Departments of Chemistry, Archaeology and Soil Science

In Situ Preservation of Wetland Heritage: Hydrological & Chemical Change in the Burial Environment of the Somerset Levels

Louise A. Jones

In situ preservation

The unique importance of waterlogged archaeological deposits results both from the exceptional preservation of organic remains, including wooden structures and artefacts, and palaeoenvironmental evidence, such as pollen and plant macrofossils. These provide the opportunity to enhance our understanding of landscape use and management, (Figure 1) vegetation change/succession, and importantly, social interactions (Williams 2009), including the organic fraction of prehistoric 'material culture and structures' (Brunning 2007) not preserved at dryland sites (Coles and Coles 1986).

Figure 1 a) Reconstruction drawing of Glastonbury Lake Village (Jane Brayne)
b) wooden palisade and foundations excavated in 1897. (Bulleid and Gray 1911)

Project Rationale

Archaeological remains and their context are a 'non-renewable resource' (Matthiesen 2003). Research into how these remains are preserved *in situ*, potential threats to preservation, and the nature of the burial environment, are therefore central issues in heritage management.

Threats to preservation may be readily identifiable, for example due to peat abstraction, or drainage, but more importantly, can also occur unnoticed within the burial environment (Matthiesen 2003). Monitoring is therefore essential to develop informed conservation strategies, and to ensure that archaeological resources are preserved for future generations and new research questions (Matthiesen 2003).

Research Objectives

This is a collaborative, interdisciplinary research project examining *in situ* preservation at two internationally important sites in the Somerset Levels, the Iron Age site of Glastonbury Lake Village, and the southern section of the Neolithic Sweet Track (Figure 2). The overall objective is to increase our understanding of the chemical, hydrological and sedimentological nature of the burial environment at these sites, through analysis of the sediment context, and monitoring spatial and temporal variability in water chemistry and water table depth. This information will be used to enhance our knowledge of the impacts of these variables on the current, and future, *in situ* preservation potential of the inorganic and organic resources preserved at these sites.

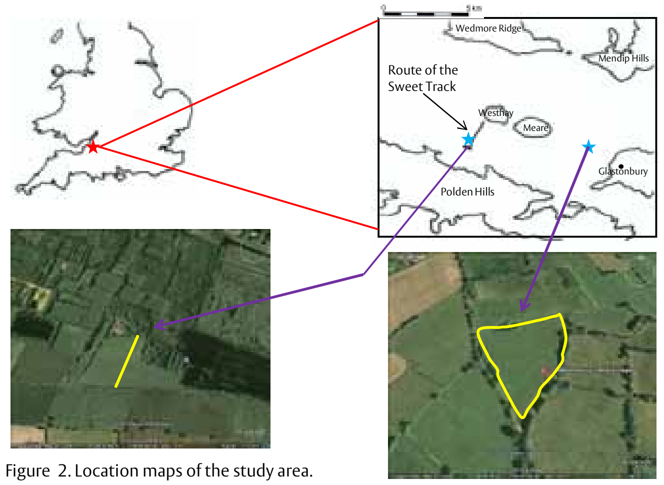

Figure 2. Location maps of the study area.

Methodology

A minimally invasive monitoring strategy was designed for both sites, based on a grid system at Glastonbury Lake Village, and a transect at the Sweet Track site.

The parameters being monitored at these sites include water table depth, redox potential, analysis of water chemistry (using ICP-OES and anion chromatography), water pH and conductivity. In addition soil moisture content using Time Domain Reflectometry (TDR) is being used at Glastonbury Lake Village (Figure 3). All of these parameters are monitored on a monthly basis.

Figure 3 a) TDR access tube b) remote sensing data logger disguised within a modified cattle trough c) metal protective plates covering the monitoring equipment d) piezometer tube (cap removed) used to monitor water table depth and collect samples for chemical analysis

Monitoring spatial, (both across the site and with depth) and temporal, variability in water chemistry, is crucial to characterising burial environments and hence preservation potential, because any changes may adversely impact on the long term preservation of artefacts, for example, though altering variables including redox potential (Douterelo *et al* 2009), the stability of corrosion layers on metal artefacts (Edwards 1998), the pH of the groundwater (Banwart 1998), or the microbiology of the burial environment (Powell et al 2001).

These monitoring techniques are being combined with sediment analysis which includes particle size analysis, X-ray diffraction (mineralogy), X-ray fluorescence (multi-element chemistry), and loss on ignition (organic matter content), to characterise and identify the sediment sequence more fully.

Initial Results – Sweet Track

The basic sediment sequence (Figure 4) comprises a thin topsoil, humified degraded peat, sphagnum and reed peats with varying quantities of wood, a humic silty clay interpreted as a buried soil horizon, and at the base, estuarine grey clays. This sequence is further complicated at the edge of the burtle (sand island) by the presence of sand lenses and thinner silty sand horizons.

