MASS HUNTING GAME TRAPS IN THE SOUTHERN LEVANT:

The Negev and Arabah "Desert Kites"

Guy Bar-Oz, Dani Nadel, Uzi Avner, and Dan Malkinson

The mass hunting of wild ungulates (hoofed animals) in the ancient Near East is vividly illustrated by the numerous desert kites distributed throughout the deserts of the southern Levant. Desert kites are large, triangular-shaped stone structures, deliberately built for the mass harvesting of wild ungulates. The kites are built of two long converging low stone walls with a circular enclosure at the apex. The enclosure can range from a few meters to 100 meters in diameter, and the walls (arms) may extend for hundreds of meters and even several kilometers. The walls are constructed of local stones and vary in thickness and height. These well-preserved constructions provide testimony to the magnitude of wild ungulate hunting and its consequences on the ancient landscape of the southern Levant.

Desert kites of the Jordanian and Syrian deserts are composed of long chains that extend across tens of kilometers (Helms and Betts 1987). In contrast, the desert kites in the Negev and Sinai are small, isolated constructions (Meshel 2000; Holzer et al. 2010). Many of the Levantine kites were constructed or used since at least the fifth–third millennia B.C.E. (Helms and Betts 1987; Van Berg et al. 2004). While the plan of desert kites is well-documented, only a few of them have been securely dated. Unfortunately, they tend to contain only a very small number of artifacts, animal bones, and/or organic remains (Holzer et al. 2010; Nadel et al. 2010).

Early travelers' accounts and ethnographic examples document that some of these traps were still used until the end of the nineteenth century to the beginning of the twentieth century C.E. (Burckhardt 1831, 220–21; Musil 1928, 26–27; Aharoni 1946, 31–33). Potentially hundreds of animals could have been caught at a single event in these desert kites.

Archaeological studies of the Syrian and Jordanian chain kites provide details regarding their structure, type, topographic situation, and distribution patterns (Helms and Betts 1987; Van Berg et al. 2004). While it is argued that the chain kites were used to trap the large migratory herds of Persian (goitered) gazelle (*Gazella subgutturosa*; Legge and Rowley-Conwy 1987; Bar-Oz, Zeder, and Hole 2011), the smaller and isolated Negev and Sinai kites were probably built to trap small numbers of local herbivore prey (e.g., Dorcas gazelle [*Gazella dorcas*], onager [*Equus hemionus*], and probably Arabian oryx [*Oryx leucoryx*]), which locally grazed in small herds year round (see also Holzer et al. 2010; Nadel et al. 2010).

Several of the Negev and Sinai kites have been subjected to a variety of archaeological, zoological, and ecological stud-

ies (Perevolotsky and Baharav 1991; Rosen and Perevolotsky 1998; Kobusiewicz 1999; Meshel 2000; Holzer et al. 2010; Nadel et al. 2010), but the majority have only been surveyed and mapped without providing enough details regarding construction techniques and state of preservation. Our renewed project included a detailed and systematic exploration and documentation of the known eleven Negev kites and excavation of four of them (fig. 1). Each of the Negev kites was mapped and recorded according to its geological, topographical, and ecological setting. Following the survey, we partly excavated the enclosures of four kites from distinct ecological settings: two adjacent kites (Samar West-A and B in the southern Arabah Valley), which were presumably used simultaneously; and two isolated ones (Sayarim in a hilly area and Pitam in the Ramon crater; fig. 1).

The results of the current surveys and excavations, together with two previously excavated kites (Har Shahamon and Samar East in the southern Arabah, reported in Holzer et al. 2010), can now be integrated in order to provide new insights regarding the function of the Negev kites, their dates, and their role in the economy and subsistence patterns of past desert people. We briefly describe here the main finds from our fieldwork, which combined survey and excavations.

Figure 1. Location of the Negev kites. Photograph from Google Earth.

