

Archaeological evidence for the tsunami of January 18, A.D. 749: a chapter in the history of Early Islamic Qâysariyah (Caesarea Maritima)

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In a previous article in this journal, we reported on recently-discovered archaeological and geoarchaeological evidence for two tsunamis which struck the Levantine coast in A.D. 115 and 551, based on fieldwork conducted on the submerged coastal shelf in and around the Roman harbor of Caesarea Maritima; we went on to consider the possible effects of these natural cataclysms on the viability of the port and the fortunes of the city over the *longue durée*. We proposed that the tsunami of 551, in particular, may have had a prolonged and significant effect on Caesarea's ability to function as a premier deep-water anchorage and economic entrepôt, which may in turn have contributed to a broader pattern of economic and demographic decline in the city and region as a whole in the decades leading up to the Persian invasion and subsequent Arab conquest in the first half of the 7th c.¹ Here, we pick up on two points made in that article, expanding on them in light of further physical traces at Caesarea of yet another tsunami, this one associated with the devastating earthquake of January 18, A.D. 749, which left such lasting traces of destruction across the region — nowhere more visibly than in the monumental topography of urban centers such as Scythopolis, Madaba, Damascus, and Caesarea itself.²

A great deal of archaeological data recovered from the harbor and its environs, which puzzled past researchers and occasioned much debate about the functionality of the port facilities at various times and about the causes of the harbor's eventual decline, might be explained as the result of tsunamis;³ indeed, many aspects of the history and topography of the site as interpreted over the course of several decades need to be re-assessed in light of the evidence we now have for recurring marine transgressions resulting from seismically-induced waves.

Life in Caesarea did not come to an end with the political and military upheavals of the early 7th c., as a growing corpus of data shows, though the city was smaller and poorer than it had been in its heyday between the 4th and mid-6th c.⁴ One early sign of continuing

1 Dey and Goodman-Tchernov 2010.

2 For the date, see Tsafir and Foerster 1992, especially 234; on the location and magnitude of the event, see Marco *et al.* 2003. At Caesarea, the best evidence of destruction attributable to the 749 earthquake comes from Area TPS, on the S side of the Temple Platform, where a thick layer of débris marks the end of the Umayyad occupation of the Late Byzantine bath complex, which was subsequently infilled and built over in the later 8th c.: see Raban and Yankelevitz 2008, 81; Arnon 2008, 85. Another probable effect of the earthquake was the collapse of the octagonal church on the platform: see Stabler and Holum 2008, 30-31. For a closely-contemporary, apparently eyewitness account of the devastation wrought by this earthquake, see the newly-translated *Continuatio of the Samaritan Chronicle of Abû 'l-Fath* = Levy-Rubin 2002, 56; on the origins and authorship of the text, *ibid.* 10-19.

3 Tsunamis now appear to be the prime force behind the submergence of the breakwaters of the outer harbor beginning in the early 2nd c., which earlier researchers found difficult to explain without invoking seismic slumping (for which there is little or no evidence); in addition to Dey and Goodman-Tchernov 2010, see also Reinhardt *et al.* 2006.

4 The archaeological and textual evidence for the condition of the city from the 7th c. onwards is

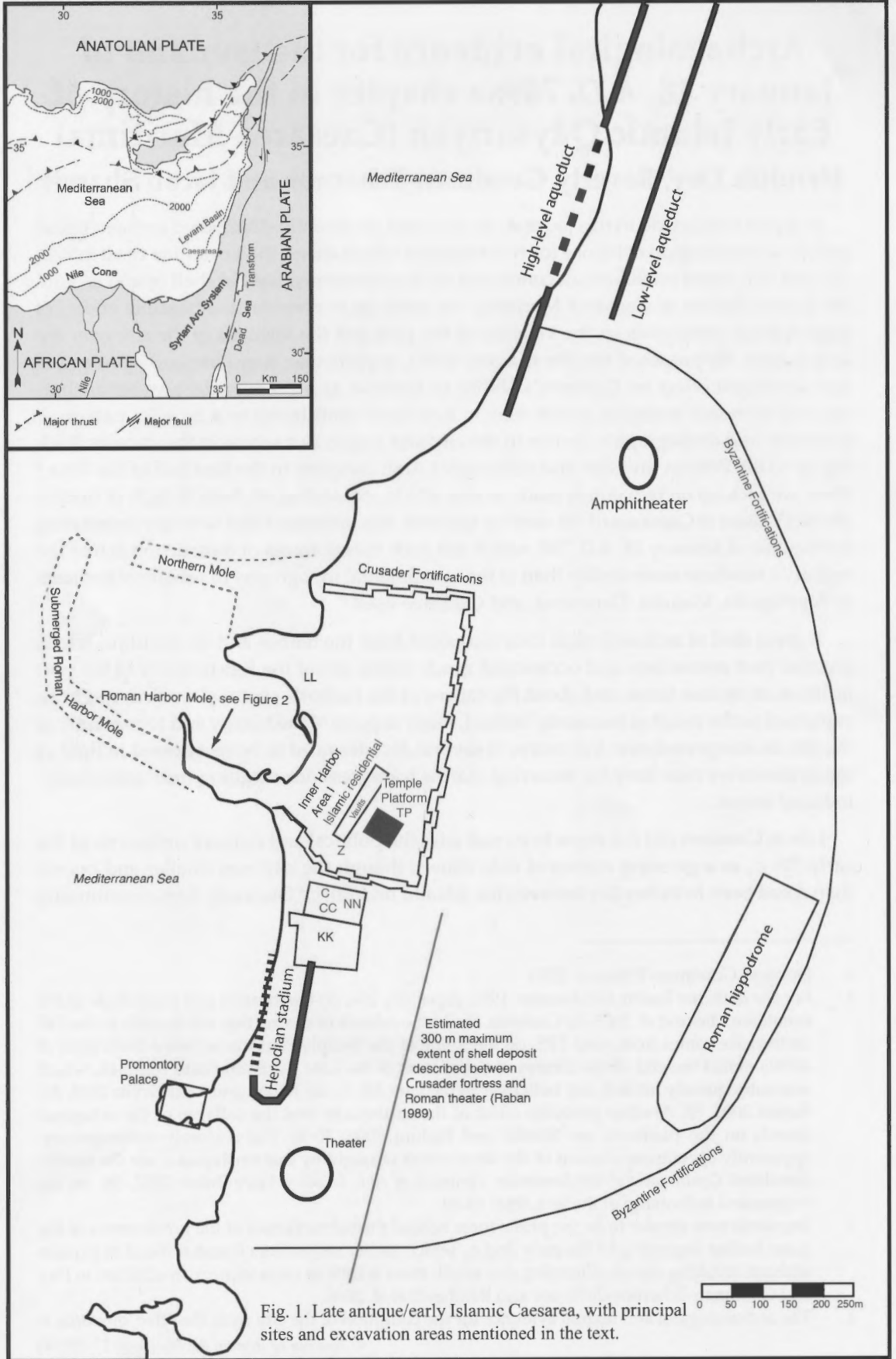


Fig. 1. Late antique/early Islamic Caesarea, with principal sites and excavation areas mentioned in the text.

