

Ten Thousand Years of Head Lice Infection

A. Araújo, L.F. Ferreira, N. Guidon, N. Maues da Serra Freire, K.J. Reinhard and K. Dittmar

How long have lice been parasites of humans? Our discovery of an intact louse egg (Fig. 1) on a hair that is over 10 000 years old pushes the previously reported date back by 8000 years, providing a new insight into the co-evolutionary history of humans and parasites.

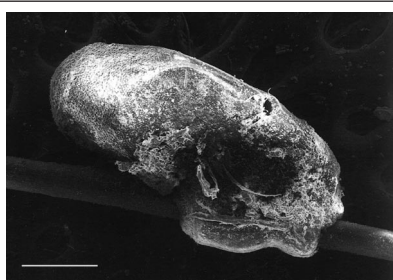


Fig. 1. Photograph of a 10 000-year-old louse egg attached to a strand of human hair. Scale bar \approx 0.26 mm.

'Louse' refers to three human parasites: head lice (*Pediculus humanus*), body lice and crab lice, which inhabit head hair, clothing, and body hair, respectively. Until now, ancient texts¹, mummies² and artifacts¹ have provided evidence of all three forms of ancient lice. *Pediculus humanus* has been found in archaeological sites in southwest USA, the Aleutian Islands, Peru², Greenland³, Mexico⁴ and on mummies of Inca sacrifices⁵.

We discovered the louse egg while analyzing human hair from an archaeological site in northeast Brazil. This egg is not only older than previously reported louse eggs, but is also the first evidence of ancient head lice east of the Andes, indicating that head lice perhaps arrived with the first human colonists that entered the New World. Radiocarbon dates for strata containing other artifacts from the site,

such as stone tools, prehistoric rock art and an unassociated human skeleton, as well as the hair, were 9870 ± 50 years (Beta 109844) and 10640 ± 80 years (Beta 104571), respectively. The egg was identified as *P. humanus* based on morphology and size (\approx 1mm), and the fact that it was attached to human head hair. The short cement base visible in Fig. 1 is also compatible with that of *P. humanus*.

Several authors believe that lice have been associated with humans since our pre-hominid ancestors, and were dispersed throughout the world by early human migrants^{1,4}, a hypothesis supported by our find. Other researchers noted differences between the adults of *Pediculus* from pre-Columbian South and North American Indians⁶. This suggests the evolution of different strains of head lice in different parts of the world⁷. Direct examination of prehistoric louse geographical and temporal isolates will contribute to this discussion. Information about louse epidemiology can also come from the study of ancient lice, eg. studies of lice from large samples of mummies from prehistoric Peru¹ have revealed differences in louse infection between males and females and adults and children due to differences in hair styles and grooming² (Box 1).

It may be that one louse species *Pediculus* (*Parapediculus*) *mjöbergi*, from New World monkeys, evolved from *P. humanus* through past contact between humans and monkeys⁸. Comparative examination of the morphology or DNA of ancient lice and modern-day *P. mjöbergi* will help establish whether this hypothesis is correct.

There is no doubt that future studies of the lice found in Brazil and of lice from other archaeological sites will contribute

to the understanding of the evolutionary and natural history of the louse and its relationship with humans.

This research was funded by CNPq, FIOCRUZ, and Fundação Museu do Homem Americano.

References

- 1 Aufderheide, A.C. and Rodríguez-Martin, C. (1998) *Cambridge Encyclopedia of Human Paleopathology*. Cambridge University Press
- 2 Cockburn, A. et al. (1998) *Mummies, Disease, and Ancient Culture*. Cambridge University Press
- 3 Sadler, J.P. (1990) Records of ectoparasites on humans and sheep from Viking-age deposits in the former western settlement of Greenland. *J. Med. Entomol.* 27, 628–631
- 4 Marsh, D.C. (1964) Pre-Columbian insects from Tamaulipas, Mexico. *Phytoprotection* 45, 134
- 5 Home, P.D. et al. (1984) The prince of el Plomo. *Bull. New York Acad. Med.* 60, 925
- 6 Ewing, H.E. (1924) Lice from human mummies. *Science* 1556, 889–890
- 7 Burgess, I.F. (1995) Human lice and their management. *Adv. Parasitol.* 36, 271–342
- 8 Retana Salazar, A.P. (1994) Filogenia de los piojos (Insecta: Anoplura) de los monos del Viejo Mundo (Catarrhini). *Rev. Biol. Trop.* 42, 633–638
- 9 El-Najjar et al. (1998) Mummies and mummification practices in the southwestern and southeastern United States, in *Mummies, Disease, and Ancient Cultures* (Cockburn, A. et al., eds) pp 121–137. Cambridge University Press
- 10 Fry, G.F. (1977) Analysis of prehistoric coprolites from Utah. *University of Utah Anthropological Papers* 97
- 11 Reinhard, K.J. and Largent, F.B. 1989) Diet and environment determined from analysis of prehistoric coprolites from an archaeological site near Zape Chico, Durango, Mexico. *J. Paleopathol. Monograph* 1, 151–156
- 12 Reinhard, K.J. (1990) Archaeoparasitology in North America. *Am. J. Phys. Anthropol.* 82, 145–162
- 13 Araújo, A. et al. (1997) Paleoparasitology of oxyuriasis. *Anais da Academia Nacional de Medicina* 157, 20–24
- 14 Hugot, J.P. (1999) Human enterobiasis and evolution: origin, specificity and transmission. *Parasite* 6, 106–112

Adauto Araújo and Luiz Fernando Ferreira are at the Fundação Oswaldo Cruz, Escola Nacional de Saúde Pública, Rua Leopoldo Bulhões 1480, 21041-210, Rio de Janeiro, RJ, Brazil. Niéde Guidon is at the Fundação Museu do Homem Americano, Rua Abdias Neves, 551 64770-000, São Raimundo Nonato, PI, Brazil. Nicolau Maues da Serra Freire is at the Fundação Oswaldo Cruz, Instituto Oswaldo Cruz, Departamento de Entomologia, Av. Brasil, 4365, 21045-900, Rio de Janeiro, RJ, Brazil. **Karl J. Reinhard** is at the School of Natural Resource Sciences, University of Nebraska-Lincoln, Lincoln, NE 68588-0368, USA. Katharina Dittmar is at the Institut für Parasitologie, Veterinärmedizinische Fakultät, Universität Leipzig, Magarethe Blank Str. 4, Leipzig, Germany. **Tel: +1 402 472 6858, Fax: +1 402 472 9642, e-mail: kreinhard1@unl.edu**

Box 1. Prehistoric Control of Lice in the New World

As in human populations today, lice were a common problem for prehistoric cultures. Lice have been found in hunter-gatherer and agricultural sites in the USA (Great Basin of Utah and surrounding states and the Colorado Plateau) and from central Mexico⁹. The prehistoric peoples in these areas appeared to control the lice by eating lice groomed from hair (a common method of louse control among tribal cultures¹⁰, even today) as adult lice have been found deep in the matrix of coprolites^{10,11}.

House style appears to have been another cultural aspect to controlling louse infection. The crowded, warm, subterranean houses of prehistoric Eskimos and Aleuts, and the development of prehistoric 'apartment-like' housing among southwestern Anasazi peoples provided ideal conditions for increased louse infections (as well as pinworms)^{12–14} and controlling lice depended on mutual grooming and sweat baths. By contrast, the open and nomadic habits of prehistoric Southwestern and Great Basin hunters and gatherers kept these populations relatively louse free¹².