Geoarchaeology in the Céide Fields: assessing the nature and intensity of Neolithic land use

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The Céide Fields are thought to be the earliest field system in Europe, dating to the Early Neolithic and covering c. 12 sq km of boggy land on the coast of Co. Mayo. The fields are thought to have been used primarily for pasture, but an area of ard marks has also been recorded and pollen analysis by O'Connell and Molloy (2001) has indicated that cereals were grown in the fields in the Early Neolithic. This project aims to determine the intensity of arable land management within the fields, and to develop a new method of distinguishing arable from pastoral agriculture To address these issues, the buried mineral soils in the Céide Fields and other Neolithic field systems in Co Mayo (Belderrig and Rathlackan) were analysed using soil micromorphology, soil phosphate and lipid analysis. Samples were taken from fields with ard marks and compared with samples from large fields at higher elevations which are thought to be for pasture. All samples were compared with controls from a buried Mesolithic soil in Belderrig, which predates any agricultural activity.

The initial results showed that the lipid biomarkers known as stanols, which can be used as indicators for ruminant dung, were present in the soil in a natural form in large quantities. This made interpretation difficult, and further difficulties were presented by the total phosphate content of the soil, which showed no significant difference between the fields and controls. However, by measuring the organic and inorganic phosphate separately, a distinction was made between the raised organic phosphate levels in the area of ard marked soil as compared with other areas within the fields. Furthermore, the organic phosphate signature from the soils within the Céide Fields was significantly higher than levels in the Mesolithic control soils.

Further lipid analysis was undertaken on bile acids from the soils. These are less problematic indicators for manures, and can be used to distinguish inputs from ruminants and humans as well as other omnivores. These samples demonstrated that ruminant dung was present in its highest levels in the area of ard marked soil, but was also present in some of the other field soils. Further analysis is currently underway to confirm these initial findings.

The work to date suggests that where arable activity took place, the fields may have been intentionally fertilised with animal dung. This is in distinct contrast to the British model, where animal manures do not appear to have been used in agriculture until the Iron Age. However, the pattern does not really reflect the Continental model either. On the Continent animal manures

were used as early as the Neolithic, but agriculture was also more intensive, with evidence for animal byres and manured fields. The evidence from the Céide Fields is unlike either model, as it seems to represent large fields used mainly for pasture and, to date, there is no evidence for byres.

Samples have also been taken for analysis of stable isotopes ($\delta^{15}N$ values in hydrophobic soil amino acids) to try and distinguish between arable and pastoral land in the Neolithic field systems. Controls were taken from the Rothamsted Experimental Research Station in order to test the method. The results are not yet available, but if successful this will provide a new way to determine prehistoric land use. This will enable us to better estimate populations in the past, as arable would support larger numbers than pasture.

O'Connell, M. and Molloy, K. 2001. Farming and woodland dynamics in Ireland during the Neolithic. *Biology and Environment (Proc R Ir Acad, Ser B),* **101**, 99-128.