

# The fall of Meroe: Invasion or decline? The dental evidence

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## Introduction

The Meroitic empire of ancient Nubia ruled over a vast area of the Nile Valley and its hinterlands from 800BC until 350AD<sup>1</sup>. The empire was politically and culturally homogenous state, centred around the illustrious capital Meroe. In the 4<sup>th</sup> Century AD, the power and influence of the empire was declining and ultimately Meroe is abandoned<sup>1</sup>. The causes for the demise the empire have been widely debated. A popular theory is that Aksumites from northeast Africa were, in part, responsible. The Aksumites controlled the Horn of Africa from around 150BC – 700AD, interacting with both the Nubians and Egyptians<sup>2</sup>. The 4<sup>th</sup> century was a period of growth and development for the Aksumites, where their wealth and political influence increased<sup>2</sup>. It has been posited that Aksumite influence was responsible for the final demise of Meroe after a period of decline<sup>1</sup>. **This study explores if there is evidence of an Aksumite presence in Nubia after the Meroitic period and whether they permanently settled the region. Dental evidence will be used to investigate if northeast African groups may have contributed to the local gene pool or if there was biological continuity between the time periods.**

## Materials and Methods

The dentition from 6 Nubian and 2 East African groups were included in the study. The groups consisted of 3 sites from the Fourth Cataract region of Upper Nubia, 3 from Lower Nubia and two from East Africa (see Figure 1). Details of the sites can be found in Table 1. The Nubian assemblages date from the Meroitic (300BC) to Medieval periods (AD 1500). Upper and Lower Nubian groups were chosen to also test if regionality affected patterning observed in the data. Data from 36 non-metric dental traits were used to assess inter-group bio-distances, following the ASUDAS system<sup>3</sup> (see Figure 2). These data were dichotomised into present or absent using standard breakpoints. To further quantify the inter-group distances, the Mean Measure of Divergence (MMD) was applied. The data was edited to achieve the most reliable results from the MMD analysis. As such, traits were removed which were non-discriminatory, correlated, or where the sample size was too small (<10)<sup>4</sup>. Twenty-one traits remained after editing. Lastly, Multi-Dimensional Scaling (MDS) was used to illustrate inter-group relationships.



Figure 1. Map of Nubia, including sites included in study. Amended from inner front cover of Sudan & Nubia, issue 11, 2007.

