Surname Distributions, Origins, and their Association with Y-chromosome Markers in the Aleutian Archipelago

By

Orion Mark Graf

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Dr. Michael H. Crawford (Chairperson)

Dr. James H. Mielke

Committee members

Dr. Bartholomew C. Dean

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The Thesis Committee for Orion Mark Graf certifies
that this is the approved version of the following thesis:

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Committee:

Dr. Michael H. Crawford (Chairperson)

Dr. James H. Mielke

Dr. Bartholomew C. Dean

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Abstract

This study is an examination of the geographic distribution and ethnic origins of surnames as well as their association with Y-chromosome haplogroups found in Native communities from the Aleutian Archipelago. The project's underlying hypothesis is that surnames and Y-chromosome haplogroups are correlated in the Aleutian Islands because both are paternally inherited markers. Using 732 surnames, Lasker's Coefficient of relationship through isonymy (R_{ib}) was used to identify correlations between each community based on of surnames. A subsample of 143 surnames previously characterized using Y-chromosome markers were used to directly contrast the two markers using frequency distributions and tests. Overall, it was observed that the distribution of surnames in the Aleutian Archipelago is culturally driven, rather than one of paternal inheritance. Surnames follow a gradient from east to west, with high frequencies of Russian surnames found in western Aleut communities and high levels of non-Russian surnames found in eastern Aleut communities. A non-significant correlation ($r = -0.0132$; $P = 0.436$) was found between distance matrices based on NRY-haplogroups and surnames, although an association was found between non-Russian surnames and the predominantly non-Russian NRY-haplogroups (R1b, I1a, and I). This indicates that admixture between Natives and non-Russian European fur-traders and fishermen replaced dominant Russian surnames in the east, while Russian surnames in the west are the remnants of Russian colonization.

This thesis is dedicated to Sarah, Oliver, and Theodore.

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Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

This study is an examination of the geographic distribution and ethnic origins of surnames as well as their association with Y-chromosome haplogroups found in Native communities from the Aleutian Archipelago. As a proxy for genetic markers, surnames have been used as a non-molecular means of characterizing the genetic structure of populations and their levels of inbreeding. The first such study was conducted by George Darwin, the son of Charles, who used surnames to estimate frequencies of consanguineous marriages in Victorian England (Darwin, 1875). This simple approach was later elaborated and extended by Crow and Mange (1965) to include the calculation of inbreeding coefficients, a method referred to as isonymy, based on the frequency of marriage between individuals with the same surname (Crow, 1983).

Advances in molecular biology have led to the increased use of molecular genetic variation to better understand human migration and population structure. The field of Anthropological genetics has experience an increase of studies using mitochondrial DNA (mtDNA) and the non-recombining portion of the Y-chromosome (NRY) to examine population structure and human migration during the latter half of the 20th century (Crawford, 2007a). Markers from mtDNA and the NRY are haploid and eliminate the confounded effects of recombination. This makes them ideal for population studies. Mitochondrial DNA is inherited maternally, meaning that it is passed from a mother to her offspring (Giles *et al.* 1980). This offers a means for identifying a maternal lineage. In the same way, Y-chromosomes are inherited paternally offering a male specific lineage. Because NRY markers and surnames are both inherited paternally, they are assumed to be correlated with one another (Jobling, 2001).

The first documented use of surnames to distinguish heritage occurred in China around 5,000 years ago, but in some communities surnames have only been in use for the last century (Jobling, 2001). No doubt, some aboriginal communities still do not use surnames. Many surnames are related to locality, clan, or trade, and the majority of surname comparisons with Y-chromosome markers have been made in Europe. European surnames have been recorded and used as markers for heritage for at least 500-700 years (Jobling, 2001).

Studies comparing Y-chromosome markers and surnames have yielded interesting results. In a study conducted in Great Britain, the so-called "Sykes" Y-chromosome has been shown to correspond to the surname of the same name with few mutational differences for the last 700 years (Sykes & Irven, 2000). Of those sampled (n = 48), almost half shared the same Y-chromosome haplotype, suggesting a single surname founder for extant Sykes males (Sykes & Irven, 2000; Jobling, 2001). In similar research, this time performed for Irish subjects, 221 surnames were categorized on the basis of kinship systems, such as clans, and putative origins, both regionally within Ireland and foreign. The results showed a significant association between Irish surnames with both Gaelic (Ulster, Muster, Leinster and Connaught) and foreign (Scottish, Norman/Norse, and English) origins and specific NRY-haplogroups (Hill, Jobling & Bradley, 2000).

Given the reported concordance between Y-chromosome variation and surnames, we investigate whether this relationship is evident among Aleut communities in southwestern Alaska, a population whose genetic structure exhibits significant geographic patterning and high levels of admixture stemming from substantial male-mediated gene flow from Russian and Western European groups. The genetic structure of the populations in the Aleutian Islands

reflects three historic periods: the peopling of the Aleutian Islands, the Russian Period, and the post Russian period. An ancestral population crossed Beringia prior to dividing into two groups (Laughlin & Harper, 1979). Of these groups, it has been suggested that Eskimos traveled further into North America while Aleuts diffused through the Aleutian Archipelago (Crawford, 2007, Rubicz, 2007, Zlojutro *et al.*, 2006). The Archaeological record indicates that the Alaskan Peninsula was populated approximately 9,000 years B.P., followed by the central islands 6,000 years B.P., and the western extend of their range between 3,000-4,000 years B.P (Dumond and Knecht, 2001; O'Leary 2001; McCartney and Turner, 1966; West *et al.*, 2007).

The Russian period (1741-1867) was marked by an influx of paternal genetic material, great demographic change (depopulation), and expansion to the Pribilof and Commander Islands through forced relocation. Surnames were first introduced to Aleut peoples during this period through baptism, adoption, and admixture. Admixture was encouraged through Russian policies directed at integrating Aleuts into the empire, and for the purpose of political control. After the establishment of a creole estate, akin to the burgher state in the Russian economic system, Native women and women of Russian and Native descent who married Russian and creole men were allowed greater social mobility. Although baptism was the greatest contributing factor to Native acquisition of Russian surnames, the lure of the creole class firmly established Russian/Native intermarriage as a strong contributing factor (Black, 2004).

After the Russian period (1867-present), British and Scandinavian fishermen admixed with Aleuts in the eastern islands in part due to the hunting policies of the US Treasury Department. Men were only allowed to hunt fur bearing animals if they were married to a Native woman (Reedy-Maschner, 2008). The lure of pelts had always been a draw for foreigners

seeking their fortune in Alaska. This policy did not discourage outsiders from hunting otters and seals, it encouraged them to marry Native women resulting in surname acquisition from non-Russian European sources through marriage.

Aleutian mtDNA has been shown to be relatively homogenous with founder haplogroups A and D representing the entire maternal ancestry of the Aleuts. A gradient is present with haplogroup A being most prominent in the west and D increasing in frequency on each island to the east. Bering Island, the furthest island to the east, haplogroup D is fixed and A is absent (Crawford, 2007; Rubicz, 2007; Zlojutro *et al.*, 2006). This is most likely the result of founder effect and drift where the majority of Aleuts moved to Bering by Russia where likely haplogroup D (Crawford, 2007, Rubicz *et al.*, 2003). There is considerable asymmetry between mitochondrial and Y-chromosome haplogroup data. There is no clear geographic gradient of Y-chromosome groups in the Aleutians. Instead, the paternal molecular data appears to be much more random with a heavy influx of gene flow from European sources. The highest levels of NRY heterogeneity is present in Bering and the Pribilof Islands. Unlike mtDNA, where haplogroups thought to be Native in origin (A and D) represent the range of genetic variation, NRY-haplogroups of Native origin only represent 15% of the population. The majority of paternal genetic variation in the Aleutian Archipelago has been attributed to European and Russian origin (Crawford, 2007; Rubicz, 2007; Zlojutro *et al.*, 2006).

The primary focus of this study is to describe the population structure of the Aleutian Archipelago based on surname markers. Surname origins are assessed based on historical data, and these were compared to molecular data from previous research in the Aleutian Island. Population structure is the measure of the relationship between elements within a population

such as genes, genotypes, phenotypes and groups of individuals (Workman and Jorde, 1980). Other parameters such as geographical distribution, as well as demographic, and social attributes have also been utilized as defining characteristics of population structure (Schull and MacCluer, 1968). These elements can be subdivided based on geography, religion, language, and other aspects of human culture in order to explore genetic or surname distributions. The underlying hypothesis of this study is that surnames and Y-chromosomes are correlated, because both are paternally inherited. Surname and molecular data were collected during the Aleut Research Program (1999 – present).

Chapter 2: Literature Review

Historical Background

Precontact

The initial peopling of America most likely occurred between 25,000 and 14,000 years ago, when the Bering land bridge was exposed (Hopkins, 1982; Elias *et al.*, 1996; Hoffecker *et al.*, 1993). Other researchers (e.g., Rogers *et al.* 1991) suggest that this peopling occurred during the Younger Dryas glacial period between 12,900 and 11,600 years BP. An ancestral population is believed to have migrated across Beringia before dividing into two groups (Fig. 1) (Laughlin & Harper, 1979). Of these groups, it has been suggested that Eskimos traveled further into North America along the northern slope of Alaska, while Aleuts diffused through the Aleutian Islands (Crawford, 2007; Rubicz, 2007; Zlojutro *et al.*, 2006).

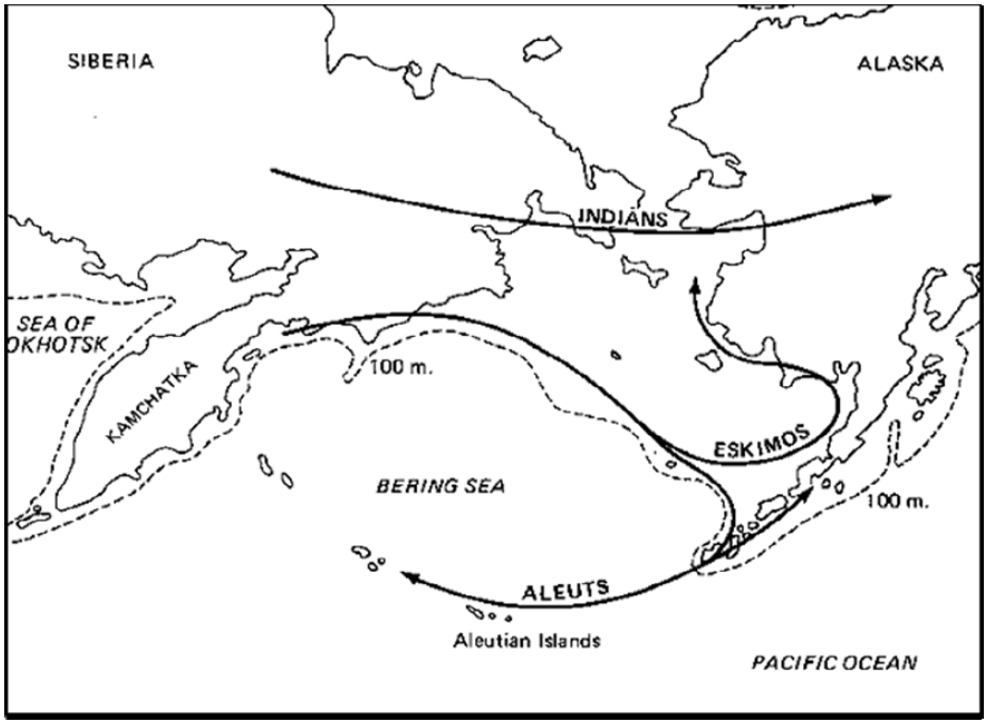

Figure 1. Map of Laughlin's theory for circumpolar population migrations in the Bering Sea region (Laughlin and Harper 1979).

The Aleutian Archipelago spans 1,200 miles between the Alaska and Siberia. There are approximately 200 islands in this volcanic archipelago (West *et al.*, 2007), divided into five major groups (Fox, Islands and Four Mountains, Andreanof, Rat, and Near Islands). Two other notable groups in the region are the Commander and Pribilof Islands, including Bering and Medni Islands and St. Paul and St. George Islands respectively. The climate is harsh and treeless, with few terrestrial resources (Crawford, 2007). The weather is maritime; winds have been recorded in excess of 200 mph; fog, rain, sleet, and snow are frequent, and the temperature is cold year round (Lantis, 1984).

The wealth of marine biomass in the region includes invertebrates, fish, and sea mammals (Black, 1976). This environment was crucial to the survival and adaptations of the first people to settle the region (West *et al.*, 2007). Lacking terrestrial resources, early Aleuts are believed to have subsisted on a marine diet, based on data from stable carbon and nitrogen isotope analyses (Coltrain *et al.*, 2006). Aleut men were likely skilled hunters (Black, 2004; Zlojutro, 2008; Dyson, 2000). It is believed that nearly all of the 200 islands in the archipelago were at one time inhabited (West *et al.*, 2007).

The earliest archeological sites in the Aleutian Islands are in the eastern region close to the Alaskan Peninsula. Sites on Unmak (Anagula Blade) and Hog Islands (Russian Spruce and Oiled Blade) date to approximately 9,000 years BP (Dumond and Knecht, 2001; McCartney and Turner, 1966). The Andreanof Islands show evidence of occupation by 6,000 years BP (O'Leary 2001), but evidence for occupation of the western islands does not appear in the archeological record until much later. Sites on Amchitka and Rat Island date to 3,000–4,000 years BP (West *et*

al., 2007). This indicates that after an ancestral population crossed through Beringia into what is now Alaska and then the Aleutian Islands were settled from east to west (Crawford, 2007).

After contact with Russia in 1741, a number of altering events occurred, including population bottlenecks caused by warfare, disease, starvation, and exposure to harsh conditions (Torrey, 1983; Lantis, 1984). Contact also led to an influx of a large amount of paternal DNA from Russia and Europe. Populations on the Commander and the Pribilof Islands were established when managers of the Russian-American Company moved Aleuts to Bering, St. George, and St. Paul Islands. During World War II, residents of Attu were imprisoned by Japan, and the U.S. government evacuated all remaining Aleutians to the Alaskan mainland. These events led to further paternal admixture from outside populations (Crawford, 2007; Rubicz, 2007; Zlojutro *et al.*, 2006).

Most scholars believe the population in the Aleutian Islands prior to Russian contact was close to 10,000 (Black, 2004). Russian ethnographer Roza G. Liapunova concluded that the maximum estimate for the Aleutian archipelago from the western to eastern islands (Attu to the Shumagins) was between 7,500 and 9,500 persons after reanalyzing all of the earliest Russian sources (Liapunova, 1990). This estimate, including 44 villages, is conservative because it does not account for men absent at the time of the census (Black, 2004). However, some scholars suggest between 12,000 and 16,000 individuals resided in the Aleutian Archipelago prior to contact (Laughlin, 1980).

The first census of the Aleutians was conducted during the years 1791-1792 by the Billings-Sarychev expedition. However, this census was incomplete as well. It did not include women and children and excluded some newly baptized men. People on the western Aleutians,

Rat Islands, and Shumagin Islands and Natives on ships off Kodiak and the Pribilof Islands were not counted (Heinrich, 1980). Population estimates of the Kodiak archipelago at Russian contact range between 5,000 and 40,000. The high figure of 20,000 to 40,000 individuals was Grigorii Shelikhov's estimation in 1790 but was likely an exaggeration meant to impress the imperial family. Black estimates the population of Kodiak to be 8,000 at Russian contact. Baranov's 1792 census counted 7,109 individuals, while Natalia Shelikhov (Grigorii's spouse) counted 7,093 in 1796. Gideon's 1795 census reported 6,418 people in Kodiak. In 1804, his estimate was 4,850. This shows a dramatic decrease, but an 1817 census conducted by naval officers refuted this decline when it counted 6,642 individuals (Black, 2004).

Although the 1817 census shows a net increase in the population of Kodiak between 1795 and 1817, the majority of evidence indicates a loss in population during the first two decades of Russian occupation. This pattern is prevalent throughout Kodiak and the Aleutian Islands as disease, warfare, and forced migrations forever changed Alaska. Khlebnikov estimated that Kodiak lost 2,412 Natives during the years 1792-1817 (Black, 2004; Khlebnikov, 1979). There was a considerable loss of life in the Aleutian Islands during the Baranov era. This can be determined through further census comparisons.

The 1791-1792 census of the central and eastern Aleutians estimated 5,000-6,000 individuals, but Fedor Burenin counted only 1,898 adult males and females in the eastern Aleutians, excluding the Shumagins, in 1806. Ivan Kriukov counted 1,508 adults and minors by 1813; Captain Vail'iev counted 1,700 individuals in the eastern Aleutians by 1721; and Veniaminov found 2,000 persons total in the eastern and central Aleutians by 1834 (Black, 2004; Veniaminov, 1840). These data show a dramatic decrease in the overall population of the

eastern Aleutians. Some estimate a 50% reduction in Aleut population during the first 30 years of Russian contact (Laughlin, 1980). Population fluctuations through the region illustrate the impact of the early period of Russian colonization.

Along with general mortality, a gender shift was also occurring in Alaska. Early Russian reports indicated that women outnumbered men in both the Aleutian and Kodiak Islands, but in all the censuses taken, beginning in 1791, and men outnumbered women. This could be the result of women being taken as wives and concubines or higher rates of female mortality due to increased environmental stresses as a result of Russians using women as laborers and increased demands placed on women in Native villages because men were being removed for use as laborers, hunters, and warriors (Black, 2004). With fewer women than men in the breeding pool, the dramatic loss in population after Russian contact would have been even more difficult to reverse.

Russians and Native Americans

First contact between Russians and Alaskan Natives occurred in 1741. This event was initiated when Peter the Great signed instructions for Vitus Bering to lead an expedition into the Pacific on December 23, 1724 (Bancroft, 1886; Black, 2004; Golder, 1922). Bering's first expedition took him and his men through the strait between Alaska and the Chukchi Peninsula. He was preceded in crossing this strait in 1648 by Semyon Dezhnyov (Black, 2004; Fisher, 1981), but Bering's expedition to the Arctic was significant in that it marked the beginning of Russian expansion into America (Black, 2004).

Imperial Russia had been rapidly expanding eastward since the reign of its first Czar, Ivan the Terrible (Black, 2004). The pursuit of a northern passage to the Pacific and the establishment of permanent settlements in the harsh environments of Siberia and Kamchatka had promoted a culture of exploration and privateering. Pushed by the crown and private corporations, individuals residing along the coast of the Sea of Okhotsk and in Petropavlovsk, Kamchatka were repeatedly driven to explore the Bering Sea and the lands beyond it.

Bering's first expedition was not an attempt to reach Alaska. Its purpose was both to build up Okhotsk as an expedition's base and to test the sea route from Okhotsk to Kamchatka's western and eastern coasts. During these voyages, Bering made landfall on St. Lawrence Island in 1732, marking the beginning of the Russian-American period (Black, 2004). The achievements of this expedition led to another Russian exploration of the Bering Sea, this time led by Afanasii Shestakov.

Shestakov, a Yakutsk Cossack, was assigned 400 Yakutsk service members in March 1727 for an expedition to map and explore the Northern and Eastern Oceans. He was authorized to recruit both "Cossack sons" and Siberian natives for the expedition. Members of his crew included military instructors, a topographer, and a mining specialist and assayer in ores. Emel'ian Basov was also on board. He would become the first private entrepreneur to attempt to exploit the bounty of the Aleutian Islands in 1743. During Russian expansion in the 18th century, private entrepreneurs often established new locations as Russian territory before the crown took over (Black, 2004).

Shestakov's expedition was an ambitious venture but quickly fell into disarray when he was killed by Chukchi in 1730. After Shestakov's failed expedition, the entire Arctic coast of

Russia was mapped during the Great Northern Expedition prior to Bering's second expedition. The crown sought to maintain a monopoly on the sale of furs to China, which had been established under the reign Catherine I by the Treaty of Kiakhta (October 21, 1727) and which it hoped a northern passage to the east would help them maintain. Bering's second expedition, an outgrowth of the goal to find such a passage, began during the reign of Anna (1730-1740) and was completed under Elizabeth in 1741 (Black, 2004; Foust, 1969; Lantzeff, 1943; Slandkovsky, 1981; Vernadsky, 1951).

Two vessels were built for Bering. He would command the *St. Peter*, and the *St. Paul* was commanded by Aleksei Chirikov. In 1740, Petropavlovsk was founded as a base of operations on the eastern shore of Kamchatka, and the two ships cleared Avacha Bay on June 4, 1741. They would not be seen again until October 12, when the *St. Paul* returned. Bering's vessel would not return until August 17, 1742 (Black, 2004).

As instructed by the senate, the two vessels sailed southeast for latitude 46° N in search of the mythical de Gama Land and Company Land from a chart provided by Louis Delisle de la Croyere. Delisle would died of scurvy aboard the *St. Paul*. The vessels were separated by a storm and fog at latitude 50° N. Each sailed on its own from this point. Their initial search for de Gama Land and Company Land likely sealed the fate of Bering and much of his crew (Black, 2004).

Chirikov made contact with Natives in late July when he reached the panhandle of Alaska. He sent a longboat ashore with a crew of ten armed men. After six days, the longboat had not returned. Chirikov and his crew had observed fires on shore and assumed his crew may be stranded due to an accident. He sent their last small boat ashore with four men on July 24.

They also never returned. The next day a small craft approached their ship. This was not one of their boats. Four men were in the craft dressed in red, they paddled instead of rowed and turned away before reaching the *St. Paul* (Black, 2004). Later interpretations of this event have suggested these men were Tlingit. Chirikov's men were never seen again, but Tlingit oral tradition spoke of blond haired, blue-eyed Indians on the Northwest Coast, suggesting they may have been captured rather than killed (Black, 2004; Olson, 1991).

Due to their losses, Chirikov and his officers decided to return to Kamchatka sooner than planned. On September 9, while in a bay at Adak in the Central Aleutians, several Aleuts approached the *St. Paul* in single-hatch kayaks. Although Chirikov requested on several occasions for the Americans to board his ship, they flatly refused. However, he did manage to trade for water, a wooden hat, and arrows. The Aleuts proved to be shrewd trade partners. When offered a Chinese cup and cloth as trade, they tossed them into the water. They also refused a copper kettle but accepted Chinese pipes and tobacco, needles, beads, knives, and an old axe (Black, 2004). This illustrates that from their earliest contact with Natives, Russians interacted with them intimately. This would eventually lead to a great deal of admixture between the two groups.

