Supporting Information

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SI Text

Archaeological Taxonomic Status of the Occurrence F and Occurrence G Assemblages

We reanalyzed archaeological material from the 1971–1973 Gramly excavations of GvJm-22 stored at the NMK. We focused on cores because, from a technological standpoint, they are among the most informative aspects of any lithic assemblage. The results show that Levallois cores, one of the defining features of MSA technology (1–3), comprise 10–33% of the archaeological material attributed by Gramly to occurrences F and G. The Levallois cores (and flakes) from occurrence F at GvJm-22 co-occur in strata with other typically MSA artifact forms (i.e., bifacially flaked points), as well as with those artifact forms considered diagnostic of LSA sites, particularly microlithic backed pieces and small "fan" scrapers. Our examination of the formal tools from strata beneath occurrence E simply confirmed previous typological attributions (4, 5). Although we collected metric data on artifact dimensions, we did not attempt a reanalysis of the abundance of different artifact types because it was clear that a number of formal tools have been separated from the remainder of the GvJm-22 collection at the NMK and could not be located. The sample size of retouched tools from previously unreported occurrence G is very low ($n = 2$) and does not include retouched points, microlithic backed pieces, or fan scrapers.

The co-occurrence of MSA and LSA lithic artifacts in occurrence F might indicate that this archaeological aggregate represents a "transitional" assemblage, formed by a gradual process of shifts in lithic technology over time, as appears to be the case at sites in Tanzania, such as the Mumba and Nasera rock shelters that sample the same time interval (6–8). However, the stratigraphic resolution of the material excavated in 1970–1973 is too coarse to understand the nature of technological change between MSA and LSA technologies at GvJm-22. The alternative hypothesis of formerly discrete assemblages with exclusively MSA and LSA artifacts that have been mixed postdepositionally or during excavation cannot be rejected. Our radiocarbon dating program focused on providing age sequences from multiple areas of the 1970–1973 excavation area. When these results are integrated with site stratigraphy, they demonstrate that Gramly's excavation of arbitrarily 5- to 10-cm-thick horizontal spits intersected natural and cultural deposits that dip ∼2°, resulting in the admixture of formerly discrete strata, a problem recognized by Gramly (4) in his definitions of occurrences E and F, but one that achieves greater significance with the identification of both MSA and LSA technological elements in occurrence F.

Therefore, we refrain from a formal archaeological taxonomic attribution for the occurrence F and occurrence G material from Gramly's 1971–1973 excavation but, instead, emphasize the presence of MSA technology (Levallois flakes and cores as well as bifacial points), where none was previously recognized. Thus, the GvJm-22 artifact assemblages span the MSA/LSA transition but do not necessarily represent one or more transitional industries. The situation at GvJm-22 is remarkably similar to the situation at the Magosi rock shelter in Uganda, where the co-occurrence of MSA and LSA artifacts (Levallois technology, retouched points, and backed microliths) from excavations in 1926 defined the Magosian Industrial Complex, once considered to be the clearest example of an industry of the "Second Intermediate Period" between the MSA and LSA (9–11). However, reexcavation of Magosi in 1963 demonstrated that this combination of MSA and LSA artifacts was artificial and resulted from the removal of sediment in 61-cm-thick horizontal increments across steeply dipping (∼45°) strata, a recognition that contributed to the abandonment of both the Magosian Industrial Complex and Second Intermediate Period concepts (11, 12). Because of similar stratigraphic problems at GvJm-22, a more precise definition of the assemblages below occurrence E and the nature of the MSA/LSA transition at the site are problems that can only be addressed with renewed excavations at the site using finer scale artifact provenience recording and microstratigraphic approaches.

Hominin Comparative Data

Metric comparisons of the KNM-LH 1 partial calvaria, summarized in Table S3, are based on the following measurements: maximum frontal breadth (XFB), bifrontal breadth, interorbital breadth, FRC, parietal chord (PAC), and frontal angle following Howells (13); minimal frontal breadth [BFT; M9 (14)]; frontal arc (FAR; M26); parietal arc (PAR; M27); TPE (15); IFT (I.12 = BFT/XFB); frontal curvature index (I.22 = FRC/FAR); and parietal curvature index (I.24 = PAC/PAR). Published measurements for RMHs are taken from Tweisselmann (15) and Howells (16). The published measurements for EMHs and LPMHs used in Table S3 are taken from other publications (16–49). Measurements in Table S3 of El Barga, El Fakhuri, Ishango, Jebel Sahaba, Lothagam, Olduvai Hominid 1, Taforalt, and Wadi Halfa were taken from the originals. Measurements in Table S3 of Wadi Kubbaniya were taken from a cast. The Ishango material was too fragmentary to be included in the principal component analysis. Shown in Table S3 are sample means, SD, and sample size.

