



# The Ceramic Assemblage of Tse Dura (*Indyer Mbakuv*) Rockshelter in Benue State, Central Nigeria

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**Abstract** We analyzed the ceramic assemblage from a re-excavated section of Tse Dura rockshelter (KA4RS1) in central Nigeria's Ushongo area to understand the archaeological sequence of human occupation and cultural changes. The analysis, focusing on motifs, forms, and petrography, identifies three phases of human occupation. The petrographic results, in particular, revealed three main fabric groups—TD-AC1, TD-AC2, and TD-AC3—all of which contain inclusions that are indicative of clay sources local to the Tse Dura rockshelter region. The first two groups, TD-AC1 and TD-AC2, contain similar inclusions; however, the third group, TD-AC3, exhibited slight variability. The variations in fabrics and inclusions are most

probably related to the potters' choice of different techniques and unique raw materials for specific vessels.

**Résumé** Nous avons analysé l'assemblage céramique provenant d'une nouvelle fouille de la section de l'abri sous roche de Tse Dura (KA4RS1), dans la région d'Ushongo, au centre du Nigeria; afin de comprendre la séquence archéologique de l'occupation humaine et les changements culturels. L'analyse axée sur les motifs, les formes et la pétrographie, a permis d'identifier trois phases d'occupation humaine. Les résultats pétrographiques en particulier, ont révélé trois principaux groupes techniques-TD-AC1, TD-AC2, et TD-AC3-qui contiennent tous des inclusions indiquant des sources d'argile locales situées dans la région des abris rocheux de Tse Dura. Les deux premiers groupes, TD-AC1 et TD-AC2, contiennent des inclusions similaires; cependant, le troisième groupe, TD-AC3, présente une légère variabilité. Les variations dans la production et les inclusions sont très probablement liées au choix que les potiers portent sur les différentes techniques et les matières premières uniques pour la confection des récipients spécifiques.

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## Introduction

This article discusses the ceramic assemblage from a re-excavated section of Tse Dura (locally known as *Indyer Mbakuv*) rockshelter 1 in central Nigeria (Fig. 1). The

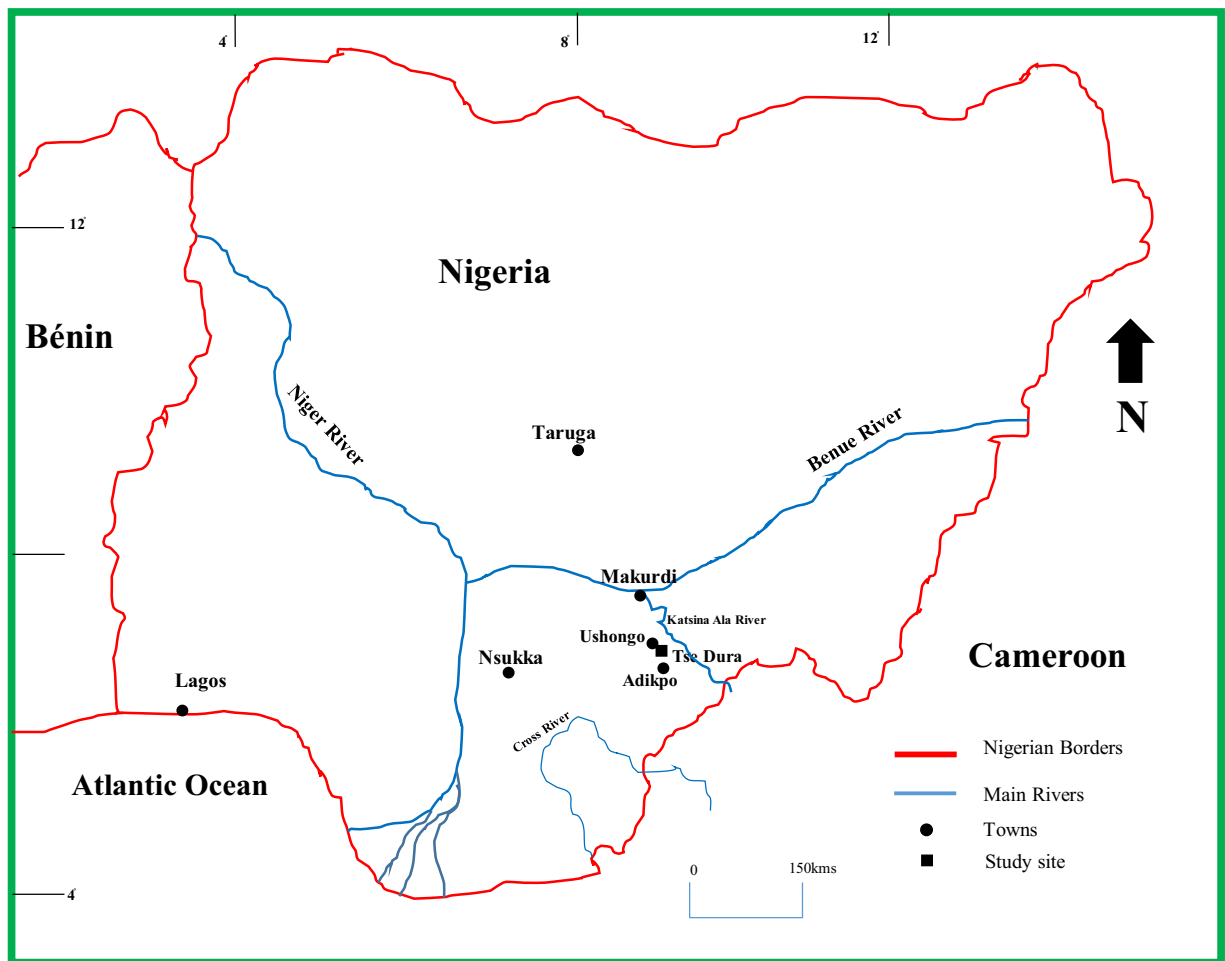
goal is to understand the archaeological sequence of human occupation, ceramic chronology, and cultural changes in the area over the past one thousand years. The study builds on the work of Bassey Andah and his students in the Middle Benue Valley from 1975 through the 1980s (Andah 1983; Andah et al. 1981; Folorunso 1981, 1983; Gundu 2013; Igirgi 1986).

In 1975, Bassey Andah initiated the “Bantu Homeland Project” in the Middle Benue Valley area to understand the beginnings of food production and iron working, the relationship between the two, and the characteristics of settlement history. He sought to identify: (i) who the first farmers and ironworkers in the area were; (ii) when agriculture and ironworking began; (iii) the forms of agricultural development (types of crops and/or animals managed; and (iv) the

impacts of these on the ecology and sociology of the Middle Benue Valley area (Andah et al. 1981).

