# SYNOPSIS OF THE PALEOLITHIC AFRICA

| Period | Sites | Tools/*Hominids*/ Symbolic Behavior | Fauna |
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| **Early Oldowan** 2.0-2.6 Ma | General: bipolar technique; cores ('choppers'), discoids, flakes used as cutting tools, cores multipurpose for hammerstones, pounding activities; not yet standardized tool forms, absent retouch on flakes; fauna low counts of modification marks *(SS1997)* but 'no need to posit a pre-Oldowan or Omo industry' *(KM1994)* or more precisely I suggest we classify Australopithecine tools and symbolic behavior as 'Pre-Oldowan' and those of Homo as 'Early Oldowan' *(JBH)* | | |
| | Ounda Gona, Ethiopia OGS-6, OGS-7 (Ar/Ar, paleomag.) **2.53±0.15-2.58** Ma *(SS2003)* | Manuported, intensively flaked chert, etc. pebble cores, flakes ('technical blades'); flaked bone *(SS2003, SD2005)* | Equid bone with cutmarks; bovid – Gona sites had active scavenging or hunting of large mammal carcasses *(DM2005, SS2003)* |
| | Kada Gona, Kada Hadar, Ethiopia EG10, 12 (Ar/Ar, paleomag.) **2.517±0.075-2.58 Ma *(SS1997)*** | Kada Gona 2, 3, 4; West Gona 4 sites; EG 10,12, volcanic rock, cores, 'well struck flakes' *(SS1997, KM1994)* | No fauna *(KM1994);* |
| ('Pre-Oldowan') | Bouri, Hata Member, Ethiopia (Ar/Ar, palaeomag., sedimentation rate) **2.45-2.50 Ma** *(HJ1999)* | Cutmarks, bone shaft hammerstone breakage, but no cores or flakes (must have manuported them); *Australopithecus garhi (HJ1999)* | *Alcelaphine* bovid and *Hipparion* both with cutmarks; other Hata: *Antidorcas, Gazella; Pelorovis, Syncerus; Hippotragini (Oryx), Kobus; Tragelaphus; Giraffidae;* Hippo, Suids, *Homotherium; Theropithecus; Deinotherium, Elephas (HJ1999)* |
| | Kapthurin Formation, Tugen Hills, Rift, Kenya (Ar/Ar brackets at) **2.393±.013 Ma** and 2.456±.006 Ma *(DAH2002)* | *Homo sp. indet. (SR2002)* | |
| | Lower Omo, Shungura Formation, Ethiopia (K/Ar and scaled) Member G:1.90- 2.32 Member F: **2.32±.03-2.34±.05 Ma** Member E: 2.34-2.40 Member D: 2.40-2.52 *(IW2000)* | 5 sites in F and 1 in G: bipolar on quartz pebbles, cores, angular fragments *(MH1976; KM1994)* (C-F) *Austral. aethiopicus* (G) *Austral. boisei* (E-G) *Homo sp. indet., (SG1996; AZ2002)* (E, G) *rudolfensis* (*GD2006),* | Elephant, hippo, bovids, but maybe derived *(MH1976)* |

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| | Upper Kada Hadar Member, Hadar, Ethiopia (8 m below Ar/Ar tuff BKT-3) > **2.33±0.07 Ma** *(KW1997, KW1996)* | Oldowan 'choppers' (surface) and end-struck flakes (*in situ*), basalt, chert, no retouch evident; faunal bones fragmented, 'may be' cutmark; maxilla AL666-1 = *Homo sp.*, 'closest to *H. habilis* OH16, OH39' *(KW1997, KW1996)* | Makaamitalu Basin AL666 taxa*): **Theropithecus oswaldi, Elaphus recki, Equidae, Kolpochoerus, Metridiochoerus,* hippo, giraffe, crocodile, **Tragelaphus, *Gazella, *Raphicerus, Syncerus,* other bovids *(KW1996)* |
| | Lokalalei, Kalochoro Formation, West Turkana, Kenya (= Omo F) **2.32-2.34** Ma (RH1999; KM1994; IW2000) | LA1 (GaJh5): basalt, etc. ; core, fragments, flakes, no retouch; only 2 'may be' cutmarks and long bone hammerstone breakage *(KM1994);* LA2C: highly controlled flaking, few retouched *(DA2005)* regularized reduction sequence *(KM1994)* | Bovids, indet species *(KM1994);* near LA1 *Homo sp. (PS2005)* |
| | Kanapoi, South Turkana, Kenya (K/Ar) 2.5 MA | Oldowan (WJ1982) | |
| | Senge 5a and Kanyatsi 2, Lusso Beds, Upper Semiliki, Zaire (faunal) 2.0-2.3 Ma *(KM199, KK1998)* | Intensive bipolar reduction waterworn quartz pebbles, flakes, many only 10-20 mm *(LB1998)* | 4400 fauna specimens, no bone surface modification marks, except two cutmarks on tortoise *(KM1994)* |
| | Uraha and Malema, Chiwondo Beds, Malawi (fauna) 2.3-2.5 Ma *(SF1995)* | UR 501 *Homo rudolfensis* RC 911 (Malema) *Paranthropus boisci (SF2002)* | |
| | Kanjera South, Homa Peninsula, Kenya KS1-3 (below palaeomag. Reunion subchron) > **2.15 ka** *(PT1999)* | 'Oldowan'; flakes, scraper; imported raw materials; KS1 flakes in direct association with small antelope; articulated hippo bones and flakes KS3; *(PT1999)* | Bovid, equid, suid, hippo, *Deinotherium* (proboscid), crocodile, fish *(PT1999)* |
| ('Pre-Oldowan') | Limeworks Cave, Makapansgat, South Africa<br><br>Member 3 (ESR LU) **2.00±0.36 Ma** 'but could b e older if ave. LU and RU 4.14±0.66 Ma = ca. 3 Ma *(BB2001)* or Member 3-4: 2.9-3.2 Member 5: ~1.7 Ma *(KK1998)* | Member 3-4 *Australopith. africanus, possibly also Paranthopos* and fauna; Member 4: manuported, waterworn red jasperite cobble, natural 'figurine of many (3) faces' of *Australopithecus/Homo? (DR1974*); is natural, world's earliest palaeoart *(BR1998; BR2003)* Member 5 artifacts or natural? *(KK1998)* | |

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| **'Classic' Oldowan**<br>~1.7-2.0 Ma | General: hammerstone/anvil bipolar continues adding direct percussion in hand; cores: choppers, polyhedrons, discoids, spheroids and subspheroids. Standardized small tools appear: 'light and heavy-duty' scrapers on flakes or fragments, rare burins and protobifaces; utilized unmodified flakes; some worked bone *(LM1971)* | | |
| | Koobi For a and Karari, East Turkana, Kenya (K/Ar and paleomag. KBS Tuff to base Olduvai subchron) **1.88-1.95 Ma** *(IW2000, TI1988)*<br>'KBS industry' in and just below KBS Tuff,<br>FxJj1 is in the KBS Tuff *(TN1985)* | Basalt cores, tools;<br>FxJj1: pebble core with 4 flakes removed, 2x2 bifacially, accidentally yielding 'inner diamond' shape, curated, 'first metaphor of core-essence' *(HJ1992)* | FxJj1: porcupine, pig, gazelle, waterbuck, hippo; FxJj3 (HAS): hippo *(WJ1982)*<br>*Homo rudolfensis*: KNM 1590, 1470 (~1.9 ka); *Homo habilis*: KNM 1805; KNM 1501 (1.75 Ma), 1502 and 1813 (1.65 Ma) *(GP2006)* |
| | Olduvai Gorge, Tanzania<br><br>Bed I (Ar/Ar) Naabi bedrock 2.029±.005 Ma<br>Tuff IA **1.976±.015 Ma**<br>Tuff IF **1.749±.007 Ma** *(WR1991)*<br>Lower BI: DK-1,2,3; MK<br>Middle BI: FLK Zinj; FLK NN-1,2,3<br>Upper BI: FLK North 1-6<br><br>Lower Bed II: 1.66-1.75 [FLK North Deino; FLK North Root Casts; HWK East 2 indet. classif.]<br><br>Middle Bed II: 1.5-1.66 *(MR2005)*<br>Middle BII: MNK Skull *(LM1971)* | Oldowan tools; utilized bone; rare flaked bones with use polish (DK, FLKNN, FLK North, HWK East 2);<br><br>DK-1,2,3: OH24 *H. habilis;*<br>MK (no tools): OH4 *habilis;*<br>FLKNN-1,2,3: OH7 OH8 *H. habilis*;<br>FLK Zinj: OH5 *Austral. boisei*; OH6 *H. habilis;*<br>FLK North 1-6: OH10;<br>Maiko (no tools): OH16<br><br>MNK Skull: OH13 & 14 *habilis* OH15 *erectus? (WJ1982)*<br>OH62 *H. habilis* (Johanson et al 1987)<br>OH65 // ER1470 (Blumenschine et al 2003) | FLKZinj, defleshing cutmarks, bone breakage for marrow; hunting small bovids likely, scavenging large prey *(BH1986);* carnivore first, hominid next, scavengers later *(BR1995)*; but hominids 'early access' not carnivores, confirms Bunn and Kroll *(DM2006)*<br><br>FLK North 1 (occupation floor): phonolite cobble or 'pitted anvil', grooved all around, pecked line of 4+2 indentations, shape like a 'baboon head' *(LM1971)*<br>FLK North 1/2: 'pitted anvil', a conical 10 cm diam. block steeply flaked (high backed) all around its flat base, with deep 9 mm pecked depression in its center *(LM1971,1976)*; 'apparent cupule' *(BR2003)* or for nutcracking? *(GN2002)*<br><br>[FLK North 1, 1 proto-biface with vague shape of screeching primate - JBH] |

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| | Sterkfontein Cave, South Africa<br><br>Member 2: (paleogmag. and sedimentation) 3.30-3.33 (Partridge 2000), but <3.0 Ma *(BL2002, MJ2003)*; (U/Pb speleothem above Stw573) 2.17±0.17 (below) 2.24+.09-.07 or **~2.2 Ma** *(WJ2006)*<br><br>Member 4 (paleomag. Reunion) = **2.14-2.15** Ma (Partridge 2005); (Schwarcz et al 1994) (ESR ave.) 2.1±0.5 Ma. (fauna) 1.5-2.5 Ma *(BL2002; WJ2006)*<br><br>Member 5 (faunal): upper 1.4-1.7 MA *(BL2001)*; base **1.7-2.0 Ma** *(CR1999)* or base and upper 1.5-2.0 *(KK1998)* | M5 East (base) (c. 1.7-2.0 Ma) quartz, quartzite cores, some throw smashed, some bipolar technique; 8 polyhedral, 6 bipolar, 4 choppers, 1 discoid core, 146 complete 4 retouched flakes, some retouched, 1 protobiface 'Oldowan' *(KK1998*); bone and horn core tools used for termite foraging *(BL2001, DF2001)*; tool residues, fresh blood, ligament and tendons, muscle tissue = quick access to fresh meat, wood and horn scraping, starch grains from tubers; some worked bone *(LT1998; SA2004)*<br><br>M5 West (upper) (1.5 Ma), 'Oldowan B' (M. Leakey) but well-made cleaver so must be Early Acheulian *(CJ1988, KK1998, MJ2003)* | M2: Stw573 *Austral. sp.*<br><br>M4: Stw5+14; Stw17; Stw52, Stw404 *Austral. africanus*; Stw36, Stw71, Stw252, Stw384 *A. robustus (CJ1988); Stw505 (Mr.Ples)*, ~515cc *africanus (CG1998)*<br><br>M5*: A, robustus*, *Theropithecus oswaldi*; teeth Stw 19b, Stw 33, Stw 42, Stw75-79 *H. habilis*; Stw53 *Homo habilis* (Hughes & Tobias 1977) // OH13, SK847 *(MJ2003; CD2006)* and has stone tool cutmarks; indicates earliest evidence of 'post-mortem manipulation of hominid carcasses' *(PT2000)*<br><br>M5 upper: StW80-83 *Homo ergaster* (KK1998) |
| | Melka-Kontouré, Awash, Ethiopia<br>Gombore I: **1.6-1.7 Ma** | Oldowan, choppers, polyhedrons, rabots; humerus fragment, *Homo erectus* (Chavaillon J & N. 1969, 1976; et al 1977) (*MJ2001)*; 'pitted anvils' as 'cupules'? or for nutcracking? *(GN2002)* | |

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| **Developed Oldowan** 1.4-1.7 Ma *(LB1998)* | General: pebble core-flake tools ('Mode I') with standardized small tools (variable random to regular retouch), bipolar and single platform cores; reduced % core-choppers, discoids, polyhedrons and heavy-duty scrapers, more refined light-duty scrapers, burins; 1st appearance of awls, edge-trimmed flakes -- *outils écaillé* and few crude bifaces in B and C and punches in C *(LM1971, WJ1982)* | | |
| Developed Oldowan A | General: Oldowan tool forms persist, with increase in spheroids and subspheroids and number and variety of light-duty tools; 1st appearance of awls, rare edge trimmed flakes, burins absent, no bifaces yet *(LM1971)* or few burins *(see below)* | | |
| F | Karari and Ileret, East Turkana, Kenya<br>Karari sites generally in the Okote Member (K/Ar on Okote Tuff) 1.53±0.03 Ma (*IW2000, TI1988)*<br><br>FxJj50 is in the Okote Tuff Complex *(BH1980)* = between Black Pumice Tuff (scaled age) **1.55±0.03 Ma** and White Tuff (scaled age) **1.70±0.03** and based on intermediate Morutot Tuff (K/Ar) **1.65±0.05 ka** *(IW2000; SN1993)* | 'Karari industry', like KBS industry, but more refined, some denticulate edges *(WJ1982)*; high % single platform cores ('core scrapers')*(LB1998);* and KBS persists as at FxJj50 *(BH1980);*<br>stone shattered animal bone shafts (for marrow) *(BH1980);*<br>Karari and FxJj50 9 flakes (all unretouched) of 54 show microwear polish = cutting soft animal tissue, soft plant material;<br>scraping and sawing wood *(KL1981);* controlled use of fire FxJj 20E and other sites 1.6 Ma *(LB2000)* | *Loxodonta africana* biozone; FxJj50: gazelle, impala, wildebeest, *Pelorovis*, giraffes, hippo, horse, giant pig, baboon, porcupine, crocodile, tortoise, snake, catfish, bird *(BH1980);*<br><br>KNM 730, 3733, 1812, *H. ergaster/erectus*, 1.60-1.64 Ma *(GP2006)*<br>Nariokotome III, KNM-WT 15000, 1.65 Ma, *H. ergaster/erectus (BF1985)* |
| | Olduvai Gorge, Tanzania<br>Middle Bed II: **1.5-1.66** *(MR2005)*<br>Middle BedIIb: HWK East, Sandy Conglomerate;<br>FLK North, Sandy Conglomerate (both same level) *(LM1971)* | Developed Oldowan A; chert pebbles; at FLK North S.C.: 1 'anvil' is 'unusual', has artificially pecked depression, 5 mm deep in center *(LM1971)*, 'apparent cupule' *(BR2003)* or for nutcracking? *(GN2002)* | Fauna HWK East 3-5SC: equids, rhino, hippo, giraffids, *Alcelaphini*, *Pelorovis*, python, turtle *(LM1971)*<br>[FLK-North-SC, 2 of awls 5 of scrapers possible zoomorphic figurations, rhino or hippo, equid, buffalo - JBH] |
| | Peninj, West Lake Natron, Tanzania<br>Upper Sands with Clay, Humbu Formation<br>Type Section – ST Site Complex (11 sites)<br>(Ar/Ar, paleomag., fauna)<br>**1.4-1.6 Ma** *(TI2003)* | Mostly basalt, 30% cores hierarchical centripetal (radial), 20% unifacial abrupt, 20% multi-facial irregular,17% unifacial centripetal, while choppers and polyhedrons 3-7%, with 'template image to obtain pre-determined flakes', 8% retouched; 71% sidescrapers, 18% notches, 7% endscrapers, burins *(TI2003)* | Close association of bone tools to bones, presence of cutmarks, ergo carcass processing (Dominguez-Rodrigo et al 2002) *(TI2003)* |

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| | Nyabusosi, Toro, Uganda NY18 (Ar/Ar on overlying tuff) **1.5 Ma** (Texier 1995, 1997) *(TI2003)* | 'Oldowan', quartz, radial strategy, carefully prepared striking platforms, as in MP (Texier 1995) *(TI2003)* | |
| F | Chesowanja, Chemoigut Formation, Lake Baringo, Kenya (K/Ar) >**1.42±0.07** Ma *(GJ1981)* | Oldowan and Developed Oldowan (A-B) (GnJi 1/6E, Gnji 2/8, FnJi 10/5); most convincing examples of regular retouch, small tools *(LB1998*); GnJi1/6E, burnt clay, only associated with artifacts and bones, magnetic analysis T 400º suggests campfire *(GJ1981; LB2000)* | Lacustrine, savanna; giraffe, elephant, rhino, antelope, horses, pigs, hippos, crocodiles, turtles *(WJ1982)*; robust *Australopithecus bosei (GJ1981)*¬ |
| | Melka-Kontouré, Awash, Ethiopia Garba IV: **1.4-1.5 Ma** *(MJ2001)* | Developed Oldowan A, 10,000 artifacts on obsidian, volcanic, rough handaxes on flakes, 2 cleavers, mostly pebble tools (Chavaillon Piperno 1975; Piperno Bulgarelli; Piperno 1977, 1986) (*MJ2001)* | *Pelorovis, Connochaetes, Damaliscus, Gazella,* Equids,, Suids *Hippopotami*, Elephants, Giraffes, *Theropithecus (Simopithecus)* (Geraads 1979) (MJ2001) Child mandible, *H. erectus* |
| | Drimolen, South Africa 1.5-2.0 Ma *(DF2003)* | No stone tools, but termite foraging bone tools *(BL2001)* | DNH7 *Australopithecus robustus; Homo (BL2001)* |
| F | Swartkrans Cave, South Africa Member 1: 1.5-1.7/1.8 Member 2: 1.5 Member 3: 1.0 Ma Member 4: MSA *(KK1998; BC1988)* | Developed Oldowan all 3 levels, with few cleavers handaxes in M#3 (Clark 1993*) (KK1998)*; 85 bone and horn core tools used for termite foraging in all three Members; *(BL2001, DF2001)*; and 4 evidence grinding to shape the tip *(DF2003)*; M3 (but not M1 or M2) recurrent burnt bones, heated 300º-500+º, evidence of multiple campfires, intensity *(BC1988)*; confirmed by ESR *(RP2004)* | SK48: *Australopithecus robustus;* in all three Members, *Homo erectus* or *ergaster* in Members 1 and 2 but most bone tools in 3 *(DF2003, KK1998)* SK847 *Homo habilis* // Stw53, OH13 *(CD2006).* Member 3 small size animal remains (carnivore tooth marks) deposited by leopards, large animals deposited by hominids/ other carnivores *(PT2004*); burnt bones mainly antelopes, but also zebra, warthog, baboon and *A. robustus (BC1988)* |

