

Post-Pleistocene Stony Layers in East Mediterranean Sites

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with Pl. III

Recent and sub-recent deposits in the East Mediterranean were frequently but briefly treated by both archeologists and Quaternary geologists. For the former, these deposits normally constitute disturbed and mixed layers; the latter were mostly interested in the deeper, Quaternary deposits. A thick post-Paleolithic layer composed almost entirely of angular stones in the cave of Sefunim, Mt. Carmel (Ronen 1968), incited interest in this phenomenon, which soon appeared to be a widespread and an evident one. We present in the following pages the data on the nature of these sediments, their possible age, and their geographical distribution. The term "stony layer" will be used in this article to avoid the Pleistocene meaning that "éboulis sec" has acquired. The cave of Sefunim will serve as the basic description for the phenomenon; descriptions of other coastal sites will follow, then inland sites. These will be described in order from south to north¹.

Sefunim

The cave of Sefunim is situated on the western side of Mt. Carmel, at an altitude of 125 m. above sea level and a distance of 3 km. from the Mediterranean. It opens to the north-northwest, with a long axis extending almost due north-south. There are two chambers, a front and a back; the latter is completely and permanently dark, and it lacks any deposits except for deterioration of the rock floor. The deposits in the cave and on the terrace contain Middle Paleolithic, Upper Paleolithic and post-Paleolithic layers. Solely this last portion of the deposits interests us here.

Cave stratigraphy, from top downwards (fig. 1):

Layer 1: Uppermost fine dust, 10 cm. or less thick, with goat dung mainly along cave walls. Few and scattered finds of potsherds and flints. It covers the entire front chamber, thinning towards the interior. This layer appears to have been deposited since occupation of the cave ceased, which we know occurred between 1904 (Mülinen 1908) and 1941 (Stekelis 1961). Then the cave was used only as an occasional resting place for goat shepherds, as it is still being used today.

Layers 2-4: A series of superimposed white plaster floors interrupted by black ash layers, altogether 5-20 cm. thick, spread over the entire front chamber. This dates to the early and late Arabic period.

Layer 5: Upper Stony Layer, 10-15 cm. This exists as a separate layer only from the entrance of the cave to 3 m. inside the present drip-line. Elsewhere it is inseparable from the Lower Stony Layer. Where it exists as a separate unit, it includes mainly Arabic pottery, with some Roman sherds and a few earlier ones.

Layer 6: A lenticular and localized brown silty sand, 20 cm. maximum thickness and 2-3 m. in width (E-W axis). It is this layer that locally separated the Upper Stony Layer from the Lower one, over a distance of 3 m. near the entrance. Layer 6 is mostly sterile, with a few Roman potsherds throughout and mainly Chalcolithic sherds at the

¹ The existence of a stony layer is inferred when specifically stated by the excavator, or when clearly visible in the sections. Since quantitative data are often missing, we assume that when the excavator states "abundant angular stones" he means stones are considerably more abundant here than in other layers of the same site.

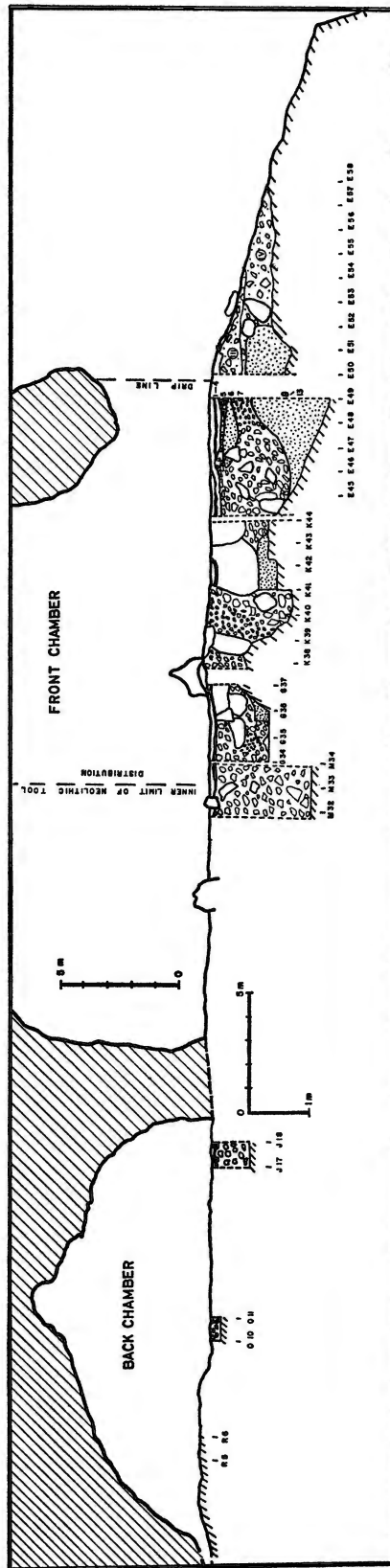


Fig. 1. Sefunim, longitudinal cross-section showing the Holocene stone-complex.

bottom, probably derived from the adjacent Lower Stony Layer. A small, thin hearth was located near the top of layer 6.

Layer 7: Lower Stony Layer: It starts at the cave entrance near the present drip-line, thickens quickly to attain 0.50 m. at a distance of 3 m., then 1 m. thickness at 4 m. from the entrance. From this point inward there is no more separation between this unit and the Upper Stony Layer, as they form one complex, existing over the entire front chamber with thickness varying from 1 m. on the east side to 2.20 m. on the west side of the cave. Its mean thickness in the excavated areas is 1.20 m. The layer includes a very abundant flint industry and potsherds, ranging in time from the Neolithic onwards. Layer 7 lies unconformably on top of Natufian and Paleolithic deposits that in contrast contain very few stones. These deposits slope downward from the cave entrance to about 5 m. inward, where they disappear. From here on to the rear limit of the front chamber, the Lower Stony Layer lies on a very crumbled and deteriorated bedrock. Only occasionally are earlier, scattered patches of brown or red silt intercalated between bedrock and layer 7.

The physical nature of the stony complex and its archeological content are of special interest. The layer is smooth and horizontal at its top, where it is the foundation for the recent plaster floors. It is probable that it was smoothed for that purpose. It is composed of angular stones with very little fine material in between (Pl. III). The size of the stones varies from boulders of up to 2 m. in length (those of 1 m. in length being common) to fragments of 2–3 cm., including all intermediate sizes. The majority falls between 10 and 20 cm. There is no apparent pattern in the distribution of the stones except for the following two features: near the entrance, from the drip-line to about 2 m. inward, where layer 7 gradually thins out and disappears, the stones are uniformly small in size – 2 cm. on the average; also, there is a general tendency of the big blocks to be at the bottom of the layer, though not in all cases.

All the big blocks, as well as the absolute majority of the small stones, are derived from the cave ceiling or walls. A few stones showed an exterior origin, being either of a different limestone or river pebbles. These manuports never exceed a negligible fraction of the stony layer within any given square meter.

Nowhere within the stony complex is there any calcareous layer, nor any cementation of the fragments. Fragments of stalagmites do occur, however, intermingled with the stones. A discontinuous and thin (0.5–1.0 cm.) calcareous crust, with black zones, exists on bedrock and below layer 7. The very basal stones tend to be friable and decomposed.

It is worthwhile to stress here that stalactites are still forming today in the cave in places of constant water dripping. A stone placed beneath such a drip point and freshly exposed in the summer of 1968 had developed a localized crust 2 mm. thick by the following spring².

To sum up, layer 7 in Sefunim constitutes a thick stony complex existing only in the front part of the cave, from the entrance to the inner limit of light penetration. The loosely packed stones, their distribution, and their angularity, make it a sort of *éboulis sec*, although the stones are not especially flat or thin.

The archeological content of layer 7 is from Neolithic up to, and including Arabic. This content might be termed "unorganized" in the sense that clear occupation levels could not have been detected. On the other hand, the Neolithic is definitely dominant in the lower part of the layer, the later periods in the higher part.

Furthermore, the earliest occupation, a Neolithic represented solely by stone implements (axes, adzes, chisels, a few arrow heads, as well as other tools and cores) shows a clear pattern of tool-distribution, pointing to the existence of different activity centers. Without going into details, it is enough here to compare the similar distribution of axes and notches (fig. 2) as opposed to that of burins and knives (fig. 3) to conclude for a normal habitation zone at the base of the stony layer.

² Summer drip is stronger than winter drip. The main drip points occur along a line on the long axis of the cave. Rough measurements have shown that some spots had a mean flow of two-thirds litres per hour, with remarkable daily variations.

