Diatomeas y cambio climático: una aproximación crítica desde el realismo climático

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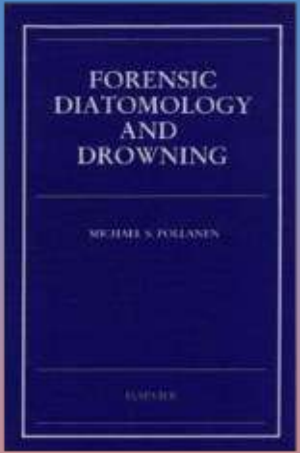
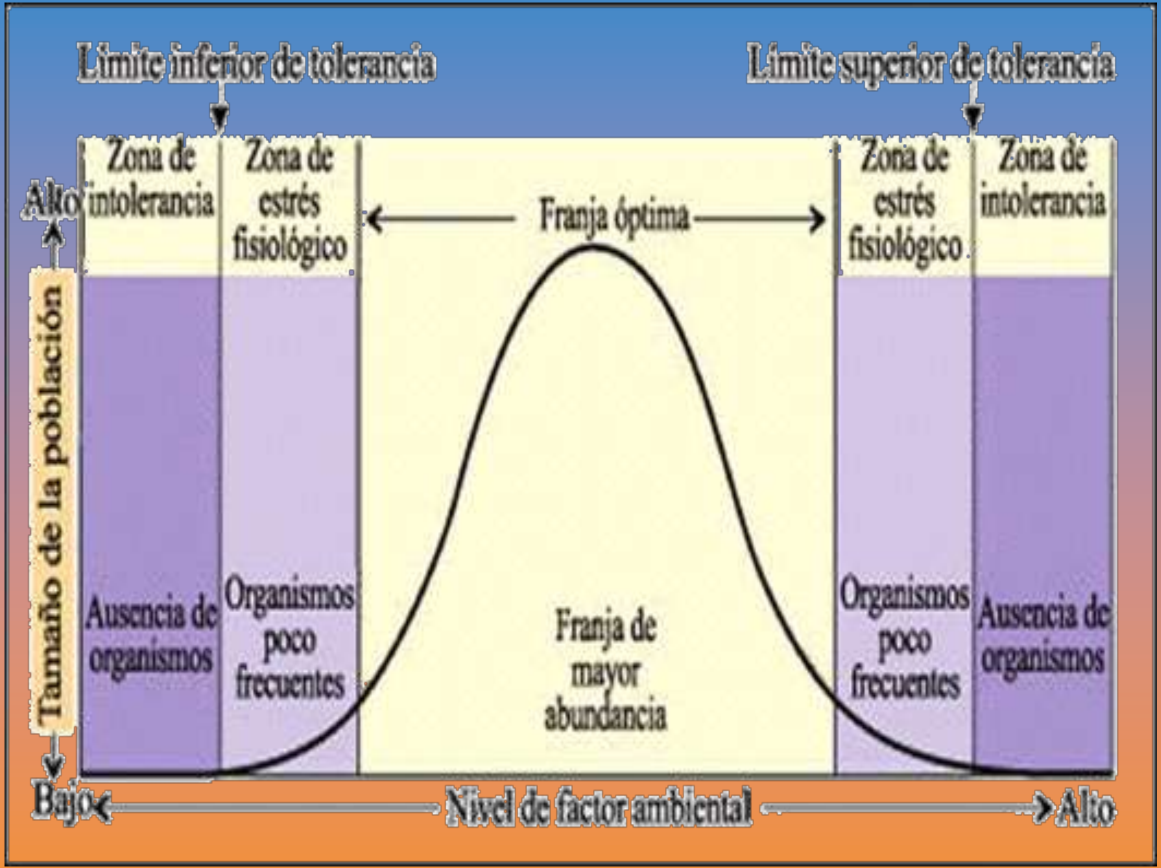
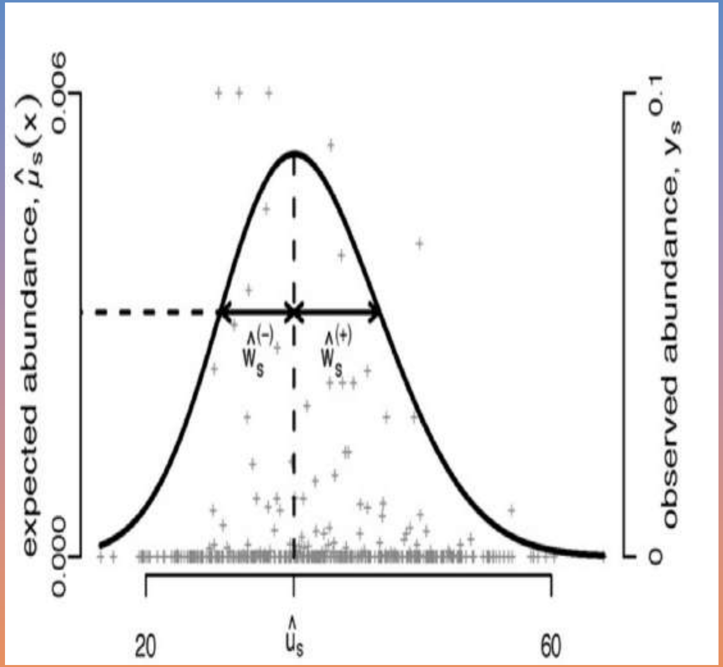
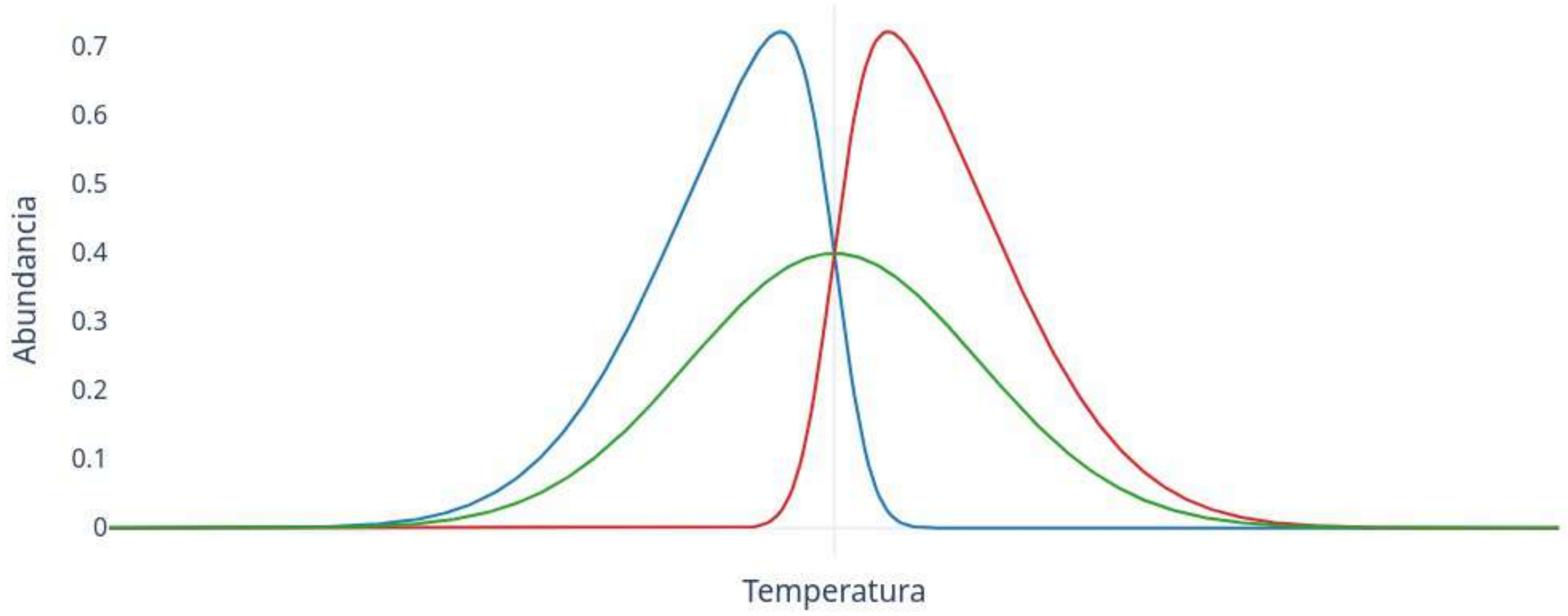
- Son algas unicelulares que viven en todos los hábitats acuáticos del mundo
- Se caracterizan por su caparazón silíceo (*frústulo*)
- Son organismos fotosintéticos: responsables del 25% de la producción primaria del planeta
- Existen centenares de miles de especies, cada una de ellas con sus preferencias ecológicas
- Responden muy bien a los cambios ambientales, en especial a la química del agua
- Por ello se usan rutinariamente como bioindicadores y *proxies* paleoecológicos.