Description of the Kites

Samar West-A (kite 7 in fig. 1): The kite is located on a plain a few hundred meters west of Kibbutz Samar and 3 km south of the rich grazing pasture of Yotvata acacia savanna and marshland oasis. Its right arm reaches the apex from the northwest, while its left arm is curved in a straight angle to the southeast and creates a narrow neck near the apex (fig. 2). Excavation revealed that the apex of the trap was built above a shallow wadi bed, in order to take advantage of the small topographic difference that is needed to hide the enclosure. The head itself is circled by a wall made of massive stones, preserved to four–five courses in height (fig. 3). Furthermore, it was revealed that a large, round pit was dug before the construction of the enclosure wall. In addition, a stone ramp was built where the arms meet the apex, to increase the vertical difference between the running plane of the hunted game and the bottom of the trap's head. Both operations created a change in depth from about 0.6–0.7 m to more than 1.5 m (Nadel et al. 2010).

A round and well-preserved tumulus was built on the neck of the kite (using the kite's stones), and it therefore marks the *terminus post quem* of the kite's usage. Charcoals from the burial chamber were dated to 2700–2250 cal B.C.E. (Nadel et al. 2010, table 1), indicating that the tumulus was built before the mid-third millennium B.C.E., that is, the Early Bronze Age.

Samar West-B (kite 8): The kite is adjacent to Samar West-A kite (fig. 2). The distance between the two arms (the right of Samar West-A and the left of Samar West-B) is only a few meters, and together the kites form the shape of a W. Like Samar West-A, it is open to the north. The right arm of Samar West-B starts at the foot of a steep hill. Both kites together block the southern exit from the rich pasture area of the Yotvata oasis.

The kite bears similarities to Samar West-A. The arms were built on a flat area, running south into a shallow wadi, where the apex was constructed. The head of the kite was surrounded by a massive wall preserved up to 1.2 m. The excavated trench clearly indicates that, before construction, the builders dug a wide, shallow pit, circa 1 m deep, including a vertical cut into the wadi bank. Furthermore, they also built a ramp on the terrace, just above the enclosure, to enhance the depth of the vertical fall and to hide the trap from the driven game.

Later the kite's enclosure was turned into a corral. Scattered wood charcoal fragments from within the corral were ^{14}C dated to 3030–2840 cal B.C.E. (Nadel et al. 2010, table 1). The ^{14}C dating, together with several micro-lunates, both of which belong to the corral habitation deposit, indicate that the kite went out of use early in the third millennium B.C.E.

Samar East (kite 9): The kite is located east of Kibbutz Samar and 1.2 km east of Samar West-A. It is also constructed

Figure 2. A view of the adjacent Samar West kites looking east. The apex of Samar West-A is on the far right, that of Samar West-B on the left, below the two vehicles (part of the left arm outside photo). Note that the two kites are almost connected like a W (center-left). The photo was taken from a nearby hill. Photo by U. Avner.

on a flat plain, with the arms opening northward to the Yotvata acacia savanna. The kite's arms are 114 and 137 m long, but the parts closer to the apex are missing due to a secondary use of the stones for the construction of a habitation unit on top of the enclosure.

The kite was excavated by Uzi Avner and A. Holzer prior to the renewed excavations discussed here (Holzer et al. 2010). The kite's apex, measuring 6 m inner diameter, is underneath the remains of a habitation unit. Most of the perimeter wall was preserved to only one course of stones, but the northern part was preserved to its original height of 1.2 m. The finds from the habitation unit included Early Bronze pottery, one copper awl, a few flint micro-lunates, goat/sheep bones, and two olive pits. Three ^{14}C and two optically stimulated luminescence dates indicated that the kite was replaced by the habitation unit around 2600 B.C.E. (Holzer et al. 2010, table 2).

Sayarim (kite 6): The kite is located on a slope facing east (fig. 4a). Its arms open to a plain on the west and steeply drop to the apex, built within a small wadi. A large part of the apex was later washed away by flash floods.

