Time and Mind: The Journal of Archaeology, Consciousness and Culture

Volume 1—Issue 3
November 2008
pp. 273–284
DOI
10.2752/175169708X329345

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Midsummer Sunset at Neolithic Jericho

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Abstract

The tower of Jericho is an architectural megalith dating roughly to 8300 BC, a time belonging to the Near East early Neolithic era, making it by far the oldest known monumental building. Ever since it was discovered there has been an unresolved debate for archaeologists and the general public alike regarding its function and purpose. The main three theories regarding the tower's purpose are that it may be part of a fortification system, that it is a part of a flood-deflection system, or that it is some sort of symbolic monument. There are, however, flaws within the fortification and flood-deflector theories, and to claim that it is a symbolic monument seems too much of a default solution, as a real reason for this is yet to be given. This paper looks beyond the site to the surrounding environment and analyses the architectural design to show that the tower is in fact inherently aligned to celestial and geographical elements, and that the ancient Neolithic builders used it as a link between them, their town, and the universe.

Keywords: Neolithic, Jericho tower, monumental building, landscape marker, celestial alignment.

Introduction

Tel a-Sultan, the site of the Jericho tower, is located some 13km north of the Dead Sea at N31°52'15" E35°26'35" at an altitude of -220m, just northwest of present-day Jericho and adjacent to Ein a-Sultan (Elisha's Spring). It is situated 1,000m east from the nearest cliffs of the Judean Mountains. The Tel's top rises, on average, 17m above its surrounding grounds and 21.5m at its peak. The Tel's surface covers an area of ~40,000m2 (Kenyon and Holland 1981).

In the years 1952–56, during excavations in strata of the PPNA (Pre-Pottery Neolithic A) Sultanian culture (Kenyon and Holland 1981; Kenyon 1957), a tower was uncovered (Figure 1). Made of undressed stone and accommodating a built stairway within, it was found at the fringes of the PPNA settlement by a stretch of a ditch and a wall in the center of the west side of the Tel (Figure 2a), seemingly completely out of place and time. Its function and meaning have been the source of a long debate and it is the purpose of this paper to try and shed new light on the mystery.

Fig 1 View of the tower from the east showing both openings (Kenyon and Holland 1981, vol. 3/2 pl. 9). Note the plaster just above the lower opening.

Previous Interpretations of the Tower

Kenyon viewed the tower as part of a system of defenses surrounding the Neolithic settlement (Kenyon and Holland 1981; Kenyon 1957), comprising peripheral oval walls that were supported, at least at one place, by a stone tower. For her, the walls and tower represented an attempt of the inhabitants to fortify their settlement against potential external threats. The first phase of this peripheral system (Kenyon's stage III) comprised the core of the tower and the first town wall. Up to a height of about half a meter the wall is clearly earlier than the tower. Higher than this, the tower and wall are bonded, representing a construction stage of the system, during which the tower was added and the wall raised. The higher parts of the two structures were essentially separate, and the tower was further raised ~4.4m over the wall. When built, the tower stood in a large open space, some 280 square meters of which were uncovered, that

