

Exploring Intersectional Identities and Geographic Origins in Ancient Nubia at Tombos, Sudan

Michele R. Buzon,^{a*} Kari A. Guilbault,^a and Antonio Simonetti^b

^aDepartment of Anthropology, Purdue University System, West Lafayette, IN, USA

^bDepartment of Civil and Environmental Engineering and Earth Sciences, University of Notre Dame, Notre Dame, IN, USA

*Correspondence to: Michele R. Buzon, Department of Anthropology, Purdue University System, 700 W State St., West Lafayette, Indiana 47907, USA
E-mail: mbuzon@purdue.edu

ABSTRACT

As part of an intersectional investigation of changes in identity and lifeways during sociopolitical changes in the ancient Nile Valley, strontium isotope analysis has provided a useful entry for understanding local practices. At the site of Tombos, human residential mobility was spurred through Egyptian imperial actions in Nubia during the New Kingdom period (~1450–1050 B.C.). During this period, immigrants and locals interacted and influenced cultural symbols displayed in burials with migration ending with Egyptian occupation. Through the examination of multiple overlapping identities and experiences, patterns emerge. Isotopically identified locals are exclusive in tumulus graves and flexed body position (all skeletally sexed as female), consistent with the surrounding region.

However, locals also used materials and practices associated with the colonizers, including pyramid, chapel, and shaft tomb types; extended body position; coffins; and artifacts. These variations provide evidence of simultaneous experiences of multiple social statuses at Tombos. The findings provide fruitful avenues to explore motivations for varying identity expression related to such ideas as family traditions, religious beliefs, gender dynamics, deliberate signaling, and the concept of foreignness. Theoretical and intersectional approaches to isotope analyses also necessitate a reassessment of methodological, analytical, and ethical issues associated with research.

Keywords: Nile Valley; strontium; identity

يقدم تحليل نظائر الاكسجين مداخلًا مفيدًا لفهم الممارسات المحلية كجزء من الدراسات المتداخلة حول تغيرات الهوية وسبل الحياة خلال التغيرات الاجتماعية والسياسية في وادي النيل القديم. أدت الإجراءات التي قامت بها الإمبراطورية المصرية (1450–1050 ق.م) في إقليم النوبة وفي موقع تميس على الأخص الي تنقلات سكانية. تفاعل المهاجرون الجدد مع السكان المحليون خلال هذه المرحلة وكان لها تأثير واضح على الرموز الثقافية بالمداخن في المنطقة حتى نهاية الاحتلال المصري. تظهر الأنماط الثقافية من خلال معرفة الهويات والتجارب المتعددة المتداخلة حيث اثبتت نتائج تحليل نظائر الاكسجين أن السكان المحليين الذين تم التعرف عليهم في مقابر الأكوام ووضع المتوفي فيها بشكل منثني جميعها هياكل عظمية لإناث، ويتوافق هذا النمط مع المنطقة المحيطة.

استخدم السكان المحليون في تلك المرحلة مواد مع بعض الممارسات المختلفة المرتبطة بالمستعمرين بما في ذلك مقابر الهرم والمعابد الجنائزية والمقابر ذات المدخل العمودي الراسي بالإضافة الي وضع الجسم الممتد والتوابيت والمصنوعات اليدوية. قدمت هذه الاكتشافات دليلاً على تجارب متزامنة لحالات اجتماعية متعددة في موقع قرية تميس. كما وفرت هذه النتائج طرق ناجعة في دراسة التعبير عن الهوية بطرق متباينة ترتبط ببعض المفاهيم مثل التقاليد الأسرية، المعتقدات الدينية، حيوية النوع البشري، مفهوم الغربة و تبادل الإشارات المتعمدة. كما ان المناهج النظرية وتداخل العلوم مع تحاليل النظائر ضرورية أيضاً لإعادة النظر وتقييم بعض قضايا المنهجية والتحليل وأخلاق البحث العلمي المرتبطة بالدراسة.

الكلمات الدالة: نهر النيل، عنصر الاسترونتيوم، هوية

As a method that has been in use for decades, isotopic analysis of human skeletal remains as a means to investigate human mobility has become increasingly sophisticated through methodological advancements, more complex research questions, and more nuanced interpretations. As with other types of bioarchaeological studies, researchers seek to use isotopic data within an archaeological and theoretical framework. At its core, bioarchaeology is contextual and explicitly interdisciplinary, integrating data, methods, and theoretical perspectives from archaeology, biological anthropology, cultural anthropology, history, medicine, geography, and other disciplines (Buikstra 1977; Buzon 2012; Buzon et al. 2005) with an increased emphasis on social theory in recent years (e.g., Cheverko et al. 2020; Geller 2021; Knudson and Stojanowski 2020). The integration of isotopic data with multiple axes of identity representing within-community diversity enriches interpretations and enables researchers to focus on the presence of various crosscutting and/or embedded communities (Blom 2017; Buzon 2012; Torres-Rouff and Knudson 2017), highlighting the advantage of this bioarchaeological approach to intersectionality research (DeWitte and Yaussy 2021). This article focuses on strontium isotope analysis ($^{87}\text{Sr}/^{86}\text{Sr}$) of human mobility at Tombos in modern-day Sudan, located at the Third Cataract of the Nile River (Fig. 1), integrated with a rich set of mortuary and skeletal data that has been gathered from more than two decades of work at the site. In particular, this study seeks to explore aspects of identity as demonstrated in mortuary practices enriched through the lens of strontium isotopic determination of geographic origin. Within the dynamic sociopolitical landscape of Egyptian colonial activities in Nubia and the development of multicultural communities, what can these combined data sets add to our understanding of the processes of identity expression in mortuary practices? How do reflections of identity change over time during and after imperial activities? What do the demographic and socioeconomic variables indicate about processes of immigration and community composition? An assessment of methodological, theoretical, and ethical issues is also presented as more strontium data are gathered for the Nile Valley region.

Theoretical Background and Axes of Identity

Contemporary researchers and archaeologists interested in identity formation and transformation find challenges to understanding these processes in various contexts. The deep time depth of archaeological investigations can greatly contribute to a long-term

perspective on identities (e.g., Hu 2013). While many archaeological studies rely on linking the material remains to social identities, the lack of systematic correspondence is recognized (Allaire 1987). How material culture changes over time in a particular community allows for the documentation of these transformations (Buzon et al. 2016). Research on cultural affiliation and ethnicity clearly shows that identity markers are mutable. This flexible and contextual character of identity is often most apparent in times of interaction and conflict (Eriksen 1992; Graves-Brown 1996; Herbert 2003; Jones 1997). The processes of intercultural consumption, involving appropriation, adaptation, indifference, and rejection, can be traced to explore the usage and development of cultural expressions over time (Dietler 2010).

Mortuary practices, which can represent the actual or ascribed roles of the deceased, are considered a significant expression of identity (Emberling 1997; Hall 1997). These visual and often public displays of identity become imprinted onto the landscape (Buzon et al. 2016). From an archaeological data standpoint, how researchers define and categorize identities and groups used in the research is important. These distinctions can impact theoretical implications of identity research. For instance, in the Nile Valley, the names we use for ancient communities are fraught with complications. As de Souza (2021) notes, early twentieth-century scholars constructed names of groups in Nubia, such as Kerma or C-Group, based on perceived material culture differences. The term “Nubia” itself is a word that did not come into usage until millennia after the earliest groups inhabited the region. The area was referred to as Kush during the time of the Tombos site occupation (Smith 2003). While we have some information from Egyptian texts about how people perceived of themselves and others (Smith 2003), the concepts have an elite bias, with the majority of views unrepresented, including those from Nubia who did not have written records during the period under study (Rilly and de Voogt 2012).

