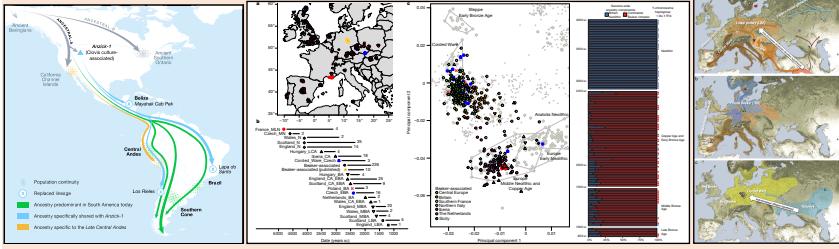


Exploring the Human Behavior Behind Biomolecular Data: the Role of Captive-Taking in Population Movement

Jakob W. Sedig[#] and Catherine M. Cameron*

1) Introduction. In this poster, we explore the potential of biomolecular techniques (ancient DNA [aDNA] and isotope analysis) to reveal the social processes behind the movement of people in the past. Drawing on Cameron's extensive examination of ethnohistoric data on captivity, we realized that biomolecular data could allow us to access the occurrence of this practice in the past, and that it is likely an important factor in the migrations and population transformations recently identified through biomolecular techniques (Figures 1-3 below). We therefore introduce captive-taking, particularly the coerced integration of non-local women into a captor's society through raiding, warfare, or "marriage," as a possible explanation for some of the patterns emerging from biomolecular studies. The goal of this study is to provide a model that we believe will be useful for interpreting at least some of the trends identified in new biomolecular data.



Figures 1-3. Examples of population transformations or large-scale migration from ancient DNA studies¹⁻³

2) Captivity and Movement. Cameron's⁴⁻⁷ examination of dozens of non-state societies in the Americas, Africa, Southeast Asia, and Europe revealed that warfare and raiding were extremely common and that captive-taking was an almost universal practice.

- Raids and warfare were instigated with the goal of obtaining women to serve as wives, concubines, agricultural labor in horticultural societies, or as producers of other sorts of goods.
- "Captive" is a temporary status; women could become concubines, secondary wives, or wives. Children might be fully incorporated into their captor's society.
- Captives who are fully incorporated may not be evident in material culture, but can be in biomolecules.

Social Group	Distance Taken	Age/Gender of Captives	Proportion of slaves in society	Date of account
North Pacific Rim ⁸	150 to 1500 km or more (mainland Alaska to far Aleutian Islands)	Purpose of raids party desire for women	unknown	Oral history and early historic accounts (early 1800s)
Northwest Coast ⁹	Close neighbors often enslaved; some long-distance raids; slaves moved further through trade	Women and children preferred (all ages, sexes taken)	5 – 25% depending on group	Early historic accounts (late 18 th & early 19 th centuries); oral histories; prehistoric
Tutchone Bands of Yukon ¹⁰	unknown	Mostly children & teenagers; wives stolen	10% (although some debt slaves & some purchased)	Reconstructed for period 1840 – 1860 (minimal European contact)
Kalinago ¹¹	Up to 800 km	Women, children, and men taken. Women kept as wives. Men & boys eventually sacrificed.	5% (very rough estimate)	Early historic period (1492 – 1600s)
Conibo ¹¹	Up to 600 km	Marriageable women and children of both sexes	> 10%	1557 first contact; then late 17 th to 19 th centuries
Yanamamö ¹²		Women, some children	12 – 17% of wives captives	Ethnography 1950s-1990s
Iroquois ¹³	Some raids covered 100's of km.	Women and child captives more often spared death	As many as 2/3 rd s of population	Historic Accounts
Germanic Tribes of northern Europe ¹⁴	100's of miles; continent wide trade	Women, children and men taken; possibly more women spared death than men.	1/3 to 1/3 of law codes deal with enslaved or semi-servile individuals.	1 st to 7 th centuries CE