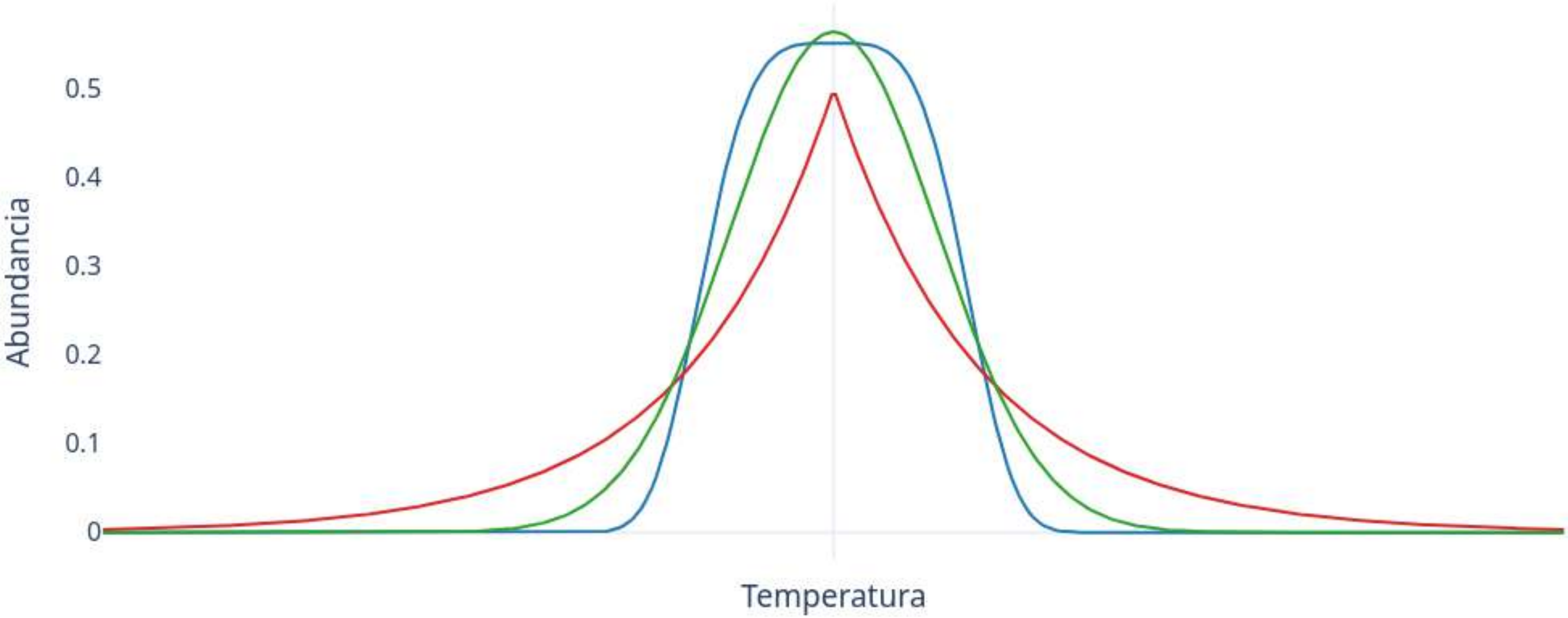

DE
Diatomaceous Earth
Crawling Insect
Killer
Necessary Organics


FORENSIC
DIATOMOLOGY
AND
DROWNING
MICHAEL S. POLLANEN


Límite inferior de tolerancia
Límite superior de tolerancia
Zona de intolerancia
Zona de estrés fisiológico
Franja óptima
Zona de estrés fisiológico
Zona de intolerancia
Alto
Tamaño de la población
Bajo
Ausencia de organismos
Organismos poco frecuentes
Franja de mayor abundancia
Organismos poco frecuentes
Ausencia de organismos
Nivel de factor ambiental
Alto


expected abundance, $\hat{\mu}_s(x)$
0.006
0.000
observed abundance, y_s
0.1
0
$\hat{w}_s^{(-)}$
$\hat{w}_s^{(+)}$
20
$\hat{u}_s$
60


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Abundancia
Temperatura



0.5
0.4
0.3
0.2
0.1
0
Abundancia
Temperatura

¿Qué nos dicen las diatomeas acerca del pasado climático de la Tierra?

