 2nd and the mid-8th century. The most extensive and disastrous appear to have been those of 551 and 748. The earthquake of 363 was equally destructive, but its effects were primarily limited to the study area. Less is known about the Palestinian earthquakes of 419, 633, 659, and 757, although those of 659 and 757 apparently caused damage north through Syria as well. The earthquake of 659/60 affected the Jordan Valley and probably the regions immediately east. The earthquakes of 306 and 502 affected the southern Lebanese littoral, but probably involved seismic activity at the Safed and Reina epicenters in the Galilee as well. An earthquake in 672 has been postulated for the southern Palestinian littoral, but is undocumented by currently extant ancient texts or archaeological data. Finally, an early 2nd century earthquake has been proposed on the basis of archaeological data, although ancient textual support for it is currently lacking. Table 1 summarizes these chronological and regional data.

Readers familiar with the excavation records of sites dating between the 2nd and the mid-8th century in the study region will immediately note that archaeologists have previously used several additional dates for interpreting evidence of destruction and rebuilding. Given the proliferation

of earthquake dates ascribed to these regions in previous catalogs and the general tendency of archaeologists to intuitively accept or reject such accounts without critical analysis, the potential for error has obviously been great.

Frequently, archaeologists have uncritically used any available earthquake date convenient for their interpretive purposes. Further, such use has often been achieved through assertion by appeal to the authority of available earthquake catalogs which we have demonstrated to contain cumulative errors in both documentation and analysis. In some instances, archaeologists have not given adequate consideration to poor construction techniques or adverse geotechnical effects when interpreting assumed archaeoseismic evidence (Karcz and Kafri 1978). That some archaeologists would refuse to take archaeoseismology seriously is understandable in light of such applications.

Archaeologists should accept a scholarly obligation in future studies to justify their use of earthquake dates by textual reference and analysis coupled with regional archaeological and geological support (Karcz and Kafri 1978: 251–52). Further, archaeologists using anciently recorded earthquakes in Syria to date destructions in Palestine and northwest Arabia should realize that these regions are structurally and hence seismically separate (Willis 1928: 86, 89–90). While both areas may be simultaneously active, an earthquake recorded for one region does not automatically imply that the other region incurred damage as well.¹⁷

EARTHQUAKE DESTRUCTIONS IN ARCHAEOLOGICAL RECORDS OF LATE ROMAN, BYZANTINE, AND EARLY ISLAMIC PALESTINE AND NORTHWEST ARABIA

A particularly difficult task is the regional evaluation of earthquake deposits as they appear in the archaeological records of excavated sites. However, this difficulty does not result from the absence of such evidence coincidental with the earthquakes documented here. Several destructions and rebuildings have been correlated with these events (as noted above), even though the exact dates used have sometimes been in error. The principal difficulties in regional earthquake analyses stem from interpretational problems in recognizing archaeoseismic deposits.

At some sites, particularly those dating to the Late Byzantine and Early Islamic periods, evidence of collapse and subsequent abandonment has often been interpreted as the sole result of the longterm decay of structures standing empty for centuries. Frequently, this evidence has been arbitrarily removed without appropriate recording during architecturally-oriented clearance projects. Further, archaeologists have often assumed that the evidence of destruction and rebuilding was solely the result of social factors, particularly invasion, civil revolt, or simple repair and renovation unrelated to earthquakes.

Since a site-by-site analysis of archaeoseismic evidence would require greater space than allowed here, the following general observations on the interpretation and nature of earthquake evidence in archaeological contexts are presented instead.

Unrecognized Archaeoseismic Evidence

Archaeological evidence of a local recovery from an earthquake, as reflected by subsequent structural repair and renovation, has not always been correlated with the prior occurrence of an earthquake. Such is the case for the evidence of architectural collapse and subsequent rebuilding at Ramat Raḥel after the 551 earthquake (Aharoni 1964: 15, 41, 121–22), and similar evidence at Capernaum after the 363 earthquake (Loffreda 1972, 1973). In part, the failure to make such correlations may stem from excavators' having been unaware that such events were recorded as having occurred at these points.

