Isotope analysis reveals varied diet amongst late Anglo-Saxon residents of Godalming, Surrey

Sam Leggett[1], Todd C. Rae[2] & Lia Betti[2]

[1.] *Department of Archaeology, University of Cambridge* [2.] *Department of Life Sciences, University of Roehampton* *Email: sal78@cam.ac.uk*

Aims and Objectives

- Investigate health and diet in an understudied region.
- Explore two major Early Medieval transitions: 'Fish Event Horizon' (FEH) c.1000 AD, Norman Conquest 1066 AD.
- Compare and contrast different groups by age, sex and grave provisioning.

The Site – Priory Orchard

- 8th – 13th Century AD.
- Rare early Christian churchyard cemetery.
- 300+ burials.
- Most individuals have no grave provision but some have limited grave goods, ash halos and/or stone arrangements in the grave.

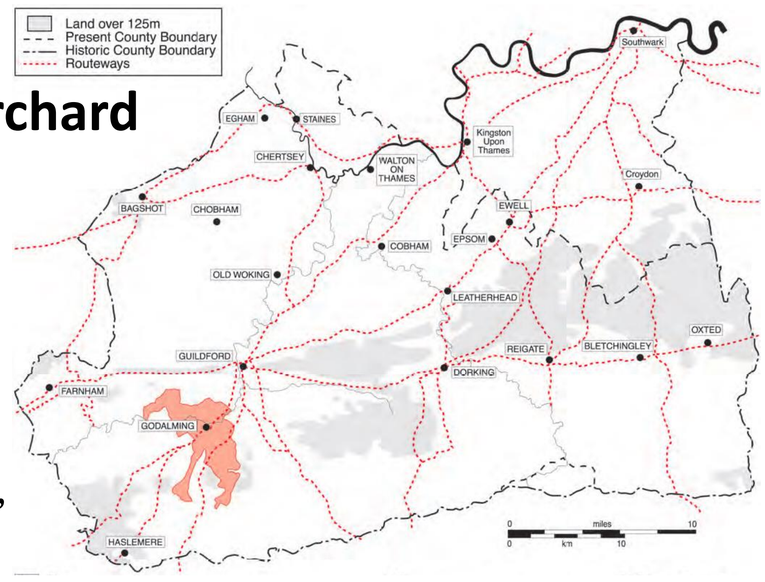

Fig. 1 – Location of Godalming in Surrey with historic routeways.

Major Findings

- ~6‰ spread in $\delta^{15}N$ values for the population indicates a varied diet.
- Social status and sex do not correlate with diet.
- Juveniles (4-16 years, n = 3) display some of the lowest $\delta^{15}N$ values.
- Diet at Godalming is close in $\delta^{15}N$ to contemporary sites but closer in $\delta^{13}C$ with cemeteries nearby, showing the impact of the FEH, the Normans and regional diversity.
- High $\delta^{15}N$ values of three faunal samples suggests that individuals with higher $\delta^{15}N$ values might have increased consumption of herbivores or freshwater resources rather than omnivorous species.