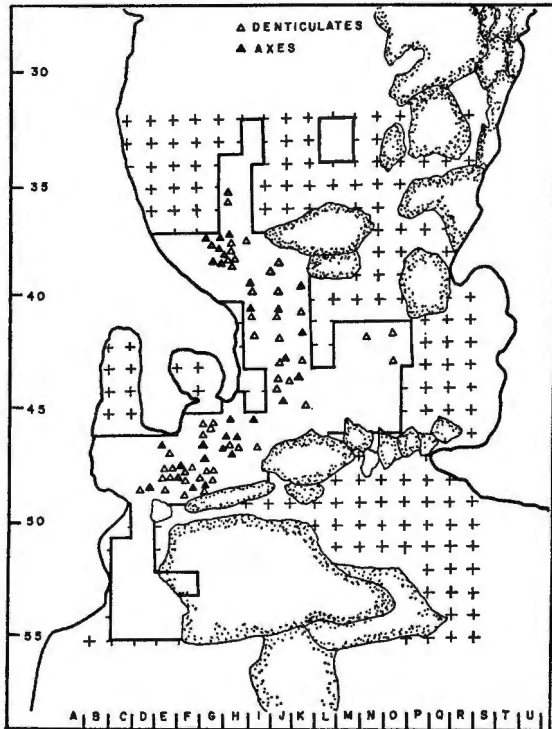


Fig. 2. Sefunim, distribution of axes and notches in layer 7 (1 sign = 1 tool).

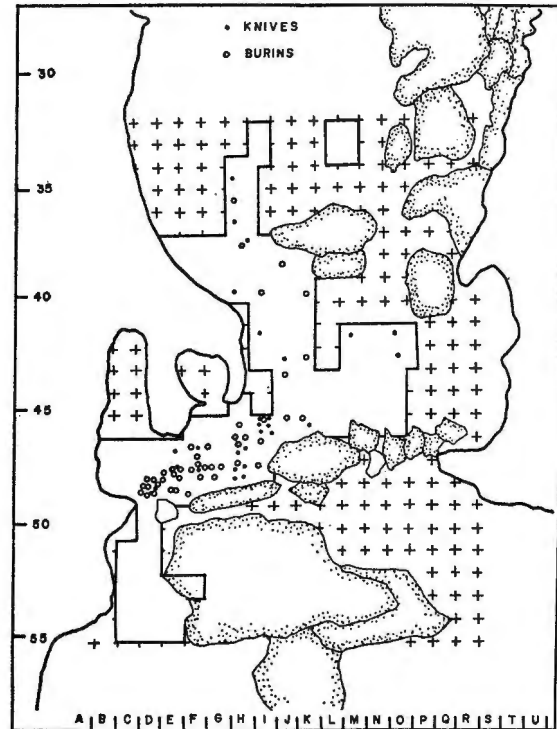


Fig. 3. Sefunim, distribution of burins and backed pieces in layer 7 (1 sign = 1 tool).

As for the ceramics, (Ben-Tor, in press), the Chalcolithic largely dominates throughout the layer. A small part belongs to the Early Bronze Age, and a few sherds represent the Iron Age, Persian, Roman-Byzantine, and Arabic periods. All the sherds are broken, and no clear occupation-level could be distinguished. None of the pottery fragments nor the flint artifacts shows rounding by water.

There are only two indications of an occupation horizon in layer 7: two small, superimposed hearths toward the top of the layer, located near the east wall of the cave 9 m. from the entrance; and a contracted burial of unknown age discovered close to the bottom of the layer, 2 m. west of the hearths.

From what precedes, one can conclude that the stony complex started during the Neolithic occupation of the cave, perhaps after a period of increased water activity, which is suggested by the thin crust underlying layer 7. (On the other hand, this crust might have resulted from water percolating through the stony layer, after or during its accumulation). The stony complex was forming through the Chalcolithic period (fourth millennium B. C.), but it is hard to estimate when it ceased. On the basis of the small amount of recent pottery, it seems that these might be intrusions from occupation on top of layer 7, contemporary to or later than the localized formation of layer 6. The existence of the localized layer 5, equally stony but thinner than 7, might be a weak renewal of stone-fall during Roman-Byzantine times, or perhaps, an artificial structure on top of layer 6 in preparation for the plasterfloor construction. Thus we tentatively may place the end of the stone accumulation around 3000 B. C.

Terrace stratigraphy (fig. 1):

The terrace deposits were enumerated in Roman numerals to avoid confusion with the cave layers.

- I) Surface deposit, grayish brown, 2-5 cm. thick, containing a mixture of pottery and flints.

- II) Reddish brown, discontinuous, disturbed layer averaging 5 cm, but up to 20 cm. in places. Contents same as I.
- III) Red silt, 30 cm. maximum thickness. Abundant stones, and in-place splitting of travertine formed on cave wall. Aceramic Neolithic, with a few later intrusive sherds.
- IV) Dark brown silt, 20 cm. thick, with very abundant stones. Aceramic Neolithic.

Layer IV lies on top of the Natufian and Paleolithic deposits. The underlying layer V, reddish brown silt, is completely devoid of stones, in a marked contrast with layers IV and III. A constructed elliptical hearth that was built in layer V was dated by C¹⁴ (Ronen, in press) as follows:

| | |
|---------|-------------------------------|
| Hv 2597 | 7730 ± 115 B. P. (5780 B. C.) |
| Hv 3368 | 9395 ± 130 B. P. (7445 B. C.) |

The first of these dates appears to result from a sample contaminated by ash from layer IV. The second measurement, ran on a sample from the bottom of the hearth, can be accepted as the time of its construction in layer V. Unfortunately, this hearth is without archeological content and therefore it is impossible to know whether it is late Natufian or early Neolithic. 5 to 10 cm. of deposits of layer V separate the top of this mid-eighth millenium hearth from the bottom of the Neolithic stony layer IV. The beginning of this stone layer can be assumed around 6000 B. C.

The correlation at Sefunim between the cave and the terrace layers is well established through a joining trench; layers III and IV of the outside are the equivalents of layer 7 inside. The only differences are that, geologically, the angular stones on the terrace are embedded in fine matrix, and less numerous per cubic meter, and archeologically, the post-Neolithic occupation is not attested here. Again we are left without a good indication of the end of the stony formation on the terrace, but its beginning could be assigned around 6000 B. C.

Coastal Sites

Stony complexes similar to that described above exist in other coastal sites. The cave of Kabara opens due west in the western cliff of Mt. Carmel near its southern edge (Turville-Petre 1932; Garrod 1954). The section is self-explanatory (fig. 4); the upper layer is a stone complex of 0.10 to 0.75 m., with no fine matrix. The archeological content of the layer, as defined by Turville-Petre, is from the "First Bronze Age to recent Arab" (Ibid.: 271). This layer immediately overlies the Natufian layer B, and it seems to be contemporary with the stony layer at Sefunim.

Inside the northwest facing cave of El-Wad, (Garrod 1932, 1937), the upper layer A was made of uncemented angular stones with very little fine material in between (fig. 5). It was 1.90-2.20 m. thick in the front chamber, becoming less pronounced toward the back of the cave where it thinned to 50 cm. and had fewer stones embedded in a black clay matrix. The archeological content, as assigned by Garrod, was from Arabic and Byzantine to Early Bronze. But there existed Chalcolithic and Neolithic as well (author's examination of the material at the Rockefeller Museum, Jerusalem; cf. Garrod 1937: 29).

The remains of recent periods were definitely more abundant toward the top of the layer, and the ancient ones dominated toward the base. In addition, the stony layer had many Natufian or Upper Paleolithic remains at its base, depending on the layer upon which it lay. Many of these were rolled and abraded, hence a post-Natufian erosional phase was postulated by Garrod. The same erosional phase may perhaps be seen in the thin calcareous crust underlying the stony layer at Sefunim, but there no abraded or rolled flints of any period were found.

The only "organized" archeological remains found in layer A of El-Wad were a contracted burial of unknown age at its base (in chamber II) and a few thin hearths (in chamber I). Layer A in the cave of El-Wad is thus a replica of layer 7 in Sefunim in all aspects.

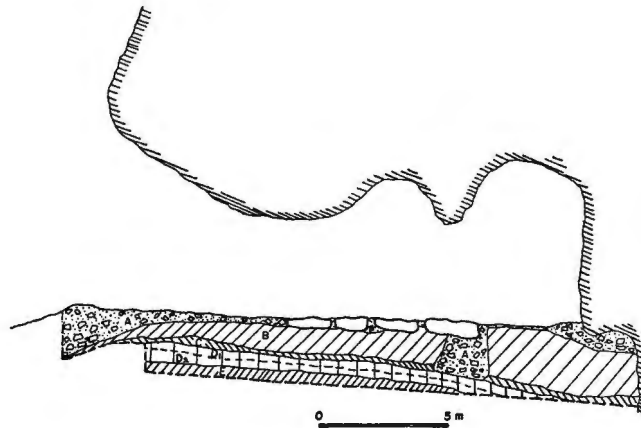


Fig. 4. Kabara, section (after Garrod, 1954).

