

Seasonal ocean upwelling recorded by the late Miocene Pisco Formation diatomites of Peru

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A 25-cm-thick sample of diatomaceous mudstone was collected in the whale fossil-bearing late Miocene Pisco Formation at Cerro Los Quesos in Peru. This macroscopically-laminated sample was divided into blocks and embedded in epoxy resin for light and scanning electron microscope (SEM) analysis. In only a few cases are laminae well preserved and, hence, useful for paleoenvironmental studies. In these few cases, a terrigenous lamina – Coscinodiscus ooze lamina – mixed lamina (Chaetoceros resting spores, Thalassionema, terrigenous material) sequence is observed. By comparison with Holocene sediment laminations from the Gulf of California, the late Miocene Peruvian triplet laminations are interpreted as an annual depositional cycle. The terrigenous lamina was deposited in the wet season (summer). Coscinodiscus ooze was the product of: (1) initial high summer primary production which took place at the thermocline during water column stratification; and (2) a subsequent 'Fall dump', or sedimentation, of the diatoms due to autumn storm-related mixing of the water column. Finally, the mixed lamina was deposited during/following the spring bloom. The frequent disruption or homogenisation of laminae observed in the slides was attributed to bioturbation by microbenthic organisms. This bioturbation was accompanied by a general absence of macrobenthos in the late Miocene diatomites of the Pisco Formation; such conditions are commonly interpreted as the consequence of a suboxic sea floor environment. In this presentation we will demonstrate the seasonal nature of the Late Miocene Pisco Formation diatomites and show novel SEM microelemental maps that help interpreting the paleoenvironmental conditions at the sea floor at the time of diatomites deposition.