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DATING THE PREHISTORIC SITE NAHAL ISSARON IN THE SOUTHERN NEGEV, ISRAEL[1]

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ABSTRACT. The prehistoric site Nahal Issaron is located on the alluvial fan of Nahal Issaron, a short wadi draining into Biqat Uvda some 50 km north of Eilat. Excavated in the early 1980s, it constitutes a major Pre-Pottery Neolithic B (PPNB) layer, with continued but sporadic occupation throughout the Late Neolithic to the Chalcolithic period. In the PPNB layer, a dense agglomeration of rounded, polygonal and rectangular structures was found, with courtyards and a variety of features such as hearths and ovens. The upper layer is badly preserved, apart from the hearths and ovens. Thirty samples from the site were ^{14}C-dated in the Rehovot laboratory and five in the Pretoria laboratory. The results enabled a fine temporal resolution between layers and a refinement of the 7th through 5th millennium BC chronology. The dates also placed the sequence of changes in architecture and lithics within a more robust temporal framework, thus making the site a key chronological anchor in the Neolithic of Southern Israel, Sinai and Jordan.

INTRODUCTION

The Neolithic settlement of Nahal Issaron is located at the eastern edge of Biqat Uvda, in the southern Negev Desert, Israel (34°55′E, 29°52′N). Biqat Uvda is a large, shallow syncline situated close to the border with eastern Sinai on one side, and a narrow band of hills forming the steep escarpment of the eastern side of the Rift Valley on the other (Fig. 1). The site is located on and in the center of the alluvial fan where Nahal Issaron, a short wadi draining eastwards from the edge of the escarpment, empties into Biqat Uvda. Precipitation is presently sporadic, averaging <50 mm per year. The Saharo-Arabian vegetation of the area is sparse, and almost entirely restricted to wadi channels. The closest sources of water are *ca.* 10 km away in the Rift Valley, *ca.* 400 m lower than Biqat Uvda.

A. N. Goring-Morris and A. Gopher directed three seasons of excavations at Nahal Issaron from 1980 to 1981, as part of the Emergency Archaeological Survey of the Negev (Goring-Morris and Gopher 1983, 1987; Gopher 1985; Gopher, Goring-Morris and Gordon, in press; Davis 1983; Lipschitz 1986). The systematic excavations completely or partially exposed some 230 m^2 in the central area of the settlement, which appears to have extended over *ca.* 500 m^2.

Given the excellent preservation of charcoal throughout much of the site, we undertook an extensive project of ^{14}C determinations. We chose samples to obtain the following results:

1. A chronological framework for the occupation history of the site.
2. A spatially extensive network of dates from all the excavated areas of the site.
3. Solutions to microstratigraphic problems.

METHODS

Thirty-five ^{14}C determinations were obtained—30 by the Weizmann Institute (Table 1) and 5 by Pretoria (Table 2). Preservation of samples tended to be poorer closer to the surface, with the exception of well-constructed hearths and ovens. Thus it was not always possible to provide samples from areas considered problematic and crucial stratigraphically. Precise locations of the samples are shown on the site plan, which includes the architectural remains from all occupational phases (Fig. 2). All sam-

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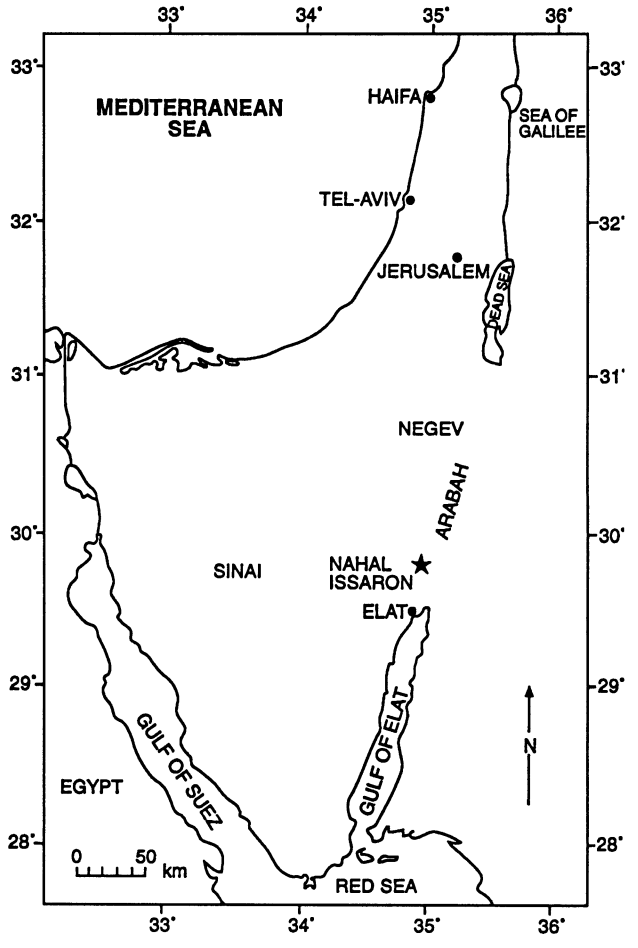