We recognize that identities are not stable. It is clear from the work of many scholars that inhabitants of the Nile Valley interacted regularly through the millennia and have a shared interconnected Neolithic background (de Souza 2021; Smith 2019). Groups should not be treated as bounded and distinct within the restrictions of these archaeologically derived names. For instance, we must question if materials and practices typically associated with “Egyptian” and “Nubian” were strictly perceived as such by the ancient inhabitants. This issue was also highlighted by a critique of an ancient Egyptian DNA analysis that failed to address alternative interpretations and recognize the

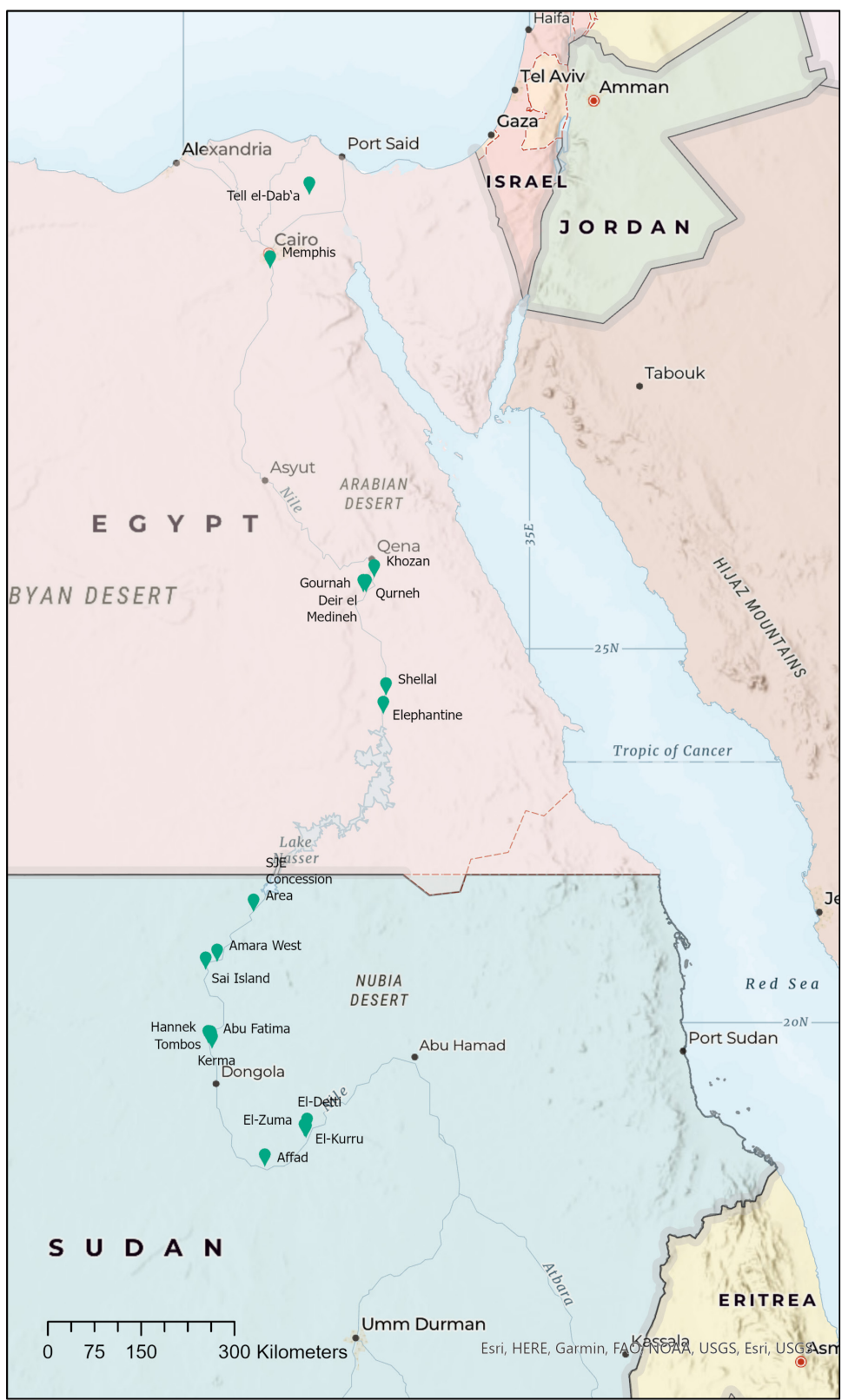


Figure 1. Nile Valley sites with published $^{87}\text{Sr}/^{86}\text{Sr}$ data.

interconnections of African regions (Gourdine et al. 2020).

Demographic variables such as age and sex can provide useful information about possible social subgroups who may have experienced life differently. Both are subject to specific cultural understandings associated with the social roles of life stage and gender. Skeletal features associated with sex exist on a continuum without strict binary distinctions. In fact, some individuals may not have typical sex chromosomes of XX/XY, or their bodies may not conform to a particular suite of osteological traits. Biological sex does not conclusively associate with how individuals understand gender identity (Agarwal and Wesp 2017). Gender is an integral aspect of identity that intersects with other social patterns, although it can be difficult to comprehend for past communities. Researchers of gender in the ancient Nile Valley recognize a correlation between biological sex and gender roles in some contexts (Li 2017; Matić 2016). As such, skeletal sex is used as a starting point for possible gender patterns with the acknowledgment that identities may be obscured with the remains available. The incorporation of isotopic examination of geographic origins provides another lens through which identities can be viewed within the context of regional patterns. Locals and nonlocals, as identified through isotopic methods, enable researchers to explore differences in identity markers as portrayed in mortuary practices and strengthen researchers' abilities to use contextual bioarchaeological data to advance our theoretical understandings of the processes.

Isotopic and Bioarchaeological Research at Tombos

Tombos was initially known from Egyptian inscriptions dating to the New Kingdom colonial period in Nubia (ca. 1500 B.C.). Through the 10 seasons of excavations at Tombos since 2000, data from artifacts, burial practices, and skeletal analyses have been compiled. Excavations in the nearby town have revealed mud brick structure foundations belonging to administrative and/or religious buildings as well as a dry moat and wall system outlining a very large, fortified town. These findings indicate that Tombos could be the ancient fortress of Taroy that is mentioned in Egyptian documents (Smith and Buzon 2018). Dating of these materials reveals it was founded in the mid-eighteenth Dynasty of Egypt (ca. 1450 B.C.). Cemetery remains date to shortly after this time and show continued usage into the Napatan period (~750 B.C.). A community of people created tombs (beginning ca. 1400 B.C.) using Egyptian styles and burial practices,

but findings also indicate that some individuals used more local practices. The combination of burial practices and mortuary artifacts with skeletal analyses provided evidence for a culturally and biologically diverse group of people who may have been Egyptian colonists and locals (Buzon 2006; Smith 2003). Given the premise that Egyptian administrators and colonists had moved to this location, and that Tombos and the likely site of origin (Thebes area in Egypt) are geologically different, earlier studies tested the usefulness of strontium isotope analysis (Buzon et al. 2007); this resulted in a range of strontium isotope values that correspond to the geologic variation.

Strontium isotope analysis at Tombos began with the goal to further explore population composition and evidence for human mobility within the context of biological and cultural variation demonstrated via mortuary and skeletal morphological analyses (Buzon 2006). Each area investigated at the site (chamber tombs, pyramid/chapel structures, tumuli) allows for an assessment of patterns regarding the relationship between various aspects of burial practice and skeletal markers that may relate to identity. Is there correspondence between different tomb structures that may represent different social groups and geographic origin? Do the isotopic data add to our understanding of how material symbols are used in this multicultural community over time? Are we able to illuminate different segments of the community through a subtle variation in traditions linked with isotope data?

The cemetery at Tombos is divided into three main areas (Fig. 2). The northern portion contains pits and underground mud brick chamber tombs (that would have once had mud brick superstructures). They are similar to tombs found in Egypt, which are large communal structures designed for multiple individuals. Based on burial inclusions and practices from the intact burials, we associate this cemetery area with lower-ranking bureaucrats and individuals employed as scribes, artisans, and servants (Buzon et al. 2016; Smith 2003). Individuals from this area have shown the largest amount of nonlocal $^{87}\text{Sr}/^{86}\text{Sr}$ values, with the highest amount during the founding of the colonial community (Buzon and Simonetti 2013; Buzon et al. 2016).