On the terrace of El-Wad, layer A took the atypical character of a brown soil with abundant angular stones, like the equivalent layers on the terrace of Sefunim. It was 1.20 m. thick near the entrance and thinned out to 0.30 m. at the terrace edge. The archeological contents were of the same periods as inside the cave, with the same distribution of the earliest periods clearly dominant in the lower part and the later periods in the upper part. Layer B, the Natufian below, contained distinctively fewer stones than A (fig. 5).

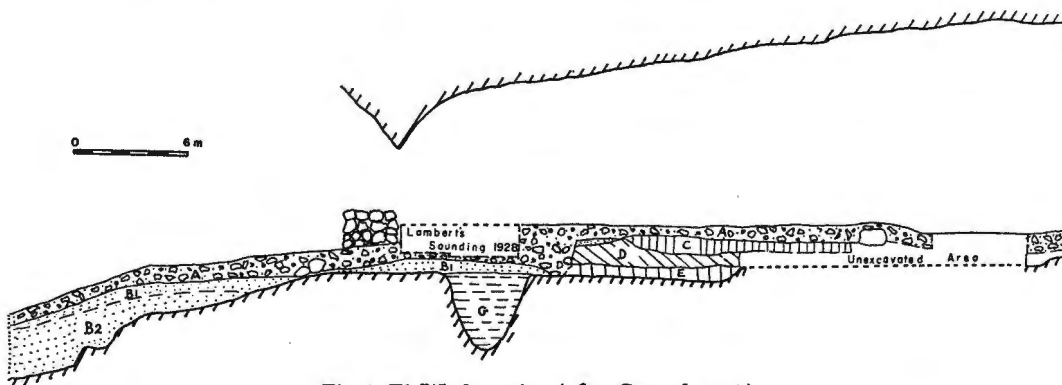


Fig 5. El-Wad, section (after Garrod, 1937).

At both Tabun and Skhul, facing respectively northwest and north, layer A is a stony complex and a terrace deposit, hence rich in fine matrix washed from the plateau above. Though in both cases the contents are simply stated as "Bronze Age to recent", it seems to us that we are dealing here with the same formation as elsewhere on the west side of Mt. Carmel, covering the time span from the Neolithic to the Bronze Age.

In Tabun (fig. 6), layer A was 1.30 m. deep near the cliff and 0.30 m. at the terrace edge, the same thickness as for El-Wad terrace. Layer B, Mousterian, is also very rich in stones, but clearly less so on the terrace than inside the chimney and the chamber (Garrod 1937: 62), a distribution indicating that the opening of the chimney is the main source of stones. Layer A, on the contrary, was especially stony on the terrace (Ibid: 59), and the cliff should be regarded as the source of stones this time. According to Garrod, layer A had potsherds from Bronze Age to Byzantine together with derived Mousterian implements and a very small Natufian element (Ibid.). It is to be noted that Tabun chimney, which was sealed

from the rest of the site by Mousterian deposits, does not show any signs of stony complex of post-Paleolithic times, nor of course any recent occupation. This will be dealt with below.

The information concerning layer A at Skhul (McCown, in Garrod 1937) is the briefest and the vaguest ever encountered by us. However, it may be judged (Garrod 1937: 94-6, and pl. L) that it is the equivalent of layer A at Tabun, both geologically and chronologically (see also McCown 1932).

A post-Natufian stony complex also exists in the cave of Abu-Usba, facing north in the south cliff of Nahal Oren. The same mixture of Bronze Age, Chalcolithic, Neolithic and some Natufian was encountered here (Stekelis and Haas 1952).

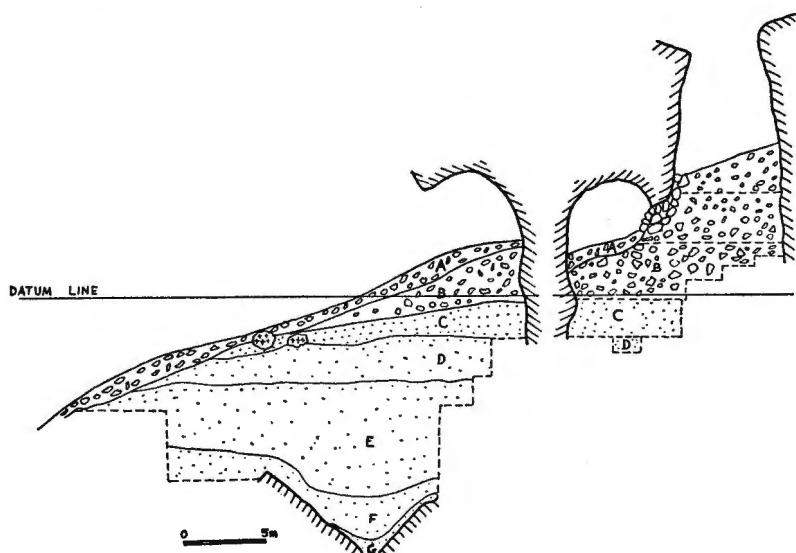


Fig 6. Tabun, section (after Garrod, 1937).

The terrace of Oren cave, facing south (Stekelis and Yizraeli 1963) has a stony layer in the horizon of the Neolithic occupation (personal observation), but as of now no section is available. (See, however, Bar-Yosef 1970: 30).

Coming north along the Mediterranean coast, Zumoffen's sections for the cave of Antelias, facing southwest (Copeland, unpublished) show important angular stony debris near the cave walls, toward the top of the deposits. Ksar Akil (Ewing 1947), facing south, is well-known for its three Paleolithic stony complexes, seen in the section (fig. 7). In the text, however, Ewing talks about big blocks in the upper layers that hampered the excavation (Ibid.: 188). These stones are not shown in the section, but Ewing stresses that they were bigger than those forming the underlying stony complexes.

The best documented Holocene stone complex on the Lebanese coast exists in layer III of Abu-Halka (Haller 1946: 10), that faces northwest. The front part of this cave has been destroyed by railroad construction, and the excavations affected only the back part. Here the stony layer is 0.40-0.60 m. thick, with big blocks at its base (fig 8). Layer II immediately above it is Roman. Layer III yielded, according to Dunand, potsherds of Roman and "énéolithique" (= Chalcolithic) periods, together with a non-characteristic flint industry (Neolithic?). The Roman sherds are seemingly intrusive from layer II. We are left, again, with a stony complex formed mainly during the Chalcolithic, perhaps including the Neolithic as well.

Abu-Halka, Ksar Akil and probably Antelias have stony layers of a nature similar to Mt. Carmel sites, and, on the basis of the Abu-Halka evidence, contemporary with them. No data is available in this

respect for Adlun (Garrod and Kirkbride 1961) or for Ras el-Kelb (Garrod and Henri-Martin 1961): the entire front part of the first and the upper layers of the second were destroyed prior to the excavations.

Summary of Coastal Sites

All the well-documented caves along the Eastern Mediterranean coast show a Holocene layer of loosely packed angular stones of varying size, with no fine material intercalated. In terraces and shelters

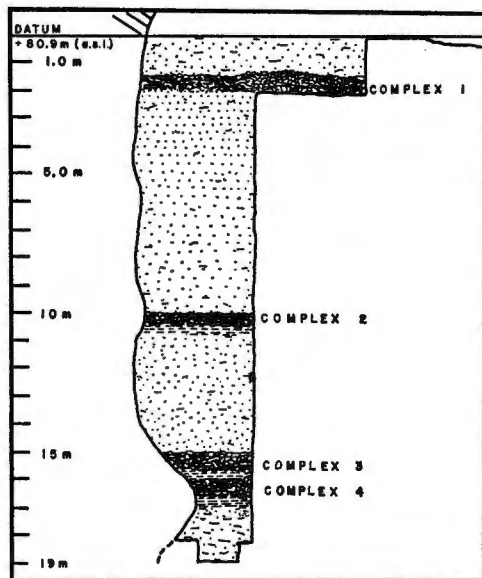


Fig. 7. Ksar Akil, section (after Ewing, 1947).