A further problem in recognizing a correlation between earthquake destructions and subsequent rebuilding results from the potential time lag between such events. While recovery in favorable economic environments might occur immediately after such a disaster, in a depressed economic environment, recovery could extend over a longer period.¹⁸

Archaeoseismic Damage and Cultural Interpretations

Archaeologists often emphasize variations in the social environment over variations in the physical environment when interpreting depositional evidence (Winterhalder 1980; Russell 1983: 12–18). In the case of earthquakes, the close temporal

proximity of such natural disasters to better known social events creates a potential for this type of interpretive error. Earthquake destructions as they appear in archaeological deposits often exhibit attributes common to our preconceived notions of what the residues of war and civil revolt might look like, particularly when accompanied by extensive evidence of burning (Russell 1980: 54–55).¹⁹ However, the geographic extent of the consequent destruction, the quantity and quality of artifacts buried beneath collapse debris, and the directional patterning of column, pilaster, and wall collapse (see below) readily differentiate earthquake destructions from most humanly patterned residues. Only in such historical incidents as the Roman reduction of Carthage and Jerusalem would human destruction approach that of major earthquakes. However, in such cases the destruction evidence would be regionally localized to relatively few sites, and would not consistently exhibit a directional patterning of collapse.

The archaeological interpretation of the depositional evidence associated with the earthquake of May 19, 363, exemplifies this interpretive difficulty. The 363 earthquake coincided with Julian's attempt to rebuild the Temple in Jerusalem (Levenson 1979) and occurred within ten years of a minor Jewish revolt in the Galilee (Lieberman 1946). Thus, while the mid-4th century destruction evidence at Hesbân (Mitchel 1980: 193–96, 684), ʿArâq el-Emîr (Lapp 1962, 1963), Shechem (Bull and Campbell 1968: 5–17), Gush Halav (Meyers, Strange, and Meyers 1979: 37), Lejjun (Parker 1983: 221), and Petra (Russell 1980) has been correlated with this earthquake, such evidence in Jerusalem was attributed to the activities surrounding Julian's Temple project (Mazar 1975: 247, 1976: 6), while at Beth Sheʿarim it was seen as evidence for a violent Roman suppression of the Jewish revolt (Mazar 1973: 6).

A similar potential for interpretive error exists with the earthquakes of 551, 633, and 659, since these dates bracket the Persian invasion of 614 and the Islamic assaults on Byzantine Palestine and Arabia between 629 and 640. Destruction evidence at Caesarea (Toombs 1978; Wiemkin and Holum 1981: 40–41), Jerusalem (Crowfoot and Fitzgerald 1929: 37, 53–54; Mazar 1975: 257; Ben-Dov 1976: 97), Pella (Smith 1973: 164), Mampsis (Negev 1971: 167), and Avdat (Negev 1961: 129–30) has been variously attributed to these invasions. A

similar interpretation was entertained for the early 7th century destruction evidence at Beth-shan (Fitzgerald 1931: 7, 1939: 4). Given the geographic extent and general depositional magnitude of these destructions, it would seem that both the Persian army and the forces of Islam invaded Byzantine Palestine and Arabia with bulldozers and destruction balls on wrecking cranes. It is strongly suggested that a more critical evaluation of destruction evidence is required before such interpretations can be sustained.

As with the use of earthquake dates, archaeologists should accept a scholarly obligation to support their invasion and civil strife interpretations by textual reference and analysis coupled with regional archaeological support. While it is certainly possible that some or all of the destruction evidence uncovered on these sites was a result of these invasions, current interpretations cannot be validly maintained while ignoring the potential of contemporaneous earthquakes. Given the known seismicity of the entire region, earthquake destructions must surely be more common in the archaeological records of the area than the reduction of urban communities on the scale of entire provinces by invading armies.²⁰

A Taphonomic Overview of Archaeoseismic Evidence

During an earthquake, the columns, pilasters, and walls of structures have a tendency to collapse in the opposite direction of the quake's epicenter or hypocenter. This directional patterning of collapse was recognized in the archaeoseismic evidence associated with the earthquake on Cyprus in 365 (Soren and Lane 1981; Soren 1981). At Kourion, the 365 destruction exhibits a collapse to the northeast, while in the simultaneous destruction at Paphos, only 30 miles away, the collapse was toward the northwest. According to triangulation, the epicenter (or hypocenter) of the 365 earthquake would have been approximately 30 miles southwest of Kourion, a well-known and currently active fault area on the floor of the Mediterranean Sea (D. Soren 1984, personal communication).