vitality following the earthquake and tsunami of 551 might be detected in the relative lack of marine deposits attributable to it found even in those parts of the city closest to the coast, which suggests that a reasonably successful effort was made to clean up the mess. A similar scenario can now be proposed for 749, with the important difference that the clean-up seems to have involved primarily the area around the inner harbor and the temple platform (Areas LL, I, TP and Z), the heart of the remaining inhabited quarter following the Arab conquest of 640-41 (fig. 1).⁵ The relative (though not total⁶) lack of traces of terrestrial strata attributable to the event of 749 in this sector is thus hardly surprising: as presumably in the case of the earlier tsunamis, most of the deposits were removed, altered, or incorporated within construction fill. In this instance we need not rely on arguments from silence, because extensive marine layers of 8th-c. date, deposited in configurations consistent with the relicts of a tidal wave (though rarely identified as such by their excavators), have been found over the past 40 years across broad swathes of the depopulated quarters of the Roman-Byzantine city.

Currently, the field of tsunami research is seeing an exponential increase in knowledge regarding the criteria required to identify and recognize tsunami deposits, thanks not least to literature produced in the wake of recent tsunami events (the Indian Ocean in 2004; Japan in 2011). A corollary has been an increase in published accounts of paleo-tsunami deposits. This trend has been subject to some criticism, with some researchers who have recently proposed tsunamis as the source of unexplained phenomena observed in the geological record being labeled “neocatastrophist”⁷ — this despite the fact that traditional accounts of historical tsunamis in the Mediterranean (which depended chiefly on texts that typically present numbers of events that far exceed what might be expected) went largely uncriticized.⁸ While only two (A.D. 115 and 551) of the 21 tsunami events described in historical records for the Israeli coast had been corroborated by physical evidence,⁹ we are confident that more will be identified as the understanding of the geoarchaeological record improves, though to sceptics tsunami researchers may seem to be wearing tsunami-tinted glasses until the science of identifying paleotsunamis becomes more widely understood and the number of physical tsunami deposits catches up to reality.

Following our own campaigns of underwater coring and excavation (2003-7) undertaken offshore from Caesarea, we initially proposed to identify horizons associated with the tsunamis of A.D. 115 and 551 only,¹⁰ and not with the tsunami of 749 whose traces, we now believe, are abundantly present. It might thus reasonably be asked why we failed to identify submerged evidence of the later event in our offshore cores. Due to the close chronological proximity (in geological terms) between the tsunamis of 551 and 749, the later event may have entrained the intermediate-period sea-bottom sands (a layer not exceeding c.40 cm, based on estimated accumulation rates for Caesarea) overlying the deposit of 551, and then have eroded and entrained much of the 551 deposit itself. The

discussed below.

5 See below at nn. 60-62.

6 See below at n.35.

7 Morhange *et al.* 2014.

8 For recent overviews of historical evidence for seismic activity and tsunamis along the coast of the Levant, see Salamon *et al.* 2007; Ambraseys 2009.

9 In addition to the catalogues cited in n.8, see Reinhardt *et al.* 2006; Goodman-Tchernov *et al.* 2009.

10 Goodman-Tchernov *et al.* 2009; Dey and Goodman-Tchernov 2010.

result would be a single horizon composed of material originating from the reworked tsunami deposit of 551, together with newly-introduced sediments and inclusions from 749. Our previous inclination to attach the horizon only to 551 is also a result of the preponderance of artefacts from the 6th c. relative to the 8th c. across most of the site. That no unambiguously 8th c.-ceramics were documented among the limited number of diagnostic sherds recovered in our cores is unsurprising. Separating the signature of these two events offshore in cores, therefore, is challenging.¹¹ If nothing else, the discrepancy has reinforced the need for wide assessments at distances on and offshore. Further, it is to be expected that traces of discrete tsunami events will not always be preserved (or equally preserved) evenly across sites involved in the same event. The preservation of a tsunami deposit is highly dependent on its size and the amount of clean-up attempted, as well as on natural factors affecting the condition of the deposit.¹² It is also likely that smaller tsunamis left no more of a marker than a large storm, and might have been easily and quickly cleaned up on shore. By contrast with 749, we have good offshore markers for the event of 115, but fewer on land. We seem to see a relationship between levels of population and the degree of onshore preservation: the more populated and active a site, the more clean-up occurred, and the less material was left undisturbed. As a result, the textual hints of tsunamis striking the Levantine coast in A.D. 306 and 365, for example, may never be corroborated in the geoarchaeological record.¹³

Turning now to the tsunami of 749, we begin with a re-analysis of past excavation reports, which suffice to provide a clear picture of the magnitude of the event and the minimum landward extent of the inundation, or 'run-up'. The results are relevant not only for their capacity to illuminate a largely forgotten chapter of the city in the 8th c., but also because they provide the best available benchmark for gauging the potential effects of the tsunamis of 115 and 551, whose traces are largely (though not entirely) absent from the terrestrial record at Caesarea. The most substantial strata attributable to a marine inundation of mid-8th-c. date appeared in the SW sector, along the coastal strip south of the Crusader fortifications. Extensive tracts of these deposits between the temple platform and the theater, a shore-parallel distance of nearly 800 m, were uncovered (and removed, usually mechanically) in the 1970s and early 1980s under the auspices of the Joint Expedition (JECM). The bulk of the deposits lay in a shallow depression situated c.10 m above mean sea-level (MSL) and separated from the sea by a low ridge 15 m above MSL. From the landward side of the ridge, beginning c.50 m from the shore, these marine layers stretched inland as far as 300 m from the sea.¹⁴ They comprised two distinct, superimposed sequences, each consisting of a thick, lower layer of densely-bedded (and in some cases imbricated) shells, rubble and sherds up to 1.5 m thick, topped by a dark, silty layer 20-40 cm thick. Datable materials in the second, upper sequence placed its formation around the

11 We are currently seeking to address the issue through better dating the offshore horizons by collecting additional cores farther offshore (where less entraining and mixing of the two events would be expected) and analyzing the better-separated terrestrial deposits discussed here.

