A monumental cemetery built by eastern Africa's first herders near Lake Turkana, Kenya

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Edited by Melinda A. Zeder, National Museum of Natural History, Santa Fe, NM, and approved June 6, 2018 (received for review December 18, 2017)

Monumental architecture is a prime indicator of social complexity, because it requires many people to build a conspicuous structure commemorating shared beliefs. Examining monumentality in different environmental and economic settings can reveal diverse reasons for people to form larger social units and express unity through architectural display. In multiple areas of Africa, monumentality developed as mobile herders created large cemeteries and practiced other forms of commemoration. The motives for such behavior in sparsely populated, unpredictable landscapes may differ from well-studied cases of monumentality in predictable environments with sedentary populations. Here we report excavations and ground-penetrating radar surveys at the earliest and most massive monumental site in eastern Africa. Lothagam North Pillar Site was a communal cemetery near Lake Turkana (northwest Kenya) constructed 5,000 years ago by eastern Africa's earliest pastoralists. Inside a platform ringed by boulders, a 119.5-m^2 mortuary cavity accommodated an estimated minimum of 580 individuals. People of diverse ages and both sexes were buried, and ornaments accompanied most individuals. There is no evidence for social stratification. The uncertainties of living on a "moving frontier" of early herding—exacerbated by dramatic environmental shifts—may have spurred people to strengthen social networks that could provide information and assistance. Lothagam North Pillar Site would have served as both an arena for interaction and a tangible reminder of shared identity.

monumentality | pastoralism | Africa | Holocene | early food production

Monumentality—creating conspicuous landmarks or public structures that reinforce cultural memories, values, and identities (1)—is often invoked as either a cause or a symptom of major social change. Early research on monumentality emphasized settings where predictable resources supported high population densities and provided regular surpluses that fostered wealth accumulation and social stratification (2); as inequality increased, elites used monumental projects to advertise their power to command labor and ritual (3). Recent research on lower-density populations of hunter-gatherers and horticulturalists in rich, predictable environments has corroborated monumentality's role in fostering hierarchies and corporate polities in such settings (4–6). However, recognizing that social complexity originates in different contexts, develops through diverse processes, and includes heterarchical forms (7, 8), archaeologists are starting to consider monumentality's possible role in alternative trajectories of social change (9). African examples of monumentality among mobile herders and hunter-gatherers may contribute new perspectives on the relations between commemorative expression, monumental construction, and social complexity (10). Some cases occur in contexts of environmental or social unpredictability: along cultural and economic frontiers, during dramatic environmental changes, or among populations using scattered, shifting resources. Monumentality is not always accompanied by evidence for social stratification.

Early in the African Humid Period (AHP)—which began 14,800–12,000 calibrated years before present (cal. BP) and ended 5,500–5,000 cal. BP (reviewed by refs. 11 and 12)—fisher-hunter-gatherers repopulated the Sahara (13), marked landscapes with rock art, and occasionally created cemeteries (14, 15). Later, as herding economies entered the Sahara (16), people began ritually interring cattle 7,400–6,500 cal. BP (17) and created other types of ceremonial sites with rock art, platforms, and/or standing stones (14, 18). Pastoralist cemeteries at el-Barga along the Nile (>100 burials, 8,000–7,500 cal. BP) and Gobero in the south-central Sahara (35 burials, ~7,200–4,500 cal. BP) included personal adornments with some burials (15, 19). As herding spread south and east amid increasing aridity after 6,500 cal. BP (16), pastoralists built megalithic structures at Wadi

Significance

Archaeologists have long sought monumental architecture's origins among societies that were becoming populous, sedentary, and territorial. In sub-Saharan Africa, however, dispersed pastoralists pioneered monumental construction. Eastern Africa's earliest monumental site was built by the region's first herders ~5,000–4,300 y ago as the African Humid Period ended and Lake Turkana's shoreline receded. Lothagam North Pillar Site was a massive communal cemetery with megalithic pillars, stone circles, cairns, and a mounded platform accommodating an estimated several hundred burials. Its mortuary cavity held individuals of mixed ages/sexes, with diverse adornments. Burial placement and ornamentation do not suggest social hierarchy. Amidst profound landscape changes and the socioeconomic uncertainties of a moving pastoral frontier, monumentality was an important unifying force for eastern Africa's first herders.

