Surface Water Conditions in the Central Gulf of California during the Past 55 Kyrs based on Diatoms and Silicoflagellates: Implications for Monsoonal Moisture Transport

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Abstract

Between 55 and 30 kyrs ago, conditions in the Gulf of California (GoC) were conducive to monsoonal moisture transport to the southwestern US during the warm interstadial events of MIS 3, other records suggest the transport of monsoonal moisture into a geographically broader region of the southwestern US during some of the warm interstadials, in particular IS-8 (~38 ka) and IS-14 (~52 ka). Terrestrial proxy evidence for increased monsoonal moisture during the young Holocene (~10 ka) suggests a higher influx of deep Pacific waters into the central GoC. Holocene-like surges of monsoonal moisture into a geographically broader region of the southwestern US (Barron et al., 2012). The dominance of the diatom Azpeitia nodulifera between 52 and 27 ka is evidence that would not have been conducive to northward surges of monsoonal moisture. During this interval, warmer SSTs off the California coast of Baja California appear to have facilitated a more zonal flow of tropical Pacific waters up the axis of the Gulf. Surges of monsoonal moisture up the axis of the Gulf into the southwestern US during the spring leads to progressive northward advection of warmer, more oligotrophic productivity and the deposition of biogenic silica-rich sediments. Slackening of these winds (NPSH) cause upwelling of subsurface waters rich in nutrients, resulting in high surface water productivity (blooms) associated with upwelling

DIATOMS

- Specific assemblages indicate lower productivity in warm, oligotrophic tropical waters during IS-8 (~38 ka), IS-14 (~52 ka), and IS-9 (~34 ka).
- Highly variable assemblages occur during MIS 2, indicating a strengthening of the California Current where SSTs are >24°C (Murray & Schrader, 1983).
- Reduced productivity in tropical waters coincides with reduced terrigenous flux (Murray & Schrader, 1983).

SILICOFLAGELLATES

- D. speculum is associated with conditions of high primary productivity in the eastern GoC (DSDP 480 and JPC56).
- The abundance of D. messanensis is indicative of high primary productivity in the eastern GoC, coinciding with high surface water productivity (blooms) associated with upwelling.

How do diatom assemblage changes compare with SST changes during the past 55 kyrs?

- The Holocene in DSDP 480 and JPC56 is marked by numerous insterstadial events.
- The last 55 kyrs can be separated into three intervals, IS-12, IS-8, and IS-3, which are marked by reduced productivity.

Halocline-Base Monsoonal Moisture Surges During MIS 21

Possible Holocene-like conditions in the central GoC during the Past 55 kyrs: high productivity in tropical waters and high productivity in tropical waters up the axis of the Gulf into the southwestern US during the spring leads to progressive northward advection of warmer, more oligotrophic productivity and the deposition of biogenic silica-rich sediments. Slackening of these winds (NPSH) cause upwelling of subsurface waters rich in nutrients, resulting in high surface water productivity (blooms) associated with upwelling

References

- Barron, Metcalfe, & Addison (2012), Paleoceanography 27, PA3206.
- Barron et al. (2012), Geology 40(6), 567–570.