REVIEW ARTICLE

A Case for Lice: Using Lice from Archaeological Sites as Proxy Data to Further Understand Human Behaviour

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ABSTRACT
Hair, body, and pubic lice plagued past populations just as much as they do today. These types of lice require a human host to survive, and they thrive in contact-rich and sedentary groups. Lice, especially head lice, are difficult to get rid of without constant attention, which makes them suitable as proxy data for studying human behaviours of the past. By studying lice in the archaeological record, archaeologists can further understand the human experience. For instance, lice, eggs, and delousing combs have been found with human remains in the archaeological record and have been collected, cleaned, and studied, to better understand the lives of past humans. Additionally, body lice can spread diseases and can indicate stressors people endured during life and prior to death, such as overcrowding and illness. Lice studies have also been used to evaluate human cultural behaviours, how people interacted with others, how people lived with lice (if and where delousing activities took place), and how people dealt with ongoing infestations in the past. This article serves to provide a comprehensive overview of the archaeological analysis of lice, the important insights that lice can bring to current understanding of the past, the importance of proper collection, cleaning, and studying of lice, and the ways in which lice in the archaeological record have informed archaeologists about the past.

Keywords: lice, proxy data, lice remedies, delousing combs, nits, pediculus

INTRODUCTION

Head, body, and pubic lice are ectoparasites that survive by drinking the blood of humans and by residing within human hair or on clothing (Amanzougaghene et al. 2016). Archaeologically, lice are sometimes found in graves with human remains (Arriaza et al. 2013b, 2014; Mumcuoglu 2008a, 2008b; Naddaf 2018), in hearths (Forbes, Dussault, and Bain 2013), in textiles (Mumcuoglu et al. 2003; Araujo et al. 2000; Amanzougaghene et al. 2016; Marcondes and Linardi 2017), and in shelters people used (Amanzougaghene et al. 2016, Mumcuoglu et al. 2003; Mumcuoglu 2008a, 2008b; Mumcuoglu and Gunneweg 2012). Previous research demonstrates that studying lice in the archaeological record adds significant interpretive value when lice are present and preserved alongside human remains to understand living conditions and mortuary practices of past human populations, and to provide insights into how cultures may have viewed these parasites.

This review article provides a comprehensive overview of the archaeological analysis of lice and the important insights that lice can bring to our understanding of the past. First, I provide information about eggs (also known as nits), lice, and delousing combs found with human remains. I will then discuss how lice are

collected, cleaned, and studied in the archaeological discipline. Next, I explain how studying lice can reveal aspects of the lives of past humans. This paper concludes with examinations of lice in a variety of archaeological sites to demonstrate that lice are a valuable form of proxy data that should be examined when they are present.

LICE: A BACKGROUND

There are approximately 530 types of known lice species of which only P. humanus capitus (head lice), P. humanus (body lice), and P. pubis (pubic lice) plague humans (Marcondes and Linardi 2017; Naddaf 2018). Head, body, and pubic lice live in human hair, in clothing, and in the genital regions respectively (Araujo et al. 2000). Lice are obligate hematophagy ectoparasites, meaning they must drink the blood of a host to survive (Arriaza et al. 2013a; Mumcuoglu 2008a) and cannot survive for more than twenty-four to forty-eight hours without a host (Naddaf 2018; Nutanson, Steen, and Schwartz 2007). Lice can live in an anoxic environment for up to 12 hours (Candy et al. 2018) and can also be submerged in water for up to 36 hours by closing their spiracles and slowing their metabolism (Arriaza et al. 2013b; Candy et al. 2018). Human lice are small (approximately 800 micrometers in length), wingless, and cannot jump, thus requiring the use of specialized claws on each of their six legs to maneuver between strands of hair (Mumcuoglu and Hadas 2011; Naddaf 2018; Nutanson, Steen, and Schwartz 2007). They can vary slightly in colour from brown, to grey, to white, and can even appear translucent (Boutellis, Abi-Rached, and Raoult 2014). There is also clear sexual dimorphism between females and males (Arriaza et al. 2013a; Nunez et al. 2017).