12 A large storm in the immediate aftermath of a tsunami, for example, could erase much of the shallower offshore horizons, while leaving terrestrial or deeper deposits in place. Szczuciński (2011, 115) documents in detail the rapidity with which both human action and storms dissipated traces of the 2004 tsunami in some of the affected areas of Thailand.

13 On these events, and the interpretative challenges posed by the too vague and/or hyperbolic textual accounts of the first millennium A.D., see Dey and Goodman-Tchernov 2010, 265, with references.

14 See especially the report by D. Neev and K. Emery in Raban 1989, 7-12, with figs. I.25-28.

14th c.¹⁵ In the lower sequence, dated by the excavators approximately to the 8th c. on the basis of finds, numerous disarticulated human remains turned up, as well as at least one complete skeleton in Area C, interbedded with the surrounding strata of shells and silt.¹⁶ Like the rest of the materials, this corpse was probably deposited by a (cataclysmic) natural event. As D. Neev and K. Emery indicated in their report, there were no signs of a man-made grave, and the surrounding horizontal strata were uninterrupted above and below the skeleton; such ‘culturally non-appropriate burials’ are now recognized as a typical feature of tsunami deposits.¹⁷ The most likely scenario would have corpses deposited by the retreating waters of the tsunami and immediately covered with more detritus, keeping the articulated skeleton undisturbed by scavenging animals or human intervention.

Unwilling to consider seriously the possibility that tsunamis might have been responsible for the deposition of these layers, the excavators variously resorted to two alternate hypotheses. The first, according to which the thick deposits stretching for hundreds of meters (in the areas excavated alone) along the coastal ridge represent the intentional deposition of materials dredged from the harbor-bottom, can be discarded on both practical and stratigraphic grounds.¹⁸ In the late 7th and early 8th c., following the Arab conquest of 640/41, this depopulated sector was transformed into lush, terraced gardens, watered by numerous wells and cisterns, built into and above the remains of the Byzantine residential and administrative buildings, many of them further infilled with soil brought from elsewhere.¹⁹ The notion that the city’s surviving population, then increasingly clustered in the environs of the Herodian harbor, would have laboriously moved tens of thousands of cubic meters of rubbish from the harbor (or anywhere else) to distribute them evenly throughout the raised coastal trough to the south, thereby burying the entirety of the garden-district laboriously constructed not long before, is implausible.²⁰ Further, the homogeneity and clear horizontal stratification of the deposits themselves cannot possibly result from the dumping of cartloads (or bucketloads) of waste; such a deposit would lack the fine bedding and interstructure described in the reports.²¹ Thus was born the alternative, second

15 Neev and Emery in Raban 1989, 11.

16 *Ibid.* 10.

17 *Ibid.*; on “culturally inappropriate burials” as a characteristic indicator of tsunami deposits, see Goff *et al.* 2012.

18 Neev and Emery attribute the original suggestion to Y. Porath, pers. comm. (*ibid.* 9; cf. also Raban’s comments at 296); see also Raban *et al.* 1999b, 155-56; Lehmann 1999, 139. J. Patrich (2011a, 51-52) continues to favor the idea.

19 Patrich 1999; *id.* 2011a, 45-49; Holum 2011a, 29-31. On Patrich’s recent, questionable emendation of his proposed dating for the abandonment of the gardens, from c.750 to c.690, see below n.33.

20 Further objections to this theory include the fact that excavated sections of the marine deposits alone cover, to a depth of several meters, a substantially larger area than the probable inhabited extent of the city in the 8th c.; the presence of similar deposits of similar date at sites from Ascalon and Gaza as far as Dor (see below, n.40); and the archaeological record for the inner harbor itself, which indicates that dredging operations ceased in the 6th c. (see below, n.34).

21 There are many further objections to the dredging theory. Despite discussion of widespread dredging refuse scattered across the site, corresponding stratigraphic hiatus from within the harbor were never described or identified (see, e.g., Reinhardt and Raban 2008). Harbor sediments are fine-grained, as the harbor creates a low-energy environment that encourages the deposition of finer sediments, not coarse shelly deposits (Reinhardt 1999; Marriner and Morhange 2007). These finer sediments tend to have some degree of cohesiveness, which, once transported, often results in patches of mud, particularly in the absence of a current or other fluid flow, as would be expected in dredging operations. The deposits described along the



Fig. 2. The harbor mole today at low tide. Dotted line highlights the Herodian-phase mole, indicating little difference in sea level relative to today.

hypothesis: that massive tectonic fluctuations caused the coastal shelf to rise and fall by as much as 10 m in repeated cycles between the Roman era and the Middle Ages, bringing the top of the coastal ridge below sea level (when the deposits were allegedly formed), then back to its current elevation, on multiple occasions.²² The proposed phenomenon is flatly impossible,²³ as subsequent work has demonstrated. If for the moment one sets aside the marine deposits in question, there is no evidence for any significant vertical displacement of the coastline over the past several millennia.²⁴ Mean sea-levels along the Levantine coast have changed very little since the Roman period, remaining within ± 50 cm of the current level.²⁵ The relationship between the bedrock of the coastline and the level of the sea, in other words, has remained quite stable over the life of Caesarea (fig. 2). Pronounced vertical displacement has occurred only offshore, where man-made features built on

terrestrial coastline do not include any mention of mud patches ('ripclasts') or any other fine residue within the deposits.