Table 1. Recorded evidence of captive taking in non-state societies

3) Biomolecular Data and Movement in the Archaeological Record. We used two sources of data in our study: Genetic sex from aDNA, incorporated into the Reich Laboratory database:

- Determining sex morphologically has ambiguities and can be difficult with fragmentary or poorly preserved remains; aDNA avoids these difficulties.
- We compiled genetic sex assessment from 2545 individuals¹⁵⁻⁸¹ from different locations and cultures across the globe to examine sex ratios evident in the archaeological record.
- We used studies that classified individuals as local or non-local and identified the sex of the individuals.
- We compiled data from 380 individuals to identify any patterns in the movement of females vs. males.

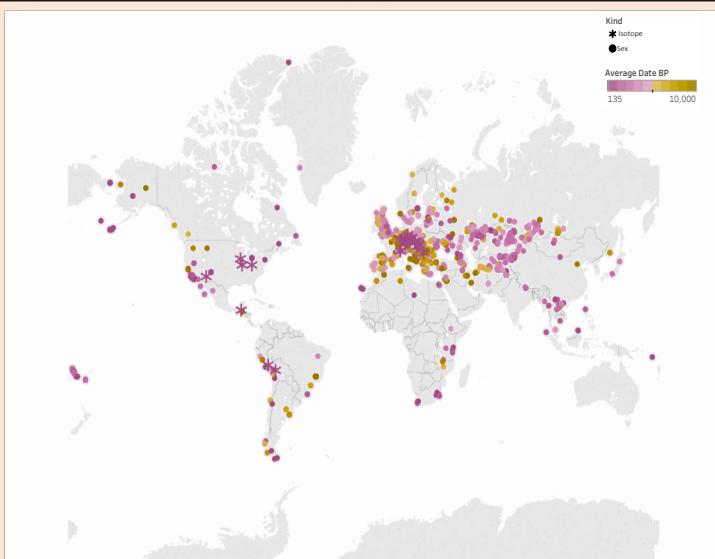


Figure 4. Location and date of individuals in study

Genetic Sex

- We found that females tend to be underrepresented in the archaeological record.
- In a normally distributed population, sex ratios should be approximately 1:1. The broad dataset represented in Figure 4 and in Table 2 might be expected to have a sex ratio of 1:1, but instead it is 1.36:1, with a significantly larger number of males than females.

Genetic Sex	N	%
Female	1071	42.08
Male	1459	57.32
Unassigned	15	.60
Total	2545	100.00

Table 2. Number and percentage of individuals with published genetic sex¹⁵⁻⁸⁰

Isotopic Data

- Data in Table 3 suggest that women tend to be far more mobile than men.

• Patrilocality and female exogamy are the most common explanations offered by scholars for this pattern. We argue that captivity of women also contributed this discrepancy.

Archaeological culture/location of isotopic study	Total Females	N Non-local Females	% Non-local Females	Total Males	N Non-local Males	% Non-local Males
Late Neolithic-Bronze Age Europe ⁸¹	36	17	47.22	34	3	8.82
1st Millennium Germanic Barbarians ⁸²	9	5	55.56	13	2	15.38
Mogollon Pueblo Villages ⁸³	43	26	60.47	30	14	46.67
Central European Corded Ware ⁸⁴⁻⁸⁵	23	11	47.83	20	3	15.00
Mesolithic-Neolithic Danube Gorges ⁸⁶	54	12	22.22	54	8	14.81
Bell Beaker South-Central Europe ⁸⁷	22	12	54.55	38	20	52.63
Late Intermediate Period Peru ⁸⁸	16	2	12.50	15	2	13.33
Hopewell Mid-continent USA ⁸⁹	29	3	10.34	18	1	5.56
LBK ⁹⁰	49	9	38.33	77	14	18.18
SUM	281	102	36.30	288	65	22.57

Table 3. Location and archaeological Culture of isotopic studies with information on sex and non-local or local provenience

Additional Evidence

- We did a preliminary examination of data in prominent aDNA studies^{2,46} to determine if "genetic" outliers within a sample set or population tended to have sex bias; results were inconclusive.
- We highlight case studies that have combined evidence in a manner conducive to identifying captives.