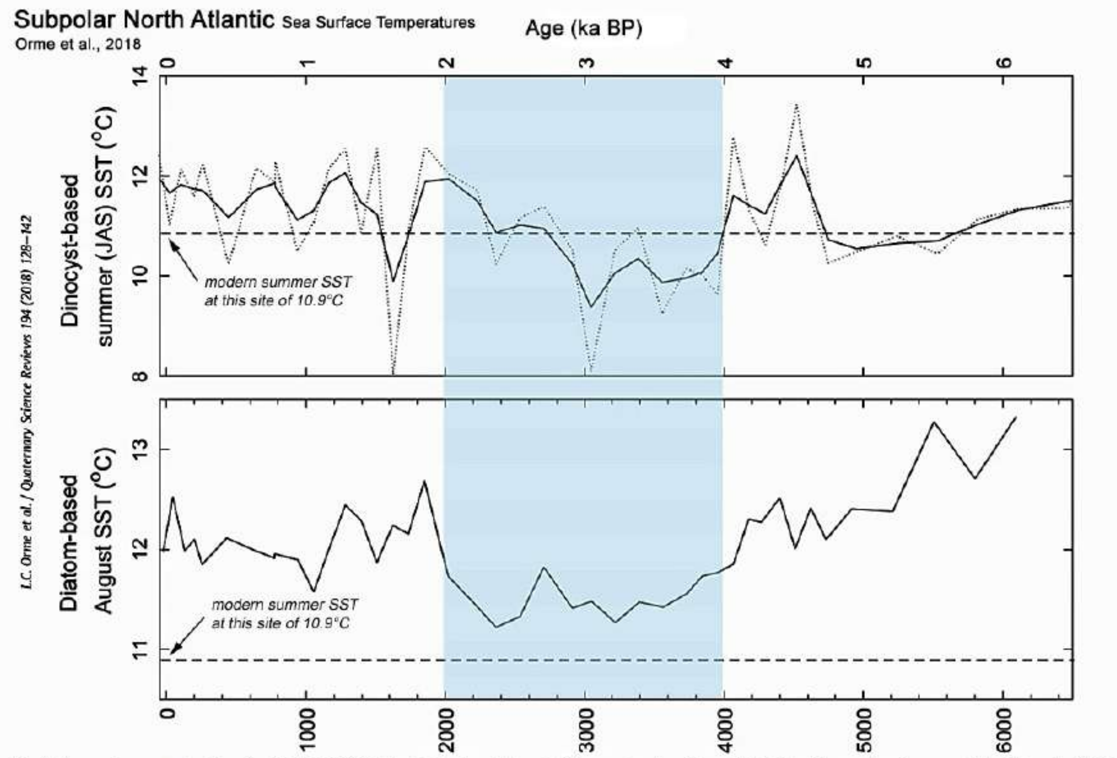


Fig. 4. Temperature reconstructions for DA12-11/2-GC01. *Top*: Diatom-based August SST reconstruction (this study). *Bot*: Dinocyst-based summer (July–September) SST reconstruction, including raw data (dotted line) and smoothed data (five point weighted running average; solid line) (Van Nieuwenhove et al., 2018). The shaded area highlights the reconstructed cold SST interval at c. 4-2 ka BP of this study and the dashed line the modern summer SST at this site of 10.9 °C (WOA2013; Locarnini et al., 2013).

Orme et al. 2018: las temperaturas modernas han seguido disminuyendo desde el inicio de la Pequeña Edad de Hielo.

Oceanologia
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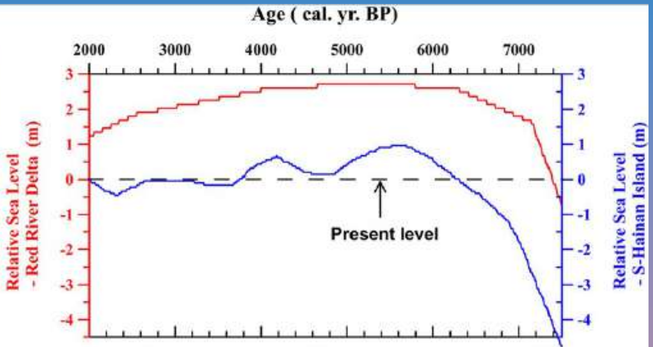
Original Research Article

A fossil diatom-based reconstruction of sea-level changes for the Late Pleistocene and Holocene period in the NW South China Sea

Jinpeng Zhang [a b c], Michal Tomczak [d], Andrzej Witkowski [b], Xia Zhen [a], Chao Li [e]

The strong monsoon in the Early Holocene overlapped with a fast sea-level rise and higher sediment supply, resulting in a "dilution" of the diatom record. The more open sea/tropical species occurred in the Middle Holocene, which is a good indicator of the climate thermal period. In addition, the Neoglacial was recorded in the Late Holocene after the highest absolute diatom abundance followed by an almost complete loss of open sea/tropical species and decrease in diatom P:B ratio in regressive sedimentary sequence. And the abrupt climate fluctuations of the last millennium could be recorded by the diatom facies, including re-intensified summer monsoon-driven warmer water into the Beibu Gulf as an invasion activity and a cooling resulting in the disappearance of tropical open sea species (i.e., Little Ice Age).