- 22 D. Neev and K. Emery (in Raban 1989, 9-10) correctly noted that the deposits must be the result of natural processes, *contra* Lehmann, Porath and Patrich (all *supra* n.18), but proposed the dramatic, repeated "tectonic oscillations" (ibid. 7-12). Neev was largely responsible for the "Yo-Yo tectonic" hypothesis: see, *inter alios*, Neev *et al.* 1973, Neev *et al.* 1978a and 1978b.
- 23 As many suspected at the time: cf. J. P. Oleson's comments in Raban 1989, 3.
- 24 Raban 1989, 18-21. One important indicator of the stability of the coastline is the city's Roman aqueduct, which shows no signs of pronounced vertical displacement anywhere along its coastal path and appears to maintain its original gradient: see generally Porath 2002; Mart and Perecman 1996. Further, harbor construction that was completed directly on the bedrock, such as that along the modern pier in the area of the ancient intermediate harbor, is still at the correct position relative to sea-level as when it was built.
- 25 See especially Sivan *et al.* 2006; also Raban 1989, 13-18 and 293-96; Mart and Perecman 1996, 4-5.

unconsolidated sediments, such as the outer portions of the harbor moles, have slumped by as much as 5 m, a process best explained by the scouring action of large storms, and especially tsunamis.²⁶

Further remains of these deposits, located near the Byzantine governor's *praetorium* south of the Crusader wall, were excavated carefully by the Combined Caesarea Expedition (Areas KK, CC and NN) and the Israel Antiquities Authority (Area 1) in the 1990s. In Area KK, amidst the remains of a group of 6th-c. warehouses just south of the *praetorium*, the excavators encountered a thick stratum of beach sand mixed with water-worn sherds, 1 m and more thick, which was itself topped by a layer of shells up to 2 m thick in the landward third of the area. These layers covered the wells, water-channels and cisterns installed in the ruins of the warehouses in the immediately preceding period (c.650-750), and were dated by the excavators to the 8th c.²⁷ A number of graves were dug into these marine strata in the Abbasid period; one contained a funerary inscription of 870, providing a firm *terminus ante* for the deposition of the marine layers.²⁸ In the adjoining Area CC, the vaults beneath the E part of the *praetorium* were covered by the same layer of sand and worn, marine-encrusted sherds, itself topped, especially in the E half, by thick shell deposits. In the 6th c., the section of the *praetorium* above the vaults featured a richly-decorated, rectangular (c.13 x 18.8 m) audience(?)-hall overlooking the sea, flanked to the south by a wing of rooms ("offices") still in use in the early Umayyad period, as evidenced by the construction of partition walls and benches in c.700 or a little before.²⁹ The complex went definitively out of use with the arrival of the marine layers, which may have caused the partial collapse of two of the vaults (nos. 4 and 13) underlying the audience-hall.³⁰ A funerary inscription of 895 accompanied a grave cut into these strata.³¹ The consensus among the excavators of this sector continued to favor harbor-dredged sediments as the probable origin of these deposits,³² though the question of why the structures and irrigated gardens laboriously built in the preceding decades would have been destroyed by the intentional deposition of the marine layers was rarely raised.³³ This seems curious, given both the lack

26 Pronounced slumping (by c.4.5-5 m) of harbor installations begins c.150 m offshore — precisely at the point where the sandstone (*kurkar*) bedrock gives way to unconsolidated sediments, as Boyce and Reinhardt's magnetometric profile of the harbor bottom (2004, especially 129) demonstrates with special clarity; cf. Mart and Perecman 1996, 9-11. For the scouring effects of tsunamis on the structures established on the unconsolidated sediments beyond, see Dey and Goodman-Tchernov 2010.

27 Patrich 1999, 82-83. More generally on the "terraced gardens" in areas CC, KK and NN, see also Patrich 2011a, 45-49; Holum 2011a, 29-31; id. 2011b, 179-81.

28 Patrich 1999, 82-83.

29 On this structure, see also Patrich 2011b, 213-16.

30 Patrich 1999, 93-95.

31 Ibid. 95.

32 Patrich (1999, 82) acknowledged the possibility that a tsunami might also have been responsible, but preferred the dredging hypothesis (cf. Raban 1989, 9); he has since (2011a, 51-52) apparently discarded the tsunami hypothesis. In his report on excavations in the W part of area KK, C. M. Lehmann (1999, 139) likewise attributed the marine sand to dredging.

33 Patrich alone (2011a, 51-52, modifying id. 1999) has attempted to address this problem, by shifting his chronology for the abandonment of the cultivated gardens from c.750 (immediately before the arrival of the marine strata, which he continues to date to the mid-8th c.) to c.690, perhaps in connection with the allegedly-violent Byzantine re-occupation of Caesarea between 685 and 690. His new dating, however, is based on the proposition that "not a single potsherd was found in the garden stratum that could be dated *only* after 700 CE" (our italics). Given

of textual or firm archaeological evidence for large-scale dredging operations in the mid-8th c.,³⁴ and especially the discovery by A. Raban *et al.* of marine strata in the vicinity of a 'reflecting pool' fronting the temple platform (Area I), the latest of which they attributed to the tsunami of 749.³⁵ As this 'reflecting pool' is really a westward extension of the quay of the inner harbor, probably built c.500 to accommodate the new staircase linking the inner harbor with the octagonal church on the temple platform, we have a good *terminus post* for all the deposits in question, which can probably be lowered further to the period after the Islamic conquest, when the pavers of the extension quay were presumably removed, leaving the recessed 'pool' in which the marine deposits were identified.³⁶

A final hypothesis regarding the origin of the shelly layers in Area KK, proposed by D. Thomas and R. Buyce on the basis of a geoarchaeological analysis conducted in 1992, was that the area was used as "a trash area or dump for a prolonged period of time". Identifying three strata (III, IV and V) lying atop thick sand and containing ceramics, bone, shell, sand and stones, they interpreted them as a "midden", arguing that the lack of imbrication of the shells negates the possibility of deposition by tsunami. However, as a new generation of tsunami studies has shown, while imbrication is an excellent marker for alignment during fluid flow, typically occurring during the backwash phase, there are ample examples of non-imbricated shell deposits of tsunamigenic origin.³⁷ The more significant tsunamigenic indicator is the allochthonous nature of the shells, which is clearly fulfilled by the presence in Area KK of *Glycymeris*, a non-edible, deeper water bivalve (which certainly has no place in a "midden"). Recent tsunami studies have also specifically recognized an entire category of tsunami deposits referred to as "dump" formation; they typically appear where the wave's energy is interrupted by natural or man-made obstacles (such as the buildings in Area KK), resulting in lower-energy depositional characteristics.³⁸

that many of the pottery types found might just as well date to the early 8th as to the late 7th c., and that there is no intermediate stratum between the garden layer and the marine layers above (as one would expect had the area lain abandoned for some 60 years, particularly given the speed with which windblown sand accumulates into dunes: see Raban 1989, 21-25), a direct link between the depositing of the marine strata and the end of the cultivated gardens remains the most likely scenario. There is in fact such an abandonment layer of windblown sand *beneath* the imported garden soil, datable between the capture of the city in 640 and the installation of the gardens, but not between the garden layers and the marine deposits (Holum 2011b, 179); Holum indeed, *contra* Patrich, dates the creation of the gardens to the late 7th c., thus bringing the moment of their abandonment close to 750.

