ID: W2039284200

TITLE: Methane fluxes and carbonate deposits at a cold seep area of the Central Nile Deep Sea Fan, Eastern Mediterranean Sea

AUTHOR: ['Miriam Römer', 'Heiko Sahling', 'Thomas Pape', 'Christian dos Santos Ferreira', 'Frank Wenzhöfer', 'Antje Boëtius', 'Gerhard Bohrmann']

ABSTRACT:

High acoustic seafloor-backscatter signals characterize hundreds of patches of methane-derived authigenic carbonates and chemosynthetic communities associated with hydrocarbon seepage on the Nile Deep Sea Fan (NDSF) in the Eastern Mediterranean Sea. During a high-resolution ship-based multibeam survey covering a ~ 225 km2 large seafloor area in the Central Province of the NDSF we identified 163 high-backscatter patches at water depths between 1500 and 1800 m, and investigated the source, composition, turnover, flux and fate of emitted hydrocarbons. Systematic Parasound single beam echosounder surveys of the water column showed hydroacoustic anomalies (flares), indicative of gas bubble streams, above 8% of the high-backscatter patches. In echosounder records flares disappeared in the water column close to the upper limit of the gas hydrate stability zone located at about 1350 m water depth due to decomposition of gas hydrate skins and subsequent gas dissolution. Visual inspection of three high-backscatter patches demonstrated that sediment cementation has led to the formation of continuous flat pavements of authigenic carbonates typically 100 to 300 m in diameter. Volume estimates, considering results from high-resolution autonomous underwater vehicle (AUV)-based multibeam mapping, were used to calculate the amount of carbonate-bound carbon stored in these slabs. Additionally, the flux of methane bubbles emitted at one high-backscatter patch was estimated (0.23 to 2.3 × 106 mol a? 1) by combined AUV flare mapping with visual observations by remotely operated vehicle (ROV). Another high-backscatter patch characterized by single carbonate pieces, which were widely distributed and interspaced with sediments inhabited by thiotrophic, chemosynthetic organisms, was investigated using in situ measurements with a benthic chamber and ex situ sediment core incubation and allowed for estimates of the methane consumption (0.1 to 1 × 106 mol a? 1) and dissolved methane flux (2 to 48 × 106 mol a? 1). Our comparison of dissolved and gaseous methane fluxes as well as methane-derived carbonate reservoirs demonstrates the need for quantitative assessment of these different methane escape routes and their interaction with the geo-, bio-, and hydrosphere at cold seeps.

SOURCE: Marine geology

PDF URL: None

PUBLICATION YEAR: 2014

TYPE: article

CONCEPTS: ['Authigenic', 'Geology', 'Echo sounding', 'Carbonate', 'Seafloor spreading', 'Petroleum seep', 'Cold seep', 'Clathrate hydrate', 'Methane', 'Carbonate platform', 'Water column', 'Oceanography', 'Mineralogy', 'Sedimentary rock', 'Geomorphology', 'Geochemistry', 'Sedimentary depositional environment', 'Hydrate', 'Ecology', 'Materials science', 'Metallurgy', 'Biology', 'Chemistry', 'Organic chemistry', 'Structural basin']