The western area of the cemetery is a field of pyramids, chapel and shaft tombs, and pits. One large pyramid structure is associated with a high-level Egyptian administrator, an individual named Siamun, the Scribe Reckoner of the Gold of Kush, an administrative position below the viceroy and military commander of the colony (Smith and Buzon 2018). This pyramid included a large chapel courtyard and was decorated with funerary cones inscribed with

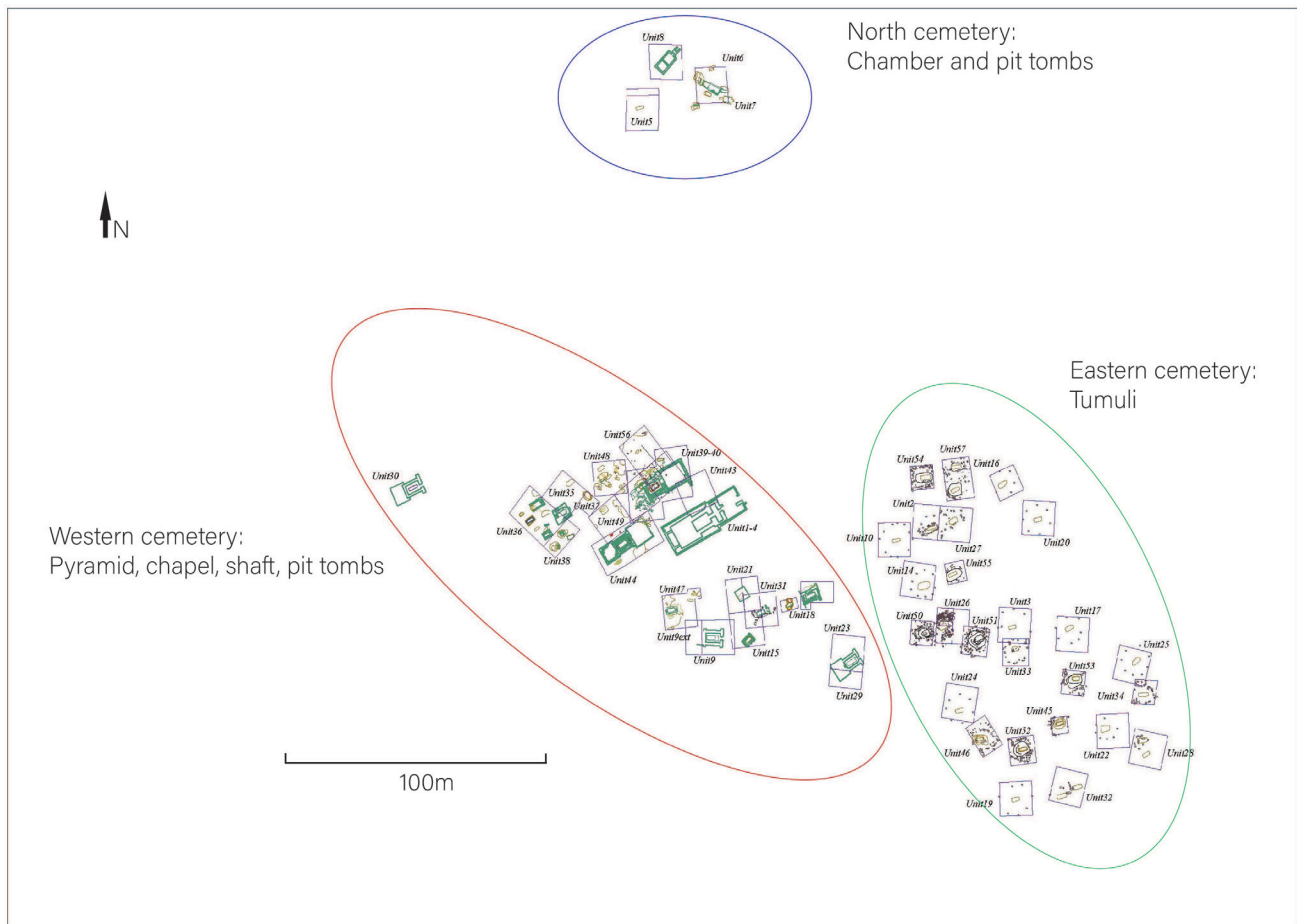


Figure 2. Site map of Tombos.

his name and title. Several subsidiary burials in pits around the tomb were also excavated. Several other large pyramids at the site remain largely unexcavated due to logistical concerns. Additionally, several chapel and shaft tombs were excavated in this area. All of the tombs in this portion of the site were communal and likely included the remains of a primary elite individual as well as family members and household staff. In general, the preservation of all types of materials was relatively poor in this section of the cemetery in the large tombs due to moisture and chamber collapse. Burials in more shallow pits were also found around many of these large tombs. The burials in the pits were comparatively very well preserved and usually undisturbed. Most contained just one individual. Primarily dating to the Egyptian colonial period, approximately 10% of these samples were outside of the local range (Schrader et al. 2019), with all individuals buried in Egyptian-style structures and using Egyptian practices, with the exception of a few individuals.

The eastern portion is the location of the tumulus graves, a burial tradition found in the local region of Nubia. Tumuli were identified by the presence of irregular drystone circles. The tumulus superstructures covered rectilinear shafts consistently oriented east-west and led down to a north-facing side chamber/ niche in all but two, which had south-facing chambers/ niches perhaps due to the location of boulders (Buzon et al. 2016). Local tumulus graves were shown to begin during this colonial period, extending into the subsequent early Napatan, and only local strontium values are found in these individuals (Buzon and Simonetti 2013; Buzon et al. 2016). The most recent excavations in 2020 at Tombos focused primarily on tumulus graves in the eastern portion of the cemetery. This current study reports results from recent excavations and the contextualization of older data within a more detailed examination of identity markers, as well as regional data to better understand how this information can be used to answer theoretical research questions and consider the methodological limitations.

Methods and Samples

The mortuary structure types were documented (superstructure, if present, and substructure) along with burial containers (such as coffins made of wood or pottery, wooden beds, reed matting), associated artifacts (typically jewelry and pottery), body position (generally extended on back or flexed on side), and body orientation. Poor preservation of organic materials due to termites and damp conditions affected our ability to observe burial containers at times. Supine burials are consistent with body positions found in Egypt during the same period. Egyptian burial tradition includes the use of coffins, both wood and ceramic (Ikram and Dodson 1998; Smith 2003). Flexed burials are typical of local Nubian traditions, like what is found at nearby Kerma (the first kingdom of Kush). Nubian practice is often associated with beds in burial (Bonnet 1991; Smith 1992; Williams 1991). Chronological information was obtained from radiocarbon dates of organic materials and datable objects (style seriation and inscriptions; Buzon et al. 2016). It should be noted that this type of study is necessarily biased by a reliance on material remains, such as those mentioned above. Some markers of identity are underrepresented due to preservation and analytical issues, such as some types of organic remains and nonmaterial markers such as language (Spencer 2014). Due to ancient tomb usage and disturbance, some samples included in the strontium isotope analysis come from isolated crania and burials that were no longer intact; age estimation and body position were not observable for all individuals.

The main research interest for the Tombos site is the identification of nonlocal individuals who could represent immigrants from Egypt during the colonial occupation of Nubia. Tombos is located at the Third Cataract of the Nile River, which is an outcrop of granite (Whiteman 1971). The cataracts along the Nile are the boundaries between Nubian sandstone and basement complex (Edwards 1989; Whiteman 1971). The local range at Tombos as established by modern and archaeological faunal samples is $^{87}\text{Sr}/^{86}\text{Sr} = 0.70710\text{--}0.70783$. The area of Thebes in Egypt, a likely location for the origin of colonists, is in a region primarily dominated by limestone; marine carbonates have an average value of $^{87}\text{Sr}/^{86}\text{Sr} = 0.70907$ (Burke et al. 1982). Hence, individuals with the higher $^{87}\text{Sr}/^{86}\text{Sr}$ signatures are hypothesized to have come from Egypt. There are five human samples from Tombos with values below the local range, which could be associated with sites further south in Nubia rather than north in Egypt (Buzon and Simonetti 2013; Simonetti et al. in review). Given this limitation, “nonlocal” for the purposes of this study refers to the $^{87}\text{Sr}/^{86}\text{Sr}$ values *above* the

local range that are more likely to be associated with Egypt.

Strontium isotope analyses were conducted at the University of Notre Dame Midwest Isotope and Trace Element Research Analytical Center (MITERAC) in a class 1000 cleanroom facility and prepared using previously published methods (Buzon et al. 2007; Buzon and Simonetti 2013). A NuPlasma II MC-ICP-MS was used to obtain the strontium isotope ratios. Repeated analyses of a 100-ppb solution of the NIST SRM 987 strontium isotope standard during the course of this study yielded an average $^{87}\text{Sr}/^{86}\text{Sr}$ value of 0.710230 ± 0.000025 (2σ ; $n = 10$). Trace element analysis of uranium (U) and calcium (Ca) using Nu Instruments Atom HR-ICP-MS and ICP-OES units was conducted to assess postburial contamination. An additional 10 human samples from recent excavations at Tombos are reported in this article along with reinterpreted previously published data (Buzon et al. 2007; Buzon and Simonetti 2013; Schrader et al. 2019).