Fig. 1. Map of Southern Levant showing location of Nahal Issaron in the southern Negev

ples were charcoal. We used the acid-alkali-acid (AAA) treatment to clean them, and they were converted to ethane and counted in proportional counters (Carmi 1987).

Results

Most of the dates accord well with and complement the technotypological seriation currently used for the Neolithic in the Levant (Gopher 1985). Only a few results, such as Pta-3000 and RT-1665 from Locus 5, are obviously aberrant in terms of the stratigraphy (Tables 1, 2; Figs. 2, 3). We calibrated the dates to calendar years using the most recent program of Stuiver and Reimer (1993). Most surprising are several dates that considerably antedate the accepted chronology based on arrowhead typologies, *i.e.*, prior to *ca.* 7750 BC. These dates derive from samples at the base of the occupation sequence. This could be explained by 1) a conjectured *founders'* occupation, which left few material remains, or 2) by the use of old wood for construction and fuel during the main phase of occupation, or 3) a combination of both.

TABLE 1. Rehovot ^{14}C dates from Nahal Issaron

Sample RT-no.	Locus*	Grid coordinates†	Depth (cm below surface)	$\Delta^{14}C$ (‰)	$\delta^{13}C$ (‰)	^{14}C age (yr BP)	Calibrated range (cal BC)‡	Probability (%)§
1506	39	W38c	175–185	−504.2 ± 4.2	−21.5	5635 ± 70	4530–4365	100
1507	34	M37c	200–205	−634.4 ± 4.1	−21.5	8080 ± 90	7245–6770	100
1508	12	M35a+b	175–180	−612.6 ± 3.9	−21.4	7620 ± 80	6537–6362	97
1509	12	M35a+d	200–205	−624.5 ± 2.7	−21.6	7870 ± 55	6991–6849	6
							6765–6562	93
1510	17	I37a+b	220–230	−677.9 ± 3.4	−21.0	9100 ± 85	8193–8027	97
1511	17	H37a	150–155	−635.9 ± 3.7	−21.5	8120 ± 80	7262–7002	98
1512	15	S36cd+T35d	175–180	−659.2 ± 3.5	−11.3	8650 ± 85	7869–7817	20
							7707–7543	80
1513	9 (10-1)	N-O/40	174–179	−474.7 ± 1.4	−21.6	5170 ± 55	4039–3940	84
							3851–3821	16
1514	36-5	T33		−629.6 ± 3.9	−21.7	8200 ± 90	7296–7044	100
1515	25	L40a+c	210–215	−665.0 ± 3.4	−21.7	8785 ± 80	7938–7700	100
1516	46	K42a	205–210	−605.0 ± 4.6		7460 ± 95	6373–6187	100
1518	3	S32	145	−462.8 ± 3.2	−17.9	4990 ± 50	3903–3881	14
							3803–3703	86
1520	36A	O35c	--	−630.2 ± 2.5	−20.8	7990 ± 55	7007–6726	100
1521	36	O35	--	−648.1 ± 4.1	−20.9	8390 ± 95	7506–7305	100
1522	36	N35d+N36b	190–200	−646.4 ± 3.3	−21.0	8350 ± 75	7484–7451	100
1606	14?	F37a	165–178	−564.5 ± 4.5	−22.0	6680 ± 85	5610–5450	100
1607	10	M40d	206–210	−681.6 ± 2.8	−22.0	9195 ± 70	8331–8092	100
1608	35?	P31a+b	140–145	−507.5 ± 3.4	−21.8	5690 ± 55	4592–4460	100
1609	28 (36-1)	Q34	156–169	−660.8 ± 2.9	−22.0	8685 ± 70	7881–7810	30
							7719–7576	70
1630	42	U32a	135–140	−503.5 ± 4.2	−22.6	5625 ± 70	4515–4428	100
1638	2	P38c	188–195	−642.7 ± 3.5	−21.8	8265 ± 80	7422–7098	100
1640	8	N31a+d+M32b	178–182	−588.5 ± 4.9	−22.0	7135 ± 95	6046–5854	99
1663	8?	P33a+b	131–136	−511.6 ± 5.1	−21.8	5755 ± 85	4713–4513	100
1664	19	M39d	184–190	−645.4 ± 4.5	−20.9	8330 ± 100	7489–7258	96
1665	5	K37d	210–215	−612.1 ± 5.4	−21.1	7600 ± 110	6533–6240	100
1691	8?	N31b+a	158–165	−586.7 ± 3.7	−21.5	7100 ± 70	5991–5854	100
1692	31 (36-9)	T33d	131–136	−546.5 ± 4.8	−21.1	6350 ± 90	5423–5221	100
1699	41	Q36b	185–190	−656.8 ± 10.2	−21.1	8590 ± 240	7936–7420	100
1700	27	F40b	190–200	−628.1 ± 5.2	−22.7	7950 ± 110	7001–6654	100
1701	38	U33d	180–185	−643.6 ± 3.5	−22.7	8290 ± 80	7472–7102	100