Author contributions: E.A.H. and K.M.G. designed research; E.A.H., K.M.G., E.A.S., S.K.P., L.B.C., S.T.G., A.C.H., A.J., C.E.K., M.H., P.K., E.N., C.N., J.J.S., and H.W. performed research; L.B.C. and A.C.H. contributed new analytic tools; E.A.H., K.M.G., E.A.S., S.K.P., L.B.C., S.T.G., A.C.H., A.J., C.E.K., and M.H. analyzed data; P.K., E.N., and C.N. performed site conservation; and E.A.H., K.M.G., and E.A.S. wrote the paper.

The authors declare no conflict of interest.

This article is a PNAS Direct Submission.

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This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1721975115/-/DCSupplemental.

Published online August 20, 2018.

Khashab in the Red Sea Hills (20) and established large cemeteries at Kadero, Kadruka, and R12 in the Nile Valley (21–23). Elaborate mortuary traditions continued for >1,000 y at sites such as Jebel Moya, as agricultural lifeways and early states developed (24).

The initial spread of herding into eastern Africa coincided with the development of a distinctive monumental tradition centered around at least six "pillar sites" built ∼5,000–4,000 cal. BP near Lake Turkana, Kenya (Fig. 1) (25). Pillar sites likely served similar (commemorative) purposes as many of the Saharan ceremonial sites but exhibit architecturally distinct elements. People interred hundreds of their dead within massive platforms ≤30 m in diameter, which contained up to 500 m^3 of fill and were marked with natural basalt and sandstone columns hauled from sources as much as 1 km away. At some sites, cairns and stone circles on or adjacent to the platform, and/or additional pillar clusters nearby, contributed to a monumental landscape.

Construction occurred amid profound shifts in environment, economy, and material cultural expression. The end of the AHP 5,500–5,000 cal. BP (11, 12) triggered major changes in terrestrial and aquatic landscapes around Lake Turkana. Early Holocene high lake levels supported regular use of shoreline sites by fisher-hunter-gatherers (26–30). From 5,300 to 4,000 cal. BP, Lake Turkana dropped by ∼55 m (31). As retreating shorelines disrupted fishing practices and exposed new habitats for herbivores, exchange and/or herder in-migration brought cattle and caprines into northwest Kenya, transforming economic strategies to include mobile herding (32, 33). As environment and subsistence changed, people created new technologies, social networks, and forms of cultural expression. Whereas early Holocene fishers used mainly local lithic raw materials (28, 29), middle Holocene herders preferred obsidian from a variety of local, distant, and island sources, some of which required extended exchange networks or boat travel (34, 35). Pottery production changed, from early Holocene ceramics with wavy-line motifs resembling Saharan traditions (27) to intricately decorated middle Holocene Nderit ware (*SI Appendix*, Fig. S1). People sculpted animal figurines from clay and stone (*SI Appendix*, Fig. S2) and placed them in pillar site mortuary fill together with broken ceramic fragments, tools, ornaments, and animal bones. Figurines and faunal remains at pillar sites include wild animals (e.g., hippo) and/or livestock (e.g., cattle and caprines).

Lothagam North Pillar Site

The largest pillar site, Lothagam North/GeJi9, lies between the two ridges of Lothagam's uplifted fault block (36), which formed a prominent peninsula into middle Holocene Paleolake Turkana (27). Lothagam North has a 700-m^2 platform; nine stone circles and six cairns cover an additional 700 m^2 to the east. Data from excavations (Fig. 2*A*) and ground-penetrating radar (GPR) (*SI Appendix*, Fig. S3) reveal a construction plan that envisioned the platform's dimensions from the outset. People first removed beach sands from a ∼120-m^2 area down to sandstone bedrock, creating a large cavity shored up with sandstone slabs. They capped surrounding beach sands with a stone pavement ringed by boulders. Within the cavity, people dug closely spaced burial pits into the soft bedrock. After bedrock floor space was exhausted, corpses were added above the pits in a series of mostly individual inhumation events, partially filling the mortuary cavity. Rubble filled the remainder of the cavity until it reached the level of the peripheral stone pavement. The entire platform was then mounded with 30–50 cm of fill and capped with rounded, uniformly sized basalt pebbles. People brought natural columnar basalt "pillars" (≤1.5 m tall) across Lothagam's western ridge and down to GeJi9,