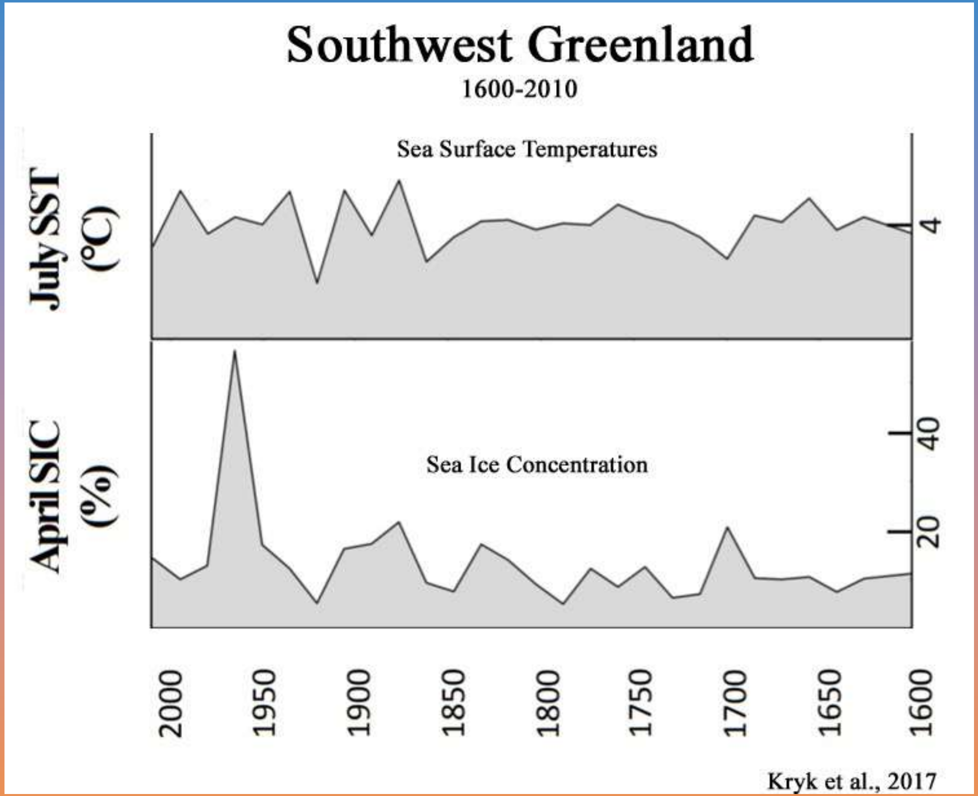
Although the regional sea-level reconstructed curves have a gap between the Red River Delta (Figure 5 and 7, from Tanabe et al., 2003) and South Hainan Island (Figure 5 and 7, from Chen et al., 1991), the diatom taphocoenosis in the core SO219/31-4 seemingly responded to the higher sea-level position. Our results support a height of 2–3 m above (>2.5 m) the present level during 6000–4000 cal. yr. BP. According to the sedimentary record, the Red River deltaic plain prograded laterally in its seaward area about 6000 cal. yr. BP and in the highest sea-level face (Tanabe et al., 2006), causing a large area occupied by the mangrove swamps to gradually emerge above sea level (Funabiki et al., 2007).



The summer monsoon drives warmer water into the Gulf due to oceanographic conditions, particularly during ca. 700–450 cal. yr. BP. in the core SO219/31-4 profile (ca. 1250–1500 AD), as evidenced by a higher percentage of tropical open sea species, e.g., *A. nodulifera*. Then, this local process makes sense as an exceptional response to climate change in terms of wet status as a "wet tropic" as commented by Mayewski et al. (2004). After