In contrast to Chirikov, Bering continued to search for De Gama Land and Company Land after losing sight of the *St. Paul*. He and his crew had searched for the *St. Paul* for three days before returning to course following Delisle's chart but abandoned this search and returned north when they reached 45° N latitude. They sighted land on July 17 and, on July 20, anchored off Kayak Island near the Alaskan panhandle, where they noted abundant signs of human occupation as well as the presence of red foxes that were unafraid of men (Black, 2004).

Bering set course for Kamchatka on July 25. On August 20, while sailing home along the Aleutian Islands, Bering chose to replenish their water supply from a brackish lake on Nagai Island. This decision would contribute to their future peril. Fur seals, red fox, and slate were observed on the Island, so Bering's party cleared the area on September 5—also when he and his crew first made contact with Aleuts. The Natives approached in single-hatched kayaks. Bering's interpreters attempted to speak with the Americans in both Koryak and Chukchi languages but were not able to communicate. The Aleuts were offered red cloth, mirrors, three Chinese metal pipes, beads, and a bell for trade. They accepted, giving two polished staffs to the Russians. Trade was quickly curtailed, however, when the Koryak interpreter somehow offended the Aleuts. No matter how hard the Russians tried, they could not convince the Americans to return. Instead, the Russians were convinced through gestures to reconvene on shore (Black, 2004).

Sven Waxell, the master of the vessel, led a group of nine men to land the next morning, when he offered vodka to an elder, who quickly spat it out. The meeting proceeded successfully until the Americans grabbed a Chukchi interpreter. The Russians, who had been concealing weapons, fired their guns into the air. This startled the Americans and allowed the Chukchi to escape and return to the longboat uninjured. The following morning, the Americans returned to the ship, this time paddling their kayaks in single file. They exchanged gifts and then returned to land. Waxell proposed that they capture all nine Aleuts, but Bering refused. They left port and set sail for open water (Black, 2004).

It was now late in the season. The weather was turning bad, and the *St. Peter* had to battle through dangerous seas toward Kamchatka. Many of the crew died. The ship was battered

by snow and hail. Bering and several of his officers were extremely ill. Bering could not get out of bed. When land was sighted on November 4, Waxell called an all hands meeting in Bering's cabin. The ship's company voted to anchor. There were 33 sick crewmembers who could not perform their duties. They knew they were near Kamchatka, and many hoped they were landing there (Black, 2004; Waxell, 1940).

On December 8, 1741, Bering died on the Island that would later bear his name (Commander Island), and the crew was forced to winter there. The ship broke off its anchor cables in mid-winter. It was beached and heavily damaged. They survived on what they could find. Sea otters were plentiful, fur seals arrived in March, and sea cows were considered a delicacy. During winter, a drift whale was pulled to shore. Its carcass was rank but edible. The men ate raw blubber in small pieces, and by spring, many were recovering from scurvy (Black, 2004).

With only one officer dissenting, the crew voted to build a new vessel out of the damaged *St. Peter*. Construction began on May 6, 1742, and was completed August 10. They set sail August 14, and left their dead buried under a large Orthodox cross. Kamchatka was sighted only three days later on August 17. They entered their home port of Okhotsk on August 26 with 45 members of the original 76-man crew (Black, 2004).

After Bering's second expedition, the majority of explorers seeking wealth in America were private entrepreneurs. The crown allowed settlements to be established by private entrepreneurs long before the monarchy moved in and took a more significant role (Black, 2004). Private entrepreneurs reaped financial benefits from the exploration of Alaska during this period, while ignoring many of the laws established to protect Native peoples in the region. The crown

failed to sufficiently enforce these laws until well into the 19th century, after the establishment of the Russian-American Company. The crown's inaction resulted in increased admixture between individuals seeking fortune in Alaska (mostly from Northern Russia and Siberia), large-scale depopulation of Natives (especially males), and a culture of exploitation where Natives were used as a work force and were relocated to locations most opportune for hunting.

Early Conflict

Even in the 18th century, the crown had laws in place regarding the treatment of Native Alaskans. They were to be treated as equals, as Russians, and any mistreatment was considered a serious offense. In fact, by the mid-19th century, the corporal punishment of Natives was considered a capital offense (Black, 2004). Natives were treated with respect according to the law later in the Russian-American period, but this was not initially the case. Private entrepreneurs who reached Alaskan soil in the mid-18th century had their interests bound to profit and did not concern themselves with fair treatment of Natives. Instead, they attempted to circumvent interacting with Natives all together or to use them as a workforce. Neither eventuality would occur without a fight.

The first private entrepreneur to reach Alaskan soil was Emel'ian Basov. On August 1, 1743, he and his skipper, Cossack Evtikhii Sannikov, navigated by dead reckoning with a compass toward the Aleutian Islands (Berkh, 1923; Black, 2004). They reached Bering Island in five days, wintering there while hunting arctic foxes and sea otters, and the skins they collected offered a hefty profit when they returned in 1744 (Black, 2004).

The lure of fox pelts probably played the greatest role in the exploration of the eastern Aleutians during this period. Sea otter hunting was commonplace, but silver and black fox pelts were twice as valuable in Kiakhta and were considered the royal fur in Moscow. Red foxes and a variety of arctic foxes were also hunted. These were in great number in the Commander Islands and provided an excellent fall back when sea otter hunting was no longer productive (Black, 2004).

The Russian claim to Alaska was only contested by Spain during the 18th century. Spain had claimed the entire west coast of North America from Mexico to the Bering Strait prior to Russian's arrival in the new world. During the reign of Catherine the Great (1741-1761) and under Empress Catherine (1762-1796), Russia would secure this territory in order to exploit its rich natural resources (Black, 2004). Bringing Alaska under the imperial scepter, however, would not come without a fight.

During its occupation, Russia struggled to maintain a monopoly of Alaskan resources. Aleuts and Tlingits were warlike people, and they were not easily persuaded to drop arms and work with Russians. The 1760s marked a time of conflict, as an increasing number of private entrepreneurs sought profit in Alaska. It was a breach of Russian law to mistreat Natives, but Russians regularly overstepped their bounds (Black, 2004). One incident included the crew of Ivan Bechevin, a merchant from Irkutsk. His crew, despite instruction that even the slightest offense toward Natives would be punishable by death (Dmytryshyn 1988; Bundy *et al.* 2003), committed violent acts, including murder (Berkh 1923; Bundy *et al.* 2003) against Aleuts on Unimak Island during 1761 and 1762. This led Aleuts from Umnak and Unalaska to declare a "war of annihilation" against the Russian fur traders (Black, 2004).

In December 1763, attacks by Aleuts resulted in the loss of eight Russian fur-trading vessels and the deaths of 188 of 200 crewmembers. In retribution, fur traders led by Ivan Solov'iev instituted a "scorched-earth" policy toward Natives. This policy would lead to the end of Aleut independence and resulted in the disbandment of the political alliance between Umnak and Unalaska (Black, 2004).

By Solov'iev's own account, his men killed 40 and 60 Natives in Umnak and Unalaska. Solov'iev believed that the most effective way to control native populations was to destroy their ability to wage war. He and his men systematically destroyed all "tools of war" in Native villages, including bows and arrows, spears, lances, kayaks, and large skin boats. Without these tools, Natives could not protect or feed themselves. The majority of Natives killed by Solov'iev's men were males, and without these able-bodied men, many local villages were left defenseless (Black, 2004).

Reports of British ships began to increase during the next couple of decades, culminating in the arrival of Captain Cook in 1778. Spanish ships were also reported to have frequented the Bering Sea, as the European powers continued to search for a Pacific entrance to the Northwest Passage (Frost, 1992). By 1785, Empress Catherine had begun the process of claiming Alaskan territory according to the "right of occupancy." Spain had claimed it under the "right of discovery." St. Petersburg issued a direct ordinance in the same year again stating that Native Americans were to be treated with kindness and forbearance at all times. The use of arms against them was forbidden, even when provoked by hostile acts (Black, 2004).

Spain's claim on Alaska was effectively eliminated when George Vancouver claimed the land north of the Columbia River and south of Alaska for the British in 1792. All future claims

on Alaska were between Russia, England, and the United States. Russian control of Alaska was concentrated on fur trade until the Unites State gained sovereignty in 1867 (Black, 2004).

The Russian-American Company

Grigorii I. Shelikhov

In 1782, Grigorii I. Shelikhov, a merchant from Rylsk, built three vessels for the purpose of establishing a permanent settlement in Alaska. Within a decade of entering the Alaskan fur trade business, Shelikhov was lobbying for a monopoly similar to that of the British East India Company and the Hudson's Bay Company (Black, 2004; Shelikhov, 1791). The establishment of a permanent settlement on Kodiak Island in 1784 by Shelikhov's company secured their position in America. Within the next two decades, his company would dominate fur trade in the region (Black, 2004).

The Pribilof Islands were discovered by Gavriil Pribylov a few years earlier in a vessel outfitted by Shelikhov and Pavel Lebedev-Lastochkin. These islands became a favorite find for Shelikhov. He originally fought to have them named the Zubov Islands after Count Platon Zubov, a close ally and supporter. Lebedev-Lastochkin and Shelikhov were at first partners in the Alaskan fur trade business but soon split and become bitter rivals. Both sought a permanent settlement in Alaska and a monopoly of the fur trading industry, though neither lived to see this occur as a monopoly of Aleutian fur trade was not granted to the Russian-American Company until 1799, four years after Shelikhov's death (Black, 2004).

Shelikhov's settlement of Kodiak in 1784 was a brutal endeavor. When his ship landed outside Three Saints Bay, he struck the natives with full force, resulting in a great loss of life

(Black, 1992; Black, 2004). The crown's policy was that native people were to be brought under the imperial scepter through persuasion, not violence. Unprovoked violence against Natives was a capital crime at this time, and steps had been taken to inform native leaders that they had this protection (Black, 2004). Shelikhov clearly ignored the crown when establishing his settlement on Kodiak.

After settling Kodiak, Shelikhov used the Kodiak Islanders as a workforce. Men were used as hunters and warriors. The people of Kodiak were deemed hostages of the company. Shelikhov fed and clothed them and forbade the exploitation of Native women. Natives who were not hostages were treated as Russians. They were allowed to leave at any time and were provided transport (Polonskii, n.d.; Black, 2004). Shelikhov dreamed of a "civilized" Alaska with all the amenities of Russian life. He shared new technology with Natives but was careful not to share the "secret of firearms" (Andreev, 1944; Black, 2004; Ginsberg, 1952). He also instructed that a full census be conducted (Andreev, 1944; Andreev, 1948; Black, 2004; Ginsberg, 1952).

As a means to control the population, he encouraged young unmarried Russians to marry Alaskan women (Andreev, 1948; Black, 2004). In a letter to chief manager Evstrat Delarov in 1789, Shelikhov suggested, "Make an effort to see to it that the single settlers being sent presently marry fine upstanding American girls; to this end I have sent you various items, necessary complements to clothing, as gifts for the brides and future wives; at weddings, supply each groom with same" (Black, 2004). A certain measure of control could have been extended upon the Native population by incorporating them into the Russian community through marriage. Shelikhov also encouraged marriage with Natives out of his practical belief that it would help his

unmarried employees avoid contracting venereal diseases. He did not approve of married men having sexual relations with native women but agreed that he could do little to stop this: "God be the judge of married men, not us" (Black, 2004).

One of Shelikhov chief concerns was bringing Russian religion and education to Alaskans. He has been credited with establishing the presence of the Orthodox Church in America (Black 2004) and repeatedly sought to increase the presence of clergy member in Alaska. He advocated the teaching of "literacy, arithmetic and singing" to Aleuts as well as training young Aleuts men in navigation, believing they could be "fine sailors," and stressed that Natives could be taught to be fine craftsmen and carpenters (Andreev, 1948; Black, 2004; Tikhmenev, 1863). Russian-America had labor shortages until the transfer of sovereignty to the United States, and Shelikhov viewed Natives as a potential solution to this problem.

Aleksandr Andreevich Baranov

In 1790, Shelikhov hired Aleksandr Baranov to be his chief manager in Alaska. Baranov, a merchant from Kargopol', would spend the next 28 years managing Shelikhov's interests. Shelikhov, who desperately wanted Baranov to be his manager, offered Baranov, who he hoped would bring a stronger presence to his American enterprise, the chief manager position for his American company three times before Baranov accepted (Black, 2004). Baranov accepted the position when Shelikhov offered excellent terms, including 210 shares in the company (Black, 2004; Kholebnikov, 1835; Pierce, 1973). In his contract, Shelikhov included a clause allowing Baranov to break Russian law regarding natives if it was deemed necessary (Black, 2004).

According to his contract, Baranov's membership dues in the Irkutsk merchant guild and expenses he might incur during his time in America were to be paid by Shelikhov. He was paid in money rather than furs. Each of his payments was given after the value of the fur was assessed, thus maximizing his earnings. His term as manager was unlimited, making it difficult for Shelikhov to remove him; however, Baranov could resign at any time given he offered ample notice. Shelikhov was also required to pay for his family's move from Irkutsk to Kargopol'. Baranov would never reunite with his wife after taking the position as chief manager (Black, 2004).

Baranov's tenure as chief manager was difficult at first. The Russian-American Company had not yet been established, Russian legitimacy in America was in question, and the relationship between Native Americans and Russian fur traders was contemptuous at best. He was responsible for both company and government business, with the government requiring him to keep track of foreign shipping and safeguard Russian sovereignty as well as protect the company's interests. His first line of business was to maintain 192 men as a labor force, expand to the Russian mainland, develop settlements, and ensure good returns on investments (Black, 2004).

The worker shortage in Alaska was Baranov's most immediate concern when arriving in Alaska. Peter the Great had established the gentry as a social class able to be attained through obligatory service to the state. Instead, it had mainly grown as a land and serf-owning class. The majority of the peasantry in Central Russia and Ukraine had become serfs by this time, and Baranov was not allowed to recruit serfs because they were by definition confined to the land they toiled. Furthermore, members of the merchant class were not allowed to own serfs. Serfs, however, could be hired with permission from their masters (Black, 2004).

The majority of Russian workers in America were from Northern Russia or Siberia (Black, 2004; Fedorova, 1971; Medushevskaia, 1952), but due to work shortages in these regions, very few skilled seafarers, shipwrights, hunters, and trappers were willing to hire themselves out to Alaska. Upon hiring Russian workers, the company was required to pay all local and state taxes for their employees for the duration of their service (Black, 2004; Fedorova, 1971). These conditions resulted in Native Americans comprising the majority of Shelikhov's workers (Black, 2004).

In 1787, Shelikhov was granted permission by Governor-General Iakobii to hire Natives if they were paid fair wages (Black, 2004; Tikhmenev 1979), and he quickly instituted large-scale recruitment. When Baranov arrived in Alaska, he had a labor force of approximately 150 Russian men (Black, 2004). These men were peasants and burghers (Black, 2004; Khlebnikov, 1835). Shelikhov required Native settlements under his control to provide workers of both sexes, and former slaves of the Aleuts and their heirs were put into service as laborers and hunters as well (Black, 2004; Tikhmenev, 1979). The Russian government was hesitant to send soldiers to the Alaskan territory, so Native American hunters and Russian laborers were also used as defense forces. Baranov employed these methods of recruitment to both his work and defense forces until he was removed from his position in 1818 (Black, 2004).

The social impact of Shelikhov and Baranov's policies during their tenure in Alaska are hard to gauge. The majority of disruptions to Native life began during the 1780s. Private fur traders, employed by Shelikhov and others, used young Native males for hunting and trapping and as warriors. Removing able-bodied men from their home settlements resulted in settlements

being left without protection and lacking a means for subsistence, creating hardship for those who remained (Black, 2004; Narochnitskii *et al.*, 1989).

Native American Treatment under Baranov

The use of Natives as skilled hunters had begun before Shelikhov had arrived on Kodiak. As early as 1786 Kodiak Islanders were being used to hunt sea otters, and by the time Baranov was chief manager, this practice was being implemented all over the Bering Sea region. Some of the hunting fleets Baranov dispatched included as many as 500-700 kayaks. These would have mainly been two hatch kayaks, so hunting parties may have exceeded 1000 men (Black, 2004; Khlebnikov, 1985). Baranov dispatched Aleut kayak fleets along the Pacific coast as far south as Baja California (Tikhmenev, 1979), and the pressure on local communities missing able-bodied men for great lengths of time was enormous (Black, 2004). The absence of Native men from their communities may have allowed Russian men increased access to Native women, resulting in increased admixture between the two groups during this period.

Soon after taking command, Baranov expanded operations to the Alaskan continent. In several areas, his operations were in conflict with native inhabitants. Conflicts between his employees and the Tlingit were common. When transgressions occurred, Aleuts were used as his main fighting force (Laguna, 1972; Black, 2004). On one occasion in 1807, when Baranov could not raise a sufficient defense force, he moved 70 kayaks full of Aleuts from Unalaska to the Northwest Coast. If these kayaks included families, an estimated 360-450 people were relocated. If families were not moved, 150-180 men were moved (Black, 2004). Relocations of Natives became commonplace under Baranov's governance. He played a major role in Native migration in the Aleutian and Kodiak Islands during the 28 years he served as chief manager.

Deaths due to accidents and hostile encounters with Tlingit during the years 1792-1805 provide a snapshot of how Russian fur trading was affecting the Native population of both the Aleutian and Kodiak Islands. According to data provided by Khlebnikov and Gedeon, 195 Aleut men were killed or captured by the Tlingit. In addition, 280-290 individuals drowned in various incidents, an additional 100 drowned in a single baidara accident in bad weather off Kodiak, and 64 drowned off Tugidok Island. Shellfish poisoning caused the death of 135-140 men, and 40 more died from illness en route to Sitka. These recorded deaths total 750-800, representing a 10% loss of Native life during this period, based on Baranov's 1792 census (Black, 2004; Gideon, 1989; Khlebnikov, 1979).

Baranov used harsh tactics to recruit Natives, including the lash and running the gauntlet (Gideon, 1989). Refusal to join long-distance hunting parties was punished with the lash for both Russians and Natives. Like most other chief managers during the Russian-American period, Baranov treated Natives and Russians alike, but he quickly identified corporal punishment as being taboo to Natives. This form of punishment was considered extremely shameful in both Aleut and Alutiiq societies. In some cases, individuals subjected to the lash later committed suicide (Black, 2004). Although the Russian empire did not abolish corporal punishment until 1860, Baranov quickly forbade this form of discipline with Natives. He instructed the head of Novo-Arkhangel'sk in 1800 that Aleut leaders should never be giving corporal or even verbal abuse, and that they were to be shown respect at all times (Black, 2004; Khlebnikov, 1835; Pavlov, 1957).

Novo Arkhangel'sk, Settlement Ross, and the Hawaiian Experiment

The Russian-American company was granted a monopoly in 1799, and construction on what would become its new headquarters, Novo-Arkhangel'sk, began on July 15, 1799. By this time, Natives were used at the main defense force for the Russian-American company, and after the establishment of their new capital, Aleuts and Kodiak islanders were moved to the Yakutat peninsula for this purpose. Although the Tlingit opposed a permanent settlement on Sitka, Baranov buried an imperial crest and possession plates. This act placed Sitka under Russian governance. Tlingit chiefs were present during the ceremony, and Chief Skautlel't was presented with an imperial crest. He formally acknowledged that the territory was given to Russia freely, but Baranov later stated that the Tlingit did not expect Russia to settle Sitka permanently (Black, 2004; Tikhmenev, 1979).

Tensions with Tlingit emerged immediately. Before Baranov had left Sitka, on April 22, 1800, he marched his forces to a Tlingit village, and in a show of force, fired cannons over the main house, though no one was killed, and courtesies were exchanged afterwards (Black, 2004; Tikhmenev, 1979). Baranov left with a tentative truce but was clearly worried about his new settlement (Black, 2004; Pavlov, 1957). His worry was justified, as the Tlingit destroyed Novo-Arkhangel'sk in June of 1802 (Black, 2004).

Baranov had been planning to establish a settlement on the Yakutat peninsula as early as 1794, and he was not going to give up Sitka without a fight. He immediately laid plans to reestablish his settlement. In 1804, he attacked a Tlingit stronghold, drove out its defenders, and established a peace negotiation that would last until 1867. Novo-Arkhangel'sk was rebuilt in a

different location as the Russian capital in Alaska eventually becoming an international port (Black, 2004).

Baranov had a great deal of success during his tenure. In 1804, Baranov took steps to solidify the future seal harvest by ordering a work stoppage. Work stoppages were common until the end of Russian-America (Arndt, 2000; Black 2004). He established the first trade agreement with King Kamehameha I in Hawaii (Black, 2004; Khlebnikov, 1835; Khlebnikov, 1985; Pierce, 1990). In 1812, Settlement Ross was established on the Northern California Coast. Ivan Kushkov (former manager of Kodiak) was placed in charge. He was sent with 40 kayaks of men, and most of these were Aleuts (Black, 2004; Khlebnikov, 1835). By 1818, Settlement Ross was producing vegetables and fruit and had domesticated cattle, pigs, and horses. The population included 26 Russians and 102 Aleuts, including some listed as "Aleuts" who were actually Athabaskans from the Kenai Peninsula (Black, 2004). Ross would remain in operation until 1841 when it was liquidated and sold to the United States (Black, 2004; Bolkhovitinov, 1990).

Russian relations with Hawaii soured after Dr. George Schaeffer, a surgeon, was sent there to represent Russian interests. Schaeffer entered into a relationship with Kamehameha's rival, King Kaumualii, and was forced to leave in 1817 (Black, 2004; Bolkhovitinov, 1975; Khlebnikov, 1835; Pierce, 1965). In 1818, Emperor Alexander ruled against annexing or furthering Russian relations with Hawaii. He stated, "Acquisition of these islands and their admission under [imperial] protection out of their free will cannot bring Russia any substantial benefits; on the contrary in many respects it will prove to be seriously inconvenient" (Black,

2004; Bolkhovitinov, 1975). Baranov's plan to add Hawaii to Russia's growing Pacific territory was essentially rebuked (Black, 2004).

