



# Ancient DNA evidence for the regional trade of bear paws by Chinese diaspora communities in 19<sup>th</sup>-century western North America

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## ABSTRACT

This study presents the results of ancient DNA (aDNA) analysis of a bear paw bone recovered from the Market Street Chinatown, a 19<sup>th</sup>-century Chinese community in San José, California. This analysis reveals that this bone derived from a Brown Bear (*Ursus arctos*) sharing genetic markers found only in Brown Bear populations living in southwestern Alberta and southeastern British Columbia, Canada. These data indicate regional trade of bear paws in 19<sup>th</sup>-century western North America, and they challenge previous archaeological models of Chinese diaspora food supply that primarily emphasize local and international food sources at the expense of regional trade. These results show that aDNA analysis can make important contributions to understanding the trade of wild animal products such as bear paws. Further, this study demonstrates the potential for historical archaeological analyses to contribute new knowledge about the trade of animals to the understanding of recent, well-documented time periods.

## 1. Introduction

In the last half of the 19th century, nearly 400,000 Chinese people migrated to North America from southern China seeking economic opportunities for themselves and their families (Chan et al., 2001; Hsu, 2000; Takaki, 1998). As with other migrant populations, Chinese diaspora communities localized their food practices in North America through a variety of strategies including importation of animals and preserved animal products from China, adoption of locally available domesticated and wild animal resources, and local production and/or procurement of southern Chinese food animals and prepared food products (e.g., Gust, 1993; Kennedy, 2015). Zooarchaeological data from Chinese diaspora sites reveal large-scale trade networks that connected Chinese communities at home and abroad through the supply of material goods and food. Archaeologists have focused their attention on the wide array of imported foods sourced from China, and commonly recovered archaeological examples include a variety of Asian plant taxa, a limited number of salted seafood products including fish and cuttlefish (*Sepia* spp.), and Chinese softshell turtles (*Pelodiscus sinensis*) (Collins, 1987; Cummings et al., 2014; Kennedy, 2016, 2017; Langenwalter, 1987; Schulz, 2002). Many of these goods were supplied by Hong Kong-based import-export firms known as *jinshanzhuang* (Gold Mountain firms), which, in partnership with affiliated Chinese

merchants in North America, provided Chinese consumers abroad with a wide range of goods shipped from China (Hsu, 2000; Kennedy, 2016; Voss et al., 2018). These same partnerships between *jinshanzhuang* and their merchant partners also facilitated the trade of Chinese-prepared goods from North America back to China, alongside a variety of other services including transporting letters and money to the home villages of Chinese migrants (Hsu, 2000).

Whereas archaeologists have heavily emphasized international trade in the supply of food to Chinese diaspora communities, the regional trade of Chinese-produced or Chinese-sourced food products has received less attention. Archaeologists have investigated a number of Chinese-run, food-based extractive industries in North America, including abalone fisheries in California's Channel Islands (Braje et al., 2007), San Francisco Bay's Chinese shrimp industry (Schulz, 1988; Schulz and Lortie, 1985), fishing villages in Monterey Bay, California (Williams, 2011), and salmon canneries along the Fraser River in British Columbia (Ross, 2013). This body of research highlights the importance of Chinese laborers and entrepreneurs in many of western North America's most important 19<sup>th</sup>-century animal-based industries; however, these projects typically focus on living quarters, work camps, or the remains of equipment at the sites of extraction and processing rather than the distribution of goods procured or produced at these sites. With the exception of limited work on Chinese-run salt fish industries in

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North America (Collins, 1987; Kennedy, 2017; Schulz, 2002), archaeologists have paid little attention to the role of the regional trade of food procured or produced by Chinese diaspora communities *within* North America itself.

A limiting factor in assessing the importance of the regional trade of animal products to North American Chinese diaspora communities is the inability of archaeologists to easily determine the geographic origin of widely available animal taxa. Typically, such determinations hinge on the recovery of animal remains from archaeological contexts outside of a species' historic native range (Crabtree, 1990:169–171; Lubinski and Partlow, 2012). In these cases, the identification of exotic animal remains serves as an indicator of the long-distance trade of animals or animal parts which may have been imported for culinary, medicinal, or other purposes (e.g., Pluskiski, 2004). In the case of Chinese diaspora sites, zooarchaeologists' frequent identification of, and fixation on, imported Asian taxa has inadvertently led to a heavy emphasis on the importance of international trade in the food supply of Chinese diaspora communities. Because many of the wild-caught animals commonly identified at Chinese diaspora sites in North America have broad native ranges (e.g., bears [*Ursus* spp.], deer [*Odocoileus* spp.], rabbits [Leporidae], and ducks and geese [Anatidae]), similar analysis of the role of regional trade has not been feasible for many of the wild-sourced animals eaten in Chinese diaspora communities. Rather, analysis of regional trade networks has been limited to marine taxa with restricted ranges such as fish collected, preserved, and distributed from disparate fisheries in North America (Kennedy, 2017).

