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Maintaining the Ramesside Empire: Isotopic Evidence for Elite Migration to Upper Nubia under Pharaonic Rule

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Abstract

Pharaonic Egypt ruled Upper Nubia (now northern Sudan) from around 1450 to 1070 BCE: previous research has demonstrated how co-opted local elites and descendants of earlier immigrants held senior administrative positions following the initial conquest. Strontium isotope data from 39 individuals buried at the colonial centre of Amara West, combined with archaeological and epigraphic evidence, enable us to demonstrate that elites continued to arrive from outside Nubia in the last 150 years of pharaonic rule, settling amongst long-standing communities. Migration to the occupied territory clearly remained a key component of the colonial project, at a time when indigenous Nubian material culture and practice had become more visible within the pharaonic towns. This pattern of immigration seems to have ceased following the pharaonic state losing control of the region.

Keywords

Nubia – Egypt – migration – cultural entanglement – colonialism – strontium isotopes

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1 Introduction

Around 1450 BCE, pharaonic Egypt completed the conquest of Kush (Upper Nubia), a region between the 5th and 2nd Nile Cataracts and now part of northern Sudan (Fig. 1). Pharaoh delegated authority to a 'King's Son of Kush', responsible for both Upper and Lower Nubia (Török 2009, 157–263). These individuals, referred to as 'viceroys' in Egyptological literature, may have spent considerable time in the region but most were buried in Egypt (e.g. Amenhotep-Huy, Davies & Gardiner 1926). In contrast, the senior officials resident in the region – the Deputies of Kush (Upper Nubia) and Wawat (Lower Nubia) – were generally interred in the burial grounds of towns founded by the pharaonic state within Nubia, where they lived and administered from (for exceptions, see Näser 2017).

A number of these centres for administration and control of the colony have been excavated, providing archaeological perspectives on both state actions and lived experience under pharaonic rule. These walled settlements contain temples, storage facilities and housing, and some included formal residences for the Deputies (Spencer 2019b). Around 1300 BCE, the pharaonic state changed its approach to the administration of the Nubian colony, with the construction of a new town, Amara West, as seat of the Deputy of Kush (Spencer 2015, 2017; Spencer et al. 2014).

Egyptian royal, biographical and administrative texts, produced by Egyptian and local elites within the colonial project, have dominated frameworks for understanding these four centuries of colonial rule (Smith 2003; Edwards 2004). Military campaigns (e.g. Davies 2017), prosopographies of officials (Auenmüller 2018), the exploitation of resources – notably gold (see Smith 1997) – and the Egyptianisation of populations in the region (for the history of this interpretative framework see Van Pelt 2013, 524–31) have long been areas of focus. In contrast, the last twenty years have been characterised by a pivot from predominantly Egyptological perspectives towards an exploration of the social, cultural, technological and artistic continuities in Nubia across millennia. Drawing upon theoretical frameworks from anthropology and the study of colonialism elsewhere, phenomena of hybridization, cultural entanglement and the continual negotiation of relationships between coloniser and colonised have been traced in Upper Nubia during the periods of pharaonic rule (Smith 2003; Edwards 2004; Van Pelt 2013; Spencer 2014b; Lemos and Budka 2021). In tandem, the diversity – material, linguistic, ethnic – of Nubian populations and cultures is increasingly a focus of research (De Souza 2021).

Archaeological science, in particular, is revealing new insights into the ancient experience of colonial Nubia, including the effect of ecological changes (Woodward et al. 2017) and landscape engineering (Dalton et al. 2023), subsistence strategies (Cartwright & Ryan 2017; Dalton & Ryan 2020; Ryan et al. 2022; Weinstock & Williams n.d.) and technological traditions (Fulcher 2022; Gasperini 2023; Rademakers et al. 2023). Bioarchaeological research within modern fieldwork projects in the cemeteries of the colonial centres is providing perspectives on ancient demographics, health and diet (Binder 2014; Binder & Spencer 2014; Buzon 2014; Schrader 2019).

Strontium isotope geochemistry allows the heterogeneous and complex social processes of migration and mobility to be surfaced. First generation immigrants to a given region can be posited, where strontium isotope values lie outside of a defined local range, typically based on data from fauna, flora, water or sediments. Those with local values are either indigenous to the region, or individuals descended from immigrants but who spent at least part of their childhood in the local area. Methodological challenges remain (Gregoricka 2021), notably the issue of equifinality where individuals with different mobility histories can have similar strontium isotope ratios: as such, the method is better suited to considering broader patterns than focusing on individuals (see Stantis et al. 2020).

Importantly, in the context of the ancient Nile Valley, this method, when used carefully, can be applied to both elites and those of lesser status. Combined with archaeological, bioarchaeological and epigraphic data, trajectories of migration can be better understood, and differences surfaced between sites and periods within the same geographic region and colonial era.

Strontium isotope analyses have been used to demonstrate that both indigenous and immigrant populations were present in the major pharaonic towns of Nubia. A large dataset from Tombos, an important pharaonic centre founded shortly after conquest and occupied for the remainder of the colonial period, reveals a persistent inwards migration, most likely from Egypt, across social classes, though the burials of the highest elite have yet to be excavated (Buzon et al. 2023). On the opposite bank of the Nile, a New Kingdom burial (one of four) within a small agricultural community at Hannek was posited as non-local, tentatively ascribed to the Second Cataract region or Egypt itself (Schrader et al. 2019: 375). In contrast, on Sai island, a pharaonic settlement 13 km upstream of Amara West and its precursor as seat of the Deputy of Kush, all of the individuals – spanning mid Dynasty 18 to the end of the New Kingdom – sampled in one elite tomb seemed to be either of local origin or descendants of earlier immigrants (Retzmann et al. 2019).

FIGURE 1 Map of showing Upper Nubia with key sites mentioned in text, with insets showing (top) Africa, (middle) Amara West town and cemeteries, and (bottom) layout of the three large pyramid tombs in cemetery D
DRAWING BY CLAIRE THORNE AND NEAL SPENCER

This paper concentrates on the latest period of pharaonic control, in Dynasties 19 and 20 (*c.*1307–1070 BCE). Did the administrative changes – including the foundation of Amara West – prompt a shift in the demographics of these towns? Were the local elite families – whether indigenous or descended from earlier immigrants – the source of the highest administrators, as was the case at some sites in Dynasty 18? Or were individuals still migrating from elsewhere to fulfill these roles? Was inward migration present across lower social classes? And how were mobility patterns altered by the end of colonial rule?

Drawing on data from the British Museum Amara West Research Project (2008–2019), and applying strontium isotope geochemistry to human remains from a range of tomb types, this study provides a case study of elite migration within the colony *after* two centuries of pharaonic rule, and what happened subsequent to the end of colonial control. Addressing these questions contributes to a wider understanding of colonialism in antiquity (Dietler 2015: 51) and the human architecture of maintaining empire.

FIGURE 2 View over Cemetery D, with pyramid and chapel of tomb G321 in foreground
PHOTOGRAPH COURTESY TRUSTEES OF THE BRITISH MUSEUM (AMARA WEST RESEARCH PROJECT)

1.1 *The Cemeteries and Human Remains*

The cemeteries at Amara West are located across an ancient river channel north of the town (Fig. 1), and were used for burials between early Dynasty 19 (around 1300 BCE) through to the early Napatan era (*c.*1070–700 BCE), though a small number of interments predate the foundation of the town (Binder 2017). Around 110 graves were identified in Cemetery C (E20.823341°; N30.385279°), situated on a low alluvial terrace next to a small ephemeral river channel (*wadi*), of which 39 were excavated (Binder 2014: 494, fig. 6). A further fifty tombs were mapped in Cemetery D on the low desert plateau north of the town (E20.824749°; N30.384704; Binder et al. 2011: 69, fig. 4), of which fourteen were excavated. Funerary rituals ostensibly mirror key aspects of contemporaneous Egyptian practice. During Dynasties 19 and 20 (*c.*1307–1070 BCE), those tombs with subterranean burial chambers housed multiple individuals, in one case as many as 37 burials. In Cemetery D, tombs featured small pyramids and funerary chapels over a shaft giving access to two or three burial chambers (Figs. 2–3, Binder 2017: 594–8). The bodies were placed in wooden coffins and accompanied by ceramic vessels and other grave goods, most commonly necklaces, scarabs and amulets with depictions of Egyptian gods, inlaid boxes (Lehmann 2023), shabti figurines, copper alloy mirrors and vessels. Only two names were attested in the cemetery: a man named I-bay (title unknown) and the 'Deputy of Kush, Paser' (Fig. 4; N. Spencer 2019a: 111–12, fig. 11). Paser held this office during the reign of Ramses III (*c.*1184–1153 BCE) and is named in inscriptions within the residence building at Amara West (Spencer 1997: pls. 152–5). Other tombs in the cemeteries reflected the continuity of long-standing indigenous funerary traditions, such as the tumulus superstructure over otherwise Egyptian-style burial chambers in tomb G244 (Fig. 5; Binder 2017: 599–606). Following the end of pharaonic rule, elements of Egyptian funerary culture (grave goods, architecture) persisted in use alongside other long-standing Nubian traditions: bodies laid to rest in a flexed position, single-burial niche tombs under tumuli, and the provision of wooden funerary beds (Lehmann 2021).