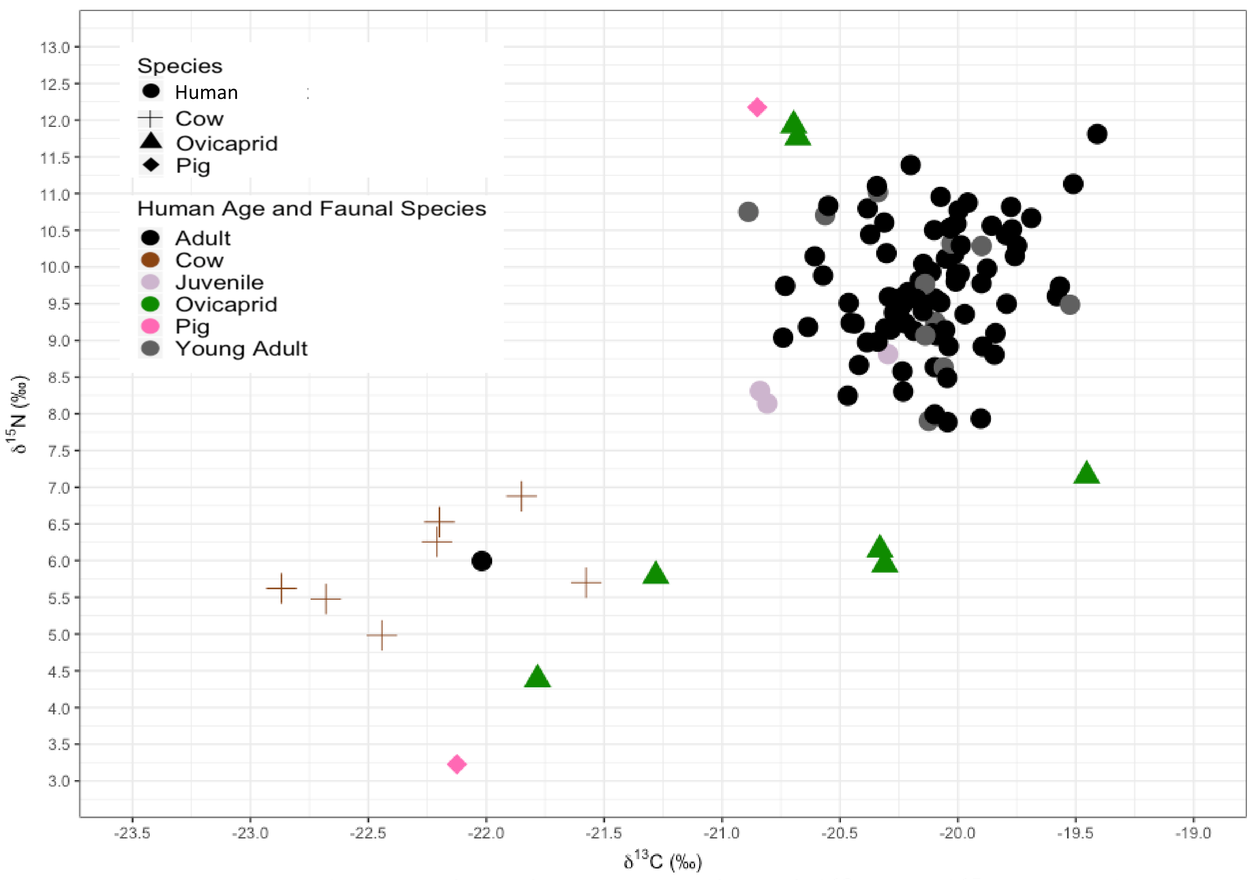

Fig. 2 – Scatterplot of human (n=93) and animal (n=16) $\delta^{13}C$ and $\delta^{15}N$ values from Priory Orchard Godalming.

