2019 PhD Proposal – China Scholarships Council and New Zealand – China Water Research Centre Joint PhD Programme Application

Information to be published on NZ – China Water Centre website if proposal is selected	
Project title	Fine-scale nitrogen cycling in freshwater sediments
Supervisors titles and names	Dr Niklas Lehto
Department	Soil and Physical Sciences
School / Centre	AGLS
University	Lincoln University
Email contact address	Niklas.Lehto@lincoln.ac.nz
Link to Supervisor's research page	Google Scholar: https://bit.ly/33CXUfq
Project outline Please outline the PhD project in 300 words (approx)	The enrichment of nitrogen (N) in surface freshwaters is a significant challenge for managing water quality in areas with intensive agricultural production. Within these environments, groundwater can often be the major source of N into the freshwaters. Sediments with rapid organic matter turnover rates can attenuate the flux of this nutrient from groundwater. However, the conditions under which this occurs, and to what extent, is controlled by a range of interrelated physical, chemical and biological factors, many of which are not well understood. So far, detailed mechanistic characterisation of these factors and their relative importance has been confounded by the very small spatial scales within which the biogeochemical cycling of N occurs in sediments. The overall aim of this project is to develop new insight into the physical-chemical reactive transport variables that define the fluxes of N through sediments into overlying water and their sensitivity to changing environmental conditions. In this project the student will work in the agricultural area of Canterbury, New Zealand with a number of groundwater-fed rivers and water bodies that are impacted by high nutrient loads. The student will undertake both in-situ field analyses of N fluxes in sediments across a range of upwelling groundwater flow regimes, and complement these findings with well-defined mesocosm experiments in the laboratory. High-resolution solute flux measurements using DET, DGT and planar optodes (see references), combined with isotopic labelling techniques, will allow the conversion rates between key N species to be quantified under different conditions. These results can then be used to parameterise and validate advanced reactive-transport models. The models can then be used to extrapolate the results to wider contexts, and test the sensitivity N fluxes to key factors with a view to anticipating potential effects of future changes to these highly dynamic environments.

References for further reading (optional)	Lehto et al. (2014) Anoxic microniches in marine sediments induced by aggregate settlement: biogeochemical dynamics and implications Biogeochemistry 119: 307. DOI: 10.1007/s10533-014-9967-0 Pagès et al. (2011) Representative measurement of two-dimensional reactive phosphate distributions and co-distributed iron (II) and sulfide in seagrass sediment porewaters. Chemosphere 85(8) 1256-1261. DOI: 10.1016/j.chemosphere.2011.07.020 Lansdown et al. (2014) Fine-scale in situ measurement of riverbed nitrate production and consumption in an armored permeable riverbed. Environ. Sci. Technol. 48(8)4425-4434. DOI:10.1021/es4056005
Please indicate if research operational funding is available to support the project, and if so, the sources of funding.	Operational funds for the research will be provided by Lincoln University.