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High-resolution stable isotope profiles of a dimitobelid belemnite: Implications for paleodepth habitat and late Maastrichtian climate seasonality

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ABSTRACT

Oxygen and carbon isotope ratios were measured on belemnites, planktonic foraminifera, and benthic foraminifera collected from Late Cretaceous sediments on Seymour Island, Antarctic Peninsula, to compare the relative depth habitats of these organisms and to provide insight on temperature seasonality at high southern latitudes near the end of the Cretaceous. Average $\delta^{18}O$ and $\delta^{13}C$ values of the belemnite *Dimitobelus seymouriensis* overlap with those of benthic foraminifera; these values are significantly different ($p < 0.01$) from isotopic compositions recorded by planktonic foraminifera. This comparison shows that *D. seymouriensis* likely inhabited waters below the surface summer mixed layer of the outer shelf. These results suggest that average $\delta^{18}O$ of *D. seymouriensis* is a good indicator of intermediate-to-deep-shelf water conditions, which in this locality is a good approximation for pelagic water temperatures in the Southern Ocean. Measurements of $\delta^{18}O$ on high-resolution samples across belemnite growth bands indicate that annual temperature variability of sub-mixed-layer neritic water along the Antarctic coastline was 5°C on average with a mean annual temperature of 6°C.