A similar patterning of collapse orientation has been noted at Petra (Kirkbride 1960: 120; Hammond 1977–78: 87), where structures, and

particularly associated pilasters and columns, exhibit a patterned collapse towards the southeast. This orientation corresponds with the previous suggestion (Russell 1980: 49–50) that the earthquakes that affected Petra were generated by seismic activity near Bir Madhkur, approximately 10 km northwest of Petra (Bender 1974: 114, 118).

It is most unlikely that either civil turmoil or military reduction would consistently result in such a directional patterning of structural collapse. In future studies, greater attention should be paid to such patterning.

When reconstruction (as opposed to abandonment) followed an earthquake destruction, it appears that buildings that had remained structurally sound were simply cleared of rubble and renovated. This often involved structural reinforcement and additions. In contrast, the ruins of less substantial structures were often leveled or filled, with usable architectural materials removed in the process. Remnants of earlier walls were often used as the foundations for newer structures built upon the leveled debris. The complete removal of damaged structures and collapse debris would represent an exceptional capital and energy investment, and would have been largely restricted to instances of imperial financing.

Structures that were not subsequently renovated or leveled were allowed to decay as rubble, and often served as quarries for building materials or as convenient refuse dumps. Subsequent liming activities in the destruction rubble commonly occurred. Quite often, water percolation through the loose collapse rubble would suspend and transmit the original construction clays and mortars to the lowest level of the destruction debris, creating secondary deposits under, around, and over the material remains on or near the floor (Russell 1980: 57; also n. 12 below). Only in cases of known or suspected valuables (e.g., large coin hoards, precious metals, or jewels), or large quantities of base metals (e.g., fixtures or plating) would there have been an incentive to salvage any of the crushed material remains from beneath the more extensive collapse debris.

Only three instances of human remains found beneath earthquake destruction levels can be noted at this time. The first consists of the remains of two individuals killed during the 363 earthquake at Beth She^carim (Mazar 1973: 35, n. 15). Two other victims have been discovered at Petra (P. C. Hammond 1983, personal communication). Exter-

nal to the study area, excavations at Kourion, Cyprus, have uncovered three victims of the August 21, 365 earthquake (D. Soren 1984, personal communication). Several reasons may be postulated for this apparent paucity of human remains: 1) the limited archaeological exposure of earthquake destructions at specific sites, 2) the decomposition of crushed remains, and 3) the fact that in the ancient world, as today, individuals sought to recover the bodies of friends and relatives from the collapse debris. On this last point, reference should be made to the eyewitness account of one Rev. Thomson concerning the circumstances extant in Safed, 17 days after the village was leveled by the earthquake of January 1, 1837:

As far as the eye can reach, nothing is seen but one vast chaos of stones and earth, timber and boards, tables, chairs, beds, and clothing, mingled in horrible confusion. Men every where at work, worn out and wo-begone, uncovering their houses in search of the mangled and putrified bodies of departed friends; while here and there, I noticed companies of two or three each, clambering over the ruins, bearing a dreadful load of corruption to the narrow house appointed for all living (as quoted by Robinson 1841: 472).

CONCLUSIONS

An evaluation of earthquake destructions in Palestine and northwest Arabia from the 2nd through the mid-8th century has been undertaken on the basis of ancient textual accounts and archaeological data. Contemporaneous archaeoseismic evidence at spatially discrete sites suggests several points of agreement between the historical and archaeological records of such events. It would further appear that many points previously seen as contradictions between these separate bodies of data might best be understood as resulting from cumulative textual errors in both ancient narratives and modern earthquake catalogs. The subjective nature of many archaeological interpretations also needs to be considered.

It has been suggested that the future use of earthquakes for chronological interpretations and the regional integration of archaeological data should be tempered with an objective evaluation of the depositional evidence for archaeoseismic damage and a critical examination of available ancient documentation. Such analyses should take into

consideration the geographic region or regions affected, local and regional tectonic structures, evidence of contemporaneous destructions at other sites, and the severity and patterning of the destruction as it appears in the archaeological record. Particularly significant in this last respect are the potential errors of interpretation that could result if the possibility of earthquake destructions is ignored while interpretations involving military invasions and social turmoil are merely asserted.