Lice have three life stages: the nit (egg) stage (Figure 1), the nymph stage, and the adult stage (Figure 2) (Arriaza et al. 2013a). Nits embryonate within five to ten days then mature through three nymphal stages over a six to nine day period before becoming adults (Arriaza et al. 2013a). A female head louse will begin to lay nits a day after mating and will lay approximately five nits every twenty-four hours (Arriaza et al. 2013a). This reproductive cycle enables a potential yield of up to 140 nits in the female head louse's lifespan (Arriaza et al. 2013a; Gill and Owsley 1985). In contrast, a female body louse has the potential to lay up to three hundred nits in her lifetime (Nutanson, Steen, and Schwartz 2007).

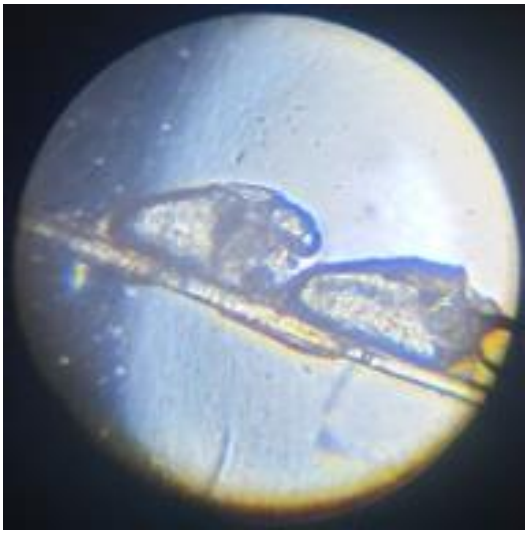

FIGURE 1—*Two nits attached to single hair shaft under a microscope. Photo taken by author.*

FIGURE 2 —*Adult louse under microscope. Photo taken by author.*

The nits of head lice are secured to the hair between 0.5 cm and 0.75 cm from the scalp (Gill and Owsley 1985) depending on environmental temperature (Arriaza et al. 2013a). In warm weather, female lice will lay multiple eggs on a single hair while in colder weather, they will lay their eggs closer to the scalp and only one egg per strand of hair (Arriaza et al. 2013a). The nits are secured by a keratinous substrate called cementum (Arriaza et al. 2013a) (Figure 3). Unlike head lice, body lice lay their nits within the seams and fibers of clothing (Araujo et al. 2000; Marcondes and Linardi 2017). After a head louse has hatched, both the cementum and the nit remain attached to the hair strand (Arriaza et al. 2013b). All forms of human lice must consume blood within 24 hours of hatching to survive (Arriaza et al. 2013a; Nutanson, Steen, and Schwartz 2007).

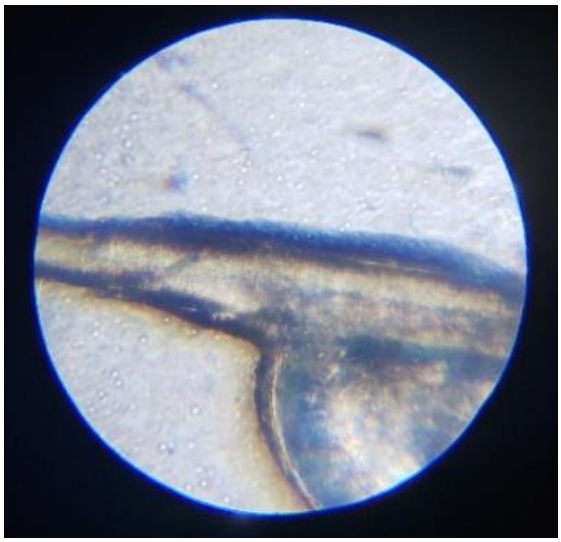

FIGURE 3—*Cementum attaching egg to hair shaft under a microscope. Photo taken by author.*

Lice must feed five times a day and are adapted to pierce the skin and drink the blood of the host (Boutellis, Abi-Rached, and Raoult 2014; Nutanson, Steen, and Schwartz 2007). When lice bite, they inject the skin with biologically active proteins including an anticoagulant and an anaesthetic, which causes intense itching in 14% to 36% of the host population (Boutellis, Abi-Rached, and Raoult 2014; Meister and Ochsendorf 2016). A head lice rash—a condition characterized by swollen lymph nodes located in the neck region and hair that is encrusted and stuck together—may also occur from scratching and this rash may lead to secondary infections such as Staphylococcus aureus (Meister and Ochsendorf 2016). Aside from itching and the potential infections scratching can cause, body lice are the only type of human lice that transmit life-threatening diseases such as epidemic typhus, relapsing fever, trench fever, and plague caused by Yersinia pestis (Amanzougaghene et al. 2016; Argenbright 2008; Boutellis, Abi-Rached, and Raoult 2014; Marcondes and Linardi 2017; Naddaf 2018).

