Ancient DNA – Modern Connections: Results of Mitochondrial DNA Analyses from Monterey County, California

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Abstract

Mitochondrial DNA analyses were performed for six prehistoric individuals from burials at three sites in Monterey County. These studies were made possible through the permission of the Most Likely Descendant (MLD), Ella Rodriguez, who was associated with the projects. Four individuals were determined to be Haplogroup A while two were determined to be Haplogroup D. Haplogroup A is common along the Pacific Coast of North and South America while one haplotype of D is potentially associated with westward movement of Penutian speakers some two to three thousand years ago. Ella was found to be genetically related to the four Haplogroup A members; she was very gratified that these studies produced such important information and that she had played a key role. She was an advocate of good archaeology and of gathering and preserving information on her ancestors to pass on to future generations.

Introduction

In recent years, mitochondrial DNA (mtDNA) has been increasingly used to trace both ancestry and population movements. One such study in California linked Donna Yocum, a Palmdale descendant, with skeletal remains from that area dating between 800 and 1,000 years ago (O'Rourke 2005). Other studies have linked living descendants in the Santa Barbara area with skeletal remains from southern Alaska dating some 10,300 years in age (Johnson and Lorenz 2006; Kemp et al. 2007).

In the past several years, we have obtained six mitochondrial DNA readings on human skeletal remains recovered from two projects we conducted in the greater Monterey Peninsula area (Figure 1). Four of these also can be linked to living descendants in the Monterey Peninsula region.

The sites involved were:

- CA-MNT-831 (P-27-000898), near Lovers Point, in Pacific Grove. This site was studied during two investigations on adjacent properties (Breschini and Haversat 2002, 2008). Four interments were recovered during the first investigation (one of which included an adult and a child).
- CA-MNT-1931 (P-27-002129; formerly CA-MNT-1482) and CA-MNT-1489 (P-27-000114), two nearby sites situated in Rancho San Carlos, adjacent to and south of the Carmel Valley, a short distance inland from Carmel. One skeleton was found at each site while monitoring nearby construction activities. Excavations at two sites about midway between CA-MNT-1931 and CA-MNT-1489 have been detailed in a previous report (Breschini and Haversat 1992).

These studies were made possible through the permission of the Most Likely Descendant (MLD), Ella Rodriguez (Figure 2), who was associated with the projects. The details of mitochondrial DNA processing and analysis have been published elsewhere (Breschini and Haversat 2008; Eshleman 2008), and so are omitted from this brief report.

These mitochondrial DNA results, the first on ancient DNA from the Monterey Peninsula area, have made a valuable contribution toward our understanding of the prehistory of the central California coast and appear to have implications for understanding both the early coastal migration and at least one subsequent migration.

Mitochrondrial DNA Results

Of the five individuals (in four interments) from CA-MNT-831, mitochondrial DNA was recovered from four individuals (Eshleman 2008). Mitochondrial DNA was also recovered from the two individuals at CA-MNT-1931 and CA-MNT-1489 (Jason Eshleman, personal communication 2000).

Haplogroup and haplotype determinations, known chronological position and, in the case of the CA-MNT-831 individuals, estimated percent of marine carbon in the diet show both similarities and differences (Table 1). The samples are compared to modern individuals including those from Johnson and Lorenz's samples for Haplogroups A and D and the detail of the variable nucleotide positions (np) between np 16051 and np 16363 that deviated from the Cambridge Reference Sequence (CRS) (Table 2 and 3). This follows the designations of Johnson and Lorenz (2006), from whom these basic tables were adapted. When compared with the CRS, four of the individuals were determined to be affiliated with Haplogroup A, while two were affiliated with Haplogroup D.