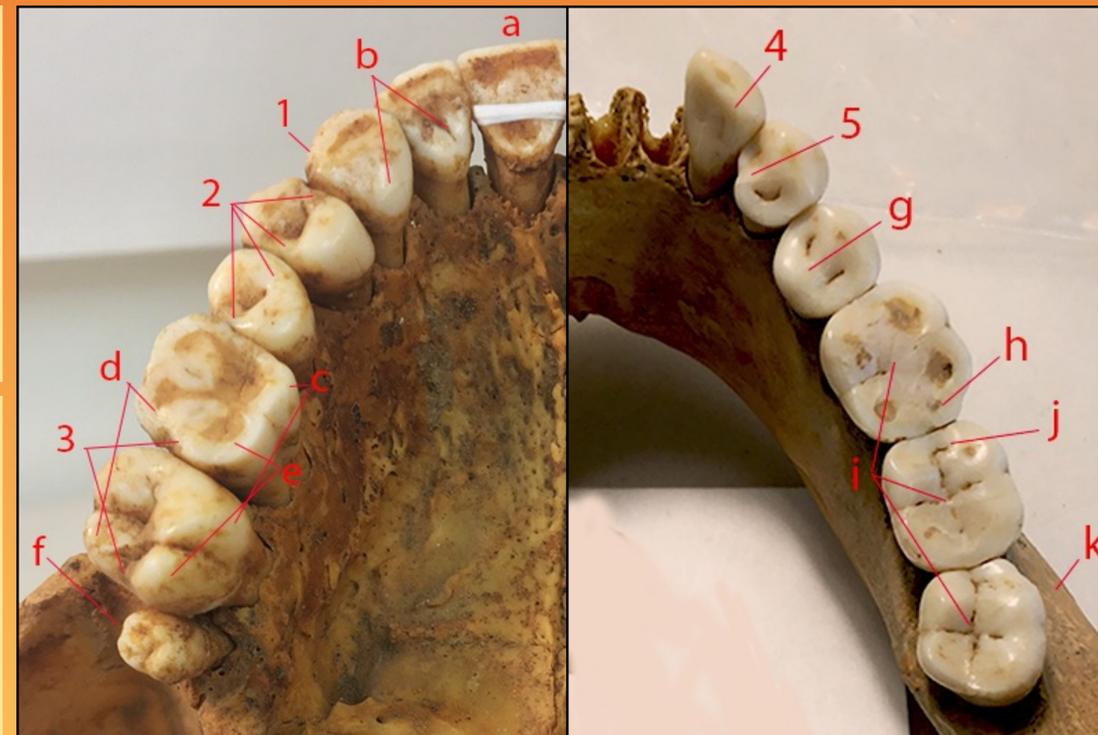


Figure 2. Upper and lower dentition of individuals from the Fourth Cataract collection, curated at the British Museum. Letters indicate trait is present, numbers indicate where traits are absent. a- labial curvature, b- tuberculum dentale, c- Carabelli's cusp, d- metacone, e- hypocone, f- reduced 3<sup>rd</sup> molar, g- multiple LP2 lingual cusps, h- LM cusp 5, i- LM groove patter (M1 & M2 = Y, M3 = X), j- anterior fovea, k- torsomolar angle (buccal direction). 1- double shoveling & distal accessory ridge, 2- Premolar accessory cusps, 3- UM cusp 5, 4- distal accessory ridge, 5- LP1 lingual cusp.

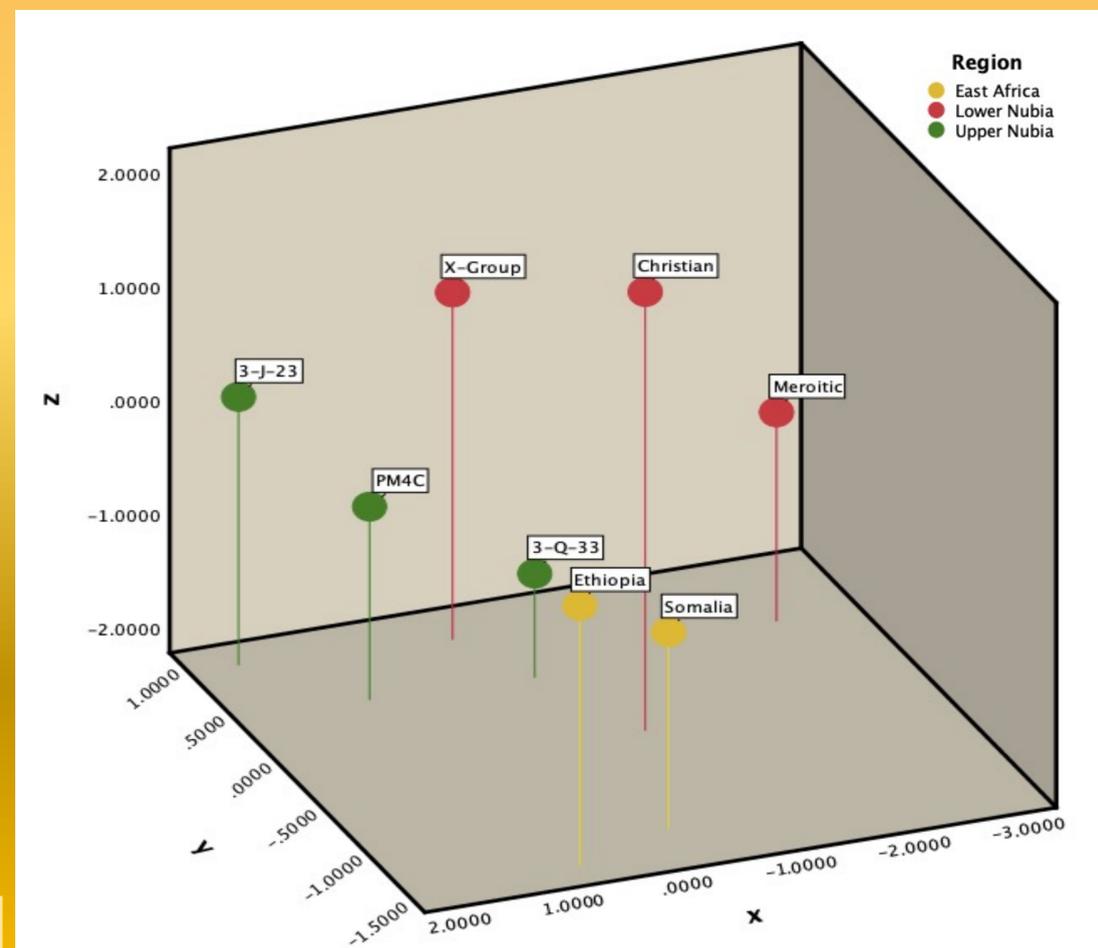


Figure 3. MDS of 21-trait MMD results.