Additional isotope systems have proven useful in assessing diagenetic alteration in samples. Simonetti and colleagues (2021) use lead (Pb) isotope compositions and uranium/lead (U/Pb) ratios to demonstrate that groundwater associated with the proximity of the site to several wadi flood plains has affected the Christian-era human samples from El-Kurru, Sudan. Pb isotope compositions in these samples generally correlated with the U/Pb values, which can be interpreted as diagenetic alteration by groundwater with variable U/Pb ratios. However, there is no correlation between the Sr and Pb isotope compositions at El-Kurru, supporting the idea that diagenetic alteration did not impact the $^{87}\text{Sr}/^{86}\text{Sr}$ values due to the higher contents of Sr in tooth enamel in comparison to Sr in groundwater. Because of the very low abundance of Pb (typically < 1 ppm) in nonaltered tooth enamel, Pb isotopes are especially useful in observing diagenetic alteration (Simonetti et al. 2021).

With export permitted by the National Corporation for Antiquities and Museum in Sudan, the human skeletal remains are curated at Purdue University. Selected pottery sherds are curated at the University of California, Santa Barbara. The remaining archaeological materials remain in Sudan. Age and skeletal sex estimates were made for each individual in the study when the necessary elements were present. Transition analysis was used to estimate age for adults (Boldsen et al. 2002), using the category of “Black” for the analyses with the understanding that the reference sample is based on twentieth-century individuals from the United States. For juvenile remains, dental development, union of epiphyses and ossification centers, and long bone length were used to determine age (Buikstra and Ubelaker 1994; Cunningham et al.

2016). Adult individuals were examined for skeletal changes associated with sexual maturation for males and females (Buikstra and Ubelaker 1994).

Results

Ten new samples are presented here (Table 1). Eight of the samples come from the eastern part of the cemetery from individuals buried in tumulus graves. All of these eight samples have strontium isotope ratios within the established local range ($^{87}\text{Sr}/^{86}\text{Sr} = 0.70710\text{--}0.70783$) at Tombos. Six have female skeletal characteristics, and two have male characteristics. All are adults, ranging from 25 to 34 years to 50 to 69 years, with one cranium aged only to indeterminate adult. There are two individuals from the western part of the cemetery. One (#181) is a much later intrusive flexed adult female burial in a New Kingdom chapel tomb that dates to the Meroitic period (366–106 B.C.) and has an $^{87}\text{Sr}/^{86}\text{Sr}$ value that is on the edge of nonlocal. The second western burial is an adolescent from a pit grave, also with a nonlocal $^{87}\text{Sr}/^{86}\text{Sr}$ value. Interestingly, this individual was buried prone, which is not typical for Egyptian or Nubian practices. The closeness of the lower limbs to each other and of the upper limbs to the torso indicates wrapping. However, the position may not have been intentional; wrapping may have inadvertently resulted in this placement (Smith 2003). The uranium ppm for these samples is 0.03 or below, indicating a low chance of postburial contamination.

Combined with previously published strontium isotope data from Tombos (Buzon et al. 2007; Buzon and Simonetti 2013; Buzon et al. 2016; Schrader et al. 2019), the total number of $^{87}\text{Sr}/^{86}\text{Sr}$ samples from the site is 145, including 68 females and 37 males. Individuals with $^{87}\text{Sr}/^{86}\text{Sr}$ values within the local range (Fig. 3, open bars) are found in all age-at-death categories (63 have age estimates), with 57 females and

27 males. Individuals with values outside of the local range (solid bars) are distributed from 8 to 14 years of age to 50 to 69 years of age, indicating that they may have lived elsewhere during childhood tooth development (11 have age estimates), with 11 females and 10 males.

The majority of the northern and western burials were created during the New Kingdom Egyptian colonial period in Nubia (~1500–1050 B.C.; 25/95, 26% nonlocal). Five individuals from these area date to the postcolonial, early Napatan period in Nubia (~1050–750 B.C.), and are all local; one dates to the Meroitic period (radiocarbon 366–106 B.C.) and is slightly above the local range. The use of tumulus graves in the eastern area begins in the late New Kingdom—five samples have radiocarbon dates that are fully or partially within the New Kingdom (Buzon et al. 2016). The remaining 20 date to the early Napatan period (corresponding to the Egyptian Third Intermediate Period). Except for the intrusive Meroitic burial, all nonlocal values come from individuals dating to the Egyptian colonial period during the New Kingdom, and none date to the postcolonial early Napatan period.

The examination of strontium isotope ratio data by tomb type reveals some differences between the tomb types and cemetery areas (Fig. 4). The most striking is that all of the samples from the tumuli, which are located in the eastern portion of the cemetery, fall within the local range ($n = 25$). Many of the samples from the other tomb types—chamber tombs in the northern cemetery, pyramid-chapel tombs in the western cemetery, and pit tombs distributed between both northern and western areas—are concentrated within the local range as well. However, these tomb types also have individuals outside of the local range: 31% of the chamber burials (16/52), 36% of pit burials (5/14), and 7% of pyramid burials (4/54).

All of the sampled flexed burials ($n = 9$) have local strontium isotope ratios. Flexed individuals are found

Table 1. Sample Information¹

Specimen	Tomb and Burial	Tomb	Tooth	$^{87}\text{Sr}/^{86}\text{Sr}$	Age	Sex
181	U47-Tomb1-B2	Chapel	RP ₄	0.70793	50–69	Female
183	U47-Tomb2-B1	Pit	LI ₂	0.70864	12–15	Indeterminate
196	U57PitB B1	Tumulus	LP ₄	0.70747	50–69	Female
197	U57PitB isolated	Tumulus	RP ₄	0.70763	Indeterminate	Female
198	U57PitBB2	Tumulus	LP ₄	0.70734	25–34	Female
199	U51L3B1	Tumulus	RP ₄	0.70741	25–34	Male
200	U50L4B1	Tumulus	RM ₁	0.70752	50–69	Female
201	U52B1	Tumulus	LP ₃	0.70741	25–34	Female
202	U52B2	Tumulus	RP ₃	0.70732	50–69	Female
203	U55L4B1	Tumulus	RP ₄	0.70757	25–34	Male

¹The $^{87}\text{Sr}/^{86}\text{Sr}$ values for samples 196–203 are also listed in Simonetti et al. (in press).

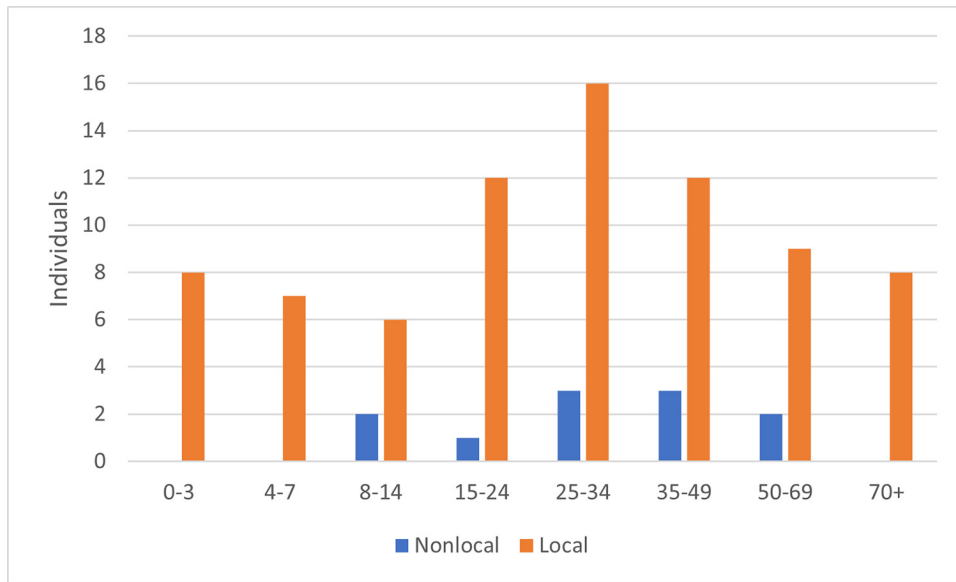


Figure 3. Locality by age at death.

