

Paleoparasitological analysis of Roman sewers from *Augusta Emerita* (Mérida, Spain)

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INTRODUCTION

The city of *Augusta Emerita* was founded in 25 BC by Emperor Augustus and it was the capital of the Roman province of *Lusitania*. Its sewerage network dates from the foundation of the city (Acero, 2011).

In recent excavations four sewer stretches were identified:

- two on the nowadays Almendralejo (NE.5) street;
- two on Espronceda (SI.11) street.

Archaeological data indicates that the first two were abandoned in the 3rd cent. AD (Heras et al. 2011), while the others from the 4th cent. onwards.

During the excavation of SI.11-L.1 (Fig. 1) two layers of sedimentation (UE 18 and UE 23) were recognized. After cleaning the stratigraphic profile, four samples were obtained UE 18 (one each 15 cm) and one from the UE 23.

In the duct SI.11-L.2 two layers of clogging were identified, referred as UE 24 and UE 22, both also provisionally dated to the Late Antiquity (Fig. 2).

MATERIAL AND METHODS

Nine sediment samples (ca. 100 gr/each) - collected with gloves, trowel and plastic bags – were search for intestinal parasites.

Samples were processed with 10% hydrochloric acid (HCL) and the swirl technique was used to separate sand and other inorganic heavy material (Reinhard et al. 2008). Commercial *Lycopodium* spores tablets Batch 124961 were introduced to quantify helminth eggs per gram of sediment (Maher 1981). Twenty slides of each sample were analyzed in optic microscope in 100x and 400x magnification.

RESULTS

All the samples were positive for helminth eggs. *Ascaris lumbricoides* was present in eight samples with quantifications varying between 9.8 and 514.98 eggs per gram.

Trichuris trichiura eggs were found in two samples with 30.29 and 140.8 eggs per gram. A larva was found in one sample, probably released from an *A. lumbricoides* egg (Fig. 5; Table 1).