Excavations recovered 320 skeletonised individuals with variable preservation, affected by the long use of certain tombs and extensive ancient and modern looting (Binder 2014; Binder & Spencer 2014). A comprehensive diachronic palaeopathological study (Binder 2014; Binder & Spencer 2014) was possible for 180 individuals, elucidating potential changes in health and living conditions according to standard bioarchaeological methods (Buikstra & Ubelaker 1994; Scheuer & Black 2000; Goodman & Martin 2002; Brickley & Ives 2004; Roberts & Connell 2004). The demographic profile suggests a population with a high number of people dying in the age range between 20 and 35 years; the low frequency of non-adults (28.8%) is consistent with differential burial practices in the wider Nile Valley (e.g. Zillhardt 2009), perhaps exacerbated by preservation issues. High levels of oral pathologies, evidence of chronic inflammatory conditions, nutritional diseases, osteoarthritis, trauma as well as evidence of cancer and cardiovascular diseases evoke a difficult living environment (Binder et al. 2014; Binder

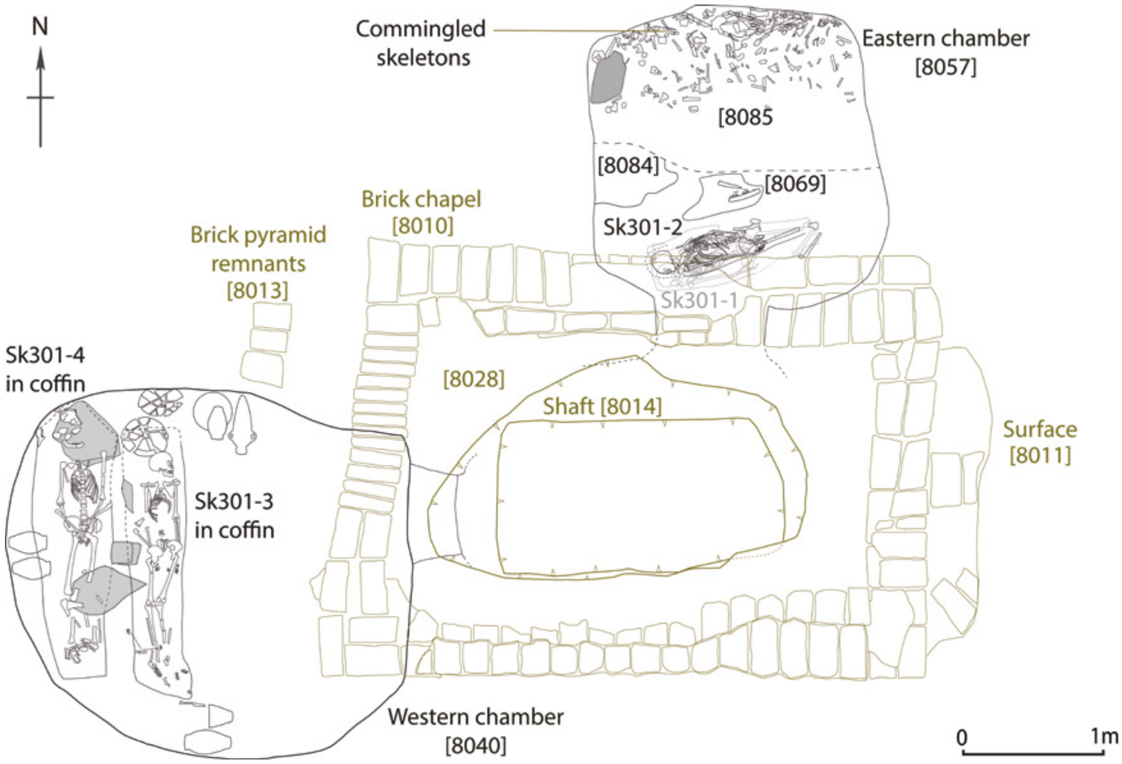

FIGURE 3 Plan of substructure (black) and superstructure (brown) of pyramid tomb G301, with individuals Sk301-3 and Sk301-1 (local) and Sk301-2 (not local); Sk301-4 not sampled
DRAWING BY MICHAELA BINDER AND NEAL SPENCER

FIGURE 4 Faience shabtis of Paser (F8543 [Sudan National Museum SNM 36967], F8548 [SNM 36971], F8577 [SNM 38142]) from the shaft of tomb G320
PHOTOGRAPH COURTESY TRUSTEES OF THE BRITISH MUSEUM (AMARA WEST RESEARCH PROJECT)

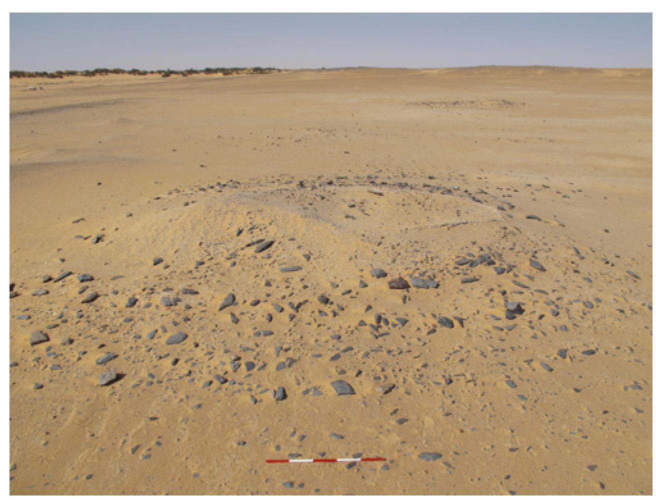

FIGURE 5 Tumulus tomb G244, in Cemetery C
PHOTOGRAPH COURTESY TRUSTEES OF THE BRITISH MUSEUM (AMARA WEST RESEARCH PROJECT)

& Roberts 2014), notably in the later period of occupation when increased aridity was prompted by the drying out of the river channel north of the town (Woodward et al. 2017).

2 Materials and Methods

Strontium isotope analysis of samples from Amara West followed established methodologies (Buzon et al. 2007; Buzon & Simonetti 2013) to provide data that might inform mobility patterns. The methodology relies on the ratios of the strontium isotopes $^{87}Sr/^{86}Sr$ in tooth enamel reflecting the isotopic composition of water and foodstuffs consumed by an individual during childhood, as dental enamel does not remodel after childhood/young adulthood (Faure and Powell, 1972). If reference data ($^{87}Sr/^{86}Sr$ ratios) exist for specific regions, it is possible to posit where the individual grew up during tooth development (Montgomery, 2010), though not of course where they were born, lived their adult lives, nor any cultural affiliation. Building a profile of bioavailable strontium has typically relied on local organisms (e.g. fauna and flora) and soils, though the latter will not always reflect the bioavailable strontium (Simonetti et al. 2023: 3).

Published data (Buzon & Simonetti 2013: 4–6, table 2; Retzmann et al. 2019: 362, table 2; Gregoricka & Baker 2023: 5–10, tables 1–3) indicates a general trend towards decreasing human and faunal $^{87}Sr/^{86}Sr$ ratios as one moves from Egypt upstream into Sudanese Nubia and further south. This has been used to posit possible Egyptian immigrants in Nubia (Buzon and Simonetti 2013), though there remains considerable overlap between values recorded between different sites.

The methodology remains limited by the paucity of published datasets for ancient soil or fauna from Egypt, in comparison to Sudan (Gregoricka & Baker 2023: tables 1–3), and few sites beyond the Nile Valley in either country, perhaps masking mobility patterns. Woodward et al. (2015) posited that aeolian dust may have contributed to river-borne sediment Sr ratios at sites in the Northern Dongola Reach varying over time, which would complicate the association of particular isotopic ratio ranges with certain sites. However, a recent assessment of human, botanical and/or faunal data from el-Kurru, the Tombos and Dongola areas suggests that Sr isotope ratios in plants remained consistent across the last 7,000 years (Simonetti et al. 2023)

In our study, all tooth samples were cleaned, abraded and chemically purified before analysis, in order to reduce post-depositional contamination (Nielsen-Marsh & Hedges 2000). Cleaning and cutting of the samples was performed at Purdue University and subsequently prepared at the University of Notre Dame Midwest Isotope and Trace Element Research Analytical Center (MITERAC). In order to assess the degree of contamination, the concentration of uranium which can reflect the update of groundwater (Hedges & Millard 1995; Kohn et al. 1999) was measured for all human and faunal samples. Acquisition of radiogenic strontium isotope ratios was carried out using NuPlasma MC-ICP-MS instrument at MITERAC. The NIST SRM 987 strontium isotope standard yielded an average value of 0.710238 ± 0000007 (2r standard error of the mean; N513 analyses). The latter is identical (given the associated uncertainty) to the accepted $^{87}Sr/^{86}Sr$ value of 0.710245 (Faure & Mensing 2005) for this standard. Alluvial sediment samples were analysed for total strontium by Ian Millar at the Natural Environment Research Council Isotope Geosciences Laboratory (British Geological Survey, Nottingham, UK) and Nu Instruments in Wrexham.