Soon after this debacle, Baranov was removed from his position. He was forced out by a contingent of naval officers and by strong criticism from members of the clergy (Barratt, 1981; Black, 1999; Black, 2004). Captain Lieutenant and Cavalier Hegameister was the first naval officer to manage Alaska. His responsibility was to the Russian state and the Russian-American Company (Black, 2004). Baranov was 72 years old, and he had spent 28 years in Alaska. High-ranking members of the company were opposed to the move, while Natives were said to be "conflicted" by his leaving. Grizzled men who had worked with Baranov wept at his removal, and his closest allies were quickly removed from power (Black, 2004). He was escorted out of Alaska on November 27, 1818. He died en route to St. Petersburg in the Sunda Strait on April 16, 1819, and was buried at sea (Black, 2004).

The Pribilof and Commander Islands

The Pribilof Islands, discovered in 1786 by the Russian navigator Gavriil Pribylov, were an important breeding ground for the northern fur seal (Black, 1983). Pribylov had located the smaller island of St. George in 1786, and St. Paul was reached on a skin boat in 1787 after being sighted from St. George. The government became aware of them in 1789, and Shelikhov began to take control in 1790 (Black, 2004).

Both Islands were uninhabited during this period (Lantis, 1984). After establishing himself on these islands, Shelikhov ordered the relocation of a large numbers of Aleuts to populate the islands. He wanted 140 men stationed there at any given time (Black, 2004). The

initial Native population on St. Paul included 50 men and 30 women from Unalaska. In addition, the company units operating on Atka and Unalaska were combined and moved to the islands (Black, 2004). This conscription of Aleuts included 137 people from Atka and Unalaska and occurred in 1788 (Elliott, 1886). After establishing a significant population on both Islands, Shelikhov formed the Northern Company, and appointed Vasilii Petrovich Merkul'iev as manager (Black, 2004; Pavlov, 1957).

Merkul'iev was a burgher from Tomsk; he would later become the first manager of the Pribilof Islands after the formation of the Russian-American company in 1799. He married an Aleut who was probably from Umnak Island, and he died in 1828 when his baidara was caught in a riptide between Akutan and Unalaska. Merkul'iev is a prominent Aleut surname on both Pribilof Islands (Black, 2004) which is probably the result of both baptism and his marriage to an Aleut. He and his assistant, Ivan Fomich Popov, repeatedly increased Native populations on the Pribilof Islands. A minimum of 70 men were brought to the Islands in 1790 from Unalaska and Umnak (Black, 2004; Narochnitskii *et al.*, 1989).

Additional Native conscription included 200 Aleut men, women, and children being moved to the Pribilof Islands from the eastern Aleutians in 1810. Russian employees were reduced to a minimum. Eventually, only one or two would remain in the islands at any time (Black, 2004). Although large numbers of Natives were brought to the Pribilof Islands from Atka, Unalaska, and Umak, the Atkan influence was greater on St. George, and, for example, Natives claim that the dialect of St. George is closer to Atkan than Unalaskan (Black, 2004).

When the United States purchased Alaska in 1867, the Pribilof Islands came under U.S. jurisdiction. Pribilof Aleuts were given American citizenship but were required to hunt fur seals

for the Alaska Commercial Company and would later hunt for the U.S. Department of Fisheries (Rubicz, 2007). There were a total of 340 Aleuts on St. Paul and St. George in 1874 (Rubicz, 2001). After the Japanese invasion of Attu in 1942, Pribilof Aleuts were moved to Funder Bay Alaska to protect them from the threat of further Japanese invasion. These 477 individuals were placed under the charge of the U.S. Fish and Wildlife Department (Kolhoff, 1995), and all were allowed to return home in 1944, and by 1970, there were approximately 640 individuals living on the Pribilof Islands (Lantis, 1984), and an estimated 750 live there today (Rubicz, 2001). Today, the Pribilof settlements are the most populated and viable in the Aleutian Archipelago (Narochnitskii *et al.*, 1989; Pavlov, 1957; Black, 2004).

Between 1825 and 1828, Aleuts conscripted by the Russian-American Company were used to populate the Commander Islands. Aleuts from the western and central Aleutian Islands, including families from Atka and Attu, were moved at this time (Rychkov and Sheremetyeva 1972; Landtis, 1984). In 1840, males from St. Paul were relocated to the Commander Islands to hunt sea otters (Derbeneva et al, 2002). The Aleut population on Bering was 45 in 1825 but quickly grew to 110 in 1826. By 1873, there were 310 Aleuts on Bering and 190 on Medni. In 1892, the population of the Commander Islands reached an all time high with 626 Aleuts residing on both islands. Over time, though, these populations would decrease due to famine, chronic alcoholism, and diseases (Rychkov and Sheremetyeva, 1972).

Emigration further reduced their population until 1917, when they became citizens of the Soviet Union. Under Soviet control, the population in the Commander Islands grew, largely due to immigration (Liapunova, 1975; Rychkov and Sheremetyeva, 1972). In 1969, the populations

on Medni and Bering were consolidated and moved to the village of Nikolskye on Bering Island. Today there are approximately 300 Aleuts on Bering Island (Rubicz, 2001).

After Baranov

Conditions in Alaska improved under Baranov's replacement, Russian naval Captain Lieutenant and Cavalier Leontii Hagemeister. Although some of his policies led to labor disputes with both Russians and Natives, Hagemeister's tenure as chief manager led to an increase in social mobility for Native Alaskans. Soon after he was appointed, he had a school built in Settlement Ross, and a census was conducted. Hagemeister was interested in the growing population of people of mixed Russian-American descent. Alaskans of mixed ethnic and biological heritage would soon become a powerful and influential class within Russian-America (Black, 2004).

Like Hagemeister and Baranov before him, the next chief manager, Lieutenant Semeon Ianovskii lobbied to increase the presence of medical care in the colony. The first company physician arrived at Novo-Arkhangel'sk in 1820. Between 1820-1826, the first hospital on the Northwest Coast of America was built in Novo-Arkhangel'sk. This hospital would be in operation until the U.S. took control of Alaska in 1867 (Black, 2004; Fortuine, 1990). Under Baranov, there had only been a short-term hospital on Kodiak. Medical care was a serious problem in the colony as evidenced by a fever outbreak in 1819. An American ship is believed to have brought the illness from Java when it landed at Novo-Arkhangel'sk. The virulent fever eventually spread to Kodiak (Black, 2004; Pierce, 1986).

Epidemics would play a part in Russian-Alaska in the near future. Chief managers after Baranov were challenged with recruiting and maintaining medical personnel. Natives were trained as medical practitioners, physicians' assistants, and paramedics; midwifery was supported; and small hospitals were established on Kodiak, Unalaska, and Atka and, later, on Norton Sound. Orthodox priests advocated that the Natives receive the small pox vaccination, so shipments of the small pox vaccine were sent to Alaska as early as 1808 (Arndt, 1985; Black, 2004; Gibson, 1983; Fortuine, 1990).

Partly due to Native resistance to vaccinations, a small pox epidemic devastated Alaska during the years 1836-1840. Mortality rates were very low among those who were vaccinated but high in those who were not. This was especially evident with Native populations. The Native community took notice of the dramatic effect of vaccinations. Because of the widespread acceptance of vaccinations by Natives of the next generation, Alaska largely escaped the small pox epidemic of the 1860s (Arndt, 1985; Black, 2004; Gibson, 1983). Relations with Natives were reaching a high point for the Russian-American Company. In 1841, orders were given to further the Russian-American Company's policy of not striking Natives. It was emphasized that no matter what rank an individual held, he could not strike a Native unless in self-defense. This policy had been in place to maintain peace with Natives since Baranov was chief manager (Black, 2004).

British and American officers visiting the colony were surprised by Russian behavior toward Natives. Captain Edward Belcher of the British warship the *Sulphur* stated that Russians were "a shade lower in civilization by their intermarriage with the natives," and U.S. Army Lieutenant Eli Huggins wrote in his journal, "There was no bar to the promotion of these creoles

either in church or state, and many of the most honored and responsible officials we met in territory were creoles who had been educated in Russia" (Black, 2004; Huggins, 1981; Pierce and Winslow, 1979). For Natives, this was a time of social mobility, and those with the greatest ability to move between classes were members of the creole class.

During the Russian period, although the crown forbade it, Natives were initially treated with disrespect. They were used as a work force, relocated based on the whims of the Russian-American company, and sent on hunting expeditions that often resulted in great losses of life. The expansion under Baranov mimicked a culture of profiteering that took Russians from the shores of Kamchatka to the North Slope of Alaska, then all the way to Hawaii and back to Sitka. Russians explored, mapped, and exploited the difficult terrain of the Bering Sea region while subjugating its populations and securing permanent settlements for the Russian empire. However, after Baranov's tenure, Natives were integrated into a larger society. Hospitals were built, vaccination programs were introduced, and higher education was encouraged and often paid for by the company and the crown. The Native population began to gain a foothold and increase, and Natives began to achieve positions of leadership in the colony. All of these events affected the dynamics of Native populations, altering their demographic makeup and affecting the distribution of both surnames and Y-chromosomes throughout the region.

Surname Acquisitions

The Creole Estate

Despite the empire building dreams of Shelikhov and Baranov, the commercial charter given to the Russian-American Company was for resource extraction from Alaska, and as

building cities and creating a new Russian civilization in Alaska was not necessary for fur procurement, the Russian government never sponsored attempts to permanently establish a Russian population in Alaska. Coupled with Native resistance to Russian colonization, there were never a great numbers of Russians in Alaska. Work shortages were severe from the onset, with many chief managers having difficulty recruiting men for long-term service. Native labor became the norm early on and was preferred over time. The rise of the creole class was in part due to the Russian government's desire to have a permanent labor pool for the company to exploit (Black, 2004). The creole class was comprised of individuals elevated in status and given leadership roles within the colony due to their membership in the creole estate. The creole estate was established in 1821 as an official classification, akin to the burgher estate, within the stratified economic system of the Russian empire (Black, 2004).

Russian-Alaskan intermarriage was often encouraged within the colony, and the offspring of these marriages grew in number until they became a prominent group. These individuals, referred to as creoles, made up a significant portion of the population of Alaska by the mid 19th century. They were Native Alaskans who could show that they had Russian ancestry in their paternal history. Natives who could show they had Russian ancestry through their maternal line would also be considered creole, but due to the shortage of Russian women in Alaska, this eventuality was far less common (Black, 1990; Black, 2004; Lain, 1976). Though labor shortages in the Alaskan colony were always severe, Natives with Russian ancestry had become a large enough group to provide a stable labor pool. Advantages to being classified within the creole estate included increased social mobility, better education, and the opportunity to be placed in leadership roles (Black, 2004).

Almost all men brought to Alaska during the Russian-American period were from Siberia or Northern Russia. Early in the Russian-American period, children born from Russian/Siberian pairings with Native women were absorbed into the Native communities. Marriages between Native women and Northern Russian or Siberian men quickly became common, and brides and children were often taken back to Russia when laborers returned home (Black, 2004). Marriages were commonly held according to Native traditions and were considered legal by Native communities (Black, 2004; Oleksa, 1990).

The Orthodox Church did not recognize unions based on Native tradition, and the crown only recognized church-sanctioned marriages as legal unions during the 19th century. There was a shortage of clergy in the colony, however, and marriages continued to be performed according to Native tradition (Black, 2004). Church marriages were possible in Novo-Arkhangel'sk and Kodiak, but men spread out across the Alaskan territory usually had no access to clergy. Indeed, some of these men did not have contact with the outside world for years. In some cases, men were left at remote outposts for three, five, or even seven years without the service of the church. Men in this situation had no recourse to the clergy. More often than not, when they wished to marry, they would create their own marriage contracts (Black, 2004; Kovalovsky, 1970).

In order for marital unions through Native tradition to be considered legal, they needed to be certified by state officials or the clergy. On many occasions, couples who were married under Native law were later married by the church (Black, 2004; Kovalovsky, 1970). In fact, Russian men who had already married Native women would vigorously seek church approval (Black, 2004; Khlebnikov, 1827). According to Russian tradition, the offspring of unions between Natives and Russians or Siberians acquired the father's name, social estate, and property (Black,

2004). This policy was incentive for Russian men to seek a legal union so they could pass their estate to their progeny.

The designation of creole was an indication of Russian and Alaskan biological descent and often, dual cultural heritage and nationality, and it was a defined class through provincial regulations. The Russian-American Company's second charter, issued by Emperor Alexander in 1821, gave the creole estate of Alaska equivalent rights as the burgher estate of Russia (Black, 2004). The burgher and merchant estates of imperial Russia comprised approximately 9% of the Russian population. The majority of Russians (~81%) belonged to the peasant order. Creoles were given the added privileges of being charged no taxes and were not required to serve in the military while in Alaska. Individuals of the creole estate were offered free education in Russia as long as they agreed to return to the Alaskan colony for a minimum of 10 years afterwards. The requirement to return to the colony was specifically addressed to individuals seeking medical degrees (Black, 2004) as its intent was to train physicians and bolster the Alaskan medical system.

The company's third charter, given by Emperor Nicholas I in 1844, recognized five social categories in the Alaskan colony: contract employees, colonial citizens, creoles, settled foreigners (Natives), and foreigners not dependent on the company (Black, 2004). Colonial citizens were defined as individuals who could leave the colony by their free will but chose to stay on their own volition. These were mostly Russians, Finns, and Siberians, but the classification could apply to creoles as well. The charter specifically stated that the children of Russian or Siberian men married to American women were eligible for colonial citizenship. Alaskans and colonial citizens educated in Russia were now required to serve 10 years in Alaska

following their training. This policy was extended to individuals with military or naval and technical education (Black, 2004). By this time, Alaska had a well established secondary and technical education system, and those completing education *in* Alaska were required to serve 15 years afterwards (Black, 2004; Dauenhauer, 1990).

The third charter addressed additional issues regarding the creole estate. Creoles were free to leave the colony as long as they were not under obligations to serve the colony due to receiving education or training. Creoles choosing to leave the Alaskan colony were to be given transportation at the company's expense. If they relocated to Russia, they were entered into the burgher estate or higher, based on personal achievement, and given all privileges of this class. Creole children born outside of wedlock were to be given education paid for by the company (Black, 2004).

It is important to note that the term *creole* was not used as a racial term in Russian-America. Instead, it was used as a class designation within the ranked system of the Russian empire. Russian wealth was passed down through paternal lines, and this was generally the case for the creole class within the Russian system. This meant that creole women choosing to marry Native men would lose their class status and be assigned to the Native man's familial line in the colony (Black, 2004). This most certainly was a determining factor in the expansion and rise of the creole class. This would encourage Native and creole women seeking wealth or social advancement to marry creole or Russian men rather than Native men.

Those of the creole class achieved positions of management and leadership throughout the colony as teachers, clergy, navigators, cartographers, ship commanders, and artists. By 1863, there were approximately 2,000 people ascribed to this exclusively Alaskan estate (Black, 2004).

By the end of Russian-America, this class had been in existence for 46 years. It had encouraged greater than a generation of Natives to adopt Russian surnames, serve Russian interests, and seek Russian education with the promise of social advancement. Outside of Orthodox baptism, this was the greatest determining factor in Native Alaskans adopting Russian surnames.

The creole class was an extremely effective influence on Native mentality. It was a privileged class abhorred by the Russian lower class and questioned by established members of the burgher estate (Black, 2004). Members were given education and social mobility not available to all Russian citizens or other Native Alaskans and played a major role in the integration of Russians and Native Alaskans that occurred during the mid-19th century. When Alaska was sold to the United States in 1867, the class was dissolved. Rather than being treated with privilege by the United States, creoles were labeled as "half-breeds" and "depraved" by military and civilian administrators (Black, 2004; Dall, 1870). Natives and creoles alike were classified as "Indians" and not given the same rights as U.S. citizens (Black, 1990).

After 1867, many creoles decided to move to Russia or the United States rather than accept their new status in Alaska. Those who stayed had few employment options. Most creoles who remained were accepted back into the Native community. Native Alaskan communities did not again realize the level of privileges creoles were offered under Russian governance until 1971 when the Alaska Native Claims Settlement Act was passed through the United States Congress (Black, 2004).

Aleuts adopted Russian surnames through marriage between Russian men and Native women, through adoptions, and through baptism. Of the three methods for surname adoption, Native conversion to Orthodoxy and acceptance of baptismal surnames played the biggest part in

Aleuts gaining Russian surnames. The combination of baptism and the advances of the creole class promoted a culture of acceptance of integration between Russians and Aleuts. Adoption of surnames through admixture, which was promoted by social advantages inherent in joining the creole class, suggests that there should be a direct link between Y-chromosome and surname markers in the Aleutian Islands.

The Church

The Russian Orthodox Church began converting Alaskan Natives almost immediately after Russians arrived in the territory. Accounts of Orthodox baptisms of Natives date back to the late 18th century (Black, 1992; Black, 1997; Black, 2004). In 1760, an Aleut boy who had been given up for dead by his local healer on Attu Island was taken to a Russian camp. His father asked that the boy be baptized, so the Russians performed a lay baptism, and the boy recovered. Given the name Leontii at baptism (Andreev, 1948; Black, 2005; Liapunova, 1979), he was one of the first Orthodox Aleuts (Black, 2004).

The Russians considered baptism a great gift that they could offer to Natives. It was only offered to Natives who had spent a great deal of time in close proximity to Russians. Those baptized would receive a baptismal name, usually the name of a saint whose feast fell on or near the day of baptism, which was often adopted as first names, while the baptismal sponsor's surname was given to the newly baptized Native as their surname. This is how Natives acquired the majority of surnames now present in the Aleutian Islands. Russians sponsoring the baptism of a Native were required to pay any costs associated with the event, and they would usually pay for the baptized person's education afterwards (Black, 2004).

Aleuts, in particular, were keen to accept new names. Ethnographic evidence suggests that they believed new names brought new power. In Aleut society, new names were usually given for acquired status, in commemoration of a deed, or for a desired state of being or character. Thus, Russian surnames had become widespread in the Aleutian archipelago by the early nineteenth century and were widespread throughout the Kodiak archipelago, Alaskan Peninsula, and Prince William Sound by the middle of the century (Black, 2004).

The baptismal relationship between Russians and Natives, second only to parent-child relationships, was like adoption, so both Natives and Russians took the relationship seriously. . It must be emphasized that orthodoxy was not pushed on Natives. Russians did not set out to convert Natives but instead converted those with whom they had established close bonds as Russians sponsoring Natives in baptism were taking on a great deal of responsibility. Widespread Orthodoxy among Alaskan Natives was first introduced to Aleuts, who later introduced Orthodoxy to other Alaskan Natives. This conversion was gradual and peaceful (Black, 1992; Black, 1997; Black, 2004).

Missionaries and clergy, who came later, found that Christianity had been adopted widely prior to their arrival. The first priest to come to Alaska, Vasilii Sivtsov, visited Kodiak Island with the Billings-Sarychev expedition. During his time in Kodiak and Unalaska during the years 1790-1791, he performed baptisms, marriages, and sacraments for those who requested his services. During June 1790 alone, he performed 126 baptisms on Unalaska, the Krenitzin Islands, and Kodiak. He also administered 16 marriage ceremonies, the majority of them among Aleuts (Black, 2004).

The acceptance of the Orthodox faith was not culturally destructive, and Native lifestyles were left relatively unchanged as there was no pressure to use the dominant language or completely change lifestyles (Black, 2004; Dauenhauer, 1990; Smith, 1980). Native healers were not rejected, and even polygynous marriages were accepted during the early stages of Native conversion (Mousalimas, 1989; Mousalimas, 1990; Mousalimas, 1992; Mousalimas, 2003; Oleksa, 1987). For these reasons, it was easier for Natives to accept Orthodoxy than many other religions.

Similar beliefs between Russian Orthodoxy and Native religion may have aided in Native conversion to Orthodoxy. Cherepanov, who reported the occurrence with Leontii, considered the Native and Russian belief systems to be similar to Orthodoxy. He cited incidents such as "prayer" and "salutation" between both groups during corresponding events: e.g. When setting out to sea Natives said, "Lord bless" while Russians said, "God aid us" or "God help us" (Andreev, 1948; Black, 2004). These examples illustrate why Aleuts readily converted to Russian Orthodoxy, in the process of adopting Russian surnames, during this period.

Russians did not consider Aleuts to be heathens, either. Both Aleutian and Orthodox faiths had intermingled themes. Aleuts valued marriage and parenthood and had a personal devotion to their faith before and after the majority converted to Orthodoxy (Black, 2004). Esk-Aleut Natives prayed to the east, as did those devoted to Russian Orthodoxy, and confessions were practiced by some Native groups as well (Yup'ik and Alutiiq speakers) (Kan, 1987; Kan, 1989; Fienup-Riordan, 1990, Fienup-Riordan, 1990). Clergy arriving in Alaska in the late 18th and early 19th century were there to serve both Russians and Natives. The adoption of Orthodox Christianity by Natives had predated the arrival of clergy, so they were not there to convert

(Black, 2004).Therefore, from the earliest stages of Russian colonization, Natives were treated as equals where religion was concerned.

When Natives were mistreated, clergy were usually the first to come to their defense. One of the earliest Native rights advocates in Alaska was Hieromonk Makarii. After arriving in Unalaska in June 1797, Makarii witnessed what he considered "barbarous" behavior toward Natives by men from the Shelikhov and Golikov Company. He submitted a letter of complaint directly to Emperor Paul I (Black, 2004). He later traveled to Okhotsk to carry his complaint to the management of Shelikhov's company. The Okhotsk office did not take Makarii seriously and attempted to detain him, so Makarii took his complaint to the Bishop of Irkustsk and Nerchinsk. The Bishop advised that he meet directly with the Emperor (Black, 2004), so Makarii went to St. Petersburg and was heard by Emperor Paul I, who ordered that the abuses of the Natives be stopped and instructed Makarii to continue his work in America (Black, 2004; Tikmenoev, 1979).

During the 28 years that Baranov managed the Russian-American Company, he was at constant odds with members of the clergy. Makarii, Gedeon, and Father Herman were some of the most notable proponents of Native rights in the colony during this period. Father Herman, a member of the Russian Orthodox mission in Alaska, attempted to administer the oath of allegiance to Natives throughout the colony in 1801. Taking the oath of allegiance to the new Emperor, Alexander I, would give Natives legal citizenship and protection under imperial law. Father Herman protested the dispatching of Natives on long hunting trips during this time, because he needed to administer the oath of allegiance to them. Baranov, who was interested in profits rather than Native rights, mocked Father Herman, calling him a "hermit" and claimed

Herman knew everything Baranov and his men thought without ever leaving his "cell" (Black, 2004; Tikhmenoev, 1979).