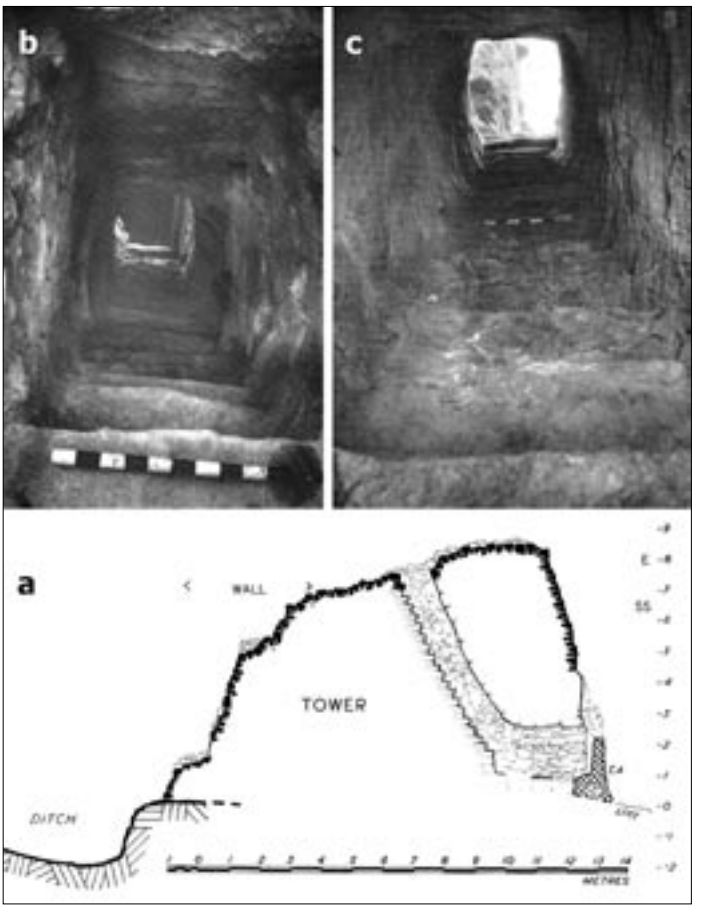

Fig 2 Section through the tower looking north (a) (Kenyon and Holland 1981, vol. 3/2 pl. 244) and pictures of the stairs from bottom (b) and top (c) (ibid., pl. 10).

stretched over the entire excavated area east of the first wall. A single companion to the tower was a house located 4m to its south. At later phases of the settlement (Kenyon's stages IV–IX) other buildings were added within the open space and, outward to the west, new walls and the ditch were built, adding skin layers to the tower.

It is true that anyone seeing the tower, wall, and ditch would think of a defensive explanation, a reasonable one considering their shape and size. Had the settlers been attacked, it seems plausible that the defenders would have used these structures, including the tower, to their advantage. To date, however, all potential attackers are eluding researchers, as are signs of other fortified settlements in the region. Male mortality rates during the PPNA in the Levant did not rise compared to those in the Natufian as would be expected had life turned violent. In fact, life expectancy of the male population had actually improved—as opposed to mortality rates of females, which

did not (Eshed et al. 2004). We have no record of any sites destroyed by invaders at this time. Considering what data we do have, it is possible that the builders of the tower may have never seen or heard of a tower in their lives and might not have even had this architectural concept in their culture. If this were the case, how could have they perceived, and followed to construct, something so alien to their conceptual world, while having no apparent reason to do so? Thus, while we accept the possibility that the tower might have been part of a defensive system, this paper shows it was much more than that.

These faults were noticed by Bar-Yosef who suggested an alternative function for the tower (Bar-Yosef 1986). According to Bar-Yosef, it cannot be viewed as part of an anti-invasion system when no invaders are shown to exist. He also pointed out that the constructors built their tower within the perimeter of the wall, a position from which they could not shoot down enemies. He surmised, then, that perhaps flooding was the problem the inhabitants faced, rather than enemies. The tower, built high above any raging calamity in context of community storage facilities, was thus likely to have also been a ritual activity center of sorts. While agreeing with Bar-Yosef's criticism of Kenyon's defense theory, Ronen and Adler (2001) argued that potential sources for floods in the area could not have generated enough water to flood the settlement for two reasons: either nearby water sources did not contain sufficient flows or they were positioned too far off to overwhelm the settlement. They suggested that since the wall and tower were built particularly thick toward the west, where the sun dies daily, they must have been constructed as a defense against evil spirits, thus shifting the tower's purpose into mythology.

In a recent consideration of ideological reasons for the tower's existence, Naveh (2003) analysed the shape and form of the tower. Calculating the amount of energy and labor used in the construction of the entire complex, he extended Bar-Yosef's estimates (Bar-Yosef 1986) and concluded, based on half a cubic meter per day per worker, that at least 10,400 working days were invested in the construction work. Under this premise, ~910 working days would have been devoted solely to the construction of the tower (the volume of which is ~450m3). Quarrying, plastering, masonry, and other required tasks were not included in this count, and would have added a significant amount of time to the project. Naveh claimed that a monument built of permanent materials on a scale so large must have had a deep symbolic value as the representative of the community's power, acting not only on the supernatural sphere but also in the political realm. The builders of the tower changed the landscape by adding a symbolic marker to it, an architectural node, and they did this with careful intent. The tower, says Naveh, stood tall as a reminder of the community's longevity, history, and lasting success. It was a huge claim of territorial ownership over the abundant resources of the area.