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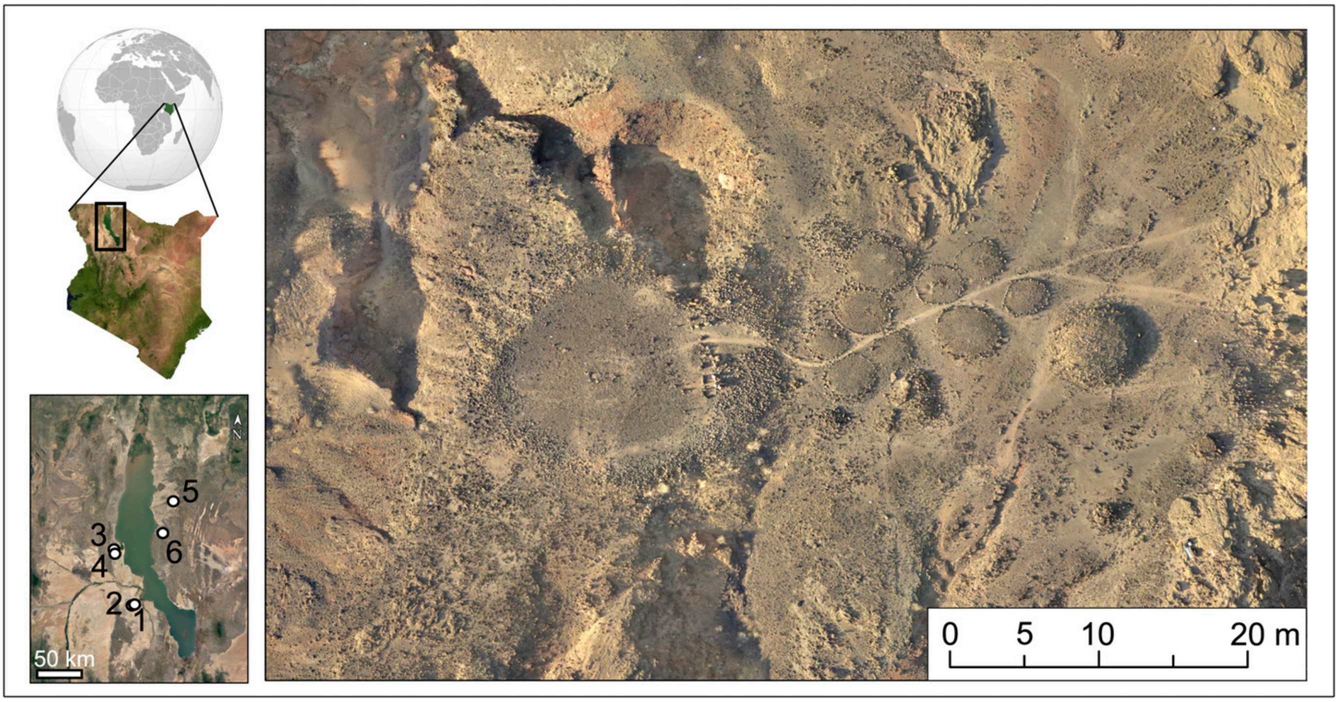

Fig. 1. Orthoimage of Lothagam North Pillar Site. The platform is the large, flat elliptical area on the west (left) side of the site; the surrounding boulder ring is eroding into gullies on the northwest side. Nine stone circles are visible to the east, on either side of the pathway. The six raised features south and east of the stone circles are cairns. The lower left inset shows locations of contemporaneous pillar sites around the middle Holocene paleo-shoreline of Lake Turkana: 1, Lothagam North Pillar Site (GeJi9); 2, Lothagam West Pillar Site (GeJi10); 3, Manemanya Pillar Site (GcJh5); 4, Kalokol Pillar Site (GcJh3); 5, Il Lokeridede Pillar Site (GaJi23); and 6, Jarigole Pillar Site (GbJj1). All locations are georeferenced except Il Lokeridede.

