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To the bottom of carbon processing at the seafloor: towards integration of geological, geochemical and ecological concepts (Vladimir Ivanovich Vernadsky Medal Lecture)

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Marine sediments are a habitat for organisms, govern the partitioning of material being buried or recycled, and act as filter for the paleorecord. Processes in the surface sediment layer determine whether carbon is recycled within the biosphere (short-term cycle) or transferred to the geosphere (long-term cycle) and as such it function as key interface in the System Earth.
Scientists from various disciplines with their own interests, paradigms and techniques have studied this pivotal role of the seafloor in processing material deposited. Marine geologists and paleoceanographers study sediments with the primary aim to extract information on past environmental conditions using down-core measurements of substances delivered to the seafloor and that have survived the processing at the seafloor. Biogeochemists quantify the fate of material delivered, in particular how much of the material is eventually buried and when and in what form is the remaining recycled to the water column, because recycling of key nutrients (e.g. N, P, Si, Fe) sustain primary production. Organic geochemists investigate how organic matter delivered to the seafloor is degraded, transformed or preserved using changes in the composition at the molecular level. Ecologists focus on the organisms, i.e. the actors consuming, producing and transporting the material deposited.
Although these disciplines often study the same material, e.g. organic matter delivered to the seafloor, they focus on different aspect ignoring key concepts, findings and approaches from other disciplines. For example, ecologists and biogeochemist studying carbon flow at the seafloor normally ignore detailed molecular information available from organic geochemistry. Bioturbation, particle transport and mixing at the seafloor, is often ignored by paleocanographers, and biogeochemists have developed advanced transport-reaction models in which the actors, the animals, mix the particles but do so without consuming organic matter, their food.
Here I present existing views on organic carbon processing at the seafloor, discuss where they agree and disagree and aim to arrive at an integrated view of carbon processing at the seafloor that is consistent with recent views within the organic geochemical, sediment geochemical, ecological and microbiological communities.