CORE-TOP CALIBRATION USING THE LIPID-BASED TEMPERATURE PROXIES $U^{K'}_{37}$ AND TEX_{86} ON THE SOUTHERN ITALIAN SHELF (SW ADRIATIC SEA, GULF OF TARANTO)

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Abstract
The core-top calibration of lipid-based temperature proxies along the south Italian shelf suggests that $U^{K'}_{37}$ primarily records winter temperatures while TEX_{86} tend to reflect summer temperatures, in particular in offshore regions. Additionally, a bias of TEX_{86} due to terrestrial input or transport cannot be excluded. Our study provides a robust basis for future reconstructions of winter climate variability in this region during the last two millennia in sediment cores with a temporal resolution of 4 yrs, which is likely to provide important information on the extension of the AO/NAO in the Mediterranean.
Keywords: Adriatic Sea, Temperature

Introduction The southward extension of the AO/NAO during winter is crucial for the Mediterranean water budget. The ESF project MOCCHA aims at providing climatic reconstructions for the Gulf of Taranto (S. Italy) with a <4-year resolution. The sediments in this region are excellently suited for this purpose [e.g., 1]. To fully exploit the sedimentary archive, a better understanding of the relation between environmental conditions and sedimentary composition is needed. Therefore a core-top calibration of molecular paleotemperature proxies has been performed. The lipid-based $U^{K'}_{37}$ and TEX_{86} proxies presumably reflect the temperature in the habitat of the source organisms, i.e., haptophytes and crenarchaeota, respectively [Fig. 1].

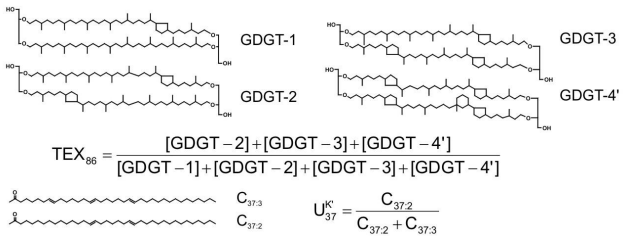

Fig. 1. Structures of GDGTs and alkenones and their related temperature proxy indices, TEX_{86} and $U^{K'}_{37}$, respectively [2, 3].

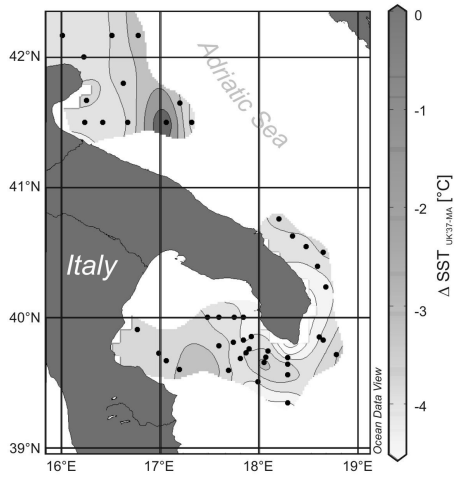

Fig. 2. Map of southern Italy showing the difference between alkenone-derived SST and satellite-based mean annual SST ($\Delta SST_{UK'37-MA}$) at the SW Adriatic coast and the Gulf of Taranto.

Usually, the transfer functions applied to the lipid composition of the surface sediments closely agree with the annual mean temperature in the overlying surface waters [2-5]. In many open oceanic settings the main productivity takes place when ambient water temperatures are close to the annual mean [4], which is not necessarily the case in the Mediterranean [e.g., 6]. Here, we elucidate the temporal relation between the lipid composition of sediment surface samples and monthly satellite-derived sea surface temperature and productivity data at the south Italian shelf.

Material and Methods The analysed sediments represent the top 2 cm of multicores from 48 stations obtained during P339 POSEIDON cruise 'CAPPUCCINO' in June 2006. Homogenized samples were extracted by using an accelerated solvent extractor (ASE 200, DIONEX). Alkenones were quantified using GC-FID. Analysis of GDGTs was based on HPLC-APCI/MS [7]. The most recent global transfer functions were used for temperature conversion [4, 5]. Satellite based environmental data and mean annual sea surface temperatures (SST_{MA}) derive from OBPG MODIS-Aqua Monthly Global 9-km data base [8].

Results and discussion In our study, the alkenone-based $U^{K'}_{37}$ reflects winter/spring SST [Fig. 2]. This agrees with maximum haptophyte production in the colder season as evidenced by chlorophyll data and sediment trap analysis. In contrast, the TEX_{86} data are more complicated. For the near-shore sites the TEX_{86} suggests that the GDGTs have been produced in winter but with increasing distance from shore the inferred ambient water temperature increases; consequently most offshore sites reflect summer SST. This is probably due to differences with respect to timing and/or depth of production, or transport of allochthonous GDGTs. Our core-top calibration documents varying degrees of seasonal bias of the two SST proxies in a regional context. This improved understanding of SST signal formation at the Gallipoli shelf provides a robust basis for future examination of temperature changes in sedimentary records covering the last millennia.

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