



Masters 2 Stage in France at INRA, Bordeaux

The influence of earthworms on the oxygen isotope composition of soil-atmosphere carbon dioxide fluxes and carbonic anhydrase activity

Rationale: Earthworms play a central role in determining the physical and chemical development of many soil environments. This activity ranges from their understated influence on soil fertility in the agriculture lands of Europe, to strikingly transforming the landscape of the Los Llanos savannah in South America. The secretion of calcium carbonate by many earthworms may allow their casts, through analysis of the oxygen isotope composition of the minerals formed, to be used as a palaeothermometer in terrestrial climate reconstructions. The use of carbonic anhydrases, enzymes which catalyse the reversible hydration of aqueous carbon dioxide, in the glands facilitating this bio-calcification may mean that this activity also influences the oxygen isotope composition of soil-atmosphere carbon dioxide exchange. Additionally, they may indirectly influence this exchange through the influence of their burrows on soil structure. This is significant given that the contemporary atmospheric oxygen isotope budget of carbon dioxide is used to partition the contribution of photosynthesis and soil respiration to net terrestrial carbon exchange. However, this relies on our knowledge of soil carbonic anhydrase activity, which has so far focussed on the role of microbial but not macrofaunal communities.

Methodology: We will assess the direct and indirect influence of the presence of earthworms on soil carbonic anhydrase activity. We will estimate this activity using a novel, non-destructive approach using online measurements of net carbon dioxide and oxygen isotope fluxes in microcosm incubations of soils, soils in the presence of worms and bioturbated soils.

Aim: To explore the influence and contribution of these abundant soil organisms to the overall carbonic anhydrase activity measured from soils and consider the potential of their influence on atmospheric CO¹⁸O budgets.

Supervisors: Sam Jones, Aurore Kaisermann, Steven Wohl, Jérôme Ogée & Lisa Wingate

Wider Context: The Masters student will be a key member in a new ERC team based in Bordeaux that will contribute to a quantitative description of CA activity in ecosystems and at the global scale. This interdisciplinary stage offers exciting opportunities to generate unique and comprehensive datasets at the interface of atmospheric science and soil biology, that will lead to a greater understanding of carbon cycling on Earth. This project offers an experience to work within a dynamic and internationally recognised team working on isotope biogeochemistry and functional microbiology and an opportunity to develop a network with many international collaborators.

Application: Please send your application (CV, letter of motivation, research interests and expertise, list of publications and the names and contact information of two referees) to Lisa Wingate (see below). The project is available from February 2017 and is funded for 6 months. The indemnité de stage follows national directives.

For further information please contact:
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ECOFUN team <https://www.bordeaux.inra.fr/ispa-ecofun/wordpress/>



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