It is hoped that this research will serve to stimulate a wider scholarly interest in the interpretive and integrative potential of archaeoseismic evidence, as well as a greater historical appreciation for the social and economic significance of ancient earthquake destructions. Further textual research and testing of the present earthquake analysis is encouraged, for through such efforts greater precision and confidence in interpretation may be achieved. The archaeological utility of the present

chronology will obviously depend upon the interpretive insights it does or does not provide.

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All errors of translation, omission, or interpretation are mine.

NOTES

¹All dates in this text are A.D., except where specified.

²Most of the dates used in this manuscript for the lives of ancient authors are those found in the *Oxford Classical Dictionary* (Hammond and Scullard 1970). Other dates for both authors and individual works were derived from commentaries by the editors of specific texts. An excellent discussion and evaluation of various ancient authors and their works is found in Vasiliev 1958.

³The present evaluation is based upon the earthquakes documented in a restricted number of ancient texts. A more thorough scrutiny of ancient sources, particularly Talmudic commentaries, Gaonic responsa, further Syriac texts, and early Arabic sources would undoubtedly reveal additional references to specific earthquakes. Further, earthquakes that caused little damage or occurred in sparsely populated or marginal regions would not necessarily have been recorded. In addition, it will be suggested that sufficient data exist to propose at least one earthquake not yet documented in ancient texts.

⁴The conversion of Syriac dates in this manuscript follows the format presented by B. H. Cowper at the end of his edition of the *Chronicle of Edessa* (1864: 39, n. i). When an event fell within the last four months of a modern year (the Syriac months of *Īlūl*, *Tishrin* I, *Tishrin* II, and *Canun* I), 312 years were subtracted from the given Syriac date. For events recorded during the rest of the year, 311 years were subtracted. When

the month of an event was unspecified, the equivalent modern dating range has been given, as with the date 126/7 (= September 126 through August 127).

⁵The title "savior and founder" also occurs in civic dedications to Hadrian at Epidauros and Pergamum (Kraeling 1938: 48, n. 98). While the exact import of this title is unclear in the case of Epidauros, Pergamum would have suffered damage in an earthquake ca. 106 (see Eusebius *Chronicon* 1844–64: 606). This honorific title may have been given as a result of Hadrian's having supplied imperial funds for the city's reconstruction. Hadrian is also known to have supplied funds for the reconstruction of the Bithynian cities damaged by an earthquake ca. 122 (Eusebius *Chronicon* 1844–64: 613).

⁶The occurrence of an earthquake in the study region ca. 113–114 is not presented as a simple assertion, but rather as a testable hypothesis. If an earthquake did occur at this time, some evidence of archaeoseismic damage or rebuilding should be expected on most of the contemporaneous sites in the study region. Further, coins of Trajan should be found sealed beneath the collapse debris, but not coins of Hadrian. The substantive testing of this proposal is encouraged, and it has been presented in the above form to facilitate attempts at falsification.

⁷I recant my earlier questioning of a 306 destruction in the Upper Galilee (Russell 1980: 57–58), on the basis of discussions with E. M. Meyers concerning the relevant archaeological and geological evidence.

⁸David B. Levenson, of the Department of Religion at Florida State University, Tallahassee, brought the accounts of Idatius and St. Augustine to my attention.

⁹Amiran (1950–51: 226) presented part of Theophanes' account of this event, but erroneously referred to p. 192 instead of p. 352, in Classen's edition of the *Chronographia* (1839). Perrey (1850: 10) also referred to page 192 of the *Chronographia* to document the 551 earthquake, but this apparently relates to an 18th-century edition of Theophanes' work which was published in Bonn (Gibbon 1907: 295, n. 126).

¹⁰The era used by Theophanes counted 5492 years from the beginning of the world until the birth of Christ (Ostrogorsky 1934: 2130). This computation does not match the era of Byzantium, the era of Alexandria (*contra* Ostrogorsky 1934: 2130), or the Hippolytan era (for a discussion of these and other dating systems, see Ware 1976: 223). However, from A.M. 6099 (606/7) until 6204 (711/12) and again from A.M. 6219 (726/7) until 6266 (773/4), Theophanes' era dates are one year short (Ostrogorsky 1934: 2130). This temporal problem was apparently not recognized by either Perry (1848–50) or Amiran (1950–51). The A.C. dates given in Classen's edition of the *Chronographia* were apparently derived by using the Hippolytan era, which counted 5500 years from the beginning of the world until the birth of Christ.