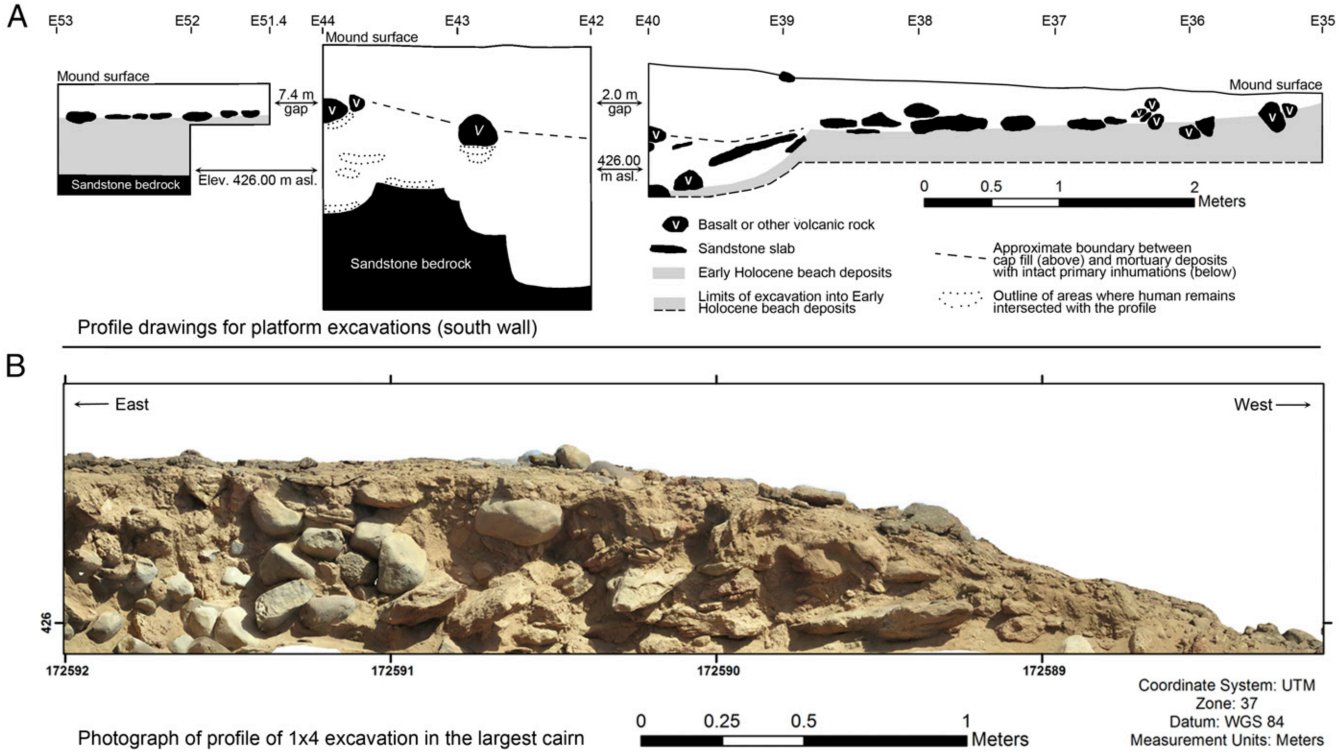

Fig. 2. Stratigraphy revealed by excavations at Lothagam North Pillar Site. (*A*) South profiles of three noncontiguous excavation units in the platform: eastern platform (1 × 1.6 m, E53-E51.4, 2009), central platform (2 × 2 m, E44-E42, 2012–2014), and western platform (1 × 5 m, E40-E35, 2012–2014). Profiles are positioned so their absolute elevations correspond; the central platform's uppermost surface is significantly higher than the eastern and western margins. The mortuary cavity is absent in the eastern platform unit, fully present in the central platform unit, and just ending in the E40-E39 portion of the western platform unit. A dashed line indicates the approximate boundary between mortuary deposits and cap fill; however, the two have no obvious differences in sediment matrix and inclusions, and the upper limit of burials does not constitute a flat surface. (*B*) Photograph of 1- × 4-m excavation trench probing the largest cairn at the eastern edge of the Lothagam North Pillar Site. Sandstone slabs at the western (outer) edge had to have been placed before sandstone slabs nearer to the center; most sandstone slabs dip toward the center of the cairn. Central portions of the cairn fill have rounded boulders and cobbles of basalt or other volcanic rocks and appear to have been placed after the sandstone slabs were laid in.

placed the pillars within fill on the platform's east side, and surrounded the entire platform with basalt boulders.