In order to characterise a locally bioavailable $^{87}Sr/^{86}Sr$ signature for Amara West, archaeological, sedimentary and modern faunal samples (teeth) were analysed using the methods described above (Table 1). Livestock rearing, fishing and cereal agriculture were all practised at the site, so much of the food consumed was available locally (Cartwright & Ryan 2017; Dalton & Ryan 2020; Weinstock & Williams n.d.); it was not possible to sample fish or cereal crop remains for this study, and that material is now inaccessible. Faunal samples (*Ovis*, *Canis* and *Sus*) contemporaneous with the cemetery were recovered from the ancient town (Dynasties 19–20). Nine modern rodent samples were collected from Ernetta island, 1 km upstream of Amara West, to provide data from species with smaller geographic ranges; Sr isotope ratios for modern domesticates could be affected by present day anthropogenic practices (Gregoricka & Baker 2023: 4). Samples from fluvial sediments, partly contemporaneous with the burials in the cemeteries, were collected from pits cut through palaeochannels around the site (Woodward et al. 2017).

Isotopic analysis was performed on enamel from a single tooth (mostly premolars and molars, see Table 2) from 39 human individuals. This dataset (12% of those excavated) was dictated by the number with sufficiently preserved teeth. Nineteen of these individuals could be dated to Dynasties 19–20, and thirteen to the late New Kingdom to Napatan era, on the basis of archaeological context and ceramics. Continuities in the ceramic forms between the last decades of colonial pharaonic rule or the period thereafter (Gasperini 2023: 109–11) mean seven individuals cannot be confidently assigned to one or the other period. Similar challenges have been noted at Tombos, exacerbated by the reduction in inscribed objects after the New Kingdom (Buzon & Smith 2023). The 39 sampled individuals were estimated to comprise eight biologically female adults, ten biologically male adults, and 21 unsexed skeletons (two adolescents, an infant and the remainder adults). The limited dataset for non-adults limits conclusions around demographic patterns.

Eleven of the sampled individuals were found in pyramid tombs in Cemetery D (G301, G309, G321, G322),

TABLE 1 Isotopic data from faunal tooth samples (archaeological and modern) from Amara West, with summary of data from comparative sites

Sample #	Grave/ building/area	Context	Taxa	Period	$^{87}Sr/^{86}Sr$
AMR-8F	E13.3.2	4042	Ovis	Dynasty 20	0.70706
AMR-9F	E12.10.9	2013	Ovis	Late Dynasty 19–20	0.70802
AMR-10F	E13.3.6	4043	Sus scrofa	Dynasty 20	0.70702
AMR-15F	D13.3.1	3008	Ovis/Capra	Dynasty 20 or later	0.70707
AMR-16F	D13	3000	Ovis/Capra	Dynasty 20 or later	0.70699
AMR-17F	D13.3.2	3101	Canis	Dynasty 19	0.70715
AMR-18F	E13.3.27	4369	Canis	Dynasty 19–early Dynasty 20	0.70727
AMR-19F	E13.7.7	4751	Ovis/Capra	Late Dynasty 19–20	0.70729
AMR-20F	D13.3.2	3025	Ovis/Capra	Dynasty 20	0.70726
AMR-21F	D13.3.2	3105	Ovis/Capra	Dynasty 19–early Dynasty 20	0.70714
AMR-40F	Ernetta	–	Rodentia	Modern	0.706370
AMR-41F	Ernetta	–	Rodentia	Modern	0.706520
AMR-42F	Ernetta	–	Rodentia	Modern	0.706490
AMR-43F	Ernetta	–	Rodentia	Modern	0.706490
AMR-44F	Ernetta	–	Rodentia	Modern	0.706456
AMR-45F	Ernetta	–	Rodentia	Modern	0.706700
AMR-46F	Ernetta	–	Rodentia	Modern	0.706480
AMR-47F	G244	9510	Rodentia	Modern	0.708050
AMR-48F	G244	9247	Rodentia	Modern	0.707390
Modern rodents					
Average		0.706772			
SD		0.000568954			
Modern range (ave ± 2SD)			0.705634	0.707910	
Modern rodents (Ernetta)					
Average		0.706501			
SD		0.000492709			
Ernetta range (ave ± 2SD)			0.706301	0.706701	
Archaeological fauna					
Average		0.70723			
SD		0.000297827			
Arch range (ave ± 2SD)			0.70663	0.70782	
All (modern and archaeological) fauna					
Average		0.70701			
SD		0.000492709			
All faunal range (ave ± 2SD)			0.70603	0.70800	

TABLE 1 Isotopic data from faunal tooth samples (*cont.*)

Comparisons to contemporaneous archaeological fauna			
Site	*Date*	*Range*	*Source*
Second Cataract (SJE Pharaonic)	1650–1350 BCE	0.70667–0.71086	Buzon & Simonetti 2013
Sai	1550–1070 BCE	0.70693–0.70828	Retzmann et al. 2019: 360, table 1
Tombos	1550–747 BCE	0.70752–0.70764	Buzon et al. 2007; Schrader et al. 2019
Third Cataract	?	0.70710–0.70783	Buzon & Simonetti 2013: 6
Kawa	1070–656 BCE	0.70740–0.71006	Buzon & Simonetti 2013: 6
El-Kurru	1070–656 BCE	0.70649–0.71037	Buzon & Simonetti 2013: 6

eighteen in chamber tombs (Cemetery C: G200, G234, G243, G244; Cemetery D: G300, G305, G309) and ten in niche tombs (all in Cemetery C). Twenty-five of the individuals were buried in an extended position, the remaining samples were from disarticulated skeletal remains. Unfortunately, none of the sampled skeletons were definitely buried in a flexed position; at Tombos all such individuals (9) had a local isotopic signature (Buzon et al. 2023: 7).

3 Results

The archaeological and modern faunal samples together provide a $^{87}Sr/^{86}Sr$ range of 0.70637–0.70805, or a narrower range of 0.70699–0.70802 if restricted to the faunal samples from archaeological deposits (Table 1). The three archaeological samples relating to animals with more restricted range fall within an even narrower span of 0.70700–0.70732 (Fig. 6). The two modern rodents found in Amara West burial chambers included one (0.70739) that falls within the range of the archaeological samples from the town and another (0.70805) above that range. Given the larger mobility ranges of the archaeological fauna and the origin of the modern rodents from Ernetta rather than Amara West, these data and resulting range should be used with caution. Nonetheless, the range is similar to data collected at Sai, only 13 km upstream (0.70693–0.70828; Retzmann et al. 2019: 360, table 2).

Samples from archaeological sediments in the tombs provided a range of 0.70633–0.71088 (Table 3), with all values at or below 0.70874 except for one outlier (AMR-8S: 0.71088). Samples from two New Kingdom flood units at Amara West provided lower $^{87}Sr/^{86}Sr$ values (0.70656–0.70670), thus within the range of the faunal data, and with a broader range than reported for the modern Nile at nearby Sai (water: 0.70679–0.70682; alluvium 0.70661–0.70763; Retzmann *et al.* 2019: 363, table 3). In summary, these control samples suggest that the range for bioavailable strontium in the local area, based on archaeological fauna and contemporaneous Nile flood deposits, can be posited at 0.70633–0.70802.

The $^{87}Sr/^{86}Sr$ ratios for the human samples at Amara West range from 0.70733–0.70841, clustering into two distinct groups, with 32 individuals below 0.70788, and seven with values above 0.70814 (Fig. 6, Table 2). The former, lower, range can be considered local to the region, on the basis of the locally bioavailable range (0.70633–0.70802) discussed above. The average value of the individuals in the group below 0.70802 and the average value of the individuals in the group above that differ significantly (t-test -12.23874, p-value < .00001), which further supports separating individuals into two groups that may reflect variable geographic origins, even if a more cautious local range is adopted (0.70700–0.70732, based on archaeological fauna with limited mobile range). All of the sampled individuals from chamber and niche tombs displayed local values, whether from New Kingdom (11) or later (13). No individuals securely dated to the Early Napatan period yielded non-local values.