Baranov was not the only member of the Russian-American Company to complain about clergy members. Nikolay Petrovich Rezanov, a high-ranking member of Shelikhov's company for a short time in the early 19th century, derided the priests as "lazy and inactive." At the same time, he complimented Gedeon on the clergy's work in agriculture (Tikhmenev, 1979). It is not surprising that high ranking officials working for Shelikhov's company would come into conflict with the clergy. During Baranov's tenure as Chief Manager, sometimes called the "darkest hour" for Alaskan Natives, clergy fought for Native rights, so conflict was sure to arise (Black, 2004).

Within a decade after his removal, parish clergy had established themselves to the point where they could serve the Orthodox community in Alaska. When Father Herman died in 1836, the spiritual mission in Alaska died with him. It was no longer needed because of the foundation that had been built by the church (Black, 2004). The Orthodox community had been growing for over 50 years, the mistreatment of Natives so prevalent during the Baranov era had subsided, and the strong advocacy for Native rights offered by the clergy was not so badly needed.

Clergy who served in Alaska after Baranov's removal had time to concentrate on building the Orthodox presence in America. Father Ioann Veniaminov served as the parish priest for the eastern Aleutians beginning in 1824. He was eventually consecrated bishop and remained in Alaska until 1850. His efforts in Alaska yielded additional churches and schools and helped to introduce the smallpox vaccination. He also translated and wrote texts in Native

languages, including “Indication of the Way to the Kingdom of Heaven” in Aleut (Black, 1977; Black, 2004).

The greatest lasting cultural effect on Alaska from the Russian period was the Native adoption of the Russian Orthodox Church. After the Russian period ended in 1867, the State continued to support the church through material support until 1917. In later years, Methodists and Baptists moved into Kodiak, Presbyterians moved into the Tlingit area, Morovians on the Kuskokwim, and Episcopalians and Roman Catholics along the Yukon (Black, 2004). Russian Orthodoxy was looked upon as superstition by members of these faiths (Black, 2004; Watkins, 1961), though Orthodoxy remained a constant within more conservative Native communities during the American period (Oswalt, 1963; Oswalt, 1990; McCollough, 1988). Today, many outsiders consider the Orthodox Church in Alaska to be a Native religion (Rathburn, 1970; Rathburn, 1981; Davis, 1970; Davis, 1984; Hosley, 1966). Native adoption of surnames through cultural rather than biological processes helps to explain the presence of a geographical distribution of surnames in the Aleutian Islands.

The End of Russian America

A third charter was granted to the Russian-American Company in 1841. This charter remained in place until 1862 and was extended thereafter until 1867, when Alaska officially became a United States territory. The charter restricted company operations in the Alaskan interior. Impeding on Native autonomy in the interior was prohibited, and the company was required to maintain good relations with Native peoples. The chief manager, now designated as the civilian provincial governor, was required to maintain schools, churches, hospitals, mills, barracks, storage, and other structures in the colony (Black, 2004).

Leading up to the Crimean War, the Russian monopoly of Alaskan resources began to falter. The Russian-American Company had spent most of its tenure in Alaska focusing on maintaining and exploiting the populations of fur seals and sea otters. In the 1830s and 1840s, Alaska's abundant whale population came under siege by American vessels. In 1835, Captain Folger took the first Alaskan right-whales off the island of Kodiak in the vessel *Ganges*, out of Nantucket (Black, 2004; Starbuck, 1989; Tower, 1907). By 1841, there were approximately 50 American whaling vessels in company waters. A year later, there were as many as 200 vessels whaling off the eastern Aleutians and the Alaskan Peninsula (Black, 2004; Bolkhovitinov, 1990; Tikhmeniv, 1978). In 1845, 263 American vessels were whaling in waters under company jurisdiction (Black, 2004; Bolkhovitinov, 1990; Kushner, 1975), and in 1848, the American ship *Superior* passed through the Bering Strait, where 154 American vessels would sail the following year (Black, 2004). This effectively opened the bowhead whaling fishery as well (Black, 2004; Bockstoce, 1986).

By this time, the company was having financial problems due to foreign vessels competing for Alaskan resources, the collapse of the Chinese trade market following the Opium Wars, and the beginning of the Crimean War. The company needed to find alternative sources of income, so it established a whaling subsidiary in 1850. The Russian-Finnish Whaling Company, headquartered in Finland, had limited success, though it lost two of its three ships by 1854, one captured and burned by the British and French and the other sold after nearly being captured in the earliest period of the Crimean War (Black, 2004; Tikhmenev, 1978).

The Russian-American Company's venture into whaling did not prove to be profitable, but the Russian ice trade helped the company survive through this troubled period. A joint

venture between the Russian-American Company and the California Ice Company began in 1851, when 250 tons of ice were shipped from Alaska to San Francisco (Black, 2004; Cummings, 1949). Russian ice trade continued with the United States until 1868, when the Russian-American Company sold its ice subsidiary to the American firm Hutchinson, Kohl, and Company (Black, 2004; Keithahn, 1967; Stevens, 1990).

When the Crimean War broke out in 1853, Russia's only military presence in the region was a garrison of 50 men in Petropavlovsk. Russia had no troops in Alaska (Gough, 1974). An increased military presence was established after British and French forces attempted to take Petropavlovsk in 1855 (Black, 2004; Bolkhovitinov, 1990; Dowty, 1971). Troops were also stationed in Novo-Arkhangel'sk once the war began. Between 150 and180 men, who the company was permitted to use for labor, were in Novo-Arkhangel'sk for the remainder of the war. (Black, 2004; Tikhmenev, 1978.; Kalmykov, 1947).

After the Crimean War, the state of affairs in the colony improved. The company was seeing profits, but the international situation was growing more complex. The British now had a permanent naval base on Vancouver Island, and they increased their naval presence in British Columbia after gold was discovered. In 1858, the British Parliament designated this territory as a Crown Colony (Gough, 1974). Meanwhile, St. Petersburg had become increasingly concerned about its inability to reasonably defend the Alaskan colony (Black, 2004). As early as 1853, Nikolaj Nikolaevič Muravi'iev-Amurskii, a Russian military member, statesman, and diplomat, had remarked to Emperor Nicholas I that "sooner or later we will have to yield our North American possession to [the United States]". His main concern, again, was Russia's inability to protect the colony against foreign nations (Black, 2004; Bolkhovitinov, 1990).

The crown, however, could not sell its American territory to the United States until after the third charter expired in 1862 (Black, 2004; Bolkhovitinov, 1990). When this date approached, the Unites States was in civil war, and discussions of the transfer of sovereignty would have to wait until the conflict was resolved (Black, 2004). The Russian government, feeling that the U.S. would eventually control all of North America, was seeking a strong alliance with the United States and did not wish for its colony in Alaska to disturb future alliances (Black, 2004; Golder, 1917; Golder, 1920). On October 9, 1867, the Russian flag was lowered, and the U.S. flag was raised in Sitka. Russia's presence in America was over (Black, 2004).

Long-term lasting changes to Alaska from the Russian period can be seen on maps and in telephone directories. Russians left a great deal of geographical names and surnames in Alaska. The Russian Orthodox Church is still strong and has shaped Alaskan culture for well over two centuries (Black, 2004). The majority of surnames, taken directly from a Russian sponsor and given to Aleuts and other Native groups, were from the Russian North and Siberia, and most of these were given through baptism. The attraction of the increased social mobility of the creole class played a significant role in promoting marriage, and thus surname adoption, between Russians and Natives, and Russian men were encouraged to marry Native women, again resulting in new surnames for Natives, for various purposes that served the interest of the crown. Together, marriage and baptism played the biggest role in Natives taking Russian surnames and also introduced generations of Natives to the Russian mode of accumulating wealth through a paternal family line.

Summary

This chapter provides an overview of Aleut history and prehistory, including archaeological, historical, and genetic data. Special emphasis was placed on the Russian-American period of Alaska to help determine surname origins for the Aleutian archipelago. Archeological evidence indicates that the eastern Aleutian Islands were first populated approximately 9,000 B.P. These settlers reached the central Aleutians by 6,000 B.P., and Attu (the western edge of their range) by 2,000 B.P. They were likely the ancestor of modern Aleuts.

The majority of Aleut surnames were acquired through Orthodox baptism. Natives being baptized would adopt the surname of their Russian sponsor as their own. Adopting surnames through cultural practices, rather than through strictly biological inheritance, proved pivotal in interpreting the results of this study. A large minority, however, were acquired through Russian-Native intermarriage. This was initially encouraged for means of control and practicality and was later a means for increasing social mobility after the creole class was established as marrying Russian and creole men became important for acquiring wealth and education for creole and native women.

Chapter 3: Genetic Background

Classical Genetic Markers

Classical genetic markers such as blood polymorphisms and serum proteins suggest Aleuts are similar to Eskimo groups and differ from other native groups from North and South America. Studies of the ABO blood group system show high frequencies of ABO*O and ABO*A alleles but low frequencies of ABO*B. Eskimos exhibit a similar pattern, while many other Native American groups lack ABO*A and ABO*B alleles all together. Some, such as natives from South America, are fixed for ABO*O or only have ABO*A and ABO*O (Laughlin, 1980; Mourant, 1985)

Blood groups MNSs, Rh, and Diego, blood protein haptoglobin, and blood serum albumin have also been characterized. Aleuts have high frequencies of MNS*Ms, moderate levels of MNS*MS and MNS*Ns, and low levels of MNS*NS, also similar to Eskimos (Rychkov and Sheremetyeva, 1972; Majumder *et al.*, 1988). Like other Native American groups, Aleuts lack Rh- phenotypes of the Rhesus blood system. They exhibit high levels of cDE and CDe alleles. Aleuts have high levels of the Di*A for the Diego blood group, which is characteristic of South American groups but atypical of North American Natives. Haptoglobin results are comparable to other Native American groups, such as the Haida, Apache, and Assiniboine, with Aleuts having nearly equivalent levels of HPA*1 and HPA*2. Aleuts are nearly fixed for the serum albumin gene AL*A, which is analogous to some Native American and Siberian groups, (Szathmary and Ossenberg, 1978).

Molecular Genetic Markers

Analyses of classical genetic markers have suggested Aleuts are related to Eskimos, American Indians, and/or Siberians (Rychov and Sheremetyeva, 1972; Szathmary and Ossenberg, 1978, Harper, 1980; Ousley, 1995). Aleuts from the Commander and Pribilof Islands have been grouped with Eskimos in more recent analyses of classical markers; St. Paul, however, clustered more closely with Chukchi and Kodiak Eskimos (Rubicz, 2007). The first molecular study of the Aleuts characterized mtDNA variation from St. Paul Island. Restriction fragment length polymorphism (RFLP) analysis suggested Aleuts had three founder lineages: haplogroups A (25%), C (1.4%), and D (66.7%) (Merriwether *et al.*, 1995, 1996). Later research, using additional restriction enzymes, allowed for greater phylogenetic resolution among matrilines, leading to the reclassification of Aleut haplogroups A and D to sublineages A2 and D2 (Zlojutro, 2008).

Prior mtDNA research in the Aleutian Islands using complete mtDNA sequencing found haplogroup D2 to be fixed on Bering Island. This was attributed to the effects of genetic drift (Derbenova *et al.*, 2002). Rubicz *et al.* 2003 disputed these results, stating that, due to the recent founding of Bering's population (in 1825), the loss of haplogroup A due to inter-generational stochastic processes is highly improbable. Instead, they attributed the fixation of D2 as a result of founder effect, rather than drift alone (Rubicz *et al.*, 2003) This suggests that the Russian orchestrated settlement on the Commander Islands was comprised of closely-knit families from Attu and Atka (Rubicz, 2007).

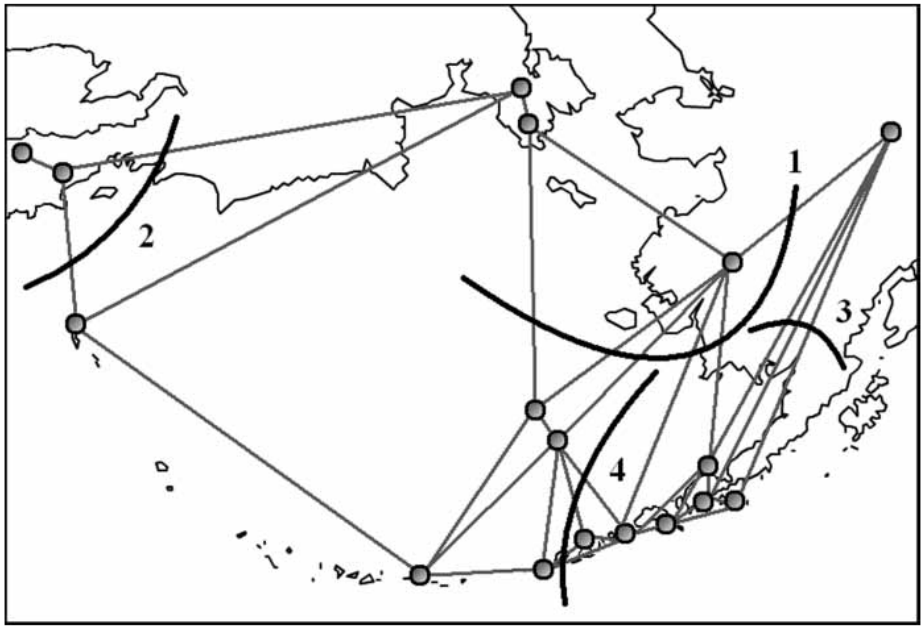

Figure 2. Genetic barrier analysis using Monmonier's maximum-difference algorithm computed from HVS-I sequence data (Zlojutro *et al.*, 2009).

Through a series of SAMOVA analyses using HVS-I sequence data from mtDNA, Zlojutro *et al.* 2009 described Aleuts as having a Siberian origin. SAMOVA results revealed significant genetic discontinuity between Aleut communities and Natives from the Kamchatkan Peninsula (Koryak and Itelmen), Northeastern Siberia (Siberian Yupik and Chukchi), and Alaska (Alaskan Yupik and Athapaskan). Genetic discontinuity was also found between Atka, Bering Island, and the Pribilof Islands, with central and eastern Aleut communities and the Alaskan Peninsula. Central and eastern Aleut communities cluster with Siberian Yupik, Chukchi and Athapaskans due to high levels of haplogroup A. Using the SAMOVA output as a guide, Monmonier's maximum-difference algorithm was applied to a Delaunay network based on a D_A distance matrix. Of the four barriers identified, the first three almost completely isolate the Aleut communities from other Beringian populations (Fig. 2). The fourth barrier (between Nikolski and Unalaska) shows some genetic discontinuity between the eastern Aleutian communities and those to the west (Zlojutro, 2009).

Network analysis of Aleut mtNDA showed three star-like clusters (A3, A21a, and D2) that represented two expansion events. Haplogroup A3 represents the ancestral group of Eskimos, Aleuts, and Na-Dene, having expanded approximately 23,285 ± 13,488 B.P. (Zlojutro *et al.*, 2006). Haplogroups A21a (previously described as A7) and D2 most likely originated in Beringia 3,000 and 5,200 B.P. respectively. They may represent a founding Aleut population (Derbeneva *et al.*, 2002; Starikovskaya *et al.*, 2005; Zlojutro *et al.*, 2006). High frequencies of haplotype D indicate Aleuts are distinct from other population in the North Pacific region (Rubicz, 2001; Rubicz *et al.*, 2003; and Zlojutro *et al.*, 2006).

Phylogeographic studies of mtDNA and Y-chromosome data suggest that both maternal and paternal Aleut lineages originated in Siberia or Beringia (Zlojutro, 2008). MtDNA samples collected from 11 locations in the Aleutian Archipelago (Akutan, Atka, Bering, False Pass, King Cove, Nelson Lagoon, St. George, St. Paul, Sand Point, Nikolski, and Unalaska) support the archaeological evidence that the Aleut Islands were settled from east to west. Of the five Native American mtDNA haplogroups, only haplogroups A and D are present in the Aleutian Islands. Haplogroup A, which is highly prevalent in Eskimo populations to the east, is the prevailing haplogroup in the eastern Aleutian Islands. Haplogroup D becomes increasingly common along an east to west gradient and is fixed on Bering (Fig. 3), which is the furthest island to the west (Crawford, 2007; Rubicz *et al.*, 2003). The high frequency of haplogroup D is atypical in Native North American groups. Other proximal groups such as the Na-Dene and Eskimo of Alaska and Chukotka are characterized by high frequencies of haplogroup A lineage (Shields *et al.*, 1993; Forster *et al.*, 1996; Starikovskaya *et al.*, 1998; Helgason *et al.*, 2006).

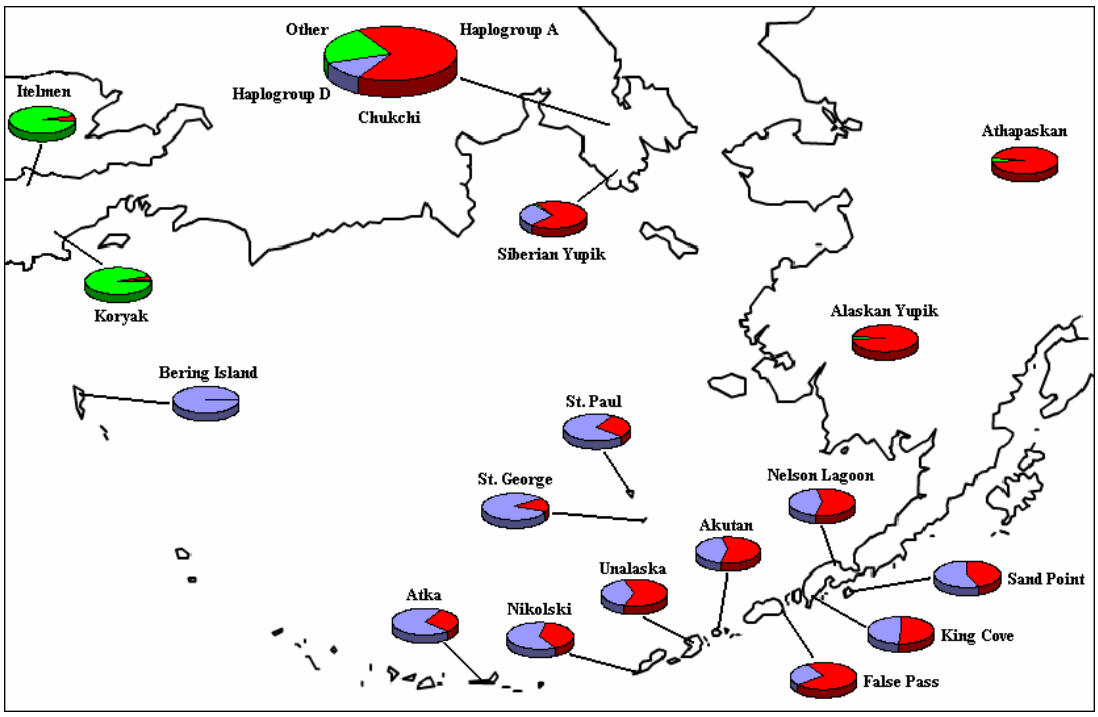

Figure 3: Circumpolar mtDNA haplogroup frequencies (Crawford, 2007).

In contrast to mtDNA, NRY-haplogroups for Aleuts are mostly from outside the Americas. Native American haplogroups Q* and Q3 (Zegura *et al.* 2004) were found in approximately 15.3% of male participants; the remaining haplogroups are most likely from Russian and European sources (Zlojutro, 2008). NRY-haplogroup Q3 probably originated in the Altai-Sayan region of southern Siberia (Zegura *et al.*, 2004). NRY Q* and Q3 were found in every Aleut community except for Nelson Lagoon. NRY-haplogroup Q3 and mtDNA haplogroups A were likely derived from a peopling of America between 10,000 and 30,000 years ago with an ancestral origin in Siberia. It has been argued that mtDNA haplogroup D came into the American population during a re-expansion event (Zlojutro, 2008).

The seven NRY-haplogroups found in the Aleutian Islands that are not Native American in origin are R1a, R1b, I1a, I, N, J and E3. They make up 84.7% of the population. All of these

are considered European in origin except for E3, which represents 2.8% of the population. Of these, R1a (25.5%), R1b (21.9%), and I1a (13.9%) were the most common. R1a and R1b were found in nearly all Aleut communities. Both patrilines are prevalent in Europe, with R1a being most prevalent in Russian and Eastern European populations (Kayser *et al.* 2005), and R1b at its highest frequencies in Western Europe and the British Isles (Semino *et al.* 2000; Alonso *et al.* 2005). I1a is another European patriline that observed at its highest levels in Scandinavia (Rootsi *et al.* 2004; Karlsson *et al.* 2006). The high levels of European NRY-haplogroups in the Aleutian Archipelago is the result of gene flow (Zlojutro, 2008).

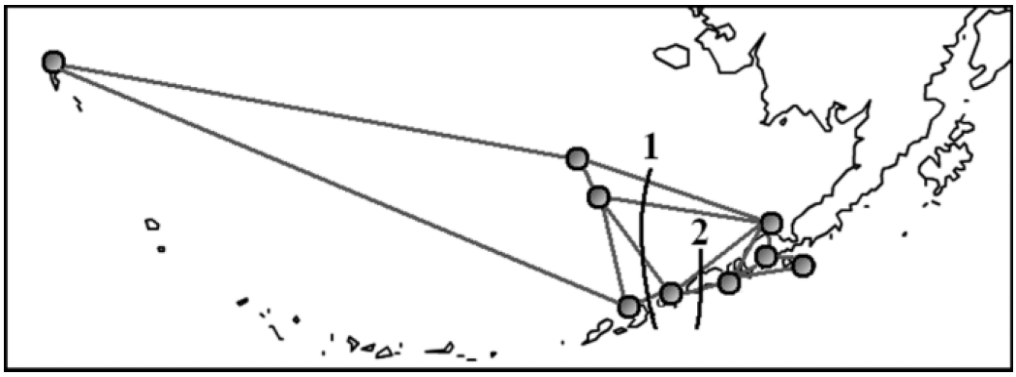

Figure 4. Genetic barrier analysis using Monmonier's maximum-difference algorithm using Y-STR data (Zlojutro *et al.*, 2009).

