The impact of gas seepage activity on iron release from South China Sea subsurface sediments

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Iron (Fe) is an essential micronutrient and commonly considered one of the key-limited factors for biological productivity in many ocean regions. Seafloor Fe supply is thought to be efficient in suboxic conditions. Recent studies shown that widely spread anoxic environments can develop in seep-impacted sediments and local bottom waters, owing to the occurrence of aerobic and/or anaerobic oxidation of methane. However, questions remain whether seep-impacted sediments can represent a source for bioavailable iron to the ocean. The relationship between the sediment iron and seep activity is also not clear. Here, we measured pyrite sulfur and iron isotopes, and Mo, U and Fe contents of the seep-impacted sediments as well from the northern South China Sea. The data obtained showing that period with intensity methane flux are associated with low Fe/Al ratios and high Fe isotopic signatures, which is consistent with the loss of isotopically light Fe due to the suboxic conditions. On the contrary, when the methane flux is relative low, the elevated Fe/Al ratios and high Fe isotopic signatures of the bulk sediments is attributed to the incorporation of isotopically high iron of iron sulfur minerals. Our study suggest that the seep-impacted sediments may represent a source of iron. These results have general implications for the marine iron cycle and for the interpretation of iron isotopic data in modern sediments and in the geological record.

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