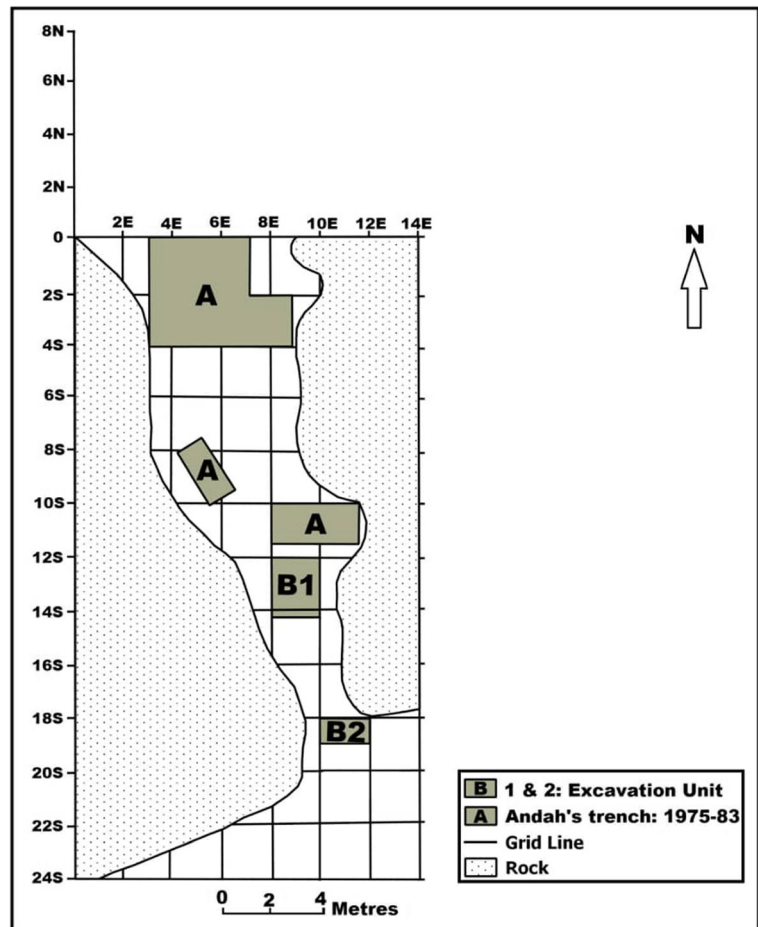
### Previous Work

The research team conducted a series of reconnaissance surveys in the vast area of the Katsina Ala River and Cross River basins. As a result, they identified several hills that were of archaeological significance. In the Ushongo area, near the Tse Dura compound, the team identified a hill complex with four rockshelters, out of which two were found to be most promising for further archaeological investigation. The Tse Dura hill complex is approximately 130 m from the Tse Dura compound, which is located 2–3 km from Ushongo town. The two most promising rockshelters were named KA4RS1 and



**Fig. 1** Map of the study area and towns mentioned in the text

**Fig. 2** Plan of Tse Dura rockshelter KA4RS1 indicating Units B1 and B2 in relation to Andah's 1975–1983 (A) excavations



KA4RS2 and were excavated between 1975 and 1983 (Andah 1983). The KA4RS1 site has two chambers, I (main chamber) and II, whereas KA4RS2 has a single chamber.

Several trenches were dug inside KA4RS1 (pits 1a-2a, 3-4abwA3, A8-9) and KA4RS2 (pits 2a & b, P3-6), and on the plains in between the two rockshelters (Units B-F). In KA4RS1, units A3, A8, and A9 are the deepest, 90–115 cm. According to Andah (1983), the artifact sequence (lithics, pottery, iron slag, smoking pipes) on the Tse Dura hill complex contained at least three broad cultural levels. The earliest, level 3, was of Later Stone Age (LSA) and occurred only in KA4RS1. It began before  $2330 \pm 70$  BP (589–338 cal BC), and was characterized by lithics, pottery, and animal bones; string roulette decorations dominated its pottery assemblage. Other pottery decoration types included grooves, incisions, comb stamping, and ordinary hatching. Cultural level 2, from  $2210 \pm 150$  years BP (593 cal BC-

85 cal AD) to  $1100 \pm 80$  years BP (771–1050 cal AD) was of Iron Age (IA). It was present in both KA4RS1 and KA4RS2. However, the transition from the LSA to IA was noted only in KA4RS1. But for the occurrence of iron slags, which was evidence for ironworking, the artifacts are not significantly different from those of cultural level 3. Just before the beginning of Cultural Phase 1, the eleventh to the eighteenth century (Folorunso 2005), there was a significant decline in the number of artifacts (microliths, pottery, and bones), which was interpreted as a cultural break (Andah 1983). Early in Cultural Phase 1, a new pottery motif—the knitted-mat impression—emerged; it became dominant, and it is still one of the major motifs among contemporary Tiv potters. This cultural level is reflected in the areas adjoining both rockshelters.

Following the first excavation season at Tse Dura, three broad categories of pottery decoration types were recognized in the archaeological sequence

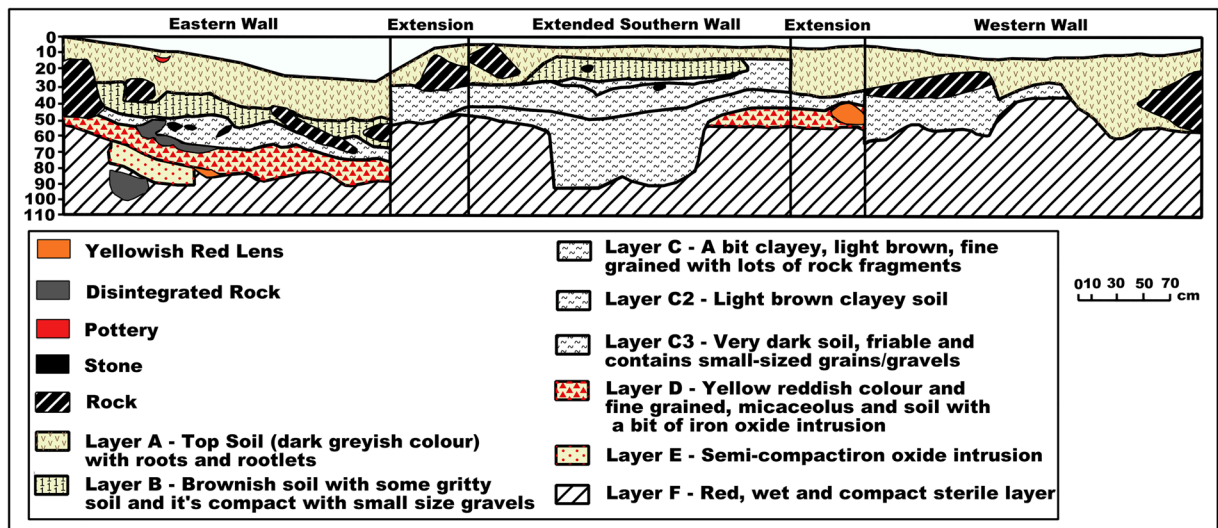


Fig. 3 Stratigraphic profiles of Trench B1, Tse Dura KA4RS1

(Andah 1983; Andah et al. 1981). The pottery from the earliest deposits was dominated by string roulette (single and double); the second occupation phase was characterized by string roulette, grooves, incision, comb stamping, and a combination of several forms. The third and final occupation sequence was dominated by knitted-mat impression. From KA4RS1, units 1a, 2a, and 3-4 abw, Walu (1979) classified the Tse Dura pottery into vessel types based on attributes and motifs. He noted that small-necked pots and the knitted-mat impression (which he called woven reticulate roulette) were the most common vessel and decoration types throughout that sequence. Folorunso (1981, 1983) expanded on Walu's work by establishing that the earliest deposits (Later Stone Age through the Iron Age, units A3 and A4) were dominated by string rouletted ceramics, comprising mostly of small forms with thin walls. In contrast, knitted-mat impressed pottery, which appeared in the later period, occurred "generally on thicker sherds" (Folorunso 1983, p. 175). He opined that the occurrence of a knitted-mat impression on thicker sherds indicated the production of bigger pots, which reflected a possible shift in subsistence and ceramic function. Therefore, he established that the early and later occupants of the sites had contrasting needs and use for ceramics.