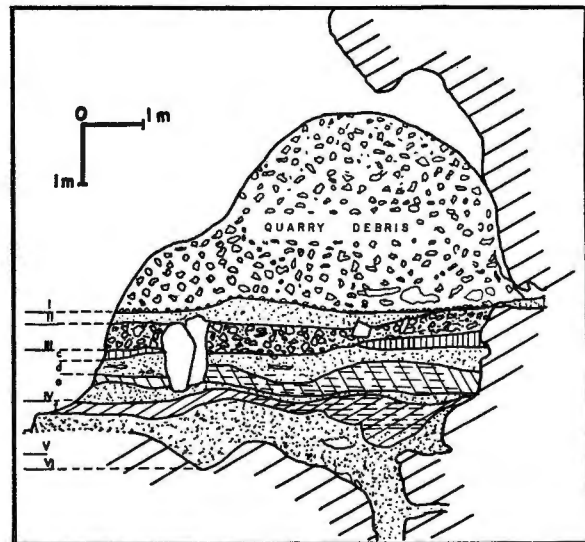


Fig. 8. Abu-Halka, section (after Haller, 1946).

this stony complex is imbedded in fine matrix. This complex occurs inconsistently above Natufian deposits (Sefunim, El-Wad, Abu-Usba, Oren) or Paleolithic deposits (Tabun, Skhul, Kabara, Abu-Halka, Ksar Akil, Antelias). This formation is sometimes overlain by late historical layers. On the basis of the best documented of these coastal sites, an approximate duration of between 6000–3000 B. C. is suggested for all of the Holocene stony complexes.

Inland Sites

Of the nine documented Judean desert sites, Erq el-Ahmar alone appears to have some parallel to the stony complex described above (Neuville 1951; Echegaray 1968). Even if some enrichment of stones can be seen from the sections of Holocene layers in other sites, it is not well expressed and not markedly different from underlying layers. In the north facing Erq el-Ahmar, Neuville notes that stones fell in and on top of layer A1, containing Bronze I–II. The underlying layer A2 is Natufian. It might be concluded that in the Judean desert there is but a very weak manifestation if at all, of a post-Pleistocene stone layer.

Continuing northward to the Judean Mountains, the Neolithic site of Abu-Gosh differs from the rest of the caves and shelters examined here, in that it is a village occupying a semi-circular depression facing southwest, near Jerusalem (Dollfus and Lechevallier 1969). Nevertheless, angular stone fragments are very abundant in the grey layer, 0.50 m. thick on the average, in which the cultural remains are

found (layer 2). In contrast, stone fragments are absent in the underlying layer 3, lying above bedrock; and stone fragments are far less abundant in the overlying surface layer 1 where they seem to derive mostly from layer 2 (fig. 9). During the occupation of this Neolithic site, attributed to the end of the seventh millennium B. C. (PPNB, *Ibid.*: 287), an important fragmentation of nearby limestone cliffs apparently took place. The date assigned here to this event is consistent with the above mentioned C¹⁴ dates at Sefunim.

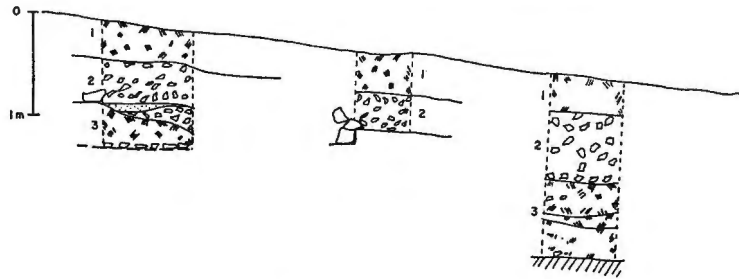


Fig. 9. Abu Gosh, section (after Dollfus and Lchevallier, 1969. Not to horizontal scale).

The cave of Shukba lies at the western slope of the Judean Mountains, opening to the southeast (Garrod 1932, 1942). Layer A is composed here of “angular fragments of loosely packed stones”, varying in thickness from 0.50 m. to 2.75 m. The upper surface is horizontal, the lower one fills in an irregular surface made partly of Natufian deposits, partly of Mousterian. The underlying Natufian layer B has very few stones in it.

Layer A lacks an inner stratigraphy, and the archeological remains are unorganized except for several hearths at one locality and a badly preserved skeleton, below the hearths. The archeological content of layer A include, according to Père Vincent, predominantly Early Bronze with some Middle and Late Bronze, and very few sherds from Iron Age to late Arabic. The above description and the section given (fig. 10) are almost a copy of the situation at El-Wad and Sefunim, hence a contemporary formation for all these stony complexes might be postulated.

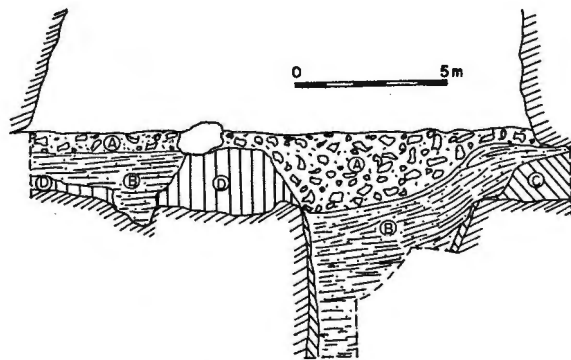


Fig. 10. Shukbah, section (after Garrod, 1942).

The cave of Qafza in lower Galilee, facing south-west, (Neuville 1951; Vandermeersch 1968), has very abundant stones of all sizes in the late deposits (layers 2-3 of Vandermeersch, apparently correspond to B of Neuville). This complex differs from the typical stony complex in coastal caves in that it is embedded in a fine matrix (fig 11). The time span of this formation at Qafza is as yet hard to determine precisely. Bronze Age and later periods are represented, accompanying a carefully built floor of thick stone slabs

(layer 3 of Vandermeersch). Unfortunately the finds of the underlying and relatively stoneless layer 4 are as yet difficult to assign typologically (Ronen and Vandermeersch, in press). There might be an aceramic Neolithic, in which case the formation of the atypical stony layer at Qafza would have been started slightly later than in the coastal sites. If layer 4 is upper Paleolithic, then the beginning of the stony formation at Qafza cannot be precised. In either case it might be concluded as roughly contemporary with the other stony complexes mentioned above.

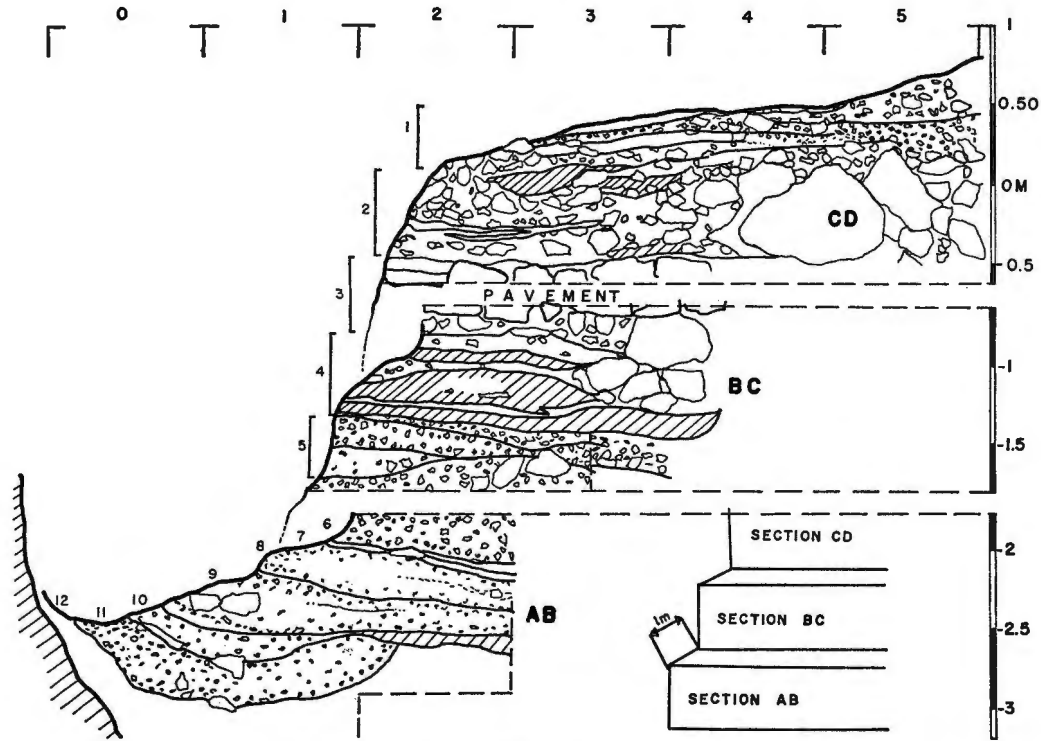


Fig. 11. Qafza, section (after Vandermeersch, in press).