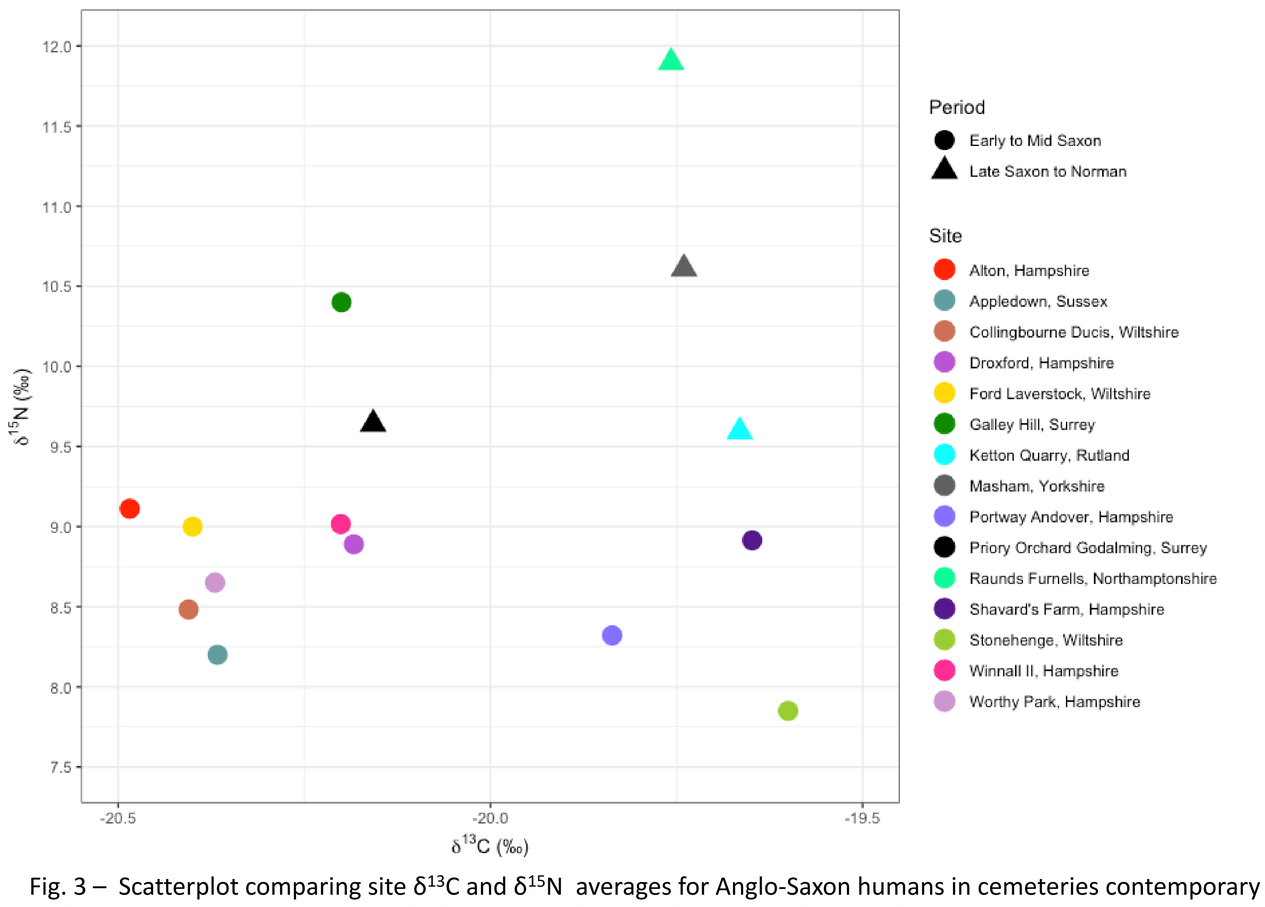

Fig. 3 – Scatterplot comparing site $\delta^{13}C$ and $\delta^{15}N$ averages for Anglo-Saxon humans in cemeteries contemporary with Priory Orchard, and sites nearby but earlier, showing the effects of regionality vs. FEH and the Normans.

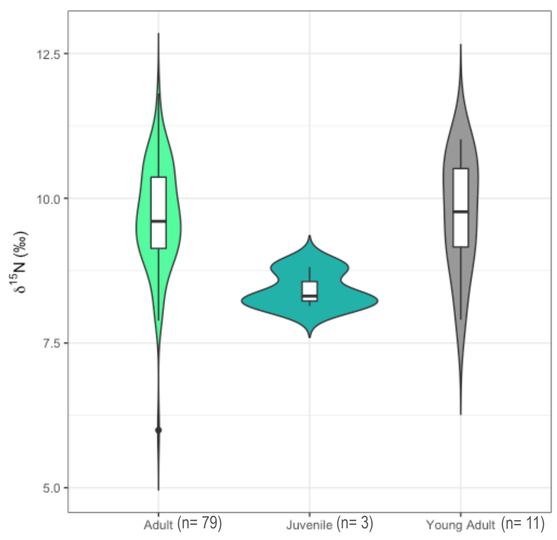

Fig. 4 – Violin plot comparing $\delta^{15}N$ values of different age categories at Godalming – Adult (n=79), Juvenile (n=3), Young Adult (n=11) . BEST Test comparing Adults and Young Adults showed no statistically significant difference.