*Loci numbers as designated on plan (Fig. 2); †See border, Fig. 2; ‡Calibrated using CALIB 3.0.3 (Stuiver and Reimer 1993); §Results are given at ±1 σ uncertainty; the probability shows the confidence in percent.

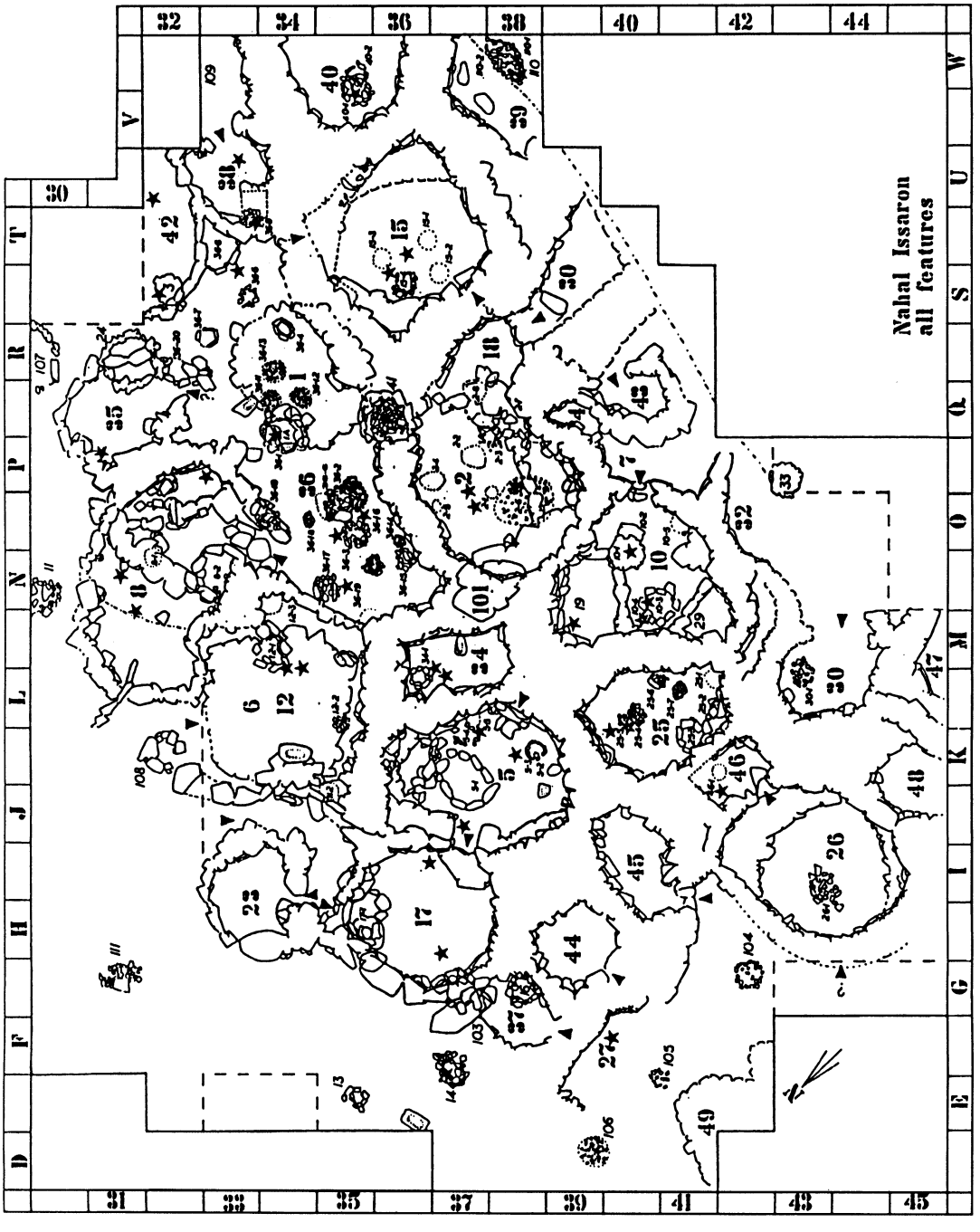

Fig. 2. Plan of the architectural remains from the excavations at Nahal Issaron (all phases). ★ = locations of charcoal samples for dating. ▶ = assumed entrance to the structures. Border represents grid coordinates (see Table 1).

TABLE 2. Pretoria ^{14}C Dates from Nahal Issaron

Sample Pta-no.	Locus	Grid coord.	Depth (cm below surface)	^{14}C age (yr BP)	Calibrated range (cal BC)*	Probability (%)†
2999	5	J37a	158–165	6460 ± 80	5440–5311	100
3000	5		200	8430 ± 80	7539–7418	91
					7345–7325	9
3376	2		160	8050 ± 80	7048–6725	90
3377	40		195	8180 ± 80	7266–7041	95
3486	15		160	6130 ± 80	5203–4944	100

*Calibrated using CALIB 3.0.3 (Stuiver and Reimer 1993)

†Results are given at ±1 σ uncertainty; the probability shows the confidence in percent.

The principal phase of occupation can be securely dated to *ca.* 7500–7000 BC and perhaps even 6750 BC, after which the site continued to be occupied sporadically until *ca.* 4500 BC, or shortly thereafter. Use of the site was probably seasonal and non-continuous, with a series of gaps in occupation. Following a brief hiatus, the latest two dates (RT-1513 and RT-1518) indicate a further brief use of the site at *ca.* 3800 BC.

When arranged sequentially (Fig. 3), the dates correlate well with depth below datum. This is somewhat surprising, given the evidence for differential depths of the various layers over the site, the excavation and construction of later features such as ovens and hearths into the underlying sediments and a general, though hardly marked, slope of the present and pre-occupation surfaces from east to west along the length of the alluvial fan. With few exceptions, the results also correlate well with field observations and subsequent analysis concerning details of the stratigraphic sequence. In certain instances, *e.g.*, in Locus 2 (Pta- 3376 and RT-1638), Locus 8 (RT-1640, -1663, -1691) and Locus 15 (RT-1512 and Pta-3486), the results provide important data on the microstratigraphy. Almost all samples provided consistent $\delta^{13}C$ results, which accord well with the identifications obtained independently on samples analyzed by Lipschitz (1986), namely that the charcoal derives primarily from C_3 vegetation, *i.e.*, indicating somewhat more humid conditions.