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| | Kromdraai, South Africa<br>B: 1.7-2.0+<br>A: 1.0-2.0 *(KK1998)* | B: *Paranthropus robustus*<br>A: cores, flakes *(KK1998)* | Hyena den *(KK1998)* |
| Developed Oldowan B<br>1.0-1.3 Ma | General: Similar to Oldowan A, but with few bifaces; 1st appearance of *outils écaillés* and punches, no protobifaces, return of burins; 1st few crude bifaces (pointed handaxe and straight edge cleaver) occur, which are contemporaneous with Early Acheulian and possibly 'borrowed'; increased % worked bone *(LM1971, WJ1982)* | | |
| | Olduvai Gorge, Tanzania<br>Middle Bed II: **1.5-1.66** *(MR2005)*<br>Middle BIIc: FC West; MNK Main; SHK<br><br>Upper Bed II: ca. 1.48 *(MR2005)*<br>Upper BII: BK, TK Upper, LLK, FC<br><br>Bed III: **800-1.15 Ma**<br>Bed III: JK<br>*(LM1971, 1994; HR1976)* | Developed Oldowan B; quartz cores at MNK Main, single platforms *(LB1998);* 98 worked, utilized bones, teeth (FC West, MNK Main, SHK, BK, bone 'biface' at FC); flaked, utilized hippo tooth (SHK) *(LM1971)*; BK two lumps of non-local red ochre *(HR1976; LL1958)* reanalyzed is red volcanic tuff (possibly used like ochre?) *(OK1981; BR2003)* | Hominids:<br>FC West: OH19<br>BK: OH3<br>LLK (no tools): OH9 *(LM1971) Homo erectus (WJ1982)*<br>JK: OH34 *(MS2000)* |
| | Gadeb, Ethiopia<br>Sites 2A, 2B, 2C, 2E<br><br>(K/Ar, paleomag.) 1.5 Ma to 0.7 Ma *(WM1979)* | 2A: Developed Oldowan B, 1 subtriangular handaxe, choppers, core-scrapers, polyhedrons flakes, few sidescrapers; 2E: 1741 specimens, 6 crude handaxes, 1 cleaver' 2B, 2C similar<br>8F: hippo butchery site, overlies Early Acheulian, overlain by 0.7 Ma reversed mag. level *(CJ1979)* | Hippo, elephant, various bovids, zebra, pig *(CJ1979)* |
| Developed Oldowan C | General: choppers much lower %; most frequent, light-duty scrapers and 1st punches; no protobifaces or polyhedrons, but few bifaces *(LM1971)* | | |
| | Olduvai Gorge, Tanzania<br>Bed IV: **600-800 ka**<br>Lower Bed IV: HEB East<br>Upper Bed IV: WK East A and C; PDK Trenches I-III *(LM1994, HR1976)* | | Olduvai Gorge, Tanzania<br>Bed IV: **600-800 ka**<br>Lower Bed IV: HEB East<br>Upper Bed IV: WK East A and C; PDK Trenches I-III *(LM1994, HR1976)* |
| | Melka-Kontouré, Awash, Ethiopia<br>Garba XII: **~900 ka** | 'Transitional Oldowan/Acheulian' *(MJ2001)* | |

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| **Early Acheulian**<br>1.0-1.7 Ma | General: bifaces = 40% or more of tools *(LM1971)*; flake blanks as single platform cores, crude handaxe with sinuous edges and large scars, trihedral picks, rare cleavers, high % core choppers, polyhedrons, spheroids, heavy-duty scrapers, large component of flakes *(LB1998*) | | |
| | Olduvai Gorge, Tanzania<br>Middle Bed II: **1.5-1.66** *(MR2005)*<br>Middle BIIc: EF-HR; probably CK; Elephant K; MLK<br><br>Upper Bed II: ca. **1.48** *(MR2005)*<br>Upper Bed II: TK Lower *(LM1971, LM1994, HR1976)* | Acheulian, TK lower tabular quartz fragments as cores; EF-HR and FxJj63 flake blanks as cores *(BL1998);* with heavier, thicker, less-standardized handaxes and cleavers more rare than later Olduvai Acheulian of Bed IV group and post-Bed IV group' (Roe in *LM1994)* | |
| | Konso-Gardula, Ethiopian Rift, Ethiopia<br>Artifacts in (Ar/Ar) Konso tuff // Chari Tuff = 1.36±0.02 *(AB1992)* [**1.39±0.02** *IW2000)*] and just below **1.44±0.05** *(AB1992)* | Acheulian, dominated by bifaces and trihedral picks (some length to 0.27m) from cobbles, blocks, cores and flakes, rare cleavers, typology like Olduvai EF-HR; pits and cutmarks on bones; mandible, teeth *H. erectus* or *ergaster (AB1992)* | Elaphus recki, Ceratotherium simum, Equidae, Hippopotamidae, Suidae, Girrafida, Bovidae (mostly Reduncini, Bovini, Alcelaphini), Theriopithecus, Papio, Dionofelis, Hyaenidaae, python, crocodile, tortoise *(AB1992)* |
| | Peninj, West Lake Natron, Tanzania<br>Upper Sands with Clay, Humbu Formation<br>Type Section – ST Site Complex (11 sites)<br>(Ar/Ar, paleomag., fauna)<br>**1.4-1.7 Ma** *(DM2001)* | Early Acheulian, with large clusters of handaxes, contemporaneous with Developed Oldowan | Of 3 handaxes, 2 flakes, phytoliths on 2 handaxe edges suggest chopping wood, on 1 flake removing cortical fibers from branches, likely Acacia, fibers on inner surfaces suggest protection or hafting, possibly from use *(DM2001)* |
| | Koobi For a, East Turkana, Kenya<br>FxJj63 | Early Acheulian; basalt flake blanks as cores *(BL1998)* | |
| | Sterkfontein Cave, South Africa<br>Member 5 (faunal): upper 1.4-1.7 or c. 1.5 Ma *(BL2001; CR1999)* | M5 West upper: Early Acheulian tools *(MJ2003, KK1998)* | |

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| F? | Gadeb, Ethiopia<br>Sites 8A, 8E, 8D, 8F, 25<br><br>(K/Ar, paleomag.) **1.5 Ma** to >0.7 Ma *(WM1979)* | 8A: Early Acheulian, 1849 artifacts, 251 handaxes and cleavers 58.8%<br>8D: 487 artifacts, bifaces 43.6% of tools, mostly handaxes, 3 cleavers<br>8E: 20,276 artifacts, bifaces (primarily lanceolates and elongated ovate handaxes) 39.9%, flake and core scrapers 22.1%; 4 ovate obsidian handaxes (source ~100 km away), 11 'rounded cobbles with pits' like Developed Oldowan 'pitted anvils' at Olduvai Bed II and III/IV and Oldowan Gomboré I; several fragments of basalt rubbed yielded red pigment, but no sure evidence of rubbing, possibly fire burned pieces of tuff;<br>25: quarry site *(CJ1979; OK1981)* | 8D: hippopotami, bovids, zebra, elephant<br>8E: hippo, bovids, zebra *(CJ1979)*<br><br>or for nutcracking? *(GN2002)* |
| | Thomas Quarry, Morocco<br>TQ I Unit L<br><br>(faunal and paleomag.) **1.0+ Ma** *(RJ1999; 2003)* or **1.0-1.5 Ma** *(GD200; RJ2004)*<br>L5 (OSL) 989±208, 1683±473, 1937±1204 (Rhodes et al) *(RJ2003)* | L1 Early Acheulian, quartzite and flint, bifaces, trihedrals, few cleavers, flakes from disc cores and polyhedrons, choppers, spheroids<br>L5 Oldowan, cores and core tools *(GD2002)* or EA without bifaces *(RJ2003)* | Few hippo, zebra, gazelle*; Kolpochoerus (GD2002) Theropithecus* (Geraads 1987) |
| | Ain Hanech and El-Kherba, Algeria (paleomag., geostratig, fauna) Olduvai ~1.8 Ma *(SM2002)* but best fit ~1.2 Ma *(GD2002)* | Oldowan tools, polyhedrons and flakes *(WJ1982; SM2002)* but like Thomas Quarry EA strata weak in bifaces *(GD2002)* | |
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| **Middle Acheulian**<br>500 ka to 1 Ma | General: shared conceptual standardization of blank shape and techniques (Kombewa, Victoria West), cleaver bit from single flat surface scar *(MJ2004);* more regularized handaxe shapes, cordiform, amygdaloid, lanceolate, trihedral picks and flake tools (mostly denticulates, notches, scrapers); some assemblages only core-choppers and flakes *(IG1977; LM1994)* | | |
| | Buia, Danakil Formation, Eritrea<br>(fauna and paleomag.)<br>top of Jaramillo = **~1 Ma** *(AE1998)* | No tools reported; between *H. erectus* or *ergaster*, with some archaic *H. sapiens* features, 750-800cc *(AE1998)* [cc = typical early *erectus*] | *Hipparion, Elephas recki*, *Equus, Ceratotherium, Pelorovis, Kobus, Suidae, Hippo. gorgops Hyaena*, crocodile, tortoise *(AB1998)* |
| | Bouri, Dakanihilyo Member, Ethiopia (palaeomag.,Jaramillo) min. 780 ka, max (Ar/Ar) 1.042±0.009 Ma = **~1 Ma** *(AB2002)* | 'prior to late Acheulian', handaxes, cleavers with invasive and fewer flake scars; Calvaria and postcranial, *H. erectus* of East African deme as Olduvai/LLK *(AB2002)* | Bone modifications, butchery equid, bovid, hippo*(AB2002)* |
| | Kariandusi, Kenya<br>31m lacustrine sediment (Ar/Ar tephra 4m below top) **0.973 ± 0.003 Ma** (Ar/Ar underlying Gilgil lava) 0.985 ± 0.003 Ma *(DA2004)* | Middle Acheulian, stone assemblages similar to Olorgesailie (Cole 1954) *(WJ1982)* | Lacustrine wet period |
| | Olorgesailie, Kenya (Ar/Ar)<br>Member 1: **992±39 ka**<br>M5: 974±7 ka<br>M7: (not dated) [800 ka?]<br>M9: **747±6 ka**<br>M10: 662±4 ka<br>M12: 601±3 ka<br>M14: 493±1 ka<br>*(DA1990)*<br><br>Hominid (Ar/Ar stratigr. and sedimentation) 900-970 ka *(PR2004)*<br><br>Member 10:<br>(K/Ar) .71±.02 and .74±.01 *(BB1987)* | M1 sites, primarily scrapers, few handaxes, cleavers, picks/trihedrals<br>M7 sites, predominantly handaxes and cleavers, less % scrapers; picks;<br>M10-11: mix of sites like M1 and M7 *(IG1977)*<br>At boundary M5 and M6-7, partial cranium, <800 cc, *H. erectus* // OH12 and Dmanisi *erectus (PR2004)*<br><br>M1 Site 15: sharp flakes with *Elaphas recki*, flakes derived from large bifacial cores (handaxes); Site 2: bones with cutmarks, Site 102: 2 hyena, 1 canid, bones of *Equus*, other ungulates; M1 in general, flakes, scrapers, Oldowan type cores (PR1989) | *Equus*, buffalo, *Tragelaphus* (bushbuck, kudu, etc.), eland, *Ceratotherium* (white rhino); *Metridiochoerus; Elephas recki*, *Hippopotamus gorgops*, giraffes, *Libytherium, Theropithecus oswaldi, etc. (IG1977)*<br><br>M7, DE/89B: 90 MNI (76 juvenile disproportion to natural age classes); blow to skull (Olduvai BK), smashing of bones; *Theriopithecus* butchery site, why specialization or ritual? *(SP1981)* |

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| Middle Acheulian continued (600-800) | Olduvai Gorge, Tanzania Bed III-IV Junction: PDK Trench IV Bed IV: **600-800 ka** Lower Bed IV: HEB West 2a, 2b, 3; WK (= Upper Channel) *(LM1994, HR1976)* | Acheulian; 'Bed IV group overall regularity of handaxe shapes improves, cleavers more frequent and often elegantly made (Roe in *LM1994)*; HEB large biface on fragment elephant bone *(LM1994)* VEK: OH12 *H. erectus* (no tools) *(WJ1982)* WK: OH28 *erectus* with Acheulian *(MS2000)* | |
| | Melka-Kontouré, Awash, Ethiopia Gombore II: **~700 ka** | Middle Acheulian, well made obsidian handaxes (Brahimi 1976)*(MJ2001)* | Bovids, Giraffes, Hippos, Suids, Equids; 2 skull fragments, *Homo erectus* (Chavaillon et al 1974; Chavailllon Coppens 1986) *(MJ2001)* |
| | Tighénif (formerly Ternifine), Algeria (McBurney 1960) *(FL1975)* (associated fauna, palaeomag.) **700 ka** (Geraads et al 1986) *(MS2000)* | 'Acheulian stage III', choppers, chopping tools, cordiform, amygdaloid, chisel-ended handaxes, cleavers, trihedral picks (Balout, Biberson & Tixier 1967) *(FL1975)*; 3 mandibles, parietal fragment, *H. erectus* (Arambourg 1963) *(CJ1982)* | *Ceratotherium simum*, *Elephas atlanticus*, *Equus*, *Hippo. amphibious*, *Bos*, *Alcelaphus buselaphus*, *Connnochaetes taurinus*, *Taurotragus*, Gazelles, camelids, *Crocuta*, *Hyena*, *Felis*, *Canis*, giant baboon, *(FL1975): Theropithecus oswaldi*, *Equus mauritanicus (RJ1999)* |
| | Thomas Quarry, Morocco TQ I Grotte a Hominidés and TQ III<br><br>TQ I (fauna, geostratigr., industry) **600-700 ka** (*RJ1999)* OIS 19? *(RJ2004)* [OIS 19 = 688-700 ka] | 'Middle Acheulian' *(RJ2004);* flaked pebbles (but disturbed unit), TCI partial mandible, TCIII cranial, maxillary fragments (Dean et al 1993) *(MS2000)*; ~400 ka // Salé Kabwe, *H. rhodesiensis* (Dean 2005 website) but dating, *H. erectus (RJ2003)* | *Theropithecus oswaldi*, *Equus mauritanicus (RJ1999)* |
| | Rhino Cave, Oulad Hamida 1 Quarry, Morocco (fauna, geostrat, industry) **600-700 ka** (*RJ1999)* (ESR EU) 435±85 (LU) 737±129 (Rhodes et al 2002) *(RJ2003)* | 'Middle Acheulian' *(RJ2004),* increased disc cores, bifaces larger, more pointed, some lanceolate, cleavers rare, tools on flakes only 3.5% (notches, denticulates, few scrapers) *(RJ1999; RJ2003)* | *Theropithecus oswaldi*, *Equus mauritanicus*; specialized hunting of white rhino *(RJ1999)* |

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| Middle Acheulian continued (500-600) | Sidi Abderrahman, Morocco -- Level M<br><br>**OIS 17?** *(RJ2004)*<br>[OIS 17 = **627-647 ka**] | 'Middle Acheulian' *(RJ2004)*,choppers, chopping tools, chunky handaxes on flakes (hard and soft hammer), trihedral picks, cleavers, flakes, 'Early Acheulian' (Biberson 1961) *(FL1975)* partial mandible, *H. erectus (MS2000)* | *Ceratotherium simum*, Rhinoceros sp., *Hippopotomus amphibius (FL1975)* |
| | S.T.I.C. Quarry, Morocco Level D<br><br>**OIS 15** *(RJ2004)*<br>[OIS 15 = **542-592 ka**] | 'Middle Acheulian' *(RJ2004)*, choppers and chopping tools, spheroids, lanceolate and lageniform handaxes, trihedrals, rare cleavers, flakes, 'Stage III' (Biberson 1961) *(FL1975)* | *Ceratotherium simum, Elephas iolensis, Equus, Hippo. amphibius,Bos primigenius, Alcelaphus buselaphus, Connnochaetes taurinus, Taurotragus (FL1975)* |
| | Tan Tan, Morocco<br><br>Middle Acheulian (est. 300-500 ka) (Kuckenburg 2001) *(BR2001, BR2003)* [but see above sites, Moroccan MA 600-700 ka JBH] | 'Middle Acheulian', handaxes, cleavers, thick quartzite flakes; quartzite naturally anthropomorphic figurine, modified with grooves to emphasize 'arms', 'legs', 'head', with traces of red, black, and white paint pigment (iron and manganese) // Berekhat Ram figurine (Kuckenburg 2001) *(BR2001, BR2003)* | Earliest evidence in world of applied coloring material *(BR2003)* |
| | Montagu Cave, South Africa (Keller 1973) probably Middle Pleistocene *(MJ2004)* | Levels 3, 5 Acheulian, 98% flakes and debitage, some rough-outs; discoid cores predominate *(MJ2004)* | |
| | Cape Hangklip, South Africa (industry) // Middle Pleistocene *(MJ2004)* | Acheulian *(MJ2004)* | |
| | Pniel 6, Lower Vaal River, South Africa Stratum 3 (faunal) OIS8 = 240-300 ka Stratum 4 (typology and fauna at Pniel 1) >800 ka *(MJ2004)* | Stratum 4: Acheulian (Beaumont 1990, Van Riet Lowe 1937) *(MJ2004)* | |

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| **Later or 'Upper' Acheulian** 300-650 ka | General: Bifaces more symmetrical and refined, cordiform, amygdaloid, ovate handaxes; some assemblages ovate dominates; greater use of soft hammer; increase use of Levallois technique, but some sites no Levallois; disappearance of core-choppers; often length of handaxes decreases; denticulates, notches, scrapers continue; few blades late contemporaneous with Final Acheulian | | |
| (500-650) | Bodo and Dawaitoli and Hargufia, Middle Awash, Ethiopia (Ar/Ar on associated fauna pooled) **0.64±0.03** (minimum age) **0.55±0.03 Ma** *(CJ1994)* but (HJ1999) skull not assoc. with Acheulian | Acheulian, well-made bifacial handaxes and cleavers, flakes; *H. erectus (CJ1994)* skull cutmarks = 'intentional postmortem defleshing' *(WT1986)* 1,250cc (range 1,200-1325) > *heidelbergensis* (ave. 1,206), but lesser encephalization quotient than *H. s.* or *H. neand. (CG2006, RG2004)* | *Kolpochoerus majus, Alcelaphus buselaphus, Damaliscus niro, Syncerus acoelotus, Theropithecus oswaldi (CJ1994)* rhino, elephant, equid, giraffe, hippo, carnivore *(WT1986)* |
| | Olduvai Gorge, Tanzania Masek Beds: (palaeomag. Emperor) **490-780 ka** *(TE1995; MS2000)*; but *(TE1995)* prefers Jaramillo 990 ka to1.07 Ma) Masek Bed: FLK Masek; (Hillwash): TK FG; HK *(LM1994)* | Acheulian, post-Bed IV group 'shows best control over raw material' working a very difficult quartzite (Roe in *LM1994)* FLK Masek: OH23 mandibular fragment *Homo erectus (MS2000)* | |
| | Kapthurin Formation, Tugen Hills, Baringo , Kenya (Ar/Ar) Kasurein Basalt 610±40 Upper Kasurein 552±15 Pumice Tuff 543±4 (sedimentation) hominids **~510-512 ka** Grey Tuff 509±9 Bedded Tuff **284±12 ka** *(DA2002)* | GnJh41, 42, 57: flake and core, handaxes <1% (est. **520-550** ka) *(DA2002; MS2000)* GoJh6, GoJh12, GnJh71: Acheulian, handaxes, cleavers, 1 Levallois core **> 284 ka** *(TC2006)* | 2 adult mandibles, KNM-BK67 and KNM-BK 8518, postcranials KNM-BK 63-66, *archaic H. s.* or *rhodesiensis (DA2002)* |