The Hayonim cave in western Galilee, ca. 17 km. from the coast and facing south-east, does not show any evidence of a stony layer such as that discussed here (Bar-Yosef and Tchernov 1966). Directly above a Natufian layer, very rich in stone debris (fig. 12), there is a thick layer of Byzantine occupation.

Still in Galilee and bordering the Jordan valley there is the group of caves of Nahal Amud. Of these, the cave of Amud in the western cliff and opening to the east, lacks altogether a stony formation of the kind and age that we are seeking³ (personal observation). The same is true for the cave of Shovakh, equally facing east (personal observation; Binford 1965). But indications of the stony layer reappear in this same wadi in those caves that face west, Emireh and Zuttiyeh.

Emireh cave and terrace (fig. 13) had an upper layer composed of fine deposits 0.25–0.50 m. thick “containing large blocks of fallen rock, worked flints of Late Paleolithic type, and pottery of all ages from Neolithic to the present day” (Turville-Petre 1927: 4). This layer lay on top of the Paleolithic deposits, that were “practically free from stones” (Ibid.). This picture fits into what we have seen elsewhere – a stoneless Paleolithic layer overlain by a stony complex containing archeological remains from Neolithic onward. We assume that at Emireh, as elsewhere, the Neolithic was more abundant at the base, the more

³ Suzuki and Takai 1970.

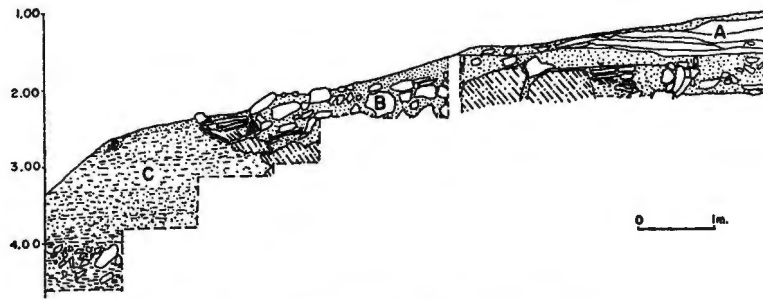


Fig. 12. Hayonim, section (after Bar-Yosef and Tchernov, 1966).

recent periods at the top. We assume thus that one deals with the same time span for this stony complex as for the coastal sites.

In the neighboring cave, Zuttiyeh, the following picture appeared (fig. 14): the five top layers, of blackish or dark brown soil contained successive occupation levels and hearths of Arabic, Byzantine, Iron Age, and, in the lowermost, Bronze Age to Neolithic (Turville-Petre 1927: 17). Underlying this occupation, according to the excavator, but well within it as seen in the section, at 1.20 m. below the surface, there was a continuous layer of fallen rock. This in turn rested on a reddish, Paleolithic layer in which stones occurred, "but they never formed a continuous layer as they had done at a depth of 120 cm." (Ibid.). Furthermore, the stones in the Paleolithic layer showed encrustations of stalagmitic and phosphatic precipitates, in contradistinction to the post-Paleolithic stones (C. Baynes, in Turville-Petre 1927: 25).

The interesting aspect of Zuttiyeh is that here the stone fall clearly took place prior to the post Bronze Age occupation, during which deposits of fine material were formed in the cave. Elsewhere in the East

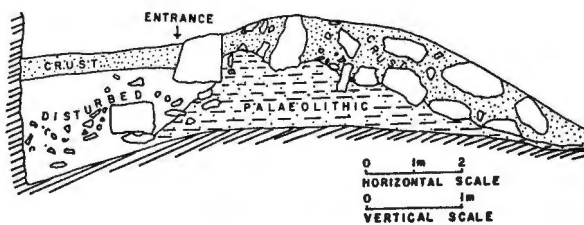


Fig. 13. Emireh, section (after Turville-Petre, 1927).

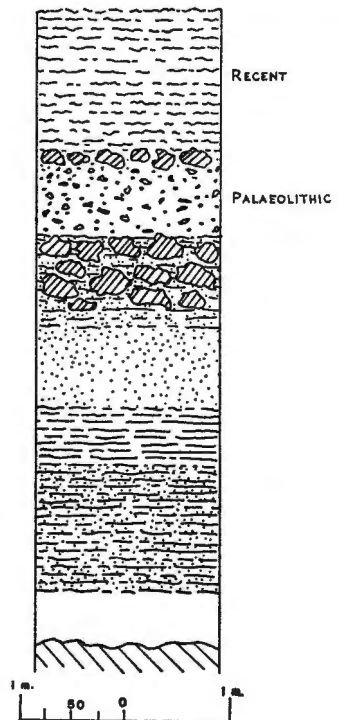


Fig. 14. Zuttiyeh, section (after Turville-Petre, 1927).

Mediterranean region this is not the case, hence the presence in the stony complexes of post Bronze Age remains.

The cave of Salha in Upper Galilee (Turville-Petre 1927: 111–115), facing west, gave the following information that concerns us here (fig. 15): a layer of rock fall of 0.40 m. thick occurs between occupation layers of Neolithic-Chalcolithic (layer III) and Chalco-Early Bronze (layer II). Layer I, the uppermost, also had a very large quantity of small stone fragments embedded in a reddish earth. The archeological content of layer I was as follows: Bronze Age dominant in the lower half, Arabic in the upper half (Ibid.: 112). We might be dealing here with two successive phases of rock fall, both forming between the Neolithic and the beginning of the Bronze Age, like the other stony complexes described above.

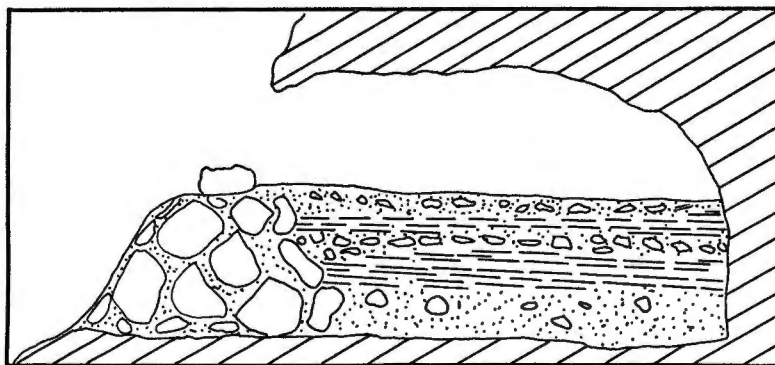


Fig. 15. Salha, section (after Turville-Petre, 1927).

The documented Syrian inland caves did not yield a clear indication of a post-Paleolithic stone complex. Thus nothing of the sort is shown in any of the published shelters of Yabrud, at 1400 m. altitude (Rust 1950; Solecki 1968). The same is true for Jerf Ajla, where the stony complex situated near the top of the section is of Paleolithic age (Goldberg 1968; Schroeder, in letteris, Toronto, February 23, 1971).

Summary of Inland Sites

Holocene stony layers exist in the East Mediterranean inland sites, with an archeological content covering the same periods as on the coast. Some differences exist however between the two regions:

a. Frequency of occurrence: this stony complex exists in only seven, out of twenty documented inland sites, as against ten out of ten documented coastal sites.

b. Aspect: judging from the available descriptions and sections, the stony complex inland is made mainly of big blocks, with fine matrix intercalated. None of the inland sites shows the thick layer made of loosely packed angular stones of the coastal sites. The cave of Shukbah is the only one exception here, with a well developed and typical stone complex at a distance of 40 km. from the sea. This will be dealt with below.

The stony complex in inland sites further differs from its coastal counterpart by the impression given of two or more phases of stone fall in some cases (e. g. Salha). This can be paralleled with the local distinction in Sefunim between a thin, upper stony complex (layer 5) and a lower, thick one (layer 7). Haua Fteah, to be described below, also shows a lower, main complex developed in layer IX and at least another, less marked one in layer VII. The nature of the present evidence does not permit to conclude if these subdivisions are local or widespread, or if they are partly due to human activity, as was suggested for layer 5 of Sefunim.

Finally, some of the inland Holocene stony layers do not differ so markedly from the underlying layers by their stone content as is the case in the coastal sites. The underlying layers in inland caves, whether Natufian or Upper Paleolithic, have a greater stone content than their coastal equivalents (e. g. Hayonim, Qafza vs. Sefunim and El-Wad).

To sum up, the post-Pleistocene stone complex is less well manifested, both quantitatively and qualitatively, inland than on the coast. The further inland we go, the less it exists⁴ (Judean Desert sites).

Additional Sites

We are primarily concerned here with East Mediterranean sites, but some additional relevant information is worthwhile to include in this survey, concerning two Cyrenaican caves.