Genetic barriers derived from an R-matrix based on Y-SNP haplogroup frequencies were reported by Zlojutro *et al.* 2009. Monmonier's maximum-difference algorithm was applied to R_{ST} genetic distances to explore genetic discontinuities in Aleut NRY data (Fig. 4). The first barrier separates Bering Island (far left), St. Paul, St. George and Unalaska from the populations further to the east, and the second barrier separates Nelson Lagoon, Sand Point, False Pass, and King Cove. The population in the middle is Akutan. Its high percentage of haplogroup Q* distinguishes this population as an outlier (Zlojutro *et al.*, 2009).

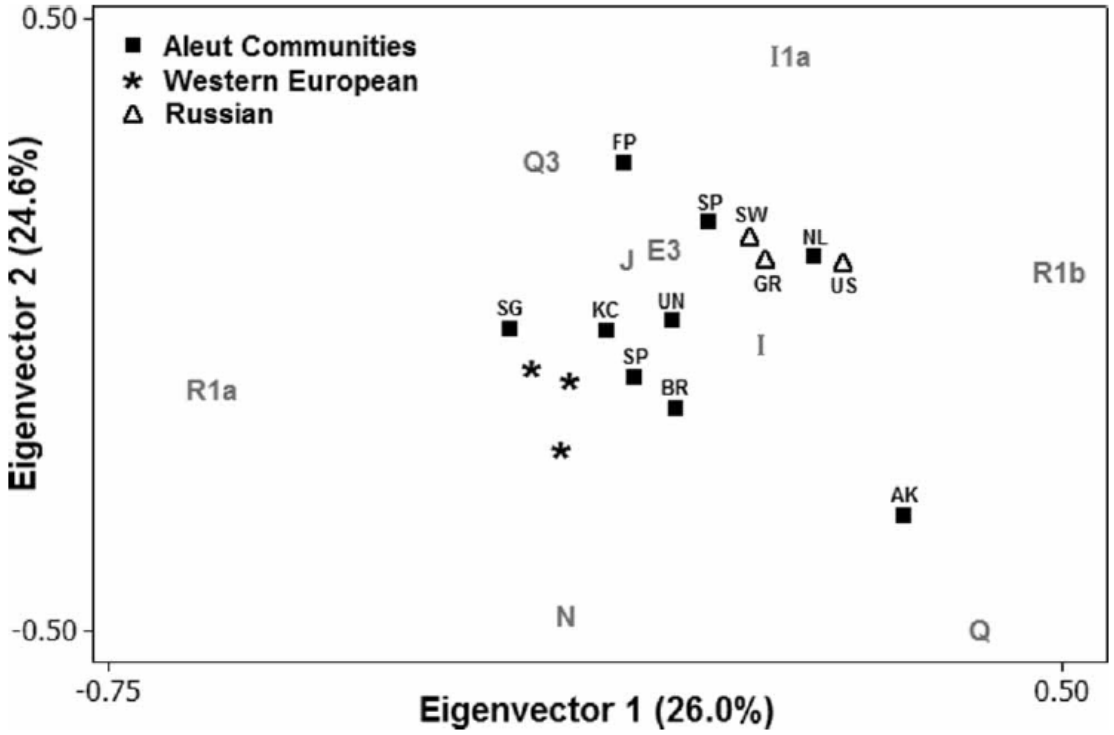

Figure 5. PCA biplot of R-matrix population coefficients and Y-SNP haplogroup scores (Zlojutro *et al.*, 2009).

Further clarification of these data was derived from a PCA biplot (Fig. 5) of an R-matrix showing the relationship of Aleut NRY-haplogroups with Western European and Russian reference populations. Two clusters were evident. One was centered on the three Russian populations and the other around the three Western Europeans populations. R1a and N oriented the Russian scores, and R1b and I1a influenced the Western European scores. All of the eastern Aleut communities except for King Cove and Akutan clustered with the Swedish, German and U.S. European reference samples. Sand Point and False Pass were represented by higher frequencies of R1b and I1a than the other Aleut communities. Akutan was pulled toward Q as an outlier, because it has the highest frequency of this haplogroup (36.4%). St. Paul, St. George, King Cove, and Bering Island are most closely associated with the Russian samples (Zlojutro *et al.*, 2009).

These results reflect the colonial history of the region. After the Russian sale of Alaska in 1867, there was an influx of Scandinavian and Western European fishermen and fur traders. Like their Russian predecessors, these Europeans were encouraged to marry and admix with the native population. Russian-Native admixture was promoted by proximity and superstition and for the purpose of controlling the population, but European admixture was a product of regulation. Due to the shortage of sea otters, the US Treasury Department only allowed men who were married to Native women to hunt fur-bearing animals during the late 19th century (Reedy-Maschner, 2008). This influenced the paternal genetics of the eastern Aleutians, where I1a and R1b are prevalent. These haplogroups are Scandinavian and Western European lineages (Semino *et al.*, 2000; Rootsi *et al.*, 2004; Karlsson *et al.*, 2006). The prevalence of R1a and N in the western islands are remnants of the Russian conquest and occupation of the Aleutians (Zlojutro *et al.*, 2009).

Chapter 4: Materials and Methods

Population samples

A total of 732 surnames were used to examine the distribution and origin of surnames in the Aleutian Archipelago. Michael H. Crawford, Rohina Rubicz, and Mark Zlojutro collected DNA samples and demographic information during field investigations between 1999 and 2005 from eleven locations: Attu, Akutan, Bering Island, False Pass, King Cove, Nelson Lagoon, Nikolski, St. George, St. Paul Islands, Sand Point, and Unalaska (Fig. 6). Participant surnames were collected using demographic questionnaires (See Appendix A) and checked for spelling in telephone directories during the sampling process.

Surnames were gathered from participants, spouses, parents, and grandparents listed in participant questionnaires. Because surnames are inherited paternally in the Aleutian Islands, the surnames of female participants could be included in this study when maiden names were used. Surnames from spouses, parents and grandparents were carefully scrutinized to avoid duplication. A subsample of 143 surnames whose participants had previously been characterized using NRY markers by Rubicz and Zlojutro (Rubicz, 2007; Zlojutro, 2008) were analyzed independently. Mitochondrial and/or non-recombining Y-chromosome haplotype data from these samples have previously been described (Crawford, 2007; Rubicz *et al.*, 2000; Rubicz, 2001; Rubicz *et al.*, 2001; Rubicz *et al.*, 2003; Rubicz, 2007; Zlojutro *et al.*, 2006; Zlojutro, 2008; Zlojutro *et al.*, 2009).

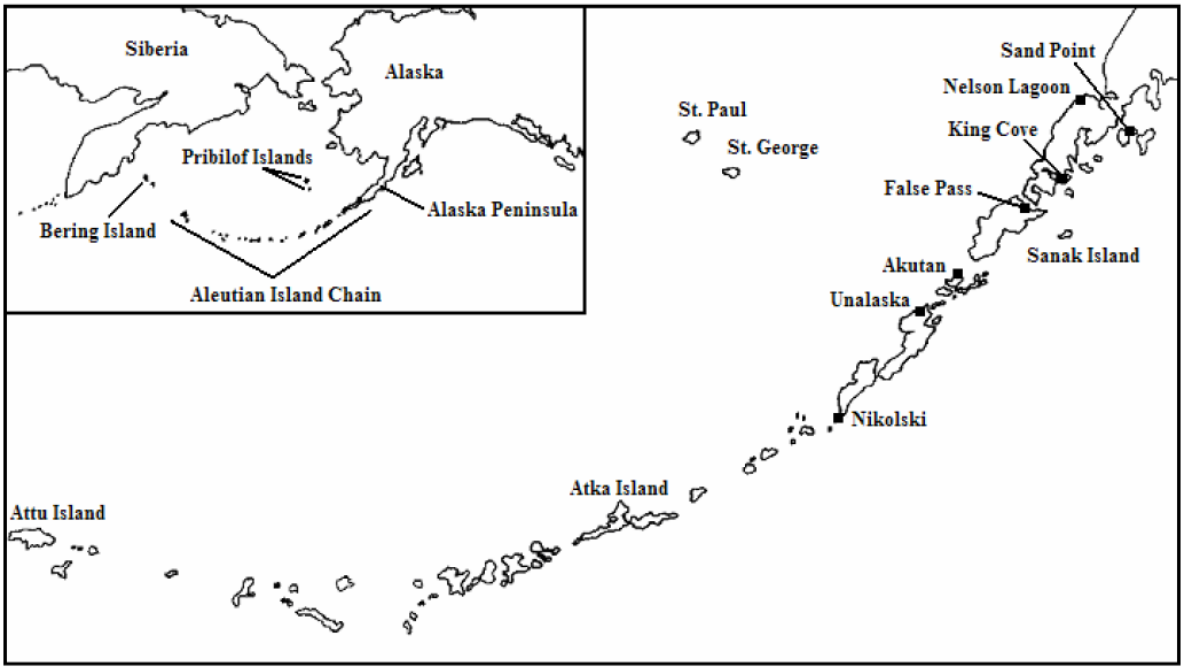

Figure 6: Map of sampled Aleut communities.

Analytical procedures

Test statistics (unbiased isonymy *(I)*, Lasker's R*i*, Fisher's α, and Karlin-McGregor's *v*) were calculated to determine the degree of isolation in each community as well as the relationship between each community (Lasker's R_{ib}, Lasker's D, and Euclidean Distance) based on surname analysis. Isonymy is a measure of similarity and can be used to measure surname variation within and between populations. Unlike genetic markers, isonymy tends to overestimate the degree of relationship between populations (Rudan and Rudan, 2000)

Unbiased isonymy *(I)* of a community can be calculated directly from surname analysis. This statistic indicates the degree of isolation in a community. Higher numbers imply higher degrees of isolation, and lower numbers indicate an increased migration rate. The equation used to calculate unbiased isonymy was adopted from Rodriquez-Larralde *et al.* (1993):

$$I = \sum_k (P_{ik})^2 - \frac{1}{N_i},$$

where P_{ik} is the frequency of surname k in the i_{th} community and N_i is the sample size.

Fisher's α (Fisher, 1943) was calculated from *I* and is analogous to the effective number of alleles in a genetic system as defined by Barrai *et al.*, (2000). It is defined as: $\alpha = 1/I$. A large α indicates high levels of migration, while a small number indicates isolation, higher inbreeding, and genetic drift (Bronberg *et al.*, 2009). It should be stressed that Fisher's α is a more accurate measure of migration in large populations.

Karlin-McGregor's *v* ($v = \alpha/(N_i + \alpha)$) is also used to examine migration (Karlin and McGregor, 1967, Piazza *et al.*, 1987), where high values indicate a great deal of movement and small numbers indicate isolation and drift. This statistic, however, is highly susceptible to bias in small populations. Barrai *et al.*, (1996) suggest it is not a simple indicator of migration rates, because *v* decreases hyperbolically with N while α is held as a constant. They suggest an interpretation of *v* requires supplementary information about N.

Distance matrices between Aleut communities were calculated from a correlation matrix of Lasker's coefficient, Y-chromosome STRs, geographical data, and two distance measures of surnames, for comparative purposes. The surname methods include Euclidean distance (Cavalli-Sforza and Edwards, 1967) and Lasker's distance (Rodriquez-Larralde *et al.*, 2000). Euclidean distance is given as:

$$(1-\theta)^{1/2}, \text{ where } \theta = \sum (P_{ik} P_{jk})^{1/2},$$

and Lasker's distance is given as:

$$D = -\log\left(\sum P_{ik} P_{jk}\right),$$

where P_{ik} and P_{jk} are the frequency of surname k in the i_{th} and j_{th} community.

Lasker's Coefficient

Lasker's coefficient of relationship by isonymy (R_i) was used to quantify surname relationships between each of the eleven communities. This method, developed from the model proposed by Crow and Mange (1965), can be used to explore a relationship by isonymy (R_i). The elements are given as:

$$R_i = \sum \frac{S_i (S_i - 1)}{2n(n-1)},$$

where S_i is the number of each surname and n is the number of individuals in the population (Lasker 1977; Lasker 1985). According to Fox and Lasker (1983), two R_i values differ significantly at the level of $p < 0.05$ if:

$$\frac{R_{i1} - R_{i2}}{\sqrt{{R_{i1}}^2 + {R_{i2}}^2}} > 1/2.$$

The statistical significance of R_i between each Aleut community was tested using this method.

Lasker's coefficient of relationship by isonymy can also be used to evaluate the relationship between populations (R_{ib}). This is based on the assumption that individuals with shared surnames are more closely related than individuals without a shared surname (Ku¨chemann *et al.*, 1979; Raspe and Lasker, 1980; Holloway and Sofaer, 1989; Biondi *et al.*, 1990; Colantonio *et al.*, 2003). The elements are given as:

$$R_{ib} = \frac{\sum S_{i1} S_{i2}}{2 n_1 n_2},$$

where S_{i1} and S_{i2} are the numbers of the *i*th surname in the population one and population two, and n_1 and n_2 are the total numbers of people in each population respectively. By using this method, it was possible to formulate a matrix of relationship by isonymy among communities (R_{ib}) for the Aleutian Islands based on surnames.

Surname and Y-Chromosome Analysis

Surnames were assigned to geographic location or population origins based on historical data and region-specific surname databases. The historical record indicates that the majority of paternal gene flow into the Aleutian Islands came from Western Europe, Northern Europe, and Russia, so surnames were assigned as originating in one of these three geographical regions. Fishermen from Western Europe were largely from the United Kingdom, while those from Northern Europe were mostly of Scandinavian origin. Russia though, was the first European power to colonize the Aleutian Islands. Surnames with minimal spelling differences were grouped together, a standard practice in surname analysis (Fuster, 1986; Küchemann et al, 1979; Madrigal and Ware, 1997; Pollitzer *et al.*, 1988; Pettener, 1990; Rojas-Alvarado, 1994; Sanna *et al.*, 2001).

Each NRY-haplogroup from the subsample (n = 143) was assigned to one of these three ethnic groups as well, with the addition of a category for haplogroups found at high levels in native North Americans. They were organized based on current Y-chromosome haplogroup frequencies for each location (Alonso et al, 2005; Karlsson *et al.* 2006; Rootsi *et al.*, 2004;

Semino *et al.* 2000; Semino *et al.*, 2004) and the historical record. For example, I1a and I were classified as being Northern European in origin, because they are found at their highest levels (30-40%) in this region. Haplogroup R1b was designated Western European, because of its high incidence throughout the United Kingdom (60-80%). R1a and N were listed as predominantly Russian, because combined they comprise nearly 70% of the haplotype diversity in Russia. Historical records verify that the majority of paternal admixture in the Aleutian Islands came from Russia, Western Europe, and Northern Europe. A fourth category included those with predominantly Native American haplogroups Q and Q3. These haplogroups represent approximately 80% of haplotype diversity in Native American groups (Hammer *et al.*, 2001). The remaining haplogroup data from these samples are at high levels in the Balkans, Central Asia, and the Mediterranean and were excluded from surname/Y-chromosome cross-tabulation (Marjanovic *et al.*, 2005; Semino *et al.*, 2000; Semino *et al.*, 2004). Of these, NRY-haplogroup E3 (2.8%) occurred least frequently in this data set, followed by J (4.9%). Native American haplogroups Q and Q3 constitute approximately 15% of the data.

The relationship between surnames and NRY-haplogroups were examined using four tables, designated as Western European, Northern European, Russian, and Native American. Surnames were listed under each appropriate molecular marker (e.g., Russian surnames under haplogroup R1a and N, Western European surnames under R1b, and Scandinavian surnames under I1a and I). Individuals with haplogroup R1a with non-Russian surnames or individuals with haplogroups I1a or R1b *with* Russian surnames were highlighted, because they were divergent from their expected group. The relationship of the European totals (R1b, I, and I1a), and Russian totals (R1a, N, Q, and Q3) were analyzed in the same manner. In this way, it was

possible to identify discrepancies between anticipated and observed surname origin based on genetic markers.

The expected hypothesis for each group is that the majority of individuals with NRY-haplogroup R1a or N would have Russian surnames. It would follow that most individuals with NRY-haplogroup I1a or I would have Northern European surnames, and those with NRY-haplogroup R1b would have Western European surnames. Any deviation from this prediction would suggest the absence of association between the two variables. The significance of this deviation was examined using contingency tables and chi-square tests. A fourth category was designated as Native American in origin. These were individuals with NRY-haplogroups Q or Q3. The prediction for this category was that all individuals would have Russian surnames. This was based on historical data. Aleuts had no formal surnames system prior to Russian contact and took surnames through admixture, baptism, and adoption.

Previous studies involving mtDNA data had been presented using frequency distributions and maps of the sampled region (Crawford, 2007). They revealed a gradient between east and west throughout the islands, which was suggestive of how the islands were initially populated. Displaying surname and NRY-haplogroup data in a similar manner allowed for easy comparisons to be made between paternal and maternal data. It also presented discrepancies between the two paternal markers.

Principal Component Analysis

Principal Components Analysis (PCA) was performed on a correlation matrix of the observed haplogroups in each surname category using a subsample (n = 143) to further explore

the relationship between the two markers. PCA attempts to explain total variation in a minimal number of axes by using eigenanalysis and plotting scores on these axes. The goal is to represent the majority of variation in the fewest eigenvalues possible. The majority of variation is described by the first eigenvalue, with the second describing the second most and the third describing the third most variation. Two or three eigenvalues can be displayed in two or three-dimensional space respectively. PCA was performed using Minitab version 14.0 (Minitab, Inc., State College, PA).

Chi-Square Test

Chi-square tests were used to examine the association between surnames cohorts based on ethnic origin and Y-chromosome markers using a subsample (n = 143). The degrees of freedom for these test were calculated using df = (a-1)(b-1), where a is the number of columns and b the number of rows in the contingency table. In this case, each contingency table had two rows and two columns resulting in three degrees of freedom. Each table emulated the following format:

		Y-Chromosome		
		Russian	Non-Russian	
Surname	Russian	a	b	(a + b)
	Non-Russian	c	d	(c + d)
		(a+c)	(b+d)	*n*

,

A chi-square test of independence was conducted on the results of each contingency table. The elements are given as:

$$\chi^2 = \frac{(ad - bc)^2 n}{(a+b)(c+d)(a+c)(b+d)}.$$

The Phi coefficient shows the degree of association between surnames and Y-chromosomes using the χ^2 test from a 2 x 2 contingency table as outlined by Sokal and Rohlf, (2000). Phi ranges between 0 and 1 in a positive or negative direction ascertained from the sign of the determinant of the table. Strong positive or negative association will be near 1 or -1.

Its elements are given as:

$$\varphi = \sqrt{\frac{X^2}{n}}.$$

Multidimensional Scaling

Multidimensional scaling (MDS) was performed on eleven Aleut communities using Statistica 4.0 (Statistica-Statsoft) to better understand surname distributions in the region. MDS was also performed on ten communities previously characterized for NRY-haplogroups from a subsample (n = 143) using NTSYS (Applied Biostatistics, Inc., Setanket, NY) and Statistica 4.0 for comparative purposes. NTSYS was used on an R_{ST} distance matrices for Y-STR data. Nonmetric multidimensional scaling was performed using Statistica on a correlation matrix of Lasker's Coefficient (R_{ib}). MDS, which represents the spatial relationship between each community in two and three-dimensional space., ordinates points based on the dissimilarity of *n* objects in a *k*-dimensional space so that the interpoint-distances correspond as closely as possible to the distances of the original matrix (Kruskal, 1964a, b). MDS differs from PCA by focusing on the distances in *k*-dimensional space rather than focusing solely on explaining variation.

Because of its emphasis on distance rather than variation, MDS is better at characterizing spatial relationships of regional populations such as the Aleut samples presented here.

The MDS algorithm uses a configuration of points produced by PCA, computing distances, d^*_{ij}, between all points, *ij*, and compares them to original distances, d_{ij}. A monotonic function, d^f_{ij}, is incorporated to preserve the given order. The statistic "stress" measures for goodness-of-fit of the distances in the displayed space to the monotone function of the original distances:

$$Stress = \sqrt{\frac{\sum (d^*_{ij} - d^f_{ij})^2}{\sum d^{*2}_{ij}}}.$$

The position of the given points are then adjusted to reduced the stress of the model until the maximum number of iterations is reached (n = 100). The lower the statistic is, the better the goodness-of-fit.

Mantel Test

Mantel tests were used to test the significance of the correlation between two or more matrices. In this case, they are used to evaluate the relationship between genetics, surnames, and geography in the Aleutian Islands. A Mantel test was employed to test the significance of the relationship between matrices using Y-STR, surname, and geographical data. An R_{ST} matrix was derived from Y-STR data using the program Arlequin ver. 3.1 (Schneider *et al.*, 2000). A geographical distance matrix (km) was computed using GEOG ver. 2.1 (Relethford, 2000). For a test involving two square matrices, $X=\{x_{ij}\}$ and $Y = \{y_{ij}\}$, the correlation is defined as:

$$r_{XY} = \frac{SP(X,Y)}{\sqrt{SS(X)SS(Y)}},$$

where SP is the sum of products for X and Y, and SS is the sum of square for each matrix (Mantel, 1967). Mantel tests were performed using MANTEL ver. 3.1 (Relethford, 1990). The significance of the test was formulated using a permutation procedure from the original matrices with the following computation:

$$Z_{XY} = X * Y = \sum_{i=1}^{N} \sum_{j=1}^{i} x_{ij} y_{ij} \ .$$

The permutated Z_{XY} quantities (n=1000) were contrasted with the original Z_{XY} to determine P-values (Smouse *et al.*, 1986).

Chapter 5: Results

This chapter presents the results based on the methods used in this study to answer questions concerning surname distributions and origins in the Aleutian Islands. It includes the results of multiple tests employed to explore the relationship between surnames: unbiased isonymy, Fisher's α, Karlin-McGregor's *v*, and Lasker's coefficient of isonymy. Tests were also applied to examine the relationship of surnames among communities, such as Lasker's coefficient of relationship by isonymy, Lasker's distance, and Euclidean distance. Frequency maps and tables were utilized for the examination of the relationship between Y-chromosome and surname markers. Statistical methods include multidimensional scaling, principal component analysis, chi-square and mantel tests. Combined with historical data, these results test the hypothesis that surname and Y-chromosome markers are correlated because they are both paternally inherited.