34 Excavations in the submerged portion of the inner harbor (area TN) actually indicate the opposite: the harbor bottom is covered by thick layers of 7th-8th c. Islamic materials, while there is almost nothing predating the 6th c., presumably because dredging continued into the 6th c. but not beyond: see Raban 1996, 556 ff.; *id. et al.* 1999b, 153.

35 Raban *et al.* 1999a, especially 215-17; also *id.* 1996, 660-62; *id.* 2009, 195-97; Stabler and Holum 2008, 23-30. Given Raban's identification of these marine deposits as wave-borne, as well as his recognition that the harbor shows no signs of dredging in the Islamic period, it seems all the more strange that he continued to maintain that the extensive, 8th-c. marine deposits in the S sector of the city resulted from the deliberate deposit of dredged materials, rather than the very 8th-c. marine transgression he identified in Area I.

36 K. Holum, pers. comm.; the issue will be treated fully in Holum and Y. Arnon's final report on the Inner Harbor.

37 Thomas and Buyce 1993 (quotation). Cf. now Bryant 2001; Scheffers and Kelletat 2004, 67 and 71; Donato *et al.* 2008.

38 Bryant 2001; this formation also explains the downslope orientation of the shells noted by

With the occurrence of damaging marine transgressions at Caesarea now firmly documented following recent study of tsunami-deposits preserved in the sea-floor in and around the ancient harbor (as was not the case during the excavations of the 1980-90s), the tsunami of 749 described in the texts presents itself *a priori* as the most likely cause of the extensive, mid-8th c. marine deposits found at the site. The final piece of the evidentiary puzzle, however, is the composition and taphonomic characteristics of the marine layers themselves, which previous excavators, working without the benefit of the recent rash of studies on tsunamigenic sedimentological deposits, failed to recognize as classic examples of tsunami deposits. Relative to the years in which the excavations reviewed here occurred, far more literature now exists to describe sedimentological markers of tsunami events, based on modern as well as ancient analogues, and it provides a more refined picture of the range of characteristics expected.³⁹

The mere presence of shell beds does not suffice to indicate a tsunami event, and must be considered in relation to a combination of a set of variables — *inter alia*, extensive lateral extent of deposits, imbrication, and the presence in quantity of allochthonous (out-of-natural-context) shells. Along the Israeli coastline, evidence for thick shell beds situated well beyond the reach of storm-waves has been described at multiple sites, including Ashkelon, Caesarea, Michmoret, Dor, Achziv, Shikmona, Yavneh Yam, and elsewhere. Many of those which have been dated belong to the 6th to 8th c.,⁴⁰ though a broader chronological span is also present, from a first appearance of the shells along the coastline at c.5500 yBP to a near-disappearance sometime between 1000 and 1500 yBP.⁴¹ The idea that these shell beds relate to a tsunami event had been put forth in 1962 by M. Avnimelech, when one such bed found 35 m above MSL could not be accounted for within Holocene sea-level changes and had some association with pumice pebbles.⁴² Otherwise, the debate over their formation has primarily revolved around sea-level and tectonic change, on the one hand, *versus* anthropogenic influence, on the other. The sea-level/tectonic changes theory can be discarded, for the reasons given above. The leading proponent of the anthropogenic hypothesis was A. Ronen, who argued that the imbricated orientation of *Glycymeris* shells seen along the Israeli coastline (in particular at Ashkelon) are the result of human intervention.⁴³ He ran experiments in which shells were dumped and then raked, which eventually resulted in a primarily concave-down distribution of the shells, similar to what is seen in many of the deposits along the coastline. He therefore argued that the shell-beds were intentionally deposited to provide stable, well-drained platforms for construction.⁴⁴ The argument fails, however, to address some important issues. First, the deposits of Ashkelon

Thomas and Buyce, which is perfectly consistent with the relicts of a tsunami with low-energy backflow (due to the presence of natural or man-made obstacles, for example): see Goff *et al.* 2012. It is increasingly possible to differentiate between man-made and tsunami dumps through a range of analyses such as quantifying the ratio of different value goods, fine-grain size analysis (granulometry), micropaleontological analysis, mineralogy and elemental analysis (XRF).

³⁹ Bryant and Nott 2001; Reinhardt *et al.* 2006; Kilfeather *et al.* 2007; Donato *et al.* 2008; Goodman *et al.* 2009; Vött *et al.* 2011; Mahaney and Dohm 2011; Goff *et al.* 2012.

⁴⁰ Presumably in connection with the tsunamis of 551 and 749. For the extent and dating of the deposits, see Ronen 1980; Ronen's anthropogenic explanation for the origin of these shell-beds must be discarded: see below.

⁴¹ Sivan *et al.* 2006.

⁴² Avnimelech 1962; Pfannenstiel 1952, especially 400 ff.

⁴³ Ronen 1980.

⁴⁴ *Ibid.* 171.

are bracketed above and below by natural deposits, and are not part of an archaeologically-defined construction sequence. Second, while Ronen correctly notes that shell was often incorporated into ancient building materials (concrete, in particular), it is never imbricated when so used, nor does shell compose as high a proportion of the deposit as it does in the Israeli coastal deposits. Third, the thickness of some of the deposits (often more than 1.5 in Ashkelon, even thicker elsewhere) has no architectural parallels in the region.⁴⁵ It defies belief that in the 6th-8th c., when a large percentage of the coastal shell-deposits in question were deposited, massive building-platforms of shell were installed all along the Israeli coastline, from Ashkelon to Caesarea, Michmoret, Dor, Achziv, Shikmona and Yavneh Yam: this was a period poor in monumental construction projects.

In fact, the majority of these shell deposits are dominated by the species *Glycymeris insubrica* (also referred to as *G. violascens*; or violet bittersweet clam), an organism that is known to live at depths up to 200 m and rarely occurs at depths above 20 m.⁴⁶ The mere displacement of these generally deeper-living pelecypods is cause for consideration of a force greater than that produced by the greatest storms. If these shells were regularly transported onto land during high storms, one would expect the shell-bed horizons to be a constant, even homogenized part of the coastal stratigraphy; instead, they appear infrequently, at widely-spaced chronological intervals. Further research may be able to demonstrate that they coincide only with tsunami events powerful enough to transport shells from depths below 20 m, but in the meantime these rather deep-dwelling shells can hardly be imagined to have been dredged up and intentionally deposited on land by human agency.

