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Who controls Fe cycling below the SMTZ of the Mediterranean Sea?

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Microbial metabolisms that attain close together different biogeochemical cycles, such as Fe, C, and N, introduce complexity to the traditional redox electron acceptors cascade in sediments, leading to spatial overlap between geochemical gradients. A good example of overlap when considering Fe geochemistry is the oftentimes peaks in dissolved Fe^{2+} observed below the sulfur-methane transitional zone (SMTZ) in different environments. While anaerobic methane oxidation mediated by Fe reduction (Fe-AOM) might explain the feature in deep lacustrine sediments, our preliminary data indicate that Fe-AOM is not significant in oligotrophic marine sediments. We described Fe speciation, nutrients, and microbiota composition in various sedimentary profiles from the Levantine Basin, Eastern Mediterranean Sea, Israel and observed coupled Fe and N cycling. In the ammonium-rich (2000 µmol L^{-1}) deep methanic sediments, strongly positive correlated increases in dissolved Fe^{2+} and NO_2^- (and/or NO_3^-) via microbe-mediated ammonium oxidation coupled to Fe(III) reduction (Feammox) is proposed. In this environment, the deep availability of Fe^{2+} favors precipitation of authigenic Fe minerals below the SMTZ.