We excavated two small trenches, one adjacent to the apex wall near the left arm and one on the eastern end of the apex. The excavation revealed an extensive wall made of boulders more than 50 cm long. The apex wall was preserved up to five courses of stones, circa 1.1 m high (fig. 4b). The accumulated deposit included fallen construction stones, typical slope and wadi gravels, and some fine loess. In one corner of the first trench, the remains of a hearth were found at a depth of 40 cm. It included ash and black discolored stones. The hearth was located on wadi material washed into the apex and thus postdates the kite. One ^{14}C date of wood charcoal from the hearth rendered 3350–3010 cal B.C.E. (Nadel et al. forthcoming).

Pitam (kite 4): The kite is located in the Ramon crater and is built on an east-facing slope. It opens to a plateau on the west and curves steeply into a small wadi on the east, where the apex is built. The lack of vegetation to the west can explain the kite's location; rather, it blocks ancient trails used by ungulates. For example, this trail is currently used by onagers that have been reintroduced into the environment (fig. 5).

A trench excavated across the apex showed that a massive

Figure 3. Closer view of the enclosure wall of Samar West-A kite. Photo by D. Nadel.

Figures 4a (right) and 4b (below). (a) An aerial view of the Sayarim kite. The arms open to the plateau, while the apex is located in a small wadi. Photo by U. Avner. (b) A general view of the Sayarim kite, looking west. Note the steepness of the slope and the location of the apex within a narrow wadi. Photo by D. Nadel.

rampart of large rocks was built for the enclosure instead of a wall, as in most kites. We also found that the enclosure was originally built within the small wadi, but the rampart actually diverted it by several meters. The only finds in the trench were a concentration of charcoal fragments, 50–60 cm below the surface. Only one piece of wood charcoal has been ^{14}C dated to 1560–1390 cal B.C.E., which is definitely a postconstruction date (Nadel et al. forthcoming).

Har Harut (kite 3): This kite is located within the Ramon crater and is among the smallest kites studied in this project (fig. 6). This construction is the only one we studied within a sandstone terrain. Like the Pitam and Sayarim, this kite's setting indicates that its location was carefully chosen in a narrow pass on ancient animal trails. Its arms differ in length, converging at a natural rock step about 2 m deep.

Nahal Eshel (kite 5): The kite is built on the edge of a plateau in a setting similar to the Sayarim kite. The arms open to the west toward a wide plain, while they converge to the apex on a steep, rocky slope (fig. 7a). The natural slope was utilized for the kite's design and the construction of the enclosure (fig. 7b). The apex is well-preserved and built of local, large stones. Some of the boulders are still standing on edge and reach a height of more than 1 m above ground.

Nahal Horsha North and South (kites 1–2): These two kites are the most northern examples we know of in the Negev. They are located above and to the west of Nahal Horsha, a broad wadi that runs to the north. They are approximately 600 m away from each other on flat hilltops. The arms of both kites are open to the plateau in similar ecological settings to those observed in Sayarim and Eshel.

The arms are made of local stones, usually preserved to a height of one–two courses and at a width of one–two stones. One of the arms was built along a natural cliff. Collapse around the arms is minimal, so it is clear that the walls were not much higher.

In both kites, the apex was set below a cliff about 5 m deep that faces east (northern kite) and southeast (southern kite), and both are opened to the west and northwest. At the bottom of the cliff, a massive rampart created a round enclosure, 5–6 m inner diameter. The volume of construction stone appears to be very large, more than 10 m^3 for each. It is clear that the apex of these kites was built by constructing a massive rampart.

Giv'at Shehoret (kite 10): A small kite in the southern Arabah Valley is situated on a plain intersected by west-east wadis. The arms are only 20 and 25 m long, but their construction was massive, as can be judged by the collapsed stones. The arms run on a steep slope, while the apex is in the wadi. This is the smallest kite in the Negev, probably unfinished. It is possible that the long arms were never constructed and thus only the section near the apex was built prior to its abandonment.

