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Three centuries of temperature records in Scotland preserved in sclerochronological archives from freshwater pearl mussels, Margaritifera margaritifera (Linnaeus, 1758)

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Bivalves are natural indicators of environmental variability as they reflect environmental conditions such as temperature in growth bands within the shell. During the winter period in temperate climes, shell growth ceases owing to the low water temperature and limited food supply. This hiatus is revealed by chemical staining as a very distinct etch-resistant band – termed the winter line. Winter lines alternate with less etch-resistant bands thus providing a chronology for any analyses which can be correlated to other proxy series and instrumental data. Freshwater pearl mussels have also been shown to form their shells in oxygen isotopic equilibrium with the ambient water thus fluctuations in water temperature can be constrained from the $\delta^{18}O_{carbonate}$data. As long as the date of collection is known, annual growth increments provide a precise dating tool for isotope samples and allow the allocation of precise calendar years to each part of the shell. Measurements of consecutive increments serve as records of isotopic composition from which derived temperatures may be correlated with other sample series and annual instrumental records, giving a high resolution proxy for temperature for a given region.

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The use of live-collected *M. margaritifera* shells is now prohibited in the UK due to the mussel's rarity and its protection under the Wildlife and Countryside Act (1981) and the European Union Habitats and Species Directive (EUHSD). Museum collections of freshwater pearl mussels thus provide an invaluable resource, with many collections in UK museums having been live-collected during 19^{th} century. As *M. margaritifera* is one of the longest-lived invertebrates, attaining an age of up to 140 years, sclerochronological and $\delta^{18}O_{aragonite}$ data have the potential to provide terrestrial climate records on the centennial scale. The use of museum specimens has the potential to establish a composite three hundred year record of Scottish environmental change. Shells from several localities in Scotland dating from the late 1700s to the present were sampled and the results compiled to construct a composite record of temperature change prior to and during the anthopogenically-induced contribution to climate change. The breadth of the collections used and the sampling protocol employed allows the examination of intra-individual and intraspecific variability in $\delta^{18}O_{aragonite}$ data from contemporaneous individuals from the same locality. Results have implications for the use of archaeological and subfossil shells in the reconstruction of past climates.