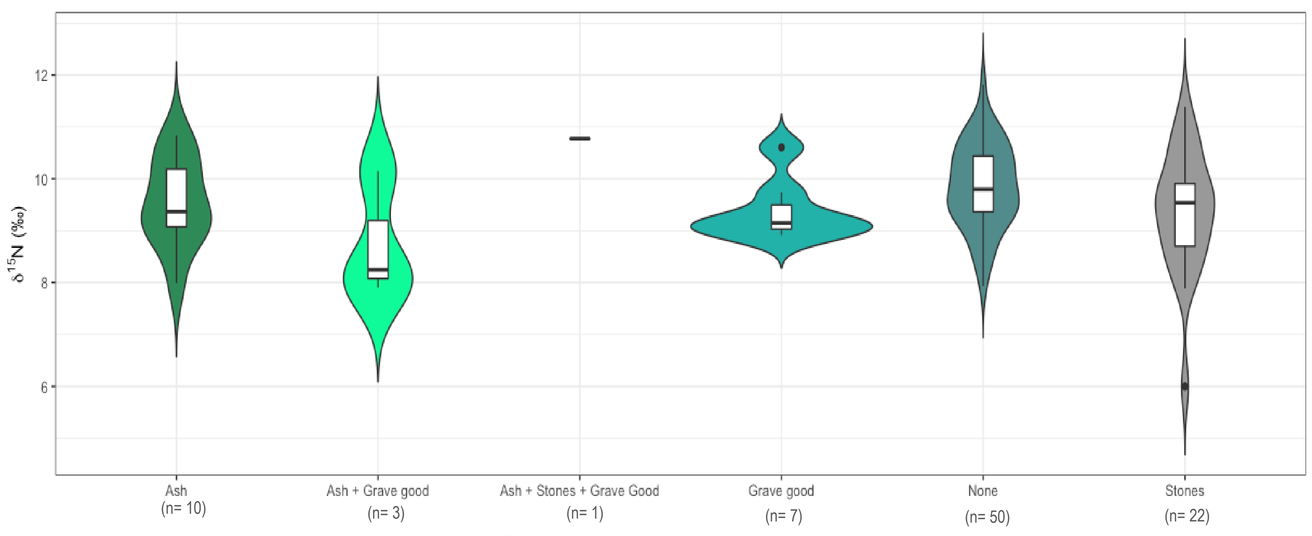

Fig. 5 – Violin plot comparing $\delta^{15}N$ values of different grave provision categories at Priory Orchard, Godalming: ash (n=10), ash + grave good (n=3), ash + stone + grave good (n=1), grave good (n=7), none (n=50), stones (n=22).

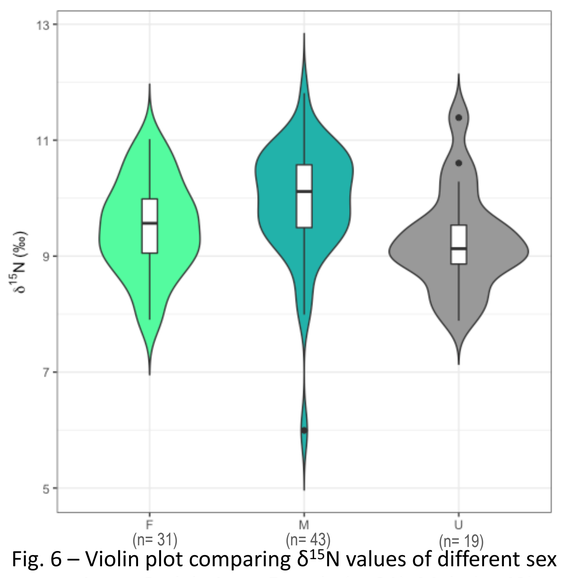

Fig. 6 – Violin plot comparing $\delta^{15}N$ values of different sex categories at Godalming – Female (n=31), Male (n=43), Unidentified (n=19). BEST Test comparing Females and Males showed no statistically significant difference.

Osteological Methods

- **Age at death:** subadults (tooth eruption: Ubelaker 1999; bone development: Scheuer and Black 2000), adults (pubic symphysis and ilium: Lovejoy et al. 1985; Brooks and Suchey 1990; dental wear: Brothwell 1991; cranial sutures: Meindl and Lovejoy 1985).
- **Biological sex:** Pelvis (Phenice 1969; Sutherland and Suchey 1991), cranium (White et al. 2011), femoral and humeral head (Stewart 1979).

Stable Isotope Methods

- **93 humans**, **ribs** preferred. **16 faunal bones** sampled as a baseline.
- **Modified Longin method** (Privat et al., 2002).
- Stable isotope values of bone collagen and dentine are reported relative to an internationally defined scale - VPDB ($\delta^{13}C$) and AIR ($\delta^{15}N$).
- Analytical error (1σ) for all collagen samples is ±0.20‰.
- Statistical analysis and graphs were carried out in **R**. Group comparisons done using the **BEST package**.

Acknowledgements

S. Leggett would like to acknowledge the help and support of her supervisors Dr Susanne Hakenbeck and Dr Tamsin O'Connell at Cambridge, as well as her funding bodies Newnham College Cambridge, and the Cambridge Trust for partially funding the study of this population. The authors would also like to thank Catherine Kneale at the McDonald Institute for Archaeological Research, Cambridge for her technical advice and support and to thank Leah Damman for her zooarchaeological expertise.