Har Shahamon (kite 11): The arms of this small kite located at a topographic saddle run from the north and west, capturing the animals driven from Nahal Roded, a broad wadi to the north. The apex is massively built in a wadi, preserved up to 2 m high. Excavation of the apex prior to the present project (Avner 2002; Holzer et al. 2010) yielded Chalcolithic pottery sherds and two olive pits, as well as burials with artifacts from later periods. Radiocarbon dates from both burials indicated the sixteenth century B.C.E. and sixteenth century C.E., while an infrared stimulated luminescence dating below the apex wall was around 1700 B.C.E., later than expected (Holzer et al.

Figure 5. A general view of the Pitam kite. Many animal trails cross the two long walls of the kite, from bottom left to upper right. A narrow rugged wadi (center) runs down the middle of the kite. The kite's apex is located in a small wadi at the bottom-center (marked by an arrow). Photo by U. Avner.

2010, table 2). Following the dig, the apex and the arms were partially restored in order to get the impression of how high the walls were originally built.

Analysis of the Evidence

Recent archaeological survey and excavations of the Negev desert kites provide compelling new evidence for the use of sophisticated game traps by ancient desert peoples. Such evidence can be grouped into several themes: the kites' ecological setting, their details of construction, their purpose, and their dating and historical context.

Ecological Setting

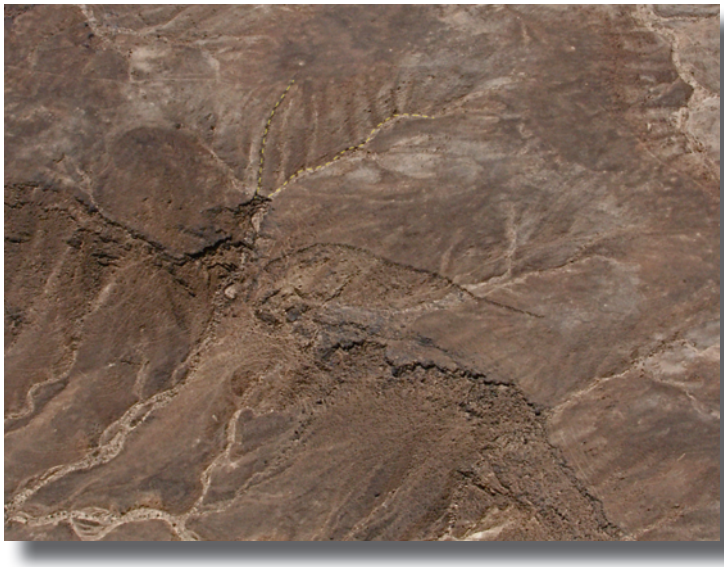
All eleven Negev kites are situated at carefully chosen, advantageous, and strategic settings. The kites can be divided into two major groups according to their environmental locations. Some opened to adjacent grazing areas (both Har-Horsha kites, the three Samar kites, Giv'at Shehoret, and Har-Shahamon kites), while others were constructed along trails of ungulates (Harut, Pitam, Sayarim, and Eshel). The latter kites are isolated and located at topographic "bottlenecks" or cliff edges in hilly environments. Even today the Dorcas gazelles and onagers use the same paths as they move from different grazing grounds in small-scale migratory moves. Indeed, in each of these kites recent animal trails cross the arms. The locations of the kites along advantageous topographic settings further stress the understanding and familiarity of past hunters with the behavioral ecology of their prey.

Three of the kites, built near pasture areas, are grouped together (the Samar kites). The archaeological data and postkite structures built onto these suggest that all were contemporaneous and could have been used simultaneously. The environmental setting of the Samar kites is clearly related to the rich pasture area of the Yotvata acacia savanna, an area that attracted a variety of ungulates year round. Also the Horsha and Shahmon kites were placed in locations that enabled the channeling of ungulates from open pasture areas. However, in contrast to Samar kites, it seems reasonable to assume that these kites were used on a more seasonal basis.