Region	Assemblage	Number of individuals	Date	Sites/Region of Origin
4 <sup>th</sup> Cataract	3-J-23	109	Medieval/Christian, AD 550 - 1500	Fourth Cataract
	PM4C	30	Post-Meroitic, AD 350 – 550	Fourth Cataract,
	3-Q-33	29	Meroitic, 100BC -350AD	Fourth Cataract
Lower Nubia	Christian*	41	Medieval, AD 350 - 1350	Faras to Gamai
	X-Group*	62	Post-Meroitic 350 – 550	Semna; Faras to Gamai
East Africa	Meroitic*	94	Meroitic, 100BC -350AD	Semna; Faras to Gamai
	Ethiopia**	40	19 <sup>th</sup> /20 <sup>th</sup> Century	North central Ethiopia
	Somalia***	77	19 <sup>th</sup> /20 <sup>th</sup> Century	Somalia, E. Ethiopia

Table 1. Skeletal assemblages used in study. \* Assemblage comprised from 4-M-53, 3-O-1 & 3-Q-33. \*\*Taken from Irish (2005)<sup>5</sup> \*\*\*Irish, unpublished <sup>6</sup> \*\*\*Irish et al. (2020)<sup>7</sup>

## Results

MMD results, in Table 2, reveal that the East African groups are more phenetically similar to the 4<sup>th</sup> Cataract groups (MMD= 0.09-0.20) than the Lower Nubian collections (MMD= 0.05-0.20). Additionally, all the Lower Nubian assemblages are significantly different from the East African collections. Broad temporal patterning can also be seen with the post-Meroitic assemblages the most similar to the East African groups and the Meroitic collections indicating the greatest difference. Considering the MMD data by region, the pattern in the 4<sup>th</sup> Cataract differs to the general Nubian data, with the Meroitic site, '3-Q-33', more similar to East African dentition than the Medieval site, '3-J-23'. Patterning on the MDS, Figure 3, shows that the 4<sup>th</sup> Cataract groups are show a greater affinity with the East African groups, indicating that geography had a greater effect on the biodistance than temporal changes.

	PM4C	3J23	3Q33	Ethiopia	Somalia	Christian	Meroitic	X-Group
PM4C	0							
3J23	0.0374	0						
3Q33	0	0.1202	0					
Ethiopia	0.0761	0.0994	0.0918	0				
Somalia	0.0611	0.1359	0.0539	0.0108	0			
Christian	0.1206	0.1647	0.1423	0.0986	0.0867	0		
Meroitic	0.2028	0.2400	0.0894	0.2015	0.1308	0.1269	0	
X-Group	0.0255	0.0599	0.0729	0.0996	0.1030	0.0122	0.1279	0

Table 2. 21 trait MMD values

## Discussion and Conclusion

The results suggest that gene flow from East Africa is more associated with geography than with broad temporal shifts. The Fourth Cataract assemblages are geographically closer to the Ethiopia and Somalia, also sharing a greater biological affinity, when compared to the Lower Nubian groups. Although temporal shifts could be observed, with the phenetic affinity between the Nubian assemblages and East African groups changing over time, the patterning was not the same in Lower and Upper Nubia regions. For the Upper Nubian 4<sup>th</sup> Cataract sites, the post-Meroitic (PM4C) group was most phonetically similar to the East African collections, followed by the Meroitic (3-Q-33) and then the Medieval (3-J-23). This indicates that there may have been gene-flow between East Africa and Upper Nubia during the Meroitic period, which increased in the post-Meroitic period. It is thought that there were interactions and potentially trade between the Meroitic empire and the Aksumite empire<sup>1</sup>, and these data indicates there also could have been mixing of people as well. The East African samples are significantly different from the Medieval assemblage (3-J-23). This could imply that the genetic influence from East Africa only lasted a few centuries after the fall of the Meroitic empire. The Lower Nubian assemblages are all significantly different from the East African collections, with the Meroitic collection showing the least affinity. This implies that gene flow from East Africa may not have penetrated into the northern parts of Nubia. **The disparities between the two Meroitic collections (3-Q-33 and Meroitic) illuminate that gene flow patterning in Nubia is changeable, even in the relative hegemony of the Meroitic empire. Comparative dental data from East Africa has helped illuminate the potential extent of gene flow between two major political entities in sub-Saharan Africa. The data suggests the relationship between the two was more influenced by geography than by temporal shifts.**

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