UNIVERSITY OF CAMBRIDGE
Department of Archaeology

CAMBRIDGE COMMONWEALTH EUROPEAN AND INTERNATIONAL TRUST

NEWNHAM COLLEGE UNIVERSITY OF CAMBRIDGE

University of Roehampton London

References

- Bayliss, A. et al. (2013). *Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD : a chronological framework*, The Society for Medieval Archaeology monograph 33. London : Society for Medieval Archaeology.
- Brooks, S. and Suchey, J. (1990). Skeletal age determination based on the os pubis: a comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods. *Human Evolution*, 5, pp.227–238.
- Brothwell, D. R. (1981). *Digging Up Bones*. Oxford : Oxford University Press.
- Buckberry, J. et al. (2014). Finding Vikings in the Danelaw. *Oxford Journal of Archaeology*, 33 (4), pp.413–434.
- Haydock, H. et al. (2013). Weaning at Anglo-Saxon Raunds: Implications for changing breastfeeding practice in britain over two millennia: Weaning at Anglo-Saxon Raunds. *American Journal of Physical Anthropology*, 151 (4), pp.604–612. [Online]. Available at: doi:10.1002/ajpa.22316.
- Hedges, R. E. M. et al. (2007). Collagen turnover in the adult femoral mid-shaft: Modeled from anthropogenic radiocarbon tracer measurements. *American Journal of Physical Anthropology*, 133 (2), pp.808–816. [Online]. Available at: doi:10.1002/ajpa.20598.
- Hull, B. D. (2007). *Social Differentiation and Diet in Early Anglo-Saxon England: Stable Isotope Analysis of Archaeological Human and Animal Remains*. Oxford : University of Oxford.
- Kruschke, J. K. (2013). Bayesian estimation supersedes the t test. *Journal of Experimental Psychology: General*, 142 (2), pp.573–603. [Online]. Available at: doi:10.1037/a0029146.
- Leggett, S. A. (2020). *From Conversion to Conquest: A Multi-Tissue and Multi-Scalar Study of Anglo-Saxon Cemeteries*. PhD, Cambridge : University of Cambridge.
- Lovejoy, C. O. et al. (1985). Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death. *American Journal of Physical Anthropology*, 68, pp.15–28.
- Lucy, S. et al. (2009). The Burial of A Princess? The Later Seventh-Century Cemetery At Westfield Farm, Ely. *The Antiquaries Journal*, 89, p.81. [Online]. Available at: doi:10.1017/S0003581509990102.
- Mays, S. and Beavan, N. (2012). An investigation of diet in early Anglo-Saxon England using carbon and nitrogen stable isotope analysis of human bone collagen. *Journal of Archaeological Science*, 39 (4), pp.867–874. [Online]. Available at: doi:10.1016/j.jas.2011.10.013.
- Meindl, R. S. and Lovejoy, C. O. (1985). Ectocranial suture closure: A revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology*, 68, pp.57–66.
- Phenice, T. W. (1969). A newly developed visual method of sexing the os pubis. *American Journal of Physical Anthropology*, 30, pp.297–301.
- Pitts, M. et al. (2002). An Anglo-Saxon Decapitation and Burial at Stonehenge. *Wiltshire Archaeological & Natural History Magazine*, 95, pp.131–146.
- Privat, K. L., O'Connell, T. C. and Richards, M. P. (2002). Stable Isotope Analysis of Human and Faunal Remains from the Anglo-Saxon Cemetery at Berinsfield, Oxfordshire: Dietary and Social Implications. *Journal of Archaeological Science*, 29 (7), pp.779–790. [Online]. Available at: doi:10.1006/jasc.2001.0785.
- Scheuer, L. and Black, S. (2000). *Developmental Juvenile Osteology*. San Diego, CA : Academic Press.
- Stewart, T. D. (1979). *Essentials of Forensic Anthropology*. Springfield, IL : Charles C Thomas.
- Sutherland, L. D. and Suchey, J. M. Use of the ventral arc in pubic sex determination. Journal of Forensic Sciences. *Journal of Forensic Sciences*, 36, pp.501–511.
- Ubelaker, D. H. (1999). *Human skeletal remains: Excavation, analysis, interpretation*. 3rd Edition. Washington, DC : Taraxacum.
- White, T. D., Black, M. T. and Folkens, P. A. (2011). *Human Osteology*. 3rd Edition. San Diego, CA: Academic Press.