

## KALAMBO FALLS PREHISTORIC SITE

#### III

The local basin in the Kalambo River valley above the famous Falls on the boundary between Zambia and Tanzania provides one of the longest records of human activity so far recovered from a single site in the African continent. Successive occupation levels and horizons cover the long period from the close of the Acheulean Industrial Complex to the present day. The site is unique in that – besides very rich and representative series of cultural finds – wood, other vegetable remains, charcoals, and pollens have been preserved, often in association with rich lithic assemblages. This enables the cultural evolution to be seen in relation to the changing ecological conditions of later Quaternary times and an appreciation to be made of the prehistoric groups who lived there. Attempts to date these stages have been made by the radiocarbon method, by U-series and ESR. The estimated age of the oldest occupation is c.300 Kya.

The final volume of this major site report, which deals with the Middle and Earlier Stone Age period, completes the project, initiated with the publication of Volume I (1969) on the geology, palaeoecology and detailed stratigraphy of the excavations, and Volume II (1974) on the later prehistoric cultures. Volume III also contains a discussion of the significance of the site and its place in the general prehistory of the continent.

J. DESMOND CLARK is Professor Emeritus of Anthropology at the University of California, Berkeley, where he taught from 1961 to 1986. Between 1938 and 1961, he was Director of the Rhodes-Livingstone Museum in Zambia. He has been author, co-author or editor of nineteen books on African and Indian prehistory and more than three hundred articles in scientific journals

© Cambridge University Press

# KALAMBO FALLS PREHISTORIC SITE

III

THE EARLIER CULTURES: MIDDLE AND EARLIER STONE AGE

### J. DESMOND CLARK

ASSISTED BY

JULIE CORMACK AND SUSAN CHIN

WITH CONTRIBUTIONS BY

M. R. KLEINDIENST, DAVID TAYLOR, ROBERT MARCHANT,
ALAN C. HAMILTON, KATHY D. SCHICK, DEREK A. ROE, NICHOLAS TOTH,
STEPHEN W. EDWARDS, JOHN A. J. GOWLETT, R. H. CROMPTON,
LI YU, R. M. ORGAN, CURTIS McKINNEY AND
YOHANNES ZELEKE





> PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS

The Edinburgh Building, Cambridge CB2 2RU, UK http://www.cup.cam.ac.uk
40 West 24th Street, New York, NY 10011-4211, USA http://www.cup.org
10 Stamford Road, Oakleigh, Melbourne 3166, Australia
Ruiz de Alarcón 13, 28014 Madrid, Spain

© Cambridge University Press 2001

This book is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2001

Printed in the United Kingdom at the University Press, Cambridge

Typeface Monotype Baskerville 10/12 pt System QuarkXPress<sup>TM</sup> [se]

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing in Publication data

ISBN 0 521 20071 7 hardback



TO

#### TIM D. WHITE

THE BEST OF FRIENDS AND FINEST OF COLLEAGUES WITHOUT WHOSE ENCOURAGEMENT AND SUPPORT THIS BOOK MIGHT NOT HAVE BEEN COMPLETED



#### **CONTENTS**

	List of tables List of figures List of plates List of contributors	<i>page</i> ix xi xvii xix
I	Geology, sedimentation, chronology and the history of the excavations J. D. CLARK	I
2	The Stone Age cultural sequence: terminology, typology and raw material J. D. CLARK AND M. R. KLEINDIENST	34
3	A reanalysis and interpretation of palynological data from the Kalambo Falls prehistoric site DAVID TAYLOR, ROBERT MARCHANT AND ALAN C. HAMILTON	66
4	The Middle Stone Age: the Lupemban Industrial Complex (Nakisasa and Siszya Industries); aggregates from Rubble I, sites A-D with Red Rubble Bed and Pits Channel in the A4 Trench, Mbwilo Member J. D. CLARK	82
5	The Chipeta Industry of the Sangoan Industrial Complex: the archaeology of the Mkamba Member, Ochreous Sands Bed J. D. CLARK	<sup>2</sup> 34
6	The Bwalya Industry: Inuga phase (Final Acheulean) and Moola phase (Upper Acheulean) J. D. CLARK	286
7	An examination of Kalambo Falls Acheulean Site B5 from a geoarchaeological perspective KATHY D. SCHICK	463
8	Modified, used and other wood and plant specimens from Bwalya Industry Acheulean horizons J. D. CLARK	481
9	The Kalambo Falls large cutting tools: a comparative metrical and statistical analysis DEREK A. ROE	492
10	Experiments in quarrying large flake blanks at Kalambo Falls NICHOLAS TOTH	600
11	A modern knapper's assessment of the technical skills of the Late Acheulean biface workers at Kalambo Falls STEPHEN W. EDWARDS	605

vii

 $www.cambri\underline{dge.org}$ 

© Cambridge University Press



#### CONTENTS

12 Allometric comparisons between Acheulean and Sangoan large cutting tools at Kalambo Falls J. A. J. GOWLETT, R. H. CROMPTON AND LI YU	612
13 Kalambo Falls: retrospect and prospect J. D. CLARK	620
14 A view of the Kalambo Falls Early and Middle Stone Age assemblages in the context of the Old World Palaeolithic DEREK A. ROE	636
Appendix A Plant foods in African prehistory: a possible basis for a seasonal model for the use of wild food resources at Kalambo Falls J. D. CLARK	648
Appendix B Geophagy and Kalambo Falls clays J. D. CLARK	659
Appendix C Carbowax and other materials in the treatment of waterlogged Palaeolithic wood R. M. ORGAN	663
Appendix D The uranium-series age of wood from Kalambo Falls GURTIS McKINNEY	665
Appendix E Study of a sample of Acheulean flakes and fragments from Site A <sub>4</sub> 1963, River Face and A <sub>5</sub> Extension at Kalambo Falls	
YOHANNES ZELEKE	675
References	682
Index	690
Plates	702