Construction and Architecture

Details of the architecture and building methods provide further information regarding the planning and construction of each kite. We found that in the Samar kites, which are constructed on a plain, the enclosure was always built in a small shallow wadi—taking advantage of the smallest topographic features. In addition, a ramp was built to hide the enclosure from the driven game, creating a topographic drop into the enclosure. A further deepening of the fall was reached by digging down to the enclosure's bottom before the construction of the wall surrounding it. The Samar kites also form a separate group in terms of arm construction. Here there are many features (stone circles in various dimensions) attached to the arms or in short distances from them. In the two Samar West and the Sayarim kites, the setting on edge of large, elon-

Figure 6. An aerial view of the Harut kite. The two short arms run on the right to a natural vertical drop. This is the only Negev kite constructed in a sandstone setting. Photo by U. Avner.



Figures 7a (above) and b (below). a) An aerial view of the Nahal Eshel kite. The arms are open (center) to the plateau on the right, leading to a steep cliff (Photo by U. Avner); b) view of the Nahal Eshel kite. Note the natural topographic drop of the cliff incorporated in the design of the kite and the construction of the enclosure. Photo by G. Bar-Oz.

gated boulders is common. In all kites, construction stones were brought from nearby, but some are very large and heavy, requiring significant effort to move them.

In three kites (Horsha North and South and Pitam) the enclosure was constructed by a wide, massive rampart, as opposed to a vertical wall in most other cases. The construction of such ramparts required a significant amount of labor. We estimate that the rampart required the movement of more than 10 m^3 of stone to construct the enclosure, the reason for which is still unclear.

The Kites' Purpose

During the past eighty years, several interpretations—other than hunting—were offered for the kites (e.g., Echallier and Braemer 1995). Until the 1970s, the leading explanation was that the kites were installations for quick collection and protection of domesticated herds during hazardous times. Additional explanations were capturing animals for domestication, collection of water, and even cult installations (see references in Holzer et al. 2010). The details studied in all Negev kites clearly indicate that hunting was the sole purpose for their construction. The main evidence is the position of the enclosure on a steep or cliffy slope or under a 5-m rock step. Another indication is the intentional enhancement of the small drop in kites built on a flat area (e.g., the Samar kites) by digging out the enclosure bottom and building a rampart. The fact that four of the kites were built on animal trails provides additional support to the hunting interpretation. Finally, the three literary accounts of hunting (Burckhardt 1831, 220–21; Musil 1928, 26–27; Aharoni 1946, 31–33) by means of large stone installations clearly illustrate the purpose of the kites. The main argument against hunting was the low nature of the arm walls, only 40–60 cm, as opposed to the fact that gazelles can leap much higher. However, experiments showed that frightened gazelles running fast along existing lines such as narrow trails can be directed by low plastic strips or even thin 16-mm plastic tubes lying on the ground. Therefore, the low construction of the arms actually demonstrates the intimate knowledge the ancients had of this animal's behavior.

Dating

The radiocarbon dating program provides solid evidence that the kites were constructed or used during the fourth–third millennia B.C.E. Our new results demonstrate that at least three kites were constructed before or during EB I. The new dates, coupled with previous dating from the southern Arabah (see above) and Sinai (^{14}C; Kobusiewicz 1999) indicate that the Negev and Sinai kites are a Chalcolithic–Early Bronze phenomenon. It is noteworthy that, within the Samar kites, the heads of all three were disturbed by later construction (Samar East, a dwelling complex; Samar West-A, a tumulus; and Samar West-B, a corral). In the case of Samar West-A and Samar East, the construction is directly dated by ^{14}C and material remains to 2800–2600 B.C.E. (EB II).