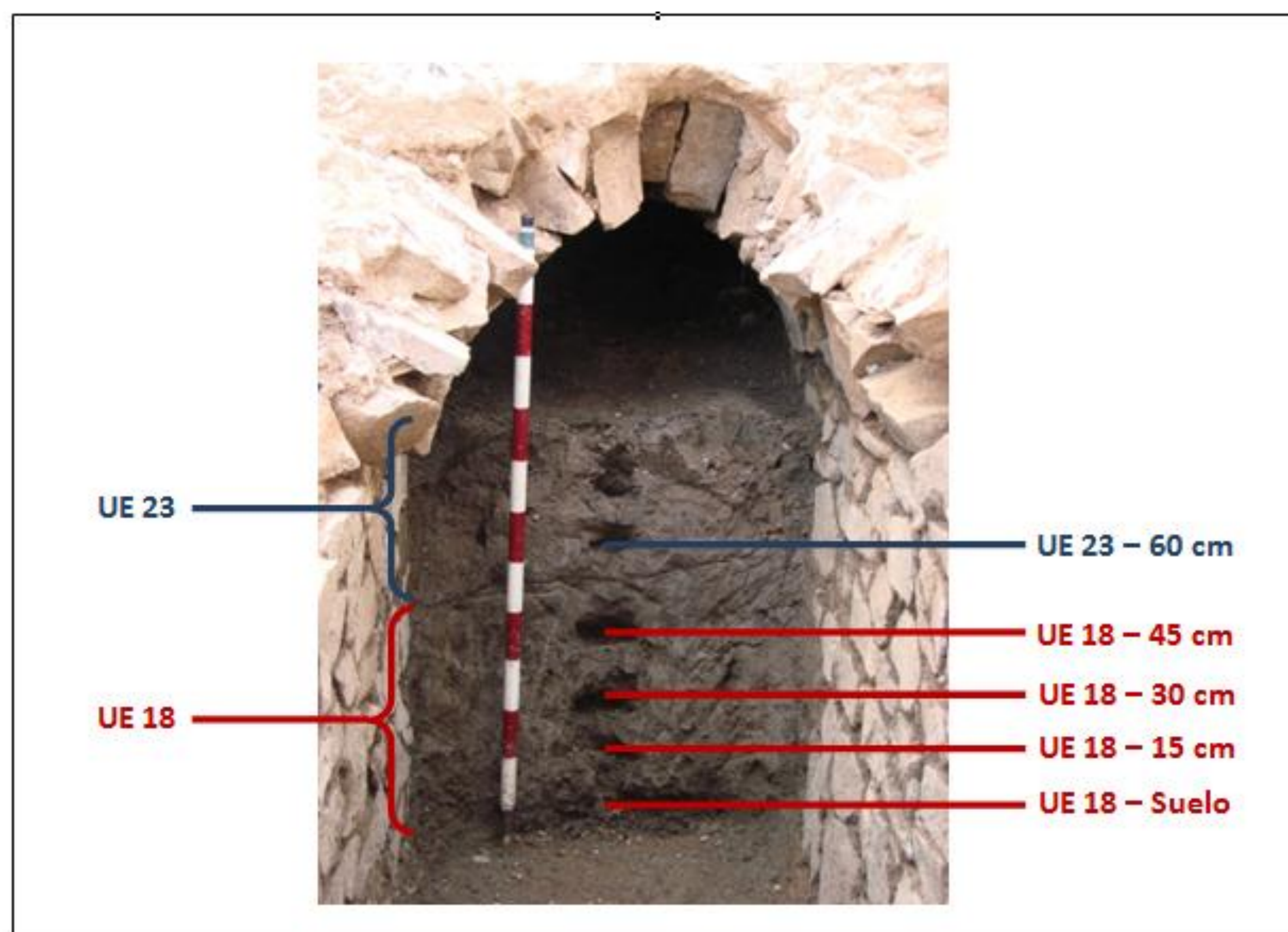


Fig. 1: Sampling points in sewer SI.11-L.1 – Espronceda. Picture: J. Acero



Fig.2: Sampling points in sewer SI.11-L.2 – Espronceda. Picture: J. Acero.

At Almendralejo st., samples were obtained from sewers NE.5-L.1 and NE.5-L.2 (Fig. 3-4).

