

Dissolved barium in the Southern Ocean: conservative vs. non-conservative behaviour as constrained by a multiple end-member mixing model

Cattaldo T.¹, C. Jeandel², F. Dehairs¹, F. Candaudap², and N. Metz³

¹ Vrije Universiteit Brussel, Analytische Chemie
Pleinlaan 2, B-1050 Brussels
E-mail: thierry.cattaldo@vub.ac.be

² Legos/OMP
14 avenue E. Belin, F-31400 Toulouse, France

³ LPCM, CNRS-URA 2076, Université . Pierre et Marie Curie
4 place Jussieu, F-75252 Paris, Cedex 5, France

Understanding the factors controlling the dissolved oceanic Ba distribution is an important task to improve our knowledge of the biogeochemistry of the Ba proxy. As a bio-intermediate element, the oceanic Ba_d contents consist in a non-conservative fraction (mainly controlled by biogeochemical processes) and a conservative fraction (essentially modified by mixing processes). We investigated to which extent the dissolved Ba is conservative using a multiple end-member mixing model approach in which Ba was used as a mixing tracer in combination with Θ , S and O₂. Six watermasses known to contribute to the composition of the intermediate and deep waters in the Southern Ocean were used in an Optimal Multiparametric Analysis model (OMPA): a northern component (North Atlantic Deep Water), two southern component (Weddell Sea Bottom Water and Warm Deep Water), a circumpolar component (Intermediate and Deep Drake Waters) and an intermediate component (Antarctic Intermediate Water). OMPA modelling was applied to data obtained during WOCE/I6 CIVA-1 expedition (1993, 30°E). For this section located at the boundary between Atlantic and Indian Oceans, O₂ and Ba model outputs suggest the occurrence of a source originating from the Indian Ocean at intermediate depths between 44° and 54°S, probably advected by the Agulhas Current and the Agulhas Retroflexion. Furthermore, model calculations indicate that bottom water possibly coming from the shelf east of 30°E is required to explain the calculated dissolved Ba distribution in bottom waters between 54 and 56°S and 68°S. Archambeau *et al.* (1998) suggested that this water could originate from the Prydz-Bay area and the present study shows that deep Prydz Bay Slope Waters could be such a source. We demonstrate that, on the time and geographic scales of inter-basin and intra-basin exchanges, the dissolved Ba is useful to constrain the relative contribution of source waters and it can be used as more classical tracers (Nitrate, Phosphate) but without their inherent problems due to the varying Redfield ratio.

Another required function is manual editing of the TIN. Adding points can be done by reusing the already implemented incremental algorithm. Deleting points remains to be sorted out.

In a later phase, once the core of the program is finished, other user friendly features will be added.