LICE IN HUMAN POPULATIONS: MECHANISMS OF TRANSMISSION AND IMPLICATIONS OF INFESTATIONS

Lice are unable to fly or jump. The only way they can transfer hosts is via shared head coverings, other items of clothing, or by transferring to the scalp of individuals in close proximity by maneuvering between strands of hair (Arriaza et al. 2013b; Boutellis, Abi-Rached, and Raoult 2014; Mumcuoglu and Hadas 2011; Naddaf 2018; Nutanson, Steen, and Schwartz 2007). Therefore, hosts with long loose hair may be more prone to a lice infestation (Arriaza et al. 2013a, 2013b, 2014). Lice thrive in large, highly aggregated human populations that are contact-rich, sedentary, and are comprised of extended social networks that allow lice to maneuver freely between hosts (Arriaza et al. 2013b). Thus, hosts living under these conditions create the opportunity for high rates of transmissions and infestations (Arriaza et al. 2013a, 2013b, 2014).

The process of removing head lice has been seen as a social action worldwide as lice are mainly removed via picking them out of hair (Arriaza et al. 2013b, 2014; Gill and

Owsley 1985). Physically removing nits and lice was the only way to control an infestation especially prior to the advent of delousing combs in the western hemisphere at least 2400 years B.P. and in the eastern hemisphere between 13,950 to 11,950 years B.P. (Arriaza et al. 2014; Mumcuoglu et al. 2003). However, removing lice is a time consuming and laborious task that tends to require help from others. Being unable to remove nits daily could result in out-of-control infestations (Gill and Owsley 1985).

Head lice are widely seen today as endemic across the world and do not discriminate between cleanliness and socioeconomic status (Forbes, Dussault, and Bain 2013), nor are they geographically distinct or confined to one specific region (Nunez et al. 2017). That being said, body lice are often associated with high stress and poor hygiene that comes from overcrowding, war, poverty, or homelessness (Boutellis, Abi-Rached, and Raoult 2014; Marcondes and Linardi 2017; Naddaf 2018; Nutanson, Steen, and Schwartz 2007), while pubic lice are often transferred through sexual contact (Kenward 1999). Body lice live in the armpit, groin, waistline, and collar area of the host's clothing (Argenbright 2008; Naddaf 2018; Nutanson, Steen, and Schwartz 2007).

The health repercussions of lice extend beyond the organisms themselves. As was mentioned previously, body lice are possible vectors for epidemic typhus, relapsing fever, trench fever, and plague (Yersinia pestis) (Amanzougaghene et al. 2016; Argenbright 2008; Boutellis, Abi-Rached, and Raoult 2014; Marcondes and Linardi 2017; Naddaf 2018). Body lice created an epidemic typhus outbreak which posed a significant problem in both World Wars and in the Soviet Union in 1918 to 1922 during the civil war, due to infected people and body lice traveling by rail (Argenbright 2008; Marcondes and Linardi 2017). Understanding body lice transmission and the stressors they cause may give bioarchaeologists a more in depth understanding of the stressors people endured during life and prior to death, such as overcrowding and illness.

LICE IN THE ARCHAEOLOGICAL RECORD: PRESERVATION AND ANALYTICAL METHODS

Preservation

Lice have been found in archaeological sites worldwide, though they are incredibly small and only preserve in areas with optimal conditions (Forbes, Dussault, and Bain 2013). To survive in the archaeological record, lice require preservation conditions such as waterlogged, arid, anoxic, or frozen environments (Forbes, Dussault, and Bain 2013). When present in the archaeological record, lice are found attached to strands of hair, beside human remains (having fallen off or detached from the hair before the death of the louse), and in the tines of teeth on delousing combs found within graves (Arriaza et al. 2013b, 2014; Mumcuoglu 2008b). Lice have also been found in hearths, the entrances of homes (Forbes, Dussault, and Bain 2013), and in coprolites (Arriaza et al. 2012; Mumcuoglu 2008a).