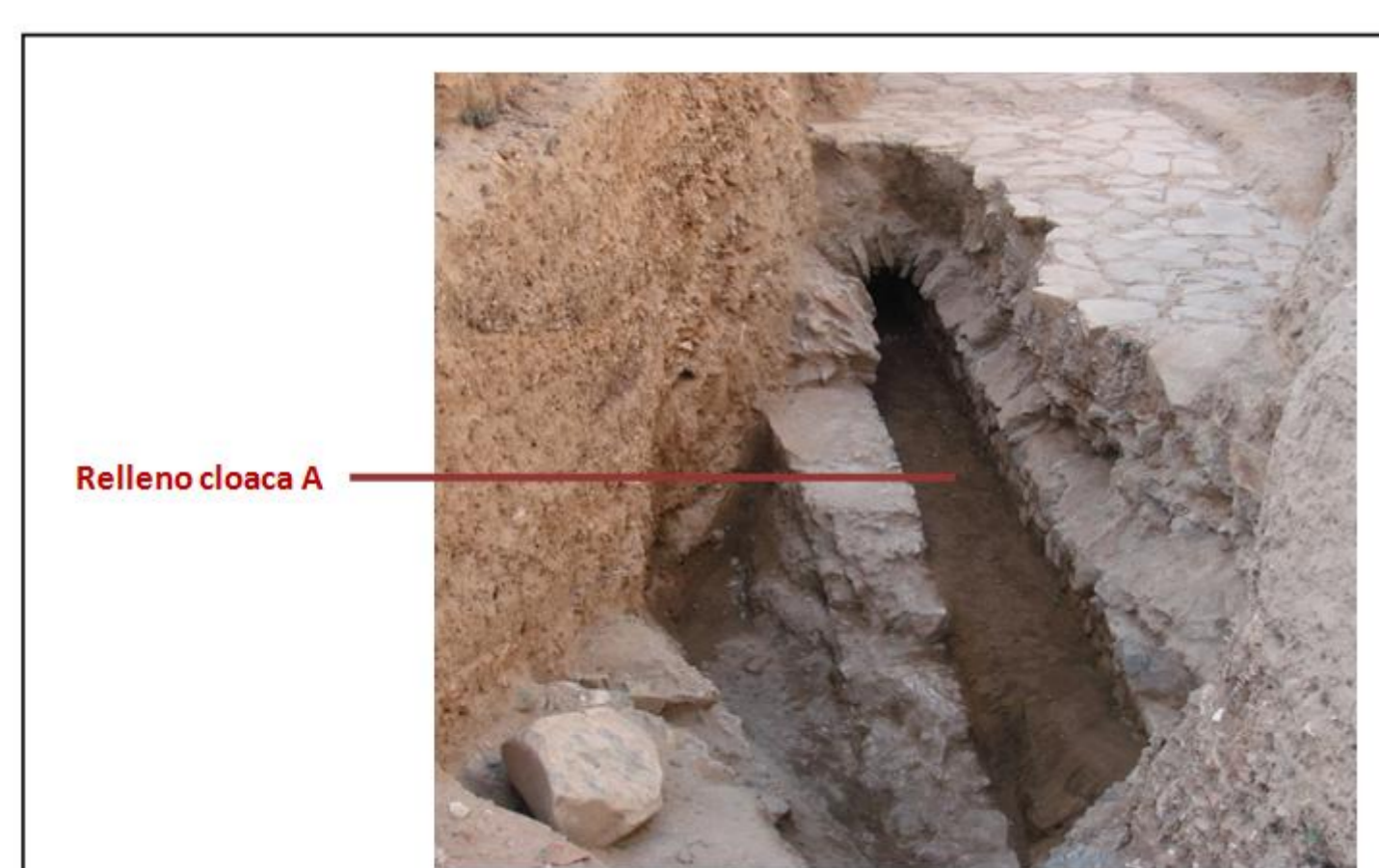


Fig.3: Sampling point in sewer NE.5-L.1 – Almendralejo. Picture: J. Acero.

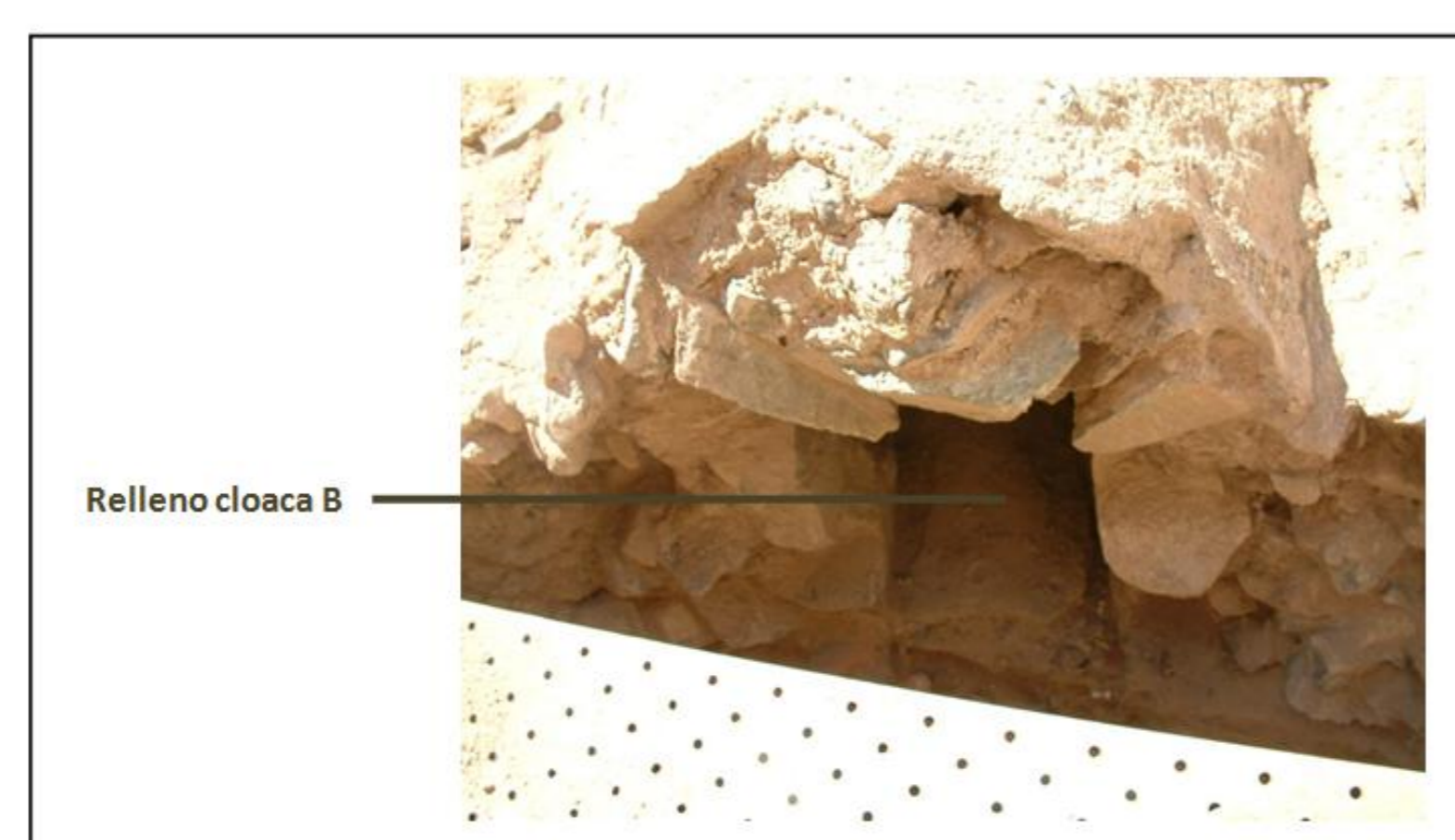


Fig.4: Sampling point in sewer NE.5-L.2 – Almendralejo. Picture: J. Acero.