Within Lothagam North's platform, the mortuary cavity holds densely arranged skeletal remains of both sexes; ages at death range from neonates to elderly (*SI Appendix*, Table S1). In the center of the mortuary cavity, a 2- × 2-m excavation unit documented at least 36 individuals, some buried immediately after death with skeletons intact, and others with disorganization of the bones that suggests delayed burial. On the edge of the cavity, excavation revealed equally close positioning: Two primary burials lay next to a bundle burial containing three crania and disarticulated, commingled postcrania. Such high density required strategic corpse placement. Individual body position and orientation varied, as if to fit the maximum number of bodies in the space available. Most skeletons were in tightly flexed positions suggestive of being bound or wrapped and were marked by boulders on the skull, torso, and/or chest. Warping (distortion of bone shape without sharp breaks) suggests that some boulders were placed soon after death, while the bone was still fresh. Burials were rarely disturbed by later interment activities. Extrapolating from the 2- × 2-m excavation, we estimate the ~120-m^2 mortuary cavity eventually accommodated >580 individuals (*Materials and Methods*). Although radiocarbon dates suggest platform construction spanned about 450 (minimum) to 900 (maximum) years, mortuary deposits accumulated over a shorter period (Table 1; see also *SI Appendix*, Fig. S4).

Personal adornments occur with nearly all skeletons (Fig. 3). Many individuals had ostrich eggshell or stone beads around the necks, hips, and/or ankles. Others had hippo ivory finger rings or forearm bangles. Two burials had disintegrated headpieces with intricate latticed arrangements of mammal incisors: Burial 3's headpiece had 405 teeth from ≥113 individual gerbils (cf. *Gerbilliscus*) and Burial 4's head/neckpiece had 45 teeth from ≥25 individual hyraxes (cf. *Heterohyrax*). Another individual was buried with 12 perforated hippo tusks that may have been strung together and worn in life; the burial pit yielded isolated caprine remains, as well as a carved stone palette with a zoomorphic face resembling a cow. Adornments were not restricted to any age, sex, or interment type; beads were present with infants and within bundle burials. This suggests ornamentation was the norm, and its absence from a few skeletons may reflect unusual circumstances or poor preservation. More than 300 vibrantly colored stone and mineral beads were found, of which 173 were associated with 20 burials. Thirty-six raw material types include soft materials such as pink analcimes (45%), dark green talc (6.3%), and purple fluorite (3.3%), and harder minerals such as bright blue-green amazonite (32%) and chalcedony (5.7%, including some carnelian) (*SI Appendix*, Fig. S5). Many volcano-derived rocks (e.g., amygdaloidal and vesicular basalt, rhyolite, and phonolite) are available locally, whereas Precambrian sources for amazonite and talc lie farther afield but still within the Turkana Basin. Creative workmanship is evident in diverse forms: incomplete circles worn as earrings or on garments, ribbed pendants, and a curved pendant recycled from a broken round bead. Ornamentation was universal, time-intensive, and personalized.

Table 1. Radiocarbon age determinations for the Lothagam North Pillar Site (GeJi9)

Provenience and context	Excavation unit	Elevation, m above sea level	Material dated	Dating laboratory sample no.	^{14}C BP	δ^{13}C, ‰	cal. BP age range, 95.4%	cal. BCE age range, 95.4%
Ashy area at base of western platform	N04E36*	426.19	Charcoal	ISGS-A2624	4,280 ± 15	−25.9	4,861–4,835	2,912–2,886
Mortuary cavity: western edge. Sample collected from cluster of perforated hippo tusks capping bundle burial B26B/C/D	N04E39†	426.001	Charcoal	ISGS-A3793	4,135 ± 20	−24.6	4,819–4,571	2,870–2,622
Platform cap deposits covering the western edge of mortuary cavity	N04E39†	426.601	OES bead	ISGS-A3792	3,845 ± 20	−3.1	4,405–4,154	2,406–2,205
Mortuary cavity: core mortuary deposits. Sieve recovery from fill around Burial 2 cranium	N04E42*	426.19–426.01	Charcoal	ISGS-A2625	4,140 ± 20	−24.6	4,820–4,575	2,871–2,626
Mortuary cavity: upper limit of core mortuary deposits	N05E42‡	426.33	OES bead	ISGS-A1492	4,265 ± 15	−5.0	4,856–4,830	2,907–2,881
Platform cap deposits covering west-central area of mortuary cavity	N05E42‡	426.741	OES bead	ISGS-A1505	4,165 ± 20	−2.9	4,827–4,619	2,878–2,670
Deposits just above stone pavement on the east side of the platform	N04.25E52‡	426.48	OES bead	ISGS-A1491	4,385 ± 15	−2.5	5,033–4,871	3,084–2,922
Stone circle 30 m east of the platform. Sieve recovery from fill (disintegrating sandstone and sand) above the pit for bundle burial B6	N14.5E84.2*	425.83–425.73	OES fragment	ISGS-A2649	4,240 ± 20	−2.2	4,855–4,726	2,906–2,777