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| Upper Acheulian continued (400-500) | Melka-Kontouré, Awash, Ethiopia Garba I: **~500 ka** | Upper Acheulian , 100s of handaxes and small flake tools *(MJ2001)* | |
| | Elandsfontein, Hopefield, South Africa -'Cutting 10' (Singer & Wymer 1968) (fauna) 400-700 ka (Marshall et all 2002) *(MJ2004; KR1991)*; but 780 k to 1.2 Ma by faunal correlation to Olduvai Bed IV *(MS2000)*; but (fauna) 0.6-1.0 Ma *(KR2007)* | Upper Acheulian (Singer & Wymer 1968), sample 90% handaxes/10% cleavers; no consistent attempt at absolute symmetry *(MJ2004)*; rough cores, sharp flakes, few retouched *(KR1978)*; 'Saldanha Man' adult calvaria, mandibular fragments, H. *rhodesiensis (CJ1970)* reclassify as *H. erectus (TN1987)* or *archaic H. s. (RK1991);* or *H. heidelbergensis (RG1998; WB2001)* | Waterhole; MNI (excavated) 1 jackal, 1 lion, 2 elephant, 2 equids, 1 rhino, 1 eland, 1 reedbuck, 3 hartebeest, 3 wildebeest, 3 *Pelorovis*, ?2 antelope, 1 tortoise = butchering site but no cutmarks noted *(KR1978)* |
| | Cave of Hearths, Limpopo, South Africa (Mason 1962) *(WJ1982)*<br><br>(comparison to other sites)<br>Bed 1: 250 ka<br>Bed 3: 200 ka<br>(Mason 1988)<br>or (paleont.) 300-<600 ka (Klein 1999) *(MJ2004)* | Bed 1, 2, 3: Acheulian mostly on flake blanks, 50/50 handaxes, cleavers; no consistent attempt at absolute symmetry *(MJ2004)*;<br>*H. sapiens rhodesiensis* (Tobias 1871) or *heidelbergensis* // Kabwe 300-<600 ka (Klein 1999) *(MJ2004)* | |
| | Salé, Morocco<br>(ESR LU) **389-455 ka**<br>(Hublin 1991) *(MS2000)* | No tools; adult calvaria, cranial fragments, *H. rhodesiensis (MS2000)* | Calvaria indicates perinatal handicap, possibly group care *(MS2000)* |
| | Sidi Abderrahman, Grotte des Ours, Morocco<br><br>**lower OIS 11** *(RJ2004)*<br>[OIS11 = 362-423 ka] | 'Middle Acheulian', high degree marine reworking, quartzite, polyhedral, discoid, Clactonian cores and cores on flakes; bifaces on flakes, often asymmetric plan *(RJ2003)* | |

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| Upper Acheulian continued (300-400) | Sidi Abderrahman, Morocco – Grotte des Littorines – Level D<br><br>**lower OIS 10** *(RJ2004)* [OIS10 = 339-362 ka] | Upper Acheulian *(RJ2004)*; 'Tensiftian', 'Late Middle Acheulian Stage VI', disc cores, well made amygdaloid and lanceolate handaxes, extensive retouch, bifacial sidescrapers,; 2 mandibles 'evolved *H. erectus?*' (Biberson 1961) *(FL1975)* | *Ceratotherium simum.,Bos primigenius, Alcelaphus buselaphus, Connnochaetes taurinus,Hippotragus,* gazelles, *Canis, Crocuta, Hyena* (Arambourg 1957*) (FL1975)* |
| | Cap Chatelier 'sommet' Sidi Abderrahman, Morocco<br><br>(OSL top of section) 317±64, 376±34 ka (Rhodes et al 2002), **upper OIS10** *(RJ2002; RJ2004)*<br><br>[OIS10 = **339**-362 ka] | Upper Acheulian *(RJ2004);* 'Final Acheulian' (Stage VIII) (Biberson 1961) ; disc cores; (3rd facies) 25% small and very small cordiform handaxes, also ovate and subtriangular; few cleavers 0.6%; 10% of flakes well retouched: sidescrapers, convergent scrapers/points; endscrapers, rare blade flakes *(CJ1982)* | |
| | Sidi Abderrahman, Morocco 'Extension'<br><br>(industry) **OIS 9** into OIS 8 *(RJ2004)* [OIS 9 = **303-339 ka]** | Upper Acheulian, frequent use of block fragments, predetermined flakes from disc cores, polyhedrons rare; ovate, even discoidal bifaces on flakes, cleavers rare *(RJ1999; 2002; 2004)* vs. Final Acheulian (Biberson 1961) *(FL1975)* | |
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| Western Desert Upper Acheulian unlike other North African (Sidi Zin or central Sahara) *(WF1976)*<br><br>(Useries, lacustrine carbonates, AAR) **> 300 ka** (limit of technique) *(SB1989)* | Dakhleh Oasis, Western Desert, Egypt<br><br>Useries, lacustrine carbonates, AAR) **> 300 ka** (limit of technique) *(SB1989)* | E72-1 and E72-2: Upper Acheulian, chert, bifaces 81% and 64% by site, mostly amygdaloid with unworked butts, double-backed, then cordiform, flakes from 'change of orientation cores, mostly denticulates, scrapers, few blades, Levallois negligible // Kharga Oasis *(WF1976)* | |
| | Kharga Oasis, Western Desert, Egypt (Caton & Thompson 1952) *(WF1976)*<br>**> 400 ka** *(SJ2004)* | K-10: Upper Acheulian, similar to Dakhleh (above), with emphasis on double-backed handaxes, amygdaloids and thick butts *(WF1976)* | |
| | Bir Tarfawi and Bir Sahara East, southwestern Egypt<br>'Late Acheulian lake'<br>(TL) 165±22 ka<br>(Useries) 448±47 ka; >350 ka (ca. 600) *(WF1994);*<br>**> 300 ka** *(SB1989)* | Upper Acheulian, more similar to Nubian Upper Acheulian *(WF1976)* | |
| | Wadi Arid and Wadi-Bir Safsaf, Egypt<br>**> 300 ka** *(SB1989)* | Late Acheulian, few coarse handaxes, flakes; overlain with Final Acheulian *(SB1989)* | |
| | Wonderwerk Cave, northern Cape, South Africa<br>8 Acheulian strata;<br>Early Acheulian, n.d.<br>Middle Acheulian (est. 800-900 ka (Beaumont et al 1992) *(BRe2003; BR1993)*<br>'Kathu Pan phase':<br>(Useries) **~350 ka**<br>or 260-420 ka<br>Fauresmith:<br>(Useries) >200 ka *(BJ1992)*; Early MSA: Useries) **168±14, 152±9**; H.P. **73±4.8** *(VJ2001)* | Early Acheulian:<br>'Kathu Pan' phase: classic handaxes, ovate, triangular, no prepared core, flakes with minimal dorsal retouch *(BJ1992)*; 2 ironstone slabs bearing engraved sub-parallel lines (Beaumont in press) abundant ochre fragments every level together with bifaces; Acheulian exotic quartz crystals, small 'pretty' colored river pebbles (Beaumont 1990, 1999; *BJ1992*) (*BR2003; BR1993*) | |

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| Upper Acheulian continued (post-300 or no date) | Erfoud, eastern Morocco | Site A-84-2 (surface) 'Late Acheulian' tools; stones of hut floor; manuport cuttlefish fossil, probably natural (no evidence of working, but very weathered), in 'life-size shape of penis' (Fiedler, 1984) // Berekhat Ram, Tan Tan *(BR2002)* | |
| | Sidi Zin, Le Kef, Tunisia (McBurney 1960) *(FL1975)* | Lower Level: choppers, chopping tools, fine lanceolate handaxes of small size, blunt bifaces, flake tools 'Micoquian' (Gobert 1950) 'Late Acheulian', (Biberson stage VI or VII) *(FL1975)* | *Ceratotherium simum. Elephas atlanticus,, Equus, Hippopotomus amphibius,Bos primigenius, Alcelaphus buselaphus, Connnochaetes taurinus, Taurotragus*; *gazelles, Ovis, Vulpes (FL1975)* |
| | El Greifa E, Fezzan, Libya (Useries calcareous sediments) **~ 200 ka** | 'Late Acheulian', large handaxes, scrapers, borers, burins; hut structure; 3 fragments ostrich eggshell disc beads (Ziegert 1995) *(BR1997)* | Lacustrine |

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| Upper Acheulian continued (post-300 or no date) | Guomde, Ileret, Kenya (Useries; direct on femur, cranium) **270-300 ka** *(MS2000)* | *H. helmei* (Brauer et al 1992, 1997; Feibel et al 1989) *(MS2000)* | |
| | Isimila, Tanzania (Th/U and Pa/U) **260K** (Howell et al 1972) *(CJ1982)* | 'late Acheulian' *(CJ1982)* assemblage type 1: up to 70% handaxes, cleavers, knives; rest small flake tools and large picks, core-scrapers, choppers, spheroids; Type 2: small tools 40-60%; Type 3: about 50% large picks, core-scrapers, choppers, spheroids but few small tools, few bifaces (HF1961) | Lower sand horizon: hippo, skull and limbs absent, half dozen unretouched quartz flakes (HF1962) *(CJ1970)* |
| | Hoedjiespunt, Western Cape, South Africa (Useries) 200-350 ka and (fauna, mollusks) **OIS 8 = 244-303 ka** *(CS2000)* | tibia, *H. heidelbergensis (CS2000)*; dental, cranial, post-cranial fragments, *H. sapiens sapiens* (Berger & Parkington 1995) *(MS2000)* | |
| | Ndutu, Lake Ndutu, Tanzania Ndutu Beds: (palaeomag. Emperor) **~30 to 470 ka** *(Wikipedia)* | Upper Acheulian; partial cranium: *H. rhodesiensis* or *heidelb.* (Clarke 1976) *(CJ1982) archaic Homo sapiens (RG1983)* | OH11 surface find, no tools, probably Ndutu Beds *(MS2000)* |
| | Kalambo Falls, Zambia (AAR on wood) **>110 ka** (Lee et al 1976) (14C) 61.7±1.3 ka (Vogel & Waterbolk 1967) *(CJ1982; IG1977)* | 'Upper Acheulian', scrapers, ovate and lanceolate handaxes, cleaver s, spheroids, awls, knives, convergent and side scrapers *(CJ1970)* | |
| | Wadi Dagadlé, Djibouti (TL basalt, associated fauna) **< 250 ka** *(BL1984)* | No tools, maxilla, partial dentition, 'more *H. sapiens* than *H. erectus*' *(BL1984)* | |

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| **Final Acheulian**<br>**150-300 ka**<br>OIS 8 = 244-303 ka<br>OIS 7 = 190-244 ka<br>OIS 6 = 130-190 ka | General: multiple reduction strategies, Acheulian bifaces, sometimes made on Levallois flakes, Levallois and disc cores; variable presence of handaxes, cleavers as well as points, blades; termed 'Final Acheulian' or 'Intermediate' with regional variants *(CJ1965)*; blades in Kapthurin and Fauresmith as in Levantine Mugharan Tradition *(AS2002)* | | |
| | Kapthurin Formation, Tugen Hills, Rift, Kenya<br><br>(Ar/Ar)<br>Upper Kasurein 552±15<br>Pumice Tuff 543±4<br>Grey Tuff 509±9<br>Bedded Tuff (K4) 284±12 ka<br>K-S Beds 235±2 ka<br><br>Sites in or below upper basaltic tuffs of Bedded Tuff (lower K4) **>284±12 ka** and above Grey Tuff <509±9<br>*(DA2002)* | GnJh15 (K3 'immediately below' K4): 'Acheulian/MSA', single & multiplatform cores, 2 picks, ~15 small bifaces, some made on cobbles, blades 74 pieces red ochre (>5 kg) pulverized and chunks, grindstones,<br>GnJh3 (Leakey Handaxe Area) (silt lower K4[?]): 'Acheulian', 15 handaxes, 6 cleavers, ~75 blades; centripetal flaking of broad ovate handaxes, cleavers on Levallois flake preforms; semi-cylindrical, radial and Levallois core reduction, blades 25% of all flakes, using uni- and bi-directional blade removals, recurrent until core exhaustion, blade cores (20-30% of cores);<br>Sites in lower K4:<br>GnJh17 (lower K4 silt or below): 'Acheulian /Sangoan?/ MSA', handaxes from Levallois cores, 2 points, 3 core-axes/picks<br>JnJi 28 (Rorop Lingop) (surface): small handaxes, Levallois cores, points, Fauresmith?/MSA'<br>JnJh63 (surface): handaxe, point *(TC2006; MS2005; DA2002; MS2000)* | |
| | Kalambo Falls, Zambia<br>> 52 ka<br>(Vogel & Waterbolk 1967) *(CJ1982; IG1977)* | 'Final Acheulian'<br>*(CJ1965)* | |

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| | Melka-Kontouré, Awash, Ethiopia<br>Garba III: **~250 ka** | Final Acheulian, sudden decline in number of handaxes and cleavers; Levallois, many retouched tools on flakes (side and endscrapers, backed knives, burins, obsidian uni- and bifacial points; similar to Herto and Stillbay MSA *(CJ2003, CJ1982)* | Remains, archaic *Homo sapiens*; 'earliest archaic *Homo*' (Hours 1979; Chavaillon et al. 1987) *(MJ2001)* |
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| **Final Acheulian - Western Desert**<br>~150-300 ka | Characteristic of all these sites is accumulation of many bifaces in vents/'eyes' of springs, suggesting either artifacts were thrown there [spring deposition] or slid down into an expanding vent and pool from surrounding surface scatter *(CJ1982)* | | |
| Eastern Sahara: 5 lacustrine/humid periods (may correlate to interglacial stages) (Useries on lacustrine carbonates, and AAR) 250-320 ka (~OIS9) - FA 190-240 (OIS7) -Moust 120-155 (OIS5e) - Atr 65-90 (OIS5c or a) - Atr 5-10 (OIS1) *(SB1995);* semiarid climate 25-40 ka and hyperarid 11-25 ka or ~15-60 ka *(CM1998)* | Bir Tarfawi and Bir Sahara East, southwestern Egypt<br>(spring vent sites)<br><br>(Useries on lacustrine carbonates, and AAR) **250-320 ka** (~OIS9) *(SB1995)*<br>[but OIS 9 = 303-339 ka OIS 8 = 244-303 ka] | BS-14: Final Acheulian, only 6 cores, rest biface trimming flakes; 88% of tools bifaces, elongated and fine, mostly triangular and cordiform, also amygdaloid and discoid, no cleavers *(WF1976)* | Equid, probably *Equus asinus (WF1976)* |
| | Dakhleh Oasis, Western Desert, Egypt<br>(Schild & Wendorf 1977);<br><br>(Useries on lacustrine carbonates, and AAR) **250-320 ka** (~OIS9) *(SB1995)* | Final Acheulian, disc cores, no Levallois, amygdaloid, cordiform, subtriangular handaxes; 'backed' bifaces (or knives) with asymmetric tips (Micoquian prondnik-like), denticulates, notches *(CJ1982)* | |
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| | Herto, Bouri Formation, Upper Herto Member, Ethiopia (Ar/Ar on underlying and overlying tuffs) **154±7-160±2 ka** *(CJ2003)*<br><br>Latest securely dated (Final) Acheulian in Africa, later than Rooidam and Kaphturin *(MS2003)* | Final Acheulian, basalt, except obsidian for points and blades; 28 of 53 cores, discoid; 'radial centripetal', Levallois for flakes, points, blades, cleavers, ovate, elongated ovate, triangular handaxes, soft hammer finishing; only 5% handaxes, picks, 1% blades; sidescrapers, some carinated (like Aurignacian) *(CJ2003)* but points not retouched *(MS2003)* | Cutmarks, repeated systematic butchery of hippo, also *Kobus, Equus, Conoochaetes (CJ2003)*<br><br>3 crania, 2 adults, 1 infant *H. sapiens idaltu* between Bodo, Kabwe *rhodesiensis* and *sapiens sapiens (WT2003)*; all 3 bear defleshing cutmarks and scrape marks, juvenile polishing (not processing for food), indicative of mortuary practice *(CJ2003)* |
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| | Hargeisa, Somalia | Final Acheulian, quartzite, large and small Levallois cores, amygdaloid and ovate handaxes, flake tools (Clark 1954) and blade element // Kapthurin *(CJ1982)* | |
| | Arkin, Nile Valley, Nubia, Sudan (Chmielewski 1968) *(CJ1982)* | Arkin 8: Final Acheulian, high % small ovate handaxes, bifacially flaked discs, choppers, a few amygdaloid bifaces from quartz (Chmielewski 1968) *(CJ1982)* | |

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| **Final Acheulian – Mahgreb** ~150-300 ka<br>OIS 8 = 244-303 ka<br>OIS 7 = 190-244 ka<br>OIS 6 = 130-190 ka | General: Trend to smaller, often very small handaxes, reduced importance of cleaver, varied finish to handaxes ranging from finely made to very crudely made; both heavy duty choppers and core scrapers and light duty flake tools; variability of core types, Levallois and disc core and cobbles with varying % of each; sometimes unprepared Quina-type flakes preferred *(CJ1982)* | | |
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| | Sidi Zin, Le Kef, Tunisia<br>3 levels<br>(geostratig. Eemian)<br>111-130 ka *(CJ1982)* | Terminal Acheulian<br>(Stage VI or VII):<br>Lower and Upper Levels (1st facies): choppers, chopping tools, lanceolate 'Micoquian' handaxes of small size, blunt bifaces, flake tools; no cleavers;<br>Middle Level (2nd facies): unifacial ovate handaxes and cleavers; well-retouched scraper and point forms (Gobert 1950) *(CJ1982)* | |
| | Ain Fritissa, Middle Atlas, Morocco | Final Acheulian (Stage VII-VIII) (3rd facies) of small cordiform handaxes, Levallois and disc cores and flake scrapers; overlain by Aterian (Tixier 1959) *(CJ1982)* | |
| | Haua Fteah, Cyrenaica, Libya<br>Lower layers (fauna and sediment rate) **OIS 5** = 74-130 ka *(CJ1982* (technology, under Aterian) probably **>130 ka** *(MS2000)* | Lower Layers: blades and blade-like flakes and bifaces, 'Pre-Aurignacian' like Amudian in Palestine; fragment flute/whistle (McBurney 1967) *(CJ1970, CJ1982)* | Eemian warm time fauna *(CJ1982)* |