¹¹I am indebted to Suzanne Olsen for meticulously translating this equivocal passage.

¹²The 551 earthquake has been used to date the 6th century destruction of the synagogue at Gush Ḥalav (Meyers, Strange, and Meyers 1979: 37; Meyers 1982: 121–22), although this correlation is suspect in light of the coin hoard sealed beneath the collapse rubble (see above). The "washed-in layer of yellowish soil" in which the hoard was found (Meyers, Strange, and Meyers 1979: 54) could represent postdestruction deposition as a result of water percolation through the loose collapse rubble, rather than human deposition prior to the 551 earthquake.

¹³It would seem that between 551 and 561, several major cities of Justinian's eastern empire were damaged by disastrous earthquakes. The probable significance of such events in the economic and political decline of the empire under Justinian's later reign has yet to be incorporated into our understanding of historical processes.

¹⁴Numerous temporal conflicts appear to exist among ancient and modern accounts of the early Islamic conquests. Contrary to Theophanes' text, Becker (1913: 340), Hitti (1951: 411–12), and Mayerson (1964: 198–99) placed the defeat of Sergius in 633/4. Further, while Theophanes dated the Islamic attack on Mu'tah (Mothus) to 631/2 (A.M. 6123; 1839: 515), the commonly accepted date is 629, prior to the capitulation of Aila, Adroa (Udruh), and al-Jarba to the forces of Mohammed in 630 (Hitti 1951: 410). A similar conflict between the chronology of Theophanes and those of Arabic, Syriac, and Jewish sources is noted for the earthquake

of 748.

¹⁵The comet mentioned by Theophanes, Cedrenus, and Michael the Syrian would not have been Halley's, since it would have returned to earth ca. March 13, 607, and again ca. September 28, 684. The changing form of the comet, which first appeared in the shape of a cross and later assumed the form of a striking sword, reflects its movement at perihelion.

¹⁶In addition to destructions in 748 and 757, the region of Syria also experienced earthquakes in 713 and 717 (Theophanes 1839: 587, 614; Ambrassey 1962: 77). The first half of the 8th century also saw the rapid decline of the Omayyad Caliphate (Hitti 1951: 527–32). The last Omayyad Caliph, Marwan II (744–750), even transferred the seat of government from Damascus to Harran (Hitti 1951: 529), probably as a result of frequent earthquake destructions and the growing discontent of his subjects. As previously observed for the disastrous earthquakes of the mid-6th century, the social and economic impact of earthquakes in the early 8th century has yet to be incorporated into our understanding of early Islamic history.

¹⁷The use of 713 and 717 earthquake dates to interpret destructions at Jerash (Crowfoot 1938: 248) and Pella (Smith 1973: 165; Smith, McNicoll, and Hennessy 1981: 17) exemplifies this tendency. Theophanes specified Syria (not Syria and Palestine) as the region affected by the 713 (1839: 587) and 717 (1839: 614) earthquakes. So did the 16th century Egyptian polygrapher Djelal-Eddin As-Soyuti (Ambrassey 1962: 77). Further textual and/or archaeological data are required before such interpretations may be sustained.

¹⁸At Capernaum, reconstruction of the synagogue after the 363 earthquake continued into the late 4th century (Loffreda 1972: 26–27). At Mt. Nebo (Saller 1941: 45–46) and Aereopolis (Zayadine 1971) in the region of ancient Moab, recovery after the 551 earthquake apparently did not occur until the end of the century. Related to this delayed recovery is the possibility that an influx of southeastern populations from decaying urban centers like Petra subsequent to the 551 earthquake was responsible for the intensified building during the late 6th and early 7th centuries in both Moab (Saller 1941: 248) and the Negev (Kraemer 1958: 23, 28–29; Colt 1962: 21–22).

¹⁹Nicomedia burned for five days and nights after the earthquake of 358 (Ammianus Marcellinus 1956: 344–45), while fire destroyed most of the structures left standing in Antioch after the earthquake of 526 (Malalas 1940: 125–28). Evidence of extensive conflagration should therefore be expected with many earthquake destructions.

²⁰The close temporal proximity of the violent mid-8th century B.C. earthquake recorded in Zech 14:4–5 and Amos 1:1 with the Assyrian invasions of Tiglath-Pileser III, Shalmaneser V, and Sargon II suggests a similar potential for interpretive error in earlier periods.

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