We agree with Naveh's analysis, but would like to take it one step further and propose that the tower had a specific symbolic function directly related to the inhabitants' view of place and time. It seems to us that to confine the symbolism of the tower only to the way it visibly hulks over

the flat surroundings of the Jordan Valley, as a symbol of power and territorial ownership, is too limiting. We will show that other factors were also at work.

Physical Attributes of the Tower

The tower was constructed and used between ~8300 BC and ~7800 BC (Burleigh 1981, 1983). It is marginally conical, having a base diameter of roughly 9m and a top diameter of about 7m, and it rises to a height of 8.25m from its base (Kenyon and Holland 1981; Kenyon 1957). Tall above the wall, the tower is shaped like a slightly conical drum of stone, round and quite symmetrical. It is built of layered concentric rows of the same undressed stones from which the walls are built. Parts of the tower were covered with a layer of mud plaster similar to that found on the first wall, suggesting that the tower may have been completely plastered. Entering the tower from its base, a short passageway leads to an enclosed stairway (Figure 2), which also bears evidence of having been heavily plastered. A group of burials were found within the fill of the passage, but these are late (Kenyon's stage VI A) (Kenyon 1957) and unlikely to be significant to the understanding of the tower at the time of its construction.

The method by which the passage and stairway were created is obvious. As the builders placed one layer of stone upon another they left room for their climbing system, constructing it inherently as the tower rose. The stairway was roofed as the surrounding walls reached a barely passable height, imbedding the stairway within the tower. The tower and its stairway were therefore planned and built according to a specific design. Considering that there are much easier ways to create a means to climb up a tower, say a ladder, this designated solution must have had deep significance and provided the builders with a value higher than a mere means for bridging the vertical distance.

The stairway consists of at least 20 stairs made of smoothly hammer-dressed stone blocks, well over 75cm in width (the width of the passageway), allowing for a tread of 15–20cm in depth, with a rise of nearly 39cm each. The stairway is roofed by sloping stone blocks boasting both a width and a length of about 1m each, constructively resting on the stones from which the entire tower was built (Kenyon 1957). The slope of the stairs—the total rise divided by the total run—is about 1.8 (~60°), whereas a modern stairway typically has a slope of 0.5 and 0.6 (~30°) (ICC 2006a, b). Furthermore, contemporary standards suggest that for a set of steps to be comfortable the sum of two risers and one tread should be between 61 and 64. Adding two risers and one tread of the tower's stairs amounts to 96, a rise that characterizes the climbing attributes of a ladder rather than a stair. With a height that does not allow for even a short person to stand straight and with a ladder-like slope, using the stairs means that both the legs and arms of the climber must be used as in a crouch.

The passage and entry are on the east face of the tower, the opposite side of the western wall. Since the stairway is straight, an axis can be drawn from entry point to exit point, facing azimuth 290° (or 20° north of the pure west). This axis, passing through the tower's hollow, is a key clue for solving the mystery of function of this unusual construction. As shall be demonstrated, its direction was extremely significant.

Geographical Alignment

It is not uncommon for geographical elements to assume importance and convey meaning. Texts have always referred to natural landmarks, and it would seem awkward to assume that this significance began with writing. Indeed, there is a large body of knowledge concerning the connection between prehistoric people and the features of their natural landscapes (Bradley 2000; Tilley 1996), expressed in on-site findings, architectural references, or landscape alterations. In fact, even modern landscape architects work under the premises that landscape is the setting that both expresses and conditions cultural attitudes and activities (Relph 1976) and that significant modification to the landscape are not possible without complementary social attitudes (Makhzoumi and Pungetti 1999). Clearly, their awareness of the natural environment, no matter how excellent their training or goodwill, cannot possibly be as acute as that of cultures whose lives were organically involved with it. Surely, the builders of a monument such as the tower of Jericho, whose lives were deeply intertwined with their surroundings, maintained such social attitudes.

