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Taphonomic considerations on pinworm prevalence in three Ancestral Puebloan latrines

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ABSTRACT

For archaeological studies it is always necessary to consider taphonomic factors that could have influenced in ancient material preservation. Parasite eggs are usually highly degraded in ancient sites dated from all periods of time and taphonomic factors are mentioned to explain absence and low quantity of eggs found. In this study, we compare parasite egg recovery of three Great House latrines: two from Aztec Ruins (Rooms 219 and 225) and one from Salmon Ruins. We compared through statistical regression the recovery of eggs with the abundance of two classes of decomposers: mites and nematodes. These microorganisms have relation with nematode larvae and parasites remains degradation, respectively, mostly in moist environments. Pinworm was the only parasite found in the sites studied. Prevalences were 32.8% at Salmon Ruins, 72.7% at Aztec Ruins Room 225 and 14.3% at Room 219. Egg preservation was considered good at Salmon Ruins and Aztec Ruins Room 225. At Room 219, the eggs were badly preserved and there was a significant statistical correlation with mites (multiple r (18) = 0.64/*P* = *0.002*). This correlation could indicate that mites could be involved in preservation, and consequently that pinworm prevalence in this latrine is underestimated. Abiotic factors such as humidity could have possibly favored the biological relation. Considering the extreme egg degradation at Room 219, it is not possible to strictly compare parasite data with other Ancestral Pueblo sites, even with Room 225, located at the same site. Room 225 prevalence is the highest found in Ancestral Pueblo sites until now. Taphonomic analysis shows that decomposers operated at different levels of severity, despite the latrines' close location.

1. Introduction

Taphonomy was firstly defined by Efremov (1940) as the study of all of aspects involved in the transition of animal remains from the biosphere into the lithosphere. Anthropologists study the degradation of biological remains after they are deposited in archaeological context (Sorg and Haglund, 2002). After the death of any given organism, it becomes a new microenvironment, serving as a food source for several decomposers. The action of these decomposers and the assimilation of the resources provided by the organism deposited in a locale, depend on factors such as climate, humidity, pH, soil, and others that influence the intensity of degradation (Lyman, 2010; Sorg and Haglund, 2002).

The taphonomy of parasite remains in archaeological contexts has been addressed by some authors beginning with Reinhard et al. (1986). In this study, the authors evaluated aspects of sample processing, sediment pH and fungal action in degrading parasite eggs. They found that fungal proliferation can degrade eggshells and embryos, thus compromising parasitological diagnosis in ancient material. More recently, parasite egg taphonomy was addressed in Morrow et al. (2014, 2016) and Rácz et al. (2015) papers. They mentioned specific characteristics of eggs morphologies and environmental conditions that make certain egg types more susceptible to decay than others. The factors they discussed included water saturation of sediments and humidity as main factors that can result in differential egg type preservation, even in samples from the same site (Morrow et al., 2014, 2016; Rácz et al., 2015).

Morrow et al. (2016) define five sets of factors that can destroy parasite eggs: abiotic, contextual, anthropogenic, organismal and ecological. Abiotic refers to temperature, soil, pH, humidity and other non-living factors. Contextual refers to the archaeological material that was analyzed to obtain the parasitological information. Anthropogenic refers to the human manipulation of the parasite source from the moment of its deposition until the collection, transportation and analysis by the researcher. Organismal refers to the individual biological characteristics of each parasite, for example, egg resistance, fecundity and life cycle. Ecological, refers to the decomposer organisms that are part of

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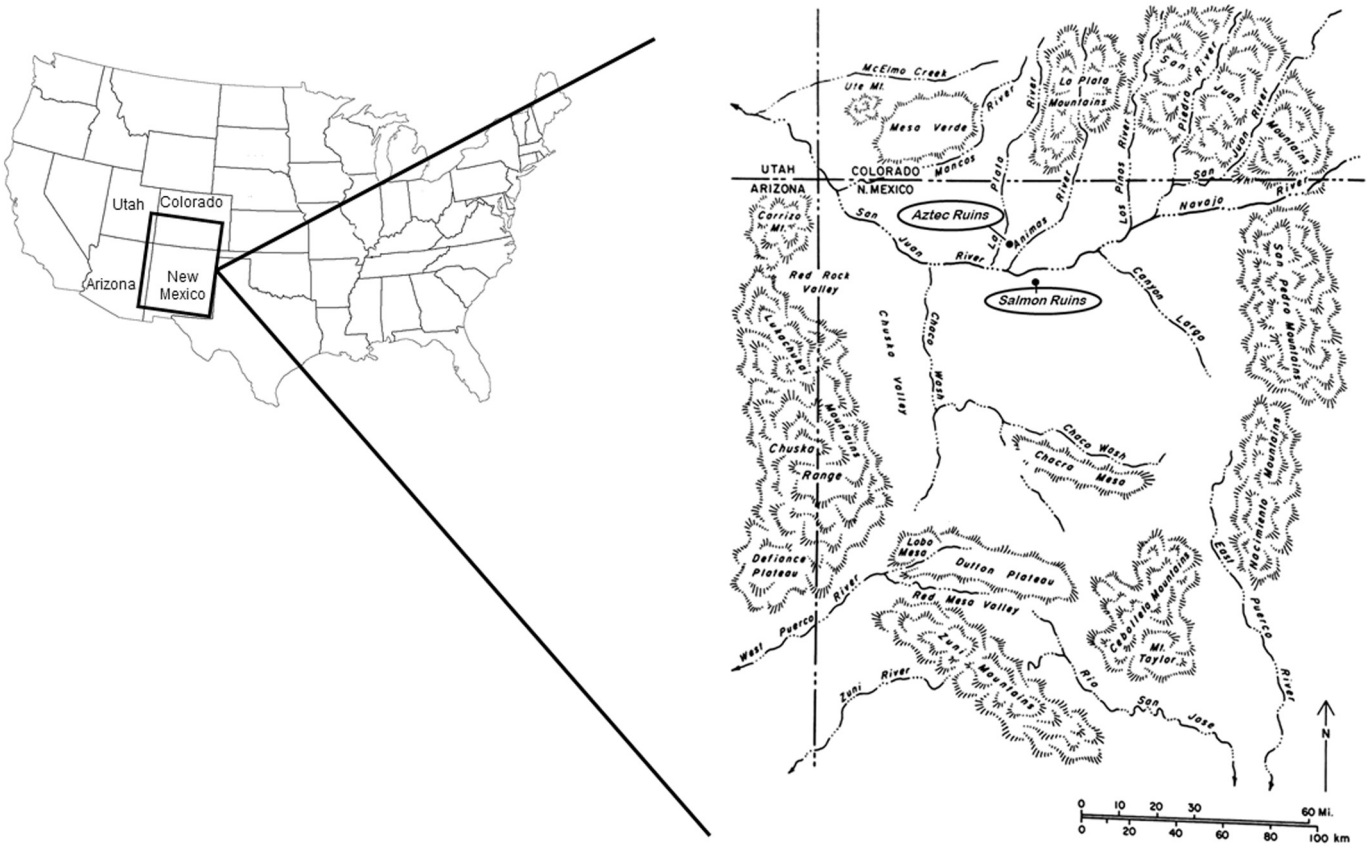