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| **Sangoan – Final Acheulian** ~150-300 ka<br>OIS 8 = 244-303 ka<br>OIS 7 = 190- 244 ka<br>OIS 6 = 130-190 ka | General: radial cores; heavy-duty bifacial 'core-axe' (flaked tip, often unworked butt), picks, amygdaloid and cordiform bifaces; light-duty tools, e.g., notched, denticulated or steep-edged scrapers; polyhedrons, spheroids *(TI1988; CJ1970);* or is Sangoan facies of Acheulian, 'core axes' = handaxes (McBrearty 1991) *(MJ2002)* | | |
| | Twin Rivers, Zambia<br><br>A-block: (TIMS Useries on travertine in breccia - corrected) (near top of unit) **266 ka** to (base of unit) **>400**, with other nearby dates 160, 192 and 225 ka, thus A-block as a whole >200 ka *(BLpig2002)* or 'likely mean age' ~265 ka *(BLP2002; CJ2001)* | Disc cores, bifacial lanceolates, convergent and denticulate scrapers, handaxe *(CJ1970)* | |
| | Sai Island, Nile River, northern Sudan<br>Site 8-B-11<br>7 occupation levels<br><br>(OSL on ES sand unit overlying Acheulian and underlying Sangoan L6) max. **223±19**<br>(OSL on base of RS sand unit overlying Sangoan L5) **182±20 ka**<br>(OSL on S sand unit overlying Sangoan L4) **152±10 ka** *(VPP2003)*<br><br>[hence Sangoan occupations between 140 and 240 ka centered on 180 ka and L6 range 160 to 240 and closer to 200+ ka - *JBH*] | 7:Late Acheulian, large lanceolate handaxes; also interstratified in Level 5; 4-6: Sangoan: Level 6: discoidal and globular cores, flake tools rare, quartz core axes, grinding stones, dense concentration of red and yellow ochre lumps, some with ground surfaces; 10 cm thick Nubian sandstone slab, steep and oblique flake scars around perimeter, top pecked flat, 10x5 cm depression (for grinding?), surrounded by 7 1 cm cupules; several chert pebbles with red/yellow ochre adhering, one with black inclusions (selected), suggests symbolic; Level 5: circle with 2 more slabs with depressions; quartzite cobbles with polish, phytoliths and starch granules, plant processing *(VPP2003);* core-axes were hafted, curated great distances *(RV2006)* | [Possible zoomorphic sculpture? – *JBH*] |

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| Sangoan continued | Simbi, Kano River Basin, Kenya<br>Units 1-6<br>(Ar/Ar tuffs Unit 6 and B bracketing Unit 4) **50 ka and 200 ka**<br>*(MS1992; MS2000)* | Unit 4: Sangoan, phonolite and quartz, mostly radial and subradial cores, also single platform, quartz by bipolar, Levallois rare, choppers, large bifaces, picks; mostly casually trimmed and small scrapers, (no lanceolates) *(MS1992; MS2000)* | Open grasslands; 90% of remains equids *(Equus oldowayensis and Equuus grevyi) (MS1992)*; also bovids, elephant tusks, fish |
| | Lake Eyasi Skull Site, Eyasi Beds, Tanzania (extrapolation from Useries and sedimentation rates, base of Mumba Beds at ~ 130±5 ka and fauna) **>130 ka** and 'easily **200 ka'** *(MM1987; MS2000)* | 'Njarasa' = Sangoan and MSA features, radial cores, core scrapers, side scrapers, core choppers but no certain retouched points or core-axes of Sangoan // Ndutu Beds and Upper Ngaloba 'MSA indeterminate' *(MM1987);* cranial fragments MNI 3-4, E1: *H. sapiens archaic (MM1987;TE2003*); or *rhodesiensis (MS2000)* | |
| | Muguruk, western Kenya<br>Muguruk Formation, Members 1-6<br>*(MS1988)* | M2: 'Sangoan' or 'Lower Lupemban' 40% radial cores, 50% Levallois (which is really kind of radial core); 23% large bifaces (handaxe, lanceolate points), 18% heavy duty choppers, picks, 'core axes'; 59% trimmed flakes and side and endscrapers, notch, denticulate, etc.; overall 41% bifacial tools<br>M3: MSA<br>M4: LSA (MS1988) | |
| | Kalambo Falls, Zambia<br>Sangoan (Useries) **65-85 ka;** but too low, see Twin Rivers Useries *(CJ2001)*<br>Lupemban (14C) 27-29<br>Magosian (14C) 9.55 (Vogel & Waterbolk 1967) *(CJ1982)* | Sangoan, thick core axe, other heavy duty tools 19%; tools mostly 74.8% sidescrapers, with Quina retouch, double-edged serrated and notched endscrapers *(CJ1982, CJ1970; MS1988)* | |

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| Sangoan continued | Camafufo, Congo Basin Angola<br>(14C) >36 ka *(CJ1970)* | Sangoan, large bifacial lanceolates, core-axe, core scraper, pick *(CJ1970)* | |
| | Mwanganda, Karonga, Malawi<br>(At contact Chiwondo and Chitimwe Formations) | Elephant butchery site, chopper, single and double platform cores, 84% utilized flakes and flake tools (convergent, notched, denticulate, end scrapers, rare crude core axes, contra view that heavy duty handaxe and cleavers are butchery tools *(CJH1970, CJ1970)* | Elephant, hippo, giraffe, *Equus*, turtle (*CJH1970)* |

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| **Fauresmith – Final Acheulian South Africa** ~150-300 ka | General: disc cores; small (smaller than Later Acheulian) ovate, lanceolate and double pointed handaxes, rare and poorly-made cleavers, large number of small tools (scrapers) *(CJ1982)*; and large thick blades from prismatic cores by hard hammer direct percussion, compare Kapthurin and Mugharan in Levant (AS2002) | | |
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| | Rooidam, Vaal River, South Africa (Th/U and Pa/U) **~174 ka** (Szabo & Butzer 1979) *(CJ1982)* | Fauresmith (Fock 1968) *(CJ1982)* | |
| | Muirton and Inhoek 6, Vaal River, South Africa | Fauresmith (Sampson 1972) *(CJ1982)* | |
| | Wonderwerk Cave, northern Cape, South Africa<br><br>(Useries) **>200 ka; 200-350 ka** *(BJ1992)* | Fauresmith phase: small, broad handaxes, prepared cores, narrow blades, convergent points; hearths, all levels; bedding of grass, branch tips; handaxe usewear indicates sedge-cutting, woodworking (Beaumont 1990) *(BJ1992)* | |
| | Blind River Mouth, East London, South Africa | Fauresmith, large grindstone incised with checker-board crisscross lines; also Early MSA; LSA *(LP1933)* | |

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| **Middle Stone Age** | General: regionalized point styles: Pre-Aurignacian; Aterian (tanged); Nubian Complex (Nazlet Khater); Ethiopian MSA (foliate and subtriangular); Kenya Rift MSA (foliate, narrow or triangular, unifacial and bifacial); Mumba industry; Lupemban (lanceolate); Katanda MSA (bone point); Bambatan (short, broad foliate and triangular) Pietersburg (elongated unifacial foliate); MSA I-IV; Howiesons Poort (small foliate, geometric); Stillbay (elongated 'willow' leaf) *(MS2000)* | | |
| **Early MSA** 200-300 ka<br>OIS 9 = 303-339 ka<br>OIS 8 = 244-303 ka<br>OIS 7 = 190- 244 ka<br>OIS 6 = 130-190 ka<br>Earliest: 240-280 ka or '250-300 ka' *(MS2000)* | General: elongated or large, relatively thick, blades and point blanks flaked from radial, single or opposed platform cores, recurrent and some Levallois, with minimal preparation of striking platform; retouched points—many elongated, prismatic blades, endscrapers and burins common; no backed microliths; evidence of hafting points and blades (tangs, grooves, mastic) *(AS2002,MS2000) and after BO1995; CG1989; JA1982)* // Mousterian + blades // Tabun D; not comparable to European MP Bordes typologies, since Africa lacks emphasis on scrapers *(MS2000);* extensive use of color pigments *(MS2000; WI1999)*; compare Levantine Mousterian 225-300 ka *(RW2003)* | | |
| **E, NE, S Africa** | Olorgesailie, Kenya<br>Locality B:<br>Olkesiteti Base (Ar/Ar) **340 ka**<br>Olkesiteti Upper (Ar/Ar) **220, 225 ka**<br>Locality G: Olkesiteti (Ar/Ar) 220, 226 ka *(BA 2005)* | Sangoan picks and elongated narrow thick bifaces with Levallois; interstratified with small flake and scraper industries, small Levallois cores = MSA?; Levallois blade cores, blades *(BA 2005)* | |
| | Florisbad, South Africa (ESR EU direct on hominid tooth, mean) **259±35 ka**<br>basal Units N, O, P: (OSL) 281±73; **279±47 ka**<br>Units M-G: (OSL) 157±21<br>Unit F: (ESR EU) 121±6 (OSL) 138±31 ka<br>Unit E:<br>*(GR1996, RR1997, KK1999)* | Units N, O, P: Early MSA, multi-platform cores, broad flakes, no bifaces ;<br>Peat I, Units N-O: curved wooden implement with longitudinal // incisions on end (Volman 1984) *(BM2003; BRe2003; BR1992)*;<br>M-G: MSA, prepared cores, highly retouched flakes, blades (triangular, notched), backed knives, burins, single, opposed and multi-platform cores;<br>F: MSA, similar forms to M-G but more expedient. many minimally retouched flakes with edge damage from use; hearth, burnt bone<br>E: late MSA, few triangular flakes<br>D: LSA *(KK1999; 1989)* | F: multiple occupations at spring fed lake; bones mostly bovids, few cutmarked, size suggests hunting; hippos, probably scavenged (Brink 1987; Henderson 1996)<br><br>Peat I: Partial cranium, between *archaic Homo sapiens* and *H. s. sapiens* (Rightmire 1987) *(KR1989); H. helmei (MS2000)* associated with Units N, O, P Early MSA *(KK1989)* |
| | Malewa Gorge, Kenya (K/Ar on tuff overlying artifacts) **240 ka** (Curtis) *(MS2000)* | 'Kenya Stillbay' (Curtis) *(MS2000)* | |
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| Early MSA continued | Kapthurin Formation, Tugen Hills, Rift, Kenya<br><br>(Ar/Ar) Bedded Tuff (min.) >284±12 ka; KS Beds 235±2 ka *(DA2002)*<br><br>Koimilot (above Bedded Tuff, sedimentation) **~200-250 ka** *(TC2006)* | Koimilot GnJh74: MSA, (older Locus 1): radial cores using Levallois and recurrent methods, oval and subtriangular flakes; (younger Locus 2): large Levallois points and elongated triangular flakes (blades) by unidirectional or convergent flaking; retouched points *(TC2006, TC2006a; TC2003)* | |
| | Haaskraal Pan, Upper Karoo, South Africa<br><br>(Useries, TL, 14C) (OES) **244+38/-40 ka** | Early MSA interstratified with Fauresmith // Kapthurin Formation *(SC2004)* | |
| | Gademotta, Galla Basin, Ethiopia – ETH-72-8b<br><br>(K/Ar on tuff underlying cultural level) **≤235±5 ka** (Wendorf et al 1994) *(DA2002)(BA2005)*<br><br>but TL < 90 ka *(SJ2006a)* | MSA, depression may be hut floor; bones; all obsidian, both Levallois and Mousterian, blade and blade cores, from 13.6% at 235 ka level to 37.7% at younger sites *(MS2000);* 'retouched bifacial foliate points, so Stillbay' (Singleton & Servello) *(SJ2006a)*;<br>(Schild) ETH-72-6 has a Nazlet Khater point, so not confined to 'Nubian' contra *VPP1998*) | Lacustrine; most abundant 3 species of antelopes, then 1 equid, 1 hippo *(SJ2006a)*<br><br>Bifacial point, ergo // MAT Arabia *(BA2006)* |
| | Omo, Kibish Formation, Ethiopia<br>Member 1 (Ar/Ar tuff below) 195.8±1.6 ka<br>Member 3 (Ar/Ar tuff above) 103.7±0.9ka and (geostratig. nearer older, so est.) **195±5 ka** *(MI2005)* | KHS: sparse lithic scatter<br><br>BNS: burnt ostrich eggshell, possible hearth, AHS: multi-component<br><br>MSA site; all three intense reduction jasper, chalcedony, mostly radial-centripetal cores, small size tools; rare *déjeté* scrapers; foliates, lanceolates and cordiform handaxes in vicinity but rare in excavations *(SJJ2004);*<br>MSA, Levallois, disc cores, bifacial retouch; points, foliates *(BA2006)* | Riverine mammalian, reptilian, avian species; KHS: 3 crania, Omo1 and Omo2, early *H. sapiens sapiens* (earliest well-dated aMH) *(MI2005*)<br><br>[foliates, handaxes, Levallois // later M.A.T.] |

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| Early MSA continued | Singa, Sudan (Useries) **130-190 ka** (McDermott et al 1996) (ESR) (EU) 82-112 (LU) 133-187 (Grün & Stringer 1991) *(MS2000, BA2006)* | No tools, calvaria (Bates 1951), *H. helmei (MS2000)* | |
| | Ngaloba, Upper Ngaloba Beds, Tanzania (correlated to marker tuff Ndutu) 120±30 ka (MD1980); (Useries associated bone) 108-130 ka (Hay 1987); (AAR) 100-200 (Bada 1987) 200 ka (Manega 1995), (correlated to Masek Beds Ar/Ar) 200-370, 200-490 ka *(MS2000)* | MSA; LH18, adult cranium, 1200cc, archaic H. sapiens *(MD1980); H. helmei (MS2000)* | |
| | Kulkuletti, Galla Basin, Ethiopia (compare Gademotta) (Ar/Ar basal cultural level) 149±12 or **181±6** ka (Wendorf et al 1975) *(CJ1982)* or OIS6 *(LMF1998)* | Open-air workshop site, MSA, mostly obsidian and other local volcanic rock, mostly Levallois, cores, flakes, blades (Wieckowska & Servello) *(SJ2006b)* | |
| | Soleb, Sudan (based on Useries Egyptian Sahara) probably >160 ka *(MS2000)* | 'Generalized MSA' or 'Late Levallois' overlain by Aterian; cranial and mandibular fragments *H. sapiens sapiens (MS2000)* | |
| | Hargeisa, Somalia | Levalloisian: Levallois, Levallois flakes/points, scrapers, some foliates; Stillbay: Levallois and disc cores, foliates, points, end and sidescrapers; (Clark 1988) *(BA2006)* | |

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| **Lupemban (Early) MSA**<br>~130-300 ka *(BLP2002)*<br>OIS 8 = 244-303 ka<br>OIS 7 = 190- 244 ka<br>OIS 6 = 130-190 ka | General: radial cores; bifacially trimmed core-axe (or 'adze') with flaked tip, often unworked butt; bifacial bi-pointed lanceolates; fine bifacial lanceolate and foliate points; occasional tanged points; light-duty tools on flakes: flake blades, few backed flakes and blades; highly refined workmanship; Levallois absent in early phase, well represented at the end *(TI1988; CJ1970)*; bone tools *(BLP2002);* follows or contemporaneous with Sangoan *(MS1988)* | | |
| | Twin Rivers Kopje, Zambia – A, B, C, D, F<br>F-block: (TIMS Useries on travertine sealing F-Block breccia - corrected) 141, 178, 195±19 ka or **140-200 ka** (was 230+35/-28)<br>A-block: (TIMS Useries on travertine in breccia - corrected) (near top of unit) **266 ka** to (base of unit) **>400**, with other nearby dates 160, 192 and 225 ka, thus A-block as a whole **>200 ka** *(BLpig2002)* or 'likely mean age' **~265 ka** *(BLP2002)*<br>Final Lupemban, if = Tshangulan at Redcliffe **95 ka** and Lupemban-Tshitolian tanged and lanceolates // Aterian in age *(CJ2001)* | A-block: 'Lower Lupemban', centripetal and blade cores, bifacial points, scrapers, awls, burins, few notable backed blades, flakes; lanceolate biface; F-block similar *(BL2002; BLpig2002);*<br>A and F-blocks: 306 specularite, hematite, limonite, manganese dioxide pieces, some evident striations for powder; brown, red, yellow, pink, purple, blue-black; manganese and huge quantity suggest ritual use *(BLpig2002)*; pestlestone with hematite stain on working surface *(CJ2001)* | Baboon, *Syncerus, Equus burchelli*, white rhino, warthog, wildebeest, *Damaliscus*, reedbuck, waterbuck, hartebeest, lechwe, klipspringer, hyena, leopard, rock rabbit, spring hare, porcupine, small carnivore (Cooke) *(CJ2001)*<br><br>F-block: hominid humeral shaft, archaic features ('*H. helmei/heidelbergensis*' (Pearson 2000) *(BLpig2002)* |
| | Kabwe, No. 1 Kopje Broken Hill Mine, Zambia (fauna) 125 ka; (AAR hominid bone) 110 ka (Bada et al 1974); or (fauna and recalibrated Olduvai sequence) >780 ka *(MS2000);* (but based on Lupemban technology) **~130-300 ka** *(BLP2002)* | Acheulian:<br>MSA 'Charama': disc and prepared cores, 13% flake blades, 2 flakes backed (Clark et al 1947); with lanceolates, burin, bone tools (White 1908); 2 bone spatulas, 1 point *(BLP2002);* cranium, cranial, maxillary, postcranials, ≥ 3 MNI, *H. sapiens rhodesiensis* holotype *(MS2000)* | *H. heidelbergensis* (Rightmire 2001) 400 to 700 ka (Rightmire 1998) *(BLP2002)*<br><br>Hominid association with points, ivory questionable *(HC2001)* |
| | Kalina Point, Kinshasa, Congo | Lupemban, bifacial lanceolates, end and side scrapers, core-axe, trimmed and utilized blades (Nenquin 1969) *(CJ1970)* | |
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| | Kalambo Falls, Zambia | Lupemban, backed flakes and blades *(BL2002*): high % laminar and convergent Levallois and retouched points, elongated non-Sangoan core axes, bifacial lanceolate points *(MJ2002)* | |
| **Nubian MP**<br>Early and Mid-MP ('N') | General: Nubian Levallois core reduction for blades, points and classical Levallois for flakes, retouched to end- and side scrapers, denticulates, burins, backed knives; bifaces, bifacial foliates, thick 'Nubian' scrapers in Early MP, but fade out in Mid MP *(VPP1998)* // Lupemban *(VP2005)*; Nubian Levallois not found in Middle East or Europe; but bifacial foliates like small handaxes of MP Europe *(OD2001)* [MAT] | | |
| | Sai Island, northern Sudan<br>Site 8-B-11<br>Upper Levels 1-3<br><br>(technology style // eastern Saharan and Nile Valley) **OIS 5** *(VPP2003)* | Levels 1,2,3: Nubian MSA with Lupemban features overlying Sangoan; distinctive thin bifacial foliates; blanks by Levallois, Nubian and discoidal reduction strategies *(VPP2003)* | |
| | Taramsa 1, Qena, Upper Egypt<br><br>EMP (Hill – Conc. 17): (OSL) **~210 ka** *(VVP1998)*<br><br>MMP (Conc. 7): (OSL)**~120 ka** *(VVP 1998)*<br><br>LMP (Conc. 28): **~30-65** ka *(VVP1998)*<br>(OSL range 49.8±12.2 to 80.4±19.0 and weighted average) **55.5±3.7 ka** *(VP1998)* | Early MP: Levallois flakes, points, Nubian core and point; handaxes, bifacial foliates, heavy sidescrapers, notches, denticulates;<br><br>Mid MP: Nubian points, Levallois flakes;<br><br>Late MP: lacks Nubian point method, but continuous Levallois to produce flakes, blades // Boker Tachtit EUP, Negev (Marks); skeleton, child, *H. sapiens sapiens* with Mid and Late MP artifacts; seated, intentional burial *(VPP1998)*, features similar to Qafzeh 9 *(MS2000)* | 'Not Nubian, but Local MP' *(VP1998);* but 'Nubian' reduction *(BA2006)*<br><br>[// M.A.T.?? - JBH]<br><br>But 'Late MP Nubian' (*VPP2001)* |