From their position beneath the eastern slopes of the Judean Mountains, the settlers would have seen a summit towering high above, ~1,300m to the west. This is the summit of Mt. Quruntul, a prominent conical peak rising ~350m above the site's locale. The Christian site of the Temptation is at the peak and the site of the ruins of Herod's fortress of Dok is just northward below the peak (Figure 3). Connecting between their environment and their modifications to it—the tower—are the stairs within the tower. Anyone climbing up the stairs would, upon exit on the higher end, be directly facing the peak of the Quruntul. Clearly, this is no coincidence.

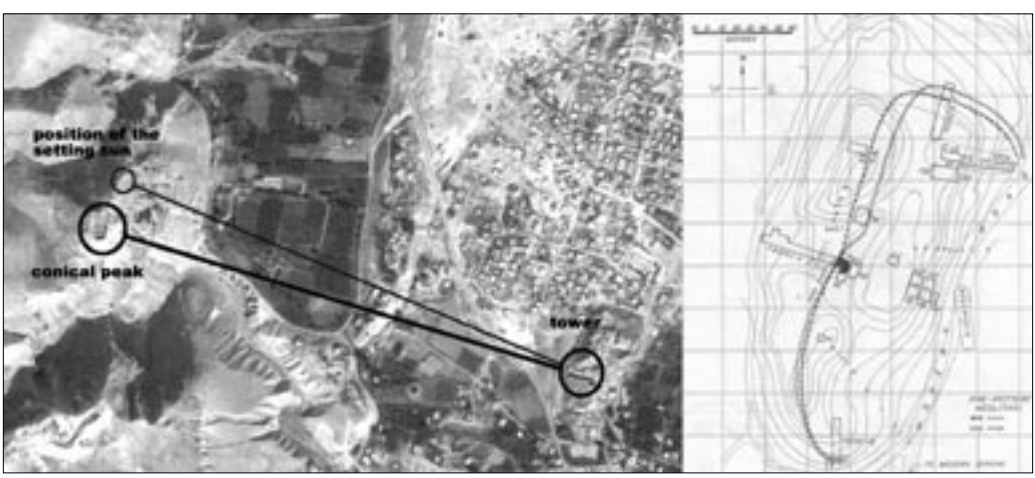

Fig 3 Aerial photo showing Tel a-Sultan (bottom right) in relation to the Quruntul (left) as well as a plan of the Tel (Kenyon and Holland 1981, vol. 3/1 fig. 2).

Furthermore, the conical shape of the tower and the mountain are somewhat similar when viewed from further off to the east. More specifically, standing 30 to 35m to the east along the axis of the stairway, on the line of azimuth 110°–290° the tower and the Quruntul would merge into one, and the entrance would appear to be directly beneath the peak. This spot, located some ~15m under the present Tel top, is yet to be excavated. Following the same logic, the wall behind the tower could symbolize the ridge from which the Quruntul emerges. The evidence, then, shows a significant geographical landmark that not only is echoed in shape by a bulky tower constructed in the settlement beneath it, but also is clearly pointed at through an inherent compass within the tower.

This evidence, although sufficient to show that the tower's purpose was first and foremost to weld together the settlement and the land surrounding it, reveals only part of the story. We believe there is an additional reason behind the tower's location, its shape, and the manner with which its builders had decided to express its geometry. This reason for choosing the Quruntul as a significant landmark is equally strong and perhaps more so, as it may even have affected the choice of the location of the settlement itself.

