



Contribution ID: 301 Contribution code: PSB-17

Type: Poster

Earthquake-enhanced dissolved carbon cycles in ultra-deep ocean sediments

Wednesday, 23 October 2024 18:15 (20 minutes)

Hadal trenches are unique geological and ecological systems located along subduction zones. Earthquake-triggered turbidites act as efficient transport pathways of organic carbon (OC), yet remineralization and transformation of OC in these systems are not comprehensively understood. Here we measure concentrations and stable- and radiocarbon isotope signatures of dissolved organic and inorganic carbon (DOC, DIC) in the subsurface sediment interstitial water along the Japan Trench axis collected during the IODP Expedition 386. We find accumulation and aging of DOC and DIC in the subsurface sediments, which we interpret as enhanced production of labile dissolved carbon owing to earthquake-triggered turbidites, which supports intensive microbial methanogenesis in the trench sediments. The residual dissolved carbon accumulates in deep subsurface sediments and may continue to fuel the deep biosphere. Tectonic events can therefore enhance carbon accumulation and stimulate carbon transformation in plate convergent trench systems, which may accelerate carbon export into the subduction zones.

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Session Classification: Poster Session B

Track Classification: Applications in Oceanography