#### **TABLES**

1.1	The Kalambo Falls prehistoric site: rock stratigraphic units (Clark 1969: Table		5.2	B1, 1956: artefacts from Sangoan (Chipeta Industry) Horizon IV	<sup>2</sup> 75
	I)	Page 5	5.3	B1, 1956 Sangoan (Chipeta Industry) Horizon	
1.2	The cultural sequence at Kalambo Falls:			IV: flake details	276
	summary of aggregate composition, strati-		5.4	B2, 1959: artefacts from Channel deposits	
	graphy and dating of the main archaeological			over Horizon IV, Sangoan (Chipeta Industry)	277–8
	units (Clark 1974: Table 10)	10-11	5.5	B2, 1959 Channel deposits over Horizon IV:	
1.3	Archaeological horizons and aggregates from			flake details, Sangoan (Chipeta Industry)	279
	Kalambo Falls prehistoric site: provisional		5.6	B2, 1959 Channel deposits: artefacts from	
	nomenclature and correlation (Clark 1969:			Subunit 2, Horizon IV, Sangoan (Chipeta	_
	Appendix K)	16		Industry)	280−1
1.4	Calibrated radiocarbon ages from excavated		5∙7	B2, 1959 Channel deposits, Subunit 2, Horizon	_
	samples of Holocene age, Kalambo Falls pre-		_	IV: flake details, Sangoan (Chipeta Industry)	282
	historic site	25	5.8	B2, 1959 Channel deposits under Horizon IV	_
3.1	Summary of stratigraphic position of	_		(subunit 3): Sangoan (Chipeta Industry)	283-4
	reanalysed pollen samples	76 <del>-</del> 7	5.9	B2, 1959 Channel deposits under Horizon IV	
3.2	Recalculated raw pollen counts, based on van			(subunit 3): flake details, Sangoan (Chipeta	_
	Zinderen Bakker's per cent data	78–8ı	_	Industry)	285
4.1	B2, 1959 artefact classes: Rubble Ia, Mbwilo		6.1	A1, 1953 Horizon IV: Final Acheulean aggre-	
	Member (Clark 1974: Table 22)	209-11	_	gate	413
4.2	B2, 1959: measurements of flakes and cores in			A1, 1953 Horizon IV: flake details	414
	Rubble Ia, Mbwilo Member (Clark 1974:		6.3	A1, 1953 Horizon V: Upper Acheulean aggre-	
	Table 23)	212-13	_	gate	415
4.3	B2, 1959: attributes of scraper classes in		6.4	A1, 1953 Horizon V: flake details, Upper	_
	Rubble Ia (Clark 1974: Table 26)	214	_	Acheulean	416
4.4	A4, 1959, Pit 2, artefact incidence: Red		6.5	A1, 1953 Horizon VI: Upper Acheulean	
	Rubble Bed (Clark 1974: Table 18)	215		aggregate	417
<b>4</b> ·5	A4, 1963, Pit 3: hillslope aggregates from Red			A1, 1953 Horizon VI: flake details	418
	Rubble Bed (Clark 1974: Table 17)	216	6.7	A1, 1955 Horizon IV: Final Acheulean aggre-	
4.6	Artefact aggregates from A4 excavation			gate	419
	Rubbles IIa and IIb: Nakisasa Industry	217		A1, 1955 Horizon IV: flake details	420
4.7	B1, 1956 Rubble I Composite: artefact aggre-		6.9	A1, 1955 Horizon V. Upper Acheulean aggre-	
	gate	218-19		gate	421
4.8	B1, 1956 Rubble I Composite: analysis of			A1, 1955 Horizon V: flake details	422
	certain classes of shaped tools	220~I	6.11	A1, 1955 Horizon VI. Upper Acheulean	
4.9	B1, 1956 Rubble I Composite: large and small		C	aggregate	423
	scraper classes	220		A1, 1955 Horizon VI: flake details	423
1.10	B2, 1959 Rubble Ib artefact aggregate: arte-		6.13	A1, 1956 artefacts from sands over Horizon	
	facts from between Rubble Ia and Ib	222-4	6	N	424
4.11	B2, 1959 Rubble Ib horizon: artefact aggre-		0.14	A1, 1956 from sands over Horizon IV: flake	
	gate	225~7	<i>c</i>	details	424
	B2, 1959 Rubble Ib horizon: flake details	228-9	0.15	A1, 1956 Horizon IV: Final Acheulean aggre-	6
	D2, 1956: artefacts from Rubble I Composite	230-1	c .c	gate	425-6
	D2, 1956: analysis of handaxes and core-axes	232-3		A1, 1956 Horizon IV: flake details	427
	D2, 1956: analysis of utilised pieces Sangoan (Chipeta Industry) artefacts from A4	232-3	0.17	At, 1956 over Horizon V: Final or Upper	0
J.1	Trench and River Face, 1959 and 1963	074	6.0	Acheulean aggregate A1, 1956 over Horizon V: flake details	428
	Trenen and River Pace, 1959 and 1903	274	0.10	Ai, 1930 over Horizon v. nake details	428

© Cambridge University Press www.cambridge.org

ix



#### LIST OF TABLES

6.10	A1, 1956 Horizon V (and Va): Upper		0.0	Weight. Handaxes plus Site B Horizon IV	
3	Acheulean aggregate.	429-30	3.3	Coreaxes and Site B Horizon V Backed	
6.20	A1, 1956 Horizon V (and Va): flake details	431		Knives	572-3
	A1, 1956 Horizon Vb: Upper Acheulean		9.10	Length. Handaxes plus Site B Horizon IV	0, 0
	aggregate.	432-3		Coreaxes and Site B Horizon V Backed	
6.22	A1, 1956 Horizon Vb: flake details	434		Knives	572-3
6.23	A1, 1956 under Horizon V: artefacts	435	9.11	Thickness/Breadth Ratio. Handaxes plus Site	
	A1, 1956 under Horizon V: flake details	436		B Horizon IV Coreaxes and Site B Horizon	
6.25	A1, 1956 Horizon VI: Upper Acheulean			V Backed Knives	574
	aggregate	437	9.12	T <sub>1</sub> /L Ratio Handaxes plus Site B Horizon IV	
6.26	A1, 1956 Horizon VI: flake details	438		Coreaxes and Site B Horizon V Backed Knives	574
6.27	A5 Composite and A5 Lower: Acheulean		9.13	Breadth/Length Ratio. Handaxes plus Site B	
	aggregate	439		Horizon IV Coreaxes and Site B Horizon V	
6.28	B1, 1953 Horizon V: Upper Acheulean			Backed Knives	575
	aggregate	440	9.14	B <sub>1</sub> /B <sub>2</sub> Ratio. Handaxes plus Site B Horizon	
6.29	B1, 1953 Horizon V: flake details	44 I		IV Coreaxes and Site B Horizon V Backed	
6.30	B1, 1955 Horizon V: Upper Acheulean			Knives	576−7
	aggregate	442	9.15	L <sub>1</sub> /L Ratio. Handaxes plus Site B Horizon	
	B1, 1955 Horizon V: flake details	443		IV Coreaxes and Site B Horizon V Backed	
6.32	B1, 1956 Horizon V: Upper Acheulean			Knives	578
	aggregate	444 <sup>-</sup> 5	9.16	T-test values. Metrical analysis of Handaxes	
	B1, 1956 Horizon V: flake details	446		plus Site B Horizon IV Coreaxes and Site B	
6.34	B1, 1956 Horizon VI: Upper Acheulean			Horizon V Backed Knives	579
	aggregate	447–8		Weight. Cleavers	580-1
	B1, 1956 Horizon VI: flake details	449		Length. Cleavers	58o−ı
6.36	B2, 1959 Horizon V: Upper Acheulean			Thickness/Breadth Ratio. Cleavers	582
	aggregate	450-I		T <sub>1</sub> /L. Cleavers	582
	B2, 1959 Horizon V: flake details	452		Breadth/Length Ratio. Cleavers	583
6.38	B2, 1959 Horizon VI: Upper Acheulean			B <sub>1</sub> /B <sub>2</sub> Ratio. Cleavers	584-5
_	aggregate	453-4		L <sub>1</sub> /L Ratio. Cleavers	586
	B2, 1959 Horizon VI: flake details	455		Cleaver Edge Angle. Cleavers	587
6.40	B2, 1959 Horizon VII: Upper Acheulean	_	9.25	Cleaver Edge Length/Breadth Ratio.	
_	aggregate	456-7		Cleavers	588
	B2, 1959 Horizon VII: flake details	458		T-test values. Metrical analysis of Cleavers	589
6.42	B2, 1959 Horizon VIII: Upper Acheulean	_	9.27	Weight. Classified Artefacts of Different Raw	
_	aggregate	459 <sup>-6</sup> 0	_	Materials	590-1
	B2, 1959 Horizon VIII: flake details	461	9.28	Length. Classified Artefacts of Different Raw	
6.44	B <sub>5</sub> , 1963 Horizon V: Upper Acheulean	_		Materials	590-1
_	aggregate	462	9.29	Thickness/Breadth Ratio. Classified Artefacts	
	Comparison of Horizon V aggregates	462		of Different Raw Materials	592
7.1	Artefact types excavated from Acheulean		9.30	T <sub>1</sub> /L Ratio. Classified Artefacts of Different	
	Occupation Horizon V at Site B <sub>5</sub> , Kalambo			Raw Materials	592
	Falls	473	9.31	Breadth/Length Ratio. Classified Artefacts of	
7.2	Assemblage comparisons between Kalambo			Different Raw Materials	593
	Falls B <sub>5</sub> , Horizon V, and Montagu Cave		9.32	B <sub>1</sub> /B <sub>2</sub> Ratio. Classified Artefacts of Different	
	layer 3	478		Raw Materials	594 <sup>-</sup> 5
7.3	Acheulean assemblage contents in layer 3,	0	9.33	L <sub>1</sub> /L Ratio. Classified Artefacts of Different	6
	Montagu Cave	478		Raw Materials Classes Edge Angle Classes of Different	596
7.4	Montagu Cave layer 5: assemblage characteristics in the four harizons (AIII IV V VI)		9.34	Cleaver Edge Angle. Cleavers of Different	
٠.	istics in the four horizons (VIII, IX, X, XI)	479		Raw Materials Classer Edge Length / Proadth Potic	597
-	Weight. All bifaces together	564-5	9.35	Cleaver of Different Pay Materials	
_	Length. All bifaces together Thickness (breadth, All bifaces together)	564-5 -66	۰ ۵۶	Cleavers of Different Raw Materials  Tetest values Metrical analysis of Classified	597
	Thickness/breadth. All bifaces together	566 566	9.30	T-test values. Metrical analysis of Classified	εοΩ <u>-</u> -
	T <sub>1</sub> /L ratio. All bifaces together  Breadth (length ratio All bifaces together	566		Artefacts of Different Raw Materials: Biface data: basic measurements	598 <del>-</del> 9
	Breadth/length ratio. All bifaces together	567 568-0	_		661
	B <sub>1</sub> /B <sub>2</sub> ratio. All bifaces together	568-9		List of clay samples from old Kalambo Lake	661
	L <sub>1</sub> /L ratio. All bifaces together  T-test values. Metrical analysis of all bifaces.	570		Clay samples from old Kalambo Lake	
9.0	T-test values. Metrical analysis of all bifaces	e=11		Sangoan Acheulean Upper Level	673
	together	571		Acheulean Lower Level	673 674

