

## Observations and modeling of sinking particle speeds in the Twilight Zone using $^{210}\text{Po}$ - $^{210}\text{Pb}$ deficit

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A one-box model of  $^{234}\text{Th}$  uptake and removal in the water column is widely used to calculate downward  $^{234}\text{Th}$  and POC flux. The elemental pair of  $^{210}\text{Po}$ - $^{210}\text{Pb}$  is an alternative method to estimate carbon fluxes which should offer significant advantages due to its different half-life (138 days) and biogeochemical behaviour. Due to its long half-life, a  $^{210}\text{Po}$  deficit is maintained below the euphotic zone and penetrates much further into the twilight zone (100-1000 m) than  $^{234}\text{Th}$ . Hence  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  profiles and  $^{210}\text{Po}$  deficit could be used to broaden our knowledge of the twilight zone.

To address this question several water column profiles were sampled during two expeditions of RSS Discovery on the North Atlantic, PAP site (summer 2009) and Irminger Basin (summer 2010). The most important contribution of this work is that  $^{210}\text{Po}$  activity down the water column is modelled using a one-box inverse model. Modelled  $^{210}\text{Po}$  activities are in very good agreement with the analysed values and the new approach provides information to understand  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  concentration profiles on the water column. A key output from the model is average downward sinking velocities. Minimum and maximum values range from  $20\text{ m}\cdot\text{d}^{-1}$  at 50 m to  $150\text{ m}\cdot\text{d}^{-1}$  at 400 m. Averaged values at PAP and Irminger areas do not follow a clear geographical pattern; however, an increase with depth is observed. Finally, the contribution of slow sinking particles into the twilight zone and its implication to the carbon storage is discussed.

## Adsorption experiments of arsenic and lead onto barite

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The work consists in the study of the retentions of arsenic and lead onto the barite surface. The barite sample is from a deposit of Múzquiz (Coahuila, México). The batch adsorption experiments using salts of As(III), As(IV), and Pb(II) was according [1]. A measurement of the pHPZC of the barite sample was determined by acid-base titrations.

	As(V)	As(III)	Pb(II)
pH adsorption	8.35	8.55	8.45
$C_{t=0}$ (mg/L)	5.92	9.69	7.07
$C_{t=24\text{ h}}$ (mg/L)	5.08	9.67	< L.D.
Adsorption %	14	0.17	100
$R_d$ (mL/g)	3.6	0.04	2951

Limit of detection (L.D.) for lead is  $0.05\text{ mg/L}$

Table 1. Results of the adsorption experiment. The adsorption was calculated taking account the concentration of the dissolved species. Calculation of the distribution ratio ( $R_d$ ) between the solutes and barite mineral was calculated as Griffin *et al.* [1].

The determination of the  $\text{pH}_{\text{pzc}}$  of the barite is about 9.8. The present study shows that the barite could be used as adsorbent for Pb(II). Although the adsorption of arsenic is lower, is more effective for As(V) than for As(III). At the pH of adsorption the As(III) the predominant species is not charged ( $\text{H}_3\text{AsO}_3$ ), but the As(V) occurs as  $\text{HAsO}_4^{2-}$  and can be electrostatically attracted to the positive surface of the barite.

[1] Griffin *et al.* (1986) Hazardous and Industrial Solid Waste Testing and Disposal 60, 390-408.