Controls on seawater ^{231}Pa, ^{230}Th and ^{232}Th concentrations along the flow path of major deep-water masses in the Southwest Atlantic

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12b. Pa and Th distributions in the ocean: controlling mechanisms

Pa-231 and ^{230}Th are naturally occurring radionuclides in the ocean, produced through the α-decay of dissolved U. Once produced, the two radionuclides are adsorbed onto particles and removed from seawater as the particles settle to the sediment. Due to its higher particle reactivity, ^{230}Th is readily removed from seawater once produced, while less particle-reactive ^{231}Pa can be advected by deep ocean circulation to high-productivity areas to be subsequently removed. Therefore, a fractionation between ^{231}Pa and ^{230}Th takes place in seawater, making the ^{231}Pa/^{230}Th ratio a potential water-mass proxy to reconstruct past ocean circulation. However, factors such as particle flux and composition also play a part in the oceanic distribution of ^{231}Pa and ^{230}Th. To make use of ^{231}Pa/^{230}Th as a paleo-circulation tracer therefore requires a thorough understanding of the controls on the distribution of the two nuclides in seawater. Despite a growing knowledge of water-column ^{231}Pa and ^{230}Th concentrations, rather little is known about the distribution of the nuclides in the South Atlantic Ocean. This basin has recently been the focus of down-core ^{231}Pa/^{230}Th records [1], but is characterised by a more complex pattern of deep-water circulation than the North Atlantic, with multiple water masses flowing in different directions.

In this study, we present high-resolution dissolved ^{231}Pa, ^{230}Th and ^{232}Th data for twelve profiles in the Southwest Atlantic collected during GEOTRACES cruise GA02s (JC057) in March, 2011. The data capture all the main Atlantic water masses along their meridional flow paths and cross a gradient of productivity and dust input. Concentrations of dissolved ^{230}Th range from 0.0060~1.27 dpm/1000l and show a nearly linear increase with increasing water depth as a result of reversible scavenging process [2]. Concentrations of dissolved ^{231}Pa range from 0.0094~0.37 dpm/1000l and show an increase with depth in the upper water column with more variable concentrations at depth. ^{231}Pa/^{230}Th ratios characterise the three deep water-masses (AAIW, NADW, AABW) and show an evolution along flow paths. There is, however, also an obvious decrease in ^{231}Pa/^{230}Th near the equator, potentially due to higher productivity in this region. We will discuss the impact of these observations on the use of ^{231}Pa/^{230}Th to assess past ocean circulation. Concentrations of ^{232}Th are low but appear to provide information about detrital inputs to the region from dust and from the Rio Plata.

[1] Negre et al. (2010) *Nature* **468** 84-88. [2] Nozaki, Tsubota (1981) *EPSL* **54**, 203-216.

Applications of XRF analysis in lithogeochemical anomaly prospecting

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X-ray fluorescence (XRF) can be used directly to analyze contents of ore-forming elements in a gold mine and other characteristic indicator elements such as Zn, Cu, Pb, As, Sb, Fe, etc. in the field. It will make contributes to delineate the favorable areas for mineralization of gold mine, and quickly obtain the location and distributional pattern of gold mine geochemical halo.

Due to the polytropism of geological samples and the differences of analytical methods, the results of chemical analysis are quite different from the results of XRF analysis. As a result, specific standard samples corresponding to each kind of elements are requested in different lithology for each mine. And then the standard curve of best sample linear can be made.

Dashui Gold Deposit in Maqu, Gansu, which was found in west Qinling mountain area, is a type of gold deposits with unique mineralization. On the basis of geochemical exploration and actual situation of the deposit, the representative 3530 m and 3490 m middle sections of No.103 exploration line of Dashui Gold Deposit were selected for measuring. The measuring device is CIT-3000SMP. The design spacing is 3 m, and the analyzing time is 120 seconds per point. Five limestone and six diorite porphyrite samples with chemical analysis results had been used to fit standard curves and establish standard database respectively by the linear fit of the peak area and contents combining with the inverse computation of software. Then multi-element analyses had been down on the survey middle sections to delicate the favorable areas for mineralization of gold mine, and quickly obtain the location and distributional pattern of gold mine geochemical halo. The results demonstrate that:

1. Au, As, Cu, Fe, Mn, Ag, Sb, Ti, Sr, etc. appear high strength anomalies on the known middle sections, meaning that they can be treated as the indicating elements for Dashui Gold Deposit.

2. There is a high anomaly area in and near the contact zones of diorite porphyrite and hematite limestone of known ore body in 3490 m middle section. The width of the anomaly is about 33m. Combining with the geological situations of other middle sections, this area is delineated as level one prospective area. This area might be formed by the combination of two narrow gold veins, and it connects with other ore veins of the higher and lower middle sections.

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