Reproductive Isolation

Surname analyses, including unbiased isonymy, Lasker's coefficients (R_i and R_{ib}), Euclidean distance, Lasker's D, Fisher's α and Karlin-McGregor's *v*, were performed on 732 surname samples from the Aleutian Archipelago. Unbiased isonymy showed that communities with large populations had smaller *I* values (Fig. 7), except in the case of St. George Island. The high *I* values for Nelson Lagoon, False Pass, and Nikolski are likely due to limited mate choices in small populations. St. George had the highest level of unbiased isonymy, even with a relatively large population size. This level of unbiased isonymy is due to the population having a single surname (Merculief - 28%). King Cove, Akutan, and Atka all have similar levels of isonymy (~0.08); Bering has a slightly lower level, while St. Paul, Sand Point and Unalaksa

Table 1: Surname analysis of 11 Aleut communities: *N* denotes sample size and *S* is the number of surnames in each community. Karlin-McGregor's *v*, Fisher's α, and unbiased isonymy are listed as *v*, α, and *I* respectively.

Community	*N*	*S*	*v*	α	*I*	*Ri*
Akutan	42	13	0.21429	11.45455	0.08730	0.04472
Atka	82	19	0.12312	11.51370	0.08685	0.04396
Bering	44	19	0.27160	16.40678	0.06095	0.03118
False Pass	30	11	0.23438	9.18367	0.10889	0.05632
King Cove	72	28	0.14008	11.72851	0.08526	0.04323
Nelson Lagoon	45	18	0.19481	10.88710	0.09185	0.04697
Nikolski	37	13	0.21143	9.92029	0.10080	0.05180
St. George	90	22	0.08721	8.59873	0.11630	0.05880
St. Paul	122	35	0.18598	27.87266	0.03588	0.01809
Sand Point	69	33	0.29870	29.38889	0.03403	0.01726
Unalaska	99	38	0.18099	21.87723	0.04571	0.02309

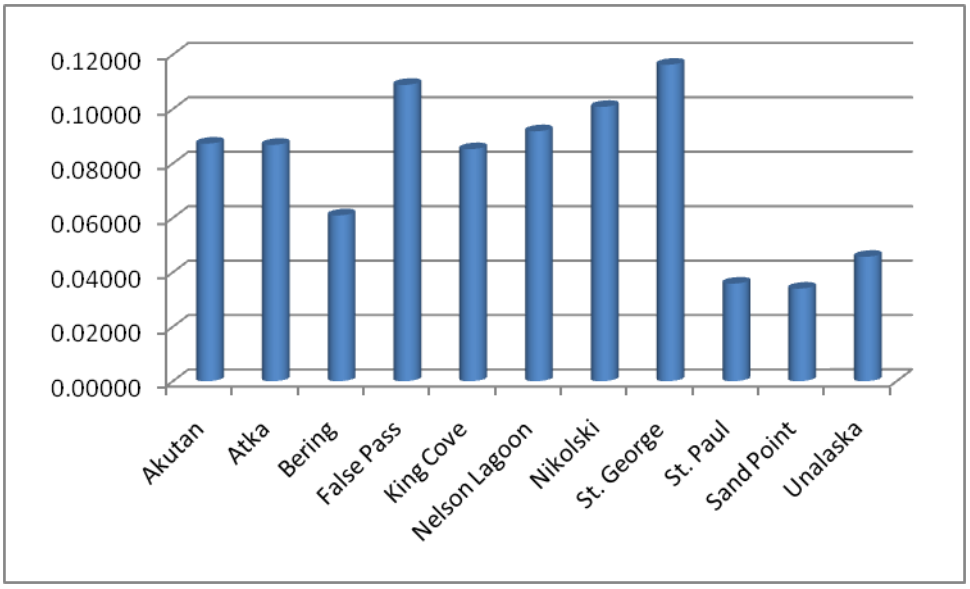

Figure 7. Unbiased Isonymy based on surnames in the Aleutian Islands (high levels indicate isolation).

show the lowest levels. St. Paul and Bering Island were both established by Russia through conscription from several adjoining islands, resulting in a greater number of surnames. St. George was established in a similar manner but was founded by individuals with few surnames.

Fisher's α showed the inverse of unbiased isonymy (Table 1). When compared with Karlin-McGregor's *v*, these two statistics indicate that St. Paul has the highest levels of gene

flow due to migration. Bering Island has the third highest Karlin-McGregor's *v*. Although False Pass had a relatively low Fisher's α, it had the next highest Karlin-McGregor's *v*. Because Karlin-McGregor's *v* is more sensitive to small population sizes (Barrai *et al.*, 1996), Fisher's α is likely a more accurate measure of migration for the small community of False Pass. Nelson Lagoon and Nikolski had intermediate levels for both statistics, indicating low migration rates. Atka, King Cove, and St. George had the lowest levels on both charts, suggesting they are the most isolated communities in the region.

Lasker's coefficient of relationship by isonymy (R_i) yielded similar results. Table 2 shows the results of the test for significant deviation between R_i values. This has been set up as a distance matrix with significant deviations ($P < 0.05$) presented in bold. Sand Point and St. Paul Islands differentiate the most from the remaining Aleut population. Having the lowest R_i values implies that they are the most heterogeneous populations. Although St. Paul and St. George are only 75 kilometers apart and were established during the same conscription event, they have significantly different isonymy levels.

Table 3 shows the 50 most frequent surnames in the Aleutian Archipelago. These are listed in alphabetical order with specificity level and local and total frequency. According to Barrai *et al.*, (1996), surnames with a greater than 50% occurrence rate are considered "specific" to that community. The vast majority of surnames in this study scored as "specific" to the community where they were observed, likely due to small population sizes, indicating that surnames observed at low levels should be considered associated rather than specific to the community where they were observed. For this purpose, surnames will only be referred to as being "specific" to a community when they occur more than 20 times in this study.

Table 2: Distance Matrix based on Lasker's Coefficient of Relationship by Isonymy (R_i)

Communities	Akutan	Atka	Bering	False	King	Nelson	Nikolski	George	Paul	Sand	Unalaska
Akutan	0.0										
Atka	0.01212	0.0									
Bering	0.24836	0.23713	0.0								
False	0.16130	0.17300	0.39052	0.0							
King	0.02396	0.01184	0.22607	0.18437	0.0						
Nelson	0.03469	0.04679	0.28008	0.12750	**0.05859**	0.0					
Nikolski	0.10346	0.11540	0.34105	0.05907	0.12702	0.06907	0.0				
George	0.19060	0.20214	0.41499	0.03046	0.21334	0.15719	0.08933	0.0			
Paul	**0.55203**	**0.54421**	0.36313	**0.64628**	**0.53646**	**0.57378**	**0.61438**	**0.66174**	0.0		
Sand	**0.57286**	**0.56535**	0.39059	**0.66310**	**0.55792**	**0.59371**	**0.63260**	**0.67786**	0.03320	0.0	
Unalaska	0.42977	0.42030	0.20851	**0.54592**	0.41094	0.45626	**0.50623**	**0.56529**	0.17046	0.20223	0.0

*Bold indicates significant deviation $p<0.05$

Table 3: The 50 most common surnames in the Aleutian Islands with their corresponding total and local frequencies. Each surname is listed with the location where was most commonly recorded.

	Absolute Frequency					*Absolute Frequency*			
Surname	**Local**	**Total**	**Specificity**	**Location**	**Surname**	**Local**	**Total**	**Specificity**	**Location**
Badaev	6	6	1.00	Bering	Kudrin	6	10	0.60	Sand Point
Berekoff	7	8	0.88	Unalaska	Kushin	7	7	1.00	St. Paul
Bereskin	7	11	0.64	Unalaska	Ladigin	8	8	1.00	Bering
Bernsten	2	5	0.40	Nelson Lagoon & Sand Point	Larsen	4	6	0.67	Sand Point
Borenin	5	9	0.56	Unalaska	Lekanin	5	6	0.83	Atka
Bourdukofsky	4	5	0.80	St. Paul	Lekanof	15	27	0.56	Unalaska
Brandell	3	6	0.50	King Cove & Nelson Lagoon	Lestenkof	7	9	0.78	St. George
Carlson	7	7	1.00	Sand Point	Mack	19	24	0.79	King Cove
Dirks	6	10	0.60	Atka	Malavansky	9	9	1.00	St. George
Dushkin	8	19	0.42	Nikolski	McGlashan	7	11	0.64	Akutan
Ermanoff	8	9	0.89	Nikolski	Melovidov	9	9	1.00	St. Paul
Fratis	6	6	1.00	St. Paul	Merculief	26	44	0.59	St. George
Galanin	4	5	0.80	St. Paul	Nelson	5	5	1.00	Nelson Lagoon
Golley	4	5	0.80	Atka	Neuzoroff	12	15	0.80	Atka
Golodoff	5	12	0.42	Atka & Unalaska	Oustigoff	5	5	1.00	St. Paul
Gould	5	6	0.83	King Cove	Philemonof	7	13	0.54	St. George
Gundersen	8	13	0.62	Sand Point	Prokopeuff	12	26	0.46	Atka
Hoblet	5	5	1.00	False Pass	Samuelson	5	5	1.00	King Cove
Jackson	8	10	0.80	False Pass	Snigaroff	10	13	0.77	Atka
Johnson	12	14	0.86	Nelson Lagoon	Stepetin	9	15	0.60	Unalaska
Kashevarof	8	8	1.00	St. George	Swetzof	4	6	0.67	St. George
Kochergin	5	5	1.00	St. Paul	Tcheripanoff	8	11	0.73	Akutan
Kochuten	2	7	0.29	St. George & False Pass	Yatchmeneff	6	11	0.55	Unalaska
Kozloff	10	10	1.00	St. Paul	Zacharof	5	6	0.83	St. Paul
Krukoff	5	11	0.45	St. Paul	Zaochney	12	12	1.00	Atka

The most prominent surname in each community is listed in Table 4. Surnames most closely associated with each community include Zaochney and Neuzoroff with Atka, Kozloff with St. Paul, Ladigin with Bering Island (100%), Johnson with Nelson Lagoon (86%), and Jackson with False Pass (80%). McGlashan and Tcheripanoff were both found to be specific to Akutan, as was Gunderson to Sand Point. Prokopeuff was one of the most numerous surnames in the Aleutians (46% in Atka), but was not specific to any one community. The relationship of St. George and the surname Merculief is probably the most significant in the Aleutian Islands. Given that out of the 44 total Merculiefs in these data, nearly 60% were observed on St. George Island, Merculief should probably be considered "specific" to St. George. The occurrences of Lekanof (56%) on Unalaska and Mack (79%) at King Cove could also be considered "specific".

Table 4: The most common surname(s) in each community

	Absolute Frequency			
Surname	**Local**	**Total**	**Specificity**	**Location**
McGlashan	7	11	0.64	Akutan
Tcheripanoff	8	11	0.73	Akutan
Prokopeuff	12	26	0.46	Atka
Neuzoroff	12	15	0.80	Atka
Zaochney	12	12	1.00	Atka
Ladigin	8	8	1.00	Bering
Jackson	8	10	0.80	False Pass
Mack	19	24	0.79	King Cove
Johnson	12	14	0.86	Nelson Lagoon
Dushkin	8	19	0.42	Nikolski
Gundersen	8	13	0.62	Sand Point
Merculief	26	44	0.59	St. George
Kozloff	10	10	1.00	St. Paul
Lekanof	15	27	0.56	Unalaska

Lasker's Coefficient

Lasker's coefficient of relationship by isonymy between communities (R_{ib}) is displayed in a correlation matrix in Table 5. The greatest observed correlations occurred between

Table 5: Correlation Matrix based on Lasker's Coefficient of Relationship by Isonymy (R_{ib})

Communities	Akutan	Atka	Bering	False	King	Nelson	Nikolski	George	Paul	Sand	Unalaska
Akutan	1.00000										
Atka	0.00348	1.00000									
Bering	0.00000	0.00347	1.00000								
False	0.00000	0.00000	0.00000	1.00000							
King	0.00132	0.00000	0.00000	0.01620	1.00000						
Nelson	0.00000	0.00000	0.00000	0.00444	0.00340	1.00000					
Nikolski	0.00644	0.00659	0.00000	0.00360	0.00807	0.00240	1.00000				
George	0.00278	0.00569	0.00000	0.00000	0.00015	0.00000	0.00646	1.00000			
Paul	0.00546	0.00145	0.00000	0.00137	0.00017	0.00000	0.00288	0.01052	1.00000		
Sand	0.00000	0.00018	0.00000	0.00266	0.00352	0.00032	0.00157	0.00016	0.00042	1.00000	
Unalaska	0.01082	0.00622	0.00115	0.00303	0.00133	0.00000	0.00573	0.00965	0.00207	0.00000	1.00000

Unalaska and Akutan, King Cove and False Pass, and St. Paul and St. George. These data were used for multidimensional scaling, which is displayed in figures 8 and 9.

Multidimensional scaling (MDS) was performed on eleven Aleut populations using the extended sample size of 732 surnames. Bering and Atka cluster in both two- (Fig 8) and three-dimensional space (Fig 9). St. George, Unalaska, Akutan, and St. Paul cluster in two-dimensional space, but Akutan and Unalaska differentiate themselves into a separate cluster in three-dimensional space, which is similar to MDS results in Figures 8 and 9. The eastern communities of Sand Point, King Cove, False Pass, and Nelson Lagoon cluster in two-dimensional space, but Nelson Lagoon and Sand Point differentiate themselves as outliers in three-dimensional space. Nikolski sits near the middle in both plots. The stress for both MDS plots indicate that they are a good fit for these data.

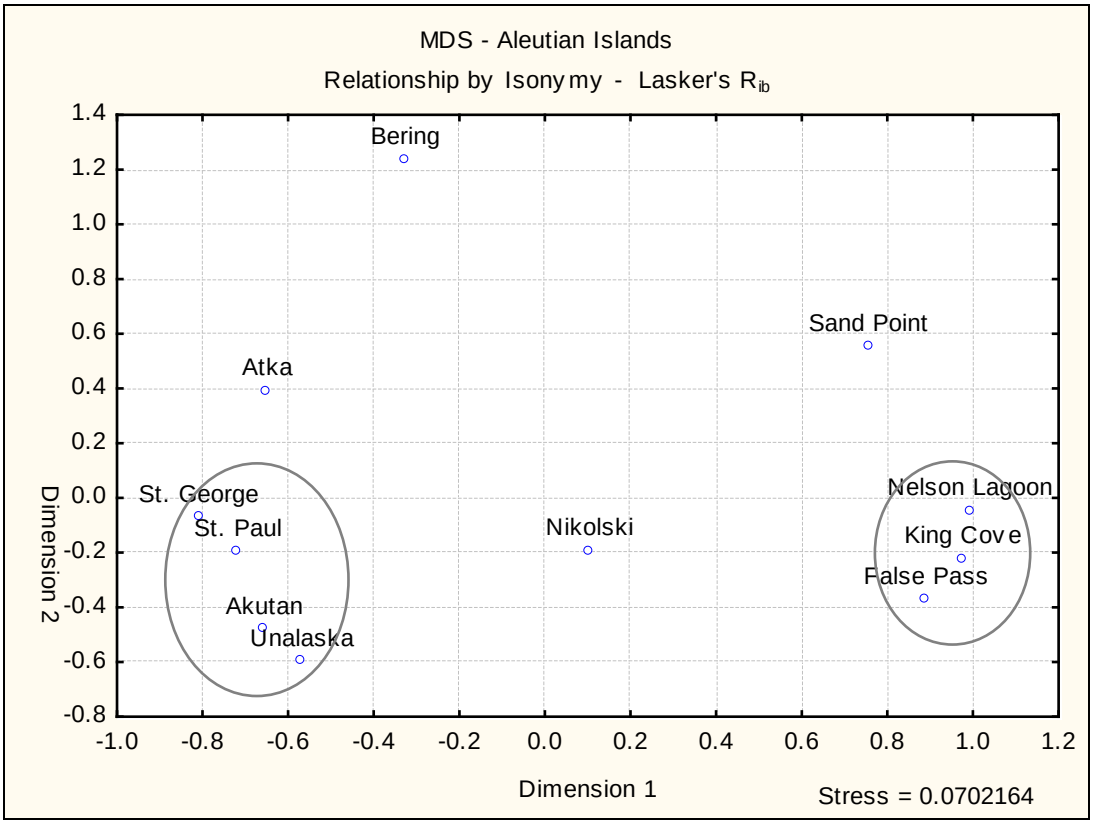

Figure 8. MDS plot based on a distance matrix from Lasker's R_{ib}.

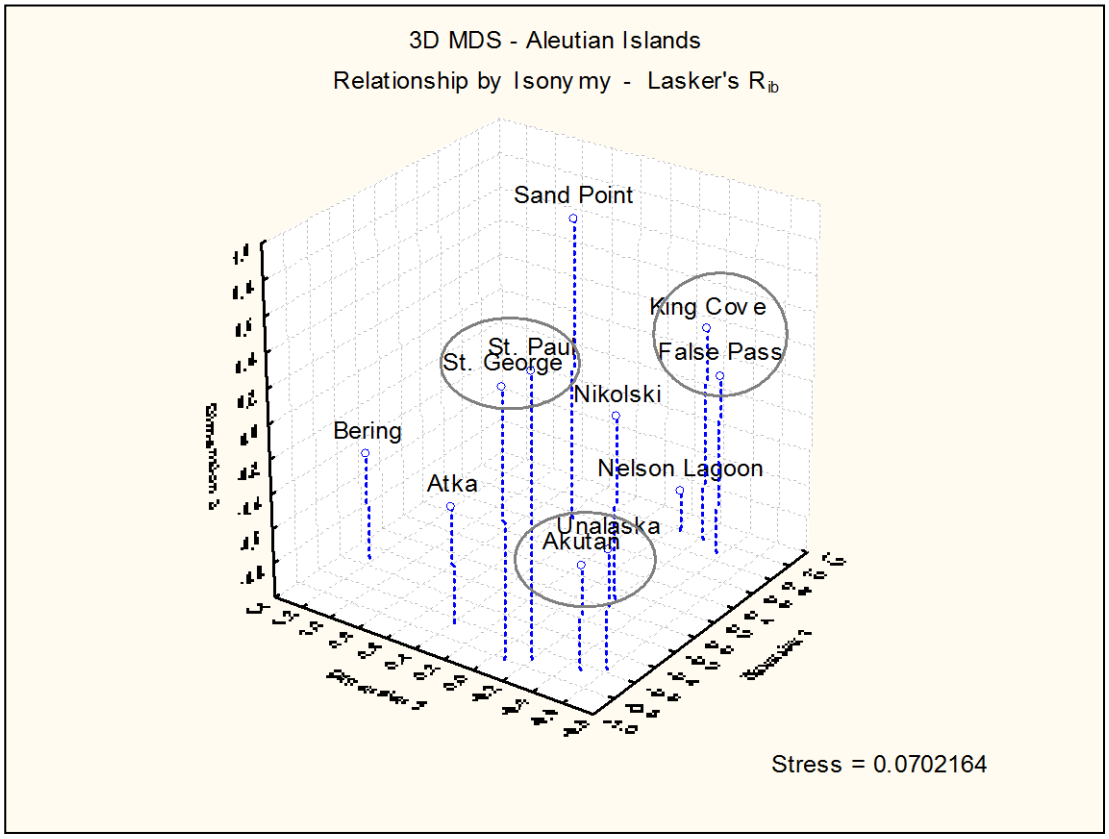

Figure 9. Three-Dimensional MDS plot based on a distance matrix from Lasker's R_{ib}.

Surname and Y-Chromosome Categorization

Since both Y-chromosomes and surnames are inherited paternally, a correlation between the two was expected. Surnames were organized into lists to determine if there was an association with specific NRY-haplogroups and specific surnames. Of the participants included in this portion of the study, there were 95 groupings between haplogroups and surnames out of 143 possible pairings. These results indicate that surnames are heterogeneously distributed in comparison to Y-chromosomes in the Aleutian Archipelago. The most common surnames from this Aleutian sample were Dushkin, Mack, and Merculief. These three represented the most significant pairings between surnames and haplogroups, but each group had only five or six

actual pairings with a specific NRY-haplogroup. The majority of surnames (68) aligned with only one haplogroup, making the relationship between these markers difficult to assess based on individual surnames, so they were broken into cohorts based on ethnic origin including Western Europe (23.7%), Northern Europe (16.7%), and Russia (59.4%).

Nine NRY-haplogroups describe the paternal genetic makeup in populations of the Aleutian Archipelago (Table 6). Haplogroups R1a and R1b account for nearly half of the populations, while I1a was observed in 13.29% of those sampled, N in 7.69%, I in 6.99%, J in 4.9%, and E3 in 2.8%. Native American NRY-haplogroups Q and Q3 (Hammer *et al.*, 2001) were noted in 15% of the population. The paternal lineages of the Aleutian Islands are largely non-native and most likely the result of Russian and European admixture (Crawford, 2007; Rubicz *et al.*, 2003; Zlojutro *et al.*, 2006).