Thus, two points become clear. First, the kites are at least as old and probably even generations older than the EB II "secondary" constructions. Second, the results indicate that during EB II there was an increase in local human occupation density

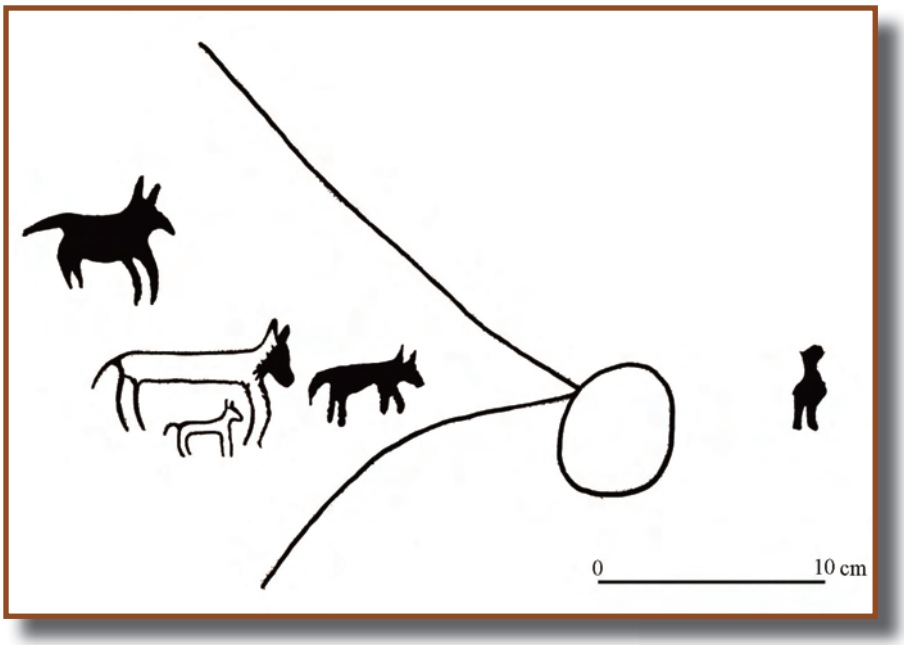


Figure 8. Depiction of a kite in a rock-drawing from southern Sinai. Note that the animals resemble the onager and not the gazelle. Courtesy of I. Hershkovitz.

in the southern Arabah (Avner 2006). The few small kites of the Negev represent only part of the desert economy that was focused on herding, as evidenced by the many corrals (e.g., Samar West-B) and other herding-related facilities (see also Rosen et al. 2005). In addition, we note that the kites went out of use at the climax of human population growth. The question of why this occurred requires further study.

From an interregional perspective, it now becomes clear that the construction and use of many of the Levantine kites, including those of the desert of Jordan (Helms and Betts 1987), south and central Syria (Echallier and Braemer 1995), and northeastern Syria (Van Berg et al. 2004), is a post-Neolithic phenomenon (see also Bar-Oz, Zeder, and Hole 2011).

Conclusions

The results of the Negev Desert Kites Project indicate that the kites were constructed either along ancient trails or near grazing areas and were utilized to trap small numbers of local herbivore prey, such as the Dorcas gazelle, onager, and probably Arabian oryx. The massive stone constructions documented in several kites indicate that they were designed for the specialized hunting of large body-sized ungulates, such as the Asiatic onagers. It appears that species behavioral ecology, herd size, and body size of target game were among the factors that determined the characteristics of each kite.

The topographic position of each kite suggests that animals were approached while grazing in a pasture area or migrating along animal trails. Once driven and frightened between the arms, the animals gained speed with no opportunity to escape. The low location of the enclosure prevented the fast-moving animals from seeing the trap until it was too late. The vertical drop in all kites (natural or artificial) ensured the injury of prey, which facilitated their slaughter by hunters hiding around the enclosure (fig. 8).