OES, ostrich eggshell. All samples are plotted finds unless otherwise specified. Dates are ordered first by location within the site (western platform, western edge of mortuary cavity, core mortuary cavity, eastern platform, and stone circle), and then by increasing elevation. The minimum period of platform use is 4,871–4,154 cal. BP (466 y), and the maximum period is from 5,033 to 4,154 cal. BP (879 y). Calibration was performed via OxCal v.4.3.2 (49), which uses the IntCal13 calibration curve (50).
*Samples excavated in 2012.
†Samples excavated in 2014.
‡Samples excavated in 2009.

East of the platform, excavations probed one stone circle and one cairn. Lothagam North's largest cairn (57 m^2) has massive sandstone slabs dipping inward: Outermost slabs were placed first, defining its large dimensions from the outset (Fig. 2*B*). The stone circle, a 16-m^2 low mound of disintegrating sandstone ringed by rounded basalt cobbles, covered a small, central bedrock pit. Within it, a bundle burial contained commingled elements from at least three persons of distinct ages. Perhaps locations or timings of death prevented immediate transport for primary burial. The stone circles' tight spacing and uniform size echo the compact placement of pits and burials within the platform (Fig. 1).

Construction at Lothagam North and other pillar sites ceased by ∼4,100 cal. BP. All of Lothagam North's architectural elements (cairns, stone circles, and platform cap) suggest orderly completion of a plan. This mortuary tradition is absent among later herding populations around Lake Turkana (25); changing social priorities, migrations, or other factors may have removed the impetus for large-scale construction and communal burial.

Discussion

Lothagam North's initial creation and final closure required heavy labor, but during the intervening decades or centuries people assembled for hundreds of mortuary rituals that may have involved little toil. This behavior is inconsistent with nascent elites consolidating authority via recurring large-scale construction initiatives. Communal values were emphasized by placing deceased of diverse ages and both sexes in a single location, without spatial or artifactual patterning that would suggest social hierarchies. Near-universal yet idiosyncratic ornamentation also argues against sequestration of resources by a social subset. Absent other evidence, Lothagam North provides an example of monumentality that is not demonstrably linked to the emergence of hierarchy, forcing us to consider other narratives of social change.

The social systems that galvanized monumental construction emerged in a singular economic and ecological context. Pillar sites are spatially and temporally bounded within the "moving frontier" phase (37) of initial herding around Lake Turkana. Herders—experienced immigrants and/or novice locals—had to juggle the distinct needs of sheep, goats, and cattle in new environments with higher livestock disease risks (38). Relations between groups emphasizing herding vs. fishing may have been delicate, and social roles within groups adopting livestock may have been contested. All these challenges, which are intrinsic to a moving frontier on an ecological transition (37), would have been exacerbated by the sudden drop in regional rainfall as the AHP ended. Availability of terrestrial plants and animals may have become unpredictable. Lake Turkana's retreating shoreline exposed new plains but demanded constant recalibration of fishing methods.

It is striking that amid all of these tensions people undertook construction of a massive communal cemetery where hundreds of individuals were buried over a span of a few centuries. In such a dynamic physical and social landscape, pillar sites may represent deliberate efforts to create stable landmarks or assembly points for dispersed, mobile people to express social unity and continuity through shared ritual. Regular congregation for mortuary events would have promoted information sharing that improved strategic planning of livestock movements across