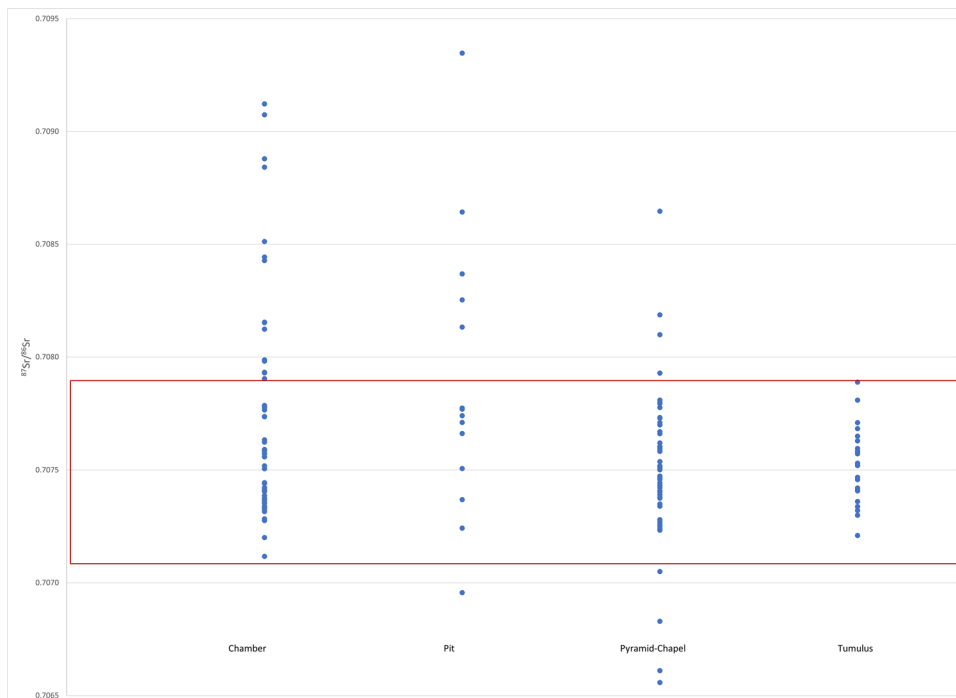


Figure 4. Distribution of samples by tomb type.

in the chamber, pyramid/chapel, and tumulus tomb types; this burial position was common in the local Nubian region. Conversely, 11 of 50 extended burials (22%) have nonlocal strontium isotope ratios. Found in all tomb types, three of the nonlocal individuals are found buried in a coffin, and one was found wrapped in a reed mat. For the local individuals, a variety of burial containers were found, including coffins, reed matting, baskets, bed (indicative of local practice), and

organic remnants that could be either decayed coffin or bed.

Discussion

Intersections in identity

As an Egyptian colonial site dating to the New Kingdom expansion of the empire, Tombos is an ideal

location to use isotope analysis to complement our understanding of the processes of imperialism and the impact of these sociopolitical processes on the local community in Nubia. The integration of $^{87}\text{Sr}/^{86}\text{Sr}$ data provides an opportunity to explore how various axes of identity intersect during this time of change. Strontium isotope analysis of human tooth enamel permits us to identify individuals whose ratios are outside of the local range, indicating that they moved locations after development of their teeth, as first-generation immigrants. The examination of various axes of identity with isotopic markers of geographic origin allows for an intersectional approach that considers the multiple overlapping categories that people experience in life (Crenshaw 1990).

Temporal change

During this colonial period, it is documented in textual records that some individuals relocated to new communities in Nubia from Egypt (O'Connor 1993). Did reflections of identity change over time at Tombos during the establishment, maintenance, and eventual collapse of colonial governance? Individuals isotopically identified as nonlocal (25/145, 17%) are found at the beginning use of the site in the mid-eighteenth Dynasty and continue through the end of the colonial New Kingdom period. The burial practices (body position, burial container, and tomb type) of these nonlocal individuals correspond with Egyptian traditions. Dating to the colonial New Kingdom period, the western cemetery with pyramid, chapel, and shaft tombs show a relatively small percentage of nonlocals (9%, 5/54), and the northern cemetery of chamber tombs has a higher rate (30%, 16/52). Pit burials scattered in these two cemetery areas also have nonlocals (36%, 5/14).

No nonlocal individuals are present after the fall of the Egyptian empire. Accordingly, the tumulus graves, which primarily date to the postcolonial early Napatan period, do not contain any nonlocal individuals. This finding was noted in earlier studies (Buzon and Simonetti 2013; Buzon et al. 2016) and continues to hold with a 60% increase in sample size from recently excavated tumulus burials. The majority of these burials, using the local tumulus style, include a more “foreign” extended body position within the graves, associated with Egyptian religious practices. The combination of local isotope values in burials with traditionally local and nonlocal mortuary practices highlights how these symbols may have been used in different ways and changed over time. Locals using Egyptian practices may be the descendants of the original immigrants, or they could be locals who chose to use these rituals. Those adhering to

the local traditions are not identified as immigrants in any case.

Socioeconomic status

The distribution of nonlocals within the tomb types of the western and northern cemeteries sheds light on the processes of community development and integration of various segments of society. Pyramid, chapel, and shaft tombs were likely owned by an elite individual and the family. However, these communal tombs may also have included household staff from different social levels (Polz 1995). Based on the inscribed funerary cones from Siamun's pyramid at Tombos, we know that at least one high-level Egyptian administrator was present. Some nonlocals in this area come from individuals with signs of high status, such as an older child, with indications of tight wrapping suggestive of mummification, a coffin, and carnelian earrings. However, another nonlocal individual, an adult female, was found in a reed mat covering, which is associated with lower status. These findings indicate that elite households may have come with staff to Tombos. Local individuals are also found with a range of burial containers, indicating a variety of societal levels and suggestive of the integration of local individuals (and descendants of immigrants) into these elite households.

The chamber tombs at Tombos are associated with “middle-class” individuals, people who may have worked with the Egyptian administration or who were artisans, for example. The chamber tombs were approximately two meters deep, and two of the three large chamber tombs that make up the bulk of the skeletal sample from this cemetery area were very well preserved (Units 6 and 7) and fully excavated. This provides some confidence in the representativeness of the isotope signature for the sample despite ancient disturbance due to reuse. Thus, the relatively high number of nonlocals from the middle-class graves implies that people working in support of the colonial administration were an important part of the immigrant community.

Demographic variation

Examining the various material culture with demographic data provides a view into the dynamics of this colonial community and population composition. Egyptian governmental officials, workers, and artisans may have moved to Tombos from Egypt to support the colonial community. As documented in Egyptian texts, these roles are more common for men than women (Matić 2016). Nonlocal values are found in both males (27%, 10/37) and females (16%, 11/68),

indicating that females did indeed relocate to Tombos. There are also some nonlocal individuals who were still children at the time of death and burial. Of the 23 children for whom strontium isotope ratio values could be analyzed, two older juveniles (older than eight years of age) have nonlocal values. There is also one nonlocal individual aged 15 to 24 who may have come to Tombos as a child. With individuals in all age categories through 50 to 69 years at death, these data suggest that families may have relocated to Tombos.

The combination of isotopic value and body position reveals some noteworthy patterns, especially when combined with sex. Individuals in a flexed position, which is associated with local Nubian traditions, are not concentrated in the tumulus graves; they are found in all tomb types, including Egyptian styles. The flexed individuals are not separated within these tombs but placed directly next to extended burials. This obvious link to local tradition in all tomb types suggests that the marker of this axis of identity alongside Egyptian positioned bodies reflects a desire to deviate from Egyptian practices and/or maintain local traditions (Smith and Buzon 2018). These flexed individuals all have strontium isotope ratio values within the local range, indicating their local origin. Additionally, the flexed burials are all individuals whose features suggest a skeletal sex of female. This is a trend that has held consistent in the more recently excavated burials from this current study as well as Schrader and colleagues (2019).

The integration of strontium isotope data has illuminated our understanding of intersectionality at Tombos. Individuals identified as local used both regional and “foreign” (or once foreign) cultural symbols during the sociopolitically dynamic Egyptian colonial period and the subsequent early Napatan periods. It is also possible that the subsequent generations of Tombos inhabitants from multicultural families that began many years prior may not have meaningfully recognized certain practices once associated with Egypt as “foreign” anymore. The cultural associations of objects and practices can change over time, especially through centuries of interaction, with once foreign objects becoming a part of local practice (Akmenkalns 2018; Spencer 2014; Van Gijseghem 2013). Thus, practices associated with foreign colonists and local inhabitants may not have held the same meaning after years of interaction. Additionally, females may have played key roles in the maintenance of local traditions, including flexed burial position and tumulus grave structures. Immigrants to Tombos from Egypt likely included family members of different ages and people of different socioeconomic statuses, such as household staff, as demonstrated by the

variable mortuary treatments. The bioarchaeological intersectional approach serves to further expand the theoretical considerations of how regional, ethnic, cultural, and group identities are defined in the ancient Nile Valley. An enriched understanding of the maintenance and transition of cultural symbols used in mortuary practices by various groups is provided through this contextual approach combined with chemical isotope markers of origin.