However, what sociocultural events or factors triggered the occurrence of the knitted-mat impressed pottery with

thick walls at Tse Dura rockshelter? To answer this question, Igirgi (1986) provided more details about the pottery by identifying attributes such as paste characteristics, vessel forms, thickness, surface finish, and decoration. Three broad ceramic color types were identified, namely pink/reddish, dark-gray/black, and "other" (Igirgi 1986, p. 63). The dark-gray/black pottery was the most common. Igirgi (1986) concluded that the colors of the sherds were related to clay types, tempering, and vessel usage: (1) dark-gray/black color had coarse clay texture and micaceous and laterite particles; (2) pink/reddish ceramics had finer clay with a lower percentage of micaceous and laterite particles; and (3) the "other" had combinations of both colors resulting from firing and cooking. Four vessel types—bowls, and small, medium, and large pots—were identified; large pots were the most abundant in the latter period (Igirgi 1986). Since the Tse Dura rockshelter site holds the oldest and longest human occupation record known so far in the Middle Benue Valley, we seek to understand the relationships between the ceramic types on the one hand and the chronostratigraphic and occupation sequence on the other? Our intervention particularly uses clay composition to understand variations in the technology of ceramic manufacture and use at Tse Dura during the last one thousand years by carrying out formal and petrographic analysis of the newly excavated ceramics from the Tse Dura KA4RS1.

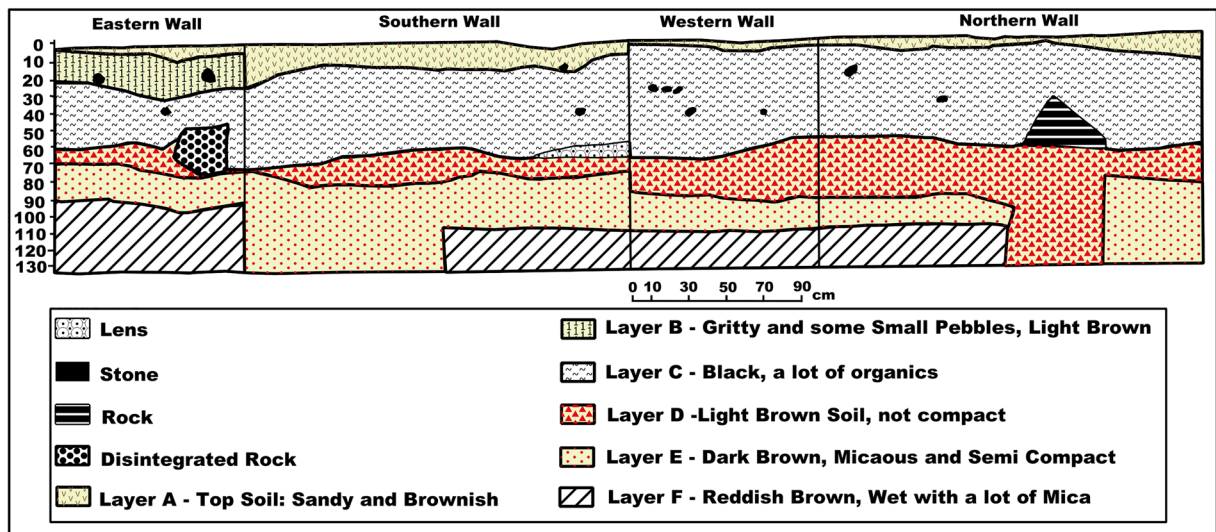


Fig. 4 Stratigraphic profiles of Trench B2, Tse Dura KA4RS1

### New Excavations at Tse Dura KA4RS1

We re-visited Tse Dura for further archaeological investigation in February to March 2017 to achieve three objectives. Firstly, we sought to use direct and/or indirect evidence as proxies (sedimentology, soil micromorphology, archaeobotany, and palynology) to reconstruct the past environment of Tse Dura, and to understand the processes which influenced human-environment interactions there from the LSA period until the recent time. Secondly, we aimed to identify the crops from the archaeological contexts that constituted the food production culture of the people who inhabited the rockshelters during the later archaeological sequences. In particular, we sought the possibility of recovering the archaeobotanical evidence of yams (*Dioscorea* spp.) since the area is known for yam cultivation. Our third objective was to reassess the chronostratigraphy of the site using ceramic forms, decorations, and petrology. This article is within the framework of the third goal. The original plan was to excavate undisturbed sections in both KA4RS1 and KA4RS2, but we were constrained by time. Since KA4RS1 was the older of the two archaeological sequences and contained both the LSA and IA cultures, we settled for KA4RS1 where we excavated two units—B1 and B2.

### Geology

The KA4RS1 rockshelter is located in the Middle Benue Valley (MBV) at 290–303 m asl. In terms of stratigraphy, the MBV is in the southern Benue Trough, or lower Benue Trough (Zaborski 1998), and sits on Precambrian Basement Complex (Obiora 2012) and Cretaceous deposits (Umeji 2013). The Benue Trough runs from the northeast of Nigeria (Lake Chad) to the Bight of Benin; it is approximately 1000 km long and 150 km wide and consists of three parts—the Abakaliki Basin (southern), Benue Basin (central), and Bornu Basin (northern). It was formed by rifting of the South Atlantic and a series of tectonic uplifts during the Middle-Late Albian (Offidile 1980; Ofoegbu 1985).

The MBV contains several drainage channels, the most notable of which is the Katsina Ala River; other tributaries include the Ambighir, Loko, and Dura Rivers near the town of Katsina Ala. The study area falls within the southern reaches of the Katsina Ala River basin where River Amire Tamen, a tributary of the Katsina Ala River is prominent (Andah 1983). The geology of the study area is characterized by Cretaceous (Albian-Maastrichtian) sediments of five Formations namely, from the oldest to the youngest, (i) the Azu River, (ii) Eze Aku, (iii)

**Table 1** A comparison of the stratigraphic sequences of Andah (1983) and those of the present study

Depth	Layer	B1	Layer	Depth	B2	Depth	Layer	Trenches A3 and A9	Depth	Pits P4–6	Level
0–35	A I	Dark grayish brown	A I	0–35	Dark gray	0–5	1	Very dark gray	0–10	Dark brown	1
35–55	B II	Dark brown	B II	35–55	Brown	5–20	2	Dark gray	10–50	Dark brown	Upper sterile layer
55–70	C III a	Light Brown	C III	55–70	Black	20–55	3–4	Reddish brown	50–100	Light brown	2
70–95	D III b	Yellowish brown	D IV a	70–95	Light brown	55–80	5	Very dark gray	100–135	Strong brown	Lower sterile layer
95–110	E IV	Reddish brown	E IV b	95–110	Dark brown	80–95	6	Dark reddish brown	135–175	Mottled yellow	3
			F V	110–133	Reddish brown	95–110	7	Yellowish red	175–215	Mottled yellow	Basal sterile layer

Agwu, (iv) Nkporo, and (v) Bassange groups. Specifically, the geological formation in the study area is dominated by outcrops of sandstones prominent in Amasiri, Makurdi, Agala, and Agbani (Zaborski 1998). The soils in these areas have a predominance of quartz and quartzite; while granite gneiss and biotite granite dominate in the adjacent area of Jato-Aka and Adzegabor towards the east. To the south, from Adikpo onwards, kaolin and kaolinitic clay are abundant. In the northern axis, the floodplains along the Katsina Ala River up to Makurdi are rich in the alluvium deposits of Neogene age. However, in the pre-Neogene deposits, rhyolite is the dominant mineral. Further to the north of Katsina Ala, towards Gboko, are outcrops of porphyritic granite, porphyritic biotite, and biotite hornblende. There are also pockets of limestone deposits along the Gboko-Yandev-Buruku axis.

#### Past Environment

The palynological, archaeobotanical (macro plants remains), and sedimentology data recovered from KA4RS1 unit B1 revealed that the palaeoenvironment of the rockshelter, ca. 1000 YBP, was dominated by Guinea savanna and dry conditions. In subsequent centuries, conditions improved and secondary forests dominated. Henceforth, the inhabitants engaged in managing plants such as *Elaeis guineensis*, *Dioscorea* spp., *Pennisetum glaucum*, *Pavetta crassipes*, *Sarcocephalus latifolius*, and *Lophira* cf. *lanceolata* (Orijemie 2018).