#### **FIGURES**

The larger illustrations, Figs. 1.1, 1.12-1.14 and 1.16-1.21, are positioned at the end of the book.

1.1	Kalambo Falls and surrounding country: locality		2.1	Characteristics of flakes (reprinted from Clark	
	maps (reprinted from Clark 1969: Fig. 1)			1974: <b>Fig.</b> 7)	40
1.2	Provisional geological map of the local basin at		2.2	Characteristics of cores (reprinted from Clark	
	Kalambo Falls (reprinted from Clark 1969: Fig.			1974: Fig. 8)	42
	5)	Page 2	2.3	Modification and retouch categories (reprinted	-
1.3	Outlines of Site A excavations, showing grids	Ū	J	from Clark 1974: Fig. 9)	44
3	(reprinted from Clark 1969: Fig. 18)	6	2.4	Retouch and utilisation (reprinted from Clark	
1.4	Plan of Site A, 1963 (reprinted from Clark 1969:			1974: Fig. 10)	47
	Fig. 19)	7	2.5	Large cutting tools (reprinted from Clark 1974:	1,
15	Plan of Site B, 1963 (reprinted from Clark 1969:	,	<u>J</u>	Fig. 11)	51
•••	Fig. 33)	8	26	Heavy duty tools: core-axes and picks (reprinted	J-
r 6	Site B excavations, showing grids (reprinted from	J	2.0	from Clark 1974: Fig. 12)	52
1.0	Clark 1969: Fig. 34)	•	0.7	Heavy duty tools: scrapers, choppers, etc.	3-
1 7	Site A: east wall section of A1 excavation, 1956	9	2./	(reprinted from Clark 1974: Fig. 13)	5.0
1./	(reprinted from Clark 1969: Fig. 20)	10-10		Light duty tools: microliths, points, discs	53
. 0		12-13	2.0	(reprinted from Clark 1974: Fig. 14)	
1.0	Site A: section at south wall of A1 excavation,				55
	1956 (reprinted from Clark 1969: Fig. 21)	17	2.9	Light duty tools: scrapers, burins, etc. (reprinted	-6
1.9	Site A: sections at west wall of AI excavation,			from Clark 1974: Fig. 15)	56
	1956 (reprinted from Clark 1969: Fig. 22)	19	3.1	Map of Kalambo Falls prehistoric site, showing	
1.10	Site A: north wall section of A1 excavation, 1956			location of main excavation sites from which	
	(reprinted from Clark 1969: Fig. 23)	21		pollen samples were collected during the period	
1.11	Site A: section of A6 excavation, 1966 (reprinted			1956–66	67
	from Clark 1969: Fig. 27)	23	3.2	DCA output for thirty-three reanalysed pollen	
1.12	Site A: west wall section of A4 excavations, 1959			samples from Kalambo Falls prehistoric site	70
	and 1963 (reprinted from Clark 1969: Fig. 28)		3-3	DCA output for thirty-three reanalysed pollen	
1.13	Site A: east wall section of A4 excavations, 1956			samples from Kalambo Falls prehistoric site	71
	and 1963 (reprinted from Clark 1969: Fig. 29)		3.4	Percentage abundances of pollen types allocated	
1.14	Site A: composite section of River Face Cliff			to five ecological categories	72
	based on excavations, 1956 and 1963 (reprinted		4.1	Lengths and breadths and ratios of unmodified	
	from Clark 1969: Fig. 32)			flakes from Rubble Ia, Site B2, 1959 (reprinted	
1.15	Site A: east, west and south wall sections, A5			from Clark 1974: Fig. 28)	124
	excavation, 1963 (reprinted from Clark 1969: Fig.		4.2	Plan forms, platform types, dorsal scar patterns	
	31)	26	_	and raw material of unmodified flakes and	
1.16	Site B: north and east wall sections of B1 excava-			blades from Rubble Ia, Site B2, 1959 (reprinted	
	tion, 1956 (reprinted from Clark 1969: Fig. 35)			from Clark 1974: Fig. 29)	125
1.17	Site B: north wall sections of B2 excavation, 1959		4.3	Details of core classes from Rubble Ia, Site B2,	
•	(reprinted from Clark 1969: Fig. 36)			1959 (reprinted from Clark 1974: Fig. 30)	126
81.1	Site B: south wall section of B2 excavation, 1959		4.4	Lengths and breadth/length ratios of small	
	(reprinted from Clark 1969: Fig. 37)		• •	scrapers, Rubble Ia, Site B2, 1959 (reprinted	
01.1	Site B: west wall section of B2 excavation, 1959			from Clark 1974: Fig. 31)	127
3	(reprinted from Clark 1969: Fig. 38)		4.5	Breadth/length ratios of large cutting, heavy	,
1.20	Site B: east wall section of B2 excavation, 1959		4.3	duty and light duty tools from Rubble Ia, Site	
	and sections in pits B3 and B4, 1959 (reprinted			B2, 1959 (reprinted from Clark 1974: Fig. 32)	128
	from Clark 1969: Fig. 39)		4.6	Artefact distribution plot, A1/56 Rubble Ic	
1.21	Site D: east and south wall sections (reprinted		4.0	Composite	129
	from Clark 1969: Fig. 41)		47	Artefacts from Rubble Ic(i) and combined (ii) and	129
	1909. 1 15. 41/		4./	. I clack it off rubble ich and combined (ii) and	

