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Enterobius vermicularis: 10,000-Year-Old Human Infection

Abstract. *Eggs of* Enterobius vermicularis *(human pinworm) were found in human coprolites from Hogup and Danger Caves, western Utah. The caves were inhabitated by man from 10,000 B.C. to A.D. 1400. The oldest coprolite containing* E. vermicularis *was radiocarbon dated at 7837 B.C. This represents the earliest known association between man and this exclusively human parasite.*

Accounts of *Enterobius vermicularis* (pinworm) infection in man date back to the beginning of recorded history (*1*). Early Chinese, Indian, Arabic-Persian and Greco-Roman medical writings all attest to the prevalence of this parasite in their native populations. The disease was recognized to produce intense anal pruritus, sometimes complicated by local secondary infection but without other serious sequelae. Hippocrates knew of the nocturnal symptoms of pinworm infection. In fact, the above clinicopathological description of enterobiasis, perhaps the most common worm infection of mankind today, remains unchanged (*2*). Direct evidence of infection in ancient populations has been provided by the finding of *E. vermicularis* eggs in dried fecal specimens (coprolites), about 1000 years old, recovered from Mesa Verde, Colorado (*3*). Our finding of *E. vermicularis eggs* in a 10,000-year-old human coprolite (Fig. 1) represents the earliest documented association of man with this ubiquitous and exclusively human parasite.

Danger Cave and Hogup Cave, in western Utah, were inhabited by prehistoric man for several thousand years (from about 10,000 B.C. to A.D. 20, Danger Cave; from about 6400 B.C. to A.D. 1400, Hogup Cave). Each has been the site of active archeological investigation (*4*). Sequential levels of major periods of human occupancy were established on the basis of analysis of several feet of cultural debris layering both caves (5 levels in Danger Cave, 16 levels and 4 major occupations in Hogup cave). Samples of a large variety of fecal and plant materials were used to date the levels with radiocarbon. Coprolites were found in nearly all levels and ascribed to human origin on the basis of form, color, and content.

Human coprolites contain a mixture of diverse plant material, bone, and charcoal, which distinguishes them from coprolites of other mammals (*5*). In all, 142 coprolites from both caves were examined microscopically for the presence of ova and parasites (*6*). Each specimen was first reconstituted in 0.5 percent trisodium phosphate for 72 hours (*7*). Six microscopic preparations were made from each coprolite—four suspensions in trisodium phosphate on coverslips and two preparations after concentration in formalin-ether (modified by substituting 0.5 percent trisodium phosphate for water) (*8*).

Eggs of *E. vermicularis* were found in one sample from level 10 of Hogup Cave (650 B.C. $\pm$ 100 years), in two coprolites from level 8 of Hogup Cave (1250 B.C. $\pm$ 140 years), in one coprolite from level 6 of Hogup Cave (4010 B.C. $\pm$ 100 years), and in one specimen from level 2 of Danger Cave (7837 B.C. $\pm$ 630 years) (*9*). In addition, eight specimens had eggs of *Acanthocephala* (thorny-headed worm) (*10*). No protozoans were encountered.

Although 2.8 percent of all coprolites (1.3 percent of all examinations) contained *E. vermicularis* eggs, this is not indicative of the true rate of infestation. Modern surveys utilizing direct fecal smears for examination show less than 5 percent of the actual infestation rate when compared to the superior cellophane tape and swab technique for the detection of *E. vermicularis* (*11*). The real rate of infestation in this aboriginal population, therefore, was probably comparable to those of modern populations. Since the worm is relaitvely harmless, there is no reason to believe community or individual health was seriously compromised, in contrast to the potentially lethal complications of *Acanthocephala* infection reported in this same population (*10*).

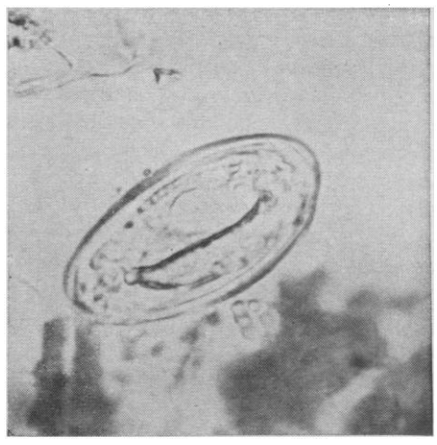

Fig. 1. *Enterobius vermicularis* egg found in human coprolite from Danger Cave, level 2 (7837 B.C. $\pm$ 630 years). Outer dimensions of egg are 55 by 30 μm.

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