In the case of Caesarea, recent study of undisturbed deposits from the sea floor further supports the contention that the terrestrial shell-beds are tsunami-formed. Within excavation trenches and in cores collected offshore (in a minimum water depth of 10 m at a perpendicular distance of c.300 m from the shore) *G. violascens* and *G. pilosa* have been found only in association with sub-surface tsunami horizons.⁴⁷ These shells are found in both imbricated and chaotic patterns, and on occasion with noted inter-bed variations based on shell fracture size. Imbrication is a specific feature that has been associated with the presence of fluid flow: the shells fall out of suspension and, while the flow is not strong enough to re-entrain the individuals, it does have the strength to turn the shell to its 'convex-up' position. Because this action requires less flow velocity than turning the shell from convex-up to concave-up, the shells remain in 'convex-up' position and even further orient on top of one another in this relatively more stable configuration.⁴⁸ The more chaotic deposits, in which the shells have varying orientations within the horizon, should reflect deposition that occurred in the absence of the associated phase of fluid flow to re-orient them prior to burial. While still requiring additional study, these variations may be presumed to relate to differing dynamics in back-channel flow of the tsunami event itself, much of which would relate to shoreline topography and to offshore harbor installations influencing and concentrating portions of the flow. Following the tsunami event, a

45 Cf. Neev, Bakler and Emery 1987, 31-32, who effectively criticized Ronen's anthropogenic argument, while continuing to maintain the now-discredited "yo-yo" tectonic fluctuations as their alternative explanation.

46 Mienis *et al.* 2006.

47 Reinhardt *et al.* 2006; Goodman *et al.* 2009.

48 Ibid.

landscape of varying channels would have developed as the water retreated from the land at a lower velocity than that at which it arrived.⁴⁹

In sum, at Caesarea the 8th-c. deposits exhibit a wide range of the factors and depositional features particular to tsunami deposits, including their sedimentological structure, allochthonous marine sediments, laterally extensive deposition along the coastline (including contemporary shell-beds tens of kilometers away), malacological inclusions, and culturally-inappropriate human remains (bodies casually deposited rather than deliberately inhumed). Taken together with the clear presence of tsunami horizons in underwater contexts just offshore, these features should be viewed as unequivocally tsunamigenic.

With the benefit of hindsight, a synoptic view of earlier excavation reports, vastly improved comparative evidence from recent tsunami studies elsewhere, and the increasing amount of geoarchaeological and archaeological evidence for marine inundations at Caesarea in the Byzantine and Islamic periods, it is possible to connect these numerous scattered 'dots' of information, all of which point to the occurrence of a powerful tsunami in conjunction with the earthquake of 749. All of the excavation reports cited above date the marine strata in question, which are composed of layers of sand and/or shell and have been identified across nearly a kilometer, from the inner harbor to the theater, to the 8th or mid-8th c. There is no doubt that a powerful earthquake struck the Levant at precisely this time; and this quake is said to have caused a catastrophic inundation of the coastline in a number of mediaeval sources, the most often-cited of which is the picturesque narrative in the *Chronicle of Michael the Syrian*, a late-12th c. Syriac text based on earlier accounts, which depicts the sea "boiling like a cauldron", swamping the coastline of the southern Levant and sinking countless ships.⁵⁰ Plausibly related to the same event is the little-known account in an anonymous Hebrew liturgical poem of an inundation of the Sharon valley (in the N part of which Caesarea lies), which provoked numerous drowning deaths.⁵¹

Some implications of the tsunami of A.D. 749 for our understanding of Early Islamic Qâysariyah

We therefore regard it as certain that much of the excavated extent of the city was literally covered with the evidence of a powerful marine incursion provoked by the earthquake of 749, above all in the SW sector along the coast but also in the vicinity of the inner harbor (Area I). In light of this conclusion, there is much work to be done to illuminate the ways in which the lives of the population and the contours of their physical environment were affected by this event, which occurred in the midst of the transition — the 8th c., roughly speaking — when the much-reduced Islamic town took shape amidst the sprawling ruins

49 Le Roux and Vargas 2005.

50 Michael the Syrian, *Chron.* 466-67 (ed. Chabot, vol. 2, 509-10). The best overview of the written sources for the earthquake of 749 is Tsafirir and Foerster 1992; on the tsunami see also Shalem 1956, 167-68; Amiran, Ariei and Turcotte 1994, 294.

51 Zulay 1936, 151-83 [Hebrew]. The relevant passage is on p. 158: "Multitudes drowned violently, those dwellers in the Shefela [coastal lowlands of Israel] and in the Sharon valley ... A current appeared ... Women and children were drowned, along with preachers of the Bible and Mishna ..." (Eng. transl. in Raban 1989, 10). The poem is dated on internal grounds between the 10th and 12th c., but the account of the tsunami may derive from earlier sources (in any case, it reports a past event: Raban 1989, 10-11); N. Shalem (1956, 167-68) long ago suggested the 749 earthquake/tsunami as the one in question.

of its Byzantine predecessor and assumed the essential elements of the configuration it would maintain until the Crusader conquest in 1101. Thanks to a recent surge in scholarly interest in the history of post-Byzantine Caesarea (itself part and parcel of a broader re-evaluation of the transition from Byzantine to Islamic rule in the Levant), enough is now known about the city in the 8th c. to permit some tantalizing glimpses of developments attributable to the natural disaster of 749.⁵² We offer here a few preliminary observations, which we hope will clarify some aspects of the archaeological and historical record as it now stands, and set the stage for future research on an event with important implications for our understanding of Early Islamic Qâysariyah.