The types of constructed kites and their geographic locations are a strong testimony of the profound knowledge of past hunters regarding their environment, the ecological behavior of local territorial ungulates and their exact trails, as well as the macro- and micro-topography of the landscape, leading to the choice of the best locations for constructing kites and their enclosures in particular.

Acknowledgments

The two Horsha kites were discovered by M. Haiman, Harut by G. Avni, and Pitam by S. Rosen. The Samar West kites were first observed from the air by E. Anati and first published by B. Rothenberg. The Shehoret kite was discovered by A. Naor and Sayarim by Y. Qishon and T. Kahana. The kites of Nahal Eshel, Samar East, and Shahmon were found by U. Avner (references in Holzer et al. 2010). The current survey and excavations were carried out on behalf of the Zinman Institute of Archaeology, University of Haifa. Fieldwork was carried out under License S-5/2008 issued by the Israel Antiquities Authority. Permit to work was also granted by the Israel Nature and Parks Authority. We thank the National Geographic Society for their generous financial support (Grant 8325-07). We would like to thank Naomi Porat and Elisabetta Boaretto for their help in dating the kites. Thanks also to Tamar Orr-Gat, Reuven Yeshurun, Kyryll Kezwik, Anna Avshalomov, Amnon Nahmias, David Hadash, and other students for their assistance in fieldwork and an anonymous reviewer for the constructive comments. Last, but not least, we are very grateful to Assaf Holtzer and Hanan Ginat for their advice and support, and we thank the generous people of Kibbutz Samar for their friendliness and hospitality.

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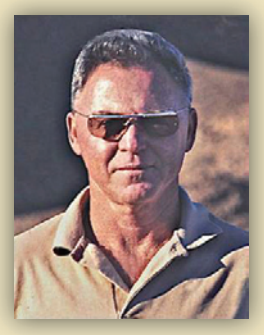
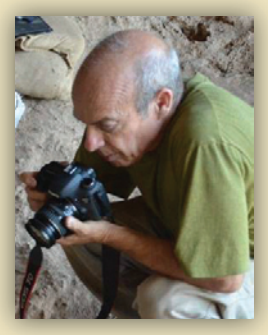
ABOUT THE AUTHORS

Guy Bar-Oz is a professor of archaeology at the University of Haifa. His research experience in zooarchaeology includes excavation and analysis of numerous prehistoric and historic bone assemblages from Israel and the Caucasus. His research focuses on three main subjects: the evolution of human hunting and subsistence behavior in prehistory, the development of complex economic-subsistence systems in the historic periods of the Near East, and human impact on the environment.



Dr. Uzi Avner served as the District Archaeologist of the Southern Negev for the Israel Antiquities Authority from 1977 to 1999. Since then he has taught desert archaeology at the Arava Institute for Environmental Studies and conducted field research in the Dead Sea-Arava Science Center. His research focuses on the archaeology of the southern Negev and the Sinai deserts. He has devoted the last thirty-six years to the study of ancient desert societies and to the protection, preservation, and conservation of desert archaeology and environment.



Dani Nadel is a professor of archaeology at the University of Haifa. He has initiated and conducted various research projects, including excavations at Ohalo II (a 23,000-year-old submerged fisher-hunter-gatherers' camp) and Raqefet Cave (a Natufian burial site). His research today is focused on the prehistoric use of bedrock mortars, burial customs, lithic technology, and spatial analysis of sites (all of the last hunter-gatherers and the first settled Neolithic communities in the Levant).

Dan Malkinson is an ecologist interested in human activities, their effects on ecological processes, and the emerging spatial patterns. His work focuses on recent disturbances and modifications caused to the landscape by humans and the resulting responses of different ecosystem elements, including the movement of large mammals across the landscape. Carrying his interest into the archeological world, he tries to merge landscape structure, mammal behavior, and human activities in order to decipher the conundrums of archeological structures.