Even if present, there is a high chance that lice could be lost during the excavation process of a site, when human remains are transferred from the site (Arriaza et al. 2013b), or when stored or transferred from museum collections (Arriaza et al. 2013a). There is also the possibility that many archaeologists do not look for lice during excavations. In sum, there is an inherent bias in the nature of the archaeological record itself and the processes of archaeological excavation and curation that may collectively curtail the preservation and study of archaeological lice remains.

Methods for Counting and Analysing Lice Preservation

When studying lice, there are a variety of tests that can be performed. At the macroscopic level, archaeologists can observe and count the number of lice and nits present on

scalps of human remains to infer the potential severity of an infestation (Arriaza et al. 2013b). As nits are approximately eight hundred micrometers (μm) in length, scanning electron microscopy (SEM) can be used to identify morphological details of mummified nits and embryos (Arriaza et al. 2013b). SEM can highlight the fragility of nits and head lice while demonstrating the strength of the cementum even after thousands of years (Arriaza et al. 2013b). As cementum withstands nit picking, grooming, and washing, archaeologists could use SEM to re-evaluate mummies that were deemed nit free (Arriaza et al. 2013b). Mummies that are lice free will not have cementum present on the hair shaft; however, the cementum will be present if nits were removed (Arriaza et al. 2013b). By evaluating the presence of cementum, archaeologists may be able to infer whether populations were able to get rid of infestations or if populations simply removed all lice and nits prior to burial (Arriaza et al. 2013b). This creates the ability to study how effective different social groups were at controlling infestations and the risks that those living in poverty may have faced (Arriaza et al. 2013b).

The cleanliness of the head affects counting and the collection of lice as there is often sediment intermingled in the hair (Arriaza et al. 2012). The counting of head lice is done by physically counting all the lice and nits that appear in a 2 cm by 2 cm area on the head of a deceased individual (Arriaza et al. 2013b, Reinhard and Buikstra 2003). This is done by taking a 2 cm by 2 cm cardboard cut out and placing the cut out 1 cm from the scalp, usually around the temporal or parietal regions (Arriaza et al. 2013b; Reinhard and Buikstra 2003). The lice and eggs that are present within this square are counted and estimates for the whole head are based on these counts (Arriaza et al. 2013b; Reinhard and Buikstra 2003). Multiple counts are necessary because sediment present in the count may be miscounted as lice, or lice may be missed in the initial count, which often causes collection and counting to be a painstaking task (Arriaza et al. 2012). Lice can be cleaned by rinsing them in distilled water twice for up to fifteen minutes (Amanzougaghene et al. 2016). Cleaning and rehydrating the lice may be required before performing any nuclear DNA, or mitochondrial DNA tests (Amanzougaghene et al. 2016). SEM testing can be performed on lice with uncoated, non-rehydrated samples of both lice and eggs (Arriaza et al. 2013a).

ARCHAEOLOGICAL INTERPRETATIONS FROM LICE

Although there are many problems in finding, collecting, cleaning, and testing lice, they are still worth studying when found. Unhatched nits can provide archaeologists with an estimate for a potential infection (Arriaza et al. 2013b) as can the sex of lice, since females help predict future infestations (Arriaza et al. 2012). Lice can also be used to evaluate human cultural behaviours. Understanding lice transmission and the relationship between lice and human behaviours is useful in assisting archaeologists in understanding how a past society may have interacted with others, how close people lived together, and how clean or sedentary a group was (see also, Gill and Owsley 1985; Arriaza et al. 2013a, 2013b, 2014; Forbes, Dussault, and Bain 2013). Through studying lice, we may be able to develop a broader picture of how a past society was constructed or determine a particular season that a site was inhabited. We may also develop a better understanding of how people dealt with ongoing infestations in the past.