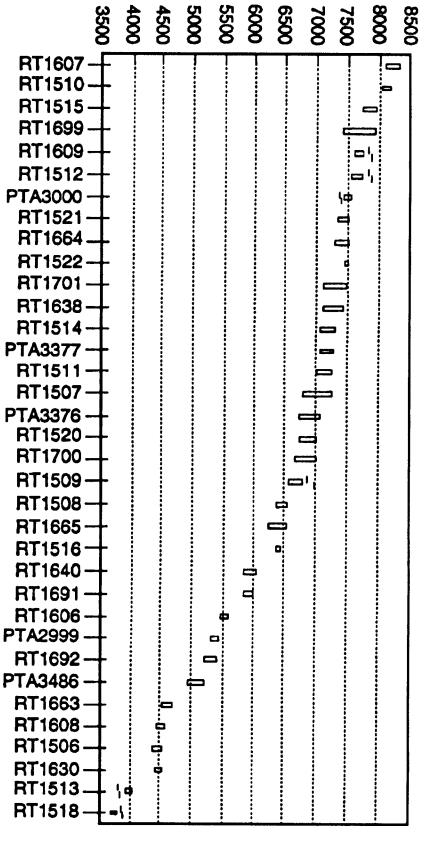

Fig. 3. ^{14}C determinations from Nahal Issaron arranged in chronological order. Dates are calibrated to calendar years BC; when more than one span is possible for a particular sample, the other less likely option is also indicated.

DISCUSSION

The Chronostratigraphy

Findings from the excavation revealed that the site comprises up to 1.5 m of cultural deposits with the following complex stratigraphic sequence of occupation (from the base up):

1. An initial, but major occupation attributable, on the basis of the technotypological characteristics of the chipped stone assemblage, to a late phase of the Pre-Pottery Neolithic B (PPNB) period, *ca.* 8400–8000 BP (uncalibrated).

   Indirect evidence seems to indicate that the earliest use of the site, of short duration, may have been an ephemeral occupation with sparse remains and occasional hearths, though the use of old wood may be another explanation. This was followed almost immediately (?) by the major architectural remains on the site: tightly clustered, small (2–3 m in diameter), interlocking subcircular through polygonal and rectangular structures and features constructed of fieldstones with walls preserved to a maximum height of *ca.* 1.2 m (Fig. 2). Superstructures were seemingly of light perishable materials (brush, skins?). The associated deposits are primarily anthropogenic in origin, with quantities of gray ash and sand in addition to the remains of collapsed walls, directly overlying the poorly sorted boulders, gravels and sands of the alluvial fan. Both within the structures and in the open, courtyard areas in between the structures were numerous hearths of various forms.

   Although analysis is incomplete, the cultural remains include an abundant chipped-stone industry, numerous grinding stones, beads and pendants made of marine mollusks and semiprecious minerals, and a small bone tool assemblage. Faunal remains include *Capra ibex* (ibex), *Gazella* sp. (gazelle), *Equus* sp. (onager), *Bos* sp. (aurochs), *Lepus capensis* (hare), reptiles, avifauna and even fish vertebrae—the Gulf of Eilat is 40 km distant to the south (Davis 1983; L. K. Horwitz, personal communication).

2. An erosional event, perhaps catastrophic in nature (a flash flood?), followed, eroding structures on the southern side of the site. The date of a hearth (RT-1506) from the overlying sediments seems to indicate that this event occurred prior to *ca.* 5600 BP but following the main PPNB occupation, *ca.* 8000 BP (Tables 1 and 2).

3. The erosional event was followed by gradual infilling and aggradation of alluvial fan settlements, especially around the margins of the earlier PPNB settlement. Within these sediments are various constructions such as hearths and ovens, which, on the basis of associated finds, can be attributed to the poorly documented (at least in the Negev and Sinai deserts) Late Neolithic through Chalcolithic periods, datable to the 8–6th millennia BP (uncalibrated). Several of the earlier PPNB structures continued to be used, and were usually modified (*e.g.,* added walls and hearths), and excavation of earlier deposits. A few poorly preserved new structures were also documented. All these activities seemingly resulted in admixture with material remains of the earlier PPNB occupation. Bone preservation for this phase was poor, and charcoal is sparse throughout the layer, except when directly associated with stone-lined hearths and ovens.