Celestial Alignment

The azimuth at which the axis of the stairs points represents more than a mere geographical beacon. Today, the sun sets on the horizon of latitude 32° at the azimuth of 298° on the longest day of the year (Bitan 2000), at an ecliptic angle of 23.5°. Due to topographical positioning, the sun sets earlier over Jericho, descending behind the Judean Mountains at the azimuth of 293°—nearly the same as the stairs—upon the northern shoulder of the Quruntul. Yet things were different in the past. Over the past 10,000 years the angle of the ecliptic has shifted by about 0.75°, and was at the time of the tower's construction about 24.25°. This means that back then the sun set 1° to the north, at the azimuth of 299° on the horizon and still on azimuth 293° at Jericho (Figures 4, 5) (Wood 1980).

The similarity between the azimuths of the setting sun and the axis of the stairs are striking. In their attempt to estimate the extent of astronomic knowledge that Neolithic populations held, Schlosser and Cierny established that the typical contemporaneous error in determining the true north was of the order of 3° (Schlosser and Cierny 1982). The axis set within the Jericho tower is well within these limits (Figure 5). To have aligned so accurately, within a building as premeditated as Jericho's tower, an axis entirely directed at two prime targets—the Quruntul and the summer solstice sunset—is surely beyond the accidental.

This alignment, however, is not as simple as it looks. Since the time of the tower's construction, the Earth's axis has also shifted, a process called precession (Berger 1976). Because the shape of the Earth is non-spherical, bulging outward at the equator, gravitational forces cause a slow directional change in its axis. Our planet takes roughly 25,800 years to go through one precession cycle, during which the positions of the stars seem to shift from a viewpoint on the Earth. During this cycle, the Earth's north axial pole, currently pointing within 1° of

Fig 4 The Quruntul viewed from the tower via Kenyon's ditch I toward azimuth 290° (Kenyon and Holland 1981, vol. 3/2 pl. 3). The picture was taken from the baulk directly above the tower. The position of the sunset at summer solstice 10,000 years ago is plotted in relation to the true horizon.

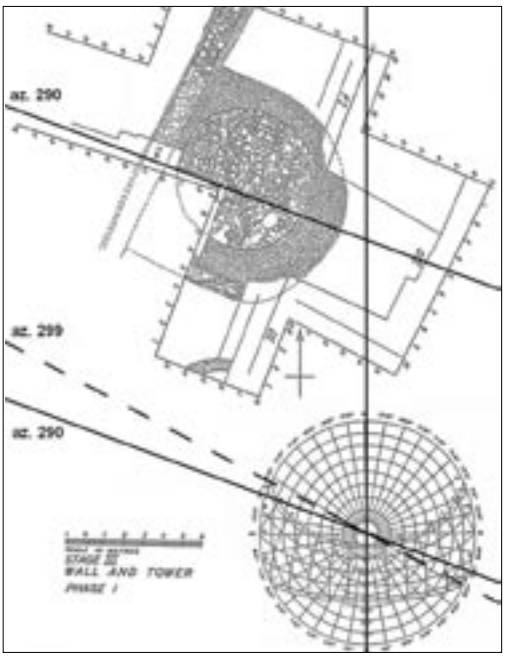

Fig 5 Plan of the tower's stage 3 phase 1 (Kenyon and Holland 1981, vol. 3/2 pl. 203), and a diagram of the sun's position for Israel's latitude 32° for summer, winter, and interim seasons, showing the northern hemisphere sky. Note the direction of the north and the direction of the stairs in relation to it at the azimuth of 290°. The sun rises at the east and sets at the west. On the summer solstice in Israel the sun rises on the horizon at the azimuth of 62° (118° east from the south in the diagram) and sets on the horizon at the azimuth of 298° (118° west from the south in the diagram). Due to topography, the sun sets over Jericho slightly earlier at the azimuth of 291°, upon the northern shoulder of the Quruntul.

Polaris, moves in a circle around the ecliptic pole while maintaining an almost constant angular radius of 23.5°. The resulting shift of the axis amounts to approximately 1° every 180 years. Back at the time of the tower's construction, sometime between 10,300 and 9,800 years ago, the axis was thus directed at a line between 54.4° and 57.2° from where it is today, counterclockwise.

This means that while the position of the setting sun at the summer solstice has moved slightly northward, the timing of the solstice has shifted considerably. The builders

of the tower would have celebrated their Midsummer sometime during contemporary late February or early March. The important factor for this discussion, however, is that the location of the setting sun seemed to be just over the Quruntul from where the tower stands, nearly as is the case today.

