Paleoecologic and paleoceanographic interpretation of $\delta^{18}O$ variability in Lower Ordovician conodont species

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Wheele et al. (2018) noted that “absolute values (14.4–16.4\%) are supportive of warm Early Ordovician seawater (e.g., Bassett et al., 2007) and equate to comparable temperature estimates for Floian seawater obtained through SIMS conodont analyses by others (Trotter et al., 2008).” Following the revised equation and refined protocol for $\delta^{18}O_{bioapatite} (%)_{Vienna Standard Mean Ocean Water [VSMOW]}$ by Pucéat et al. (2010) and Griffin et al. (2015), calculated seawater temperatures for the Early Ordovician range between 40 $^\circ$C and 50 $^\circ$C (Bassett et al., 2007; Trotter et al., 2008; Wheele et al., 2018) and thus represent the highest temperature record within the entire Phanerozoic (see Gradstein et al., 2012). According to James and Stevens (1986) and Pohler (1994), cool upwelling currents are suggested based on Si- and P-rich deposits of the Cow Head Group, wherefore relatively low temperatures of bottom waters and the deeper aphotic zone are expected. However, referring to the thermally stratified water column model of Wheele et al. (their figure 3) conodonts such as Tropodus sweeti produced $\delta^{18}O_{bioapatite/WM}$ (WM—white matter) whisker-plot mean values of 16.2$\%$ and 16.5$\%$, which conclude that temperatures in depths of ~300 m below sea surface were at least as high as 40 $^\circ$C. How do the authors explain such high paleotemperatures?

Our second concern is that the conodont assemblage collected from the Factory Cove Member derived from a channelized grainstone lens of proximal slope settings. From the sedimentological point of view, especially, such deposits are rich in allochthonous conodont elements, which either were transported down the slope from shallower habitats or moved up-slope from deeper environments by upwelling currents (Broadhead et al., 1990; Bábek and Kalvoda 2001; Purnell and Donoghue, 2005; von Bitter and Purnell, 2005). Even those well-preserved fused conodont clusters are not a useful indicator of low sediment transport distances here, as such of ten remain well-preserved due to the protective facetal envelope produced by nektobenthic or pelagic predators (e.g., Zatoň et al., 2017; Zhang et al., 2017).

Hence, we have strong reservations that oxygen isotope data of conodonts from a sole sample derived from a debrite-bed of a “not preserved shelf edge and upper slope” are appropriate for reconstruction of a depth-related seawater-temperature stratification model concluding a pelagic life mode of conodonts during the Early Ordovician. Such a paleoecologic and paleoceanographic model could presumably only be established by measurement of $\delta^{18}O_{bioapatite}$ of conodont elements from multiple sample series of different bathymetric settings transecting the same basin. Therefore, we think that arguments provided with this case study are insufficient for solving the question of whether conodonts had a pelagic life mode over a nektobenthic one.

REFERENCES CITED


