ID: W1991302317

TITLE: The short-term fate of organic carbon in marine sediments: Comparing the Pakistan margin to other regions

AUTHOR: ['Clare Woulds', 'J. H. Andersson', 'Gregory L. Cowie', 'Jack J. Middelburg', 'Lisa A. Levin']

ABSTRACT:

Pulse-chase experiments with isotopically labelled phytodetritus conducted across the Pakistan margin reveal that the impact of biological activities on benthic C-cycling varies markedly among sites exhibiting different seafloor conditions. In this study, patterns of biological C-processing across the Pakistan margin oxygen minimum zone (OMZ) are compared with those observed in previous tracer studies. Variations in site environmental conditions are proposed to explain the considerable variations in C-processing patterns among this and previous studies. Three categories of C-processing pattern are identified: (1) respiration dominated, where respiration accounts for >75% of biological C-processing, and uptake by metazoan macrofauna, foraminifera and bacteria are relatively minor processes. These sites tend to show several (although not necessarily all) of the properties of being cold and deep, and having low inputs of organic carbon to the sediment and relatively low-biomass metazoan macrofaunal communities; (2) active faunal uptake, where respiration accounts for <75%, and metazoan macrofaunal, foraminiferal and bacterial uptake each account for 10?25% of biological C-processing. This type is further split into metazoan macrofaunal- and foraminiferal-dominated situations, dictated by oxygen availability; and (3) metazoan macrofaunal uptake dominated, characterised by metazoan macrofaunal uptake accounting for ?50% of biological C-processing, due to unusually large biomasses of the phytodetritus-consuming animals. Total respiration rates (of added C) on the Pakistan margin fell within the range of rates measured elsewhere in the deep sea (?0.1?2.8 mg C m?2 h?1), and seem to be dominantly controlled by seafloor temperature. Rates of metazoan macrofaunal uptake of organic matter (OM) on the Pakistan margin are larger than those in most other studies, and this is attributed to the large and active metazoan macrofaunal communities in the lower OMZ, characteristic of OMZ boundaries. Finally, biological mixing of Pakistan margin sediments was reduced compared to that observed in comparable tracer studies on other margins. This probably reflects faunal feeding and burrowing strategies consistent with low oxygen concentrations and a relatively abundant supply of sedimentary OM.

SOURCE: Deep-sea research. Part 2. Topical studies in oceanography/Deep sea research. Part II, Topical studies in oceanography

PDF URL: None

CITED BY COUNT: 72

PUBLICATION YEAR: 2009

TYPE: article

CONCEPTS: ['Phytodetritus', 'Benthic zone', 'Respiration', 'Sediment', 'Oxygen minimum zone', 'Foraminifera', 'Ecology', 'Oceanography', 'Total organic carbon', 'Seafloor spreading', 'Biomass (ecology)', 'Bathyal zone', 'Carbon cycle', 'Biology', 'Environmental chemistry', 'Environmental science', 'Ecosystem', 'Geology', 'Paleontology', 'Chemistry', 'Upwelling', 'Botany']