Importantly, the seven individuals in the higher cluster were all buried in pyramid tombs within Cemetery D (no tombs of this form were found in Cemetery C). These seven individuals were laid to rest in an extended position; six can be securely dated to Dynasties 19–20, and the other is also possibly of that date. Six are buried in the cluster of largest pyramid tombs (Fig. 1), seemingly built for the Deputies of Kush (Binder et al. 2017). Tomb G322 was used for the burial of at least twenty individuals during Dynasties 19–20, of which five were sampled, all returning ratios (0.70814–0.70837) above the local range. The central chamber included burials of a young adult

TABLE 2 Isotopic data for human remains from Amara West, with summary of data from comparative sites

Sample no. (bold: interpreted as outside local range)	Grave	Tomb type	Context	Skeleton	Tooth type	Burial position	Estimated biological sex, estimated age (yrs)	Ceramic dating (Gasperini 2023) *for tomb chamber*	$^{87}Sr/^{86}Sr$
AMR-36	G243	Chamber tomb	9301	Sk243-9	Unrecorded	Extended	Male, 21–35	Dynasty 19–20	0.70731
AMR-12	G305	Chamber tomb	8110	Sk305-3	Premolar	Extended	Female, 21–35	Dynasty 19–8th century BCE	0.70733
AMR-3	G211	Niche & chamber tomb	9026	Disarticulated	Incisor	Could not be determined	Could not be determined, adult	Late Dynasty 20–Early Napatan	0.70741
AMR-11	G305	Chamber tomb	8100	Sk305-2	Premolar	Extended	Male, 36–50	Dynasty 19–8th century BCE	0.70747
AMR-2	G210	Niche tomb with tumulus	9022	Disarticulated	Molar	Could not be determined	Could not be determined, adult	Early Napatan–8th century BCE	0.70749
AMR-25	G234	Chamber tomb	9135	Sk234-10	Premolar	Extended	Male, 36–50	Dynasty 19–20	0.70750
AMR-4	G201	Chamber tomb	9019	Disarticulated	Molar	Could not be determined	Could not be determined, adult	Late Dynasty 20–Early Napatan	0.70752
AMR-33	G243	Chamber tomb	9304	Sk243-13		Extended	Female, 21–35	Dynasty 19–20	0.70752
AMR-24	G234	Chamber tomb	9201/9202	Disarticulated	Unrecorded Premolar	Could not be determined	Could not be determined, adult	Dynasty 19–20	0.70753
AMR-20	G216	Niche tomb	9169	Disarticulated skull	Premolar	Could not be determined	Could not be determined, adult	Late Dynasty 20–Early Napatan	0.70754
AMR-15	G218	Niche tomb	9060/9061	Disarticulated	Premolar	Could not be determined	Could not be determined, adult	Late Dynasty 20–8th century BCE	0.70754
AMR-31	G244	Chamber tomb with tumulus	9247	Disarticulated	Premolar	Could not be determined	Could not be determined, adult	Dynasty 19–20	0.70755
AMR-5	G211	Niche & chamber tomb	9033	Sk211-2	Molar	Extended	Male, 25–35	Late Dynasty 20–Early Napatan	0.70755
AMR-14	G305	Chamber tomb	8113	Sk305-6	Premolar	Extended	Male, 21–45	Dynasty 19–8th century BCE	0.70756
AMR-22	G201	Chamber tomb	9174	Sk201-1	Premolar	Extended	Male, 25–50	Late Dynasty 20–Early Napatan	0.70756
AMR-7	G211	Niche & chamber tomb	9034	Disarticulated	Molar	Could not be determined	Could not be determined, adult	Late Dynasty 20–Early Napatan	0.70756

TABLE 2 Isotopic data for human remains from Amara West, with summary of data from comparative sites (*cont.*)

Sample no. (bold: interpreted as outside local range)	**Grave**	**Tomb type**	**Context**	**Skeleton**	**Tooth type**	**Burial position**	**Estimated biological sex, estimated age (yrs)**	**Ceramic dating (Gasperini 2023) *for tomb chamber***	**$^{87}Sr/^{86}Sr$**
AMR-37	G244	Chamber tomb with tumulus	9515	Sk244-8	Premolar	Extended	Male, 25–35	Dynasty 19–20	0.70756
AMR-34	G243	Chamber tomb	9300	Sk243-1	Molar	Extended	Could not be determined, 0–2	Dynasty 19–20	0.70756
AMR-17	G226	Niche tomb with tumulus	9076/9077	Disarticulated	Premolar	Could not be determined	Could not be determined, adult	Late Dynasty 20–8th century BCE	0.70757
AMR-1	G200	Chamber tomb	9001	Disarticulated	Premolar	Could not be determined	Could not be determined, adult	Late Dynasty 20–Early Napatan	0.70758
AMR-32	G244	Chamber tomb with tumulus	9506	Sk244-4	Premolar	Extended	Male, 20+	Dynasty 19–20	0.70758
AMR-23	G234	Chamber tomb	9201/9202	Disarticulated	Premolar	Could not be determined	Could not be determined, adult	Dynasty 19–20	0.70759
AMR-56	G244	Chamber tomb with tumulus	9457	Sk244-15	Molar	Extended	Could not be determined, 9–14	Dynasty 19–20	0.70760
AMR-6	G300	Chamber tomb	8005	Disarticulated	Premolar	Could not be determined	Could not be determined, adult	Dynasty 19–20	0.70763
AMR-30	G309	Pyramid tomb	8168	Sk309-7	Premolar	Extended	Female, 21–35	Dynasty 19–8th century BCE	0.70770
AMR-13	G305	Chamber tomb	8105	Sk305-1	Canine	Extended	Female, 30–50	Dynasty 19–8th century BCE	0.70772
AMR-27	G309	Pyramid tomb	8146	Sk309-4	Premolar	Extended	Female, 21–35	Dynasty 19–8th century BCE	0.70773
AMR-10	G301, western chamber	Pyramid tomb	8063	Sk301-3	Molar	Extended	Female, 36–50	Dynasty 19, reign of Ramses II (1279–1213 BCE)	0.70780
AMR-21	G230	Niche tomb	9125	Disarticulated	Premolar	Could not be determined	Female, adult	Late Dynasty 20–8th century BCE	0.70781
AMR-8	G301, north eastern chamber	Pyramid tomb	8061	Sk301-1	Premolar	Extended	Could not be determined, 12–15	Dynasty 19	0.70785
AMR-19	G216	Niche tomb	9167	Sk216-1	Molar	Extended	Male, 20–30	Late Dynasty 20–Early Napatan	0.70788

TABLE 2 Isotopic data for human remains from Amara West, with summary of data from comparative sites (*cont.*)

Sample no. (bold: interpreted as outside local range)	**Grave**	**Tomb type**	**Context**	**Skeleton**	**Tooth type**	**Burial position**	**Estimated biological sex, estimated age (yrs)**	**Ceramic dating (Gasperini 2023) *for tomb chamber***	**$^{87}Sr/^{86}Sr$**
AMR-18	G226	Niche tomb with tumulus	9076/9077	Disarticulated	Premolar	Could not be determined	Could not be determined, adult	Late Dynasty 20–8th century BCE	0.70788
AMR-52	**G322, central chamber**	**Pyramid tomb**	**8520**	**Disarticulated**	**Premolar**	**Could not be determined**	**Could not be determined, adult**	**Dynasty 19–20**	**0.70814**
AMR-9	**G301, north eastern chamber**	**Pyramid tomb**	**8062**	**Sk301-2**	**Premolar**	**Extended**	**Could not be determined, 12–18**	**Dynasty 19**	**0.70817**
AMR-50	**G322, central chamber**	**Pyramid tomb**	**8527**	**Sk 322-10**	**Premolar**	**Extended**	**Male, 20–35**	**Dynasty 19–20**	**0.70824**
AMR-49	**G322, north western chamber**	**Pyramid tomb**	**8536**	**Disarticulated**	**Molar**	**Could not be determined**	**Could not be determined, adult**	**Dynasty 19–20**	**0.70832**
AMR-53	**G322, northern chamber**	**Pyramid tomb**	**8388**	**Disarticulated**	**Premolar**	**Could not be determined**	**Could not be determined, adult**	**Dynasty 19–20**	**0.70835**
AMR-51	**G322, central chamber**	**Pyramid tomb**	**8526**	**Sk322-9**	**Premolar**	**Extended**	**Female, 30–45**	**Dynasty 19–20**	**0.70837**
AMR-55	**G321**	**Pyramid tomb**	**8431**	**Disarticulated**	**Premolar**	**Could not be determined**	**Could not be determined, adult**	**Dynasty 19–8th century BCE**	**0.70841**
Average			0.70772						
SD			0.000301104						
Human range (ave ± 2SD)							0.70712	0.70832	
Late Dyn 20 – Napatan	n = 13								
Human average			0.70748						
Human standard deviation			0.00015						
Human range (ave ± 2SD)							0.70732	0.70764	
Dynasty 19–20	n = 19								
Human average			0.70780						