Fig. 1. Geographical location of Aztec Ruins and Salmon Ruins. Modified from Gwinn Vivian (1990).

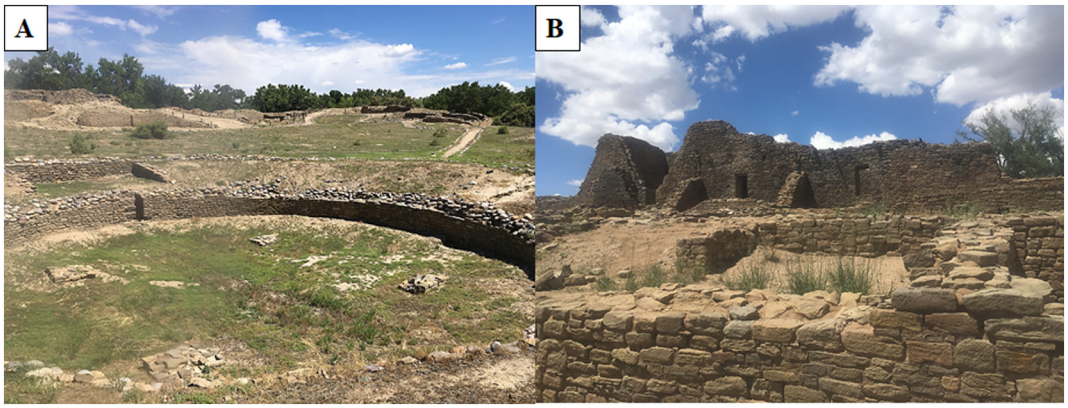

Fig. 2. A and B – A: View of the remaining ruins of Salmon Ruins. B: View of the remaining ruins of Aztec Ruins. Photos: Morgana Camacho.

the environment from which the archaeological material came from.

Ancestral Pueblo archaeological sites exhibit excellent coprolite preservation (Reinhard, 2008; Reinhard and Bryant, 2008). These sites are located in dry environments, recognized as one of the best places to preserve parasite remains (Reinhard et al., 1986). Among the sets defined by Morrow et al. (2016), the Organismal and Ecological conditions are the most relevant to the study in these sites. Organismal conditions to be considered involve the resistance of thick-walled eggs such as whipworm compared to thin-walled eggs such as pinworm (Jaeger and Iñiguez, 2014). Hatched nematode larvae, such as those from hookworms, are most susceptible to decay. Ecological conditions to be considered include decomposer organisms such as free-living nematodes, mites, fungi, bacteria and insects. The taphonomy experience as of 2012 was summarized by Reinhard who wrote: "In our combined experience there is significant decomposition of remains from latrines by fungi and arthropods as described by Reinhard et al. (1986). In contrast, coprolites exhibit the best preservation. Mummies (Reinhard and Urban, 2003) and sediments from sacra (Fugassa et al., 2008) also show excellent preservation of delicate eggs" (Reinhard et al., 2013).

From Ancestral Pueblo sites, coprolites have been recovered from caves and open site latrines (Reinhard, 2008). For many years, researchers have noticed that pinworm eggs from open sites are more poorly preserved than those recovered from caves. This was especially true for Chaco Great House latrines (Reinhard, 1992; Reinhard and Clary, 1986). Mites are arachnids, usually microscopic, that possess mouthparts specialized to the various feeding habits (Roberts et al., 2013a). These are organismal taphonomic factors that are frequently seen in Ancestral Pueblo coprolite samples (Reinhard et al., 2012). Mites have been associated with free-living nematode predation.