#### Chrono-Stratigraphy, Lithology, and Archaeological Sequence

Following extensive discussions with Dr. B. J. Tubosun of the Department of Archaeology and Anthropology, University of Ibadan, one of the archaeologists who participated in the 1975–1983 excavations, new units were opened in the undisturbed areas of KA4RS1's chamber I (Fig. 2). These are located at the southernmost narrow end (B1) and the back exit (B2). In February to March 2017, the excavations of a 2 m × 2 m unit (B1) and 2 m × 1 m unit (B2) were undertaken. The excavation was done at 10 cm spit levels and reached the sterile

**Table 2** Motifs/spit level (bodysherds) in Tse Dura KA4RS1, Unit B1 (2.5 × 2 m)

Pottery motifs	Surface	0– 10	10– 20	20– 30	30– 40	40– 50	50– 60	60– 70	70– 80	80– 90	90– 100	100– 110	Total	%
Body sherds														
Eroded	47	12	101	218	473	165	64	21	80	9	9	8	1207	44.2
Knitted-mat impression (small)	25	10	15	101	18	10	12	8	11	4	7	3	224	8.2
Groove	7	1	6	9	40	26	1	1	7		2	2	102	3.7
Incision	1	2	2	16	8	16	2				1	2	50	1.8
Plain	41	26	7	75	160	42	17	13	15		6	1	403	14.8
Single string roulette	7	8	9	30	72	50	2	1	6		1		186	6.8
Groove and punctate				1	1				2		1		5	0.18
Finger impression	7	2		15	28	18	1		3	1			75	2.7
Twisted cord roulette	14			1	14	11	2			1			43	1.57
Knitted-mat impression (big)	30	10	18	71	32	11	3	2	4				181	6.6
Burnished		4	6	13	13	3	1		2				42	1.54
Carved wood roulette	3		1	2	1		1						8	0.29
Double string roulette				15	32	6	1						54	1.97
Groove (cyclic)				1	12	4							17	0.62
V-pattern			1	6	4								11	0.4
Zigzag				1	4	2							7	0.25
Wavy				3	3								6	0.22
Groove and wavy				2		3							5	0.18
Fingernail impression	2			1	1								4	0.14
CWR and groove				2									2	0.07
Double string and groove				2									2	0.07
Double string roulette and incision						1							1	0.04
Embossed							1						1	0.04
Embossed and incision					1								1	0.04
Excision					1								1	0.04
Groove and embossed				1									1	0.04
Groove and incision						2							2	0.04
Groove and notching					1								1	0.04
Groove and single string roulette	3	1											4	0.14
Groove, punctate and single SR	1												1	0.04
Groove, ridge and incision						1	1						2	0.07
Incision and punctate						1	1						2	0.07
Incision and wavy				1									1	0.04
Incision (cross), groove and wavy incisions						1							1	0.04
Knotted strip				1									1	0.04
Knotted strip, grooves and punctate				1									1	0.04
Maize cob roulette	1												1	0.04
Knitted-mat impression (big) and single S.R.				1									1	0.04
Knitted impression (big) and groove				1									1	0.04
Knitted impression (small) and incision			1				1						2	0.07
Notching	1				2								3	0.1
Plant impression								1					1	0.04
Punctate				1		1							2	0.07
Punctate and excision			1										1	0.04
Punctate and single string	1												1	0.04
Single string and incision					2								2	0.07
Single string and wavy				1									1	0.04

**Table 2** (continued)

Pottery motifs	Surface	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100	100–110	Total	%
Stamping						1							1	0.04
Twisted cord and wavy				1									1	0.04
V-pattern and groove						2							2	0.07
V-pattern and incision					1								1	0.04
Wavy				3	3								6	0.22
Wavy & single string R.		1											1	0.04
Zigzag and groove					1								1	0.04
Unidentified	14	10		2	3	19	1			1			50	1.8
Total	205	87	168	596	928	396	112	47	130	16	27	16	2728	100

layer at depths of 1.1 m for unit B1 (Fig. 3) and 1.33 m for unit B2 (Fig. 4). Owing to the presence of some very dark soils at the southern wall of B1, the unit was extended by 50 cm. The excavation of the extension ended at 1.1 m depth. A comparison of the units B1 and B2 sequence with Andah's (1983) is shown in Table 1. The inventory of the recovered potsherds and decoration types are presented in Tables 2 and 3. A total of 2972 and 6202 potsherds (body and rim sherds) were recovered from units B1 and B2, respectively. The other finds and dates from the site are included in Tables 4, 5, and 6. Radiocarbon dates of charcoal samples from trench B1 were obtained from SUERC Radiocarbon Laboratory, Glasgow (Table 6). Two other dates, one from a *Pennisetum glaucum* (pearl millet) grain and the other from charcoal particles, were obtained from unit B2 (Table 6). Two samples of potsherds were collected from each spit level of B1 (Table 7) for petrographic analysis to understand clay and raw material sourcing, and their relationships with ceramic technology, vessel forms, and functions.

In Unit B1 (Fig. 3; Tables 2 and 4), the first layer A (topsoil) is a sandy deposit approximately 15–35 cm thick and dark grayish-brown (Hue 2.5Y, 4/2). It was underlain by a gritty sandy dark brown layer (layer B; Hue 7.5YR, 3/2) that is 10–20 cm thick. Below this is a light brown layer (C, Hue 7.5YR, 6/4), 5–15 cm thick, overlying a yellowish-brown gritty and sandy layer (D) with red patches (Hue 10YR, 5/4), 5–25 cm thick. Layer E (reddish-brown; Hue 5YR, 5/4) is a semi-compact, micaceous layer rich in iron oxides. It is about 17 cm thick and occurs only in the northern wall. Layer F, the sterile layer, is predominantly red (Hue 2.5YR, 4/6) but

contains mottled yellowish-brown “patches” in a few areas. It is wet and sticky, highly micaceous, 20–25 cm thick but reached 50 cm in the southern and western walls.

The topsoil of unit B2 (layer A) is a sandy deposit, dark gray (Hue 7.5YR, 4/0), approximately 25 cm thick (Fig. 4). Layer B is also brown (Hue 7.5YR, 5/4) but slightly more compact, c. 25 cm thick, and only represented in the eastern wall. Layer C is black (Hue 2.5Y, 2.5/0) with lots of organics and 40 cm–70 cm thick; it contained a majority of the artifacts, namely pottery, lithics, charcoal, and iron slag. Layer D is light brown (Hue 7.5YR, 6/4) and not compact; it is approximately 10–30 cm thick but reached 50 cm in the northern wall. Layer E is dark brown (Hue 10YR, 3/3), moderately compact, and contains some mica; it is about 20–25 cm thick but also reached 50 cm in the southern wall. Layer F is reddish-brown (25–40 cm thick, Hue 5YR, 5/4), very compact with lots of laterites and mica; it contains the sterile layer. The archaeological sequences in units B1 and B2 are similar. Both have three main lithological units, I–III, with slight variations in color. Unit I is dark gray (0–35 cm), and unit II is brown with two variations—dark brown (IIa, 35–70 cm) and light brown (IIb, 70–95 cm). Unit III is reddish-brown and lies between 95 and 133 cm.