Table 6. Haplogroup Frequencies

Y-hg	**n = 143**	**Frequency**
R1a	36	25.17%
R1b	35	24.48%
I1a	19	13.29%
Q3	12	8.39%
N	11	7.69%
I1a	10	6.99%
Q	9	6.29%
J	7	4.90%
E3	4	2.80%

The frequency distributions of NRY-haplogroups with each surname group showed loose associations between the two makers. Figure 10 shows the percentages of NRY-haplogroups that occur in conjunction with each surname group. The central pie has frequencies of surnames based on ethnic origin, and the outer pies show the haplogroup distribution for each group. All nine NRY-haplogroups are present in individuals with Russian surnames. The largest percentage of haplogroups from this group was R1a. Together, R1a and N describe 41% of Russian surnames. R1b was found in conjunction with surnames of both Northern (38%) and Western European (39%) origin. I and I1a were associated with 37% of Northern European surnames. NRY-haplogroup Q was only found in association with Russian surnames, while Q3 was found

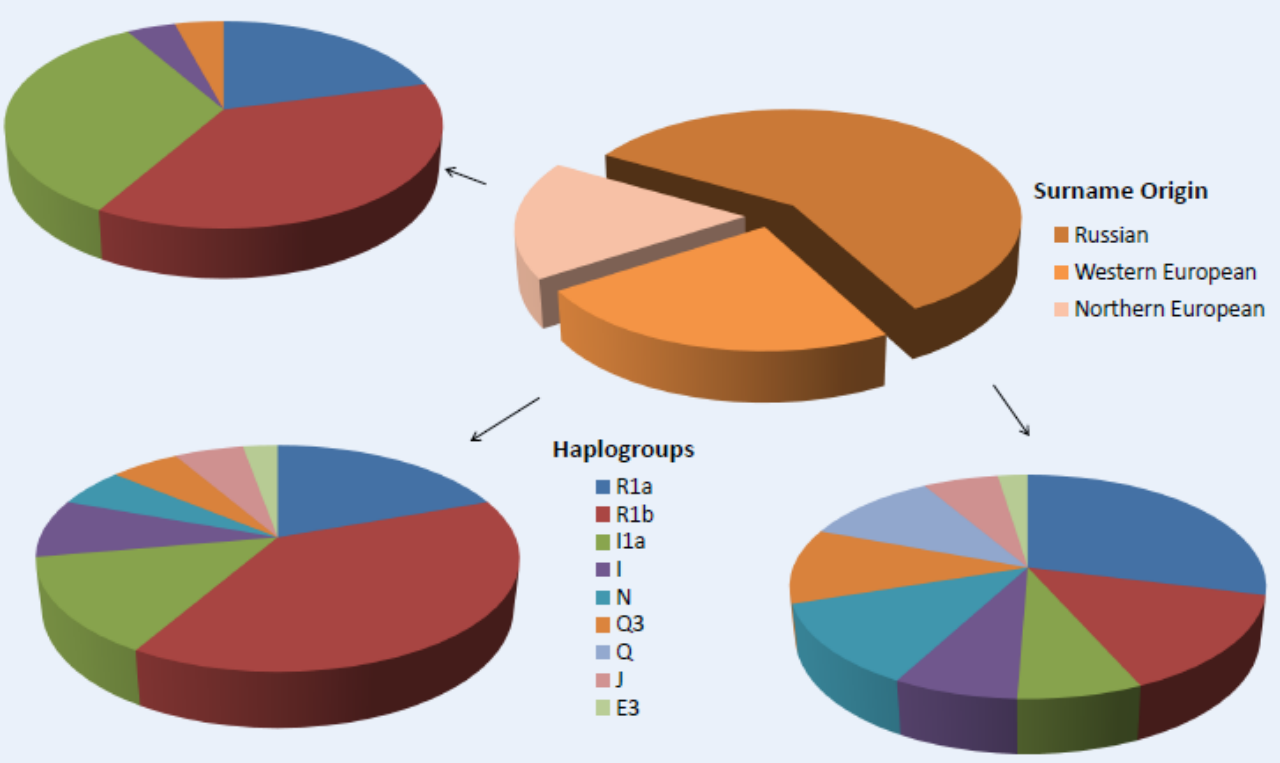

Figure 10. Aleutian NRY-haplogroup diversity found in each surname group.

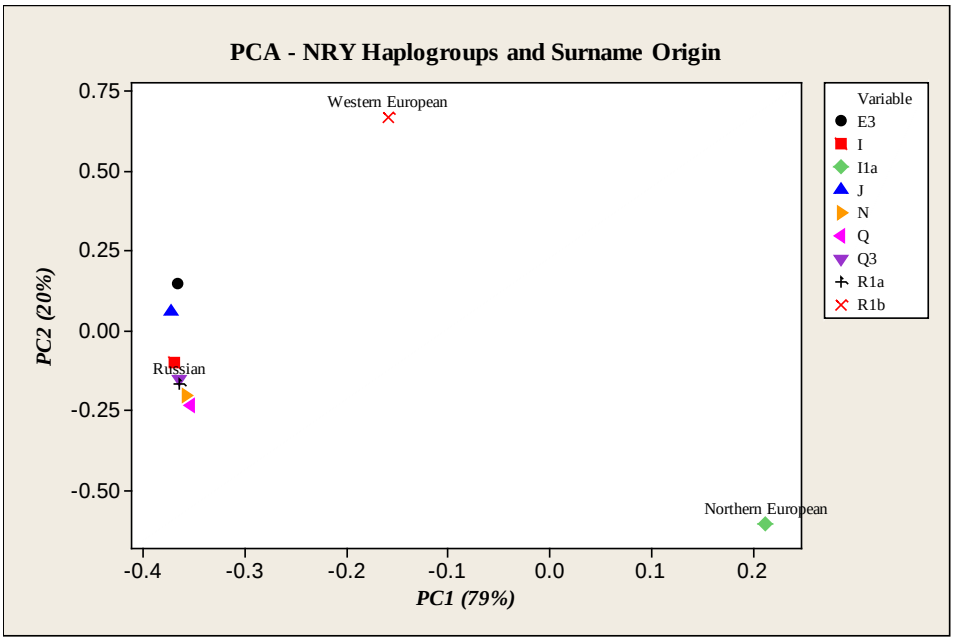

Figure 11. Principal component analysis of NRY-haplogroups based on a correlation matrix of observed haplogroups in each surname category.

at low levels in all three groups. Northern European surnames were only found to be affiliated with five NRY-haplogroups.

Principal component analysis of the frequency of NRY-haplogroups grouped by surname origin suggested that a relationship exists between specific haplogroups and surnames from Western and Northern European. The majority of variation in the Principle Component Analysis (PCA) plot (Fig. 11) is on the PC1 axis, with most NRY-haplogroups clustering with Russian surnames. The remaining haplogroups, I1a and R1b, are closely associated with Northern and Western Europeans respectively. Of the haplogroups that cluster with Russian surnames, J and E3 are the most divergent. It is important to note that although these results are informative, they could be biased toward Russian surnames, due to the number of these surnames (~60%) in these data. The results of this PCA indicate a correlation exists between haplogroups I1a with Northern European surnames and R1b with Western European surnames. It is notable that NRY-haplogroups Q and Q3 cluster with Russian surnames, along with R1a, N, I, J, and E3. Of these haplogroups, R1a and N are found at the highest percentages in Russia, representing close to 70% of the total haplotype variation in that region. NRY-haplogroups J and E3 are found at their highest levels in the Balkans, while I is found predominantly in Scandinavia (Karlsson *et al.* 2006; Marjanovic *et al.*, 2005; Rootsi *et al.*, 2004; Semino *et al.*, 2000; Semino *et al.*, 2004)

Surname and Y-Chromosome Analysis

The relationship of 143 surnames and Y-chromosome markers in the Aleutian Archipelago was analyzed, with each surname and each Y-chromosome designated as originating from Western Europe (England), Northern Europe (Scandinavia) and Russia. Lists of these names in conjunction were quantified and analyzed using cross-tabulation and contingency

tables, maps were constructed using surname and NRY-haplogroup frequencies in order to determine if a geographical gradient could be identified using either marker, and multidimensional scaling was used to identify whether or not there were similarities between the two markers. These results were further examined using chi-square and mantel tests.

Maps and Tables

A comparison between frequency maps offered interesting results. NRY-haplogroup frequencies did not follow any geographical distribution, but surname frequencies grouped by origin did follow a geographical distribution. The majority of surnames originating in Northern and Western Europe were found in the Eastern Aleutians, with Russian surnames gaining in frequency in each successive community to the west. Russian surnames were fixed on Bering Island, St. Paul Island, and Nikolski (Fig 12). In contrast to surname data, there was no clear relationship between NRY-haplogroup distributions and geography (Fig 13). Bering and St. Paul Islands showed the greatest amount of genetic heterozygosity. Haplogroups I1a and R1b were found at their highest levels in Eastern Aleutian communities, with R1a increasing in frequency in communities to the west. The highest frequencies of R1a were found in Nikolski and St. George Island. Akutan and False Pass had the highest frequencies of Native American haplotypes Q and Q3 respectively.

The relationship of surname and NRY-haplogroup origins were examined using cross-tabulation and chi-square tests. Surnames were ordered in lists based on a shared haplogroup. The initial list included surnames found in conjunction with Native American haplogroups Q and Q3 (Hammer *et al.*, 2001). The majority of these surnames (85.7%) were Russian in origin, though three non-Russian surnames were highlighted as differing from the expected group. The second list consisted of surnames found in conjunction with haplogroups I and I1a. In this case,

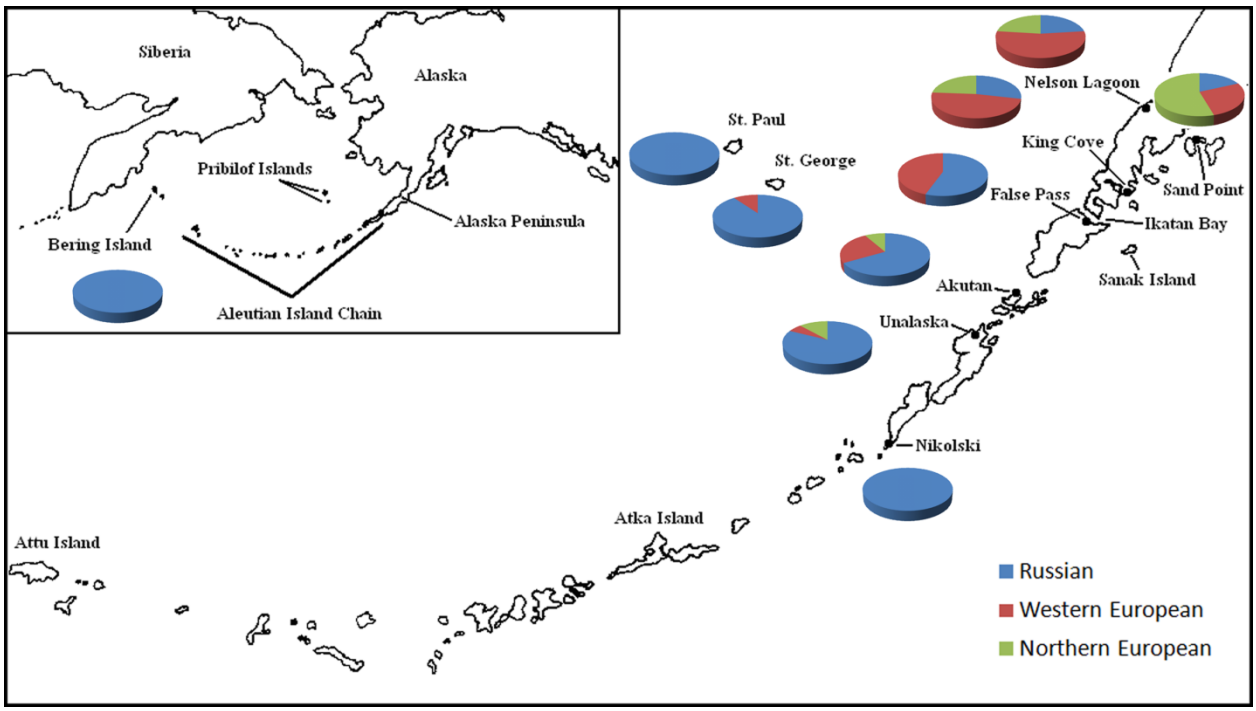

Figure 12. Surnames frequencies in the Aleutian Islands displayed as pie charts.

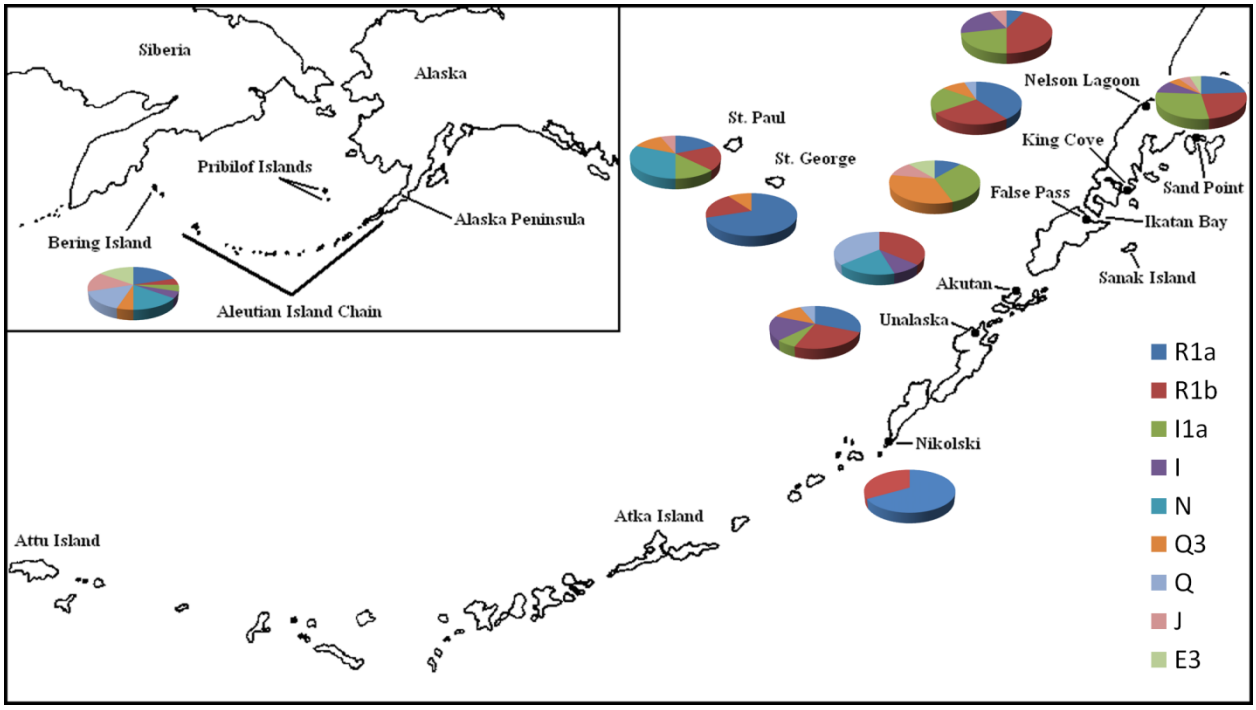

Figure 13. NRY-haplogroup frequencies in the Aleutian Islands displayed as pie charts.

surnames were expected to be non-Russian European, so Russian surnames deviated from expectation, as was the case when Russian surnames were found in conjunction with the predominantly Western European haplogroup R1b. The last category included haplogroups R1a and N, which are found at high frequencies in Russia (Alonso et al, 2005; Karlsson *et al.* 2006; Rootsi *et al.*, 2004; Semino *et al.*, 2000; Semino *et al.*, 2004) so that non-Russian European surnames were highlighted as deviating from expectation. The highest percentage of Russian surnames was found in the Native American pairing, followed by the Russian group (66.7%). The European groups were both comprised of approximately 40% Russian surnames.

Two additional groups were organized from these findings in order to further examine the relationship between surnames and Y-chromosomes. These groups were used to test whether the assumption that Russian surnames would be associated with NRY-haplogroups R1a and N and non-Russian European surnames would be associated with NRY-haplogroups R1b, I1a, and I. The initial group, titled "Russian Total", included haplogroups R1a, N, as well as Q and Q3. The latter two haplogroups were included in this group because of their significant association with Russian surnames. The second group was titled "Non-Russian European total", and included pairings between haplogroups R1b, I1a and I with surnames. Non-Russian European surnames were deviations from expectation for the Russian group, and Russian surnames were deviations from expectation for the non-Russian European total. Because of their association with predominantly Russian surnames, haplogroups Q and Q3 were included in the Russian total.

Contingency tables (Table 7) and chi-square tests were employed to test the association between each surname and haplogroup pairing. A significant association ($P < 0.005$) was found between the Russian total and Russian surnames, and the same association ($P < 0.001$) was also found between the European total and non-Russian European surnames. This association was

sustained between Russian surnames and Native American haplogroups Q and Q3 at $P < 0.05$ but was found to be non-significant between the remaining groupings. Surprisingly, the weakest association was between Russian surnames and haplogroups R1a and N, most likely the result of a large number of Russian surnames that were paired with non-Russian haplogroups.

Table 7: Chi-Square results for surname/NRY-haplogroup assocation

Native American					**Q & Q3**	
		Y-Chromosome				
		Russian	Non-Russian			
Surname	Russian	18	64	82		
	Non-Russian	3	58	61		
		21	122	*286*		
				X^2=	8.100138	p<0.005
				φ =	0.238001	

Russian Total					**R1a, N, Q, & Q3**	
		Y-Chromosome				
		Russian	Non-Russian			
Surname	Russian	50	32	82		
	Non-Russian	19	42	61		
		69	74	*286*		
				X^2=	12.46376	p<0.001
				φ =	0.295227	

Non-Russian European Total					**R1b, I1a, & I**	
		Y-Chromosome				
		Russian	Non-Russian			
Surname	Russian	39	22	61		
	Non-Russian	25	57	82		
		64	79	*286*		
				X^2=	15.82622	p<0.001
				φ =	0.332675	

Multidimensional Scaling

Multidimensional scaling based on a distance matrix constructed from Lasker's Coefficient (R_{ib}) using 143 indicates Bering Island and False Pass to be the most divergent

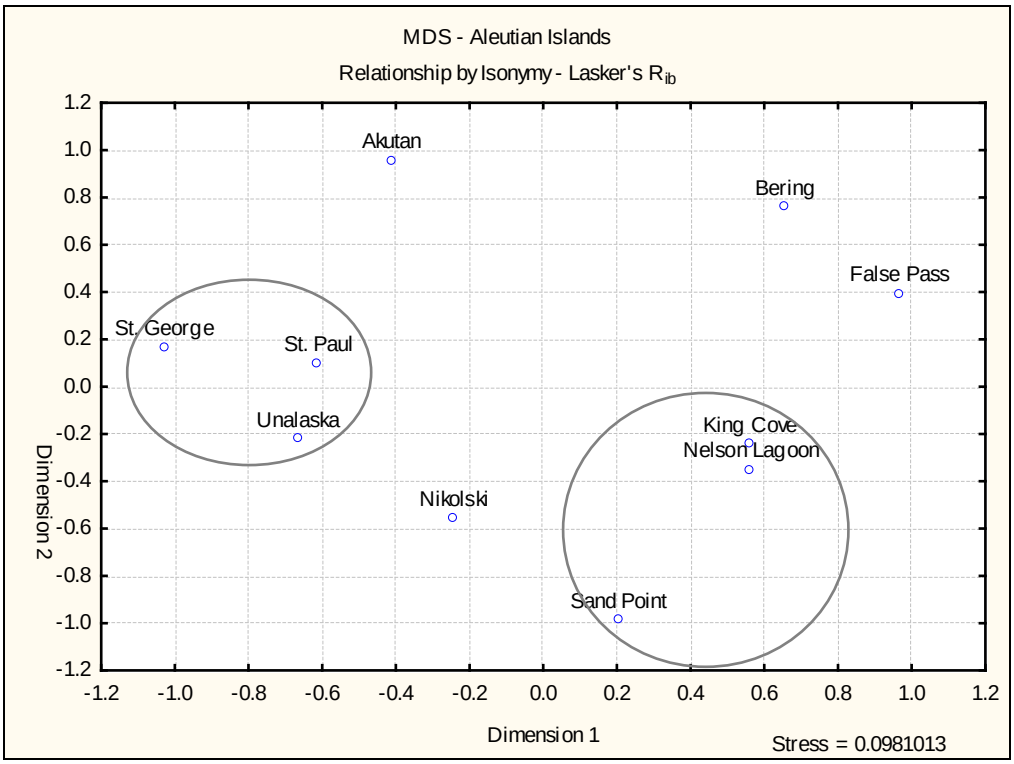

Figure 14. MDS plot based on a distance matrix from Lasker's Coefficient of relationship (R_{ib}).

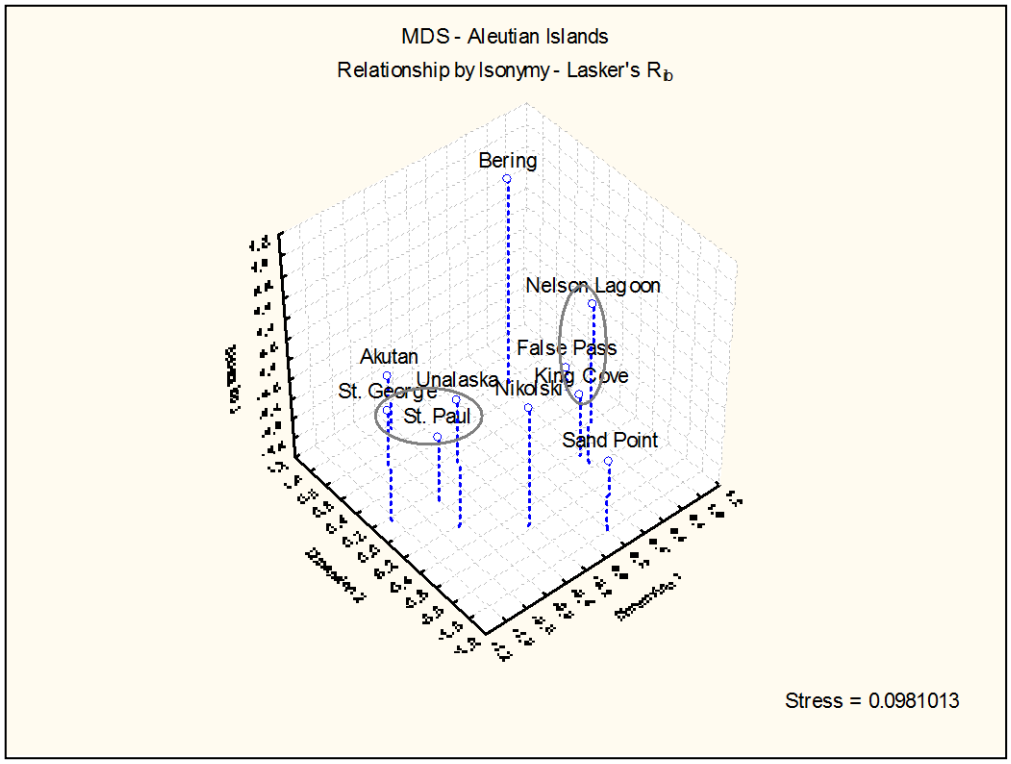

Figure 15. Three-dimensional MDS plot based on a distance matrix from Lasker's Coefficient of relationship (R_{ib}).