TABLE 2 Isotopic data for human remains from Amara West, with summary of data from comparative sites (*cont.*)

Sample no. (bold: interpreted as outside local range)	**Grave**	**Tomb type**	**Context**	**Skeleton**	**Tooth type**	**Burial position**	**Estimated biological sex, estimated age (yrs)**	**Ceramic dating (Gasperini 2023) *for tomb chamber***	**$^{87}Sr/^{86}Sr$**
Human standard deviation			0.000337028						
Human range (ave ± 2SD)							0.70713	0.70847	
Comparisons to contemporaneous populations									
Site (north to south)	*Date*		*Mean*	*SD*			*Range*	*Source*	
Memphis	1550–1070 BCE		0.70777	0.00034			0.70735–0.70872	Buzon & Simonetti 2013: 6, table 2	
Qurneh	1550–1070 BCE		0.70777	0.00017			0.70731–0.70798	Buzon & Simonetti 2013: 6, table 2	
Qurneh	1550–1070 BCE		0.70815	0.00056			0.70751–0.70877	Touzeau et al. 2013: 95	
Shellal	1550–1070 BCE		0.70765	0.00031			0.70705–0.70811	Buzon & Simonetti 2013: 6, table 2	
Second Cataract (SJE) C-Group	2000–1600 BCE		0.70758	0.00026			0.70701–0.70807	Buzon & Simonetti 2013: 6, table 2	
Second Cataract (SJE Pharaonic)	1650–1350 BCE		0.70746	0.00027			0.70658–0.70769	Buzon & Simonetti 2013: 6, table 2	
Sai, tomb 26	1425–1325 BCE						0.70729–0.70805	Retzmann et al. 2019: 362, table 2	

TABLE 2 Isotopic data for human remains from Amara West, with summary of data from comparative sites (*cont.*)

Tombos Napatan	1070–747 BCE	0.70747	0.00026		0.70721–0.70767	Buzon & Simonetti 2013: 6, table 2; Buzon et al. 2016: supplementary table 5; Buzon et al. 2023: fig. 4
Tombos New Kingdom	1450–1070 BCE	0.70766	0.00045		0.70656–0.70935	Buzon & Simonetti 2013: 6, table 2; Buzon et al. 2016: supplementary table 5; Schrader et al. 2019; Buzon et al. 2023: fig. 4
Hannek	1550–1070 BCE	0.70783	0.00137		0.70713–0.70966	Schrader et al. 2019: 375
Kerma	1680–1050 BCE	0.70748	0.00029		0.70718–0.70812	Buzon & Simonetti 2013: 6, table 2
El-Kurru	1070–656 BCE	0.70780	0.00003		0.70777–0.70782	Kozieradzka-Ogunmakin 2020: 224, table 1

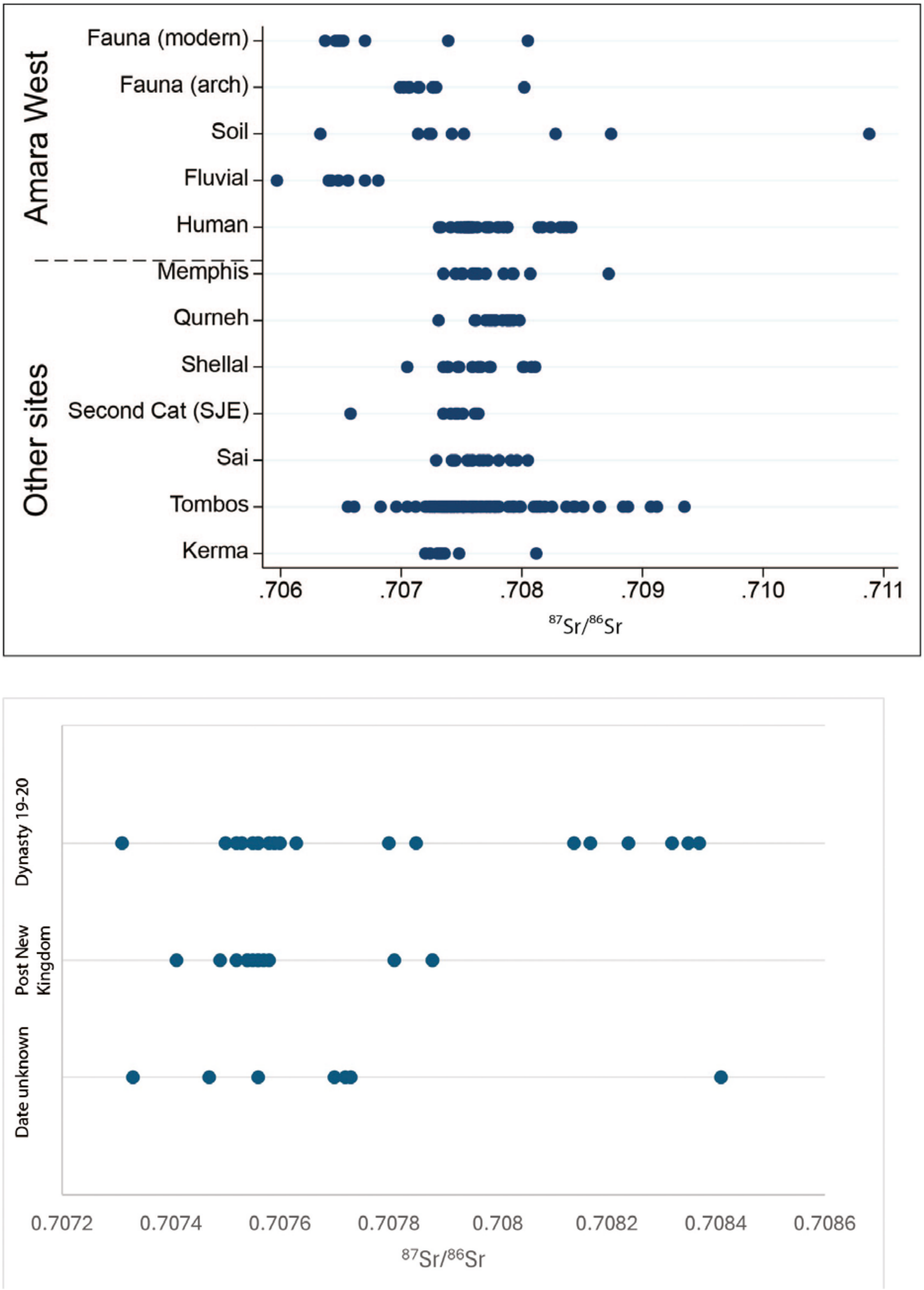

FIGURE 6 (Above) Human/faunal/soil Sr ratios at Amara West and comparative sites; (below) Amara West human Sr ratios by time period
DIAGRAM BY MICHELE BUZON

TABLE 3 Isotopic data for sediment, from archaeological and riverine contexts at Amara West, with summary of data from comparative sites

Sample #	Area context	Grave	Skel no.	Period	Type	$^{87}Sr/^{86}Sr$
AMR-23S	9174	G201	–	Late Dynasty 20 / Early Napatan	soil	0.70828
AMR-4S	9019	G201	–	Late Dynasty 20 / Early Napatan	soil	0.70723
AMR-7S	9034	G211	–	Late Dynasty 20 / Early Napatan	soil	0.70874
AMR-19S	9167	G216	–	Late Dynasty 20 / Early Napatan	soil	0.70714
AMR-15S	9060–9061	G218	–	Early Napatan?	soil	0.70725
AMR-18S	9076–9077	G226	–	Late Dynasty 20–8th century BCE	soil	0.70752
AMR-21S	9125	G230	–	Early Napatan?	soil	0.70742
AMR-8S	8061	G301	Sk-301/1	Dynasties 19–20	soil	0.71088
AMR-11S	8100	G305	Sk-305/2	Dynasty 19–8th century BCE	soil	0.70633
AWP (A)	–	Amara West palaeochannel	–	205 BCE ± 180 (OSL)	fluvial	0.70681
AWP (B)	–	Amara West palaeochannel	–	205 BCE ± 180 (OSL)	fluvial	0.70597
AWP (C)	–	Amara West palaeochannel	–	405 BCE ± 335 (OSL)	fluvial	0.70640
AWP (D)	–	Amara West palaeochannel	–	405 BCE ± 335 (OSL)	fluvial	0.70648
AWP (E)	–	Amara West palaeochannel	–	835 BCE (interpolated)	fluvial	0.70642
AWP (F)	–	Amara West palaeochannel	–	1270 BCE ± 215 (OSL)	fluvial	0.70670
AWP (G)	–	Amara West palaeochannel	–	1270 BCE ±215 (OSL)	fluvial	0.70656
Archaeological sediments						
Average		0.70786				
SD		0.001322871				
Sediment range (ave ± 2SD)			0.70522	0.71051		
Archaeological and fluvial sediments						
Average		0.70726				
SD		0.001211445				
Soil range (ave ± 2SD)			0.70483	0.70968		
Fluvial sediments						
Average		0.70648				
SD		0.000268869				
Fluvial range (ave ± 2SD)			0.70594	0.70701		