Fig. 3. Ornaments and palette recovered from mortuary contexts at Lothagam North. Counterclockwise from upper right. (*A*) Remnant of headpiece with latticed arrangement of teeth (incisors) from gerbils (cf. *Gerbilliscus*); portions of the individual's cranium are visible to the left and upper right of the headpiece. (*B*) Stone palette with zoomorphic bovine carving. (*C*) Human finger bones with ivory rings still in place. (*D*) Cluster of perforated hippo tusks adjacent to cranium of primary burial. Additional secondary human remains, a caprine calcaneus, and the stone palette were found below the scale marker. (*E*) Detail of hippo tusk perforation; the largest tusk is ~3 cm wide. (*F*) Sample of stone and mineral bead pendants and earrings. Pictured materials include amazonite, fluorite, zeolite, talc, hematite, and chalcedony; specific material identifications are given in *SI Appendix*, Fig. S5.

extended areas, or even fostered networks for long-distance exchange or risk sharing. The need to actively propagate such social connections would be strongest during initial stages of the moving frontier and dramatic environmental shifts (39), waning after herding became entrenched into a "static frontier" with routine networks of interaction, and once rainfall and shorelines stabilized at lower levels. The chronology of pillar site construction and closure matches these expectations, suggesting that monumentality around Lake Turkana helped mitigate social and economic uncertainties in a frontier situation.

Pan-African comparison shows that monumental mortuary expression in the Sahara, Sahel, Nile, and Turkana often coincided with the local advent of herding. However, Turkana pillar sites lack obvious material cultural links to monumental sites in other regions. Forms of expression vary: cattle burials in the central Sahara (17), megaliths in the eastern Sahara (18), aggregate cemeteries in the southern Sahara and along the Nile (15, 19, 21–23), built mortuary spaces in the Red Sea Hills (20) and around Lake Turkana (described here), and cairn and cremation treatments linked to early pastoralism in central Kenya (40, 41). Together, these examples show that distinct forms of commemoration and mortuary treatment arose independently along the arc of herding's spread through Africa, each stimulated by local conditions and needs. This emerging pattern requires additional investigation and careful comparison, to see whether (or how) similar socioeconomic circumstances may have prompted the emergence of monumentality in different parts of the continent.

Turkana pillar sites and other cases of African monumentality have potential to reshape global perspectives on the processes of social change. Together with central Asian pastoralist cases (42, 43), they prove monumentality can develop among mobile and/or dispersed populations. Pillar sites join a growing number of studies in diverse ecological and economic contexts that decouple monumentality from the emergence of hierarchical social forms (44–47). Because monumentality entails the cooperative mobilization of large groups to create durable reminders of shared history, ideals, and/or cultural memory (1), it is a reliable signifier of complex social forms. Discovering monumentality in these new settings—amid societies that are not hierarchical, and among mobile groups in unpredictable landscapes—opens the door to future research that may reveal alternative pathways to social complexity in many parts of the globe.

Materials and Methods

Methods for excavation and spatial data collection are described in *SI Appendix, Supplementary Text*.

GPR Interpretation. Research followed standard protocol for GPR field data collection and processing (ref. 48; see also *SI Appendix*, Fig. S3). To correlate GPR signals with depositional elements, the reflection profile running nearest the N04 excavation gridline (*SI Appendix*, Fig. S3*A*) was compared with strata visible in the 2014 ongoing excavations in the western and central platform, and to records of 2009 test excavations in the eastern platform. For example, the depth of the Early Holocene beach sand visible in the western 1- × 5-m excavation trench was correlated directly to the reflections in adjacent GPR profiles to directly tie known stratigraphic horizons to radar reflections. This allowed for an accurate placement in true depth of the Early Holocene beach sand unit and the underlying sandstone bedrock visible between 80- and 100-cm depth.

These natural horizons were truncated when the pillar site builders created the mortuary cavity, visible in the middle of the reflection profile (*SI Appendix*, Fig. S3*A*). Vertical incisions cutting out these stratigraphic layers were observed in all reflection profiles across the grid. Reflection profiles were then resampled to derive reflection wave amplitudes from all profiles in the 20- × 22-m grid. Those amplitude values were averaged in a slice generated from between 80- to 120-cm depth and regridded to generate an image of the strength of the reflected waves, with pixels every 5 cm. A map-view image (*SI Appendix*, Fig. S3*B*) illustrates that the high-amplitude reflections are produced from the bedding layers where the sediments were undisturbed by burial activities. Where these sedimentary units were removed to create the mortuary cavity, and homogenized sediments were later placed in the ground during multiple burial episodes that eventually refilled the cavity, the map displays very low amplitude or no radar reflections at all, as there are no layers in those fill units within the mortuary cavity to reflect radar energy. Human remains that are known to be abundant in these homogenized fill units within the incision boundaries are too small to reflect energy and appear as areas of no or small-amplitude reflections. The total area in the grid where the strata were removed for burial is 119.5 m^3 (*SI Appendix*, Fig. S3*C*).