Interpreting Living Conditions

People have developed a multitude of ways to deal with lice including preventative measures as well as treatment methods. These methods vary depending on the time, the place, and the culture in question. Not all people saw lice as a nuisance and not all people actively sought to dispose of the infestations (Arriaza et

al. 2013b). However, other populations have picked the lice out of the hair (Arriaza et al. 2013b, 2014; Gill and Owsley 1985), used herbal remedies (Mumcuoglu and Hadas 2011), and developed delousing combs (Arriaza et al. 2014; Mumcuoglu 2008b; Mumcuoglu and Gunneweg 2012; Mumcuoglu and Hadas 2011) to eradicate infestations. Some populations have also disposed of lice by eating them and by throwing them into hearths or entranceways (Forbes, Dussault, and Bain 2013). The following sub-sections highlight several of these diverse cultural approaches of coping with and treating lice infestations as discovered archaeologically.

Case Study: The Chinchorro

The Chinchorro population, who occupied northern Chile and Southern Peru from 11,950 B.P. to 3450 B.P., had long hair, lived close together, and did not remove lice from their hair, which resulted in a high prevalence of head lice (Arriaza et al. 2013b). Although they did not remove lice, children may have had lice removed from their heads as they do have lower rates of head lice (Arriaza et al. 2013b). However, since the prevalence of lice infestations were so high and there is no evidence for delousing combs, this population may have even seen head lice as normal and not as an infestation (Arriaza et al. 2013b). As mummifying technology progressed, wigs began to be made from human hair and took the place of the deceased's natural hair (Arriaza et al. 2013b). Arriaza et al. (2013b) note that even young children had these elaborate wigs, suggesting that wigs were made from the hair of others and not just the hair of the deceased as young children would not have enough hair to create wigs of this length out of their own hair. When mortuary wigs were being utilized, there appears to be a decrease in nits and lice population, yet cementum was still present. The presence of cementum without nits and lice suggests that the nits and lice were being removed after death due to a desire to not have them in the afterlife (Arriaza et al. 2013b). Lice are useful archaeologically as they can help archaeologists infer how people would have viewed lice and how these views may change over time.

Case Study: The Chiribaya People

The Chiribaya people lived between 950 and 700 B.P. along the coast of what is now Peru and Chile (Reinhard and Buikstra 2003). In the 1990s, mummies found at the archaeological sites of El Yaral, Algodonal, and Chiribaya Alta were examined for the presence of head lice (Reinhard and Buikstra 2003; Reinhard and Camacho 2019). It was determined that Chiribaya Alta was an administrative center along the coast that overlooked arable farmlands, while El Yaral was further inland and at a higher elevation (Reinhard and Camacho 2019). Mummies found at Algodonal were mostly immigrants and farmers who were economically poor and were considered a relatively destitute subpopulation (Reinhard and Camacho 2019).

Through studying head lice on the mummies found at these three sites, Reinhard and Buikstra (2003) were able to show that lice prevalence rate was 18% at El Yaral, 36% at Chiribaya Alta, and 71% at Algodonal. Algodonal had the highest rate of infestation. These infestations may have been increased due to the poorer economic status that resulted in overcrowding and a lack of hygienic practices while Chiribaya Alta only experienced a moderate infestation rate due to overcrowding (Reinhard and Buikstra 2003). Delousing combs were found within graves at Chiribaya Alta showing that this group had the technology to remove head lice, which may be why prevalence was lower at this site compared to Algodonal (Reinhard and Buikstra 2003). El Yaral experienced the lowest infestation rates as the population was not as dense as the population at Chiribaya Alta (Reinhard and Buikstra 2003).

Evaluating the head lice infestation at Chiribaya Alta showed that head lice prevalence varied according to age and sex, with children having the least amount of infestation and men having the highest (Reinhard and Buikstra 2003; Reinhard and Camacho 2019). Reinhard and Buikstra (2003) suggest that the reason children had less head lice may have been due to their lack of involvement in social settings such as schools or childcare settings unlike that of modern-day children. Men at Chiribaya Alta used head coverings and had long hair that was styled into elaborate hairstyles (Reinhard and Buikstra 2003; Reinhard and Camacho 2019). These hair styles resulted in a lack of nit picking for several days, which led to men having higher infestations than the women who wore their hair in simple braids (Arriaza et al. 2014; Reinhard and Buikstra 2003; Reinhard and Camacho 2019). Archaeologists can also infer how this prevalence varied both between and within groups, and why the prevalence may have varied.

