Supporting Online Material for

Planktonic Foraminifera of the California Current Reflect 20th-Century Warming

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Coring and Processing

The principal box core of this study, BC3001, was collected with a Soutar box corer on November 30, 2001 and successfully recovered intact surface sediments. The coring site was chosen based on the excellent structure of laminae observed in other cores. This core was subsampled with a 14 x 14 cm acrylic liner and the core bottom frozen with dry ice to prevent sediment slumping upon opening. The core was then opened and the frozen sediments surrounding the liner washed away until the acrylic liner could be sealed at the bottom. Kasten core SBKC 9210-1302 (see *1* and *2* for details) provides a longer sedimentary record than the box cores. Cores were stored at ~5^{o}C and allowed to drain for subsampling.

Sections of each core were sliced into vertical slabs along the core length. A single trim slab was first sliced from the widest point at the shrunken top to the point of equivalent width at the bottom of the section. Each vertical section, now of equal width, was then sliced into six vertical slabs down the core, each of which revealed the

laminated sequences. Slabs 1, 3, 4, and 6 were sliced to 2.5 cm width to be used for analyses while slabs 2 and 5 were cut to 1 cm width for high resolution X-radiographs.

Chronology

A detailed chronology was developed based on visual identification of individual varves from the X -radiographs of the slabs from several cores. Since sedimentary sequences vary across the basin, examination of slabs from several cores reveals different perspectives of the structure of laminae. Gray layers were considered as instantaneous deposits (*3*) for the chronology developed. This chronology is anchored by the well-established varve count from several box cores extending to 1880 that has been verified by ^{210}Pb dating (*4*). Uncertainty in the varve count increases down core owing to occasional diminished clarity in laminae structure or erasure of laminae by gravity flows in all cores. Core SBBC 3001-0111 extended through a large homogenous layer, which is given a date here of 1736, but was dated at 1739 by (*5*). The top of the *Macoma* layer, a distinctive shell-rich horizon that can be recognized in all cores, was dated here at 1830 but at 1835 by (*4*) and at 1839 by (*5*). The *Macoma* layer itself is 2.3 cm thick in SBBC 3001-0111 and interpreted as representing 11 years based on the average sedimentation rate of 2.1 mm/year in surrounding varves.

Subsampling and enumerations

Each thick slab of 2.5 cm thickness was subsampled in the desired intervals based on the developed chronology. Box cores were sampled in two-year intervals and the Kasten core sampled in five-year intervals. The sampling error associated with the excision of each sampling interval may typically be half a year and may be as high as 1

year but would not be propagated down-core. Material from slabs 1 and 3 was combined into a single two-year sample from SBBC 0110-3001. Each sample was disaggregated by heating in a solution of 20% hydrogen peroxide buffered with sodium pyrophosphate and then sieved at 125 and 500 μm. Samples were then dry-sieved for enumerations of five different size fractions (150-180 μm, 180-212 μm, 212-250 μm, 250-300 μm, and 300-500 μm).

Counts from SBBC 0110-3001 were made from each size fraction, or a split of the size fraction such that approximately 100 tests or more were counted in each size fraction. Species identification followed the taxonomy of (*6*) with PD-intergrade (*N. pachyderma – N. dutertrei* intergrade) distinctions made following (*7*). The average number of tests counted per sample was greater than 500. Abundances are expressed as no./cm^2/year and are corrected for slightly different area of each sample due to the combined factors of core shrinkage and removal of a trim slab. *G. calida, G. rubescens, G. glutinata, G. siphonifera,* and *G. digitata* are grouped together as 'Other Subtropical spp.' since they show similar patterns of abundance, generally have similar biogeographic affinities (tropical to subtropical), and few tests (if any) were counted in much of the time series. Unidentified species, species characterized as PD-intergrades, and other species with too few tests quantified to be reliable indicators of abundance are not shown or considered further. Counts from the Kasten core were made from the >300 μm size fraction of the four thick slabs of 2.5 cm thickness each.

A Principal Component Analysis (PCA) was done on the log normalized time series of species abundances from the box core. The resulting first principal component (PC1) was compared with the updated Kaplan Sea Surface Temperature (SST)

reconstruction for the 5^o X 5^o grid centered at 122.5^o W 32.5^o N (*8*). Large El Niño events in the California Current are indicated based on observations of highest SST in the Kaplan SST index and other instrumental records (*9-11*). PC1 is also compared with the average of log normalized time series of abundance from a core taken in 1992 (and analyzed with the aforementioned methods) and with similar time series from a core taken in 1969. These time series are of *G. bulloides*, *G. ruber*, and *O. universa* from the >180 μm size fraction (A. Soutar, unpub. data), as well as *N. dutertrei*, *G. calida* and *G. siphonifera* from the >250 μm size fraction (Berger, 1971 and unpub. data).

Supporting Online Material References

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