At the Haua Fteah (McBurney 1967), which opens to the north on the Cyrenaican coastal plain, several layers especially rich in angular stones are visible in the sections. The best developed stone complex occurs in layer IX, of ca. 1 m. depth and apparently with no fine matrix. Repeated stone fall occurs intermittently up to layer VI. Layers IX (Lybico-Capsian) through VI (Neolithic) actually cover the time span of 6000–3000 B. C., so that these stone complexes are contemporary with those observed along the East Mediterranean coast (cf. Taute 1970).

A somewhat similar, though less clear and less developed phenomenon is seen in the cave of Hagfet ed-Dabba, ca. 17 km. from the sea and opening to the south (McBurney and Hey 1955: 195). Stone fragments abound in layers I and II. The age of these stony formations is unclear: Roman potsherds were found not only in layers I and II, but in III and even IV, where they are clearly intrusive. The stony complex of layer I might have been formed prior to the Roman occupation, in which case we could again be dealing with the same time period as that of Haua Fteah. No other stony layer exists in the cave of Dabba.

Thus in Cyrenaica, like in the East Mediterranean, post-Paleolithic stony complexes exist, and more clearly evidenced on the coast than inland. These stony formations seem to fall within the same time span in both of these areas.

Discussion

The considerations presented above are partly based on evidence provided by workers who had but minor interest in the recent layers. Nevertheless, Neuville's and Garrod's descriptions of their strata are highly informative. Turville-Petre's description of his work in Galilee, although somewhat more schematic, is quite detailed concerning the recent layers.

A post-Pleistocene stony complex is shown to exist in seventeen out of thirty documented East Mediterranean sites, as well as in two Cyrenaican sites. It is well developed both in its geological appearance and in its geographical distribution. Actually it is far better developed and more widespread than any similar formation dating from that portion of Pleistocene time commonly represented in the East Mediterranean sites, i. e. from Middle Paleolithic onward.

The date of this formation is not easy to assign, partly due to insufficient description of the archaeological content, and partly to the ease with which more recent material could have penetrated the loosely packed stones. Too much importance need not be attached, however, to the frequently repeated label of "Bronze Age to recent", assigned to the archaeological content of this complex and apparently coined by

⁴ It is interesting to mention here that the Natufian horizon at Eynan (Perrot 1966) is directly covered by 0.10 to 0.15 m. of loosely packed talus debris, the age of which can unfortunately not be determined. This in turn is covered by 0.40 m. of recent alluvium including fewer stones.

Garrod. This label was sometimes assigned without close examination of the contents, sometimes by using old and incorrect notions of pottery types. (See for example the discussion in Garrod 1932: 268)⁵. In those cases where a closer examination was made and an accurate description given, or when the material could be restudied, then Neolithic and Chalcolithic are shown to dominate (cf. Shukba, El-Wad, Sefunim, Zuttiya, Salha). Some sites, of course, may not have been occupied during the entire formation of the stony complex. On the basis of the evidence from Sefunim, where the layer starts 5–10 cm. above a C¹⁴ date of 7400 B. C., we assume the beginning of the stony formation at about 6000 B. C. This assumption is further supported by the stony layer within which the PPNB site of Abu Gosh is situated.

The end of the formation of all stony complexes is more difficult to fix. The evidence of archeological content is tenuous in this respect, and in most of the cases frequencies of cultural remains per period are not given. Judging mainly from the evidence of Sefunim, supported by that of El-Wad and Abu-Halka, the end of the stony formation is believed to occur ca. 3000–2500 B. C. Thus the formation of the stony complex would have taken place between the sixth and the third millenniums B. C.

Table 1 summarizes the available data. The sites are grouped into coastal and inland groups, each listed from south to north (see map, fig. 16). The direction faced by each site is given, as well as information related to a former, pre-Neolithic stony layer. Though we are not directly concerned here with this former stony layer, it furnishes with some comparative data.

Table 1. Occurrence of Stony Complexes in East-Mediterranean Sites
(Listed from South to North)

| Sites With Post-Pleistocene Stony Complex | Stone Complex | | Facing | Sites Without Post-Pleistocene Stony Complex | Stone Complex | | Facing |
|---|---------------|-------------|--------|--|---------------|-------------|--------|
| | Post-Pleist. | End-Pleist. | | | Post-Pleist. | End-Pleist. | |
| Coastal | | | | Inland, cont. | | | |
| 1. Kabara | + | — | W | 8. Tabban | — | — | SE |
| 2. El-Wad | + | — | NW | 9. Abu Sif | — | — | SE |
| 3. Tabun | + | — | NW | 10. Tor Abu-Sif | — | + | S |
| 4. Skhul | + | — | N | 11. Zweitina | — | — | W&N** |
| 5. Usbah | + | — | N | 12. Sahba | — | — | SE |
| 6. Oren, terrace | (+)* | + | S | 13. El Khiam | — | + | SE |
| 7. Sefunim | + | — | NW | 14. Umm Naqus | — | + | SE |
| 8. Antelias | (+) | — | SW | 15. Umm Qatafa | — | + | SW |
| 9. Ksar Akil | (+) | + | S | 16. Hayonim | — | + | SE |
| 10. Abu-Halka | + | — | NW | 17. Shovakh | — | — | E |
| Total | 10 | 2 | | 18. Amud | — | — | E |
| Inland | | | | 19. Yabrud II, III | — | (+) | S |
| 1. Erq el-Ahmar | (+) | + | N | 20. Jerf Ajla | — | + | S |
| 2. Abu Gosh | + | — | SW | Total | 0 | 7 | |
| 3. Shukbah | + | — | SE | Cyrenaica | | | |
| 4. Qafza | + | + | SW | Haua Fteah | + | — | N |
| 5. Emireh | + | — | W | Dabba | + | — | S |
| 6. Zuttiyah | + | — | W | | | | |
| 7. Salha | + | — | W | | | | |
| Total | 7 | 2 | | | | | |

* Parentheses indicate insufficiently documented occurrences.

** Has two openings.

⁵ Layer A 1 at Erq el-Ahmar was assigned as to "Early and Middle Bronze" as early as 1931 (Neuville 1932). As it was conceived in that time, this Early Bronze may very probably include Chalcolithic as well.

A note is necessary for the term "end-Pleistocene stone complex", used in Tables 1 and 2. In its most typical occurrence, this earlier stone complex is known from Ksar Akil (fig. 7). In all other East Mediterranean sites it occurs less typically, in some cases in Natufian (Hayonim, fig. 12; Oren, Tor Abu-Sif), in other cases in Upper Paleolithic (Qafza, fig. 11; Umm-Naqus, Erq el-Ahmar, El-Khiam [?], Jerf Ajla), finally in sterile layers underlying Holocene deposits (Umm Qatafa layer B). While their age is by no means the same, common to all these stone layers is their being the latest Paleolithic or Epi-Paleolithic occurrences of this kind preserved in the mentioned sites; hence their comparative value.

The information in Table 1 can be summarized as follows:

a) In all of the documented coastal sites the Holocene stony complex is present. An older stony complex exists only in two. Out of twenty inland sites, only seven contain the Holocene stony complex, and nine have an End-Pleistocene one.

b) Altogether, seventeen sites contain the Holocene stony layer, of which fourteen face north or west. Out of eleven sites where a former stony complex exists, eight face south or east.

These observations suggest a correlation between site location, its facing direction and the formation of stony layers. Furthermore, they would suggest that there has been a clear change of distribution of the two latest stony complexes with the older occurring in preference in inland sites facing south or east, and the recent one occurring in preference in coastal sites and those facing north or west. These two factors – proximity to the sea and orientation – are to some extent related, since most coastal sites face north or west while most inland sites face south or east. Our assumption of different patterns of distribution for the two latest stone formations can be further checked with the data in Table 2.

Table 2. Distribution of Stony Complexes According to Location and Facing of Sites

| Sites | Total No. | Facing | | Post-Pleist. Stony Complex | Facing | | End-Pleist. Stony Complex | Facing | |
|---------|-----------|--------|--------|----------------------------|--------|--------|---------------------------|--------|--------|
| | | N or W | S or E | | N or W | S or E | | N or W | S or E |
| Coastal | 10 | 8 | 2 | 10 | 8 | 2 | 2 | | 2 |
| Inland | 20 | 8 | 12 | 7 | 6 | 1 | 9 | 3 | 6 |
| Total | 30 | 16 | 14 | 17 | 14 | 3 | 11 | 3 | 8 |

End-Pleistocene stone layers are more abundant inland than on the coast (nine against two cases), but the most typical occurrence is specifically on the coast (Ksar Akil), so that proximity to the sea cannot be shown as a dominant factor in these formations. As for orientation, it was mentioned above that eight of the eleven cases occur in south or east facing sites, and indeed the two coastal sites with the older stone formation are precisely those two that face south (Oren and Ksar Akil), contrarily to all other documented coastal sites. When inland sites alone are considered, however, then the orientation does not seem to be of importance: eight sites face north or west and three of them have an End-Pleistocene stony layer, i. e. almost 50 %. Twelve inland sites face south or east, of which again 50 % have End-Pleistocene stony layers. Yet, when all sites are considered, then of the fourteen that face south or east eight have this formation, but only three, out of the sixteen facing north or west, have it. Orientation of sites seems to us an important factor in the formation of End-Pleistocene stony layers, but the observations are too few to permit a definite conclusion.