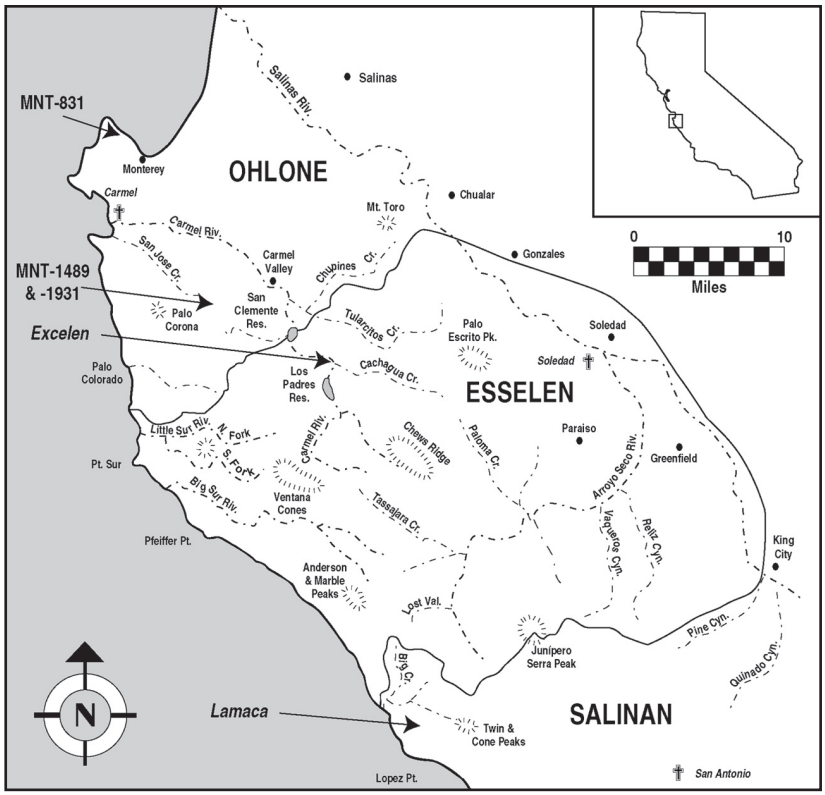

Figure 1. The Monterey County coast showing locations of archaeological sites and ethnographic districts mentioned in the text.

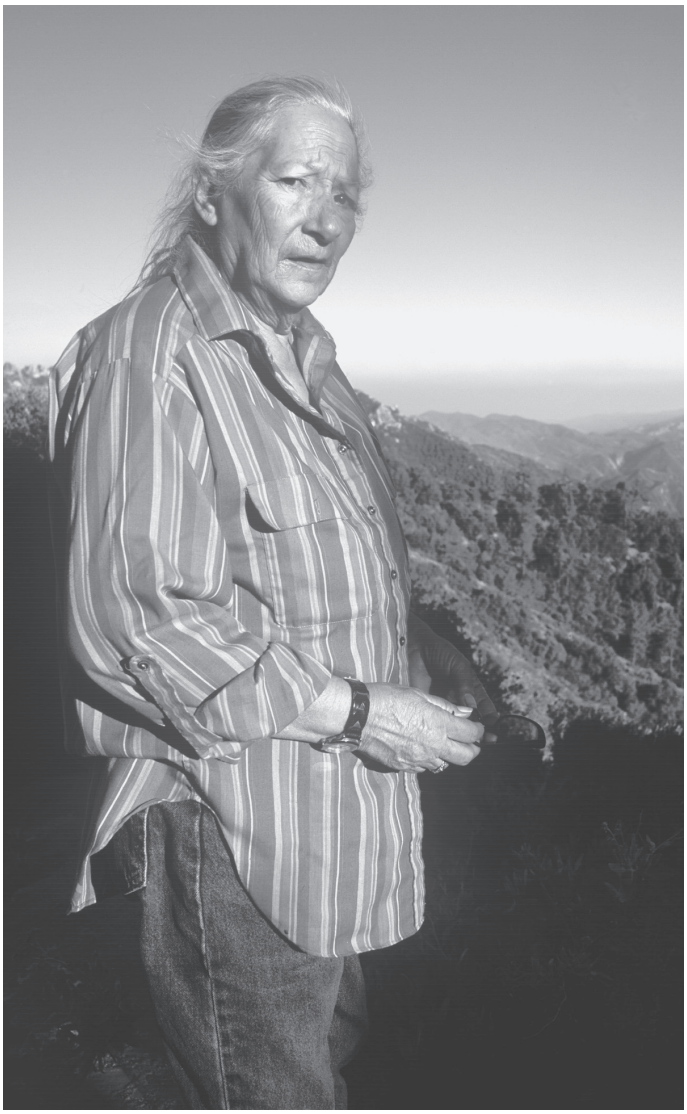

Figure 2. Ella Rodriguez, 1932-2005.