хi

	(iii), A1 excavation, 1956 and No 12 from A4/59 River Face; selected as later to final Lupemban (Siszya Industry).	130–1	4.27	Tools from 'Main Erosion Surface', Rubble I in A4 excavation, 1959; probably derived from Rubble II and, therefore, earlier Lupemban	
4.8	Artefacts from Rubble Ic(i) and Ic Composite, A4/59, River Face excavation (No. 15), and Ic(ii) and Ic Composite from A1 excavation, 1956;		4.28	(Nakisasa Industry) Earlier Lupemban (Nakisasa Industry) tools from stone line correlated with Rubble IIb, A4 excava-	169
	selected as later to final Lupemban (Siszya			tion, Pit 1, 1963	170
	Industry). Artefacts from Rubble Ic(ii) and Ic(iii), A 1	132–3	4.29	Artefact distribution plot, B1/56 Rubble Ic Composite	
4.9	excavation, 1956; selected as later to final		4.20	Artefacts from B1/56 Rubble I Composite (Nos.	171
	Lupemban (Siszya Industry)	134-5	4.30	6 and 11); remainder from B2 excavation, 1959;	
4.10	Artefacts from the lower half of the Red Rubble	31 3		selected as later to final Lupemban (Siszya	
•	Bed, A4 excavation, pits 2 and 3, 1959 and 1963;			Industry)	172-3
	later to final Lupemban (Siszya Industry)	136–7	4.31	Artefacts from Rubble I Composite, B1 excava-	
4.11	Artefacts from Rubble Ic(i), A 1 excavation, 1956			tion, 1956, and remainder from Rubble Ib, B2	
	except no 11, from A4/59 River Face; selected as	0		excavation, 1959, and D2/56 (No. 9); Selected as	
	later to final Lupemban (Siszya Industry)	138–9		later to final Lupemban (Siszya Industry)	174-5
4.12	Artefacts from Rubble Ic(iii), At excavation,		4.32	Artefacts from Rubble I Composite (Nos. 15, 19,	
	1956; selected as later to final Lupemban (Siszya Industry)	140-1		20, 22, 30 and 31), B1 excavation, 1956, and remainder from Rubble Ib and between Ia and	
4.12	Artefacts from Rubble Ic(i), AI excavation, 1956	140 1		Ib, B2 excavation, 1959; selected as later to final	
43	and A4 River Face, 1959; selected as later to final			Lupemban (Siszya Industry)	176-7
	Lupemban (Siszya Industry)	142-3	4.33	Artefacts from Rubble I Composite (Nos. 5 and	-,- ,
4.14	Artefacts from Rubble Ic(i) and Ic(iii), Ar excava-		100	8), B1 excavation, 1956; D2 1956 (No. 11);	
	tion, 1956; selected as earlier Lupemban			remainder from Rubble Ib, B2 excavation, 1959;	
	(Nakisasa Industry)	144-5		selected as later to final Lupemban (Siszya	
4.15	Artefacts from Rubble Ic(i) and Ic(ii), AI excava-			Industry)	178–9
	tion, 1956; selected as earlier Lupemban		4.34	Artefacts from Rubble I Composite (Nos. 8, 10	
6	(Nakisasa Industry)	146-7		and 17), B1 excavation, 1956, and remainder	
4.10	Artefacts from Rubble Ic(i), Ic(ii) and Ic(iii), A1 excavation, 1956; selected as earlier Lupemban			from Rubble Ib and between Ia and Ib, B2 excavation, 1959; selected as later to final	
	(Nakisasa Industry)	148-9		Lupemban (Siszya Industry).	180-1
4.17	Artefacts from Rubble Ic(i), AI excavation, 1956,	-1- 3	4.35	Artefacts from Rubble I Composite, B1 excava-	
• •	and Site A4 River Face excavation, 1959 (No. 7);		1 33	tion, 1956, and remainder from B2 excavation,	
	selected as earlier Lupemban (Nakisasa Industry)	150-1		1959, Rubble Ib; (Nos. 4 and 6) and between Ia	
4.18	Earlier Lupemban tools (Nakisasa Industry) from			and Ib; selected as later to final Lupemban	
	Rubble correlated with IIa and IIb in A4 excava-			(Siszya Industry)	182–3
	tion, Pit 1, 1963	152–3	4.36	Core-axes from Rubble I Composite, B1 excava-	
4.19	Core-axes and pick, earlier Lupemban (Nakisasa			tion, 1956, and Rubble Ib, B2 excavations, 1959. Selected as earlier Lupemban (Nakisasa	
	Industry) from Rubble IIb, A4 excavation, 1959, Pit 2 and Extension, 1963.	1 E 4E		Industry).	184-5
4.20	Tools from Rubble I Composite in A4 excava-	154-5	4.37	Artefacts from Rubble I Composite, B1 excava-	104 5
7.20	tion, 1959, and Rubble Ia in A3 excavation, 1956;		4.37	tion, 1956, and Rubble Ib, B2 excavation, 1959;	
	probably derived from the Red Rubble Bed, and			selected as earlier Lupemban (Nakisasa	
	therefore late to final Lupemban (Siszya			Industry)	186–7
	Industry)	156–7	4.38	Artefacts from Rubble I Composite, B1 excava-	
4.21	Artefacts from Red Rubble Bed, A4 excavation,			tion, 1956 (No. 6) and from stonelines Ia and Ib,	
	1959, Pit 1; selected as late to final Lupemban	ο.		B2 excavation, 1959; selected as earlier	-00 -
	(Siszya Industry) Artefacts from the upper half of the Red Rubble	158–9	4.00	Lupemban (Nakisasa Industry)	188-9
4.22	Bed, A4 excavation, Pit 2, 1959; selected as late to		4.39	Artefacts from Rubble I Composite, B1 excava- tion, 1956, and from Rubble Ib, B2 excavation,	
	final Lupemban (Siszya Industry)	160~1		1959; selected as earlier Lupemban (Nakisasa	
4.23	Earlier Lupemban (Nakisasa Industry) and			Industry)	190-1
1 5	derived Sangoan tools from Rubble IIa and IIb,		4.40	Artefacts from Rubble I Composite, B1 excava-	<b>J</b> -
	A4 excavation, 1959	162–3		tion, 1956, and Rubble Ia, B2 excavation, 1959;	
4.24	Earlier Lupemban (Nakisasa Industry) artefacts			selected as earlier Lupemban (Nakisasa Industry)	192-3
	from Rubble IIa and IIb, A4 excavation, 1959	164–5	4.41	Artefacts from Rubble I Composite, B1 excava-	
4.25	Earlier Lupemban (Nakisasa Industry) tools from			tion, 1956, and Rubble Ib, B2 excavation, 1959;	
	Rubble IIa and IIb, A4 excavations, 1959 and 1963,	166	4 40	selected as earlier Lupemban (Nakisasa Industry)	194-5
4 06	with one specimen (No. 1) from channel ("Z") Earlier Lupemban (Nakisasa Industry) tools from	166–7	4.42	Artefacts from Rubble Ia, B2 excavation, 1959; selected as later to final Lupemban (Siszya	
4.40	Rubble IIa, A4 excavation, Pit 2 Extension, 1963	168		Industry)	196-7
	, 1			· · · · · · · · · · · · · · · · · · ·	J 1