A monument thus aligned with the sun at the time when agriculture was beginning to be introduced is a powerful manifestation of the fundamental way in which life had changed in the early Neolithic period. We may well expect that the tower and what it symbolized were the beginning of an established astronomy, because keeping a calendar was essential for the planning of the farming year (Wood 1980). The colossal effort invested in its construction may thus mark the beginning of a new way by which time was reckoned and a major change in social and cognitive attitudes. However, the archaeological data from Jericho and other Early Neolithic sites indicate that at that time people were still hunter-gatherers and thus it seems that the Jericho tower reflects first and foremost a conceptual change in the relationship between man and nature and an emerging need of the first sedentary communities to establish their place in the world via landscape and celestial markers. The transition to agriculture followed this major conceptual change and the construction of the Jericho tower prior to the adoption of farming is an indication of a major change in the ideology and social organization of the last hunter-gatherer communities living in the southern Levant.

Concluding Remarks

As shown, the tower of Jericho is rooted to its exact position by celestial and geographic bonds. Its position was chosen carefully by builders who had precisely defined their desires. The location upon which it was built is the only one from where the sunset and the Quruntul can both be revered by a single instrument. The tower's shape was purposely designed, as was its height, and the stairway within it was carefully built by people who were aware of their environment to act as an inner compass, pointing at what they had intended it to. Following Ruggles' methodology (Ruggles 1996, 1999), the possibility for this being a freak chance is minute. The tower was built using what can only be described as Neolithic groundbreaking technologies; it was very much the super-skyscraper of its day. If those who made it were anything like us, the tower must have made an unforgettable impact on any observer with its revolutionary attributes and evident force of imagination as well as its enormous local significance.

The tower of Jericho is not the only megalithic site which stone-age populations used to connect themselves with the world around them, whether via landscape foci or celestial geometries. Examples are abundant, including Nabta Playa (Malville et al. 1998) in southern Egypt, Newgrange (Patrick 1974) in Ireland, Stonehenge (Pollard and Ruggles 2001) and monuments on Bodmin Moor (Tilley 1996) in England, Chankillo (Ghezzi and Ruggles 2007) in Peru, Ramat Saharonim in Israel (Rosen et al. 2007) and other similar sites. In fact, it seems that many ancient civilizations were continuously ascertaining if their place in the universe was securely established. The Jericho tower, however, seems to be by far the oldest known site of its kind and of the rare breed where the ancient builders intentionally used both

topographical and astronomical elements to shape their monument.

The tower of Jericho thus seems to indicate that architecture and architectural space were established very early on as more than mere functional components in the human habitat. Instead, they assumed a role as conveyors of meaning. From the very beginning of times when humans had just begun to develop some sense of territorial ownership toward their environment, the process of shaping architecture and architectural space had been driven, first and foremost, by a sweeping, comprehensive need to transform the immediate environment into a meaningful place. Architecture is, and always was, a fundamental endeavour rooted deeply in the human experience.

It is thus clear that the builders of the Jericho tower were fully aware of their actions and their consequences when they connected their habitat with the surrounding universe, earthly and celestial. It is also clear that their efforts must have been justified by their perception of the universe (Ruggles 1996). The tower, then, cannot be understood in isolation from its surroundings. The exact reasons behind the choice of this particular peak might never be revealed, yet the evidence speaks strongly for itself. The Quruntul is indeed the most prominent natural marker seen from the position of the settlement. Symbolically, it is the source of the water on which the settlement depended and the sun dies behind it. In fact, it would have been quite surprising not to see any recognition of this monumental peak, giver and taker of life.

Acknowledgements

We thank Prof. Avi Gopher and Prof. Naama Goren-Inbar for their help and advice and the British School of Archaeology at Jerusalem for their permission to use plates from Kenyon's Jericho reports.

References

Bar-Yosef, O., 1986. "The Walls of Jericho: An Alternative Interpretation." *Current Anthropology* 27: 157–62.