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| Eastern Sahara: 5 lacustrine/humid periods (may correlate to interglacial stages) (Useries on lacustrine carbonates, and AAR) 250-320 ka (OIS9) - FA 190-240 (OIS7) -Moust 120-155 (OIS5e) - Atr 65-90 (OIS5c or a) - Atr 5-10 (OIS1) *(SB1995);* semiarid climate 25-40 ka and hyperarid 11-25 ka or ~15-60 ka *(CM1998)*<br><br>(Useries preliminary) BT Green Lake 90 ka to BT Grey Lake 125 ka (Schwarcz) *(WF1987)* | Bir Tarfawi and Bir Sahara East, Egypt<br><br>(Useries, TL, AAR) White Lakes: ~175+ ka [= **OIS7** (Schild comment)]<br><br>Grey Lake W1: ~125 ka<br>Grey Lake W2: ~115 ka<br>Grey Lake W3: ~100 ka<br>Green Lake W4: ~70+ ka = **OIS 5** *(VPP1998)*<br>Grey Lake 1-3: **OIS5e** *(SB1995)*<br><br>BT Lake Phase 1: (TL) 96±14; (OSL) 129.2±7.7 ka<br>BS Lake Phase 2: (OSL) 103.9+9.5/-13.2 ka and (TL range) 84±10 to 109.6±10.6 ka<br>BT Lake Phase 3: (OSL) 96.4+7.2/-10.9 and 119.3±22.9 ka (Wendorf & Schild 1993) *(MN1999)* | White Lakes: E88-14 Sand Pan: E87-1; E87-4; E86-1: Early MP, 'Local Complex' with foliates<br><br>Grey Lake W1: BS11, BT14 and Grey Lake W2: BT14 with foliates = 'Early Nubian MP Complex'<br>Grey Lake W3: BT14 and Green lake W4: BT14, E87-3, E6-2 = 'Mid-Nubian MP Complex' (with Nazlet Khater points and Aterian characteristics)<br>Post-60 ka = 'Aterian *sensu stricto*' *(VPP1998, VP2005)*;<br><br>but (Schild comment) no Nubian points at any level, and foliates at W4 late level, contra (*VPP*) [see below, NE Africa Mid-MP Mousterian at BT and BS] | Lacustrine, gazelle prominent; fish, turtle; BT-14: white rhino, giraffe, buffalo, antelope; gazelle, probable meat-processing living site *(WF1987)*<br>All Mousterian sites: white rhino, camel, ass, buffalo, warthog, large antelope *(WF1976)* |
| | Sodmein Cave, Quseir, eastern desert, Egypt<br>7 occupation levels<br><br>MP5: (TL) 109±8-127±10 ka (mean) **118±8 ka (OIS5e or d)**<br><br>MP4: (14C) >44.5ka<br>MP3: (14C) >45ka<br>MP2: (14C) >30ka<br>UP2: (14C) 25.2±0.5 *(MN1999)* | MP 'Nubian Complex' *(VPP1998)*<br>MP5, 'Early Nubian MP', huge fireplaces with Nubian Levallois core, bifacial tools<br>MP4: Nubian Mid-MP<br>MP3: Nubian Mid-MP, Levallois (classical and Nubian), truncations<br>MP2: tanged Levallois products, Aterian<br>MP1: Emireh points<br>UP2, hearth, UP tools<br>UP1 *(MN1999)*<br>Importation of Nubian points suggests MP4, MP3 used as hunting station *(VPP1998)* | MP5 fauna, similar to Bir Tarfawi and Bir Sahara fauna dated to last interglacial *(MN1999)* |

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| Nubian MP<br>Early and Mid-MP<br>continued | Al Tiwayrat, Qena, Upper Egypt<br>(geostratig.) Last Interglacial *(VP2005)*<br>= 74-130 ka | Early MP: hardhammer, opposed platform continuous reduction cores to produce thick elongated blades, 1 Levallois Nubian core, 1 bifacial foliate; no retouched tools *(VP2005)* | |
| | Arkin 5, Nile Valley, Nubia, Sudan<br>(Chmielewski 1968)<br>*(CJ1982)* | Bifacial lanceolate forms, strong Levallois element (over Arkin 8, Final Acheulian) (Chmielewski 1968) *(CJ1982);*<br>numerous foliates, tangs, could be classed as variant of Aterian *(WF1976)*;<br>chert mining as at Nazlet Khater NK-1, NK-4 UP sites *(VP1984)* | |
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| **African Mid-MSA**<br>OIS 5 = 74-130 ka<br>OIS 4 = 59-74 ka<br>'dry spell 60-20 ka' | | | |
| **Lower Nile Valley Mid-MP** | General: special Levallois point production, 'Nubian 1 and Nubian 2' (Guichard & Guichard 1965, 1968) *(VPP1998)* | | |
| **Nubian Mousterian ('N Group)**<br>By OIS 4, totally modern behavior, multifunction modular settlement systems *(VPP2001)* | General: Nubian 1 method of Levallois point production; Nazlet Khater points made on Levallois and often Nubian blanks with invasive ventral retouch and truncations (// Solecki's 'Nahr Ibrahim' technique or 'truncated-faceted pieces'), notches and denticulates; foliate tools and Nubian end and sidescrapers rare or absent; but some assemblages from Nubia have a few bifaces (Guichard & Guichard 1965, 1968) *(VPP1998)*; circular bifaces // M.A.T Oman *(BA2006)* | | |
| | Nazlet Khater, Lower Nile, Upper Egypt (geostratig.) **~110 ka** *(VPP1998)* | NK-1 and NK-3: 'Nubian Complex Mid-MP', *(VPP1998)*; Levallois cores, Nubian reduction, foliates, points, blades, side and end scrapers *(VPP1998)*; | |
| | Makhadma 6, Lower Nile, Upper Egypt (geostratig.) **~65 ka** *(VPP1998)* | Mid-MP, 'Nubian Complex' *(VPP1998)* | |
| | Wadi Halfa, Nubia, Sudan 11 'encampments' (Marks 1968, Van Peer 1991) *(VPP1998)* | Mousterian A: scrapers, burins of UP type, no bifacial tools;<br><br>Mousterian B: Type A + bifacial tools *(VPP1998)*; circular bifaces (Marks 1968) // M.A.T *(BA2006)* | |
| (but not counted as Nubian N) | Porc Epic Cave, Dire Dawa, Ethiopia<br><br>(obsidian hydration) occupied between **61and 77.5 ka** *(CJ1984)* | 'Late MSA', non-local basalt, obsidian; mostly points, scrapers, edge damaged blade and flake forms, few foliates, burnt bone, apparent hearths *(CJ1984)*; mandibular fragment, *H. helmei (MS2000)* | 298 fragments of ochre, at least 40 with clear wear facets from grinding (CJ1984; Clark 1988) *(MS2000; BR1992)* |

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| **Mousterian ('K Group') ('Denticulate/Typical' Mousterian)** | General: classic Levallois, plus single and double platform cores; Nubian Levallois, foliated tools, Nubian end and sidescrapers and bifaces absent; no blade reduction strategies; similar to Nubian Early MP (Marks 1968, Van Peer 1991) *(VPP1998)* | | |
| | Nazlet Khater, Lower Nile, Upper Egypt<br><br>(geostratig.) **~110 ka** *(VPP1998)* | NK-2 (MP level): 'Local Complex of Lower Nile Valley Mid-MP' *(VPP1998)* | |
| | Bir Sahara East, Eastern Sahara, Egypt *(WF1976)*<br><br>[BS-11 = Grey Lake 1?? = ~125 ka] | BS-11, 1 tanged; BS-12, BS-13: Levallois, Nubian and bifacial retouch; unifacial and bifacial points, handaxes [?], blades, but no foliates *(BA2006)*; all 4th Level sites dominated by denticulates, 55% to 77% of tools, thus Denticulate Mousterian *(WF1976)* | |
| | Bir Tafawi, Eastern Sahara, Egypt<br>BT surface<br><br>(Useries on underlying limestone)<br>118 to 172 ka;<br>(AAR) 125-130 ka<br>thus lake at OIS 6 and Typical Mousterian **OIS 5** *(HCs2001)*<br>**[= 74-130 ka]** | BT-14: Levallois reduction, end- and sidescrapers, awls, denticulates, notches *(WF1987)*;<br>BT surface: Typical Mousterian (*HCs2001)*; or BT-14 (A-F, N): 'Mousterian', plus Nubian reduction, points, blades; bifacial foliates, tanged points (Wendorf and Schild 1980) (*BA2006)* | |
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| | K'one, Ethiopia<br><br>(K/Ar) **140 ka** | MSA, Levallois, Nubian, bifacial retouch, unifacial and bifacial points, blades, scrapers (Kurashina 1978) *(BA2006)* | |
| | Aduma, Ardu Beds, Middle Awash, Ethiopia 8 sites<br><br>(Ar/Ar, Useries, OSL) **80-100 ka** *(YJ2005)* | MSA, 'Aduma industry', flake-based, Levallois (22%), Levallois blade and micro-Levallois (30%), micro-Aduma, Nubian (1.6%), disc (1%); unifacial and bifacial points (23% of retouched tools), borers, few blades, bladelets, scrapers (7% to33%), distinctive small (LSA-like) obsidian, notches, denticulates, rare grindstones;<br>cranial remains *H. sapiens sapiens (YJ2005)*;<br>are small points arrowheads or atlatl darts? *(BA2005)* | Basal Ardu B: fish, crocodile, hippo<br>Ardu B (gravel): (ditto) with *Clarias* (catfish) 80-90%; water dependent antelopes, and bushbuck<br>Ardu B (silt): (ditto), A8B probable hippo butchery site;<br>Ardu B/C interface: (ditto) plus water independent oryx<br><br>A8A cutmarked bones (hippo, crocodile);<br>multiple habitat subsistence strategy comparable to recent hunter-gatherers *(YJ2005)* |
| | Station One, Nile 2nd Cataract, Khor Musa, Sudan<br><br>n.d.<br>*(RJI2004)* | MSA, primarily quartz pebbles, single platform and centripetal and radial Levallois, and irregular cores, some bi-directional // East Africa, Mumba, Pomongwe, etc. 70% blanks are flakes, some blades, ovoid to trapezoidal; *façonnage* technique, non-diagnostic tools; sidescrapers, notches, denticulates, few points, few small bifacial foliates, not Nubian, but //East Africa Late MSA *(RJI2004)* | Suggests East Africa through Bab al Mandab into Arabia during OIS5 interglacial *(RJI2004)*<br><br>Oman sites flanking Rub' al-Khali, non-prepared core, but *façonnage* common, small bifacial foliates *(RJI2004b)* |

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| **North African 'Mousterian'** OIS 6 = 130-190 ka | All light-duty small tools, a number of standardized scrapers, points and flake knives; Levallois and disc core methods of flake production, with three variants: Nubian with many denticulates, with and without bifaces, Cyrenaican and Maghrebian *(CJ1970)* | | |
| | Jebel Irhoud Cave, southern Morocco (ESR mammal teeth overlying *in situ* JI4) (EU) 90-125, (LU) 105, 190 ka, probably **OIS 6 = 130-190 ka** (Grün & Stringer 1991) *(MS2000)*; supported by fauna *(HJJ1992)* | MP, lineal or recurrent Levallois flakes, no Quina retouch, minimal bifacial retouch; mostly notches, sidescrapers; denticulates, no endscrapers or tanged points *(HJJ1992)* earlier designated 'Levallois Mousterian', points, side- and convergent scrapers, hearths *(CJ1970)* | 4 MNI, *H. helmei (MS2000)*; I3 mandible, features comparable to Skhul-Qafzeh series; I4 archaic features; I1 and I2 skull also match Skhul-Qafzeh but neither La Chapelle Neanderthal nor Florisbad; in sum same population as Skhul-Qafzeh though slightly more primitive as fits earlier dating *(HJJ1992)* |
| | Haua Fteah, Cyrenaica, Libya – Upper layers (technology) probably **> 90** or **>130 ka;** 127-140 ka (Klein 1999) *(MS2000)* (C14) 47±3.2 (McBurney 1967) *(CM1998)* | Upper Layers: Mousterian // 'Levallois Mousterian' *(CJ1970)*; 2 young adult mandibular fragments, *Homo helmei (HJJ1992; MS2000)* | |
| **'Mousterian of Acheulian Tradition'** | General: an early Mousterian with both Levallois reduction and bifacial reduction from cores for foliates and handaxes *(BA2006)* | | |
| | Buri Peninsula, Abdur Reef, Red Sea Coast, Eritrea<br>4 strata:<br>Beach facies<br>Upper Coral Zone<br>Lower Shell Zone<br>Basal Cobble Zone<br><br>(geostratig.) all strata: Last Interglacial 115-135 ka or ~ 125 ka (TIMS Useries on coral Upper Coral Zone)<br>AN-4: 117.2±0.6 to 125.9±0.7 ka<br>AN-7: 136.4±0.7<br>AN-13: 156.0±0.9 (probably erroneous), thus ca. 118-136 ka and mean age of reef **125±7 ka** *(WR2000)* | 'Early MSA', bifacial (Acheulian-like) handaxes (large, flat teardrop shaped) and obsidian (occasionally chert, quartz) flake and blade tools;<br>AN-4 Lower Shell Zone: quartz handaxe, several obsidian flake tools;<br>Basal Cobble: obsidian flake tools; handaxes also at AN-1, AN-12;<br>AN-7: obsidian flake tools in Lower Shell Zone.<br>Also flakes and blades (basal cobble, lower shell zone, and/or beach) at AN-1, 4,7, 10, 11, 12, 13; AS-1 (lower shell zone), AS-2, AC-1 (beach facies) *(WR2000)* | Earliest evidence for human coastal marine adaptation // some South African MSA sites: Die Kelders, Klasies, Hoedjies Punt, Sea Harvest, Herold's Bay, oldest being Klasies OIS 5 100-115 ka *(WR2000)* |
| | Tit Mellil, near Casablanca, Morocco | MAT, with small bifaces (Sept online) or 'Final Acheulian' *(CJ1982)* | Spring site; elephant, rhino, hippo (Jean Sept online) |

| **Central Africa / Katanda Mid-MSA** | | | |
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| | Mumba Shelter, Lake Eyasi, Tanzania<br>Levels I-VI-A, B (Kohl-Larsens1943)<br>VI-B: (Useries bone immediately below M21) 131.71+8/-7 ka and 109.486+44/-23 ka<br>V: (Useries bone) 65.686, 46.600 ka (AAR) 45-65<br>IV (14C tufa) 25.13±0.32 (Bischoff & Rosenbauer 1981); (14C snail) 36.9 (Mehlman 1989, 1991) *(BG1988; AS1998; WR2000)* thus base.~**130 ka** *(MM1987; MS2000)* | VI-B: MSA, lower ratio Levallois and points; higher % side and notched scrapers, bifacial tools, and heavy-duty tools *(BA1995, BG1988)*; M21, 3 teeth, *H. sapiens. sapiens* though sample small *(BG1988)*<br><br>VI-A: MSA, points well made<br>V: 'Late' MSA, Mumba industry, crescents, geometrics, backed knives // H.P<br>II: LSA to Iron Age *(MM1987; MS2000)* | Lacustrine, *Phacochoerus*, (T. White) 7 equid, 8 bovid, 1 suid, partial hippo tooth (Kohl-Larsens) *(MS2000)* |
| | Katanda Upper Semliki Valley, D. R. Congo/Zaire<br>Kt2, Kt9, Kt16 near or at base of Katanda Beds<br>Kt 9: (TL) 82±8 ka<br>(OSL) 90 ka<br>(ESR EU) 89±22 ka<br>(LU) 155±38 ka;<br>(Useries teeth) 140±4 and 174±1 ka overestimates;<br>combined age all methods > **89+22/-15 ka** *(BA1995)* or **~80 to 90 ka** *(YJ1995)*; minimum age **75 ka** *(MS2000)* | Kt9: MSA, quartzite and quartz, primarily discoidal cores but also single and multiple platform cores, spheroids, rubbing stones, retouched scrapers rare, lacks unifacial or bifacial points; no blades, no microliths, no handaxes; bone industry: 10 barbed and unbarbed bone harpoon points, flat dagger; hafting grooves<br>Kt16: 1 bone harpoon; several large bifacial pieces, few blades, 2 grindstones *(YJ1995)* | Dense gallery forest and grasslands, rare zebra, blue wildebeest, small hartebeest, sitatunga, clawless otter; crocodile, fish remains predominant; primary subsistence, fishing for *Clarias* (giant catfish) *(BA1995)* |
| | Mumbwa Caves, central Zambia<br>Basal MSA: **OIS5e**<br>Upper MSA<br>MSA/LSA Transition<br>LSA<br>Iron Age<br>*(BLP2002; BL1995)* | Basal MSA, quartz plus chalcedony, quartzite; hearths, windbreaks, 1 kg+ blocks of non-local hematite showing grinding or scraping; probably natural anthropomorphic dolomite piece (Barham 2000) *(BR2003)*<br>MSA/LSA Transition and LSA: ground bone points, drilled bone fragments, 1 decorated bird bone, beveled end, 2 pair notches on one surface, 1 pair obverse, with traces of hematite *(BL1995)* | |