#### LIST OF FIGURES

	Artefacts from Rubble Ia, excavation B2, 1959;		6.4	Upper Acheulean flake tools from Site A,	
4.43	Arteracts from Rubble 1a, excavation b2, 1959,		0.4		
	selected as later to final Lupemban (Siszya	. 0	c	Horizon VI, 1953 excavation	332
	Industry)	198–9		Sites A and B: Upper Acheulean flakes and cores	334-5
4.44	Lanceolates from Rubble Ib, B2 excavation,			Sites A and B: Upper Acheulean handaxes	336-7
	1959; selected as earlier Lupemban (Nakisasa		6.7	Artefact distribution plot, A1/56, Horizon IV	338
	Industry)	200-1	6.8	Final Acheulean tools from Horizon IV and	
4.45	Artefacts from Rubble I Composite, B1 excava-			immediately over, A1/56 excavation	339
. 15	tion, 1956 and from Rubble Ib, B2 excavation,		6.0	Final Acheulean handaxes and cleavers from	555
	1959; selected as earlier Lupemban (Nakisasa		5	Horizon IV, A1/56 excavation	340-1
	- 1 Tail	202-0	6 10	Final Acheulean picks from Horizon IV, A1/56	340 .
6	Industry)	202–3	0.10		240-2
4.40	Core-axes from Rubble I, D2 excavation, 1956			excavation	342-3
	and Rubble Ib, B2 excavation, 1959; selected as		0.11	Site A (Horizon IV) and Site B (Horizon V):	
	earlier Lupemban (Nakisasa Industry)	204–5	_	Upper Acheulean small tools and core-scrapers	344 <sup>-</sup> 5
4-47	Core-axes from Rubble Ib, B2 excavation, 1959;			Artefact distribution plot, A1/56, Horizon V	346
	selected as earlier Lupemban (Nakisasa Industry)	206–7	6.13	Artefact distribution plot, A1/56, Horizon Vb	347
4.48	Artefact distribution plot, D2/56 Rubble Ic		6.14	Sites A and B: Upper Acheulean cleavers from	
	Composite	207		Horizon V	348
4.49	Analysis of artefacts from D2/56 Rubble I		6.15	Sites A and B: Upper Acheulean cores	<b>34</b> 9
	Composite (Stoneline 1)	208		Upper Acheulean (Bwalya Industry, Moola	0.0
5. I	Sangoan (Chipeta Industry) handaxes (various)	248-g		Phase) bifaces from A1/56, Horizon Vb	350-1
	Sangoan and Final Acheulean artefacts from A4	-4- 3	6 17	Upper Acheulean handaxes and knife from	JJ° -
J-2	River Face excavation A <sub>5</sub>	050-1	0.17	A1/56, Horizon VI and from B2/59 Horizon VIII	050-0
- 0		250-1	6.0		<b>352</b> <sup>-</sup> 3
5.3	Sangoan core-axes from Ochreous Sands		0.10	Site A: Upper Acheulean handaxes from A1/56,	
	Channel B1/56, Horizon IV, A4 River Face		c	Horizon VI	354
	Extension 1959 and B2/59, Horizon IV	252-3	0.19	Upper Acheulean (Bwalya Industry, Moola	
5∙4	Sangoan (Chipeta Industry) small tools and util-		_	Phase) cleavers from A1/56, Horizon VI	355
	ised/modified flakes	<sup>2</sup> 54 <sup>-</sup> 5	6.20	Upper Acheulean (Bwalya Industry, Moola	
5.5	Sangoan artefacts from the Ochreous Sands Bed			Phase) tools from A1/56 excavation, Horizon VI	356-7
	Mkamba Member	256 <del>-7</del>	6.21	Sites A and B: Upper Acheulean flakes, core-	
5.6	Artefact distribution plot, B1/56, Horizon IV	258		axes and tools	358-9
	Sangoan (Chipeta Industry) core-axes from	ŭ	6.22	Upper Acheulean (Bwalya Industry, Moola	00 0
٠,	Horizon IV, B1/56 excavation	258-9		Phase) handaxes, cleaver and pick from A6/66	
5.8	Sangoan (Chipeta Industry) tools and cores from	J- J		excavation, Horizon 2.	360
J. J	Horizon IV and associated sands	260-1	6 22	Upper Acheulean small tools from A6/66	300
E 0	Sangoan (Chipeta Industry) small tools from	200 1	0.23	excavation	361
3.9	Horizon IV, stone line	262-3	6.04	Site A: Sangoan and Final Acheulean artefacts	301
*		202 3	0.24		a6a a
5.10	Sangoan (Chipeta Industry) tools from Ochreous	-C	6	from A5/63 Composite horizon	362-3
	Sands Bed subunit 1, B2/59 excavation	264–5	0.25	Final Acheulean bifaces from Site A, A <sub>4</sub> RF	
5.11	Sangoan (Chipeta Industry) core-axes from			extension, A5/63	364-5
	Horizon IV in Channel Sands subunit 2	266	6.26	Final Acheulean (Bwalya Industry, Inuga Phase)	
5.12	Sangoan (Chipeta Industry) pick and core-axes			bifaces from Site A, A <sub>4</sub> RF Extension A <sub>5</sub> /6 <sub>3</sub>	<b>366</b> –7
	from Ochreous Sands Channel, Horizon IV and		6.27	Final Acheulean (Bwalya Industry, Inuga phase)	
	below	267		from Site A, A <sub>4</sub> RF Extension/A <sub>5</sub> Composite,	
5.13	Sangoan (Chipeta Industry) artefacts from			1963.	<b>368</b> −9
	Ochreous Sands Channel over (subunit 1) the		6.28	Site B: Upper Acheulean tools from Horizon VI	370-1
	Horizon IV stone line	268–9		Site B: Upper Acheulean small tools from	<b>5,</b>
5.14	Artefact distribution plot, B2/59, Horizon IV	270	3	Horizon V	372-3
	Sangoan cleaver and 2 core-axes from B2/59	-/-	6 20	Artefact distribution plot of all artefacts from	3/- 3
<b>3.1</b> 3	excavation in Ochreous Channel Sands subunit		0.30	1956, 1959 and 1963 excavations	074
	2 (Horizon IV stone lines) and Site D 1956 exca-		6 01	Distribution of bifaces from B1/56, B2/59,	374
	vations		0.31		
		271	<i>c</i>	B5/63 Acheulean Horizon V	375
5.10	Sangoan (Chipeta Industry) core-axes from		0.32	Site B: Upper Acheulean lanceolate handaxes	
	Ochreous Sands Bed B2/59 excavation			from Horizon V	376
	(Horizon IV)	272	6.33	Upper Acheulean handaxes and cleavers from	
5.17	Weight comparisons of Acheulean bifaces and		_	Horizon V	377
	Sangoan core-axes by raw material	273	6.34	B Site: Upper Acheulean artefacts from B2/59	
6.1	Upper Acheulean cleavers from Horizon V at			Horizon V	378-9
	Sites A and B	329-30	6.35	Site B: Upper Acheulean handaxes from	_
6.2	Upper Acheulean pick from Horizon V, Site A	-		Horizon V	380-1
	1953	331	6.36	Upper Acheulean (Bwalya Industry, Moola	-
6.3	Sites A and B: Upper Acheulean tools, cores and		•	Phase) lanceolate handaxes from B1/56 and	
-	other debitage	332-3		B <sub>2</sub> / <sub>59</sub> , Horizon V	382