Methodological and Practical Issues

Strontium isotope data from Tombos have been used to understand changes in population composition in this community that was established during the Egyptian colonial occupation of Nubia and was occupied for some centuries during and after the imperial rule. With Tombos, we have used strontium isotope analyses to ask if migration, defined as one-way, long-term, permanent relocation (Gregoricka 2021), has occurred from Egypt during the New Kingdom occupation of Nubia. Nonlocal values correspond with some individuals who display Egyptian-style burial traditions in terms of tomb style, burial position, burial container, and artifacts. This lends some support to the validity of the method in a region where analyses of human residential mobility using $^{87}\text{Sr}/^{86}\text{Sr}$ began fairly recently (Buzon et al. 2007), and many sites in the Nile Valley region have not been explored. Previous research has documented that some sites in Nubia, such as Kerma, located 10 km from Tombos, have values similar to the Tombos local range ($^{87}\text{Sr}/^{86}\text{Sr} = 0.70710\text{--}0.70783$). Kerma human values primarily range from $^{87}\text{Sr}/^{86}\text{Sr} = 0.70718\text{--}0.70758$. Data from the site of Qurneh near Thebes, a likely location of origin for Egyptian colonists, have higher strontium isotope ratios, with human values primarily ranging $0.70761\text{--}0.70790$ (Buzon and Simonetti 2013).

We must also consider that mobility, defined as movement across shorter distances within one’s own cultural or political boundaries, may also have occurred (Gregoricka 2021). However, as more data are gathered by the authors as well as other researchers working at sites in the Nile Valley region, it is becoming apparent that many sites in the Nile Valley, especially in Sudan, where more studies have been completed, overlap to a large extent (Fig. 5). The similarity in human values and local ranges as determined by faunal samples indicate that caution should be taken when interpreting mobility between sites in the region. Research should be confined to questions where the possible origin location and site under investigation show sufficient geological differences and where available data are sufficiently variable between

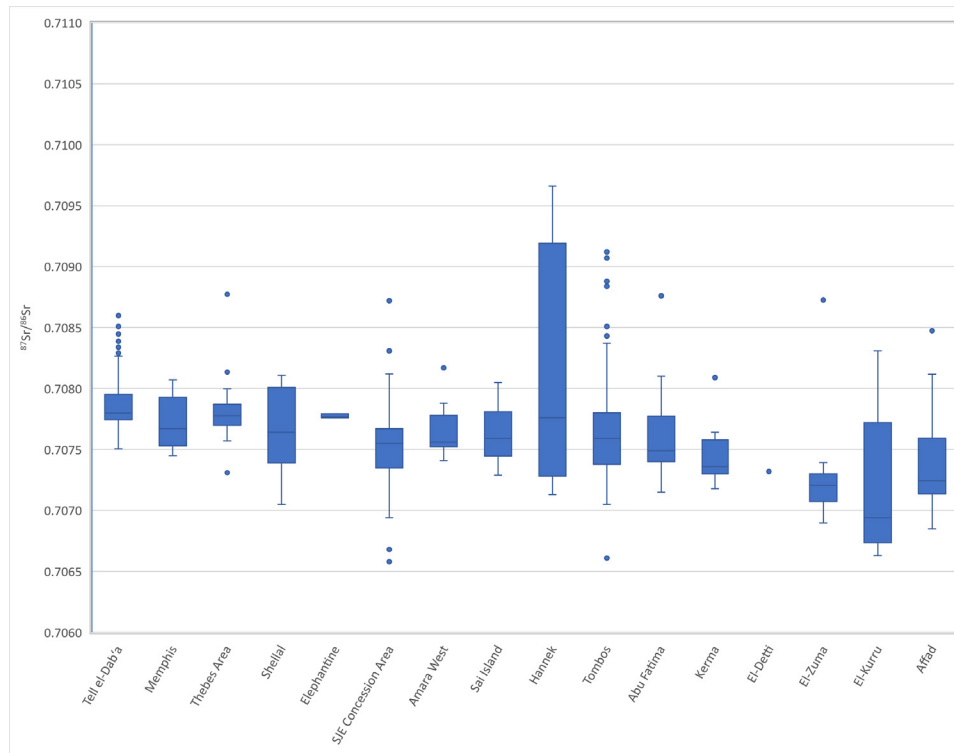


Figure 5. $^{87}\text{Sr}/^{86}\text{Sr}$ values of Nile Valley sites - box (Buzon et al. 2007; Buzon et al. 2016; Buzon and Simonetti 2013; Kozieradzka-Ogunmakin 2021; Osypinska et al. 2021; Retzman et al. 2019; Schrader et al. 2019; Simonetti et al. 2021; Stantis et al. 2020; Touzeau et al. 2013).

possible origin and burial place. Researchers have documented that strontium isotope data are often misunderstood and misinterpreted, especially when used by nonspecialists (Madgwick et al. 2021). It is important that isotope data are used collaboratively with other types of archaeological data; complementary isotope systems may also provide fruitful new avenues of research (Simonetti et al. 2023).

When considering the relocation of children and family members, it is important to note that the interpretation of strontium isotope ratio values in permanent human teeth is complicated by lactation. While many of the teeth sampled from Tombo are premolars (Buzon et al. 2007; Buzon and Simonetti 2013; Buzon et al. 2016; Schrader et al. 2019), which primarily develop after lactation (with some possible crossover into the weaning period), some substitutions were necessary at times when premolars were not available. Clinical research has shown that calcium in breastmilk is mobilized from skeletal calcium stores rather than diet due to hormonal cycles (Kovacs 2005, cited in Yazıcıoğlu 2017). Teeth, such as the first molar, that form during lactation will reflect the strontium isotope ratio of the location of the mother's residence prior to nursing (where skeletal tissues

developed), rather than the location of the child (Yazıcıoğlu 2017). Thus, it is possible that some individuals will have nonlocal signatures when born locally if the mother recently relocated.

Preservation may play an important role in who can be studied and may bias the available sample. Of the dozen or so pyramid, chapel, and shaft tombs, few had well-preserved remains. These tombs are deep—more than 5 m deep—and this western area of the site appears to have been more affected by groundwater than the northern section of chamber tombs. Many of the tombs had a damp burial matrix with skeletal remains and artifacts in comparatively worse condition. For many of the tombs, we were unable to continue or complete excavation because the damp conditions caused structural damage to the underground chambers. Thus, most of the burials excavated were in the shaft leading to the main chambers. The tomb owner and other elite family members would be located at the foundation of the main chamber. It was rarely reached for most tombs. As a result, the sample is likely skewed toward less elite individuals and people who were buried some years after the tomb was created (i.e., not the first placement of burials, which may make them more likely to be locals).

Ethical Responsibilities

Other interpretive issues relate to conducting research in ethical ways. The samples from Tombos were excavated from a site in Sudan, a country that has allowed the export of human skeletal remains for curation and research as storage and museum spaces in Sudan have filled (Fushiya 2021). As the discipline places more attention on ethical standards with granting agencies and publications requiring descriptions of permissions, questions arise. Who should be consulted for permissions to excavate, analyze, and export human remains? In Sudan, permission is granted by the National Corporation of Antiquities and Museums (NCAM), the governmental antiquities agency. Over time, researchers working in various communities in Sudan as well as in other locations have begun to value interaction with and input from communities local to the archaeological sites (Fushiya 2021). For the Tombos Archaeological Project (www.tombos.org), an effort has been made to connect with different constituents in the community, including adult men and women, as well as school-aged children through a variety of public lectures, educational materials, activities, and site tours. Ongoing programs are in development, such as community-based ethnographic research on perceptions of the archaeological site in the daily lives of community members and the archaeological research.

As highlighted by publications focusing on Africa's ancient DNA revolution, foreign researchers who take samples for destructive analyses may be viewed as "biocolonialists" (Avila Arcos 2018). Protocol suggestions for ethical research include dignified treatment of human remains, protection of cultural heritage, and preservation of research opportunities along with exchanges with multiple stakeholders, including local communities (Prendergast and Sawchuck 2018). Focus on Sudanese academic collaboration and research capacity building is also vital. Toward this goal, the American Sudanese Archaeological Research Center (AmSARC; www.amsarc.org) was created in 2017 as a U.S. nonprofit organization (author Buzon is a founding member and current treasurer). The goal is to support American and Sudanese research and collaboration by facilitating scholarly ties between institutions and sponsoring research and contributing to the research infrastructure. AmSARC offers tuition scholarships for Sudanese archaeological students pursuing MA and PhD degrees in Sudan, a research grant for U.S. students/postdocs doing fieldwork in Sudan, and frequent virtual lectures by Sudanese and other researchers. AmSARC members are involved in several collaborative projects with Sudanese colleagues as well as institutional programs to expand bioarchaeological and archaeological research and

training capacity (Buzon and Marshall 2022). Through these engagements and continued work via the American Sudanese Archaeological Research Center, more truly collaborative endeavors are the goal.