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| **Aterian MSA**<br>**Mid-MSA 65-128 ka**<br>65-90 ka *(CM1998)*<br>Arid 12-70 ka (Wendorf & Schild 1992) | General: flake-based industry, Levallois, discoid and other prepared cores; tanged, pedunculated flakes worked into points; bifacial foliated 'leaf' points from core reduction; flake-blades with faceted striking platforms, flake tools (endscrapers; burins; knives, awls, denticulates), rare small handaxe; exotic raw materials, bone industry, temporary brush huts, fences, highly mobile *(WJ1982; CM1998, BA2006)* with Nazlet Khater type retouch, hence component of 'Nubian Complex' *(VPP1998)* | | |
| Eastern Sahara: 5 lacustrine/humid periods (may correlate to interglacial stages) (Useries on lacustrine carbonates, and AAR) 250-320 ka (OIS9) – FA 190-240 (OIS7) –Moust 120-155 (OIS5e) - Atr 65-90 (OIS5c or a) - Atr 5-10 (OIS1) *(SB1995)*; semiarid climate 25-40 ka and hyperarid 11-25 ka or ~15-60 ka *(CM1998)* | Bir Tarfawi, southwestern Egypt<br><br>Aterian correlated to Eastern Sahara pluvials **OIS5e and OIS5c/a** *(SB1995)*<br>Aterian at OIS 5 *(HCs2001)* **[= 74-130 ka]** | BT14A, B, C: Aterian, B &C, living areas, high Levallois index; A, butchery site, low Levallois index; A and B high % (44%, 63%) denticulates, only 3% tangs, 6% bifacial foliates, endscrapers *(WF1976)*<br>E86-1 (Aterian workshop site): quartzite, Levallois cores, flakes, Tayac point, sidescrapers; other sites, few bifacial foliates *(WF1987)* | Lacustrine, BT-14A: gazelle prominent, white rhino, wild ass, warthog, antelope ostrich; fish, turtle, bird *(WF1976); (WF1987*)<br><br>Or BT-14 is Nubian Complex EMP and MMP and Aterian at Eastern Sahara is Late MP *(VPP1998)* |
| | Wadi Arid and Wadi-Bir Safsaf, Egypt *(SB1989)* but compare *(SB1995)* revision | >300 (beyond technique limit) 212±18, 141±7 *(SB1989)* | Lacustrine occupations |
| | Dakhleh Oasis, Western Desert, Egypt (Useries) **<120/134 ka** (Kleindienst & Wiseman 1996) *(CM1998)* | Aterian | |
| | Kharga Oasis, Western Desert, Egypt<br><br>Refuf Unit, early MSA Mata'na Unit, younger MSA: (overlain by 100 ka tufa) so **OIS5e** humid event;<br>Aterian Unit associated with 50 ka tufa *(SJ2004)* | KO6E: Aterian, 22% bifacial foliates *(WF1976)*<br>E-76-4: Aterian, evallois, bifacial reduction, points, blades, tanged points, foliates (Wendorf & Schild 1980) *(BA2006)*<br>Nazlet Khater points (Nubian Complex) with tanged points at Bulaq Pass *(VPP1998)* | |
| | Wadi Kubbaniya, near Aswan, Egypt<br>Site E-78-11 | Aterian, Levallois, bifacial foliates, tanged points, end and sidescrapers (Wendorf & Schild 1999) *(BA2006)* | |

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| | Uan Tabu, central Acacus, Libya<br>Unit IV (Layers 21-25) (OSL) 61±10 ka (humid geostratig.) **65-90 ka** *(CM1998)* | Aterian, Levallois flakes, blades, points 63% of toolkit, sidescrapers 7%, endscrapers 1%, tanged pieces 4%, 20% notches and denticulates, 2 cleavers; after hiatus, Neolithic *(CM1998)* | |
| | Uan Afuda, central Acacus, Libya- Unit III (TL) 70.5±9.5 to 73±10 ka (OSL) 69±7 ka and 90±10 (humid geostratig.) **65-90 ka** *(CM1998)* | Levallois flakes, not diagnostic to Aterian, but otherwise similar industry; after hiatus, Neolithic *(CM1998)* | |
| | Jebel Gharbi, northwestern Libya **40-80 ka** *(GE2006)* | Aterian at spring sites to escape drier areas of North Africa *(GE2006)* | |
| | El Guettar, Tunisia<br><br>Terrace 3 Formation (containing spring): (14C) 47±4 and 57±7 ka *(AN2006)* but (fauna moist phase) // Libyan and Eastern Sahara Aterian wet phases = 65-90 ka and 120-155 ka *(SB1995)* | Levels T, B1, B2: Levallois elongated points, disc cores, bifacial foliates, denticulates, convergent scrapers, blades, 1 or 2 tanged points; 'Final Mousterian' // Qafzeh F and Tabun C; at bottom of spring pile of 60 spheroids, 1 tanged point in base center of pile, elongated points near top, apex spheroid white cortex, flaked black one pole, red ochre other pole; triangle and lozenge plaques at base *(GM1954)* | Rhino, bovid (*Bos primigenius*?) bones in spheroid pile; and other moist climate fauna' dominance of bovids and equids *(GM1954)* |
| | Dar-es-Soltan I and II, Morocco<br>(AAR) **60-70 ka** *(RJ2004)* (est. date of Libyan Aterian) 60-90 ka *(MS2000)*<br>(14C) >27 and >30 ka (Ruhlmann 1951, Roche 1956) *(CM1998)* | DS I and II: Aterian, DS II: 'enigmatic heap of sandstone slabs 1 m diameter, 30 cm high' (Debénath 1994) *(MS2000)*; 3 MNI, adult, adolescent, child, *H. sapiens sapiens (WJ1983)* | |

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| | Seggédim, eastern Niger | Aterian, 4 drilled quartzite flakes, probable pendants (Tillet 1978; Debénath 1994) *(MS2000)* | |
| | Bir el Ater, Tunisia<br>(14C) >35 ka<br>(Close 1980) *(CM1998)* | Aterian type site *(WJ1982)* | |
| | Mugharet el 'Aliya, Tangier, coastal Morocco<br>Layer 10 (EU) 61±9 ka (LU) 81±9 ka<br>Layer 5, 6, 9 (EU) 39±4 and 44±5 (LU) 47±5 and 56±5 ka, or overall between **35 and 60 ka** *(WP2003)* | Layer 5, 6, possibly 9: Aterian *(WP2003)*; 2 MNI, juvenile maxillary fragment, adult tooth, *H. helmei (MS2000)* | [Date suggests coastal adaptation during Sahara arid phase JBH] |
| | Oued Djebanna, Algeria | Aterian, perforated shell of *Arcularia gibbonsula* (Morel 1974) *(MS2000)* | |
| | Taforalt Cave, northwestern Algeria (Roche 1953, Debanath 1992)<br><br>MP layers (TL, Useries) from **OIS6 to <40 ka**<br><br>Layer 4: 25.76 ka<br>Layer 3: 22.2 ka<br>Layer 2: max 17.085 ka *(EFCHED Project, Nick Barton, online)* | Mousterian tools in silcrete;<br>4 layers of Aterian flint, bifacial foliates, perforated marine shells from ~35km away;<br>Layers 3-4 (YS): Early UP Transitional<br>Layer 2: Ibero-Maurusian<br>UP levels yielded >180 burials H. sapiens sapiens, largest collection in world *(EFCHED Project, Nick Barton, online)*; more than half with evidence of spina bifida (Ferembach 1953) | |

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| | Grotte Zouhra, Morocco | Aterian, bone pendant (Debenath 1994) *(MS2000)* | |
| | El Mnasra I (Grotte des Contrebandiers), II (Grotte Casino), Témara, Morocco (14C) >40 *(CM1998)* | Aterian, 4 polished unpointed bone tools (Hajraoui 1994) *(MS2000)*; mandible fragment, *H. sapiens sapiens (MS2000)* but earlier view *neanderthalis (WJ1982)* | |
| | Rabat, Témara, Morocco | No industry; skull fragments, mandible, *H. sapiens sapiens (MS2000)* but earlier view *neanderthalis (WJ1982)* | |
| | Zouhrah, El Harhoura, Morocco | Aterian; mandible, teeth, *H. sapiens sapiens (MS2000)* | |
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| **Late MSA**<br>OIS 4 = 59-74 ka<br>OIS 3 = 24-59 ka<br>'dry spell 60-20 ka' | General: Target blank of flake or blade production is small; projectile technology, intensified subsistence strategies, fish and shellfish; more diverse raw materials and long distance exchange; greater use of ochre and symbolic artifacts (incised pieces, beads); regional point styles *(BA2005)*; compare Levant Tabun B = return to triangular blanks, removed from mainly unipolar convergent Levallois cores, broad-based Levallois points; short thin flakes and some blades; also radially prepared cores in upper contexts of Tabun B *(BO1995);* ca. 46-48 to 80-90 ka *(BO1992)* | | |
| **NE Africa Late MSA**<br>(arid to hyperarid, deserts abandoned for Nile) | General: traditional Levallois system (of 'K Group') is adapted for efficient, almost continuous production of blades as in UP, which parallels Negev (Marks & Vollman 1983, Marks 1990) *(VPP1998)* and thin flakes, while single and double platform cores for flakes and blades (Phillipson 1993); continues Levallois for light-duty flake tools, high % denticulates; notches, Tayac point, end- and sidescrapers (// European Denticulate Mousterian) *(CJ1970)* | | |
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| | Taramsa 1, Lower Nile, Egypt – Conc. 28<br><br>LMP (Conc. 28): probably **~30-65** ka *(VVP1998)*<br><br>(OSL range 49.8±12.2 to 80.4±19.0 and weighted average) **55.5±3.7 ka** *(VP1998)* | Late MP 'Local Nile Valley Complex': lacks Nubian point method, but continuous Levallois to produce blades // Boker Tachtit Negev (Marks); skeleton, child, *H. sapiens sapiens* with Mid and Late MP artifacts; seated, intentional burial*(VP1998, VPP1998)* | |
| | Khor Musa, Nubia 2nd Cataract, Sudan<br>34A, 34D<br><br>(redated 14C) **>40 ka**, possibly 60 ka (Mark 1968, Wendorf & Schild 1992) *(MS2000)* | 'Khormusan industry', blade-and-burin similar to Dabban, Levallois, radial disc cores, retouched flakes, points, blades, side- and endscrapers, grindstones, few polished bone tools (Phillipson 1993); habitation sites of Nubian N Group quarries but only rare Nazlet Khater points *(VPP1998; BA2006)* | |
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| | Nazlet Safaha and Wadi Halfa, 2nd Cataract Nile, Sudan | 'Halfan industry', Levallois with bladelets and diminutive flake tools (backed blades, burins, inverse side scrapers), which become microlithic by 15 ka *(CJ1970)* | |
| **Central Africa Late MSA** | Mumba Shelter, Lake Eyasi, Tanzania<br><br>V: (Useries on bone) 46.6 and 65.696 ka; (AAR eggshell) 45-65 for upper V; (14C) range 29 to >37 ka *(BG1988; MS2000)* hence **ca. 65 ka** *(MS2000I)*; but unreliable dating methods *(AS2002)*<br><br>III: (14C, AAR) 30-37 ka (see LSA below) *(MS2000)* | VI A, B: Early MSA<br>V: 'Mumba industry', 'late MSA' with high % backed geometrics typical of LSA, // Howiesons Poort, low % radial cores and points; 'transitional' // Botswana, Zimbabwe, South Africa, no 'abrupt discontinuity' MSA to LSA; eggshell beads (AAR direct) **52 ka** (Hare et al 1993);<br>III: LSA, eggshell beads *(MS2000)* | Level V: Large quantities of giant land snail (*Burtoa nilotica*) *(MS2000)* |
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| | Matupi Cave, Ituri, D. R. Congo/Zaire<br>(14C) >40.7 ka (van Noten 1977) *(BA1995)* | LSA microlithic cores // Ishango *(BA1995)*; but lacks microblade cores, thus MSA *(MS2000)* | |
| | Loiyangalani, Tanzania (n.d.) | MSA, 2 OES beads, ochre pencils, bone artifacts *(TJ2004)* | |
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| **South African Early and Mid-MSA** | Dominated by prepared core production of flakes and flake blades and principal retouched pieces are scrapers, points and denticulates // Mousterian of Near East and Europe; lack formal bone, ivory or shell tools and art objects *(KR1989)* | | |
| | Klasies River Mouth, South Africa<br>Cave 1, Layers 37-38 (= RBS and LBS Members = (geostratig.) **OIS 5e = ~111-130 ka**<br>(Useries speleothem cap LBS) **108.6±3.4 ka** (Vogel 2000) (Feathers 2002 OSL 'LBS' 106.8±12.6 ka)<br>Shelter 1A, Layers 37-39: MSA I *(ES2005; SR1982; DH1989, DH2001)*<br><br>Cave 1, Layers 14-17, 17a, 17b (= SAS Member)<br>Shelter 1A, Layers 22-36: MSA II<br>(geostratig.) 80-100 ka<br>(Useries-ESR base of SAS) **101±12 ka** *(GR2005);* Useries 77.4±7.0 to 100.8±7.5 *(VJ2001)*; (Feathers 2002 OSL 68.4±6.5 to 80.6±17.6 ka) *(ES2005; SR1982; DH1989, 2001)*<br><br>Shelter 1A, Layers 1-9: MSA III<br>Layers 10-21: H.P.<br>Cave 1, Layer 13: MSA IV<br>Cave 5 MSA<br>(geostratig.) > 60 ka<br>(14C) > 50 ka<br>*(SR1982; DH1989, 2001)*<br>(AAR) **60 ka** (Brooks et al 1993) *(MS2000)* | MSA quartzite, single and opposed platform cores primarily to produce flake blades, parallel and convergent to point (points), with minimal retouch; also disc and Levallois cores, biconical and chopper cores; worked points and worked flakes (scrapers, denticulates, gravers, borers, backed);<br>MSA I: elongated blades, points; soft hammer<br>MSA II –Lower: Mossel Bay: thick wide Levallois flakes;<br>MSA II-Upper: Stillbay: bifacially worked pieces (Wurz);<br><br>MSAII-a and II-b: 180 red ochre pieces, >50% with wear facets, incisions to remove powder, 14 from MSAI; 1 bone fragment with 4 thin // grooves, 2 with serrated edges;<br>Cave 5: 1 hematized shale 'crayon' *(SR1982, DH2001; WI1999)*<br><br>III: H.P. (see below) | MSA I Level (MNI by %) eland, blue antelope; *Pelorovis*, *Syncerus*, cape fur seal, then hippo, wildebeest, and rarer bushpig, cape grysbok, *Diceros bicornis*, reedbucks;<br><br>MSA II Level: primarily cape fur seal, cape grysbok, and eland; then rock hyrax, *Pelorovis*, blue antelope; then *Syncerus*, bushbuck;<br><br>MSA IV Level: mostly *Syncerus*, eland, blue antelope, cape fur seal, rock hyrax *(SR1982)*<br><br>20% bones cutmarked, broken spear tip in neck bone of *Pelorovis*, some burnt, few signs of carnivore gnawing, hence active hunters *(MR1998)*<br><br>Fragmentary human remains MSA I, II, III, and LSA, *Homo sapiens sapiens (SR1982);* have cut and percussion marks and burning, indicates cannibalism *(WT1987; DH2001)* |
| | Florisbad, South Africa<br>Units M-G: (OSL) 157±21<br>Unit F: (ESR EU) 121±6 (OSL) 138±31 ka<br>*(GR1996, RR1997, KK1999)* | M-G: MSA, highly retouched<br>F: MSA, expedient *(KK1999; 1989)* but no points *(MS2003);* large ochre grinding slabs (de Beaune 1993) *(MS2000)* | |

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| OIS 6 = 130-190 ka<br>OIS 5 = 74-130 ka<br>OIS 4 = 59-74 ka<br>OIS 3 =24-59 ka | Border Cave, South Africa<br>Strata 5-4 BS (MSA 1):<br>(AAR) > 100<br>(TL) 5WA **~180 ka**<br>(ESR EU) 5WA-1: **174±9**<br>5WA-2: **227±11 ka**<br>5BS-2: 166±6<br>5BS-5: 147±6<br>4BS: 82±2;<br>4WA-1: 118±4; 4WA-6: 116±5; 4WA-7: 174±5ka<br>(TL) 4WA.C: **165-180 ka** or OIS7 [=190-244] for undated 6BS Stratum<br><br>Stratum 3 (H.P.): (AAR) bracketed >56, <100 ka<br>3BS (ESR) **58±2 to 74±4**<br>3WA (ESR) **66±2 ka**<br>1RGBS (ESR) **76±4 ka**<br><br>Stratum 2 (MSA3):<br>2WA: (AAR) 69±7 ka<br>(ESR) **63±2 ka**<br>2BS base (LR.C):<br>(AAR) 56±6 ka<br>(ESR) 48±1 ka<br>2BS-UP: (AAR) **47±5 ka**<br>(AMS) >49 ka<br>(ESR) 41±2 ka<br><br>(ESR recalibrated *GR2001*) *(MG1999)*<br><br>Stratum 1 (Early LSA):<br>(see LSA below) | Strata 4-6: 'MSA 1'<br>Stratum 3 'MSA 2' = Howiesons Poort<br>Stratum 2: 'MSA 3'<br>Stratum 1: 'Early LSA';<br><br>BC1 calvaria, BC2 mandible, uncertain provenance; tenuous association to 5BS and if proven by direct dating, early *H. sapiens sapiens* before 130 ka *(GR2001)*<br><br>BC3 infant skeleton with perforated *Conus* shell in 'shallow grave' cut into 4BS, below ash horizon at base of Stratum 3, hence 'older than Stratum 3' (Cooke et al 1945), but no trace of admixture 1BS (*sic*) and 4BS if intrusive; and similar perforated *Conus* from IRGBS UP (Beaumont 1994) suggests it belongs to age of IRGBS, **76 ka**, and hence H.P.; and *Conus* manuported 80 km. *(GR2001)* and BC3 burial stained by red ochre (de Villiers 1973) *(MS2000)*<br><br>BC5 mandible, in base of 3WA (H.P.) = age 66 ka *(GR2001)*; *H. s. sapiens* (Rightmire 1989) *(MG1999)* | Ochre pieces through entire MSA sequence and OES beads in 'Early MSA' level *(BP1978; WI1999)* ochre, 27.7% wear facets by weight, in MSA2a,b *(WI1999)*<br><br>Stratum 2WA: rib fragment with 12 notches along edge (Beaumont 1978) *(BR1992)*<br><br>(ESR)<br>BC1, BC2 < 90;<br>BC3 **70-80 ka;**<br>BC5 50-65 ka *(GR1990):*<br>Direct dating of BC5 by (ESR ICP-MS) **74±5 ka** *(GR2003)* |