Table 1. Mitochondrial DNA determinations from the Monterey Peninsula area.

Site	Burial	Haplogroup	Haplotype*	Age	% Marine Carbon**
CA-MNT-831	1	A	A01	Cal BP 5253	92.5
	2	A	A01	Cal BP 1868	80.0
	3			Cal BP 4810	82.0
	4a	D	D01	Cal BP 200	10.0
	4b	D	D01		
CA-MNT-1489		A	A01	Late Period	
CA-MNT-1931		A	A01	Late Period	

* Haplotypes after Johnson and Lorenz (2006), Tables 3 and 6.
**Estimate based on stable isotopes (N15, C13).

Table 2. Haplogroup A as identified on the central coast.

Sample	Ethnolinguistic Group	Haplo-group	16093	16111	16129	16183	16189	16209	16221	16223	16257	16263	16278	16290	16301	16311	16319	16327	16362
CRS			T	C	G	A	T	T	C	C	C	T	C	C	C	T	G	C	**T**
CA-MNT-831 Burial 1		A01		T						T				T			A		C
CA-MNT-831 Burial 2		A01		T						T				T			A		C
CA-MNT-1931	Rumsen	A01		T						T				T			A		C
CA-MNT-1489	Rumsen	A01		T						T				T			A		C
JJ039 (Ella Rodriguez)	Esselen	A01		T						T				T			A		C
JJ133	Salinan	A01		T						T				T			A		C
JJ135	Chumash	A02	x	T						T				T		C	A		C
JJ136	Chumash	A02		T						T				T		C	A		C
JJ010	Chumash	A03	C	T						T				T			A		C
JJ070	Chumash	A03	C	T						T				T			A		C
JJ091	Chumash	A03	C	T						T				T			A		C
JJ002	Chumash	A04	C							T				T			A		C
JJ153	Chumash	A05	C							T				T			A		C
JJ036	Salinan	A06		T						T			T	T			A		C
JJ040	Chumash	A07	C	T					T	T				T			A		C
JJ058	Yokuts	A08		T		C	C			T				T			A		C
JJ085	Chumash	A09	C	T	A					T				T			A		C
JJ168	Chumash	A10		T						T	T	A		T	T		A		C
JJ221	Luiseno	A11		T						T				T			A	T	C
JJ253	Chumash	A12	C							T				T			A		C
JJ123	Salinan/Yokuts	A13		T				C		T				T			A		C

Notes: The four specimens of ancient Haplogroup A obtained from our studies are shown at the top. Samples obtained by John Johnson from living descendants, including Ella Rodriguez, are prefixed by "JJ." Modified from Johnson and Lorenz (2006: Table 3).

Discussion and Interpretations

Eshleman (2002:32) and Lorenz and Smith (1996) have stated that Haplogroup A was the most common haplogroup in North America. In Eshleman's sample, Haplogroup A was found most commonly along the west coast, among the Bella Coola, Chumash, Haida, and Nuu-Chah-Nulth (Nootka). He notes the presence of Haplogroup A for the one Esselen sample, and, based on Lorenz and Smith (1996), among the Salinan. More recently Johnson and Lorenz (2006:47) noted the presence of Haplogroup A among 17 individuals of Esselen, Salinan, Chumash, and Yokuts ancestry (the one Esselen is the same individual cited by Eshleman, above.) Within Haplogroup A there are a series of subdivisions, or haplotypes. Johnson and Lorenz (2006:46) identify 13, and note that haplotype A01 is the principal founding haplotype for Haplogroup A in the Americas.