The artifacts recovered from B1 include pottery, iron slags, microliths, charcoal, and archaeobotanical remains; pottery was dominated by knitted-mat impressed decoration throughout the sequence (Table 2). The variations in the number and occurrence of artifacts suggest some temporal phases. For instance, in B1, three broad phases were recognized: (i) 110–60 cm, (ii) 60–20 cm, and (iii) 20–0 cm. The earliest phase (110–60 cm), lasting from 1031–1161 cal AD to 1210–1274 cal AD,



**Table 3** Motifs/spit level (bodysherds) in Tse Dura KA4RS1, Unit B2 (2 × 1 m)

Pottery motifs/spit levels	Surface	0– 10	10– 20	20– 30	30– 40	40– 50	50– 60	60– 70	70– 80	80– 90	90– 133	Total	%
Body sherds													
Eroded	6	530	732	414	286	401	630	215	16	2		3232	56.2
Knitted-mat impression (small)		164	241	111	42	165	161	50	14	1		949	16.5
Knitted-mat impression (big)	2	62	119	50	44	171	92	83	33	1		657	11.4
Plain	1	49	104	52	14	70	77	33	11	3		414	7.2
Twisted cord roulette		7	16	6	3	23	16	13	1	1		86	1.5
Single string roulette		10	8	1	3	7	16	3	2	1		51	0.9
Groove and single string roulette		2		2	1	8	8		2			23	0.4
Punctate		8	5			5	18	4	2			42	0.7
Incision (cyclic)									1			11	0.2
Finger impression		3	1			2			1			7	0.1
Groove		24	11	6	7	17	15	3				83	1.4
Double string roulette		6	2	12		2	5	1				28	0.5
Twisted cord roulette and groove			5	3	1	2	1	3				15	0.3
Incision			3	1		4	2	2				12	0.2
CWR		3			2	1		1				7	0.1
V-pattern			3				2	2				7	0.1
Burnished		6							2			8	0.1
Punctate and twisted cord roulette					1	1		1				3	0.05
Groove (cyclic)		2					3					5	0.08
Knitted-mat impression (big), groove and incisions			1									1	0.01
Knitted-mat impression (big), TCR, wavy excision						1						1	0.01
Knitted-mat impression (small) and Excision						1						1	0.01
Knitted-mat impression (small), wavy excision						1						1	0.01
Knitted-Mat impression (big), wavy incision, CWR		1										1	0.01
CWR and groove						1	1					2	0.03
Double string roulette and incision		6										6	0.10
Embossed and Notching							2					2	0.02
Excision							1					1	0.01
Excision and comb impression						1						1	0.01
Excision and single string roulette										1		1	0.01
Fingernail impression and embossed		1										1	0.01
Groove and embossed						1						1	0.01
Groove (cyclic) and twisted cord R				2								2	0.03
Groove (cyclic), groove and twisted CR						3						3	0.05
Groove and knitted-mat impression (small)						2		1				3	0.05
Groove and notching			1									1	0.01
Groove and punctate			1			1	7					9	0.16
Groove and double string roulette		5	3									8	0.14
Groove and excision						1						1	0.01
Groove, punctate and double string						1						1	0.01
Incision and excision						1						1	0.01
Notching		1										1	0.01
Notching and twisted cord			1									1	0.01
Punctate and single string						1	2					3	0.05
Punctate, groove and twisted cord R		1										1	0.01
Punctate, groove and embossed							1					1	0.01

**Table 3** (continued)

Pottery motifs/spit levels	Surface	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–133	Total	%
Punctate, incision and double string R.					1							1	0.01
Twisted cord (cyclic)							1					1	0.01
Twisted cord R and Excision		2				1						3	0.05
Twisted cord roulette and incision								1				1	0.01
Twisted cord and cyclic groove							1					1	0.01
Twisted cord and Knitted-Mat impression (big)							1					1	0.01
Twisted cord and wavy							2					2	0.03
Unidentified			6			2			33			41	0.71
V-pattern and Twisted Mat impression (big)					1							1	0.01
Wavy		1					1					2	0.03
Wavy and single string					1	1	4					6	0.10
Total	9	894	1263	660	407	899	1070	416	118	10	–	5746	100

had pottery with decoration types such as knitted-mat impression, grooves, incision, punctate, and single string roulette, as well as iron slag, lithics (made predominantly of quartz), and archaeobotanical remains (pearl millet, charcoal and, charred parenchyma cells). Pottery sherds were initially few ( $n=43$ ) but eventually increased to 240 at the upper level of this earliest phase. A total of 19 iron slag pieces and 128 microliths were recovered.

The second phase (60–20 cm), postdating the thirteenth century, had a marked increase in pottery ( $n=2191$ ), iron slags ( $n=67$ ), and lithics ( $n=487$ ). Flakes and notched flakes of rhyolite also occurred in this phase. There was a diverse array of animal bones and teeth; pearl millet remained dominant, while embossed pottery, as well as sherds with circular and wavy grooves, multiples of v-pattern, zigzag, and notches, were prominent. The marked increase in iron slag and pearl millet indicated increased ironworking and farming activities. The third phase (20–0 cm) witnessed a significant reduction in pottery ( $n=283$ ); maize cob roulette motif occurred for the first time in the upper levels. Iron slags ( $n=240$ ) increased, but microliths and pearl millet disappeared; and archaeobotanical remains are dominated by palm kernels, rachis of Poaceae, *Sesamum indicum*, *Phyllanthus* sp., and *Citrullus* cf. *lanatus*.

Turning to unit B2, the knitted-mat impressed pottery also dominated throughout (Table 3). However, unlike B1, four temporal phases were identified

corresponding to: (i) 120–133 cm, (ii) 90–120 cm, (iii) 40–90 cm, and (iv) 0–40 cm. The lowest level, 120–133 cm, was sterile; level 90–120 cm did not contain pottery but had two pieces of iron slag, charcoal particles ( $n=73$ ), caryopses of charred domesticated *Pennisetum glaucum* ( $n=8$ ), and the petal ( $n=1$ ) of an unidentified plant were recovered. A date of 888–1015 cal AD was obtained from charred pearl millet at level 100–110 cm. Although pottery was absent from the earliest deposits (level 90–133 cm), the recovery of iron slags and charcoal particles suggests little archaeological deposit in this section of the rockshelter.

In the third phase (40–90 cm), pottery was sparse ( $n=11$ ) at a depth of 90 cm, but rose to 2820 at 40 cm. Knitted-mat impressed decorations dominate the ceramics at this level, but other pottery motifs include grooves, incisions, carved wood roulette, finger impression, and a combination of embossed and v-pattern and wavy lines. Iron slag increased from two in the early phase of this level to 392. A total of 97 lithics were also recovered, and charred pearl millet remains (*Pennisetum glaucum*) were quite abundant. This phase ended at 1265–1319 cal AD. In the fourth and final phase (40–0 cm), there was a reduction in the volume of artifacts. Pottery and iron slag pieces decreased to 2171 and 157, respectively, and lithics were down to 18 at the beginning of the phase and eventually disappeared. Pearl millets are absent, but sorghum (*Sorghum bicolor*), groundnuts (*Arachis hypogea*), and grass (Poaceae) inflorescences were abundant.

**Table 4** Summary of materials recovered from KA4RS1 Unit B1

Artifacts/levels	Surface	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100	100–110	Total	% P	% T
Pottery	228	103	180	638	1009	429	115	48	133	16	27	16	2942		74.4
Rim sherds (Diagnostic)	15	6	10	27	55	21	2	1	3				140	91.5	
Rim sherds (Undiagnostic.)	1	3		3		5	1						13	8.5	
Neck sherds	7	7	2	12	26	7							61	2.1	
Body sherds (Plain)	41	26	7	75	160	42	17	13	15		6	1	403	13.7	
Body sherds (Dec.)	103	39	60	301	292	170	30	13	35	6	12		1068	36.3	
Body sherds (Undec.)	61	22	101	220	476	184	65	21	80	10	9	8	1257	42.7	
Total pottery													2942	100	
Animal bones	1	–	–	2	11	1	–	–	–	–	–	–	15		0.4
Animal teeth	–	–	–	1	–	1	–	–	1	–	–	–	3		0.07
Bone tool	–	–	–	1	–	–	–	–	–	–	–	–	1		0.02
Charcoal	–	–	–	+	+	++	+++	++	++	+	+	+	+++		+++
Charred wood	–	1	–	–	–	–	–	–	–	–	–	–	1		0.02
Groundnut shells	7	1	–	–	–	–	–	–	–	–	–	–	8		0.2
Iron slag	–	240	–	45	7	4	11	6	7	2	4	–	326		8.3
Lithics	2	–	–	53	223	60	151	51	72	–	4	1	617		15.6
Palm kernel	9	21	3	–	–	–	–	–	–	–	–	–	33		0.8
Seed	1	–	–	–	–	–	–	–	–	–	–	–	1		0.02
Wood	–	5	–	–	–	–	–	–	1	–	–	–	6		0.1
TOTAL	248	371	183	740	1250	495	277	105	214	18	35	17	3953		100