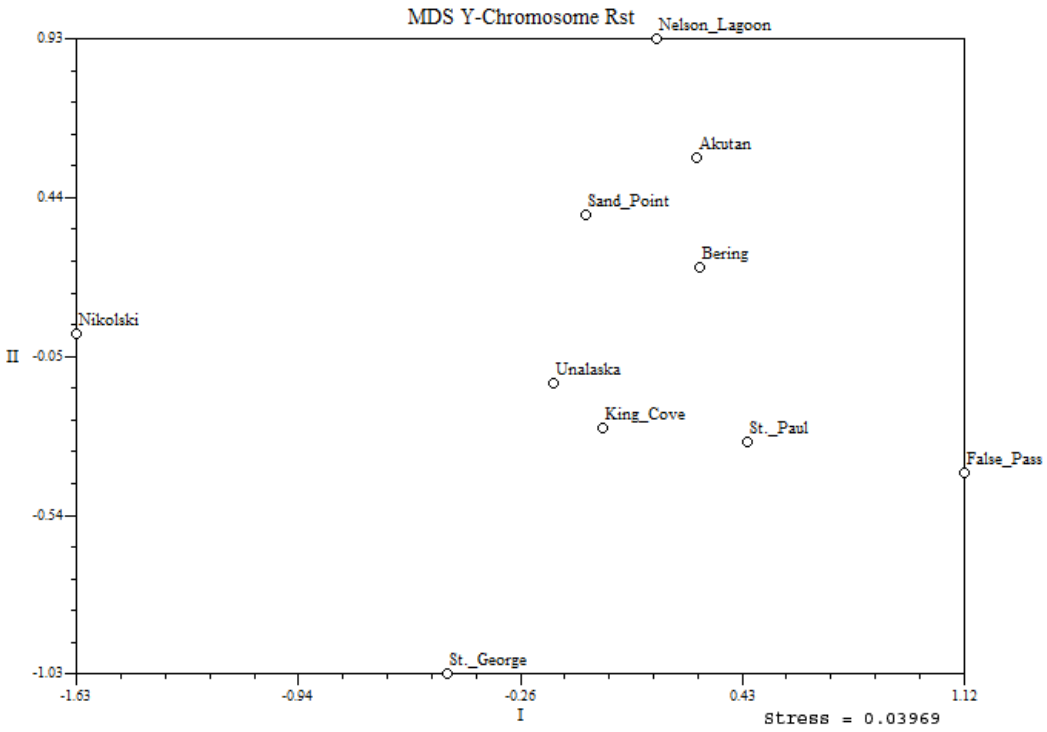

Figure 16. MDS plot based on a R_{ST} distance matrix computed from Y-STR data.

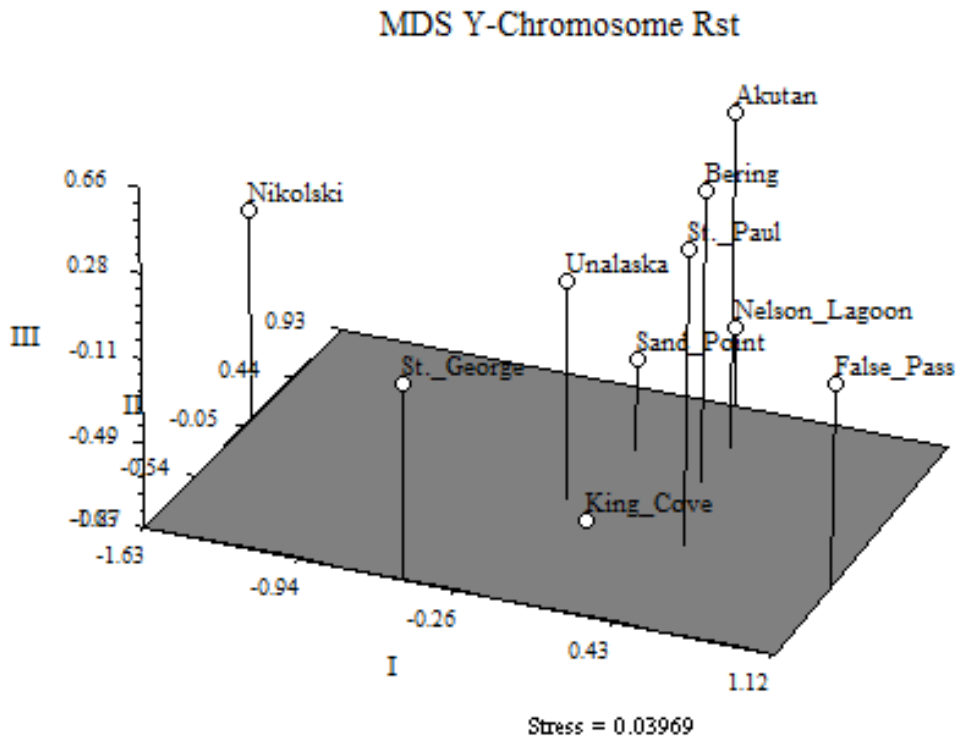

Figure 17. Three-dimensional MDS plot based on a R_{ST} distance matrix computed from Y-STR data.

communities. Bering shared surnames with no other community in this study, and False Pass shared surnames with King Cove. In the expanded sample set (n = 732), Bering shared surnames with the community of Unalaska; False Pass was not nearly as isolated. Unalaska, St. George, and St. Paul cluster together. Akutan is slightly divergent but notably closer to this cluster than the remaining communities. The eastern communities of King Cove and Nelson Lagoon are grouped closely together, with Sand Point in close proximity (Fig 14). Nikolski lies as an intermediate community between east and west. In three dimensions (Fig 15), Bering remains an outlier, and Sand Point differentiates itself as an outlier from the remaining eastern communities. The general trend remains that the eastern communities reside on one side of the plot while the western communities reside on the other side.

Multidimensional scaling based on an R_{ST} distance matrix from Y-STR data shows Nikolski and St. George to be the most divergent group in two-dimensional space, while False Pass and Nelson Lagoon also appear to be outliers. Unalaska, King Cove, and St. Paul aggregate in close proximity to a cluster between Sand Point, Bering and Akutan (Fig 16). A three-dimensional MDS plot further defines these data, describing Nikolski, St. George, and False Pass as clear outliers. In three-dimensional space, Akutan and Bering, group more closely with St. Paul, while Sand Point is closer to Nelson Lagoon and Unalaska. King Cove is closest to Unalaska and Sand Point (Fig 17).

These results reveal an interesting contrast between surnames and NRY-haplogroups. According to Y-chromosome markers, Nikolski, False Pass, and St. George are the most significant outliers. Bering clusters with Sand Point and Akutan, and Unalaska clusters with King Cove and St. Paul. Surnames do not follow this trend, however. Instead, Bering is the biggest outlier. Sand Point is also a significant outlier, with the remaining data clustering

geographically as eastern or western communities. This is a trend that is not followed in the NRY data.

Mantel Test

A Mantel test showed a non-significant negative correlation between matrices based on Y-chromosome and surname data (Lasker's R_{ib}) (r = -0.0132; P = 0.436). This is a surprising result, because a stronger correlation was expected between these two paternally inherited markers. A non-significant correlation (r = 0.470; P = 0.104) was found between Lasker's R_{ib} and geography; however, this correlation was found to be significant in the expanded sample set (r = 0.471; P = 0.032). These results are more comparable to the correlation between the maternally inherited mtDNA with geography (r = 0.717; P < 0.001) than Y-chromosome markers with geography (r = -0.149; P = 0.796) (Zlojutro, 2008). A correlation was also observed between distance matrices constructed from Euclidean Distances based on surnames and geography (r = 0.477; P = 0.032). The correlation between Lasker's R_{ib} and Euclidean Distance was 0.881 (P = 0.016). Lasker's D was found to have a non-significant negative correlation with geography (r = -0.449; P = 0.788). This is comparable to its relationship with both Lasker's R_{ib} (r = -0.409; P = 0.937) and Euclidean Distance (r = -0.423; P = 0.969). A mantel test run between Lasker's R_{ib} and an F_{st} distance matrix from mtDNA data resulted in a non-significant correlation of 0.388 (P = 0.150).

Chapter 6: Discussion

Unlike the findings of Sykes and Irven (2000) and Hill *et al.* (2000), this research found that despite the fact that both systems are transmitted paternally between generations Aleut surnames and their ethnic origins are not significantly associated with NRY-haplogroups through the use of Mantel tests, multidimensional scaling, frequency distributions, and chi-square tests. Mantel tests showed a non-significant negative correlation between surnames and Y-chromosomes, suggesting a lack of association between the two markers. Multidimensional scaling revealed Bering to be a significant outlier when using surname data; however, Bering clusters with Akutan and Sand Point in multidimensional scaling (MDS) plots derived using Y-chromosome markers. Further discordance is evident in the fact that Nelson Lagoon and Nikolski are significant outliers using Y-chromosome data while they are not when using surname data. The lack of concordance between Y-chromosome and surname date, when using MDS and Mantel tests, is likely the result of the cultural inheritance of surname through the baptismal process rather than through biological inheritance. Chi-square tests showed an association between surnames and haplogroups but only when they were compiled as two large groups (non-Russian European total and Russian total) and with the Native American category. When separated into more specific arrangements (Western European, Northern European, and Russian), this association broke down. Admittedly, most surname studies include more samples, so the lack of association between surnames and Y-haplogroups in this study could be due to small sample sizes suggesting that it may not be coincidence that there were significant associations when these groups were aggregated.

Based on the MDS plot for Lasker's R_{ib}, there is evidence for geographic patterning of surnames. Along the first dimension, the eastern communities are separated out from the more

westerly ones, with the exception of Bering Island, which is an outlier. This pattern likely reflects the higher frequency of non-Russian surnames in this region *versus* the higher frequency of Russian surnames in the western communities and in the Pribilof Islands. This is also reflected by a significant Mantel correlation between geography and R_{ib} in the extended sample set including 732 surnames. An equivalent correlation was found between surnames and geography using the subsample of 143 surnames, but it was not statistically significant. The clustering of Unalaska, St Paul, and St. George is probably the result of the Pribilof Islands being established through forced relocation from Unalaska (Black, 2004; Elliott, 1886). Aleuts conscripted from Atka and Attu populated Bering (Rychkov and Sheremetyeva 1972; Lantis, 1984), which is reflected by Bering and Atka's association in MDS plots using the extended sample set.

Surname frequency distribution followed a geographical pattern from east to west with a prevalence of European surnames in the eastern islands and Russian surnames in the west. Russian surnames increase in frequency until they are ultimately fixed in three of the western communities. This is a trend that more closely resembles maternal heritage as shown in mitochondrial DNA studies (Crawford, 2007b; Rubicz, 2007) than those in Y-chromosome studies (Zlojutro, 2008; Zlojutro *et al.*, 2009). Zlojutro *et al.* (2009) found significant genetic (NRY) discontinuity between the western and eastern parts of the Aleutian Island chain, but there was not as clear geographical distribution based on haplogroup frequencies. These results would further indicate that surnames have not been inherited in parallel with Y-chromosomes in the Aleutian Archipelago. Instead, there appears to be a significant cultural aspect to their inheritance, namely the widespread adoption of surnames through baptism.

Most Aleut surnames were obtained through Native baptism into Russian Orthodoxy, not direct paternal inheritance. Those baptized would receive a surname from their Russian sponsors (Black, 1997; Black, 2004). This process negated the transfer of genetic material that generally occurs when an individual receives a surname, creating a discontinuity between the two markers (surname and NRY-haplogroups). Aleuts who obtained surnames through Russian-Native admixture as members of the creole class achieved positions of management and leadership throughout the colony. Numbering close to 2,000 at the time of Alaska's transfer from Russian sovereignty to the United States, this class had been in existence for 46 years, encouraging greater than a generation of Natives to adopt Russian surnames. The class was quickly dissolved after the transfer of power, leaving creoles to find work in a newly hostile environment. Largely because they were labeled as "half-breeds" and "depraved" by military and civilian administrators (Black, 2004; Dall, 1870), many creoles chose to leave Alaska (Black, 2004). The exodus of Aleuts with mixed heritage after the sale of Alaska may further explain the lack of congruity between Russian surnames and Y-chromosomes R1a and N that we find today in the Archipelago. Very simply, creoles with Russian fathers migrated to Russia, taking their Y-chromosomes with them.

After the Russian sale of Alaska in 1867, there was an influx of Scandinavian and Western European fishermen and fur traders. During the late 19th century, these Europeans were encouraged to marry and admix with the native population through policies initiated by the U.S. Treasury Department to control the dwindling population of sea otters in the region. Only individuals married to native women were allowed to hunt fur-bearing animals during this period, and in an effort to take advantage of this regulation, Western European and Scandinavian men actively sought and wedded Native Aleut women (Reedy-Maschner, 2008). This produced

a Y-chromosome signature in the eastern Aleutians, where this marital trend was most common, resulting in elevated frequencies of non-Russian I1a and R1b haplogroups, with the prevalence of R1a and N in the western Aleutian Islands representing remnants of earlier Russian conquest and occupation (Zlojutro *et al.*, 2009).

Using mtDNA sequences and Y chromosome STR data, Rubicz (2007) and Zlojutro (2008) calculated relative reproductive isolation and expansion levels for each native community in the Aleutian Islands by employing gene diversity and neutrality tests. Their findings indicate that Bering Island, St. George, and St. Paul are the most isolated communities in the Aleutian Islands. Of these, Bering was by far the most isolated, followed by St. George and then St. Paul. Rubicz (2007) explained the low genetic diversity levels on Bering Island as a consequence of founder effect from its original settlement and its subsequent closure from other Aleut communities after the sale of Alaska in 1867. Low genetic diversity levels in the other amalgamated communities, St. George and St. Paul, are likely the result of their 19th century founding (Zlojutro 2008). In comparison, the combined results of surname statistics (unbiased isonymy, Karlin-McGregor's *v*, Fisher's α, and Lasker's R_i) suggest that St. George is the most isolated community in the Aleutian Archipelago. This is the result of the high frequency of a single surname (Merculief) on this island. When examining all of the within-group isonymy statistics, Sand Point, Bering, St. Paul, and Unalaska appear to be the least isolated communities. This is in stark contrast to molecular data indicating Bering and St. Paul are more isolated than the majority of Aleut communities. When evaluating surnames between-group statistics (Lasker's R_{ib}, Euclidian Distance, and Lasker's *D*) Bering Island was the most outlying community. However, its within-group diversity suggests that it is one of the least isolated communities. This is the product of Bering having an abundance of surnames while sharing few

with other Aleut communities. The geographic and reproductive isolation of Bering after the sale of Alaska in 1867 is reflected in these findings. Of the remaining populations, Unalaska is the largest community in the Aleutian Islands, and it is a major hub for the Pacific fishing industry, while Sand Point is one of the most eastern communities and has an established majority of European surnames. Therefore, it is not surprising that these communities have high migration rates.

Of the most frequently observed surnames, those found to be specific or associated with communities tended to correspond to the geographical patterning found in the Aleutian Islands. Communities in the eastern Aleutians were found to correspond to Western or Northern European surnames, while western communities were found in association with Russian surnames. For example, Jackson was found to be associated with False Pass, Mack with King Cove, and Gundersen with Sand Point; Merculief was found to be specific to St. George, Lekanof to Unalaska, and Prokopeuf to Atka. Two names were found to be associated with Akutan, which is interesting because one (McGlashan) was Western European and the other (Tcheripanoff) was Russian.

The high frequency of Mack observed on King Cove suggests that an individual or family with this surname settled or gained prominence in its history. It is significant that an individual or family with a Western European surname settled this eastern Aleut community, matching Y-chromosome (Zlojutro, 2008) and historical data (Reedy-Maschner 2008) and indicating that fishermen from Western and Northern Europe contributed a significant amount of paternal admixture to this region during the 19th century. This is also the case for St. George, where the first manager of the Pribilof Islands (Vasilii Petrovich Merkul'iev) was stationed on St. George

Island from 1799 until his death in a baidara accident in 1828 (Black, 2004; Pavlov, 1957). The association of the surname Merculief with the prevalence of a NRY-haplogroup found at high levels in Russia (R1b) (Semino *et al.*, 2000; Semino *et al.*, 2004) on St. George is the strongest argument for a direct association between the two markers in the Aleutians. Merkul'iev, a prominent historical figure on St. George, married an Aleut and resided on the island for a great deal of time. The prevalence of his surname (Merculief) on the island is likely the results of both admixture and baptismal sponsorship.

The most observed surname in each community could probably be explained due to baptism, Russian/Native admixture, or admixture between Natives and European fishermen. Akutan and Atka both have more than one surname recorded as the most observed name in the community. In Akutan, one of these surnames is Russian, while the other is European. Using Monmonier's maximum-difference algorithm, Zlojutro *et al.* (2009) showed that Akutan was an outlier due to its prevalence of haplogroup Q. Akutan is not an outlier in the surname data but instead follows an east to west gradient. All of the prevalent surnames on Atka are Russian. Along with the other western communities, this suggests that Russians heavily influenced the western islands, and would coincide with the findings of Zlojutro *et al.* (2009).

Overall, surname distributions appear to follow a culturally derived path rather than one of biological inheritance in the Aleutian Islands. The majority of Russian surnames occur in the west, while non-Russian surnames are prominent in the east. There is a significant association between non-Russian surnames and non-Russian Y-chromosomes in the Aleutians as a result of recent historical developments (i.e., hunting regulations and the corresponding increase in admixed marriages during the 19th century). Secondly, Native American NRY-haplogroups Q

and Q3 are significantly associated with Russian surnames. Natives adopting Russian surnames through the baptismal process of the Russian Orthodox faith explain this relationship. The lack of a significant association between Russian surnames and the predominantly Russian NRY-haplogroups R1a and N has a more complicated explanation. When creoles were forced out of their prominent role in society after the sale of Russia in 1867, many chose to leave. The paternal lineage of the creole estate would have been composed of individuals characterized by haplogroups found at their highest frequencies in Russia or North America, along with an obligatory Russian surname. By removing these individuals, it is likely that the association between Russian surnames and the predominantly Russian NRY-haplogroups R1a and N was weakened. Combined with Orthodox baptism, this offers an explanation for the lack of an association between these two markers.

Chapter 7: Conclusion

This study analyzed surname diversity and the association of surnames with Y-chromosome haplogroups in eleven native communities in the Aleutian Archipelago in order to complement prior research involving mtDNA and Y-chromosome markers. The association between Y-chromosome haplogroups and surnames was found to be non-significant, and surname measures of isolation and migration were largely inaccurate in comparison with genetic diversity levels using mtDNA and Y-chromosome markers. Using mantel tests, MDS plots, and cross-tabulation and chi-square tests, geographical patterning, comparable to Y-chromosome haplogroups, was observed in surnames, with a non-Russian European surname signature observed in eastern Aleutian communities. A correlation, *not* found between Y-chromosomes and geography, was observed between surnames and geography using mantel tests and frequency maps. Frequency maps exhibited an east-to-west distribution of surnames, with non-Russian European surnames predominant in the east and a gradual increase in Russian surname frequency in each community to the west.

Surnames and NRY-haplogroups were acquired in the Aleutian Islands as a result of Russian colonization and the later sale of Alaska to the United States. During the two and a half centuries since Russian contact, gene flow from outside sources has resulted in a paternal genetic structure where Native haplogroups are the minority, and because Aleuts did not have a formal surname system in place prior to 1741, all of their surnames are from Russian and non-Russian European sources. Russian colonization resulted in an influx of paternal genetic admixture and surnames from Russia and caused a demographic shift (depopulation in the Aleutian and Kodiak Archipelagos). While the sale of Alaska yielded a similar paternal influx, this time from

Western and Northern European fishermen, it also caused the disenfranchisement of people of both Russian and Native decent. In doing so, it removed an established class from its leadership role, returned Natives to subjugation that they had not experienced during the later Russian period, and removed the medical and educational infrastructure that had been put into place through Russian and Native efforts.

Unlike Native acquisition of Y-chromosomes, the majority of surnames were not obtained through direct descent. Instead, they were mainly acquired through Russian Orthodox baptism, which resulted in Natives receiving surnames from their Russian baptismal sponsors. This explains the high levels of Russian surnames as well as the discontinuity between surname and Y-chromosome haplogroup distributions found throughout the region. The creolization of the Aleutians did not widely occur until Emperor Alexander gave the creole estate equivalent rights as the burgher estate in Russia, offering incentive for Natives to marry Russians. During the four and a half decades that followed, an estimated 2,000 creoles amassed in the islands. But this large pool of admixed individuals was diluted when creoles largely chose to leave the region after the benefits of their class were stripped upon the sale of Alaska. The widespread Native adoption of surnames shifted from mainly Russian to non-Russian European sources after 1867 when Western and Northern Europeans began to exploit the region. This process was exacerbated by the U.S. Treasury Department's policy allowing only individuals married to Native women to hunt fur-bearing animals in the Archipelago.

Therefore, NRY-haplogroups and surnames in the Aleutian Islands are associated between non-Russian European markers where they were inherited through direct decent but not between Russian markers where the majority of surnames were acquired through baptism. Widespread adoption of Russian Orthodoxy was the biggest contributing factor to the breach

between these two markers, and it also explains the association between predominantly Native American NRY-haplogroups Q and Q3 with Russian surnames. The surname signature in eastern Aleut communities where non-Russian European surnames are found in abundance along with high levels of NRY-haplogroups R1b, I and I1a are both a direct result of the sale of Alaska and the U.S. Treasury Department's hunting policies during the 19th century.

The use of surnames in this study allowed for an elaboration of the biological implications imposed by culture and demographic events, emphasizing the importance of understanding hereditary trends (i.e., adoption/baptism rates as opposed to admixture) prior to concluding how a population's structure has taken shape. The use of Lasker's coefficient in the Aleutian Islands, yielding similar results as research involving much larger sample sets (i.e., Barrai *et al.* (1996) and Bromberg *et al.* (2009) in Switzerland and Buenos Aires, respectively), demonstrating that this method can be employed in small communities. Further research into Native communities with high levels of European paternal admixture would clarify these findings, indicating whether or not the lack of association found between surnames and Y-chromosome markers in the Aleutian Islands is more universal.

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Date of Visit: _____ Interviewer: _____ Location: _____ Individual Number: _____

Name: _____ Residence: _____ Birth Date: _____ Birth Location: _____ Phone Number _____ Age: ___

Spouse: _____ Birth Date: _____ Birth Location: _____ Aleut?: _____ Residence: _____ Age: _____

Family History:

Relation	Name	Birth Date	Birth Location	Aleut?	Residence	Alive/Dead	Age[1]
Father							
Father's Mother							
Father's Father							
Mother							
Mother's Mother							
Mother's Father							

[1]Current age or age at death

Brothers & Sisters:

Name	M/F	Half Sib?	Birth Date	Birth Location	Aleut?	Residence	Alive/Dead	Age	Mother	Father