Estimate of Number of Individuals Buried in the Mortuary Cavity. Volumetric calculation of the mortuary cavity was precluded for two reasons. First, the base of the mortuary cavity is too deep for detection via GPR. Second, excavations showed that the burial pits made the base of the mortuary cavity highly irregular. Therefore, calculations instead focused on (*i*) defining the areal extent of the mortuary cavity (A_{MC}) via GPR, (*ii*) determining the number of individuals typically buried within the mortuary cavity beneath a single square meter of the platform's surface (I_{SQM}) as revealed by excavation, and (*iii*) estimating the total number of people interred within the mortuary cavity (P_{MC}) by solving the equation $P_{MC} = A_{MC}(I_{SQM})$. GPR data established A_{MC} as 119.5 m^2. Excavation of a 4-m^2 area within the perimeter of the mortuary cavity yielded numerous inhumations, for which bioarchaeological analysis provided two mechanisms for calculating I_{SQM}. Dividing the number of dentitions recovered (n = 20) by the area excavated in the central platform (4 m^2) suggests a conservative I_{SQM} of 5. Dividing the minimum number of individuals, or MNI, (n = 36) by the area excavated in the central platform (4 m^2) suggests a more liberal I_{SQM} of 9. If $P_{MC} = A_{MC}(I_{SQM})$, then the number of individuals buried within the Lothagam

North's mortuary cavity is estimated to range from 585 to 1,053. This range should itself be regarded as a minimum for two reasons. First, excavations in N04E39 identified additional burials outside the depositional incisions detected via GPR, so there may be substantial numbers of people outside the mortuary cavity. Second, while we can exclude the possibility of a shallower base anywhere in the mortuary cavity (because higher bedrock surfaces would have come within the range of GPR detection), mortuary cavity deposits may be deeper in some areas than those observed during excavation; these would be even further outside the range of GPR detection and might accommodate a greater number of individuals.

Radiocarbon Dating. Eight samples (three charcoal and five ostrich eggshell) were submitted to the Radiocarbon Dating Laboratory at the Illinois State Geological Survey (ISGS), Prairie Research Institute, University of Illinois at Urbana–Champaign between 2009 and 2016. Specific information on radiocarbon sample collection, preparation, analysis, and date calibration is provided in *SI Appendix*, Fig. S4.

Bioarchaeological Field and Laboratory Methods. Recovery and documentation of human remains followed standard protocols for exposure, mapping, and documentation, with special considerations for high-heat/high-UV recovery situations, high density of burials, state of bone preservation, and future sampling for aDNA, isotope, dental calculus, and other research. Detailed descriptions of these methods are given in *SI Appendix*, Table S1.

Mineral Identification. Cataloging, classification, and preliminary identification of the bead assemblages from Lothagam North took place in August 2015 at the Turkana Basin Institute. Full procedures are described in *SI Appendix*, Fig. S5.

ACKNOWLEDGMENTS. We thank the people of Turkana County, the National Museums of Kenya, and Kenya's National Council of Science and Technology for permission to conduct research. Crew members S. Derbyshire, A. DeRenzis, E. Doyle, B. Kimeu, H. Duke, M. Ekaale, F. Ekai, J. Ekusi, A. Ekutaan, J. Etabo, L. Lowasa, Z. McKeeby, C. Ogola, S. Pilliard, M. Rizzo, H. Sale, A. Shoemaker, B. Smith, and C. Swoger contributed to field and laboratory research 2009–2014. Funding was provided by the Turkana Basin Institute (reconnaissance in 2007), the National Geographic Society (Grants W20-08 to J.J.S. in 2008, CRE8644-09 to E.A.H. in 2009, and CRE9473-14 to E.A.H. in 2014), the National Science Foundation (Grant BCS1124419 to E.A.H. 2012–2016), and the Wenner-Gren Foundation (Grant 58962 to C.E.K. in 2015). The Turkana Basin Institute gave crucial logistical support at all stages of research, and funded the costs of this publication.

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