TABLE 3 Isotopic data for sediment (*cont.*)

Comparisons to other regions			
Site	*Date*	*Range*	*Source*
Nile, various	2050–400 BCE	0.70800–0.70820	Krom et al. 2002
Sai, Nile water	Modern	0.70679–0.70682	Retzmann et al. 2019: 363, table 3
Sai, alluvium	Modern	0.70661–0.70763	Retzmann et al. 2019: 363, table 3
Sai, alluvium	Palaeo	0.70752–0.70801	Retzmann et al. 2019: 363, table 3
Sai, tomb 26	1425–1325 BCE	0.70791–0.70819	Retzmann et al. 2019: 363, table 3
Downstream of Atbara confluence	Modern	0.70570–0.70660	Krom et al. 2002
Blue Nile	Modern	0.70650	Talbot et al. 2000

male (Sk 322-10/AMR-50), a female of 30–45 years old (Sk 322-9/AMR-51) and a disarticulated adult individual (AMR-52). The other two non-locals individuals in G322 were an adult buried in the north-western burial chamber (AMR-49) and another (AMR-53) in the northern chamber, associated with the shabti inscribed with the name I-bay. A further non-local individual was identified (AMR-55) in another large pyramid tomb (G321) though due to extensive looting, the biological sex, age or burial position could not be established.

Non-local individuals were also encountered in both smaller pyramid tombs from which sampling was possible. The principal (western) chamber of pyramid tomb G301 housed the coffin burials of an adult man and woman (Fig. 3): the latter (Sk 301-3/AMR-10) fell within the local range. A secondary chamber held the bodies of at least six individuals: commingled remains and two intact juveniles buried in supine position, one (Sk 301-1/AMR-8, 0.70785) within the local range, the other with a higher value (Sk301-2/AMR-9, 0.70817).

4 Discussion

4.1 *Local Individuals*

The data presented above suggests that the majority of individuals sampled (32/39) had ratios (0.70741–0.70788) consistent with the local region, though with the caveat that individuals with such values are found at sites along the Nile Valley, though as one moves north the mean and range increases. Those individuals were buried in graves of all types: multi-chamber tombs, including one with a tumulus superstructure (G244), niche tombs (a form only attested in the Early Napatan period) and in pyramid tombs. No individuals from shallow pit burials were sampled, as none yielded well preserved skeletal remains, precluding insights into the geographic origin of those provided with the most modest interments. Local signatures were not found in the big pyramid tombs, only in two more modest pyramid tombs (G301, G309).

Thirteen of the local individuals could be securely dated to Dynasties 19-20, with a further six possibly of that date. As between six and seven individuals of that date range had non-local signatures, or 20–30% of our dataset from that period, this suggests a substantial proportion (70–80%) of the inhabitants of the town may have grown up at Amara West or in the wider Upper Nubian region. Given the small proportion of burials for which isotopic analyses was feasible, these ratios are only indicative and may mask demographic patterns, or indeed changes within that timespan. Most were buried in an extended position (9/13, and all six of those which could only be dated as Ramesside-early Napatan), underlining how aspects of pharaonic funerary traditions were being selected for those who grew up locally.

At least one of the 'local' individuals (Sk 301-3) was part of the elite and ostensibly identified as culturally Egyptian: a female buried in a small pyramid tomb (G301) during the reign of Ramses II (Binder et al. 2011), alongside an adult male who may have been a priest, military officer or administrator (for pharaonic elites in Nubia, see Auenmüller 2018). Both were provided with coffins, and the burial chamber also included a scarab inscribed with the name of Ramses II, Egyptian-style ceramics and a Canaanite wine jar, alongside a small piglet placed as food offering. Dating to the first century of the town's occupation, this woman may have been born at the site or relocated to Amara West from elsewhere – perhaps another settlement founded by the pharaonic state – in the region.

In G301, the subsidiary northeastern chamber (Binder et al. 2011: fig. 14) included both a 'local' (Sk 301-1, 0.70785) and 'non-local' (Sk301-2, 0.70817) individual. Another pyramid tomb of modest scale (G309) housed two local individuals. As noted for Tombos, we should consider the possibility that household staff were buried with their family, whether having travelled from Egypt together or being indigenous to the area (Buzon et al. 2023: 9). Individuals of local origin are also attested in other Ramesside tombs in both cemeteries, including tumuli (G300, G244; the latter includes the individual with evidence of metastatic carcinoma, Binder et al. 2014), and two-chambered (G234, G243) tombs.

The range (0.70741–0.70788) for those posited as local individuals is within the published data ranges for human remains from Upper Nubia, based on data from individuals buried in Second Cataract region, Sai, the Third Cataract and Kerma (Table 2), though more tightly clustered. This might reflect a less heterogeneous demographic of a town founded within an occupied territory already under pharaonic control for 150 or so years, whereas Tombos and Sai were founded soon after the initial conquest. The Second Cataract samples represent communities living outside the major (pharaonic) centres and within a century of the pharaonic conquest.

Turning to burials dating to the transition from pharaonic rule to its aftermath, all thirteen sampled individuals fell within the local $^{87}Sr/^{86}Sr$ range, most likely indicating a fall-off in the number of immigrants to the area after the end of pharaonic rule, whether from Egypt or elsewhere. Three were found in chamber tomb G200 (which housed three other burials, not sampled), but the rest were all buried in niche tombs, a form of funerary structure reintroduced to Amara West after colonial rule (G210, G211, G216, G218, G226, G230). Two were laid out in extended position (the remainder were too disturbed to ascertain body layout), typical for this period at Amara West, alongside other aspects of ostensibly Egyptian (coffins, amulets) and Nubian (*angareeb*-beds) funerary traditions. Of course, we cannot ascertain if these local individuals were descended from Egyptian or other migrants, nor whether they self-identified as Egyptian and/or Nubian.

At Amara West, given there is no evidence for occupation of housing areas after 1000 BCE, later burials may include interments of individuals living at settlements on the West Bank (Vila 1980; Gasperini 2023: 125). The make-up of communities in the aftermath of pharaonic control can also be traced at Tombos (Buzon et al. 2016: 295–7; Buzon & Smith 2023), where all of the individuals sampled from tombs of that era display a local signature (Buzon et al. 2023). Following an earlier era of pharaonic occupation of Lower Nubia (*c.*1950–1700 BC), a shift in political allegiance to Nubian rulers can be demonstrated through epigraphic evidence from Buhen (Säve-Söderbergh 1949) and a similar switch can be posited for Amara West and Tombos at the end of the New Kingdom.

4.2 *Immigrants at Amara West*

The seven individuals with $^{87}Sr/^{86}Sr$ ratios outside the local range are all from pyramid tombs in Cemetery D. One disarticulated individual (AMR-55) was recovered from the chapel of a pyramid tomb (G321), and is of uncertain date; the others can be securely dated to Dynasties 19–20. These large funerary monuments (Figs. 1–2; Binder 2017: 594–8, fig 5) marked burials of the high elite, with commanding views across the now dry river channel towards the town. Shabtis (Fig. 4) attest to the use of one such tomb for the burial of a Deputy of Kush, Paser (N. Spencer 2019a: 112–12, fig. 11): it is reasonable to posit the other large pyramid tombs also housed Deputies and their dependents, given their similar structures, scale and spatial proximity. Monuments for two named Deputies of Wawat lie adjacent to each other at Aniba (Näser 2017).

All five individuals sampled in pyramid tomb G322 yielded $^{87}Sr/^{86}Sr$ ratios (0.70814–0.70837) consistent with a non-local origin. Poor preservation precluded isotopic analysis of the other fifteen individuals found in the tomb, thus G322 may have contained both individuals who grew up in the region and others who arrived from elsewhere after childhood. The disturbed nature of the tomb does not allow us to establish if this is a group of immigrants arriving at one time, or across several generations, or indeed whether one of these skeletons was that of a Deputy of Kush. As non-local signatures were found for two female individuals, these immigrants may have included family groups – note AMR-9 is a 'non-local' adolescent – who then opted to bury their dead at that site rather than return to their region of origin. This was also posited at Tombos (Buzon et al. 2023); an alternative possibility is that females were migrating to the region, whether independently or to join family groups already resident in Upper Nubia (see Stantis et al. 2020 for Tell el-Dab'a in the Nile Delta, where a patrilocal pattern is proposed based on isotopic data).