Conclusion

When used in conjunction with other types of archaeological data, the isotopic identification of residential mobility has great potential to expand our understanding of population composition and dynamics of identity in the past, enabling more detailed discussions of theoretical research questions. For example, highlighting the variation in $^{87}\text{Sr}/^{86}\text{Sr}$ values along with various axes of identity (ethnicity and cultural affiliations via mortuary practices, sex/gender, socioeconomic class) provides new information about subgroups that may have existed at Tombos during the sociopolitical transitions that occurred during and beyond the Egyptian colonial occupation of Nubia. Through the examination of 145 samples from Tombos, it has become evident that practices associated with area traditions are continued by local individuals along with the use of practices connected to the colonizers that may have become incorporated into local ways over time. Nonlocals are found in tombs that display mortuary practices associated with the colonizers. However, it is essential to not overlook the possible sources of biases and other methodological issues as researchers strive to incorporate theoretical approaches. Additionally, concern for ethical research should remain at the forefront of isotopic studies.

Acknowledgments

The collaboration of Stuart Tyson Smith on the Tombos Archaeological Project is greatly appreciated. The community of Tombos is gratefully acknowledged for their participation and support during our field seasons. The archaeological remains used in this study were excavated and exported with the cooperation of the National Corporation for Antiquities and Museums in Sudan, facilitated by El Tahir Adam Elnour and El Hassan Ahmed Mohamed. The isotopic analyses and recent fieldwork were supported by the National Science Foundation (BCS grants 1916718/1916719) and Purdue University Exploratory Research in the Social Sciences Grant. Mohamed Faroug Ali provided collaborative field support in Sudan and the Arabic translation of the abstract. Kaitlyn Sanders assisted with transition analysis. The authors thank the reviewers and the Associate Editor for their helpful and constructive comments.

References

- Agarwal, Sabrina C., and Julie K. Wesp, eds. 2017. *Exploring Sex and Gender in Bioarchaeology*. University of New Mexico Press, Albuquerque.
- Akmenkalns, Jessika. 2018. *Cultural Continuity and Change in the Wake of Ancient Nubian-Egyptian Interactions*. University of California, Santa Barbara.
- Allaire, Louis. 1987. Some comments on the ethnic identity of the Taino-Carib frontier. In *Ethnicity and Culture*, edited by Reginald Auger, Margaret F. Glass, Scott MacEacher, and Peter H. McCartney. Archaeological Association, University of Calgary, Calgary, pp. 127–133.
- Arcos, María C. Ávila. 2018. Wielding new genomic tools wisely. *Science* 360(6386):274–274. DOI: 10.1126/science.aat3780.
- Blom, Deborah E. 2017. A bioarchaeological perspective on community and the tension between individual and population. *Archaeological Papers of the American Anthropological Association* 28:104–111. DOI: 10.1111/apaa.12092.
- Boldsen, Jesper L., George R. Milner, Lyle W. Konigsberg, and James Wood. 2002. Transition analysis: A new method for estimating age from skeletons. In *Paleodemography: Age Distributions from Skeletal Samples*, edited by R. D. Hoppa and J. W. Vaupel. Cambridge University Press, Cambridge, pp. 73–106.
- Bonnet, Charles. 1991. Upper Nubia from 3000 to 1000 BC. In *Egypt and Africa: Nubia from Prehistory to Islam*, edited by W. V. Davies. British Museum Press, London, pp. 112–117.
- Buikstra, Jane E., and Douglas H. Ubelaker, eds. 1994. *Standards for Data Collection from Human Skeletal Remains*. Arkansas Archaeological Survey Research Series No. 44, Fayetteville.
- Buikstra, Jane E. 1977. Biocultural dimensions of archaeological study: A regional perspective. In *Biocultural Adaptation in Prehistoric America*, edited by RL Blakely. University of Georgia Press, Athens, pp. 67–84.
- Buzon, Michele R. 2006. Biological and ethnic identity in New Kingdom Nubia: A case study from Tombos. *Current Anthropology* 47:683–695. DOI: 10.1086/506288.
- Buzon, Michele R. 2012. The bioarchaeological approach to paleopathology. In *A Companion to Paleopathology*, edited by Anne L. Grauer. Wiley-Blackwell, New York, pp. 58–75.
- Buzon, Michele R., Jacqueline T. Eng, Patricia M. Lambert, and Phillip L. Walker. 2005. Bioarchaeological methods. In *Handbook of Archaeological Methods*, vol. II, edited by D. and Christopher Chippindale Maschner. AltaMira Press, Lanham, MD, pp. 871–918.
- Buzon, Michele R., and Jenail Marshall. 2022. Countering the racist scholarship of morphological research in Nubia: Center the “people” in the past and present. *Journal of Ancient Egyptian Interconnections* 35:2–18.
- Buzon, Michele R., and Antonio Simonetti. 2013. Strontium isotope ($^{87}\text{Sr}/^{86}\text{Sr}$) isotope variability in the Nile Valley: Identifying residential mobility during ancient Egyptian and Nubian sociopolitical changes in the New Kingdom and Napatan periods. *American Journal of Physical Anthropology* 151:1–9. DOI: 10.1002/ajpa.22235.
- Buzon, Michele R., Antonio Simonetti, and Robert A. Creaser. 2007. Migration in the Nile Valley during the New Kingdom period: A preliminary strontium isotope study. *Journal of Archaeological Science* 34:1391–1401. DOI: 10.1016/j.jas.2006.10.029.
- Buzon, Michele R., Stuart Tyson Smith, and Antonio Simonetti. 2016. Entanglement and the formation of the ancient Nubian Napatan state. *American Anthropologist* 118(2):284–300. DOI: 10.1111/aman.12524.
- Cheverko, Colleen M., Julia R. Prince-Buitenhuys, and Mark Hubbe, eds. 2020. *Theoretical Approaches in Bioarchaeology*. Routledge, New York.
- Cunningham, Craig, Louise Scheuer, and Sue Black. 2016. *Developmental Juvenile Osteology*, 2nd ed. Academic Press, San Diego.
- de Souza, Aaron. 2021. After “InBetween”: Disentangling cultural contacts across Nubia during the 2nd millennium BC. *Sudan & Nubia* 25:230–242.
- DeWitte, Sharon N., and Samantha L. Yaussy. 2021. Bioarchaeological applications of intersectionality. In *Theoretical Approaches in Bioarchaeology*, edited by C. M. Cheverko, J. R. Prince-Buitenhuys, and M. Hubbe. Routledge, New York, pp. 45–58.
- Dietler, Michael. 2010. *Archaeologies of Colonialism: Consumption, Entanglement, and Violence in Ancient Mediterranean France*. University of California Press, Berkeley.
- Edwards, David N. 1989. The Nubian environment. In *Archaeology and Settlement in Upper Nubia in the 1st Millennium A.D.*, vol. 537. BAR International Series, Cambridge, pp. 13–14.
- Emberling, Geoff. 1997. Ethnicity in complex societies: Archaeological perspectives. *Journal of Archaeological Research* 5:295–344. <https://www.jstor.org/stable/41053148>.
- Eriksen, Thomas Hylland. 1992. *Us and Them in Modern Societies: Ethnicity and Nationalism in Mauritius, Trinidad and Beyond*. Scandinavian University Press, London.
- Fushiya, Tomomi. 2021. Sudan: Cultural heritage management. In *Encyclopedia of Global Archaeology*, edited by Claire Smith. Springer International Publishing, New York, pp. 1–11.
- Gellar, Pamela L. 2021. *Theorizing Bioarchaeology*. Springer, New York.
- Gourdine, Jean-Philippe, Shomarka O. Y. Keita, Jean-Luc Gourdine, and Alain Anselin. 2020. Ancient Egyptian genomes from northern Egypt: Further discussion. *ANHK* 28/29: 155–161.
- Graves-Brown, Paul. 1996. All things bright and beautiful? Species, ethnicity, and cultural dynamics. In *Cultural Identity and Archaeology*, edited by P. Graves-Brown, S. N. Jones and C. Gamble. Routledge, London, pp. 81–95.
- Gregoricka, Lesley A. 2021. Moving forward: A bioarchaeology of mobility and migration. *Journal of Archaeological Research* 29:581–635. DOI: 10.1007/s10814-020-09155-9.
- Hall, J. M. 1997. *Ethnic Identity in Greek Antiquity*. Cambridge University Press, Cambridge.
- Herbert, Sharon. 2003. Excavating ethnic strata: The search for Hellenistic Phoenicians in the Upper Galilee of Israel. In *The Politics of Archaeology and Identity in a Global Context*, edited by Susan Kane. Archaeological Institute of America, Boston, pp. 101–113.
- Hu, Di. 2013. Approaches to the archaeology of ethnogenesis: Past and emergent perspectives. *Journal of Archaeological Research* 21(4):371–402. DOI: 10.1007/s10814-013-9066-0.
- Ikram, Salima, and Aidan Dodson. 1998. *The Mummy in Ancient Egypt: Equipping the Dead for Eternity*. Thames & Hudson, New York.
- Jones, Sian. 1997. *The Archaeology of Ethnicity: Constructing Identities in the Past and Present*. Routledge, New York.
- Knudson, Kelly J., and Christopher M. Stojanowski, eds. 2020. *Bioarchaeology and Identity Revisited*. University Press of Florida, Gainesville.
- Kovacs, C. S. 2005. Calcium and bone metabolism during pregnancy and lactation. *Journal of Mammary Gland Biology and Neoplasia* 10(2):105–118. DOI: 10.1007/s10911-005-5394-0.
- Kozieradzka-Ogunmakin, Iwona. 2021. Isotope analysis and radiocarbon dating of human remains from El-Zuma. In *Early Makuria Research Project El-Zuma Cemetery*, edited by M. El-Tayeb and Ewa Czyżewska-Zalewska, vol. 1. Brill, Leiden, pp. 220–227.
- Li, Jean. 2017. *Women, Gender and Identity in Third Intermediate Period Egypt: The Theban Case Study*. Routledge, Oxford.