this wet and humid stage, the Little Ice Age (roughly AD 1400–1850/ca. 550–100 cal. yr. BP, Esper et al., 2016) cooling period can be reflected on by the very low content of tropical open sea species (as *A. nodulifera*) in this studied core profile within the span of ca. 450–120 cal. yr. BP.

The high sea level, above the present level, in stages 4 and 5, in the Middle Holocene Climatic Optimum period, was clearly documented by more significant open sea/tropical diatom species and coastal planktonic species percentages, respectively. The late Holocene regression of sea levels was marked by a pronounced reversion of diatom taphocoenosis, responding to neoglacial climate. Fossil diatom assemblages outlined responded to paleoclimate of global warming in the deglacial and early Holocene.

"nuestros resultados evidencian una altura de 2-3 m por encima del nivel actual hace 6000-4000 años" (NO Mar de China)

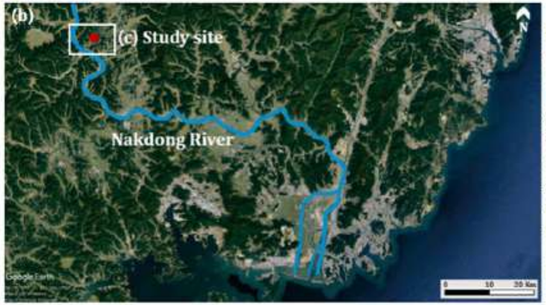


"La temperatura superficial marina de julio durante los últimos 400 años varía solo ligeramente de un mínimo de 2,9 a un máximo de 4,7 °C. La cobertura de hielo marino fue baja [durante el siglo XX]" (Groenlandia)