A single non-local individual (Sk301-2, 0.70817) was found in a more modest pyramid tomb (G301) in the same cemetery, placed over a local individual (Sk 301-1, 0.70785) in the secondary chamber (Fig. 3). The presence of non-local individuals in a tomb containing local middle elites (Sk301-3 and 4, see above) reveals how inward migration was not restricted to the most senior officials and their families: could this non-local individual be a family member or household staff?

Where were these migrants from? Egypt remains the most obvious candidate, given the pharaonic state ruled the region, with Egyptian cult temples maintained, textual evidence for military and mining expeditions and the flow of raw and worked materials back to Egypt. Evidence for objects made in Egypt being present at Amara West, for example a quartzite statue (N. Spencer 2019a: 120 [2], fig. 17) or marl clay ceramic vessels (Gasperini 2023: 116–17), attests to ongoing networks of circulation for objects between Amara West and Egypt throughout the site's occupation. Furthermore, these non-local individuals are buried in tombs consistent with contemporaneous practices in Egypt itself: pyramid and chapel superstructures, communal burial chambers furnished with coffins and other distinctive grave goods (Binder 2017).

The isotopic data presented here suggests that they were born and raised outside this region, perhaps downstream of the First Nile Cataract, where $^{87}Sr/^{86}Sr$ are generally higher (Fig. 6, Tables 1, 2), though sites in Nubia also feature a small number of individuals with markedly higher values and thus assumed to be immigrants to these sites (Buzon et al. 2023, fig. 5; Table 2). Some individuals may have grown up within settlements in Lower Nubia, notably Aniba as seat of the Deputy of Wawat, but isotopic data from that site is not available. Such a scenario would still represent a posting from elsewhere in the pharaonic empire into Upper Nubia, the most southerly region under the state's control. Looking further afield, there is evidence for the resettling in Nubia of people captured in campaigns in Western Asia, the opposite side of Egypt's colonial endeavour (Kemp 1978: 34), though it would be surprising to see such relocated individuals buried in elite pyramid tombs.

How does this new evidence from Amara West fit with existing research on mobility in pharaonic Nubia? Inscriptional evidence suggests the placing of Nubian elites in charge of certain areas on behalf of the pharaonic state throughout Dynasty 18 (Fitzenreiter 2004: 176–81; Davies 2005: 53–4; Török 2009: 263–84; Morkot 2013: 944–50). This included Ruiu – a Nubian name – the first attested Deputy (of Wawat), whose tomb may have been converted to a cenotaph during his lifetime (Näser 2017). Some of these local elites were brought to Egypt for a period to integrate them into the pharaonic worldview (Müller 2013: 47–8, 244–7). It has been assumed that Egyptianised Nubians then formed the core of the colonial administration throughout the later New Kingdom (e.g. O'Connor 1993: 65).

Biodemographic data from the sites of Tombos and Sai provide another perspective on mobility in New Kingdom Nubia. An intersectional study of isotopic data from 145 individuals at Tombos, occupied from the mid-18th dynasty through the Napatan Period, revealed continued inward migration after Dynasty 18 and how that manifested across different social groups in the New Kingdom: 9% of individuals buried in pyramid tombs (5/54), 30% of 'middle class' chamber tomb burials (16/52) and 36% of pit burials (5/14) were non-local (Buzon and Simonetti 2013; Buzon et al. 2016; Buzon et al. 2023: 9, fig. 4). No non-local signatures were found amidst the five individuals buried in the tumulus cemetery during, or in the transition from, the New Kingdom (Buzon et al. 2023: 7) echoing the results from Amara West (tomb G244). Unfortunately, the rock-cut burial chambers of the Dynasty 18 pyramids at Tombos were inaccessible, so it is unknown if the high elite – which included a 'scribe of counting gold', Siamun – fell into a local or non-local category. At Tombos, as with Amara West, Early Napatan data includes no non-local individuals.

At Sai, isotopic data have only been published from one tomb, with all sampled individuals yielding a local strontium isotope value (Retzmann et al. 2019). Correlating the published sample list (Retzmann et al. 2019: table 2) with the phasing presented in the archaeological publication (Budka 2021), the nine individuals span the reign of Thutmose III to the end of the New Kingdom, or around 280 years: the original male and female adult burials (individuals 145 and 324), the overseer of gold-workers Khnumose and his presumed wife (159, 160), two adult females of late Dynasty 18 (124, 359), an older male and infant of Dynasty 19 (3a, 5), and an adult male of Dynasty 20 (1). The earliest are posited as either 'converted citizens' of Nubian origin, or locally born offspring of Egyptian immigrants (Retzmann et al. 2019, 372–3), the former interpretation aligning with the Dynasty 18 textual record.

The Amara West data presented here are particularly important, then, in adding evidence for high elite inward migration – perhaps including Deputies of Kush and and their families – during the last two centuries of a 380-year era of pharaonic rule. Unfortunately, other than Khnummose at Sai (local signature), no isotopic data is available for other senior positions attested through inscriptions, such as town mayors (Auenmüller 2018). Khnummose (Sai) and Siamun (Tombos), whilst not having the status or responsibilities of the Deputies, were still officials central to the colonial project, given their roles concerned the oversight of gold extraction.

For less elite groups buried in the pharaonic towns in New Kingdom Nubia, as far as can be based on tomb sizes and types, inward migration also seems to have remained a persistent phenomenon. This may have been particularly true of the lower-middle echelons of the elite, buried in more modest pyramid tombs, which comprised a mixture of locally raised individuals (the original female burial Sk301-3 in G301, and a very high proportion of burials in Tombos pyramid tombs) and those from elsewhere. Tomb 26 at Sai is at present unusual, as all nine sampled individuals were local.

That patterns may have differed between the sites is further suggested by the data from chamber tombs, posited as 'middle class' individuals and their families (e.g. 'lower-ranking, bureaucrats and individuals employed as scribes, artisans, and servants'; Buzon et al. 2023: 4). At Amara West, all the individuals sampled from such tombs were brought up in the region, whereas a significant proportion (30%) of New Kingdom burials were non-local at Tombos. Chronological variation within sites is also likely, particularly at a site with longer occupation span such as Tombos. There, the non-local component within chamber tombs peaked in the decades following foundation (Buzon et al. 2023), echoing the interpretation gained from texts of a colonial administration focused upon co-opting locally based individuals in the generation following the conquest.

Our lack of isotopic data from desert areas of Nubia, or indeed other regions (western Sudan, Red Sea coast) limit the potential for exploring whether some non-local signatures could be consistent with areas other than Egypt. If so, it would represent a wider co-opting of elites, from areas beyond the Nubian Nile Valley and Egypt, and would extend the archaeological evidence thus far attested for trade and material networks that brought together the Nubian Nile Valley with regions such as the Gash Delta (Manzo 2017), perhaps even building on pre-pharaonic links between Kerma and other polities in this region of Africa (see the 'coalition theory' of Bonnet 2017: 114).

4.3 *State- and Community-Level Migration and Mobility in Occupied Nubia*

Assuming the high elite inward migration in the Ramesside Period was from Egypt or elsewhere within the New Kingdom empire, could it have been part of a strategic shift by the pharaonic state? Around 1300 BCE, the state introduced a new architectural model for its borders and urban foundations in occupied areas. The new early Dynasty 19 walled towns in Nubia – at Aksha and Amara West – are distinctive in scale and layout from their Dynasty 18 predecessors, a phenomenon echoed on Egypt's northern frontiers (Spencer 2014a: 23–34 and 5, fig. 3). This new form, and perhaps function, of the pharaonic towns may have been complemented by posting high officials and their families to the Nubian colony, as indicated by the isotopic evidence from Amara West. Of course, new postings may also have been in response to specific situations, such as the rebellions in the reigns of Ramses II (Spalinger 1980; depicted on the West Gate at Amara West: Spencer 2016: 34, pls. 187–90), Merenptah (Abbas 2020, 141–3) and Ramses III (Redford 2018). The late Dynasty 20 Deputy of Wawat Paenniut dealt with an uprising in the Aniba area, and the inscriptions in his tomb underline the continued importance of Deputies for the pharaonic state's management of occupied Nubia (Fitzenreiter 2004: 178–86).

It may, of course, be possible that some Deputies during this period were appointed from local families, as was already the case with Ruiu in mid-Dynasty 18 (Davies 2005: 57 [27]). Epigraphic evidence indicates Deputies were sometimes drawn from those already serving in the Nubian administration: Amenemope was promoted from 'scribe of the Viceroy' (of Nubia) to Deputy of Kush in the time of Tutankhamun (Kawai 2015: 314). The evidence from Amara West, that elite families could come from outside the region, underlines how specific patterns might emerge at different places, and at different times.

