

Aminostratigraphy of coastal sedimentary sequences, Kerch Strait, northeastern Black Sea

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Introduction

The principal methods used to constrain the timing of sea-level and environmental changes for the Last Interglacial sedimentary sequences have been Uranium-series and luminescence dating. An alternative to these, used with success in studies on Australian coastal sedimentary sequences, is the amino acid racemization geochronological technique. Recent technological (Bruckner et al., 1991) and methodological developments (Kaufman and Manley, 1998; Hearty et al., 2006) now allow for calibrated age determinations on suitable skeletal carbonates including individual foraminifers and ostracods.

Marine coastal sedimentary sequences at Eltigen in the Kerch Strait have been ascribed a Last Interglacial age (MIS 5e, 125 ka) based on U/Th dating techniques (Zubakov, 1988; Arslanov, 1993; Dodonov et al., 2000; Arslanov et al., 2002). However, the southernmost section at Eltigen (our BS-4, Fig. 1) has also been dated to MIS 7a and 7c (Bylinsky et al., 1990). The focus of this study is to date the coastal sedimentary sequences at Eltigen, Kerch Strait, Ukraine, using aminostratigraphy, and where possible to correlate these deposits with similar sediments from the Taman Peninsula, Krasnodar Territory, Russia.

Methods

Reverse-Phase High Performance Liquid Chromatography was used to examine the extent of amino acid racemization (AAR) in the bivalve molluscs *Cardium edule*, *Chione gallina*, and *Mytilus*. The extent of AAR was additionally analyzed in whole-rock samples, a term referring to the total content of skeletal carbonate material within a sediment sample. The AAR method used is based on Kaufman and Manley (1998) for shells and Hearty et al. (2006) for whole-rock samples, with modification of both by strong bleaching (12.5% NaOCl) for one hour. This method uses pre-column derivatization with o-phthalaldehyde (OPA) and N-isobutyryl-L-cysteine (IBLC) to produce fluorescent chiral primary amino acids as diastereomeric derivatives, separable with a reverse-phase column.

Results

D/L ratios from whole-rock samples indicate that the sediments from BS-4 (Fig. 1) are older than those recovered from BS-5, 6 and 8 (Fig. 1), and the sediments of those latter study sites are of an equivalent aminostratigraphic age. D/L ratios from articulated and disarticulated single mollusc shells, principally *Chione gallina*, suggest that the age of the fossils at these locations (BS-4 and BS-6) are the same. Results from a limited number of articulated *Chione gallina* from Maly Kut (BS-11) indicate the shells from this study site are younger than those of Eltigen. Results from *Chione gallina*

from Cape Tuzla are inconclusive (only two samples to date), but also suggest that these sediments are younger than those of Eltigen. D/L ratios from disarticulated valves (Eltigen) are not different from D/L ratios on articulated samples, suggesting that reworking of shell material for most of the sedimentary sequence at Eltigen is intraformational. However, the older whole-rock samples from the southern study site at Eltigen indicate that at the initial time of sedimentation, reworking of pre-existing bioclastic sediments may have occurred.

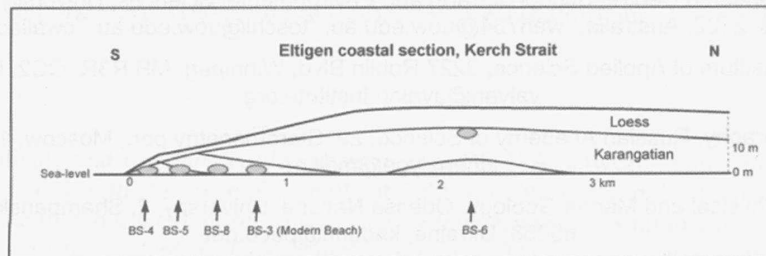


Figure 1. Study sites at Eltigen. Sketch adapted from and modified after Dodonov et al., 2000.

Discussion

Based on the extent of racemization in the amino acids glutamic, valine, and alloisoleucine, a MIS 5e age seems appropriate for the raised sedimentary sequence at Eltigen. However, D/L ratios in articulated *Chione* are generally lower for study site BS-4 than for BS-6 (Fig. 1), which is the opposite of the apparent stratigraphic sequence. Accepting a MIS 5e age for Eltigen and using a parabolic method for age estimation, the articulated *Chione gallina* from Cape Tuzla are of MIS 5e (using valine) or 5c age (using glutamic acid), while those from Maly Kut are early MIS 3 (valine or glutamic acid).

The AAR age of the sedimentary sequence at Maly Kut, previously correlated with Eltigen based on the presence of *Chione gallina* and similar marine molluscs, appears erroneously young. The distribution of D/L ratio based ages correlates with preservational differences in these shells. The best preserved shells (BS-6) have the higher D/L ratios, those more poorly preserved (BS-9, 11) have lower D/L values. AAR age differences between these molluscs are therefore likely to be related to differences in physical and diagenetic environments between the individual study sites rather than large chronological variations.

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