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Biomarker based reconstruction of Pleistocene climate and environmental conditions in the Gulf of Alaska: Preliminary results obtained from IODP Expedition 341 sediments

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A remarkable sedimentary record that extends from the Miocene to the late Pleistocene/Holocene has been drilled during IODP Expedition 341 (May - July 2013) in the Gulf of Alaska. The recovery and examination of sediments along a transect of five drill sites (U1417 - U1421) from the deep ocean towards the continental slope and shelf offshore the St. Elias Mountains enables the reconstruction of the palaeoceanographic and environmental development in the NE Pacific during a period of significant global cooling and directly addresses the overall research objectives of the IODP programme.
The knowledge about palaeo sea surface conditions and their relation to climate changes in the subpolar NE Pacific is relatively scarce and mainly confined to the past 17 ka BP (Barron et al., 2009; Davies et al., 2011; Addison et al., 2012). Biomarker based reconstructions of the sea surface conditions (i.e. sea surface temperature (SST), sea ice coverage, marine primary productivity) that characterised the subpolar NE Pacific during critical time intervals of Plio- and Pleistocene climate change may provide new information on oceanic and atmospheric feedback mechanisms and further enable the identification of teleconnections between the palaeoceanographic evolution in the North Pacific and the North Atlantic.
Here we present preliminary biomarker data obtained from sediments from the distal deepwater site U1417 and the proximal site U1419 located at the Gulf of Alaska continental slope. Variability in the distribution and abundance of short- and long-chain n-alkanes, sterols, and C25-highly branched isoprenoids (HBIs) is interpreted to reflect changes in the environmental setting. These data provide insight in marine primary productivity changes (in response to cooling and warming intervals) and the variable input of terrigenous organic matter via meltwater and/or iceberg discharge events. The C25-HBI diene/triene ratio - hitherto used as a sea ice proxy in the Southern Ocean (Etourneau et al., 2013) - is applied to gain information about the variability in polar water/sea ice extent in the study area. Previously, Rowland et al. (2001) documented that not only the degree of unsaturation in C25-HBIs but also the E- to Z-isomerisation in the C25-HBI trienes increases with increasing water temperature. Based on this observation we suggest that the ratio of the Z-isomer to the E-isomer in the trienes might reflect SST changes and could be used as an additional SST proxy. The applicability of this approach, however, needs further evaluation (e.g. through comparisons with alkenone SST data obtained from Expedition 341 sediments).

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