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Controls on barium and radium-226 distributions along GEOTRACES GP15

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Radium-226 (^{226}Ra; $t_{1/2}$= 1,602 yr) and Ba are strongly correlated to one another in the ocean. However, the extent to which this correlation reflects an active biogeochemical coupling versus a passive sharing of the same circulation is unclear. The GEOTRACES GP15 section provides an ideal dataset with which to test these hypotheses. Radium-226 activities and Ba concentrations were determined in the Pacific along 152°W from 55°N to 20°S on samples collected between September–November 2018. We isolated the circulation component of the distribution by performing an optimum multiparameter analysis of the encountered water masses and modeled the distributions of ^{226}Ra and Ba based solely on physical transport of these water masses. The difference between the modeled and observed ^{226}Ra and Ba distributions reflects three significant non-conservative processes that influence ^{226}Ra and Ba distributions in the Pacific. First, in the north Pacific, intermediate waters (0–1,500 m) exhibit substantial deficits in ^{226}Ra and Ba that are likely caused by their incorporation into barite. Second, significant positive ^{226}Ra and Ba anomalies are found in deep waters (below 3,000 m) along the entire GP15 section, reflecting accumulation of ^{226}Ra and Ba from sediment diffusion and particle dissolution, respectively. Third, there are persistent positive ^{226}Ra anomalies between 5°N and 20°S around 2,500 m. Importantly, there are no corresponding Ba anomalies, suggesting a solute source unique to ^{226}Ra, such as from hydrothermalism. We augmented this statistical analysis with measurement of particulate ^{226}Ra, Ba, and Ba isotopes, which bring additional insight into the sources of particulate material to the deep ocean.