



How the oxygen isotope ratio of rain water influences the isotope ratio of chicken eggshell carbonate

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The stable oxygen isotope ratio of chicken eggshell carbonate was analysed from chicken eggs laid under free range, and organic farming regimes from across the UK. The eggshell carbonate oxygen isotope data shows a clear depletion in $\delta^{18}\text{O}$ distribution from the southwest to the northeast. Although consistently offset by around 1 permil, the same isotopic distribution as that seen in eggshell carbonate is observed in the $\delta^{18}\text{O}$ ratio of rainfall and groundwater from across the UK. This distribution is related to the Rayleigh distillation of rainfall driven by westerly winds across the UK landmass. The clear relationship observed between eggshell $\delta^{18}\text{O}$ values and that of rainwater presumably reflects the nature of free range chickens which must be drinking locally derived rainwater and supplementing their diet and water intake with locally derived food. These results suggest that the oxygen isotope value of chicken eggshells can be used as a forensic tool to identify the locality that free range and organic eggs were laid within the UK. Furthermore, if suitable material is preserved in the archaeological and geological record then such a relationship can potentially be used to establish the oxygen isotope value of rainwater from which ancient and / or ancestral birds lived.