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Organic carbon stocks and burial rates of the Norwegian Trough and North Sea

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The global carbon cycle is currently being perturbed by the large-scale burning of fossil fuels, leading to rising global temperatures and related stress and damage to life on Earth. At the same time, we lack a detailed understanding of the various reservoirs and fluxes of the coastal and marine carbon cycle. Quantification of marine organic carbon stocks and their vulnerability to climate change and human activities is crucial for effective climate change mitigation and other management strategies. Recently, research has focussed on the ability of salt marshes, mangroves, seagrasses and macroalgae, so-called Blue Carbon ecosystems, to remove carbon dioxide from the atmosphere and store it as organic carbon. Likewise, fjords have been identified as locations of rapid burial of organic carbon. Less attention has, however, been directed to continental shelf sediments, presumably due to low carbon densities found in such sediments. Despite this, there are indications that organic carbon stocks of surficial shelf sediments are important: It was estimated that the upper 10 cm of the north-west European continental shelf sea sediments store between 230 and 882 teragrams (Tg) of organic carbon. A recent study found that organic carbon stocks of continental shelf sediments by far exceed those of salt marshes and seagrasses in the United Kingdom. Additionally, it was reported that marine sediment organic carbon stocks might be of similar magnitude as terrestrial soil stocks in some maritime nations.

Here we report on initial results of a pilot study, which aims to spatially predict organic carbon stocks and burial rates of surface sediments in the Norwegian Trough and North Sea. This pilot study attempts to establish suitable methodologies for making such spatial predictions based on a comprehensive set of existing data on organic carbon concentrations, sediment properties and sedimentation rates. It is hoped that a complete assessment of stocks and burial rates on the Norwegian continental shelf will subsequently be conducted under the auspices of the MAREANO seafloor mapping programme. Initial results indicate that the Norwegian Trough stores approximately 67 Tg of organic carbon in the upper 10 cm of the sediment column alone. By comparison, the sediments of the Norwegian part of the North Sea, which have organic carbon densities typical for the north-west European continental shelf, contain approximately 36 Tg of organic carbon in an area that is 25% larger than the Norwegian Trough. These results indicate that the Norwegian Trough is an important regional store for organic carbon. Subsequent analysis will attempt to shed light on burial rates and the residence time of organic carbon within the zone of active degradation.