The recently-translated *Continuatio* of the Samaritan Chronicle of Abû ʿI-Fath, an Arabic text of the 14th c. which preserves a contemporary chronicle of events of the 7th-10th c. written by a Samaritan living in Palestine,⁵³ provides precious information on the fate of Caesarea's inhabitants at the time of the Arab conquest; moreover, it conforms closely with the archaeological evidence of widespread depopulation of the city following the Arab siege of 634-640/41. According to this text, the "Byzantines" and Samaritans living in the coastal cities, including Caesarea, fled the onslaught of the Arabs and went to "Byzantium", after sending much of their portable wealth to inland villages away from the embattled coastal zone, expecting to recover it upon their return — which never came.⁵⁴ The wealthier residents will have been the first to find the means to escape,⁵⁵ a conclusion supported by widespread signs of abandonment of structures both inside the city and in the surrounding countryside, recently analyzed by K. G. Holum, whose conclusions we confine ourselves to summarizing.⁵⁶ There is a clear, albeit necessarily episodic, pattern of abandonment and sometimes destruction of farms and villas outside the city walls which can be dated to c.640;⁵⁷ these are the holdings of Caesarea's wealthy proprietors, the leading men (*prôtœuontes*) of the city, who stored the agricultural produce of their rural estates in warehouses such as those attached to the opulent private residences excavated in the city's SW sector. These urban *domus* and warehouses were abandoned and partially spoiled c.640, after which they lay empty for a generation or more, when a typical dune formation of windblown sand accumulated over the remains.⁵⁸ The organic-rich soil for the irrigated, terraced gardens, discussed above, was deposited directly on this abandonment layer in the last quarter of the 7th c. As Holum notes, these gardens apparently continued in use into the first half of the 8th c., when they were covered — with no intervening strata to indicate a phase of abandonment — by the marine layers of sand and/or shell.⁵⁹

52 On Caesarea itself, notable recent contributions include Arnon 2008; Patrich 2011a; Holum 2011a and 2011b; Whitcomb 2011. For the Levant in general, see, e.g., Bowersock 2006; Walmesley 2007; Sivan 2008; Holum and Lapin 2011; Avni 2011.

53 Levy-Rubin 2002, 1-45.

54 Ibid. 51; on the historical accuracy of this source, *ibid.* 10-19. See also 53 on the sack of Caesarea in 640/41: "Whoever was able to flee fled by sea, whoever opposed them they [the Muslims] killed, and whoever submitted to them was unharmed. The city was captured, and they inhabited it. After they captured it, every place stood in awe of them."

55 On the social and demographic implications of the preceding passage, especially the flight of the Byzantine landowning classes from the coastal cities of Palestine, see Levy-Rubin 2011.

56 Holum 2011a, especially 29-31; *id.* 2011b, 179 ff.; cf. also Patrich 2011a.

57 Holum 2011a, 17-18; Patrich 2011a, 43-44.

58 Holum 2011a, 29; *id.* 2011b, 177-81.

59 *Ibid.* Holum's chronology seems preferable to the revised dating proposed by Patrich, for the reasons outlined above at n.33.

When these layers are recognized as the relicts of the tsunami of 749, the sequence of events seems quite clear: this ruralized but nonetheless lush, carefully-maintained agricultural zone was buried beneath the debris left by the receding waters, and it was almost immediately transformed into a burial ground, the first occupants of which, like the articulated skeleton apparently deposited together with the marine layers, may indeed have been victims of that catastrophe (fig. 3).

To the north, around the inner harbor, the first signs of new occupation and building activity likewise date to the end of the 7th c. In the remains of the large warehouse in Area LL, which, like the structures in the SW sector, had lain abandoned for some 50 years after the Arab conquest of 640, new floors were installed and existing rooms subdivided into smaller chambers through the addition of new walls.⁶⁰ The really profound changes in this sector, however; began in the mid-8th c. Much of the inner harbor basin in Area I was filled with a thick deposit of rubble, interspersed with ceramics and other portable items, and then almost immediately covered, along with the rest of Areas LL, I and TP, with a dense network of streets, houses, workshops, cisterns and grain warehouses, all of which continued to be occupied and refurbished until the Crusaders captured the city in 1101.⁶¹ Abundant sequences of ceramics,

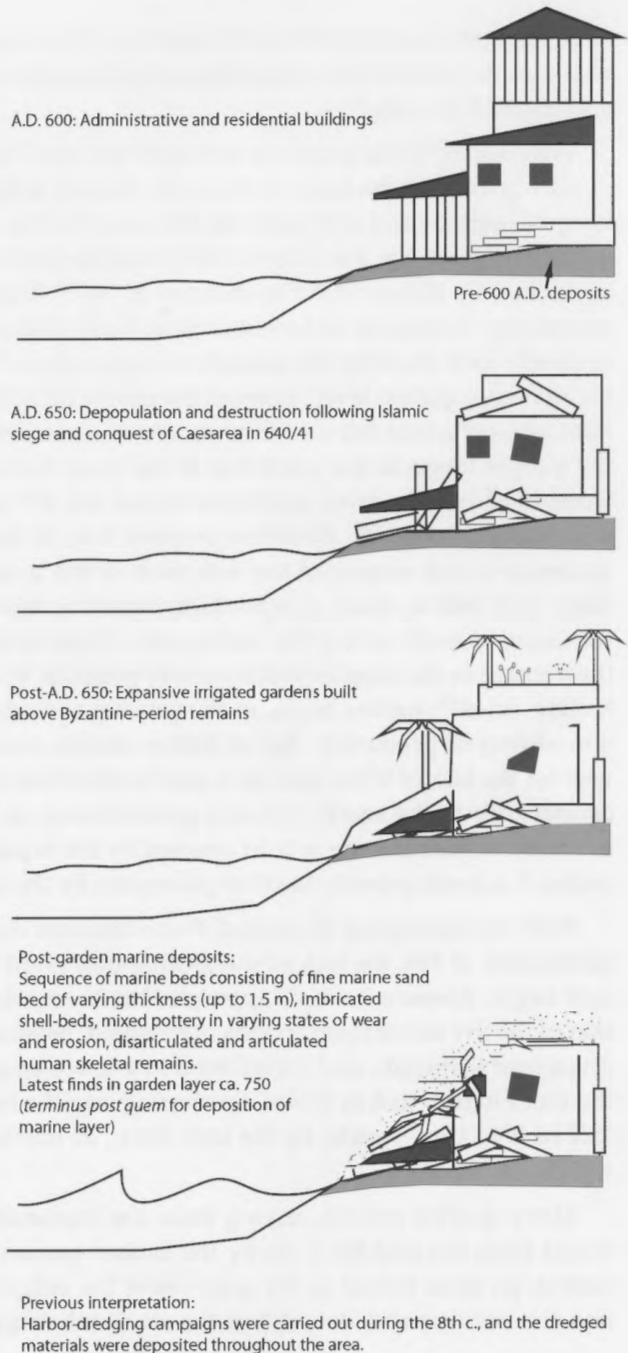


Fig. 3. Schematic rendering of depositional sequence in the SW sector at Caesarea.

