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Inter- and intra-specific variability in shell chemistry of well-preserved bivalve shells from the Early Campanian (Late Cretaceous) Kristianstad Basin in Scania, Sweden

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The Campanian age (Late Cretaceous) is generally considered as a period of globally ice-free, warm greenhouse climate (Huber et al., 2002). Understanding controls and modes of Earth's climate change in such a greenhouse world is essential for predictions of future climate change due to anthropogenic greenhouse gas emissions. Most of the literature on Late Cretaceous climate changes focuses on reconstructing the evolution of humid/arid conditions on land and/or past atmospheric and oceanic temperatures. Assessing the extent of seasonal change has seldom been studied so far, although such data constitute a fundamental component of the climate system. Fossil bivalve shells offer a valuable record for studying past climates at a seasonal scale. The chemistry of bivalve shells can record information about the environment in which bivalves grew, and incremental measurements of chemical changes in growth direction have the potential to yield records of seasonal changes in this environment. Examples of chemical proxies used for these palaeoseasonality reconstructions are stable carbon and oxygen isotopes and trace element ratios (e.g. de Winter et al., 2017). However, many open questions still exist regarding the incorporation of these chemical proxies into bivalve shells. Many of these challenges arise from the influence of so-called vital effects on the chemistry of precipitated carbonate in the shells (Weiner and Dove, 2003). In modern bivalves, these vital effects have been shown to interfere with characteristic relationships between shell chemistry and the environment and these vital effects appear to be distinct not only between different bivalve species but also between specimens of different ontogenetic age (Freitas et al., 2008). In this study, an attempt is made to isolate the effects of environmental change from vital effects recorded in stable isotope and trace element records from fossil bivalves. This is achieved by comparing results from different species and different individuals of the same species in the same palaeoenvironmental setting. The Early Campanian Kristianstad Basin localities used in this study offer abundant bivalve fossils from various taxa (Sørensen et al., 2015). Comparing multi-proxy records both within and between species sheds light on the influence of species-specific and age-specific effects on the expression of seasonal variations in shell chemistry. It also allows disentangling vital effects from environmental influences in an effort to improve palaeoseasonality reconstructions in the Late Cretaceous greenhouse.

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