Key: +, scarce; ++, present; +++, abundant; +++++, very abundant, %P, percentage pottery; %T, percentage total

*Dec*, decorated; *Undec*, undecorated

## Ceramic Analysis

The recovered potsherds were initially classified based on their motifs (Tables 2 and 3), according to descriptions in the literature (Andah 1983; Haour et al. 2010; Igirgi 1986). Rim morphology and a diameter chart were used in the description of the vessels (Fig. 5). The sizes of the vessels were inferred from the rim diameter. All the 407 rimsherds were analyzed for their morphological attributes based on lip shape/ morphology, thickness, color, and fabric (clay matrix and inclusions).

Twenty-one ceramic samples were selected at random from unit B1 for petrographic analysis (Fig. 6). Eleven are from the earlier occupational phase (twelfth to thirteenth centuries cal AD), and the rest are from the more recent (1265–1319 cal AD) phases of the site (Table 6). The samples include ceramics with coarse and non-coarse textures as well as those with distinctive

decorative motifs (Table 7; Fig. 6). Standard petrographic thin sections were prepared from each ceramic sample at the Department of Archaeology, University of Cambridge, and studied with the polarizing light microscope at the McBurney Laboratory for Geoarchaeology in the same institution. The first phase of the study identified petrographic groups which were divided into fabric classes or groups according to clay matrix and inclusions (Fig. 7; Table 7). These fabric classes or groups were described using a method proposed by Whitbread (1995) and modified by Patrick Quinn (2013) (see ESM 1). The main inclusions and composition of each fabric group were described as the basis for making inferences about ceramic technology. The petrographic groups, along with macroscopic observations and comparison with the geological map of Benue State (Fig. 8), were used to identify the provenance of the compositional groups of the ceramics.

**Table 5** Summary of materials recovered from KA4RS 1, Unit B2

Artifacts/levels	Surface	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100	100–110	110–120	120–133	Total	%P	%T
Pottery	10	919	1327	689	437	1019	1200	457	133	11	–	–	–	–	6202	88.4	
Rim sherds (Diagnostic.)		6	29	18	17	81	57	25	9						242	3.9	
Rim sherds (Undiagnostic)		11	35	1	2	27									76	1.2	
Neck sherds	1	8	–	10	11	39	46	16	6	1					138	2.2	
Body sherds (Dec.)	2	315	421	194	107	426	363	168	58	5					2059	33.2	
Body sherds (Plain)	1	49	104	52	14	70	77	33	11	3					414	6.7	
Body sherds (Undec.)	6	530	738	414	286	403	630	215	48	2					3273	52.8	
Total Pottery															6202	100	
Charcoal	++	++	+++	+++	+++	+++	+++	++	++	++	+	+	+	+	+++	+++	+++
Grinding stones	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	0.03	0.03
Iron	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	0.01	0.01
Iron slag	–	1	67	89	–	45	206	106	26	9	–	1	1	–	551	7.8	7.8
Lithics	–	–	4	82	45	32	50	24	19	3	–	–	–	–	259	3.7	3.7
Palm kernel	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	0.01	0.01
Total	10	921	1336	792	437	1092	1418	565	212	23	+	1	1	–	7016	100	100

Key: +, scarce; ++, present; +++, abundant; +++++, very abundant, %P, percentage pottery; %T, percentage total

Dec, decorated; Undec, undecorated

**Table 6** AMS dates from KA4RS1

Sample	Source	Material	Depth (cm)	AMS Age	2 Sigma Cal (95% Probability)
SUERC-73889	Tse Dura RS1 B1	Charcoal	60–70	802±29 BP	1210–1274 cal AD
SUERC-73890	Tse Dura RS1 B1	Charcoal	100–110	933±29 BP	1031–1161 cal AD
SUERC 75309	Tse Dura RS1 B2	Charcoal	40–50	684±34BP	1265–1319 cal AD
SUERC-76717	Tse Dura RS1 B2	Pear millet	100–110	1097±32 BP	888–1015 cal AD

### Petrographic Classes/Fabric Groups

The thin sections of the 21 ceramic samples from Tse-Dura could be divided into three main petrographic classes or three fabric groups, namely TD-AC1 class (Coarse Igneous Fabric Group), TD-AC2 class (Micaceous Igneous Fabric Group), and TD-AC3 class (Fine Micaceous Sandstone Fabric Group) (Fig. 7a–f; Table 7). These three fabrics constituted 96.3% of all the rimsherds from B1 and B2, while the sherds with a

combination of fine and coarse igneous inclusions constituted 3.7% of the total rim sherds. All the thin sections show a non-calcareous, possibly alluvial clay matrix, and the large majority are characterized by the presence of sand-grain size angular to sub-angular fragments of igneous rocks, possibly granite or basalt (Fig. 7(a-b)).

The TD-AC1 paste recipe is associated with several types of ceramics and varying decorative styles (Table 7). It is found mainly in the most recent occupation phases at the site (0–90 cm depth, unit B1), and due

**Table 7** Details of the 21 ceramic samples from KARS1-B1 with their petrographic classifications, fabric descriptions, and decoration types

Sample	Depth	Color	Thickness	Fabric Description	Decoration Type	Petrographic Group	Radiocarbon Dates
1	0–10	Brown	9.0 mm	MSI	Incision	TD-AC2	
2	0–10	Light red	8.3 mm	NMS	Finger nail impression	TD-AC1	
3	10–20	Dark gray-black	9.1 mm	NMS	Carved wood roulette	TD-AC2	
4	10–20	Dark gray-black	8.6 mm	NMS	Incision+ Punctate	TD-AC1	
5	20–30	Dark brown	14.7 mm	Fine sand	Grooves	TD-AC1	
6	20–30	Dark gray-black	7.5 mm	MSI	Grooves	TD-AC1	
7	30–40	Brown	10.2 mm	MSI	Single string roulette	TD-AC2	
8	30–40	Light brown	9.2 mm	MSI	Knitted-mat impression + grooves	TD-AC3	
9	40–50	Light brown	11.0 mm	HMS	Mat impression	TD-AC1	684±34 BP (1265–1319 cal AD, SUERC 75309)
10	40–50	Light brown	11.2 mm	HMS	Cross incision+ punctate	TD-AC3	684±34 BP (1265–1319 cal AD, SUERC 75309)
11	50–60	Brown	12.1 mm	MSI	Double string roulette	TD-AC2	
12	50–60	Light brown	13.2 mm	NMS	Mat impression	TD-AC1	
13	60–70	Light red	8.2 mm	ISI	Single string roulette	TD-AC3	802±29 BP (1210–1274 cal AD, SUERC 73889)
14	60–70	Light red	8.5 mm	ISI	Grooves	TD-AC3	802±29 BP (1210–1274 cal AD, SUERC 73889)
15	70–80	Light brown	9.0 mm	MSI	Knitted-mat impression	N/A	
16	70–80	Light brown	7.9 mm	MSI	Single string roulette	TD-AC1	
17	80–90	Brown	8.1 mm	MSI	Single string roulette	TD-AC3	
18	80–90	Brown	9.2 mm	NMS	Plain	TD-AC1	
19	90–100	Black	8.0 mm	MSI	Single string roulette	TD-AC2	933±29 BP (1031–1161 cal AD, SUERC 73890)
20	90–100	Black	8.5 mm	HMS	Grooves	TD-AC2	933±29 BP (1031–1161 cal AD, SUERC 73890)
21	90–100	Black	7.3 mm	HMS	Grooves	TD-AC2	933±29 BP (1031–1161 cal AD, SUERC 73890)