⁶⁰ Stabler and Holum 2008, 8-9; Holum 2011a, 29.

⁶¹ Raban *et al.* 1999a, 217-24. More generally on the flourishing early Islamic houses, workshops and storage-facilities in areas LL, I and TP, see Stabler and Holum 2008, 8 ff.; Holum 2011b, 183 ff.

coins, and prestige items from the vicinity of the inner harbor and Temple Platform further testify to the presence of a sizeable and prosperous population in the Umayyad, Abbasid and Fatimid periods.⁶²

With regard to the sequence of events that culminated in the formation of this new residential quarter at the heart of the early Islamic settlement, a key piece of evidence is the layer of marine sand and worn sherds found inside the W extension of the quay (Raban's "reflecting pool") at the edge of the erstwhile harbor basin in Area I, already tentatively associated by Raban with the tsunami of 749.⁶³ These "beach deposits" were themselves covered by "terrestrial sediments and an Early Abbasid wall dated to the late 8th c.", which evidently took shape in the immediate aftermath of the event in question.⁶⁴ Just to the west, the same occupation levels covered the rubble fill of the harbor basin itself. Given the abundant signs of a mid-8th c. marine incursion elsewhere at the site, we have little doubt that the marine layers in the extension of the quay were, as Raban thought, deposited by the tsunami of 749, the same event that buried the SW sector of the city beneath marine sand and shell deposits. We therefore propose that, in the immediate aftermath of the marine incursion which swamped the extension of the quay, the inner harbor was intentionally filled with rubble, much of it probably resulting from destruction caused by the impact of the tsunami itself and/or the earthquake. Those responsible for the clean-up disposed of the detritus in the most expeditious way possible, by dumping it into the adjacent (already largely silted⁶⁵) harbor basin, in the process extending the shoreline west and providing a modicum of protection against future marine inundations. This scenario also accounts well for the lack of 8th-c. marine deposits identified in this area relative to the (abandoned) coastal strip to the south. Within a generation or so at the latest, the 'reclaimed' portions of the inner harbor were in turn covered by the expanding fabric of the early Islamic town center,⁶⁶ a development plausibly prompted by the needs of an expanding population.

With the increasing likelihood that a tsunami struck Caesarea in connection with the earthquake of 749, the task of integrating that event into its broader historical context can now begin. Already it seems apparent that the marine inundation caused the transformation of the SW sector from an area of irrigated, terraced gardens into a barren expanse soon given over to burials, and contributed to a reworking of the topography of the area around the inner harbor just as it was developing into the heart of Islamic Qâysariyah, where the 12.2 ha 'Old City' would, by the later 9th c., be surrounded by the reduced circuit of walls which still stands.⁶⁷

Many queries remain, among them the explanation for the divergent trajectories followed from the mid-8th c. on by the former garden zone in the southwest and the inner harbor, an issue linked to the question of the religious and ethnic identities (not to mention the number and density) of the city's inhabitants in the later 7th and 8th c.⁶⁸ From

62 On the ceramics, see Niamir 1999 and especially Arnon 2008. On the coins, see Lampinen 2008. For additional finds of early Islamic jewelry, metal and glass vessels, and elaborate metalwork, see Holum 2011b, 186. For a survey of Arabic texts of the 9th to 11th c. which present Caesarea as a flourishing coastal town, see Holum 2011b, 169-73.

63 *Supra* n.35.

64 Raban *et al.* 1999a, 217-20; cf. Holum 2011b, 183.

65 Reinhardt and Raban 2008, 177-78.

66 Raban *et al.* 1999a, 220-24.

67 On the wall, see Porath 1990; Holum 2011b, 173-75.

68 For a speculative but thought-provoking attempt to identify zones of Christian, Jewish and

the chronicler Al-Bâladhurî (9th c.), we learn that Qâysariyah's mosque was restored and other unspecified repairs undertaken after 690, when caliph 'Abd al-Malik recaptured the city from the Byzantines who had occupied it for the preceding 5 years.⁶⁹ It is tempting to connect this information with the closely-contemporary signs of new types of occupation, after a hiatus of a half-century, in the garden district in the southwest and the warehouse in Area LL,⁷⁰ and reasonable to imagine an increasing proportion of Muslims among the local populace from the late 7th c. onwards.⁷¹ Yet a column was inscribed with a cross after it had been incorporated into one of the retaining walls of the terraced gardens of Area CC in the late 7th c., clear testimony to the continuing presence of a Christian population.⁷² Presumably we see here the descendants of the humble Christian populace who had been unable or unwilling to flee during or immediately after the siege of 634-640/41. Might these gardens even have been constructed by the Byzantine garrison between 685 and 690, to supplement whatever supplies arrived at the embattled city by sea? Might the presence of a subaltern, Christian population in this area help explain why it was left derelict after the events of 749, while the Muslim population went about restoring and expanding their stronghold in the environs of the harbor? The responses to these and a host of other questions about the transformation of the site in the centuries after the Arab conquest await further study. For the moment, we can state with some confidence that the earthquake and associated tsunami of 749 were not the least among the contingencies that shaped the destiny of Early Islamic Qâysariyah.

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Muslim settlement at Caesarea in the early Islamic period, see Whitcomb 2011.

69 Al-Bâladhurî, *Kitâb Futûh al-Buldân* (ed. de Goeje 1866, 143-44); Eng. transl. Hitti 1916, 220: "In the days of Ibn-az-Zubair the Greeks went out against Kaisariyah and devastated it and razed its mosque to the ground. When 'Abd-al-Malik ibn-Marwan was settled in his rule, he made repairs in Kaisariyah, restored its mosque and left a garrison in it. Moreover, he built Tyre and outer Acre which had shared the same fate as Kaisariyah."

70 Cf. Holum 2011b, 173-75 and 181.

71 Cf. Whitcomb 2011; Holum 2011b, 176. The news about the installation of a permanent garrison following the recapture of the city in 690 (supra n.69) is relevant here; the architecture and small finds from the inner harbor also suggest a predominantly Muslim population from the later 8th c. on (Holum 2011b, 186), as do the many inscribed tombstones of the 9th- and 10th-c. from Muslim burials in the surrounding cemeteries (ibid. 176).

72 Patrich 2011a, 51.

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