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| | Apollo 11 Cave, Namibia<br>Levels A-H<br><br>G (AAR) **≥83 ka**<br>(14C) >49 ka<br><br>F (AAR) **63±6 and 69±7**,<br>(14C) >48 ka<br><br>E (AAR) **59±6 ka**<br>(14C) 26.3 to 46.4 ka<br><br>E/D boundary (AMS eggshell) **41.2±1.65 ka**<br>(min. but 14C 26.3; 26.7; 28.4 ka)<br><br>D: (14C) 12.5 to 19.8 ka;<br>(AAR 9.2 ka)<br><br>C: (14C) 6.2 to 10.4 ka<br><br>A-B: (14C) 0.3-1.7 ka<br>*(WW1976; MG1999)* | H: Early MSA, large points, flake blades, denticulates;<br>G: Stillbay, wider blades, bifacial points, 2 notched bone fragments, pigment;<br>F: Howiesons Poort, 3 ostrich eggshell fragments with incised crisscross lines, pigments; 2 notched bones<br><br>E: 'Late MSA/LSA transitional'; blades, traces of gum mastic found on a blade; 6 painted slabs (1 'feline with human legs'; 1 'zebra' or 'giraffe'; 1 'antelope'; 1 'rhino'; 2 with minimal markings, indeterminate image), may be exfoliated or portable art; 1 'painted pebble';<br><br>D: ELSA, 'ostrich eggshell beads and containers, seashells, pigments and minerals'<br><br>C: LSA 'Wilton', 'OES beads, engraved fragments, pendants and other fragments of OES and seashells, OES containers, pigments and minerals'<br><br>A, B: Pottery *(MG1999)*<br><br>Early to LSA: ochre crayons and incised eggshell fragments to base of MSA *(WW 1974, WW1976)*; (Vogelsang 1998) *(MS2000)* | |

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| | Blombos Cave, South Africa<br><br>Oldest dune sand (OSL) 143.2±5.5 ka (OIS6 low sea level 130-190 ka)<br><br>M3: (OSL) **98.9±4.5 ka** (OIS5c high sea level 96-103 ka), provisionally 100-140 ka<br><br>M2: (TL 2 burnt lithics) 76±7 and 105±9, (OSL) range **76.8±3.1 ka to 84.6±5.8 ka** (OIS5a high sea level 74-91 ka)<br><br>M1: (TL 5 burnt lithics from CA/CB and CC levels [upper M1], mean age between) **74±5 ka** and **78±6 ka**<br>M1-CC: (OSL) **72.7±3.1** (ESR teeth EU) 62±6 (LU) 80±6 ka (Jones 2001) (OIS5a high sea level 74-91 ka)<br><br>Hiatus dune (OSL-SAR) 69±5 ka and 70±5 ka (OIS4 low sea level 59-74 ka through OIS2 12 ka) *(JZ2006; TC2006)*<br><br>L1-L3: LSA: (14C) range 290±20 to 2000±40 BP *(HC2001)* | M3: quartz, Levallois flakes, infrequent retouch (notches, denticulates); no points; most utilized ochre of all levels<br>M2: MSA, thick flakes, few bifacial points; hearths; 21 worked bone tools (awls, points) ground and polished; shape and usewear suggests awls; 3 have projectile-like shape; some bone tools with evenly spaced incisions<br>M1: Stillbay, silcrete, pressure flaking; >400 bifacial lanceolate to elliptical points, finely crafted, some unifacial points, few retouched flakes (endscrapers, raclettes); point preforms imported, finished in situ; 10+ bone tools; 1 mandibular fragment engraved with '11 subparallel lines and 1 obliquely crossing line'; 2 geometrically engraved ochre pieces (1 with tri-line over row Xs (BCC CD); 1 crosshatched (BCC CC), associated hearths; 8000 pieces of ochre, most worked by scraping and grinding, in all levels *(HC1997, 2001, 2002; DF2001, 2005; SM2004)*<br>MII (CF): 2 and MI: 39 *Nassarius* (tick) shell beads, perforated, with string wear *(DF2005; HC2004);* 9 more bone artifacts, 2 points, 1 tanged, 2 awls and 2 awl tips, 1 retoucher, with incised lines, 2 fragments with possible engravings *(DF2007)* | M3: mostly a shell midden<br>M2: high numbers points suggests use as hunting station or specialized production camp; and in general subsistence by hunting, shellfish collecting, and catching large fish and reptiles; *(HC2001; MS2000)*; primary MSA fauna: dune mole rat, rock hyrax, fur seal, grysbok/steenbok, eland; tortoise; fish bones all levels; and faunal array same as LSA levels *(Blombos Cave Project online)*<br><br>M3, M1: 5-7 MNI humans, 9 teeth, 3 have striae suggestive of palliative tooth pick use; some crown diameters like modern African, some larger; morphology similar to Die Kelders Cave 1 *H. sapiens sapiens (GF2001):*<br><br>[Note: mandibular engraving, broken, but could easily have been 9 or 10 horizontal lines and 3 or 2 oblique lines, so same conceptual set as engraving on ochre pieces; #8937 has 8+1 = 9 // oblique strokes over 4 reverse obliques and 1 horizontal crossing line; #8938 has a tri-line engraved over a row of X's, composed of 8 heavy strokes top to left and 9 lighter (iterated) strokes top to right; i.e., probably all three moon counts –as well as composite X and tri-line signs -- JBH] |

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| | Rose Cottage Cave, South Africa<br><br>Basal layer LEN: (OSL) 86±6 ka<br>MSAII: (TL mean) **70.5±5**<br>Layer KUA (top MSA II) (OSL) 62±4 ka<br>or **OIS4 59-74 ka;**<br><br>Layer EMD (bottom of HP) (OSL) 66±4 ka;<br>HP: (TL) between **56.3±4.5 and 60.4±4.6 ka**<br>Layer BER (near top of HP) (OSL) 59±4 ka<br><br>Layer LIN (base post-HP) (OSL) 57±3 ka<br>MSAIII: (TL) **50.5±4.6 ka**<br>Layer LYN (near top layer) (OSL) 33±2 ka<br><br>Late MSA: **27.7-30.8 ka**<br>Transitional: **20.6 ka**<br>(OSL – Aitken) *(VH2005)* | MSAII, 7 unifacial, 1 bifacial point, 5 knives, 3 sidescrapers, 3 backed tools, several hundred blades, flakes;<br><br>H.P.: 300 backed tools, including geometrics, 1 point, 9 knives;<br><br>MSAIII: 72 points, 82 knives, 99 scrapers, 13 backed tools *(VH2005)*<br><br>Late MSA:<br><br>Transitional MSA/LSA: 295 pigment pieces, 20% modified by weight *(WI1999)*<br>pigment pieces all levels *(WI1999)* | |
| | Cave of Hearths, Makapansgat, Limpopo, South Africa<br>Beds 4-9 = MSA | MSA, Beds 4-5: Pietersburg, disc cores, little to no Levallois, flake blades and points, minimal retouch;<br>Beds 6-8: Bambata, worked points, gravers; crescents, trapezes, fine borers, grindstones;<br>Bed 9: 'Umguzan' // 'H.P.' = 'Magosian' (Sampson 1974) *(SR1982)*<br>Bed 9 (H.P.): broken circular ostrich eggshell pendant, 3 cm diameter, central perforation (Mason 1962, Mason et al 1988) *(MS2000)* | |
| | Umhlatuzana, South Africa | MSAII:<br>H.P.:<br>MSAIII:<br>Final MSA:<br>Early LSA:<br>1,675 pigment pieces over all five levels, 14.5% modified by weight (WI1999) | |

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| | Mossel Bay, South Africa<br>C: MSA<br>C1: MSA<br>C2: Howiesons Poort<br>C3: MSA<br>C4: MSA<br>B: LSA<br>A: LSA *(SR1982)* | Early phase: triangular flakes, flake blades, unifacial, denticulate points, scarpers; Later phase ('classic Stillbay') silcrete, unifacial and bifacial foliate tools (Keller 1969) (CJ1970) | |
| | Pomongwe Cave, Matopos Hills, Zimbabwe<br>Layers 22-27:<br>(14C) 35.75 to >42 ka<br><br>Layers 13-21:<br>(14C) 21.7±0.4 to 35.75<br><br>Layers 10-12:<br>(14C) 15.8±0.1<br>(Cooke 1963) *(CJ1965)*; probably **125 ka** (Klein 1978) *(BRe2003)* | Layers 22-27: Proto-Stillbay 'Charama', ochre from all spits;<br>Layers 13-21: Bambata Stillbay, increased ochre and stained lithics<br>Layers 10-12: 'Magosian' (Cooke 1963) *(CJ1965, CJ1982; WI1999)*<br>'MSA levels': 2 granite slabs stained with ochre (Walker 1987) *(BA2000,BRe2003; BR1992)* | |
| | Orange River, South Africa | Phase 1: very large narrow blades, some backed<br>Phase 2: blades continue, burins and trimmed points; single platform blade cores, Levallois core<br>Phase 3: blades continue, backed blades, burins and points rare; prismatic and microblade cores; endscrapers all 3 phases Sampson 1968) *(CJ1970)* | |

| **Mid-MSA – Stillbay** | | | |
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| | Hollow Rock Shelter, South Africa | MSA Stillbay, >1000 pieces pigment, 45% use wear by weight, *(WI1999);* 2 incised and notched (serrated) ochre fragments (Evans 1994) *(MS2000)* | |
| | Bambata Cave, Zimbabwe<br><br>probably 125 ka (Klein 1978) *(BRe2003)* | MSA Stillbay, backed flakes, borer, bifacial subtriangular points (Jones 1940) *(CJ1970);* evidence of ochre use (Jones 1940) *(BRe2003):*<br>Wilton:<br>Neolithic: | |
| | Olieboompoort, Transvaal, South Africa | MSAII: 304 pigment pieces, mostly specularite, 'crayons', 11.95 kg, 18.2% modified by weight, 1 of 5 grindstones with ochre stain (Volman 1984) *(WI1999)* | |
| | ≠Gi, Botswana<br>2 Units<br>(TL, AAR) **70-80 ka** or 77 ka (Brooks & Yellen 1987; Brooks et al 1990) *(MS2000)* | MSA: 'Bambatan', highly retouched, with broad foliate and triangular points, 600 points (41% of retouched tools), points highly curated, multitask; grindstones stained with ochre *(KK1989; MS2000)*<br>'MSA/LSA transitional // White Paintings Shelter' *(MS2000)* | MSA: dominated by zebra, cape warthog, and large bovids, at least 1 *Pelorovis* (Halgren & Brooks 1983; Brooks & Yellen 1987; Kuman 1989), suggests projectile point hunting *(MS2000)* |
| | Die Kelders Cave, western cape, South Africa<br>(OSL) **60-70 ka** *(FJ2000)*<br>(ESR layers 4-5, 6, 10, 12) **70±4 ka** *(SH2000)* | 'Late MSA', radial cores, flakes, flake blades; denticulates *(KR2004)*; grindstones stained with ochre (Avery et al 1997) *(MS2000);*<br>teeth, fragments *H. sapiens sapiens (MS2000)* | |

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| | Rhino Cave, Tsodilo Hills, Botswana<br>(tool style) analogous to MSA ≠Gi ~77 ka<br>(other Tsodilo Hills sites dated 64 ka and 96 ka)<br>*(S. Coulson interviews online 2006)* | MSA level: specular hematite crystals, hammerstones, grindstones; mining in other Tsodilo Hills caves during Holocene (Robbins et al 1998);<br>MSA: 13,000 lithic artifacts, 115 finely retouched points; manuported quartz and rock crystal, those with red color burnt white; overlain by LSA; rock wall of cupules and abraded grooves, engravers in MSA level, image of 'python' *(S. Coulson 2006)* | "ritual function" of the points inferred: all roughed out elsewhere and finished at Rhino Cave; found in three states: perfectly intact, broken in half, or (in 22 cases) burned in the midst of the debitage created during their manufacture. The latter are the only burnt things encountered in the test pit, and none of the points bear any kind of impact fracture suggestive of use as part of projectile weapons *(S. Coulson interviews online 2006)* |
| | Windhoek (on slope by ancient spring, 3 springs currently active), Namibia<br><br>n.d., but 'Glen Gray' 'early MSA' [=Mid-MSA regional variant – JBH] | MSA, in pile 1.3 m in diameter, 75 cm high, made of 36 spheroids, (35 of 'fine crystalline quartz', 1 of 'red sandstone') each weighting 600-1200 g; mostly 8-10 cm. diam; all have notch, 1.5 cm diam. and 'few' mm deep, accompanied by 1 unifacial 'lancehead' (7 cm. long) on a faceted flake MSA, perhaps 'Glen Grey Falls or earliest MSA', 1 fragment, would have been 8 cm. long, perhaps 'Upper Fauresmith' handaxe, larger than recent 'native' hammerstones, perhaps workshop or 'depot' *(FG1954)*, may be cairn, symbolic // El Guettar and Dar-es-Soltane 2 (Clark 1982) *(MS2000)* | |

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| **Howiesons Poort** (Southern Africa) Between **54 and 70** ka *(VH2005)* | General: Dominated by backed tools, crescents and other small geometrics (apparently insets in multi-component tools), small blades, endscrapers and burins similar to MSA forms made on flakes and blades from single and double platform, radial and irregular cores; lanceolate and foliate points, exotic silcretes manuported to site; not using indirect percussion, but soft hammer marginal percussion; hence not similar to European UP; has variation site to site, and fades into classic MSA of scrapers, unifacial points, hardhammer; bone tools *(SS2007; MS2000)* formerly called or confused with LSA 'Magosian' *(WJ1982)* | | |
| | Klasies River Mouth, South Africa<br>Shelter 1A, Layers 10-21<br>Cave 2, Layers 1-5<br><br>(geostratig.) OIS5a-4 = 59-91 ka, centered on **70 ka** *(WS1999)*<br><br>(Useries-ESR at base and top) **53 to 64 ka**<br>(Useries) 65.6±5.3 ka *(VJ2001)*<br>(OSL) 46.7±3.3 and 52.4±4.0 (Feathers 2002);<br>(TL mean) **56±3 ka** (Tribolo 2003);<br>(AAR) **65ka to 80 ka** (Miller et al 1993, 1999) *(ES2005; SR1982; DH1989, 2001; MS2000)*<br>(combining ESR and Useries for 1 tooth yields single date) **53±3 ka** (Grün) *(VH2005)* | Howiesons Poort, mostly double platform, small and micro-cores to produce thin flakes and flake-blades with delicate trimming; crescents, trapezes, triangles; 1 bone point, utilized ochre pieces *(SR1982)*; 102 ochre pieces, 50% of total all levels from H.P. Level ; Microburin used to notch blades for snapping; notches on unbacked edges suggest hafting (Wurz 1999); as barbs for spears (Deacon 1989) or projectiles (Volman 1984) *(MS2000)*; backed blades larger than LSA, so not projectile points *(DH1996)* | [Some 'notched flakes' (*SR1982*:fig.6.6) appear zoomorphic: fish, skate, buffalo, other shapes – JBH]<br><br>A *chaîne opératoire* analysis (exotic non-local materials; standardized blank type, size and design) shows making of backed artifacts reflects imposition of style, i.e., 'communication through the medium of symbols', implies language use, long preceding UP *(WS1999)* |
| | Border Cave, South Africa<br>'MSA2' = HP:<br>(ESR) ranges from **58±2** to **76±4 ka** (see above) | Howiesons Poort Level (see above)<br>ochre, 27.7% wear facets by weight, in MSA2a,b *(WI1999)* | |
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| Howiesons Port continued | Howiesons Poort, eastern cape, South Africa | H.P. type site, unifacial, bifacial points, flake blades, truncated blades, crescents, triangles, trapezes, thumbnail scrapers, burins, exotic silcretes, quartz *(CJ1970;WJ1982)*; 1 hematite fragment, ground trihedral base with 18 (3, 11, 4) notches along its edges; 1 bone point *(SP1928)* | |
| | Boomplaas Cave, South Africa<br>OCH (14C) >49 ka<br>(AAR) **56 and 65 ka**<br>(Useries) 62.4±2 ka or ~60-70 ka *(VJ2001)*<br>[or **72-80 ka** (Brooks et al 1991; Miller et al 1993, 1999) *(MS2000)*]<br><br>OLP (14C) >40, 37, 32 ka<br>(AAR) **44±4 ka**<br>(Useries) 35.2±2.6 ka<br>BP (14C) c. 32, 33 ka<br>(AMS eggshell) **32.9 ka**<br>GWA (top MSA3) (14C) 17.8, (AAR) 17.8 ka<br><br>CL (14C) 12.5 to 14.0 ka<br>(AMS eggshell) 10.4 ka<br>(*MG1999;* Vogel 2000) | OCH: Howiesons Poort<br>OLP: base of MSA3<br>BP: MSA 3<br>GWA: top of MSA 3<br>CL: base of LSA<br>(*MG1999)*<br><br>OLP: MSA3, 1 complete and 1 unfinished ostrich eggshell bead (Deacon 1995) *(DF2005)*<br><br>Pigment, 16.9% wear facets by weight, in H.P. MSA3 and Early LSA levels *(WI1999)* | |
| | Diepkloof Shelter, South Africa<br><br>(TL) H.P. between 55 and 65 ka *(RJT2006)* or 'centering on 71±8 ka' *(VH2005)* | Stillbay:<br>H.P.: 2 ostrich eggshell fragments engraved with subparallel lines, may have been water container // Apollo 11 (Wendt 1972; Vogelsang 1998) *(MS2000)* | |

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| **Late MSA Southern Africa**<br>OIS 4 = 59-74 ka<br>OIS 3 = 24-59 ka | General: radial cores, flakes, flake blades, typical of MSA, denticulates (serrated edges), but no LSA geometrics nor bone tools; no backed pieces like H.P., no bifacial points like Stillbay *(KR2004)* | | |
| | Sibudu Cave, KwaZulu-Natal, South Africa<br><br>H.P. – not yet dated<br><br><u>Late MSA</u>:<br>RSp: (OSL) **53.4±3.2 ka**<br>(14C) >41 ka, >45 ka<br>BSp: (OSL) **56.7±2.3 ka**<br>Or: (OSL) **61.5±2.2 ka**<br>SS: (OSL) **57.0±2.3 ka**<br>P: (OSL) **59.6±2.2 ka**<br>Ch2: (OSL) **60.8±2.3 ka**<br>Y1: (OSL) **59.0±1.9 ka**<br>B/Gmix: (OSL) **58.1±2.5**<br>Ch2: (OSL) **60.8±2.3 ka**<br><br><u>Final MSA</u>:<br>MOD: (14C) **26.0±0.42 ka**<br>Bu: (OSL) **35.2±1.8 ka**<br>(14C) 42.3±1.3<br><br><u>Iron Age</u>:<br>BSS (14C) 960±25<br><br>*(WL2004)* | H.P.:<br>RSp: Late MSA, hardhammer for flakes and blades, soft hammer for retouch; no predetermined flakes, retouch used to achieve desired edges; 15% retouched; unifacial points dominant; no difference in technology with MP Europe *(VPD2005)*;<br>Bu: Final MSA, unifacial and bifacial points, small non-point bifaces, scrapers, notches, rare hollow-based triangular points (projectile); 3 notched bones: 1 with 10 or 11 equally spaced // notches; residue plant fiber, cells and starch grains (BSp but direct AMS 28.88±0.170); 1 fragment w/1 notch (BSp); 1 with series of 3 flaked notches on edge (MOD) 1 bone pin (Bu/Co/MOD);<br>BSS: Iron Age: bone blank *(CC2006; CC2004)* | MSA, extinct *Pelorovis*, *Megalotragus* and *Equus*, and extant land and marine species (mussels, molluscs, fish; rhino, hippo, suids, many medium and large bovids, equids, many large mammals, mostly adult age, suggesting deliberate hunting, considerable hunting skills; Final MSA similar, high MNI wildebeest, hartebeest, buffalo, large bovids *(PI2004)*<br><br>Final MSA, points were hafted on wooden shafts, used in hunting, bound by plant twine, possibly resin, also ochre used *(LM2005)* |
| | Ysterfontein 1 Shelter, western cape, South Africa<br>(AMS) > 46.4 ka (stratig.) ~ 46-57 ka or ~71-115 ka (tools) **~ 46-57 ka** *(KR2004)* | Late MSA, radial cores, flakes, flake blades; denticulates; no LSA geometrics nor bone tools; no backed pieces like H.P., no bifacial points like Stillbay; similar to Die Kelders Cave; hearths, red ochre and black manganese pieces, 1 of each color striated, diorites with ochre rubbing or grinding smears, maybe for hafting or for art; *(KR2004)* | Shellfish by MNI and kg foremost black mussels, then limpets, typical of coastal MSA and LSA; tortoise; (unlike LSA) fishbones, absent; plenty of ostrich eggshell, but not decorated; mammals: cape fur seal, zebra, rhino, steenbok, reedbuck, blue antelope, wildebeest, eland, *Pelorovis*, also penguin, birds, probably whale *(KR2004)* |