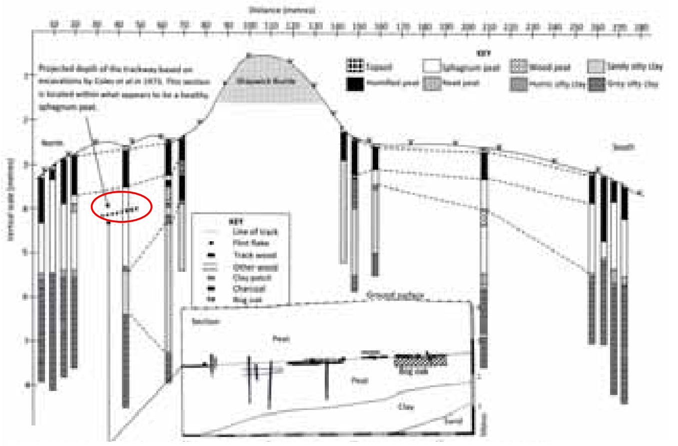

Figure 4. Simplified cross section of the sediment sequence at the Sweet Track, including a cross section of the area excavated by Coles *et al* in 1973

During excavations the Sweet Track was identified ~150cm beneath the ground surface (Coles *et al* 1973). At a similar level it is possible that there may also be Mesolithic and or Neolithic organic remains preserved within the peat, providing possible evidence of activities or occupation.

The initial coring data suggests the Sweet Track to the North of the Burtle is located within 'healthy' peat below the upper humified horizon. Crucially, however, peat wastage in this area (Figure 5) may have altered the depth of peat, and therefore the depth of the trackway beneath the ground surface. Although these appear positive findings this is therefore not conclusive evidence that the preservation state of the trackway is good. In addition, without this monitoring it would not be possible to identify any potential impacts on preservation due to any variability in water table depth, water chemistry, pH or redox potential.

Figure 5. Section of a Bog Oak exposed by peat wastage at the Burtle site of the Sweet Track, Somerset. Length 1.2m. (Photograph Louise Jones)

Conclusion

Monthly monitoring of both sites, and analysis of samples between visits is ongoing. Samples have been collected over ten months and this data is now being integrated to start interpreting and understanding these results. It is possible however that patterns in the data, particularly those for the water table depth, may not become apparent until monitoring has continued over at least a whole year.

References

1. Banwart, S. (1998) Groundwater geochemistry in the burial environment. In: Corfield, M., Hinton, P., Nixon, T. and Pollard, M. (eds.) *Preserving archaeological remains in situ. Proceedings of the Conference 1st-3rd April 1996*. London: Museum of London Archaeological Service, 66-72
2. Brunning , R. (2007) Monitoring waterlogged sites in peatlands: where, how, why and what next? In: Barber, J., Clark, C., Cressey, M., Crone, A., Hale, A., He nderson, J., Housley, R., Sands, R., and Sheridan, A. (eds.) *Archaeology from the Wetlands: Recent Perspectives. Proceedings of the 11th WARP Conference, Edinburgh 2005. 41-47*
3. Bulleid, A. and Gray, H. (1911) *The Glastonbury Lake Village. Volume 1. A full description of the excavations and the relics discovered, 1892-1907*. Glastonbury: The Glastonbury Antiquarian Society,
4. Coles, J. M., Hibbert, F. A. and Orme, B. J. (1973) Prehistoric Roads and Tracks in Somerset, England: 3. The Sweet Track. *Proceedings of the Prehistoric Society*. **39,** 256-293
5. Coles, B. and Coles, J (1986) *Sweet Track to Glastonbury*. *The Somerset levels in Prehistory*. London: Thames and Hudson
6. Douterelo, I., Goulder, R. and Lillie, M. (2009) Response of the microbial community to water table variation and nutrient addition and its implications for *in situ* preservation of organic archaeological remains in wetland soils. *International Biodeterioration and Biodegradation*. **63,** 795-805
7. Edwards, R (1998) The effect of changes in groundwater geochemistry on the survival of buried metal artefacts. In: Corfield, M., Hinton, P., Nixon, T. And Pollard, M. (eds.) *Preserving Archaeological Remains In Situ. Proceedings of the conference 1st-3rd April 1996*. London, Museum of London Archaeology Service
8. Matthiesen, H (2003). The preservation of the past for the future. In: Jørgensen, L., Stogaard, B. And Gebauer, L. (eds.) *The Spoils of Victory*. *The North in the Shadow of the Roman Empire*. National Museum. 356-363. Gylling, Narayana Press.
9. Powell, K. L., Pedley, S., Daniel, G. And Corfield, M. (2001).Ultrastructural observations of microbial succession and decay of wood buried at a Bronze Age archaeological site. *International Biodeterioration and Biodegradation*. **47**, 165-173
10. Williams, J. (2009). The Role of Science in the Management of the UK's Heritage. National Science Strategy 1. April 2009. URL: http://www.heritagesciencestrategy.org.uk. [Accessed 20 June 2009]

Acknowledgements

- This PhD project is funded by the Science and Heritage Programme, (AHRC/EPSRC) with English Heritage as case partners, & additional support from Somerset County Council. Particular thanks to Dr. S. Payne, Dr. R. Brunning and my supervisors, Professor M. Bell, Dr M. Almond & Dr S. Robinson.

Contact information

- Department of Archaeology, University of Reading, Whiteknights, RG6 6AB,
- Email: l.a.jones@reading.ac.uk