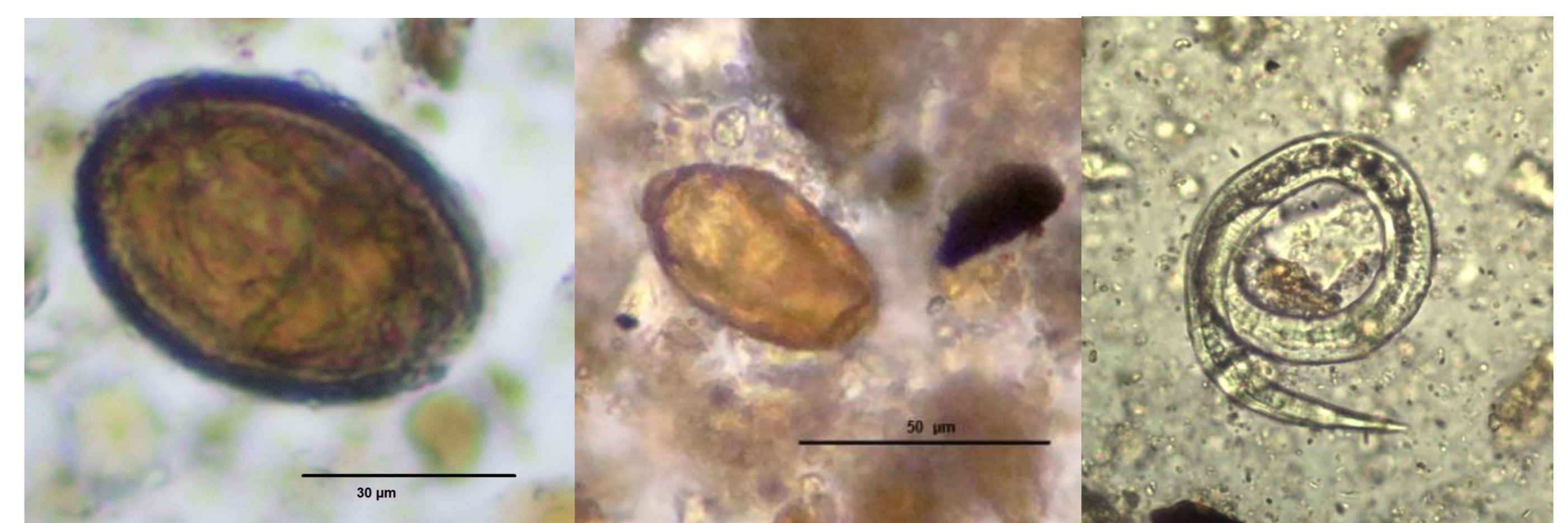


Fig. 5: From left to right: *Ascaris lumbricoides*, *Trichuris trichiura* eggs, and larva found in the sewers from *Augusta Emerita*. Pictures: L. Sianto.

Table 1: Helminths found in *Augusta Emerita* sewers and egg quantification per sample.

Sewer	Helminths (eggs per grain)
SI.11-L.1 - UE 18 floor	<i>Ascaris lumbricoides</i> (66,2)
SI.11-L.1 - UE 18- 15cm	<i>Ascaris lumbricoides</i> (47,94)
SI.11-L.1 - UE 18- 30 cm	<i>Ascaris lumbricoides</i> (44,31)
SI.11-L.1 - UE 18- 45 cm	<i>Ascaris lumbricoides</i> (26,87)
SI.11-L.1 - UE 23- 60 cm	<i>Trichuris trichiura</i> (140,8)
SI.11-L.2 - UE 24	<i>Ascaris lumbricoides</i> (288,36) Larva, probably <i>A. lumbricoides</i>
SI.11-L.2 - UE 22	<i>Ascaris lumbricoides</i> (514,98) <i>Trichuris trichiura</i> (30,29)
NE.5-L.1 - sewer A	<i>Ascaris lumbricoides</i> (441,03)
NE.5-L.2 - sewer B	<i>Ascaris lumbricoides</i> (9,8)

DISCUSSION

Both parasites are specific to humans and have been widely found in European archaeological materials from various dates. These parasites have been related to lack of hygiene of inhabitants (Bouchet et al. 2003, Anastasiou 2015).

The study of latrines has sometimes revealed animal parasites associated with human waste, indicating a common use of the structure or the proximity between the residents and their animals, which can lead to zoonoses (Rocha 2006, Reinhard et al. 2013). In this case, however, the absence of nonhuman parasites indicates that the sewers were used mainly for the dumping of fecal material from human city housing.

This research continues to try to correlate parasites found with archaeological studies.

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