

Origin and migration of fluid in the Sumatra subduction input: application of a geochronological method using a long-lived radioisotope of dissolved iodine

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Iodine has a strong biophilic character and is highly enriched in organic matter in the marine environment. Organic matter is decomposed by thermogenic and microbial processes during the sedimentation and releases iodine into the interstitial water. Iodine has one stable isotope (^{127}I) and one long-lived radio isotope (^{129}I) with the half-life of 15.7 Myr. Therefore, the $^{129}\text{I}/^{127}\text{I}$ ratio of marine interstitial water has been used for identifying the origin of fluid. We applied iodine geochronology to the interstitial waters extracted from the deep drilling cores recovered by IODP Exp. 362, where Sumatra subduction input sediments develop more than 1400 m without major fractures. The concentration and isotopic ratio ($^{129}\text{I}/^{127}\text{I}$) of iodine dissolved in the interstitial water were analyzed in order to characterize the source and potential age of iodine prior to the subduction and examine the basic geological factors controlling the fluid migration in the input sediment body.

Concentrations of iodine and methane increase and TOC decreases toward 200 meters below seafloor (mbsf) and 1250 mbsf, which indicate degradation of organic matter around that depth and subsequent release of iodine and methane into the interstitial water. Iodine gradient is controlled by the degradation of iodine-rich organic matter microbially in shallow sediment (at 200 mbsf) and geothermally in deep sediment (at 1250 mbsf), respectively. The $^{129}\text{I}/^{127}\text{I}$ ratios between 0 and 400 mbsf vary between 300×10^{-15} and 800×10^{-15} , and the lowest ratio of 300×10^{-15} is found at 175 mbsf. There are some thick sand layers > 60 meters between 0 and 400 mbsf. These porous layers transport allochthonous dissolved iodine and interstitial water, which are relatively old. However $^{129}\text{I}/^{127}\text{I}$ of 1300×10^{-15} at 67 mbsf corresponding to the sediment age of 3 Ma at 200 mbsf which is the zone of degradation of organic matter. $^{129}\text{I}/^{127}\text{I}$ between 400 to 1480 mbsf decrease from 700×10^{-15} to 400×10^{-15} , resulting from mixing with deep (old) iodine and shallow (young) iodine. In the input sediment, iodine gradient is strongly controlled by degradation of organic matter and the migration is controlled by vertical diffusion which indicates poor fluid migration or slow migration rate. However, the horizontal advection/migration of interstitial water is significant within the thick-porous sandy layers.

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