Table 3. Haplogroup D as identified on the central coast.

Sample	Ethnolinguistic Group	Haplogroup	16129	16142	16179	16223	16241	16261	16291	16301	16304	16319	16325	16342	16362
CRS			G	C	C	C	A	C	C	C	T	G	T	T	T
CA-MNT-831 Burial 4a	Rumsen	D01				T							C		C
CA-MNT-831 Burial 4b	Rumsen	D01				T							C		C
JJ006	Yokuts	D01				T							C		C
JJ025	Yokuts	D01				T							C		C
JJ043	Yokuts	D01				T							C		C
JJ047	Yokuts	D01				T							C		C
JJ054	Yokuts	D01				T							C		C
JJ060	Tubatulabal	D01				T							C		C
JJ098	Chumash	D01				T							C		C
JJ196	Chumash?	D01				T							C		C
JJ280	Mono	D01				T							C		C
JJ363	Gabrielino	D01				T							C		C
JJ059	Miwok	D02	A			T							C		C
JJ163	Unidentified	D02	A			T							C		C
JJ017	Kitanemuk	D03				T					C		C		C
JJ048	Kawaiisu	D03				T					C		C		C
JJ001	Chumash	D04				T	G			T				C	C
JJ067	Chumash	D04				T	G			T				C	C
JJ076	Chumash?	D04				T	G			T				C	C
JJ165	Chumash	D04				T	G			T				C	C
JJ050	Cahuilla	D05				T						A	C		C
JJ075	Costanoan	D06		T		T							C		C
JJ093	Chumash	D07				T		T	T				C		C
JJ145	Vanyume	D08				T							C		C
JJ155	Yokuts	D09			T	T							C		C
JJ416	Salinan	D10				T			T				C		C

Notes: The two specimens of ancient haplogroup D from CA-MNT-831 are shown at the top. Samples obtained by John Johnson from living descendants are prefixed by "JJ." Modified from Johnson and Lorenz (2006: Table 6).

Likewise Haplogroup D was represented by 10 haplotypes, with haplotypes D01 and D04 representing founding haplotypes for the Americas (Johnson and Lorenz 2006; Kemp et al. 2007). The latter haplotype is also referred to as D4h3 (Tamm et al. 2007). The D04 haplotype appears associated with an early coastal migration, as individuals of this haplotype are found from California to the tip of South America. The D01 haplotype was most likely associated with overland migrations, and exhibits distant genetic relationships to Penutian groups in the Columbia Plateau region, as well as groups elsewhere in North America (Eshleman and Smith 2007:293).

Our samples provide four additional examples of Haplogroup A01 and two of Haplogroup D01. This brings the total number of haplotype A01 samples to six. All six of these samples are associated with Monterey County and are either from coastal sites or from individuals whose ancestry is traced to villages in reasonable proximity to the coast (Figure 1). This is consistent with Eshleman's sample, which found Haplogroup A associated primarily with the Pacific Coast.

The presence of the two Haplogroup D01 samples is consistent with the Utian expansion, a westward movement of Penutian speakers some two to three thousand years ago.

The age distribution of the samples also was consistent with the idea that Haplogroup A01 was spread along the coast by an early coastal migration, while Haplogroup D01 was a spread by a subsequent migration from inland.

We were told when we received the initial data several years ago that our oldest Haplogroup A sample, radiocarbon dated to about 5,250 B.P., was the oldest example of that haplogroup in western North America, if not the New World. This information was confirmed by statements in Eshleman et al. (2003:13). However, recent findings of Haplogroup A in ca. 14,300 year old coprolites at Paisley Cave in southern Oregon have far surpassed the age of our oldest sample (Gilbert et al. 2008).

But the age of the Haplogroup A01 sample was not the biggest surprise from this research. The real surprise came from our Most Likely Descendant, Ella Rodriguez (Figure 2), with whom we worked for 28 years and who permitted us to analyze these six samples of human bone.