Turning to the Holocene stony layers (Table 2), these exist in 100 % of the coastal sites as against 30 % in inland sites, suggesting that proximity to the sea is a dominant factor. This formation is present in fourteen out of the sixteen documented north- or west-facing sites, but in only three out of fourteen south- or east-facing sites. The pattern of orientation is clearly shown in the marginal inland areas of this occurrence: the single Judean Desert site where this Holocene formation can be detected faces

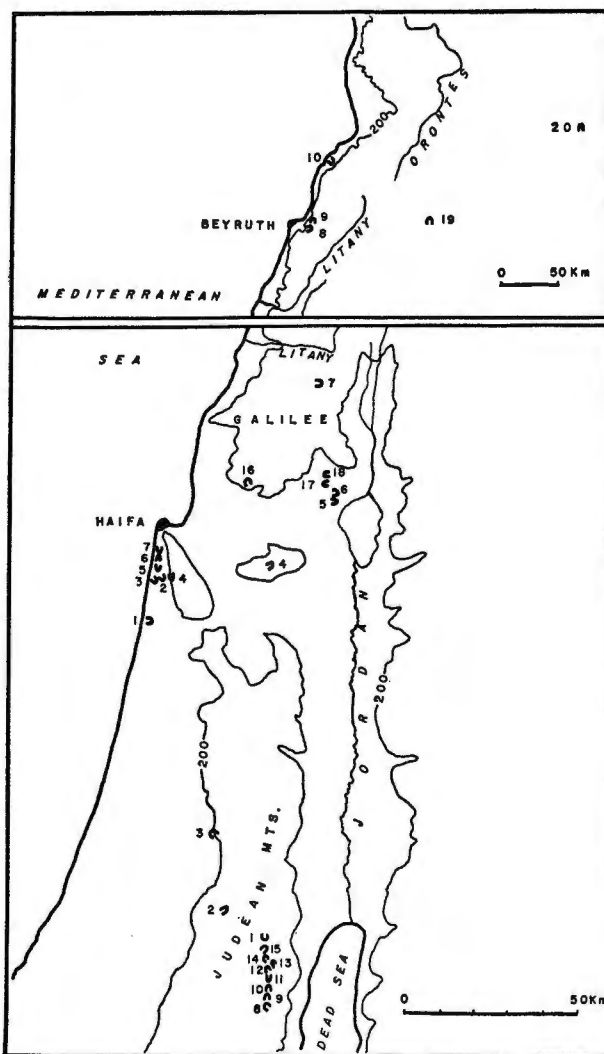


Fig. 16. Map showing location and orientation of sites mentioned in the text.

Coastal sites: 1 Kabara, 2 El-Wad, 3 Tabun, 4 Skhul, 5 Abu Usba, 6 Oren, 7 Sefunim, 8 Antelias, 9 Ksar Akil, 10 Abu Halka.

Inland sites: 1 Erq el-Ahmar, 2 Abu Gosh, 3 Shukbah, 4 Qafza, 5 Emireh, 6 Zuttiyeh, 7 Salha, 8 Et-Tabban, 9 Abu Sif, 10 Tor Abu Sif, 11 Zweitina, 12 Sahba, 13 El Khiam, 14 Umm Naqus, 15 Umm Qatafa, 16 Hayonim, 17 Amud, 18 Shovakh, 19 Yabrud, 20 Jerf Ajla. (Numbers are the same as in Table 1.)

north (Erq el-Ahmar)⁶. In the group of sites of Nahal Amud, the two caves facing west have this formation (Zuttiyeh and Emireh), but the two facing east lack it (Amud and Shovakh). Thus, north- or west-facing sites definitely favored the formation of the Holocene stony layer (fig. 17).

⁶ The only other Judean Desert site where cave ceiling is reported to have collapsed in a recent, but unprecisable period is Umm-Qatafa, facing SW. (Neuville 1951).

Turning now to a possible cause for the formation of the recent stony layer, the only one that concerns us here, its clear pattern of geographical distribution would a priori favor a climatic cause. But given the fact that stone complexes are normally associated with cold periods, and that such stony layers are rare even in the Holocene of northern latitudes, other causes for the East Mediterranean phenomenon should first be considered. In ascending order of probability, earthquakes, then human activities will be examined.

It is possible to postulate that earthquakes affected the entire length of the East Mediterranean littoral, and to a lesser degree the inland areas between the sixth and third millennium B. C. But this hypothesis fails to explain why in the marginal, inland occurrences of the stony complex, north- or west-facing sites were far more affected than those facing east or south. The closely situated caves of Nahal Amud constitute a strong case against the earthquake hypothesis.

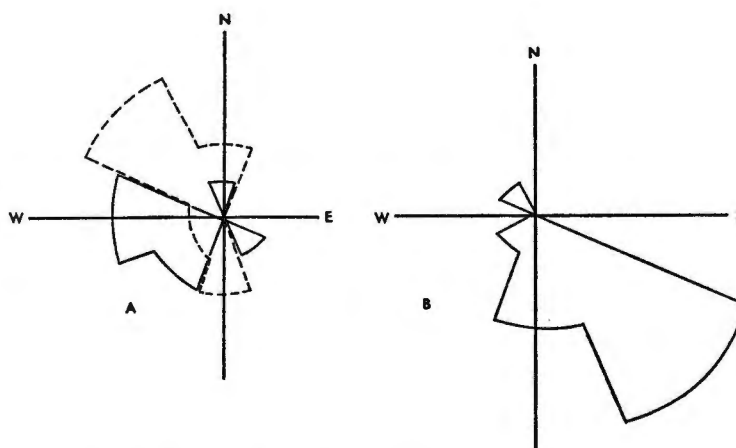


Fig. 17. Orientation of sites. A, with Holocene stony layer. B, without Holocene stony layer.
(Solid line: inland sites; broken line: coastal sites.)

The fragmentary and mixed aspect of the pottery from the stony layer at Sefunim suggested to A. Ben-Tor that the complex might be an artificial filling material (personal communication). An outside source for this filling material is excluded, for practically all the stones are derived from the cave walls. There remains the possibility of which C. S. Coon is well aware, that of "angular rubble produced by stonecutters' picks" (Coon 1957: 101). Quarrying in caves may have taken place for two reasons: first, as a supply of building stones; second, to fill up irregularities and to level the living floor. As for the hypothesis of stone supply, there are no stone constructions known today of the sixth through fourth millenniums B. C. in the vicinity of Mt. Carmel or in Galilee that would require such an extensive quarrying. Furthermore, the many natural cliffs would offer as easy quarrying and easier transportation of stones than many of the caves concerned here. There is no apparent reason for quarrying in Zuttiyeh but not in Shovakh, only 1 km. apart and equally accessible. The cave of Salha, said by the excavator to have an especially difficult access, is hard to imagine as a quarry. And finally, we are once again hurt by the facing distribution: why exploit preferentially west and north facing caves? Stonecutters' picks thus seem excluded as a source for building stones. There remains the possibility of filling irregularities of the underlying surface. This hypothesis fits many of the observed facts, as follows: the Holocene stony complex lies in most of the well documented caves upon a very irregular surface (e. g. Sefunim, El-Wad, Shukbah, Kabara, among others), the leveling of which could have been done by stone debris quarried from the walls. It would have been the work of the Neolithic inhabitants, or whoever the first post-

Natufian occupants of the cave were. Thus the absence of the stone complex in the chimney of Tabun would be explained simply by the lack of post-Pleistocene habitation there. The stone complex in El-Wad is further reported to fill a vertical man-made hole 1.50 m. deep (Garrod 1932, 1937) in the front chamber. The angular stone debris confined to the cultural layer at Abu-Gosh would in this case result from local quarrying activity, though for building materials in this case.

Finally, the hypothesis of filling material might explain the geographical distribution pattern of the phenomenon. In several caves a pre-stony complex erosional phase was postulated (Shukbah, El-Wad, Abu Halka), which might very well have been a phenomenon confined mainly to the coastal area, where caves would have required leveling and filling material.