Berger, A.L., 1976. "Obliquity and Precession for the Last 5 Million Years." *Astronomy and Astrophysics* 51: 127.

Bitan, A., 2000. *Climatology Atlas for Physical and Environmental Planning in Israel* (in Hebrew) (3rd edn). Tel Aviv: Meirav.

Bradley, R., 2000. *The Archaeology of Natural Places*. London: Routledge.

Burleigh, R., 1981. "Radiocarbon Dates," in K. Kenyon, and T. Holland (eds), *Excavation at Jericho* (Vol. 3): *The Architecture and Stratigraphy of the Tel*. London: British School of Archaeology at Jerusalem: 501–4.

Burleigh, R., 1983. "Additional Radiocarbon Dates for Jericho," in K. Kenyon and T. Holland (eds), *Excavation at Jericho* (Vol. 5): *The Pottery Types Series and Other Finds*. London: British School of Archaeology at Jerusalem: 760–5.

Eshed, V., Gopher, A., Gage, T.B., and Ershkovitz, I., 2004. "Has the Transition to Agriculture Reshaped the Demographic Structure of Prehistoric Populations? New Evidence from the Levant." *American Journal of Physical Anthropology* 124: 315–29.

Ghezzi, I. and Ruggles, C., 2007. "Chankillo: A 2300–year-old Solar Observatory in Coastal Peru." *Science* 315: 1239–43.

International Code Council (ICC), 2006a. "International Building Code 2006." Thomson Delmar Learning.

International Code Council (ICC), 2006b. "International Residential Code 2006." Thomson Delmar Learning.

Kenyon, K.M., 1957. *Digging Up Jericho*. London: Benn.

Kenyon, K.M. and Holland, T.A. (eds), 1981. *Excavation at Jericho* (Vol. 3): *The Architecture and Stratigraphy of the Tel*. London: British School of Archaeology at Jerusalem.

Makhzoumi, J. and Pungetti, G., 1999. *Ecological Landscapes Design and Planning: The Mediterranean Context*. London: Taylor & Francis.

Malville, J.M., Wendorf, F., Mazar, A.A., and Schild, R., 1998. "Megaliths and Neolithic Astronomy in Southern Egypt." *Nature* 392: 488–91.

Naveh, D., 2003. "PPNA Jericho: A Socio-Political Perspective." *Cambridge Archaeological Journal* 13(1): 83–96.

Patrick, J., 1974. "Midwinter Sunrise at Newgrange." *Nature* 249: 517–19.

Pollard, J. and Ruggles, C., 2001. "Shifting Perceptions: Spatial Order, Cosmology and Patterns of Deposition at Stonehenge." *Cambridge Archaeological Journal* 11(1): 69–90.

Relph, E.C., 1976. *Place and Placelessness*. London: Routledge & Kegan Paul.

Ronen, A. and Adler, D., 2001. "The Walls of Jericho were Magical." *Archaeology, Ethnology and Anthropology of Eurasia* 2(6): 97–103.

Rosen, S.A., Bocquentin, F., Avni, Y., and Porat, N., 2007. "Investigations at Ramat Saharonim: A Desert Neolithic Sacred Precinct in the Central Negev." *Bulletin of the American School of Oriental Research* 346: 1–27.

Ruggles, C., 1996. "Archaeoastronomy in Europe," in C. Walker (ed.), *Astronomy Before the Telescope*. London: British Museum Press: 15–27.

Ruggles, C. 1999. *Astronomy in Prehistoric Britain and Ireland*. New Haven, CT: Yale University Press.

Schlosser, W. and Cierny, J., 1982. "Astronomical Orientation of Neolithic Sites in Central Europe," in D.C. Heggie (ed.), *Archaeoastronomy in the Old World*. Cambridge: Cambridge University Press: 225–30.

Tilley, C. 1996. "The Powers of Rocks: Topography and Monument Construction on Bodmin Moor." *World Archaeology* 28(2): 161–76.

Wood, J.E., 1980. *Sun, Moon, and Standing Stones*. Oxford: Oxford University Press.