These inward migrants to Amara West chose to bury the deceased in imposing family tombs, with cultural affiliation to Egypt (see Eckardt and Muldner 2016: 213) suggested by tomb architecture, burial goods and treatment of the body (Binder 2017). Yet we should not assume that those who moved to Upper Nubia may have experienced their migration within a 'politically and economically continuous' landscape (Bernardini 2011: 31), nor that these elites would have preferred a burial back in Egypt, as suggested by ancient Egyptian literature and biographical texts that express a desire to return bodies to Egypt (e.g. Strudwick 2005: 336).

In fact, these tombs which housed non-local elites bear evidence of the complexity of interactions as individuals and groups negotiated the colonial experience and projected mutable identities, with community agency likely a major factor in the persistence of indigenous practices. Even amidst ostensibly Egyptian architectural and funerary culture, space was afforded to Nubian culture. Remains of distinctive handmade Nubian pots were found in the courtyard of pyramid tomb G322 where five non-local individuals were buried, perhaps left as offerings (Gasperini 2023: 120). This hybridity of Egyptian and Nubian practices, technologies and visual culture is evidenced elsewhere at Amara West through architecture Spencer 2010), pottery-making (Spataro et al. 2015; Gasperini 2023: 118–20), pigment use (Fulcher 2022; Fulcher et al. 2021), funerary beliefs and practice (Binder 2017; Lehmann 2021), and household ritual (Stevens 2017; Spencer 2019a: 105–11). As Lemos (2022: 8–10) points out, even typical 'Egyptian' object types could be distinctively modified by particular communities in both pharaonic towns and the hinterland.

A trajectory of elite movement, perhaps prompted or sanctioned by the pharaonic state, was complemented, of course, with other migration patterns between Egypt and Nubia, and within these regions. Isotopic data from Tombos indicate that sub-elite individuals from Egypt were buried in the cemetery throughout the New Kingdom (Buzon et al. 2023), and a non-local individual was identified in the rural community at Hannek (Schrader et al. 2019: 375). We might expect traders, soldiers, conscripts and prisoners, farmers and skilled artisans (including potters, see Smith 2014) to have moved around within the region, types of roles that may be represented in the lower elite tombs discussed here. Written correspondence between individuals in Thebes and Nubia (Wente 1967) attest to the long-distance movement of individuals between the areas over a number of years towards the end of Dynasty 20. Some of these travellers from Egypt would likely have stayed on in Nubia, becoming integrated into communities through marriage and other ties, another scenario for the presence of non-local individuals at sites in Upper Nubia. Temporary migration was also a phenomenon, with desert hinterland sites (e.g. Stevens & Garnett 2017) and gold-working camps (e.g. Edwards 2020: 398–407) likely occupied on a seasonal or irregular basis.

The isotopic data does not, of course, indicate who had agency in the mobility or migration of groups or individuals, nor their motivations. We should not assume the pharaonic state was responsible for all such migrations, particularly in a region with persistent phenomena of transhumance and pastoral state models (Edwards 1998; Emberling 2014), much of it on a seasonal rhythm (Gatto 2011). Elsewhere in Sudan, the isotopic analysis of several teeth in an individual has indicated the possibility of multiple mobilities, with people moving in and out of an area across their lifetime (Gregoricka & Baker 2023: 14); poor preservation precluded such an approach at Amara West.

The 'local' individuals, which make up the majority of sampled individuals at Amara West in Dynasties 19–20, may have been members of families based at the site for several generations, or included those who had moved from other settlements in Upper Nubia, or even Lower Nubia; a very limited dataset exists for the latter region's bioavailable strontium. The transfer of the residence of the Deputy of Kush to Amara West during the reign of Seti I (*c.*1305–1292 BC; Morkot 2013: 913; Spencer 2017: 329–35, figs. 7–9) likely resulted in groups of officials and their families transferring to the new town from the earlier centres of Soleb (Auenmüller 2018: 247–9) and Sai (Auenmüller 2018; Auenmüller 2020: 379–81; Budka 2020: 82–3; Budka 2021: 395–401), along with important monuments (e.g. a large royal stela moved from Sai to Amara West: Spencer 1997: 15 [100]). It is not possible to identify isotope ratios distinctive to the closely related sites of Soleb, Sai and Amara West, all within a 50 km stretch of the river Nile.

Intra-regional mobility likely also included migration between rural hinterlands and urban centres. Some of the individuals buried in remote areas built distinctively Egyptian-style rock-cut tombs (Vila 1977a: 145–59; Osman and Edwards 2012: 73–4, figs. 3.22, 3.24; 319–20, figs. 8.20.12–14) suggesting an affiliation with some aspects of pharaonic culture. Perhaps some had recently arrived from Egypt, but did not reside in one of the major centres. Or were these locally raised individuals and families that sought to incorporate aspects of Egyptian practise into their identities? Importantly, these tombs allow us to move beyond the Egyptian-Nubian dichotomy and models of cultural entanglement so prevalent in research focused upon the major centres, to gain insights into alternative practices, amidst scarcity, deployed on the margins of the colonial project (Buzon & Smith 2023; Lemos & Budka 2021).

Migration out of Nubia is of course also attested, with a diversity of communities and archaeologically designated cultural groups evidenced at a number of settlements and cemeteries in Egypt from the third millennium BC onwards (Raue 2019; De Souza 2020; Meurer 2021). Pan-Grave immigration into Lower Nubia, downstream of the Second Cataract, followed the early Dynasty 18 conquest (De Souza 2018).

This study also brings into focus gaps in our understanding and opportunities for future research. Few strontium isotope datasets are available from Egypt – limited by restrictions on sampling, export of material, or access to in-country laboratory facilities – or other arenas of pharaonic control and influence, such as Sinai, the Western Desert Oases or the Levant. Further data are also needed from the hinterlands of the Nubian Nile Valley, the metropolis of Kerma and areas further upstream (see Buzon et al. 2019: 237–8), and other regions which interacted with Nubia, such as central Sudan and the Eastern

Desert, if we are to more fully reconstruct mobility vectors in Nubia under pharaonic rule. Presently, the majority of data is derived from riparian settlements: at desert sites more heterogeneous water sources and increased reliance on pastoralism could also impact isotopic signatures (e.g. at Ghazali: Ciesielska et al. 2023: 16–17). Beyond the availability of data, other factors complicate interpretation: non-local signatures might have been transferred to a newborn via lactation if a mother had relocated around the time of birth (Buzon et al. 2023: 11) and few sites provide a combination of human, faunal, botanical and sedimentary data across a long timeframe (see Simonetti et al. 2023). This may mask equifinality, where individuals growing up in different localities may display the same signature (Stantis et al. 2020: 9). Only with further data and methodological advances will more nuanced insights be possible.

5 Conclusions

This study reveals how Amara West, a new colonial centre founded around 1300 BCE for the pharaonic control of Upper Nubia, was principally inhabited by those who had grown up in the region, presumably also including descendants of earlier migrants. The new administrative structure of early Dynasty 19 did not result in a significantly altered demographic make-up. Rather, as in the towns founded as part of the initial colonial annexation around 1500–1450 BCE, for example Sai and Tombos, evidence suggests migrants, descendants of migrants and indigenous groups were all present.

At Amara West, however, a small number of high elite individuals, had grown up in a different region, likely Egypt, and then moved to Amara West and were buried in the most prominent pyramid tombs. Thus 150 years or more after the region was conquered, senior officials, women and possibly families were moving to colonised Upper Nubia and choosing to stay. The pharaonic state was not solely relying on those already in the region, whether descendants of previous immigrants or co-opted local elites. In fact, there is not yet evidence for local elites and descendants of earlier migrants ascending to the highest positions at Amara West, in contrast to the textual and isotopic data (from Sai) for Dynasty 18, though poor skeletal preservation precluded the sampling of all individuals buried in the big pyramid tombs.

Lower-middle elite burials at Amara West did, however, include individuals brought up in the region, with no examples identified of non-local individuals outside the pyramid tombs (it was not possible to analyse individuals from pit burials). Perhaps unsurprisingly, inward migration to Amara West markedly decreased following the end of pharaonic rule, with all of the analysed individuals from the post-colonial era displaying local signatures. This pattern is found at other sites, such as Tombos.

Broad demographic continuity is thus evident through and beyond the end of Egyptian control, though complemented by continued inward elite migration. In considering the human architecture of the ancient empire, this case study reminds us of how different mechanisms for staffing senior positions could be achieved within the same colonial projects, shifting across the centuries of pharaonic rule, but also varying from one colonial town to the next.

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