Ancient DNA (aDNA) analysis offers a potential path towards resolving the geographic origins of animal products imported from regional sources. This analytical method is not suitable for all taxa, as effectively identifying the geographic origin and subsequent trade of animals through aDNA analysis requires both a robust DNA reference database and taxa-specific genetic markers that are geographically restricted (Haile et al., 2010). These requirements mean that ancient DNA analysis lends itself most readily to the examination of commercially and/or culturally important species that have been the subjects of significant genetic research; examples include domesticated pigs, cattle, and dogs. To date, ancient DNA analysis has not been extensively used in the study of the historical long-distance trade of wild-caught animals (but see Conrad et al., 2018), although the technique is commonly applied to modern animal forensic and conservation efforts (e.g., Ogden and Linacre, 2015; Puckett and Eggert, 2016; Pukk et al., 2016; Signorile et al., 2016; Wasser et al., 2015; Zhang et al., 2015). Given this, aDNA analysis should be suitable for tracing the historical distribution, movement, and trade of many well-studied animals including endangered and threatened species.

Bear paw bones offer a case study for the use of aDNA analysis in tracing the regional trade of North American wild animals in Chinese diaspora contexts. Bear paw bones are regularly recovered in low numbers from Chinese diaspora archaeological sites throughout western North America (Brott, 1982; Gust, 1993; Henry, 2012; Johnson, 2017; Kennedy, 2016; Staski, 1985), and their presence in Chinese diaspora faunal assemblages has been interpreted as evidence of the transplantation of southern Chinese feasting practices (Henry, 2012) and as representative of the increased access to high value ingredients afforded through the process of migration (Kennedy, 2016). Chinese preparations for bear paws included drying, salting, or soaking them in herb mixtures, and they were part of a suite of bear products including soft tissue parts such as gall bladders and livers that were consumed as part of Traditional Chinese Medicine preparations and in feasting contexts (Anderson, 1988:218; Simoons, 1991:433–434). The skeletal elements present in bear paw preparations typically include all bones from the distal phalanges through the lower legs (distal radius/ulna and tibia/fibula, respectively). The bear paw elements recovered from Chinese diaspora archaeological sites in North America are typically identified as unspecified bear (*Ursus* sp. or Ursidae) specimens, owing to a frequent lack of comparative specimens covering taxa from North

America and potential imports from Asia, removal of diagnostic portions of the metapodials during butchery, and general similarities between the elements of members of genus *Ursus*. To date the procurement and trade of bear paws has not been archaeologically studied. The frequent occurrence of bear paw bones at North American Chinese diaspora sites alongside the existence of an extensive DNA reference database generated by conservation-driven genetic research on North American bear populations (e.g., Cronin et al., 2013) presents an opportunity for aDNA analysis to contribute to understandings of both the trade of wild animal food products by 19<sup>th</sup>-century Chinese diaspora communities and broad trends in human-bear interactions in North America.

### 1.1. The Market Street Chinatown

This study provides the first archaeological evidence of the regional trade of bear paws in Chinese diaspora communities by presenting the results of aDNA analysis of a bear paw bone recovered from the Market Street Chinatown, a 19<sup>th</sup>-century urban Chinese community in San José, California. The Market Street Chinatown was founded in 1866 in San José, California, and at its peak it was home to over 1000 permanent residents and served as a “home base” for an additional 2000 to 3000 laborers who returned to it during work breaks and for festivals and holidays (Laffey, 1993; Voss, 2008; Yu, 2001). Historical accounts and an 1884 Sanborn fire insurance map show that the Market Street Chinatown was a dense urban center with businesses including grocery stores, restaurants, butchers, a fish market, pharmacies, medical practices, and small-scale manufacturers of commercial goods (Laffey, 1993; Voss, 2005:430; Yu, 2001). The proximity of the Market Street Chinatown to San Francisco, with its large Chinese community and strong connections to Hong Kong-based *jinshanzhuang*, ensured a reliable supply of both internationally- and regionally-sourced imported trade goods. Like other large Chinese diaspora communities of the time, the Market Street Chinatown served both as a home and as protection for its residents against growing anti-Chinese sentiment in the late 19th century (Baxter, 2008); however, violence directly impacted the community when the Market Street Chinatown was burned to the ground in May of 1887 in an arson fire (Yu, 2001). Despite claims that “Chinatown is dead. It is dead forever” (San Jose Daily Herald, 1887; Yu, 2001:30), San José's Chinese community rebuilt following the fire and formed two new Chinese communities in San José: the Woolen Mills and Heintleville Chinatowns (Allen et al., 2002; Yu, 2001).

The Market Street Chinatown remained undisturbed until an urban development project threatened the site and Chinese descendant community activism ultimately led to its excavation in the early 1980s (Lum, 2007; Voss, 2008). Working under salvage conditions, archaeologists identified and excavated more than 60 pit features containing domestic refuse related to both tenement housing structures and mixed merchant/laborer households (Voss, 2008:42). These excavations recovered tremendous amounts of material culture and faunal remains, although analysis of the assemblage was not possible following excavation and it was placed into long-term curation. In 2002, analysis of the collection began under the auspices of the collaborative Market Street Chinatown Archaeological Project (Lum, 2007; Voss, 2005), and this work has since encompassed several projects examining faunal remains recovered from the site (Clevenger, 2004; Henry, 2012; Kennedy, 2016, 2017). As with other Chinese migrant sites in North America, analysis of the Market Street Chinatown faunal remains reveals food practices centered on domesticated animals including pigs (*Sus scrofa*), cows (*Bos taurus*), and poultry, copious amounts of fish, and a small selection of wild animals including the bears discussed below.

A total of 29 bear bones from four separate archaeological features (Fig. 1) have been identified in the Market Street Chinatown faunal collection. During zooarchaeological analysis, these remains were conservatively classified as Ursidae due to the lack of distinctive

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