xiii

6.37	Site B: Upper Acheulean cleavers from Horizon V	383	7.7	Breakdown of major artefact classes in Montagu Cave Layer 3	477
6.38	Upper Acheulean (Bwalya Industry, Moola Phase) handaxes (mostly unifacial) from B1/56	303	1.8	Pointed stake or (?) digging stick; long pointed tools; and stick with smooth truncated lower	477
	and B2/59, Horizon V	384		proximal end	482-3
6.39	Site B: Upper Acheulean knives and cleavers or	J-4	8.2	Short/club-like tool; flat/pointed tool, pointed	T J
•	side-scrapers from Horizon V	385		and spatulate ended tool; and wood fragment	484-5
6.40	Upper Acheulean core-scrapers and utilised/		8.3	Short slender stick with spatulate distal end;	
	modified tools from B1/56 and B2/59			obliquely truncated stick; short wood fragment;	
_	excavations	386 <del>-</del> 7		smoothed section of wood; obliquely truncated	
6.41	Site B 1956, Horizon V: spheroid of quartz and			stick with greenstick fracture; short torpedo	
_	bifacial pick	388		shaped piece of wood with remains of a hole;	
	Site B: Upper Acheulean primary flakes	389		irregular piece of wood with hole; and thin sliver	
6.43	Site B: Upper Acheulean flaking waste, flakes			of wood	486–7
c	and core rejuvenation spalls	390-1	8.4	Pointed tool; wooden tapering splint; concavo-	
0.44	Distribution of tree trunks and other wood,		0 -	convex wood fragment; and pointed fragment	<b>488</b> –9
6	B1/56 excavation under Horizon V	392	0.5	Flat, spatula-type fragment; irregular wood frag-	
0.45	Acheulean handaxe from B1/56 excavation, Horizon VI	200		ment; broad flattish pointed specimen; and wood	400-1
6 46	Site B: Upper Acheulean tools from Horizon VI	393		Percentage frequency histograms to show the	490-1
	Excavation B2, 1959: the stone semi-circle feature	394 <sup>-</sup> 5	9.1	classified breakdown of the large cutting tool	
0.4/	on the Acheulean Horizon V surface.	396		groups from the nine horizons at Kalambo Falls	523
6.48	Excavation B2, 1959: part of Horizon VI, Upper	390	0.2	The basic linear measurements taken from all	J <del>-</del> 3
J.75	Acheulean	397	9	implements	524
6.49	Distribution of artefacts and wood on part of	331	0.3	Measurement of cleaver edge angle and cleaver	J- <del>1</del>
13	Horizon VII, B2/1959 excavation	398	3.3	edge length	5 <sup>2</sup> 5
6.50	B <sub>5</sub> , 1963 excavation: plan of Horizon V, Upper	33	9.4	An implement aligned for measurement	5 <sup>2</sup> 5
Ü	Acheulean	399		Measurement of Li for asymmetrical implements	526
6.51	Upper Acheulean handaxe and pick from B2/59,	000		A 'double cleaver' and a cleaver with convex	•
Ü	Horizon V	400		working edge, for comparison	526
6.52	Site B: Upper Acheulean large primary flakes	401	9.7	Key to the handaxe shape diagrams	527
	Site B: Upper Acheulean primary flakes from	-		Framework for the cleaver shape diagrams.	528
	Horizon V	402-3	9.9	Array of cleaver shapes	529
6.54	Site B: Upper Acheulean scrapers and small		9.10	Handaxe shape diagram: Site A, Horizon IV	530
	tools from B2/59	404-5	9.11	Handaxe shape diagram: Site A, Horizon V/Va	531
6.55	Site B: Upper Acheulean cleaver B2/59,			Handaxe shape diagram: Site A, Horizon Vb	532
	Horizon VII	406		Handaxe shape diagram: Site A, Horizon VI	533
	Site B: Upper Acheulean artefacts from B2/59	406-7		Handaxe shape diagram: Site B, Horizon IV	534
6.57	Site B: Upper Acheulean tools from B2/59,			Handaxe shape diagram for Site B, Horizon V	535
C - 0	Horizon VIII	408		Handaxe shape diagram: Site B, Horizon VI	536
0.58	Site B: Upper Acheulean handaxes from B2/59,			Handaxe shape diagram: Site B, Horizon VII	537
6 -0	Horizon VIII Site B: Upper Acheulean cleavers and handaxes	409		Handaxe shape diagram: Site B, Horizon VIII	538
0.59	from B2/59, Horizon VIII	410		Core-axe shape diagram: Site B, Horizon IV Knife shape diagram: Site B, Horizon V	539
6 60	Site B: Upper Acheulean knives and choppers,	410		Cleaver shape diagram: Site A, Horizon IV	540
0.00	etc. from B2/59, Horizon VIII	411		Cleaver shape diagram: Site A, Horizon V/Va	541 549
6 6ı	Artefact distribution plot from B5/63,	411		Cleaver shape diagram: Site A, Horizon Vb	542 543
••••	Horizon VI	412		Cleaver shape diagram: Site A, Horizon VI	544
7.1	Map of the Kalambo Falls site area showing			Cleaver shape diagram: Site B, Horizon IV	545
•	major geological features (redrawn after Clark			Cleaver shape diagram: Site B, Horizon V	546
	1969: Fig. 1)	464		Cleaver shape diagram: Site B, Horizon VI	547
7.2	Map showing location of Kalambo Falls sites A,	• -		Cleaver shape diagram: Site B, Horizon VII	548
	B, C, and D (redrawn after Clark 1969: Fig. 2)	469	9.29	Cleaver shape diagram: Site B, Horizon VIII	549
7.3	Plan view of the artefact horizon on the		9.30	Percentage frequency histograms showing use of	
	Occupation Floor V at Kalambo Falls Site B5	470		main rock types at Kalambo Falls: whole sets of	
7.4	Breakdown of the major artefacts classes at			large cutting tools	550
	Kalambo Falls B, Floor V	471	9.31	Percentage frequency histograms showing use of	
<b>7</b> ·5	Breakdown of major categories of large cores			main rock types at Kalambo Falls: handaxes	551
_	and tools at Kalambo Falls B5, Floor V	472	9.32	Percentage frequency histograms showing use of	
7.6	Size distribution of debitage from Kalambo Falls			main rock types at Kalambo Falls: cleavers	552
	B <sub>5</sub> , Floor V compared to that produced in 107		9.33	Percentage frequency histograms showing use of	
	experiments replicating Oldowan and Acheulean			main rock types in the manufacture of knives at	
	artefacts	474		Site B, Horizon V	553

