**CSR SI: Across the sediment-water interface. Biogeochemical cycling in coastal and shelf seas**

***Editorial Text***

This issue of “Continental Shelf Research” is dedicated to the exchange of particles, solutes and gases across the sediment-water interface in coastal waters and shelf seas, and its role in biogeochemical cycling. Coastal and shelf regions, which make up approximately 10% of the global seafloor, provide key societal services including food, recreation, energy production, infrastructure, nutrient cycling and waste disposal (Jickells, 1998). Their value is amongst the highest of any global ecosystem (Costanza, 1997). The coupling of exchanges between the benthic and pelagic environments is key to maintaining many of the ecosystem functions in shelf seas. The temporal and spatial patterns of these exchanges are largely controlled by sediment type (Hicks et al. 2017, Silburn et al. 2017), which is a product of the physical and biological characteristics of the bed, and the magnitude and duration of near-bed hydrodynamics (Huettel et al. 2003). The numerous feedback loops and interactions make this a complex system, and the papers presented within this special issue tackle key issues surrounding these exchange processes, and their spatial and temporal variability.

The first four papers focus on processes occurring in UK waters. The first three present research and analysis undertaken as part of the Natural Environment Research Council (NERC) and Department for Environment, Food and Rural Affairs (Defra) funded “Shelf Sea Biogeochemistry” (SSB) research programme. This programme aimed to increase our understanding of the cycling of nutrients and carbon and the controls on primary and secondary production in UK and European Shelf Seas (Thompson et al. 2017; Kröger et al. 2018). Shelf Seas: The Engine of Productivity, Policy Report on NERC-Defra Shelf Sea Biogeochemistry programme. Cefas, Lowestoft. DOI: 10.14465/2018.ssb18.pbdAll). However, the processes of exchange across the sediment-water interface are widely applicable, and the final papers in the special issue look further afield, to the coastal and shelf systems of China.

The three SSB papers examine inter-related aspects - physical, geochemical and biological - of sediment-water interface research. The first paper discusses the physical processes that govern resuspension of particulate material from the seabed (Thompson et al. 2019). The authors use *in-situ* flume measurements to investigate the spatial and seasonal variability of bed erodibility, relating them to the characteristic properties of the sediments and the likelihood of resuspension occurring under different conditions. The second paper presents new approaches designed to increase our understanding of near surface geochemistry in sediment cores (Statham et al. 2019). This research correlates colour gradations in sediment profile images with geochemical processes in sub-surface sediments. The third paper looks at the biodiversity of benthic macrofauna over a spatially variable area in the Celtic Sea (Somerfield et al. 2019). The authors relate variation in environmental and sediment variables to the changes observed in the infaunal community structure using non-parametric multivariate techniques. The fourth European based paper moves to shallow waters, investigating denitrification in intertidal and subtidal sites (Rosales Villa et al. 2019). These measurements are linked to the wider nitrogen cycle in the North Sea, with discussions about the different rates measured through direct and modelling approaches.

The penultimate paper looks at the seasonal controls of acidification in the Yellow Sea, China, and its importance for calcification rates (Li and Zhai 2019). The authors discuss the implications of declines in subsurface-water pH on predicted calcification to 2050 and potential stressors for benthic fauna. Finally, the last paper considers exchange from the perspective of a contaminated environment in Dalian Bay, China, examining the physical controls of bubble-mediated release of methane into the water column and the atmosphere (Kunpeng et al. 2019). Bubble release rates were found to be highly influenced by changes in water depth related to tidal movements, and potential seasonal temperature effects were hypothesised, requiring further research into the topic.

The temporal and spatial heterogeneity of coastal and shelf sea environments both reflect and influence the dynamic exchange processes occurring across the sediment-water interface. The papers presented in this special issue explore this variability, reflecting the wide range of physical, geochemical, biological and anthropogenic controls on benthic-pelagic coupling and exchange in this complex system.

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