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Morphological, geochemical, and ecological differences of two extant menardiform globorotaliid planktonic foraminifera

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Taxonomic consistency is the basic prerequisite for any foraminiferal study. In particular, interpretation of planktonic foraminiferal geochemical data requires consistent selection of monospecific tests, since different species are adapted to different ecological niches and hence different calcification depths. Recording stable isotope signals and temperatures of ambient seawater during calcification, species-specific planktonic foraminiferal oxygen isotope values (δ^{18}O) and Mg/Ca ratios reflect environmental conditions at different depth levels of the upper water column, which makes them suitable for paleoceanographic and climate reconstructions. However, since slight morphological differences may reflect different life habitats, the geochemical composition of a foraminiferal sample is highly dependent on the selection of morphologically alike specimens used for analysis. In order to exemplify the impact of unintended mixing of slightly varying species on δ^{18}O values and Mg/Ca ratios, this study investigates morphological characteristics and geochemical signatures of *Globorotalia cultrata* (d'Orbigny, 1839) and *Globorotalia menardii* (Parker, Jones & Brady, 1865). Both species are often assembled as "*G. menardii*" group or referred to as synonyms and are commonly suggested to represent seasonal thermocline habitats. In general, both nonspinose species precipitate circular to oval, lobulate, and low trochospiral tests showing 5–6 chambers in the final whorl. The perforate chambers meet at limbate sutures, which are straight on the umbilical side and curved on the spiral side. Tests are rimmed with an imperforate keel. The umbilical extra-umbilical aperture is furnished with an imperforate lip. In contrast, tests of *G. cultrata* differ from *G. menardii* in surface and keel. The surface of *G. cultrata* is smooth and shiny, at shallow sites transparent, and shows only few subconical pustules of sizes <10 μm. The surface of *G. menardii* is moderate to heavily encrusted with cuboid calcite pustules of up to some 10 μm in size. Instead of the less strongly calcified keels of *G. cultrata*, the pronounced keels of *G. menardii* show a sugar-like appearance. Our data reveal significantly different species-specific shapes and weights in conjunction with significantly different δ^{18}O values and Mg/Ca ratios implying that tropical *G. cultrata* inhabits the deeper mixed layer and records $\approx$5°C higher temperatures than seasonal thermocline-dwelling *G. menardii*.