9.34	Percentage frequency histograms showing use of		13.4	Site A excavation A4 and River Face Extension	
	main rock types in the manufacture of core-axes			1959. Composition and attributes of Sangoan	6
	at Site B, Horizon IV	553		composite assemblage	630
9.35	Handaxe shape diagram: Site A, Horizon V/Va, distinguishing implements of hard quartzite and		13.5	Site B excavations B1, 1956 and B2, 1959. Comparisons of Sangoan assemblages, compo-	
		E E 4		nents and attributes, from Horizon IV.	631
0.06	feldspathic quartzite Handaxe shape diagram: hard quartzite handaxes	554	126	Site A excavation A4, 1959 and 1963.	03.
9.30	from Site B, Horizon V	555	13.0	Comparison of components and attributes of	
0.27	Handaxe shape diagram: feldspathic quartzite	333		earlier Lupemban (Nakisasa Industry) assem-	
9.37	handaxes from Site B, Horizon V	556		blages from Rubble IIa and IIb	633
0.38	Handaxe shape diagram: silicified mudstone	33	13.7	Site B excavations B1, 1956 and B2, 1959.	33
<i>3</i> -3-	handaxes from Site B, Horizon V	557	3,	Components and attributes of Lupemban	
9.39	Handaxe shape diagram: Site B, Horizon VI,	00.		(Nakisasa and Siszya Industry) assemblages from	
0 00	distinguishing implements of hard quartzite and			Rubble Ia, Ib and I Composite and with the	
	feldspathic quartzite	558		aggregate from sands over Horizon IV (Sangoan)	635
9.40	Cleaver shape diagram: Site A, Horizon V/Va,		А.1	Relative importance of weekly activities of	
	distinguishing implements of hard quartzite and			Kalaba's villagers, reflecting seasonal availability	
	feldspathic quartzite	559		of different resources	653-4
9.41	Cleaver shape diagram: Site A, Horizon VI, dis-		A.2	Relative annual importance of hunting, collect-	_
	tinguishing implements of hard quartzite and			ing and fishing of average male	655
	feldspathic quartzite	5 <b>6</b> 0	<b>A</b> .3	Annual breakdown of one male's agriculture	
9.42	Cleaver shape diagram: Site B, Horizon V, dis-			activities	656
	tinguishing implements of hard quartzite and		<b>A.</b> 4	Seasonal relationship of male agricultural pur-	
	feldspathic quartzite	56 <b>1</b>		suits and hunting	657
9-43	Shape diagram for knives from Site B, Horizon		<b>A</b> .5	Suggested models for the seasonal use of plant	
	V, distinguishing implements of hard quartzite	c		and animal resources in the local basin and sur-	C 0
	and feldspathic quartzite	562	ъ.	rounding terrain	658
9.44	Shape diagram for core-axes from Site B		D.1	The alpha-emitting isotopes and their half-lives	660
	Horizon IV, distinguishing implements of hard		ъ.	which are used in uranium-series dating	668
	quartzite, feldspathic quartzite and silicified	-6-		A graph for determining uranium-series ages	668
	mudstone	563	D.3	The distribution of uranium for each cultural	660
10.1	The hypothetical reduction sequences for the		D.	zone The distribution of samples by their uranium	669
	three principle raw material initial forms at		15.4	The distribution of samples by their uranium content and uranium ratio for each cultural level	669
	Kalambo Falls: large quartzite boulders, quartzite cobbles, and silicified mudstone		Dea	Plots by cultural level of uranium content and	oog
	chunks.	601	D.ja	age ratio for the Sangoan	670
	Experimental handaxe replications by the author	607	Dab	Plot of Th <sup>230</sup> /Th <sup>232</sup> and U <sup>234</sup> /Th <sup>232</sup> for the	0,0
	Map of African Acheulean sites from which	007	25.50	Sangoan	670
	material has been studied	613	D.5c	Plot of U <sup>234</sup> /Th <sup>232</sup> and U <sup>238</sup> /Th <sup>232</sup> for the	•
12.2	Measurement system employed	614	- 3	Sangoan	670
	Scatter plots of the Kalambo Falls A6 and B4	•	D.6a	Plots by cultural level of uranium content and	•
	biface samples illustrating Length/Breadth and			age ratio for the Acheulean Upper Level	671
	Thickness/Breadth relations	616	<b>D</b> .6b	Plot of Th <sup>230</sup> /Th <sup>232</sup> and U <sup>234</sup> /Th <sup>232</sup> for the	•
12.4	Multivariate Allometry coefficients of the			Acheulean Upper Level	671
-	Kalambo Falls Acheulean assemblage A6, seen		<b>D.6</b> c	Plot of $U^{234}/Th^{232}$ and $U^{238}/Th^{232}$ for the	
	in comparison with STIC, Kapthurin and			Acheulean Upper Level	671
	Kariandusi, and the comparable curves from the		D.7a	Plots by cultural level of uranium content and	
	set of Kilombe assemblages	617		age ratio for the Acheulean Lower Level	672
12.5	Multivariate Allometry coefficients of the		<b>D</b> .7b	Plot of Th <sup>230</sup> /Th <sup>232</sup> and U <sup>234</sup> /Th <sup>232</sup> for the	_
	Sangoan assemblage B <sub>4</sub> , seen in comparison		_	Acheulean Lower Level	672
	with Kilombe Area Z	618	D.7c	Plot of U <sup>234</sup> /Th <sup>232</sup> and U <sup>238</sup> /Th <sup>232</sup> for the	c
13.1	Site A excavation A1, 1956. Comparisons of		г	Acheulean Lower Level	672
	assemblage composition and attributes. Horizon			Flake type (Toth)	677
	IV Final Acheulean, Horizons V–VI Upper	600		Flake raw material	677 6
	Acheulean Site A granutian As 1969 Comparisons of	625		Flake physical condition	677
13.2	Site A excavation A5, 1963. Comparisons of			Flake dorsal scar	677 677
	assemblage composition and attributes. Final			Flake platform thickness Flake platform breadth	677 677
	Acheulean from A5 Composite and A5 Lower Horizons	626		Flake platform length	6 <sub>77</sub> 6 <sub>7</sub> 8
12.0	Site B Upper Acheulean from Horizons V at BI,	020		Flake platform scars	678
-3.3	1956, B2, 1959 and B5, 1963. Horizon from B1,			Flake platform angle	678
	1956 and 1959 and Horizons VII-VIII from B2,			Flake length	678
	1959. Comparisons of composition and attributes	627		Flake breadth	678



E.12	Flake thickness	678	E.22 Mid-section maximum dimension	679
E.13	Flake maximum dimension	678	E.23 Distal end raw material	68o
	Chunk raw material	6 <b>78</b>	E.24 Distal end physical condition	68o
	Chunk physical condition	679	E.25 Distal end maximum dimension	68a
	Chunk maximum dimension	679	E.26 Splits raw material	68a
E.17	Proximal end raw material	679	E.27 Splits physical condition	68a
E.18	Proximal end physical condition	679	E.28 Splits maximum dimension	<b>68</b> a
	Proximal end maximum dimension	679	E.29 Snaps raw material	681
•	Mid-section raw material	679	E.30 Snaps physical condition	68ı
	Mid-section physical condition	670	E.31 Snaps maximum dimension	68r

#### **PLATES**

The Plates are grouped together at the end of the volume, following page 701.

- 1.1 View of the Kalambo Falls from the path on the Zambian, south, side of the gorge
- 1.2 Air photograph of the local basin of the Kalambo River
- 1.3 View of the local basin looking east up the course of the river from Mkamba village at the top of the Tanganyika Cliff
- 1.4 General view of the A4 Trench in process of excavation
- 1.5 General view of the B2/59 excavation looking west to the river
- 4.1 At, 1956 excavation. South-west part of Rubble I Composite overlain by Mbwilo Member Sands and the older and younger channel fills of the Chiungu Member of the Kalambo Falls Formation
- 4.2 A4 Trench, Pit 1, 1963. Bedded sands (bed 12), some grits and some sand (bed 13) over Red Rubble (bed 14) with late Middle Stone Age, Siszya Industry artefacts
- 4.3 A4 Trench, Pit 2, 1963. Red Rubble (bed 14) with bedded sands and clay lenses below and over Rubble IIa, with earlier Lupemban (Nakisasa Industry) artefacts
- 4.4 A4 Trench, 1963, Rubble I in wall sections over sands and Rubble II exposed in floor of excavation
- 4.5 Earlier Lupemban (Nakisasa Industry) core-axes from Site B2, 1959, Rubble Ib
- 4.6 Earlier Lupemban (Nakisasa Industry) lanceolates from Site B2, 1959, Rubble Ib
- 4.7 Split cobble anvils from Rubble I at A1, 1956, B1, 1956, and B2, 1959 associated with earlier and later Lupemban (Nakisasa and Siszya Industries)
- 4.8 Later Lupemban (Siszya Industry) core-axes, to show the range of types from Rubble I at Sites A and B, 1956 and 1959.
- 4.9 Middle Stone Age lanceolates from B2 and A3, 1956 excavations
- 4.10 Blades and blade cores of the later Lupemban (Siszya Industry) from Rubble I at Sites A and B, 1956
- 5.1 A4 Trench, 1959, Rubble II in wall sections and Ochreous Sands Bed below. Sangoan artefacts only found in the basal stone line and sands
- 5.2 B2, 1959 excavation, exposing the stone line

