

## **The application of Flow Cytometry to the study of ancient agriculture: Evidence for Mesolithic farming in Northern Britain ~ 7200 Cal yr BP.**

Richard Jones (1), Richard Tennant (2), Jackie Hatton (1), Rob Lee (2), and John Love (2)

(1) University of Exeter, Geography, Exeter, United Kingdom, (2) University of Exeter, Bioscience, Exeter, United Kingdom

The onset of agriculture in the UK, (the Mesolithic-Neolithic transition ~ 6000 - 5500 Cal yr BP), has commonly been viewed as the end point of a cultural and technological wave that began in Eastern Europe on the Hungarian Plain ~ 7500 Cal yr BP. This view is not without its critics, due in part to the uncertainty regarding the timing and rate of expansion and the difficulty in identifying the point at which agriculture first arrived in a particular location. Evidence for potential 'episodes' of Mesolithic agricultural activity in the UK has been identified in the UK pollen record, but this data is very tentative. Cereal pollen is typically present in very low concentrations (requiring very large, time consuming counts) and differentiating early cereal pollen from local grasses is very problematic, particularly in areas where the local grasses were domesticated.

We present a multi-proxy record from Mere Tarn (54°8'12.09" N 3°7'24.28"W), ~ 2km from the Morecambe Bay coast in South Cumbria, UK; a region with a long history of human occupation extending back into the Palaeolithic. A lacustrine core spanning the Mesolithic and Neolithic has been analysed using a combination of 'traditional' pollen analysis, Flow Cytometry and ancient DNA (aDNA). Flow Cytometry is employed to increase the concentration of cereal type grains in a sample, whilst also providing a more 'targeted' sample for aDNA analysis.

The results so far provide clear evidence for an early phase of 'Mesolithic' agriculture in the catchment, spanning only two centuries (~ 7300 to 7100 Cal yr BP). This phase is characterised by the occurrence of large cereal type grains (> 38 $\mu$ m), evidence for woodland clearance and the expansion of key anthropogenic indicators such as *P. lanceolata*. It occurred over 1600 years before the main transition into permanent and intensive agriculture in the catchment, at a time of significant changes in regional climate and sea-level. The results from Mere Tarn provide the earliest evidence for agricultural activity in the UK, adding to the on-going debate on the evolution of agriculture in NW Europe. These results also highlight the significant role Flow Cytometry could play in the study of early agriculture.

Tennant, R.K., Jones, R.T., Brock, F., Cook, C., Turney, C.S., Love, J. and Lee, R., 2013. A new flow cytometry method enabling rapid purification of fossil pollen from terrestrial sediments for AMS radiocarbon dating. *Journal of Quaternary Science*, 28(3), pp.229-236.