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| | Lion's Cavern, Ngwenya Range, Swaziland, South Africa (14C) **10 ka to 43 ka** or infinite **>40 ka** (Beaumont 1973) *(MS2000)* | MSA, tools, including mining tools, ochre mine, 1200 metric tons removed (Beaumont 1973) *(MS2000; BR1992)* | |
| | Zombepata Cave, Sipolilio Zimbabwe (14C) infinite, **>40 ka** (Cooke 1971) *(DF2005)* [industry???] | MSA, 2 stone rings of micaceous schist, ornamental (Cooke 1971) *(DF2005)* | |
| | Nswatugi, Zimbabwe (14C) infinite, **>40 ka** (Cooke 1971; Walker 1995; Larsson 1996) *(MS2000)* | Late MSA 'Tshangulan', beads; 3 granite slabs with 1 definite, 2 probable ochre stains (Cooke 1971; Walker 1995; Larsson 1996) *(MS2000)* (Walker 1987) *(BR1992)* | |
| | Bushman Rock Shelter, South Africa (n.d.) [industry???] | MSA, OES beads (Plug 1982) *(DF2005)* | |
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| | Equus Cave, South Africa (ESR, fauna, stratig.) **44-93 ka** (Grine 2000, Schwarcz & Rink 2000, Feathers & Bush 2000) *(MS2000)* [industry???] | MSA; mandible fragments, teeth, *H. sapiens sapiens (MS2000)* | |

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| **Later Stone Age** | General: chalcedony, quartz, agates, cherts; microlithic, often but not always backed bladelets, blunted by retouch to facilitate hafting for barbs on multi-barbed spear, arrowheads, knife, sickle and saw blades; endscrapers, distinctive burins; diminished size of axe, adze blades and scrapers; bone tools *(CJ1970)*; microblade cores *(MS2000);* probable first appearance of hafted projectile points after 40 ka, but not during MSA based on ballistic criteria *(SJ2006)*; shift from 'radiating' to 'circulating' settlement pattern and longer distance exchange patterns *(AS2002)* with backed microliths as gifts in delayed reciprocity systems like San *hxaro* gift-giving beginning in Howiesons Poort (Deacon and Wurz 1996) or beads *(AS2002)* | | |
| **Early or Initial LSA MSA/LSA transition '40-50 ka'** *(MS2000)* OIS 3 = 24-59 ka | General: Transitional industries, mixing MSA and LSA elements, with or without MSA points *(MS2000).* Compare timing of Levantine Early Ahmarian/UP // Bohunician central Europe (43-36 ka) and Karim Bom, Altai, Siberia (43 ka) *(KS1999)* | | |
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| East Africa fully microlithic by 50 ka *(AS2002)* | White Paintings Rock Shelter, Tsodilo Hills, Botswana<br><br>MSA/LSA: (OSL mean) **55.4±4.7 ka** but possible contamination (Feathers 1997) *(RR1997)* or **38-50** ka (Robbins 1999) *(MS2000)*<br><br>LSA (14C, AAR) 33 and 37 ka; (AMS direct dating) drilled eggshell preform: **26 ka** *(MS2000)* | Basal MSA:<br><br>MSA/LSA transitional: large blades, 1 unbarbed bone point, bladelets, large backed crescent;<br><br>LSA: bone harpoons and other bone tools, ostrich eggshell fragments, preforms, beads (Robbins et al 1994, Robbins 1999) *(MS2000)* | Fish and mammals *(MS2000)* |
| | Olduvai Gorge, Naisiusiu Beds, Tanzania<br><br>(AMS 14C) > 42 ka, (Ar/AR) 42±10 ka but also 90±30 (Manega 1993) (ESR 9 dental samples EU) 59±5 (LU) 62±5 ka or average **60±10 ka** *(AS2002)* | Early LSA, Lemuta industry, high % large backed tools on quartz, chert and obsidian; low % convex endscrapers; no burins; large bipolar cores common (Leakey et al 1972, Merrick 1975) obsidian from 250 km away (Merrick & Brown 1984) *(AS2002)* | |
| | Nturnot, Ntuka River 3, Kenya (GvJh11)<br>15-16: (geostratig. > 5m below 14C 30 ka) **>50 ka**<br><br>Upper 8 (horizon just below microblades) (14C) **29.98 ka** (AAR) **32 ka *(AS2002)*** | Strata 15-16, MSA/LSA transitional, radial cores, blades, small bifacial points and backed microliths;<br>Strata 10-lower 8: ' Early LSA,' microlithic but no blades or bladelets<br>Upper 8: LSA microcores, microblades | |

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| Based on EYM LSA began as early as 55 ka, but more likely around **50 ka** *(AS1998)* | Enkapune ya Muto Shelter (GtJi12), near Lake Naivasha, Kenya<br><br>RBL4: Endingi industry **> 50 ka** (14C) >41 ka<br><br>GG/GL Nasampolai industry, (ObsHyd) 46 ka; thus between 40 to ~50 ka<br><br>DBL1: Sakutiek industry (14C) 35.8; on eggshell **39.9±1.6**; probably OIS3 *(MS2000; AS2002; AS1998)* | MSA/LSA transitional 'Endingi': flakes with faceted platforms from radial cores, backed geometric microliths, sidescrapers, points, burins but blades and blade cores rare;<br>LSA 'Nasampolai', blade-based almost totally backed tools<br>LSA 'Sakutiek', obsidian, highest % thumbnail scrapers, *outils écaillés (AS2002)* | MSA/LSA Endingi: ochre on 2 flakes, ochre stained grindstone *(AS1998; MS2000)*<br>LSA Nasampolai, ochre on back of several backed blades suggests hafting;<br>LSA Sakutiek Level (37-40 ka): ostrich eggshell, 13 beads, 12 perforated preforms, 593 shell fragments // Mumba, Kisese II, Border, Boomplaas and recent *hxaro* gift exchange system *(MS2000; AS2002; AS1998)* |
| | Mumba Shelter, Lake Eyasi, Tanzania<br>(14C tufa, boundary III-IV) 25.13±0.32 and (snail) 36.9±0.8; (eggshell, lower III) 26.9±0.76; (upper III, charcoal) 1.78±0.8 ka *(BG1988)*; **'well before 40 ka'** or **30 to >37 ka** (Mehlman 1989, 1991) *(MS2000)* | III: LSA, ostrich eggshell beads *(MS2000)*;<br><br>MNI 18 skeletons, burials, 1 dated 5 ka *(BG1988)* | |
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| | Border Cave, South Africa<br>Stratum 1:<br>Level 1WA<br>(AMS charcoal) 37-40<br>(AMS eggshell ) 36.1±0.9<br>(ESR) **36±1 and 39±3 ka**<br>Level 1 BS-LR.B<br>(AMS charcoal) 38.5±1 ka<br>(ESR) LR.1: 33±1 ka<br>(ESR recalibrated *GR2001*) *(MG1999)* | Early LSA (no cultural hiatus); non-microblade microlithic; microblades arrive late to South Africa with Robberg industry; ostrich eggshell beads; incised notched bone (Beaumont et al 1978; Miller et al 1992) *(AS2002; MS2000)* | Early LSA ESR and 14C dating could be related to palaeoclimatic amelioration coeval with Dansgaard-Oeschger event 12 at 42 to 44 ka (Bischoff et al 1994; Blunier et al 1998) *(GR2001)* |

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| Early UP/LSA continued | Hofmeyr, South Africa (Useries and OSL 3 samples) 33.0±2.5, 34.7±3.4, 40.9±4.2 (mean) **36.2±3.3 ka** *(GF2007)* | No tools; cranium, *Homo sapiens sapiens* with some archaic features; closest to Eurasian UP crania versus Skhul, Neanderthal, or modern KhoeSan, Sub-Sahara Africans, Europeans, EAsia or Oceania; supports Out-of-Africa *(GF2007)* | |
| | Nazlet Khater, Upper Egypt<br><br>NK4: (14C) 30.36±2.3 to 35.1±1.1 ka *(VP1984)* (OSL) **38-45 ka** *(VP2003)*<br><br>NK1: (14C) chert mine: 31.6+3.6/-2.5 ka *(VP1984)*<br><br>NK2 (UP Level): (14C) **37 ka** *(VP2003)* | NK4, chert mine; early UP blade-and-burin industry, no trace of Levallois, single platform for blades, mostly denticulates, some endscrapers, burins, bifacial axes; NK2, burial with bifacial axe, facing east, grave covered with blocks, 2nd burial with fetus bones and ostrich eggshell fragments; *H. sapiens sapiens*, 1400cc, with some African MSA archaic features *(PRS2000, VP1984, VP2003; RB1992)* | |
| | Shuwikhat 1, Upper Egypt 22-25 ka (Paulissen et al 1985; Vermeersch & Paulissen 2000; Wendorf & Schild 1976) *(CA2002)* | UP, large blades struck from opposed platform cores, denticulated blades, burins, endscrapers; no Levallois (Vermeersch et al 1990) *(CA2002)* | Large mammals, catfish, a hunting and fishing base |
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| **Mid-LSA** 20-40 ka | | | |
| **Dabban**<br>20-40 ka *(CA2002)* | Blade-and-burin industry; punched blades; many straight, blunted backed blades, various scraper and burin forms; perhaps a coastal adaptation; replaced by microblade Eastern Oranian industry around 14 ka *(CJ1970)* | | |
| | Haua Fteah Cave, Cyrenaica, Libya<br><br>(14C) ~40 ka<br>(McBurney 1967)<br>*(AS1998)* | Dabban; lunates, backed bladelets, endscrapers, burins, backed blades; chamfered blades; angle burins (McBurney & Hey 1955) *(CJ1970)* | |
| | Hagfet ed Dabba Cave, Cyrenaica, Libya<br>(14C) ~40 ka<br>(McBurney 1967)<br>*(AS1998)* | Dabban type site *(CJ1970)* | |
| **Central Africa** | Kisese II Rock Shelter, Tanzania<br>MSA/LSA: (14C eggshell) **31.48 ka**<br>(Deacon 1995, Deacon 1966; Inskeep 1962)<br>*(DF2005)* | MSA/LSA Transitional: ostrich eggshell beads *(DF2005)*; ochre crayons with wear facets (Inskeep 1962) *(RB1992)* | |
| **South Africa** | Rose Cottage Cave, South Africa<br>~ 20 ka *(MS2000)* | LSA (earliest level)<br>*(MS2000)* | |
| | Sehonghong and Strathalan, South Africa<br>~ 20 ka *(MS2000)* | LSA (earliest level)<br>*(MS2000)* | |
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| **Late LSA**<br>10-24 ka | General: dominated by backed bladelets, and even endscrapers and burins made on flakes that are by-products of bladelet manufacture; many regional variants; sudden, abrupt appearance with no predecessors; few use-wear studies indicate not used or for multiple tasks and no clear evidence for hard hafting, and may have social function; associated with Mechta-Afalou type (Mechtoid) robust *H. sapiens sapiens (CA2002)* | | |
| **Iberomaurusian**<br>16-22 ka | Taforalt, eastern Morocco<br>**22 ka** (Roche 1976) *(CA2002)* | Iberomaurusian ('Oranian') overlying hiatus above Aterian *(CA2002)* | |
| | Tamar Hat, eastern Algeria<br>**Before 20 ka** (Saxon et al 1974) *(CA2002)* | Iberomaurusian overlying hiatus above Aterian *(CA2002)* | |
| | Haua Fteah Cave, Cyrenaica, Libya<br>(14C) 7-13 ka *(CJ1970)*; but more likely dates of 16 ka and **18.6 ka** associate to Oranian; last Dabban date is 28.5 ka *(CA2002)* | 'Eastern Oranian', backed bladelets 82%-94% of tools; bone borers, bone points, overlies Dabban blade-and-burin industry but not derived; coastal adaptation (McBurney & Hey 1955) *(CJ1970; CA2002)* | |
| **Fakhurian/ Kubbaniyan** | Esna, Nile Valley, Egypt<br>Site E71K12<br><br>(14C) **19.5-21 ka** *(CA2002)* | 'Fakhurian': Backed bladelets, with Ouchtata retouch, perforators, notches, denticulates, few endscrapers; 2 skeletons *(BYA2006)* | Hunting dorcas gazelle, hartebeest, wild cattle (Vermeersch & Hendricks 2000) *(BYA2006)* |
| | Wadi Kubbaniya, near Aswan, Egypt<br>E81-3, E81-4<br>(14C) **19-21 ka** (Vermeersch & Hendricks 2000) *(BYA2006)* | Early UP: 80% chert, but many exotics; single platform cores, backed bladelets (some possibly with Ouchtata retouch), perforators, notches, and denticulates *(BYA2006)* | Hunter-gatherers, fishing catfish, talapia; hunting dorcas gazelle, hartebeest, wild cattle *(BYA2006)* |
| | Wadi Kubbaniya near Aswan, Egypt<br>~12 other sites, including quarry site E-83-3<br><br>E-78-7: (14C) **17.85±0.2**<br>E-83-2: **16.66±0.37 ka**<br>E-78-9: **18.23±0.2**<br>(Close 1989) *(BYA2006)* | Classic Phase: Up to 90% backed bladelets struck from opposed platform cores; single platform cores; bladelets with Ouchtata retouch, end scrapers, notches, denticulates and a few burins; large grinding stones, mortars, pestles (Midant-Reynes 1992, 2000) *(BYA2006)* | Semi-sedantary, especially fishing for catfish (Close 1989) *(BYA2006)* |

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| **Ballan-Silsilian** 15-16 ka | Wadi Halfa, Nubia, Sudan (Wendorf 1968) GS2B-II on Kom Ombo Plain, E71-K20 near Esna and Arab el-Sahaba *(BYA2006)* | Geometric UP, single and opposed platform cores, microburin technique, triangular and trapezoid tools, burins, pointed and backed bladelets and truncated bladelets *(BYA2006)* | |
| **Afian** 12.3-12.9 ka | Nile Valley, Egypt Six concentrations of stone tools at Thomas Afia village (E71-K6B – K18A-E), site GS-2B-1 at Kom Ombo, and E83-4 at Wadi Kubbaniya and Makhadma-4 *(BYA2006)* | Geometric UP, opposed platform cores (some true Levallois, and some "bent"), producing elongated flakes, bladelets, microflakes, backed bladelets, geometric microliths (including scalene triangles and lunates) and microburins *(BYA2006)* | |
| **Kenya** | Nderit Drift, Kenya (14C) 13-14 ka *(AS2002)* | Eburran Phase 1, micro-blade cores and microblades abundant, nucleaform burins; backed microliths virtually absent (Bower et al 1977; Merrick 1975) *(AS2002)* | |
| | Ol Tepesi, GsJi53, Kenya (14C) 14 ka *(AS2002)* | 'Kiteko industry' microlithic, similar to Nderit Drift *(ditto)* | |
| | Masai Gorge RS, Kenya ~10 ka *(AS2002)* | Eburran Phase 2 | |
| **Ishangian** | | | |
| | Ishango, Lower Semliki Valley, D. R. Congo/Zaire Ishango 11 Early LSA (14C eggshell calibr.) range **19.78±0.24** to **25.29±0.35 ka;** LSA/Neolithic 1680-3140 Ishango 14 Early LSA **16.5±0.48 to 22.15±0.50** *(BA1995)* | Early LSA, double row barbed harpoon points, human remains Later LSA, micro-cores *(BA1995)* | |

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| **South Africa – Late LSA** | | | |
| | Klasies River Mouth, South Africa<br>Cave 1, Layers 1-12 Lower and Upper Midden<br>Cave 5 Cutting and Midden<br><br>(14C) 315±105 ka *(SR1982)* | Layers 1-12: LSA, single and double platform, irregular and micro-cores; flakes, flake blades, points; worked flakes (gravers, borers); well-made bone tools; red ochre, ostrich eggshell; Midden: perforated cowry shell, perforated slate pendant, bored circular stone disc; slate palette with traces of red ochre, sinkers;<br>Cave 5: many pecked pebbles bearing traces of red and black pigment; 12 other rock fragments with black or brown ochre; 1 flat boulder painted in black with thin white lines, a man and 4 fish or dolphins; flat pebble with red grid pattern on both faces; striated slate palette *(SR1982)* | |
| **Robberg Industry**<br>12-22 ka *(AS2002)* | | True microblades, small flakes, but backed segments rare (Deacon 1984) *(AS2002)* | |
| **Smithfield**<br>Holocene boundary *(AS2002)* | General: Large convex scrapers, but typical LSA backed microliths and convex endscrapers ('thumbnail' scrapers) are rare *(AS2002)* | | |
| | Cave of Hearths, Limpopo, South Africa<br>Bed 10 | Smithfield (CJ1965) | |
| **Wilton**<br>3-8 ka *(AS2002)* | General: Characterized by very small geometric microliths and thumbnail scrapers on fine-grained raw material *(AS2002)* | | |
| | Boomplaas Cave<br>(14C) 4.45±0.75, 5.0±0.75 *(SR1982)* | Wilton LSA, 4 painted stones (Deacon, Deacon & Brooker 1976) like those at Klasies River Mouth Cave 5 LSA *(SR1982)* | |
| **Tshitolian** | | | |
| | Kinshasa | | |
| | Bene Tshitolo | | |
| **Nachikuan** | | | |
| | Nachikufu | | |

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