- Horizon IV with the Sangoan (Chipeta Industry) artefacts in situ
- 5.3 Sangoan (Chipeta Industry) core-axes from B2, 1959 excavation. Ochreous Sands Channel Horizon IV and under Horizon IV
- 5.4 Sangoan (Chipeta Industry) convergent coreaxes from B2, 1959 excavation. Horizon IV and Ochreous Sands Channel under Horizon IV
- 6.1 Site A, 1953: the first excavation at Kalambo Falls exposing part of Rubble I Composite at the top of the section, cross-bedded sands below with Final Acheulean Horizon IV and coarse grey pebbly sand below over exposed surface of Acheulean Horizon V with artefacts and wood in white unbedded sands
- 6.2 A1, 1956 excavation: south-east area in process of excavation of Horizon IV with Final Acheulean artefacts and wood
- 6.3 A1, 1956 excavation looking north and showing the exposed remnant of Horizons Va and Vb with Upper Acheulean artefacts and natural rocks, some of which were possibly used as anvils
- 6.4 B1, 1956 excavation showing the north-west wall section, with Rubble I Composite at the top over coarse and fine bedded sands and clays of the Ochreous Sands Bed of the Mkamba Member
- 6.5 B1, 1956 excavation looking west, showing the exposed surface of Horizon V with many Upper Acheulean artefacts and, in the drain at the right, wood in the underlying Horizon VI
- 6.6 B1, 1956 excavation: western end showing the tree trunks interbedded with black organic clays and sands, with Upper Acheulean artefacts and plant material
- 6.7 B1, 1956 excavation: charred log and possible long pointed tool opportunistically modified by use
- 6.8 B2, 1959 excavation, looking north, showing Horizon V surface with Acheulean artefacts and, in foreground, the exposed channel bank with artefacts, wood and matted organic material
- 6.9 B2, 1959 excavation showing the semicircle of stones in grid squares G-H/2-4 on Horizon V
- 6.10 B2, 1959 excavation showing the logs and other wood, matted fibrous organic plant concentrations and Acheulean artefacts in Horizon VI

xvii

#### LIST OF PLATES

- 6.11 B2, 1959 excavation: Upper Acheulean handaxes and other artefacts with wood and some organic plant material on Horizon VII
- 6.12 B5, 1963 excavation: general view of the exposed surface remnant of Horizon V with many Acheuelean bifaces and other artefacts
- 6.13 B5, 1963 excavation: close up of handaxes, cleavers, and other Acheulean artefacts on Horizon V
- 6.14 Upper Acheulean handaxes from B1, 1956 excavation, Horizon V
- 6.15 Upper Acheulean cleavers from B1, 1956 excavation, Horizon V showing parallel, divergent and convergent plan forms, U- and V-shaped butt ends, and straight to oblique bits
- 6.16 Upper Acheulean light duty tools from B1, 1956 excavation, Horizon V: single and double edged, convergent scrapers and borers showing straight, convex, and concave retouch, some denticulate
- 6.17 Upper Acheulean large primary flakes from Horizon V and small flakes from unspecialized cores and biface trimming from Horizon VI, Site A1, 1956
- 6.18 Upper Acheulean modified tools: a cobble and a quartzite slab
- 6.19 Four close-up views of the core-scraper with use wear facet from Horizon VI, B1, 1956 excavation
- 8.1 Two water-smoothed sticks; pointed tool or digging stick; and long pointed lengths of tree branches
- 8.2 Stick with bark attached and truncated lower end; two views of a short heavy piece of wood possibly used as a club or mallet
- 8.3 Two views of a flat pointed piece of wood with possible oblique adze-like cuts; a peeled stick with green stick fracture and oblique truncation

- 8.4 Wood chip made with a Neolithic axe for comparison with wood chip from Acheulean Horizon V, B1/56
- 8.5 Large log from the bole of a tree showing an oblique transverse groove
- 8.6 Four modified pieces of wood possibly opportunistically used
- 8.7 Three pieces of bark from dark clay bed under Horizon V, B1/56, Horizon VI
- 8.8 Carbonised immature fruits of the Borassus palm (Borassus aethiopum)
- 8.9 Seeds and nuts recovered from the dark clay bed, Acheulean Horizon VI, B/56
- 8.10 Twigs, reed stems, thorns and grasses with three shredded pieces of inner bark
- 8.11 Wood fragment preserving the hole where the subsidiary branch grew out; short right-angle section of a branch with bark still adhering
- 8.12 Charred logs from black clay bed, Acheulean Horizon VI, B1/56
- 10.1 Using hand-held, hard-hammer percussion to remove large flakes from a boulder core (lava from northern Kenya)
- 10.2 Throwing a quartzite boulder against a quartzite boulder core at Kalambo Falls, detaching a large flake in the process
- 10.3 A range of large flakes suitable as blanks for Acheulean handaxes, cleavers, picks and knives
- 10.4 Making a cleaver at Kalambo Falls from a flake blank, using a quartzite hard hammer
- 10.5 A close-up of a quartzite bifacial cleaver made experimentally from a large flake at Kalambo Falls

xviii



#### CONTRIBUTORS

- J. DESMOND CLARK, Professor Emeritus of Anthropology, University of California, Berkeley
- ROBIN H. CROMPTON, Senior Lecturer in Anatomy,

  Department of Anatomy and Cell Biology, University of

  Liverpool
- STEPHEN W. EDWARDS Director, Regional Parks Botanic Garden, c/o Tilden Regional Parks, Berkeley, California
- JOHN A. J. GOWLETT, Department of Archaeology, University of Liverpool
- ALAN C. HAMILTON, World Wildlife Fund, Godalming, UK
  MAXINE R. KLEINDIENST, Professor Emeritus of
  Anthropology, University of Toronto
- LI YU, Research Fellow, Department of Anthropology and Cell Biology, University of Liverpool
- CURTIS MCKINNEY, Adjunct Professor, Department of Geology, Florida International University, Miami, and Miami Dade Community College, Miami

- ROBERT MARCHANT, Faculty of Biology, Universiteit Van Amsterdam, The Netherlands
- R. M. ORGAN, Research Laboratory, British Museum

  DEREK ROE, Professor of Palaeolithic Archaeology, Donald

  Baden-Powell Quaternary Research Centre, University of
  Oxford
- KATHY D. SCHICK, CRAFT: Center for Researching the Archaeological Foundation of Technology, Indiana University, Bloomington
- DAVID TAYLOR, Senior Lecturer, Department of Geography, National University of Singapore
- NICHOLAS TOTH, CRAFT: Center for Researching the Archaeological Foundation of Technology, Indiana University, Bloomington
- YOHANNES ZELEKE, Post Doctoral Fellow, Laboratory for Human Evolutionary Studies, University of California, Berkeley

xix