The hypothesis of the Holocene stony complexes being man-made filling material seems thus plausible, yet several logical considerations render it rather questionable. First, why should terraces, that show absolutely no signs of a preceding erosion, also be covered by stones? One might argue that this is the by-product of the cave-filling process, whereby stones had been spread on the terrace too. These might explain occurrences such as Sefunim, or El-Wad, but certainly not Tabun, where there is no cave to fill and no signs of erosion on the terrace. The second point to be questioned is the very nature of the fill. It is conceivable that stone fragments be used for this purpose in Sefunim, where the quantity of former deposits available is negligible. (We estimate at ca. 500 m.³ the minimum volume of the stony complex as against ca. 60 m.³ the maximum volume of pre-Neolithic deposits). But in El-Wad, as in many other caves, pre-existing deposits would have constituted a more convenient filling material and a far easier one to obtain than the extremely hard East Mediterranean limestones. Also, it is difficult to explain a more pronounced erosional activity in west and north facing inland caves than in those differently oriented. Finally, thicknesses up to 2 m. (El-Wad, Shukba, and Sefunim) seem excessive for filling purposes.

In consideration of all these observations, it seems that stonemasons' picks could at best be responsible for a few stony complexes or for a certain portion of their formation in each site. They cannot be regarded as the overall cause of these formations.

It seems then that a climatic cause is the only hypothesis that might account for the formation of the Holocene stony complex. The preferential occurrence of this complex on the coast and in north- or west-facing sites strongly suggests that humidity, rather than cold, played the most important role. In Israel today north- and west-facing slopes are far more humid than the opposing ones, combining more rain, almost the entire dew and less evaporation; apparently this was true for the period of 6000–3000 B. C. as well. The absence of a stony complex in Tabun chimney can thus be explained by its special topographic conditions, being practically closed to any post-Mousterian climatic influences except through the single vertical opening at the top of the chimney. The chimney might have acted as a vacuum-funnel and an isolator, rather than transmitter of external conditions. The perfect cylindrical shape of the chimney might be another reason why stone fragments were not formed in it.

The apparent anomaly mentioned above of Shukbah, which at a distance of 40 km. from the sea shows a very marked and typical stone layer, can now be explained by the fact that the coastal plain covers most of these 40 km. Shukba had a more pronounced marine influence than Hayonim, only half that distance away from the sea but surrounded by mountains, or than Qafza, which is in the rain shadow of Mt. Carmel.

The climatic conditions on the East Mediterranean coast during the period under consideration (End-Boreal and Atlantic of Europe) are entirely unknown. However, supporting evidence for this being a humid period came recently to light:

1) Pollen record. In the Hula Basin (northern Jordan Valley, Horowitz 1968) the pollen remains for the Atlantic period are interpreted as "humid and hot", with 36 % of A. P., as against 10–15 % in the Boreal period (interpreted as "hot and dry") and 60 % A. P. in the last pluvial ("humid and cool"). An

inland humid phase is a significant argument for a contemporary, and most probably more marked, humid phase on the coast.

According to the pollen diagram from the Ghab Valley in Syria (Niklewski and Van Zeist 1970), the period between 6000 and 3000 B. C. is at the peak of zone Z2, where a high representation of oak suggests either denser or more widespread forests than today. This peak of A. P. is higher than most End-Pleistocene tree peaks recorded in the Ghab.

The pollen record from western Iran, on the other hand (Van Zeist 1969), does not reveal any special feature between the sixth and the third millenniums. Here there appears a gradually and continuously increasing tree cover from ca. 12,000 B. C. on, culminating at ca. 3000 B. C. when the present oak forest vegetation became established⁷.

2) Hydrological record. The study of some circum-Mediterranean valleys (Vita-Finzi 1969) would suggest that a period of dissection of the older fill occurred from ca. 8000 B. C. on to the classical period (Ibid.: 96). The dissection phase is said to be a period of low humidity on the whole, with a few heavy rains. Since the dissection phase includes the period of the Holocene stone formations in the East Mediterranean, there seems to be a contradiction. However, there is a phase of aggradation seen in only three cases which would be contemporary with the dominant dissection phase and hence are considered local anomalies. The Tunisian coast case was assigned between the seventh and fourth millenniums, i. e. contemporary with our stone formation (Casteny 1955, cited by Vita-Finzi, Ibid.). A similar case in Jordan, which resulted in the Hasa formation in Wadi Hasa (Vita-Finzi 1966) was assigned to 8000–2000 B. C., but nothing precludes dating this formation between 6000 and 3000 B. C., thus matching both the Tunisian terrace formation mentioned above and the East Mediterranean stone formations⁸.

3) In Haua Fteah (Higgs, in McBurney 1967), the bovines, a hot and dry climate indicator, are at their absolute minimum between 6000–3000 B. C., and the caprines (= humid and cool) at their maximum, even more so than during any preceding period in the long Haua Fteah record. While the dominance of caprines in the Neolithic may reflect domestication, it is not so in the Lybico-Capsian (McBurney, pers. comm.), where indeed the important stony complex of layer IX was formed.

The Haua Fteah data further support the view that humidity, and not cold is responsible for the Holocene stone complexes. It seems that "most of the temperature rise closing the last glacial age took place . . . between the extreme limits of 11,000–7000 B. P." (McBurney 1967: 55), that is between 9000–5000 B. C., and "a marked temperature maximum occurred between 6500 and 4500 years B. P." (Ibid.), that is 4500 to 2500 B. C. The formation of the stony complexes thus accompanies the end of the post-Pleistocene temperature rise and continues through its maximum.

4) The suggested time span for the formation of the East Mediterranean stony layers roughly matches that of the Saharan subpluvial⁹ (ca. 5000–2350 B. C., Butzer 1966: 449), and that of the "cattle-nomads culture" both in the Sahara (Ibid.) and in the South Arabian desert (Anati 1970). Trans-Saharan con-

⁷ The pollen records of the Ghab and the Hula Valleys differ from that of western Iran not only for the Holocene, but even more so for the late Quaternary, this being a dry period in Iran, humid in the Ghab and very humid in the Hula.

⁸ The dating of the Hasa formation is tenuous. Its beginning is assigned to ca. 8000 B. C. (Vita-Finzi 1966) because the earliest artifacts found in it were Kabaran (Garrod's identification in Vita-Finzi, Ibid.). A C¹⁴ date of 2000 B. C. (from a hearth 1 m. below the surface) suggests the end of the formation. If the Kabaran implements are *in situ*, then the formation could have started as early as 15,000 B. C. If, on the other hand, they are intrusives, a point left unclear in the description of the formation, then a beginning date of ca. 6000 B. C. can be suggested. The C¹⁴ date, possibly contaminated by percolating water, is of small indicative value for the end of the formation.

⁹ This time span also roughly matches, interestingly, that assigned to the 2–3m. beach in Lebanon (6000–4000 B. C., Sanlaville 1969).

nections are also postulated, for the sixth through the third millenniums, between the Caspian on one hand and the Shamarkian, near Wadi Halfa, on the other hand (Wendorf 1968: 1052. C¹⁴ dates for the Shamarkian range between 5750 and 3270 B. C.).

Conclusions

The widespread existence in the East Mediterranean of a stony complex formed between ca. 6000–3000 B. C. has been documented above. Its pattern of distribution – expressed more on the coast than inland, and more in sites facing north or west than those facing south or east – suggests a pronounced increase in humidity for the period under consideration. This, together with other supporting evidences that came to light recently, is in accord with the conclusion “that between the sixth and the third millenia B. C. rainfall and humidity were distinctly greater than now” (Fisher 1963: 62), a conclusion that seems more firm today than when those lines were written¹⁰. Was the formation of the Holocene stone layers a single, more or less continuous process, or was it made up of distinct episodes? The present data would suggest that different processes took place at different regions, mainly the coast vs. inland areas. But the matter doubtless needs much refinement, and detailed studies of East Mediterranean Holocene deposits are badly needed. An intriguing problem lies in the fact that the Holocene stone complexes are better represented than those of the Pleistocene in the East Mediterranean, which would suggest that in certain times and places the Holocene might have been more humid than the Pleistocene. This is not substantiated by any pollen record known today from the East Mediterranean. At this point, one can only emphasize the possibility that the radical changes in human history that this region has seen during the Holocene were less independent of environmental changes than is sometimes held.

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The drawings were made by Miss Helen Wells, Arizona State University.

¹⁰ The then existing evidences did not convince Fisher, whose final conclusion was that „wetter conditions prevailed in the Near East only in Late Tertiary and Quaternary times” (Ibid.: 64).

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1. Sefunim, layers 1-7 in square G 45 (the scale is 10 cm.).



2. Sefunim, blocks at base of stony complex, square M 42.