**Fig. 5** Pottery recovered from KA4RS1, B1 and B2: i–ii. Bowls; iii–iv. Small pots; v–vi. Medium-sized pots; and vii–viii. Large pots. Decorations: i. grooves, ii. Plain, iii. Groove and punctate; iv. Double string roulette, v. grooves, wavy lines and string roulette, vi. Finger nails impression, vii. Groove and string roulette, viii. Carved wood roulette and grooves



to its characteristic inclusions, this petrographic class was named “Coarse Igneous Fabric Group.” Given the highly weathered conditions of the aplastic inclusions, it is not easy to accurately identify the type of igneous rocks from which this fabric originated. Temper was probably collected from outcrops of granite or basalt, abundant within 4–8 km of the site (Fig. 8). Of significance is the variation within this petrographic class in terms of the modal grain size of the coarse fractions of inclusions, which may help identify the added temper from naturally occurring inclusions. The shape and size of voids could be interpreted as negative impressions of non-durable organic materials. The matrix of TD-AC1 samples shows low optical activity and seems to have been well-fired. However, considering the variable degree of optical activity and color of the matrix observable on the thin-sections, the firing atmosphere seems to have fluctuated between reducing and oxidizing conditions, indicative of open-air firing.

The TD-AC2 class shows similarities with TD-AC1 in terms of temper, but mica flakes occur in the paste of

the former. It is characterized by the presence of small fragments of igneous rocks, in an alluvial, non-calcareous matrix. Micaceous minerals—biotite mica—are remarkably abundant (Fig. 7(c-d)). Due to the presence of abundant mica flakes, this class was named “Micaceous Igneous Fabric Group.” Variable clay sources and types of available raw clay used in the pastes may explain the subtle differences between classes TD-AC2 and TD-AC1.

Lastly, the third-class TD-AC3, named Fine Micaceous Sandstone fabric group, is characterized by abundant biotite mica flakes and grains of polycrystalline quartz, mixed with monocrystalline quartz grains in an alluvial, non-calcareous matrix (Fig. 7(e-f)). Inclusions seem to suggest the presence of sedimentary rocks in the paste, in the form of either naturally occurring or added sandstone. Outcrops of sandstone were identified close to the site (Fig. 8), suggesting a more local origin of temper or artifacts belonging to this group. The matrix of the samples showed low optical activity and was



**Fig. 6** Photograph of the twenty-one ceramic samples from Tse-Dura KA4RS1 (Unit B1) and their decoration styles. 1. incision; 2. fingernail impression; 3. carved wood roulette; 4. incision and

punctate; 5–6, 14, 20–21. grooves; 7, 13, 16–17, 19. single string roulette; 8, 15. knitted-mat impression; 9, 12. mat impression; 10. cross incision and punctate; 11. double string roulette; 18. plain

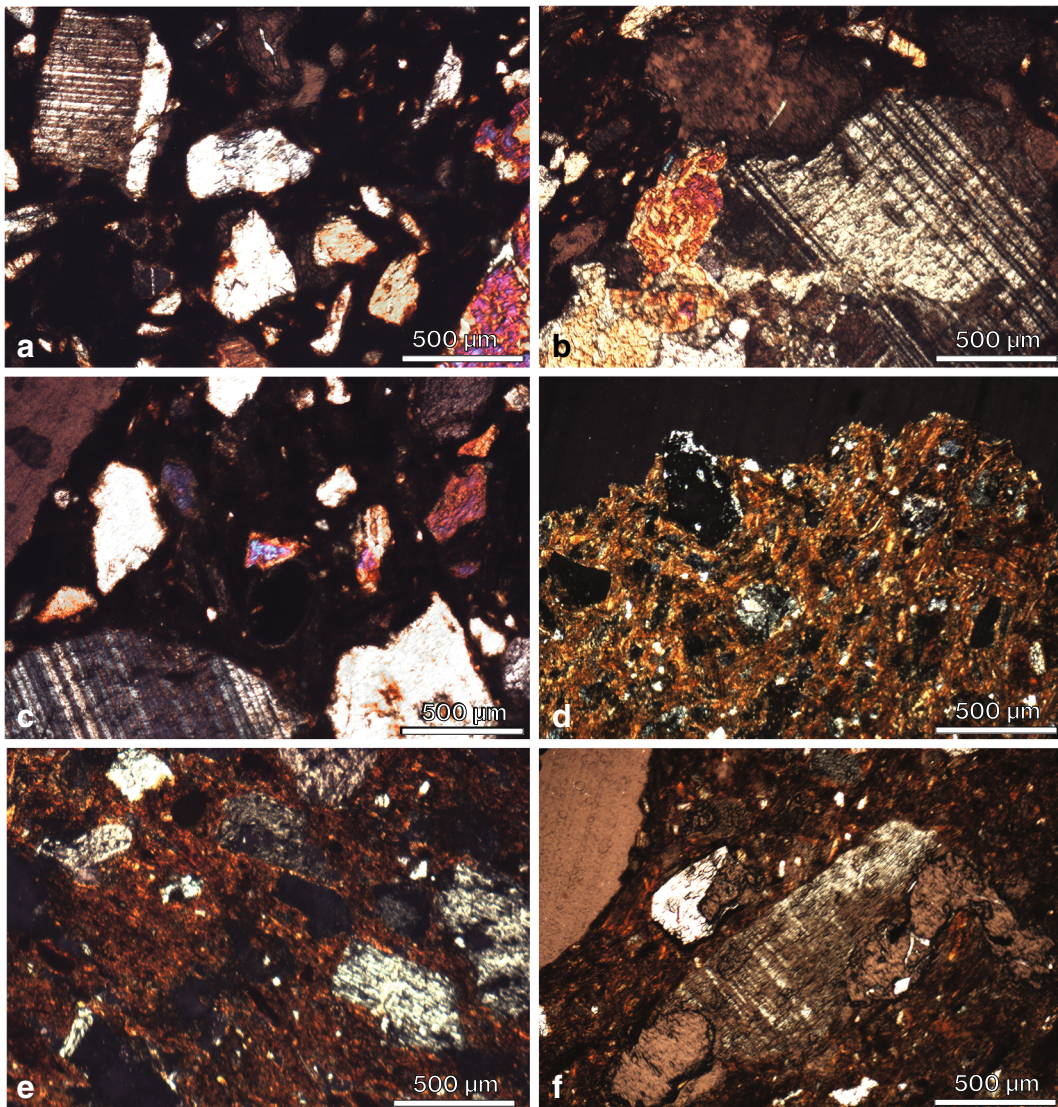
reasonably well-fired. Furthermore, the sherd samples of this category also show irregular fluctuations between reducing and oxidizing firing conditions.

#### Ceramic Sequence

We identify three temporal occupation phases, I-III, based on the archaeological sequence in both units.