Some years ago, Ella contributed a sample of her own DNA to John Johnson's ongoing studies, and the results were included in Johnson and Lorenz's (2006) paper as sample JJ039. She was the one Esselen sample noted in their work and in Eshleman's (2002) dissertation. Ella was found to have haplotype A01.

When the results of our studies came back, the oldest dated individual, radiocarbon dated to about 5,250 B.P., also had haplotype A01, as did three other more recent individuals (Table 1). This finding established a direct lineage tie for Ella dating back over 5,200 years, making her one of the best-documented Native Americans in California! Given that this burial was female, this ancient individual could even have been one of Ella's direct ancestors.

In addition to radiocarbon and mitochondrial DNA, we obtained stable isotope readings from the CA-MNT-831 burials. These suggested that for the 5,250 year old individual, marine resources made up over 90 percent of the diet, and that much of this probably came from pinnipeds.

This research also documents the persistence of haplotype A01 for over 5,200 years in the coastal areas of Monterey County. Given the coastal distribution documented by Eshleman (2002), it is likely that this haplogroup is one that spread initially through coastal migration, and it is entirely possible that it persisted for 10,000 or more years along the central coast. We

have documented with this study that it persisted for at least 5,200 years in the Monterey Peninsula region.

It is also likely that the haplotype D01 identified from the recent burial at CA-MNT-831 represents a more recent terrestrial migration, possibly of Penutian speakers expanding from the Central Valley to the coast. This individual had a largely terrestrial orientation, with only about 10 percent of the diet coming from marine resources.

This information documents the importance of conducting, when possible, mitochondrial DNA studies in conjunction with both radiocarbon and stable isotope studies (Breschini and Haversat 2006, 2008). First, without precise age estimates, such as provided by radiocarbon dating, it can be difficult to determine the age of a burial. Second, the dietary inferences that can be tied to specific times in the prehistoric past can tell us a great deal about ancient subsistence and settlement patterns.

Ella died shortly after we received these results, but she was very gratified that these studies produced such important and useful information and that she had played a key role. She was an advocate of doing good archaeology and of gathering and preserving information on her ancestors to pass on to future generations. There was a time when some claimed she wasn't even an Indian, in order to push her out of monitoring jobs, but in the end Ella was vindicated by research that she herself made possible.

Future Research

Some studies of Native American mitochondrial DNA are now including the complete mitochondrial genome (e.g., Tamm et al. 2007, Achilli et al. 2008, Fagundes et al. 2008), whereas the samples reported here analyzed only a small segment of the mitochondrial genome. These complete mitochondrial genomes, of course, allow for a much more detailed examination of the mutations which have occurred.

Unfortunately, it is currently prohibitive to analyze the complete mitochondrial genome of ancient bone samples. Because of this, we are unable to compare our ancient sample from CA-MNT-831 with the more recent complete genome samples.

However, there are some important avenues for future research. John Johnson (personal communication, 2008) advises us that he has secured a DNA sample from another descendant who, like Ella, traces his ancestry to the ethnographic Esselen district of *Excelen* (Figure 1).

And while Ella has died, she has relatives with the same mitochondrial DNA, and we have contacted them about obtaining a DNA sample. It is possible that in a few months we will be able to add two complete mitochondrial genome samples from the Esselen to the growing worldwide database.

It is likely that more surprises are in store for us, and Ella would have loved to see them.

Acknowledgments

We would like to express our gratitude to Ella Rodriguez for making this study possible. She wanted to learn about her ancestry and encouraged all the archaeologists she worked with to do better work. We would also like to thank John Johnson of the Santa Barbara Museum of Natural History for sharing his knowledge of the field and for his support in preparing this paper. John Romani commented on an earlier draft of this paper and provided details on the Palmdale mitochondrial DNA study.

End Note

The haplogroup designations are currently undergoing rapid change and refinement based on a number of recent complete mitochondrial genome studies. We have used the haplogroup designations provided to us in this paper, but caution the reader that it will be necessary to check for nomenclature changes.

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