Sex Bias in Genetic Outliers?	Case Studies
	Location Lech River Valley, Germany ⁹¹
	Location Eulau, Germany ^{95,91}
	Location Porton and Amesbury Down, England ²

Figures 5-6. Examples of genetic outliers from key studies^{2,46}

4) Discussion Recent studies have identified the widespread practice of warfare, raiding, and captive-taking in non-state societies in the past. Data presented above indicate that females are underrepresented in the archaeological record, yet more females had relocated to new communities during their lifetime than males; thus, captive-taking almost surely explains some of the patterns evident in the data. Yet even with multiple, distinct lines of evidence, the adoption of new social roles by captives makes them difficult to identify, especially if captives are forced to change their social practices (we provide criteria for identifying captives in Table 5).

Although biomolecular techniques have provided new insight on migration, some⁹²⁻⁹⁴ have raised concerns regarding the sweeping claims aDNA studies have made about ancient social groups and movement. These scholars are concerned that the broad categories used by geneticists flatten archaeological cultures and lack the nuance evident in material culture. Yet we note that prior to biomolecular advancements, the archaeological study of migration was mostly limited to examinations of the spread of material culture, and arguments about whether or not abrupt changes in material culture patterns were spurred by migrants or diffusion of ideas. The data we examined demonstrate that, at the individual level, women move from place to place often, making cultural boundaries fluid. We feel that a multi-layered approach that incorporates captive research can help ameliorate these concerns and help bridge the gap between archaeological theory and biomolecular data.



Figure 7. Conibo Indians in the late 1800's, possible captives in front of a longhouse.

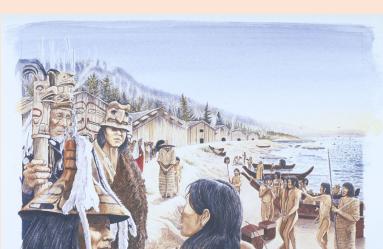


Figure 8. Northwest Coast Village. Villagers gather to greet a raiding party returning home?

Criteria	Evidence
Skewed Sex Ratios	Within a region, do some sites have more males than females, or vice-versa? With aDNA, genetic sex determinations can be made from small bone fragments, thus many more individuals can be examined and incorporated into examinations of sex ratios.
Isotopic Data	Within a region, are males more mobile than females? The reported proportion of captives in small-scale societies was substantial, ranging from 5–25% and as much as 50% in some groups. Additionally, captives were generally taken from beyond the regions where men normally looked for wives (DeBoer 2008). Distances usually were greater than 50 km, but could exceed 1000 km.
Genetic Ancestry and Relatedness	Admixture proportions, mt /y haplogroups, and related individuals provided a new class of data for assessing captivity. For example, captured women might be expected to have different or more diverse mt haplogroups than their captors. "Outlier" individuals within a group may also be indicative of captivity.
Other Archaeological Evidence	Archaeological evidence for raiding or warfare is a strong indicator that captive-taking also occurred. Other indicators of captive-taking include iconography which may show bound or abused people, oral histories in which captives or slaves are characters, and biomorphological evidence of trauma/abuse.

Table 5. Key criteria for identifying captives in the archaeological record

- 5) Future Research**
- Harness the power of biomolecules to identify captives and consider their role amongst new evidence of ancient migrations.
 - Synthesize biomolecular and archaeological data so that captive individuals become apparent, leading to a richer understanding of the movement of people in the past.

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#Jakob W. Sedig, Reich Laboratory of Medical and Population Genetics, Harvard Medical School
Jakob.Sedig@hms.harvard.edu

*Catherine M. Cameron, Department of Anthropology, University of Colorado, Boulder
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