#### *Occupation Phase I (ca. 888-1015 cal AD - 1210-1274 cal AD)*

The earliest decoration types include knitted-mat impression, grooves, incisions, and roulette and finger impressions, groove and punctate, and plain sherds. The distribution of these decoration types (Tables 2 and 3) is similar in both units B1 and B2. The ceramics were predominantly of slightly in-turned, everted, and



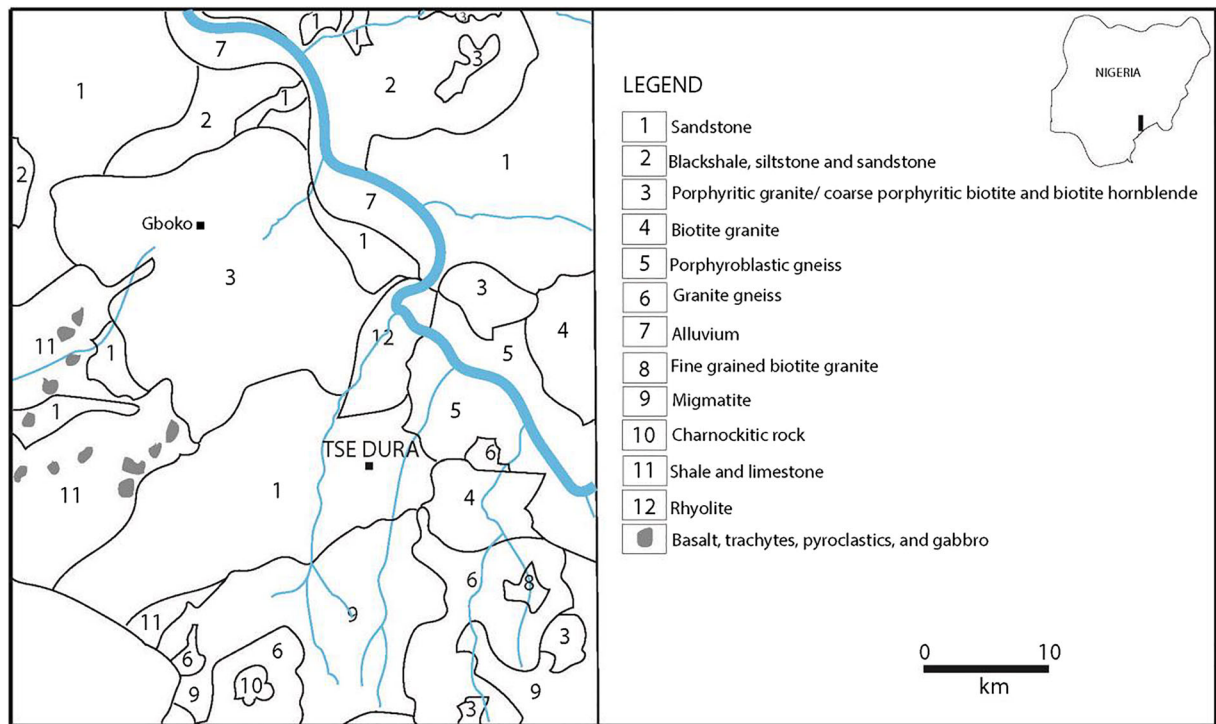
**Fig. 7** Thin section photomicrographs of samples from trench RS1-B1, Tse-Dura, central Nigeria. TD-AC1, or Coarse Igneous Fabric Group (**a, b**); TD-AC2, or Micaceous Igneous Fabric Group (**c, d**); TD-AC3, or Fine Micaceous Sandstone Fabric Group (**e, f**).

Caption: **a** Tse-Dura sample 05 XP; **b** Tse-Dura sample 09 XP; **c** Tse-Dura sample 03 XP; **d** Tse-Dura sample 20 XP; **e** Tse-Dura sample 14 XP; **f** Tse-Dura sample 17 XP. Scale bar is 0.5mm

straight rims, with beveled and rounded lips (Fig. 5). The main decorative motifs are knitted-mat impression, grooves, and striations. The color and paste of the ceramics ranged from brown and red to reddish-brown. They have little micaceous inclusions but are filled with rounded and angular quartz inclusions. The sherd thickness is 0.6–1.1 cm, while the rim diameter is between 10 and 22 cm. These represented bowls and small pots. The pottery fabric is dominated by coarse igneous inclusions,

consistent with O. Akinade's previous observation (1984). The source of these inclusions is located 4–8 km from Tse Dura rockshelter (Fig. 8). If pottery were produced on the Tse Dura hills, the potters would have traveled some distance to secure suitable clay and inclusions. However, pottery could have been brought to the site. The latter seems to be a more plausible explanation for the occurrence of this fabric (TD-AC 1-2) in the early period at the site.





**Fig. 8** Geology Map of the study area and other towns in Benue State, central Nigeria (source: Nigerian Geological Survey Agency, 2009)

*Occupation Phase II (1210–1274 cal AD,  
1265–1319 cal AD)*

The varieties of rim lips recovered are flattened, rounded, and beveled types. The majority of the rims are everted while slightly inverted, straight, carinated types are few (Fig. 5). The decorations are mainly knitted-mat impressed motifs; and the sherds are generally brown in color and highly micaceous, with 0.6–2.5 cm thickness, although the majority are 1.0–1.5 cm. The rim diameter is predominantly 20–30 cm. The majority of these vessels are large and medium-sized pots, and they occurred mainly in levels 30–50 cm and 40–60 cm in B1 and B2, respectively. These levels yielded about 36–49% of the entire pottery recovered.

The appearance of new pottery decoration motifs in this occupation level (finger impression, carved wood roulette, and embossed pottery) could be associated with a socially active community. Also, three innovations occurred: the appearance of large vessels, everted rims, and the predominant use of micaceous fabric. This third phenomenon represents marked changes in the clay type and production technique, and the sherds with this attribute are classified as Micaceous Igneous Fabric Group. The variable clay sources and types of raw clay used in

the pastes may explain the subtle differences between classes TD-AC2 and TD-AC1.

*Occupation Phase III (Fourteenth  
Through the Eighteenth Century)*

This phase had a combination of in-turned and everted rims. Knitted-mat impression continued to dominate, but ceramics with burnished effect and maize-cob and knotted strip rouletted decorations showed up. The vessel forms include bowls, as well as small, medium, and large pots. Ceramic thickness ranges from 0.5 to 1.9 cm, and rim diameters are 12–25 cm. There was an unprecedented increase in pottery ( $n=3532$ ) as well as a diversity of motifs (46 types) and forms at the initial period of this occupation phase (Tables 3 and 5). The fabrics are both micaceous and non-micaceous. The subsequent decrease in the number of sherds noted at 30 cm depth signaled the reduced significance of the rockshelter as a settlement site. The number of wild plants and faunal remains also declined during this period. This reduction in the archaeological deposits was possibly linked to migration from the hills. If so, the migration does not seem to have been abrupt but gradual, considering the continued dominance of knitted-mat impressed and

burnished and knotted-strip-decorated pottery up to the topmost layers of the units.

## Conclusion

The ceramic assemblage of Tse Dura KA4RS1 was studied to understand the ceramic forms and motifs as well as their mineral composition and fabric. The knitted-mat impression motif was the most dominant throughout the sequence and is still present in the study area's contemporary pots. Four forms of ceramic vessels were identified: bowls, small-, medium-, and large-sized pots. The earliest ceramics are characterized by TD-AC1 (Coarse Igneous Fabric) and TD-AC2 (Micaceous Igneous Fabric), which contained inclusions that naturally occur at a distance of 4–8 km from the site. The occurrence of these ceramic fabric recipes throughout the archaeological sequence, irrespective of decoration motifs, indicated local sourcing of the clay matrix for producing specialized vessels needed for storage and brewing. The third group of ceramics (TD-AC3 class or Fine Micaceous Sandstone fabric), which appeared at 80–90 cm in the latter part of Occupation Phase I (after 1031–1161 cal AD), exhibit variability but the origin of the temper was from the immediate locality of the Tse Dura rockshelter. These ceramics are bowls, small pots, and non-specialized forms. These “new” forms of ceramics indicate a technological change in pottery production during the late twelfth or thirteenth century. The ceramic analysis shows the patterns of changes and continuities in the ceramic traditions of Tse Dura for about one thousand years. The people of Tse Dura acquired ceramics or the raw materials for on-site production of ceramics from a distance of about 4–8 km in the early occupation phase, but on-site local clay and temper were preferred in the later occupation phase.

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## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

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