Available online at www.sciencedirect.com
SCIENCE DIRECT®
ELSEVIER
Palaeogeography, Palaeoclimatology, Palaeoecology 228 (2005) 43–57
PALAEO
www.elsevier.com/locate/palaeo

Freshwater bivalves tell of past climates: But how clearly do shells from polluted rivers speak?

Elena Dunca [a,b], Bernd R. Schöne [b,*], Harry Mutvei [a]

[a] *Museum of Natural History, Department of Palaeozoology, Box 50007, 10405 Stockholm, Sweden*
[b] *Institute for Geology and Paleontology, Bio-INCREMENTS Research Group, J.W. Goethe University, Senckenberganlage 32-34, 60325 Frankfurt/Main, Germany*

Received 5 September 2004; accepted 24 March 2005

Abstract

Freshwater bivalves, *Margaritifera margaritifera* (Linnaeus) and *Unio crassus* (Philipsson), from rivers in Sweden (79 specimens) and England (one specimen) were used to study the effects of human-induced pollution on shell growth (Table 1). We analyzed variations in annual and daily shell growth rates of 80 specimens from unpolluted and polluted (pH < 5, oxygen depletion and eutrophication) localities. 35% of the variability in annual growth of shells from unpolluted rivers is explained by ambient temperature during June through August. Daily shell growth also co-varies with the temperature during the growth season (approximately April–October). Long-term trends in temperature and growth compare well to each other. A weak correlation was also found for shell growth and the summer North Atlantic Oscillation (NAO) index. However, all of these environmental signals are obscured in specimens from polluted settings. In settings with high human impact, shell growth does not co-vary with summer temperatures or the NAO. Results of our study suggest a judicious sampling strategy when shells are used for climate reconstructions.

Keywords: Temperature; Sclerochronology; River; Acidification; Eutrophication; Climate proxy

1. Introduction

Shells of freshwater bivalves from mid- to high latitudes provide long, uninterrupted, seasonally to inter-annually resolved archives of continental paleoclimate. Such information can complement climate proxy data derived from tree–rings (e.g., Schweingruber et al., 1991; Grudd et al., 2002; Linderholm et al., 2003) and stalagmites (e.g., McDermott et al., 1999; Frisia et al., 2003; Niggemann et al., 2003). Like bivalve mollusks from marine settings (e.g., Pannella and MacClintock, 1968; Clark, 1975; Jones et al., 1989), freshwater mussels show the following shell growth characteristics: (1) They sensitively record ambient environmental conditions during growth as

* Corresponding author. Tel.: +49 69 798 22863; fax: +49 69 798 22958.
E-mail address: B.R.Schoene@em.uni-frankfurt.de (B.R. Schöne).

0031-0182/$ - see front matter © 2005 Elsevier B.V. All rights reserved.
doi:10.1016/j.palaeo.2005.03.050