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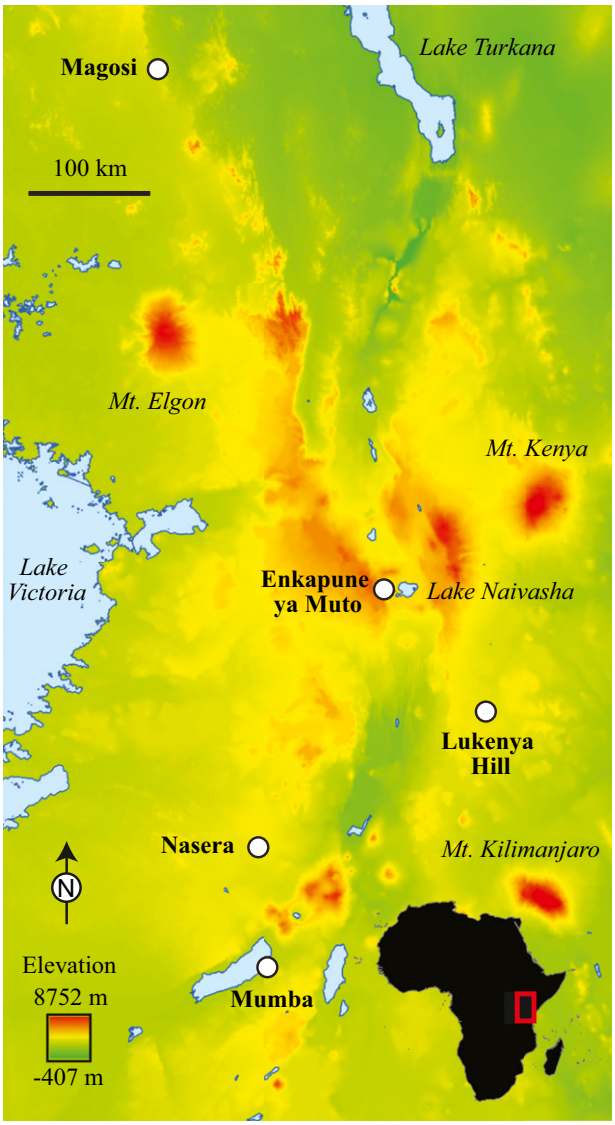

Fig. S1. Topographic sketch map of eastern Africa showing archaeological sites and major geographic features mentioned in this study.

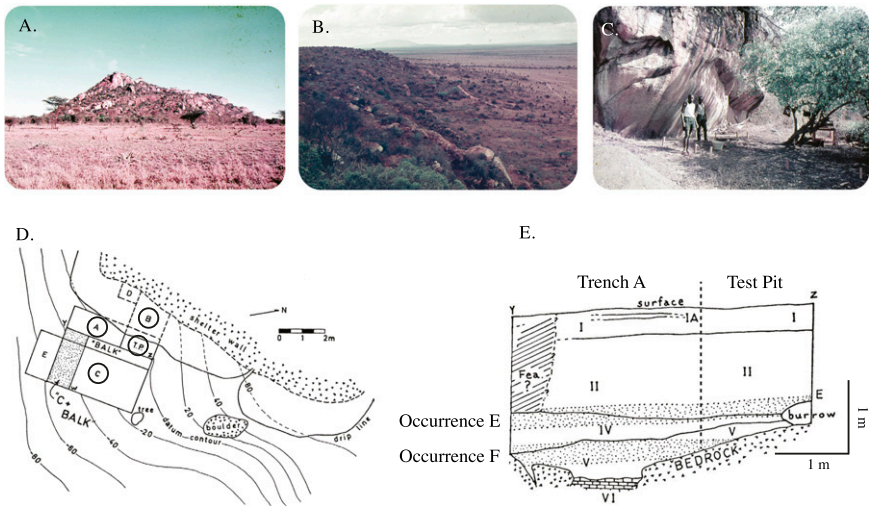

Fig. S2. R. M. Gramly's 1970–1973 excavations at GvJm-22: the Lukenya Hill inselberg (*A*); the view of the Athi-Kapiti Plains from Lukenya Hill (*B*); GvJm-22 at the beginning of the excavation (*C*); plan view of the GvJm-22 excavations, showing excavations units A–E, the test pit (T.P.), and the sediment balk, with circles denoting units sampled in this study (*D*); and profile view of the south wall of the test pit and trench A, with stippled areas showing the location of archaeological strata occurrence E and occurrence F (*E*). Modified with permission from ref. 4, © 1976 Royal Anthropological Institute of Great Britain and Ireland.