   In general, the deposits of this level are less obviously anthropogenic. Taken in conjunction with the marked decrease in the density of associated small finds, the overall impression is of sporadic and much less intense occupation of the site throughout this prolonged phase. That hunting continued to be practiced is indicated by distinctive arrowheads of the period amongst the chipped-stone tools, almost invariably mixed with types characteristic of the preceding phase. Grinding stones are also quite common. Rodent activities and the extremely fluid nature of the sandy, ashy sediments made assignment of specific loci or phases difficult. Charcoal from this and the previous phase included *Tamarix* sp., *Haloxylon persicum, Retama roetam, Anabasis articulata* and *Acacia tortilis,* all species currently present in Biqat Uvda or the adjacent Rift Valley (Lipschitz 1986).

4. The topmost layer excavated shows evidence for continued occupation of the immediate area during the Early Bronze Age (5th millennium BP (uncalibrated)), as indicated by the presence of a large site a few tens of meters from the Neolithic site. The fact that the former is mostly deflated on the surface of the alluvial fan, and that parts of the upper phase of Nahal Issaron are exposed signifies that, since the 5th millennium BP (uncalibrated), geomorphological conditions remained relatively stable, with virtually no aggradation of the alluvial fan, but rather minor deflation.

   Because of the complex stratigraphic sequence at Nahal Issaron, we could not always assign features or sublayers within structures to specific phases. For example, we have been unable to isolate any definitely undisturbed subassemblages belonging to Phase C. In almost all instances, flint tools common to the late phase of the PPNB are also present. These could either be intrusive or, alternatively, represent a conservative continuation of PPNB knapping traditions into the Late Neolithic of the desert regions (see Gopher, Goring-Morris and Gordon, in press). Farther north, in the Mediterranean regions of the Levant, evidence is also increasing for such continuity throughout the 8th millennium BP, and perhaps even later.

Settlement Patterns

The site of Nahal Issaron is of considerable importance in that it provides the longest and most complete evidence for semicontinuous occupation, from the 9th through 6th/5th millennia BP (uncalibrated), of any locality investigated to date in the Negev and Sinai (and perhaps the Transjordanian desert areas). Following a possible brief and ephemeral founders' phase, indirect evidence indicates that the main, late PPNB settlement may have been occupied on a seasonal (winter/spring?) basis by a small band of hunter-gatherers when climatic conditions were more favorable than the present regime. Arrowheads, notches and denticulates dominated the chipped stone assemblage, with few scrapers or burins, and with sickle blades entirely absent. Small quantities of distinctive, elongated borers are also present. Such a band may have been mobile for much of the year or, alternatively, based farther away in more favorable environmental settings (southern Transjordan? southern Sinai?), in light of similar stylistic attributes of the chipped stone tools to sites in those regions. The settlement at Nahal Issaron is located midway between the two regions, both of which have furnished evidence for relatively dense occupation at this time, for example, at Basta. Though permanently occupied farming and herding communities are documented in the Mediterranean zone of the Levant at this time, the peripheral desert regions continued to be occupied by small, mobile bands of hunter-gatherers.

The settlements at Nahal Issaron became increasingly sporadic and less intensive with time. Given the poor bone preservation at the site, it is not possible to determine whether these occupants were primarily hunter-gatherers or herders, hunters and gatherers (arrowheads are the most diagnostic chipped stone tools). Though presence of grinding stones indicates some form of (vegetal?) processing, the absence of sickleblades suggests that agriculture was not practiced prior to the Early Bronze Age in this area. Pastoralist economies in the peripheral regions of the Levant developed during the Late Neolithic and Chalcolithic, though evidence of their growth and diffusion is extremly scanty in the region (Goring-Morris 1994).

Conclusion

The series of ^{14}C dates obtained from the complex stratigraphic sequence at Nahal Issaron illustrates the importance of close collaboration between field archaeologists and scientists working with dating methods. The present case study also demonstrates the importance of obtaining series of dates

from individual sites and layers to offset likely problems of intrusions and other taphonomic processes. Combined with the architectural remains and other artifacts of the material culture recovered during the excavations, the evidence leaves little doubt that Nahal Issaron represents a key site for comprehending cultural processes in the southern Negev during the Early Holocene, a period during which hunter-gatherers shifted to pastoralist economies.

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