- Madgwick, Richard, Angela Lamb, Hilary Sloane, Alexandra Nederbragt, Umberto Albarella, Mike Parker Pearson, and Jane Evans. 2021. A veritable confusion: Use and abuse of isotope analysis in archaeology. *Archaeological Journal* 178(2): 361–385. DOI: 10.1080/00665983.2021.1911099.
- Matić, Uroš. 2016. (De)queering Hatshepsut: Binary bind in archaeology of Egypt and kingship beyond the corporeal. *Journal of Archaeological Method and Theory* 23(3):810–831. DOI: 10.1007/s10816-016-9288-9.
- O'Connor, D. 1993. *Ancient Nubia: Egypt's Rival in Africa*. The University Museum, University of Philadelphia, Philadelphia.
- Osypinska, Marta, Piotr Osypinski, Zdzislaw Belka, Marek Chlodnicki, Paweł Wiktorowicz, Robert Ryndziewicz, and Michał Kubiak. 2021. Wild and domestic cattle in the ancient Nile Valley: Marks of ecological change. *Journal of Field Archaeology* 46(7):429–447. DOI: 10.1080/00934690.2021.1924491.
- Polz, Daniel. 1995. Excavations in Dra Abu el-Naga. *Egyptian Archaeology* 7:6–8.
- Prendergast, Mary E., and Elizabeth Sawchuk. 2018. Boots on the ground in Africa's ancient DNA "revolution": Archaeological perspectives on ethics and best practices. *Antiquity* 92(363): 803–815. DOI: 10.15184/aqy.2018.70.
- Retzmann, Anika, Julia Budka, Helmut Sattmann, Johanna Irrger, and Thomas Prohaska. 2019. The New Kingdom population on Sai Island: Application of Sr isotopes to investigate cultural entanglement in ancient Nubia. *Ägypten und Levante/Egypt and the Levant* 29:355–380. <https://www.jstor.org/stable/26926574>.
- Rilly, Claude, and Alex de Voogt. 2012. *The Meroitic Language and Writing System*. Cambridge University Press, Cambridge.
- Schrader, Sarah A., Michele R. Buzon, Loretta Corcoran, and Antonio Simonetti. 2019. Intra-regional $^{87}\text{Sr}/^{86}\text{Sr}$ variation in Nubia: New insights from the Third Cataract. *Journal of Archaeological Science: Reports* 24:373–379. DOI: 10.1016/j.jasrep.2019.01.023.
- Simonetti, Antonio, Michele R. Buzon, Loretta Corcoran, Abigail M. Breidenstein, and Geoff Emberling. 2021. Trace element and Pb and Sr isotope investigation of tooth enamel from archaeological remains at El-Kurru, Sudan: Evaluating the role of groundwater-related diagenetic alteration. *Applied Geochemistry* 132:105068. DOI: 10.1016/j.apgeochem.2021.105068.
- Simonetti, Antonio, Michele R. Buzon, Stefanie S. Simonetti, Kari A. Guilbault, Maha Ahmed Kordofani, and Naomi F. Miller. 2023. Assessing the impact of Holocene climate change on bioavailable Sr within the Nile River Valley: Geochemical and radiogenic isotope perspectives. *Bioarchaeology International*. DOI: 10.5744/bi.2022.0024.
- Smith, Stuart Tyson. 1992. Intact Theban tombs and the New Kingdom burial assemblage. *Mitteilungen Des Deutschen Archäologischen Instituts Kairo* 48:193–231.
- Smith, Stuart Tyson. 2003. *Wretched Kush: Ethnic Identities and Boundaries in Egypt's Nubian Empire*. Routledge, London.
- Smith, Stuart Tyson. 2019. Gift of the Nile? Climate change, the origins of Egyptian civilization and its interactions within northeast Africa. In *Across the Mediterranean—Along the Nile. Studies in Egyptology, Nubiology and Late Antiquity Dedicated to László Török on the Occasion of His 75th Birthday*, edited by Ádám Bollók Tamás A. Bács, and Tivadar Vida. Archaeolingua, Budapest, pp. 139–159.
- Smith, Stuart Tyson, and Michele R. Buzon. 2018. The fortified settlement at Tombos and Egyptian colonial strategy in New Kingdom Nubia. In *From Microcosm to Macrocosm: Individual Households and Cities in Ancient Egypt and Nubia*, edited by Julia Budka and Johannes Auenmüller. Sidestone Press, Leiden, pp. 205–225.
- Spencer, Neal. 2014. Creating and re-shaping Egypt in Kush: Responses at Amara West. *Journal of Ancient Egyptian Interconnections* 6:42–61.
- Stantis, C., A. Kharobi, N. Maaranen, G. M. Nowell, M. Bietak, S. Prell, and H. Schutkowski. 2020. Who were the Hyksos? Challenging traditional narratives using strontium isotope ($^{87}\text{Sr}/^{86}\text{Sr}$) analysis of human remains from ancient Egypt. *PLoS One* 15(7):e0235414. DOI: 10.1371/journal.pone.0235414.
- Torres-Rouff, Christina, and Kelly J. Knudson. 2017. Integrating identities: An innovative bioarchaeological and biogeochemical approach to analyzing the multiplicity of identities in the mortuary record. *Current Anthropology* 58(3):381–409. DOI: 10.1086/692026.
- Touzeau, Alexandra, Janne Blichert-Toft, Romain Amiot, François Fourel, François Martineau, Jenefer Cockitt, Keith Hall, Jean-Pierre Flandrois, and Christophe Lécuyer. 2013. Egyptian mummies record increasing aridity in the Nile valley from 5500 to 1500yr before present. *Earth and Planetary Science Letters* 375:92–100. DOI: 10.1016/j.epsl.2013.05.014.
- Van Gijsegem, Hendrik. 2013. Our children might be strangers: Frontier migration and the meeting of cultures across generations. *Archaeological Review from Cambridge* 28: 169–189.
- Whiteman, A. J. 1971. *The Geology of the Sudan Republic*. Clarendon Press, Oxford.
- Williams, Bruce Beyers. 1991. A prospectus for exploring the historical essence of ancient Nubia. In *Egypt and Africa*, edited by W. V. Davies. British Museum Press, London, pp. 74–91.
- Yazıcıoğlu Santamaria, G. Bike. 2017. Locals, immigrants, and marriage ties at Kültepe: Results of strontium isotope analysis on human teeth from lower town graves. In *Movement, Resources, Interaction, Proceedings of the 2nd Kültepe International Meeting Kültepe, 26–30 July 2015 Studies Dedicated to Klaas Veenhof*. Brepols, Turnhout, Belgium, pp. 63–84.