Case Study: The Pitchfork Mummy

The Pitchfork Mummy was one of two bodies excavated at the Pitchfork Rock Shelter in northwestern Wyoming (Gill and Owsley 1985). The skull of one of these mummies was missing and the second mummy had no preserved hair strands from the frontal, parietal, or temporal regions although they did have hair present from the occipital region (Gill and Owsley 1985). It should be noted that when a host has long hair, the frontal region of the skull is not a preferred spot for lice to lay their eggs rather, lice will lay their eggs in the temporal region and the nape of the neck (Gill and Owsley 1985). Even with parts of the skull missing, this second mummy had a high prevalence of head lice located in the hair strands from the occipital region (Gill and Owsley 1985). The high prevalence of head lice was used to infer that the second mummy may have experienced social unrest and long-term isolation prior to death and may have been a warrior or had renegade status (Gill and Owsley 1985). The Pitchfork Mummy had nits ranging from 0.5 cm to 9 cm from the scalp with as many as four to eight nits present on some individual hair strands (Gill and Owsley 1985). As hair grows an average of 0.3 mm a day and a female louse typically lays eggs between 0.5 cm and 0.75 cm from the scalp, we can infer that the Pitchfork Mummy had lice for a period of around three hundred days leading up to his death (Gill and Owsley 1985).

The removal of lice is a social activity, usually performed by close kin (Arriaza et al. 2014), as it is incredibly difficult to remove lice effectively from one's own head. When lice are not regularly removed from one's head, the infestation can worsen as mentioned above with both the Chinchorro and the Chiribaya cultures. However, for those who did not have the means to remove lice from their own heads, they too experienced a worsened infestation as seen in the Pitchfork Mummy. If an individual with lice is removed from their social group, they will inevitably see an increase in head lice population (Gill and Owsley 1985). Archaeologists can examine lice infestations to better understand the importance of social groups in treating lice infestations and how long someone may have been away from their social group (Gill and Owsley 1985).

Remedies

There are a variety of remedies past populations have developed to deal with lice. Herbal remedies developed around the world have helped to reduce infestations. Remedies for disposing of lice include using soda scum and bryony (a climbing flowering plant that produces fruit), oil and vinegar, viper broth, acre seeds, Delphinium, quicksilver, oil of roses, cresol powder, naphthalene, sulfur, mercury powder, and even kerosene (Mumcuoglu and Hadas 2011).

Delousing combs are the oldest remedial therapy, having been used in the western

hemisphere at least 2400 years B.P. and in the eastern hemisphere between 13,950 to 11,950 years B.P. (Arriaza et al. 2014; Mumcuoglu et al. 2003). These combs are one of the best remedial therapies for getting rid of head lice and are still in use (Arriaza et al. 2014). Although delousing combs vary slightly in shape and style, they are effective tools for removing all stages of head lice (Figure 4) (Mumcuoglu 2008b). The basic style varies between single-sided delousing combs (Figure 5) and double-sided delousing combs (Mumcuoglu 2008b; Mumcuoglu and Gunneweg 2012). These combs are easy to grip and there is an extra labour cost associated with making dense combs suggesting that they were deliberately made for delousing (Arriaza et al. 2014). The tightly bound tines would have only been good for delousing and not for simply brushing hair (Arriaza et al. 2014). SEM examinations also ruled out the use of these combs for secondary functions such as that of textile manufacturing (Arriaza et al. 2014).

FIGURE 4—*Modern-day delousing comb with eggs and nits in teeth. Photo taken by author.*