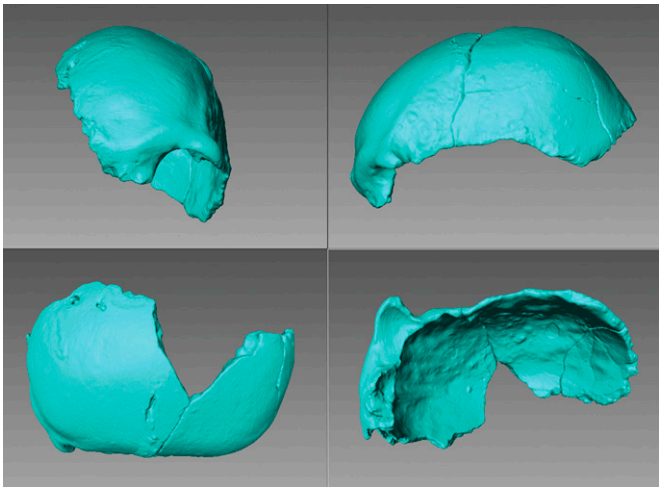

Fig. S3. Virtual reconstruction of the KNM-LH 1 calvaria (clockwise from upper left) in anterior, left lateral, superior, and inferior views.

Table S1. Frequency of cores from GvJm-22

Core type	Occurrence E, 120–150 cmbs*	160–170 cmbs	Occurrence, F 170–205 cmbs	Occurrence G, 210–225 cmbs
Levallois preferential	0	2	3	2
Levallois recurrent	1	13	32	0
Levallois (method indeterminate)	0	0	2	0
Single platform	198	9	34	6
Double platform (opposed)†	63	0 (2)	2 (11)	3 (1)
Multiple platform	17	0	8	2
Bipolar	145‡	9	17	1
Centripetal	0	5	25	1
Irregular/other	0	4	8	1
Core fragment	36	1	1	2
Total	349	45	143	19

Cores are defined as pieces with three or more removals; core types follow Mehlman (1), Boëda (2), and Kuhn (3).

*Data are from Barut (4).

†Opposed platform cores are shown in parentheses.

‡Includes split pebbles ($n = 3$).

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Table S2. Hominin comparative samples

Groups	Specimens	Country
KNM-LH 1	Lukenya Hill	Kenya
NK2	Nazlet Khater 2	Egypt
HOF	Hofmeyr	South Africa
IWO	Iwo Eleru	Nigeria
MPH	Middle Pleistocene *Homo* fossils from Africa	
	Florisbad	South Africa
	Kabwe 1	Zambia
EMH	Early modern human fossils from Africa and Southwest Asia	
	Border Cave 1	South Africa
	Dar-es-Soltan H5	Morocco
	Herto 1 (BOU-VP-16/1)	Ethiopia
	Jebel Irhoud 1 and 2	Morocco
	Ngaloba LH18	Tanzania
	Omo Kibish 2	Ethiopia
	Qafzeh 3, 6, and 9	Israel
	Skhul IV, V, VI, and IX	Israel
LPMH: Late Pleistocene modern humans		
EUP	European Upper Paleolithic modern human fossils	
	Abri Pataud	France
	Barma Grande	Italy
	Brno 2	Czech Republic
	Cioclovina	Romania
	Cro-Magnon 1, 2, and 3	France
	Dolní Věstonice 3, 13, 14, 15, and 16	Czech Republic
	Grotte des Enfants 4, 5, and 6	Italy
	Khvalynsk	Russia
	La Crouzade V	France
	Mladeč 1, 2, 5, and 6	Czech Republic
	Pavlov 1	Czech Republic
	Peştera Muierii 1	Romania
	Peştera cu Oase 2	Romania
	Podkumok	Russia
	Predmostí 3, 4, 9, and 10	Czech Republic
	Satanay	Russia
	Skhodnya	Russia
	Sunghir 1	Russia
LPA	Late Pleistocene fossils or samples from North Africa	
	Afalou-Bou-Rhummel ($n = 37$)	Algeria
	El Barga Mesolithic ($n = 26$)	Sudan
	Esna (El Fakhuri)	Egypt
	Jebel Sahaba ($n = 22$)	Sudan
	Taforalt ($n = 30$)	Morocco
	Wadi Halfa ($n = 15$)	Sudan
	Wadi Kubbaniya	Egypt
LPS	Late Pleistocene fossils or samples from Southwest Asia	
	Ein Gev 1	Israel
	El Wad ($n = 16$)	Israel
	Erq El-Ahmar ($n = 2$)	Israel
	Eynan Mallaha ($n = 19$)	Israel
	Hayonim ($n = 7$)	Israel
	Kebara ($n = 5$)	Israel
	Nahal Ein Gev	Israel
	Nahal Oren ($n = 15$)	Israel
	Ohalo H2	Israel
	Rakefet	Israel
	Shukbah ($n = 5$)	Israel
	Wadi Mataha F-81	Israel

Table S2. Cont.