FIGURE 5—*A modern day, single-sided delousing comb. Photo taken by author.*

Double-sided delousing combs had teeth with larger spaces on one side for detangling hair and tightly packed tines on the other side that were effective for lice removal (Arriaza et al. 2014; Mumcuoglu 2008b; Mumcuoglu and Gunneweg 2012). As high numbers of lice on the tines of tightly packed delousing combs indicated, these were effective delousing instruments that are still used today (Mumcuoglu 2008b). Overall, wood is considered to be the most popular material used to make delousing combs (Arriaza et al. 2014; Mumcuoglu 2008b; Mumcuoglu and Hadas 2011), yet delousing combs were also made of bone, ivory (Arriaza et al. 2014; Mumcuoglu 2008b), and precious metals such as silver, which were rare yet used by Indian aristocracy (Mumcuoglu 2008b). In the eastern hemisphere, delousing combs have been found in royal tombs dating to Pharaonic Egypt (Mumcuoglu 2008b; Mumcuoglu and Gunneweg 2012; Mumcuoglu and Hadas 2011), in Masada dating to the first revolt (1884 to 1876 B.P.) (Mumcuoglu et al. 2003; Mumcuoglu and Gunneweg 2012), and in caves such as the Christmas Cave in the Delta

of Wadi Kedron near the Old City of Jerusalem 2100 to 1900 years B.P. (Mumcuoglu 2010). In the western hemisphere, delousing combs have been found in ancient burials along coastal and inland Chilean sites (Arriaza et al. 2014). These combs were used in life as well as included as grave goods (Arriaza et al. 2014).

Delousing combs are the oldest remedial therapy, are found worldwide and are effective tools for removing head lice (Arriaza et al. 2014: Mumcuoglu 2008b; Mumcuoglu et al. 2003). These combs were a cultural response to an endemic and persistent problem. Delousing combs were usually locally made from raw materials native to the area and were manufactured for lice control independent of secondary uses (Arriaza et al. 2014). By studying lice remedies, archaeologists can further understand what treatments were used to treat lice and how effective these treatments were. This understanding adds another layer of complexity to our understanding of the people we study.

Disposal

Picking lice out of hair is one way of removing head lice, but once they are removed, they need to be discarded. People have crushed them between teeth (Gill and Owsley 1985), eaten them, as evidenced in coprolites (Gill and Owsley 1985; Mumcuoglu 2008a), or tossed them in hearths and in entrance ways (Forbes, Dussault, and Bain 2013). Taxation was also a way of remedying head lice (Arriaza et al. 2014). The elite class of the Incans, during the Late Horizon Period (474 to 407 B.P.) encouraged the poorer populations to pay their taxes with live head lice as a way of keeping the lice population down, while also getting people to provide something that they had produced (Arriaza et al. 2014). By studying how lice was disposed of, archaeologists can make inferences on how people removed lice, used lice, and, in turn, how different cultures may have viewed infestations.

CONCLUSION

Lice have been the companions of humans throughout the ages, surviving in human hair and clothing (Araujo et al. 2000). The close proximity of lice to humans and the impact of lice on their hosts make them valuable proxy data when they are found. By studying lice, researchers have the potential to add a layer of complexity to the people and societies that they study including class, social interactions, their hygienic customs, and even funeral practices. Lice can inform archaeological interpretations by providing insight into the lives of nomadic people (Arriaza et al. 2013b), or if people lived under crowded or high stress conditions (Boutellis, Abi-Rached, and Raoult 2014; Marcondes and Linardi 2017; Naddaf 2018; Nutanson, Steen, and Schwartz 2007), and may also tell archaeologists about the grooming practices of people in the past (Arriaza et al. 2013b, 2014; Reinhard and Buikstra 2003; Reinhard and Camacho 2019). Humans have developed numerous ways of living with and exterminating lice such as picking nits and lice from the hair (Arriaza et al. 2013b, 2014; Gill and Owsley 1985), using a plethora of remedies such as oil and vinegar, viper broth, or sulfur to kill or prevent infestations (Mumcuoglu and Hadas 2011), and have also developed technologies such as delousing combs to combat infestations more effectively (Arriaza et al. 2014; Mumcuoglu 2008b; Mumcuoglu and Gunneweg 2012; Mumcuoglu and Hadas 2011).

Managing lice is a highly social activity, which has been viewed and treated differently throughout time and around the world (Arriaza et al. 2013b, 2014; Gill and Owsley 1985). As a result of different societies dealing with lice and the various records and artifacts uncovered, archaeologists have been able to better understand how people would have interacted within their environments, some stressors they

would have faced, and how people would have responded to the creatures that still plague us today. Lice are a valuable form of proxy data and careful attention should be made when excavating human remains to look for lice so they can be examined to help further understand the people and societies that we study.

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