Groups	Specimens	Country
LSA	Late Stone Age fossils or samples from Sub-Saharan Africa	
	Elmentieta A, B, D, E, F, and F1	Kenya
	Fish Hoek	South Africa
	Gamble's Cave II (4 and 5)	Kenya
	Ishango NFPr (n = 3)	Democratic Republic of Congo
	Lothagam 2, 4b, 7, and 10	Kenya
	Makalia 1	Kenya
	Matjes River	Kenya
	Mumba X	Tanzania
	Naivasha	Kenya
	Nakuru IX	Kenya
	Olduvai Hominid 1	Tanzania
	Tuinplaas 1 (Springbok Flats)	South Africa
	Willey's Kopje 1, 2, and 3	Kenya
NEOAF	Neolithic fossils or samples from North Africa	
	Ain Dokkara	Algeria
	Asselar	Mali
	Columnata (n = 13)	Algeria
	El Barga Neolithic (n = 25)	Sudan
	Gambetta 1	Algeria
	Hassi-el-Habiod (n = 21)	Mali
	Mechta el Arbi 1–3 and 5	Algeria
	Medjez II (n = 4)	Algeria
RMH	Recent modern human samples	
	Bushman (n = 82)	South Africa
	Zulu (n = 101)	South Africa
	Dogon (n = 99)	Mali
	Teita (n = 83)	Kenya
	Egypt (n = 111)	Egypt
NEAND	Neandertal fossils	
	Amud 1	Israel
	La Chapelle-aux-Saints 1	France
	La Ferrassie 1	France
	Shanidar 1	Iraq
	Spy 1	Belgium
	Steinheim	Germany

Table S3. Comparative craniometric descriptive statistics

		BFT	XFB	FMB	DKB	FRC	PAC	FRA	FAR	PAR	TPE	IFT	ICF	ICP
KNM-LH 1		103.00	111.00	107.40	30.20	120.00	114.00	128.41	140.00	125.00	10.20	92.79	85.71	91.20
EMH	M	105.25	120.30	116.79	27.33	116.11	118.10	132.70	129.89	128.75	8.83	87.88	87.89	92.94
	S	5.73	5.12	8.13	2.96	5.52	9.48	4.86	6.51	8.48	2.21	3.46	2.53	2.39
	N	13	10	7	7	12	10	9	9	8	6	10	10	8
LPMH	M	97.61	118.15	104.96	26.06	112.16	117.29	128.47	129.19	130.41	7.21	82.75	87.50	90.00
	S	5.99	6.48	6.63	2.80	6.20	6.50	6.76	7.49	8.07	1.58	4.63	2.67	2.99
	N	248	221	142	113	224	216	167	266	263	161	196	241	202
RMH	M		111.72	96.69	22.34	108.65	111.31	126.66			7.70			
	S		5.69	4.46	2.54	5.24	6.40	4.36			0.98			
	N		476	476	476	476	476	476			64			
Adjusted Z-scores*														
KNM-LH 1 vs. EMH		−0.1740	−0.7653	−0.4411	0.3707	0.3075	−0.1823	−0.3634	0.6391	−0.1763	0.2231	0.5981	−0.3630	−0.2905
KNM-LH 1 vs. LPMH		0.4559	−0.5580	0.1854	0.7433	0.6398	−0.2560	−0.0045	0.7315	−0.3395	0.9360	***1.0958***	−0.3396	0.2031
KNM-LH 1 vs. RMH			−0.0644	***1.2218***	***1.5710***	***1.1008***	0.2138	0.2043			***1.2819***			

BFT, minimal frontal breadth; XFB, maximum frontal breadth; FMB, bifrontal breadth; DKB, interorbital breadth; FRC, frontal chord; PAC, parietal chord; FRA, frontal angle; FAR, frontal arc; PAR, parietal arc; TPE, vault thickness at parietal eminence; IFT, frontotransverse index; ICF, frontal curvature index; ICP, parietal curvature index; M, mean; S, standard deviation; *N*, number.

*Adjusted Z-scores of KNM-LH 1 relative to both the Late Pleistocene modern human and recent modern human samples; the values in bold and italic (<−1 or >1) are outside 95% of the comparative sample range of variation (49).