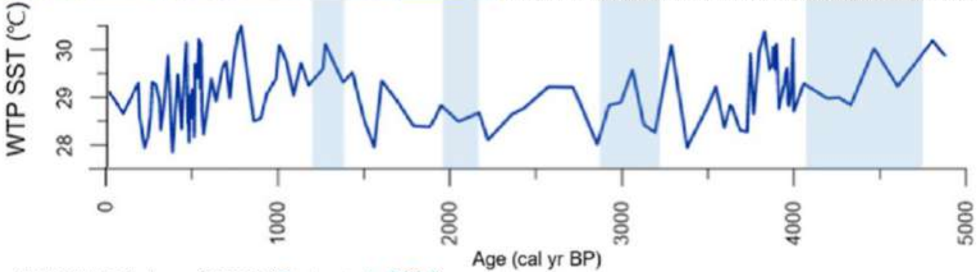
Quaternary Science Reviews 263 (2021)

Multi-proxy indications of depositional evolution and paleo-natural disasters (flooding and fire) in the southern part of the Korean Peninsula during the Holocene

ELSEVIER Eunmi Lee [a, b], Sangheon Yi [b, c, *], Jaesoo Lim [b, c], Ara Cho [b], Yongmi Kim [b], Kyoung-nam Jo [a]



These observations are interpreted as indicating that sea levels reached the vicinity of the study area during this period; these marine species were brought into the area indirectly along the Nakdong River at high tide or by typhoon-driven seawater invasion. Hwang et al. (2013) reported marine sediment consisting of gray silt with abundant shell fragments during the Middle Holocene (ca. 7000–5200 cal yr BP) in the Bibong-ri area, located about 25 km from the present study area toward the Nakdong River estuary. In addition, the diatom assemblage proportion of marine species was also highest (at about 90%) at ca. 6000 cal yr BP. Therefore, these climatic conditions together with sea-level rise caused high water levels in the Nakdong River and increased river discharge during the Early to Middle Holocene, resulting in the formation of a permanent rather than a temporary water body within the study area.



WTP SST (°C) data of MD81 (Stott et al., 2004).

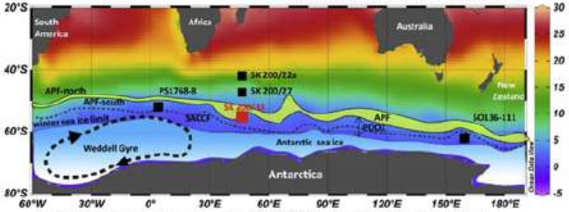
Lee et al. 2021: Las temperaturas de la superficie del mar coreano son más cálidas que hoy durante gran parte de los últimos 5.000 años

Marine Micropaleontology
Volume 160, September 2020, 101894

ELSEVIER

Antarctic sea-ice and palaeoproductivity variation over the last 156,000 years in the Indian sector of Southern Ocean

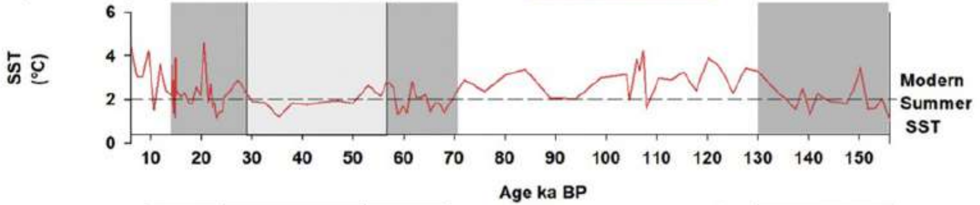
Pooja Ghadi, Abhilash Nair, Xavier Crosta, Rahul Mohan, M.C. Manoj, Thamban Meloth

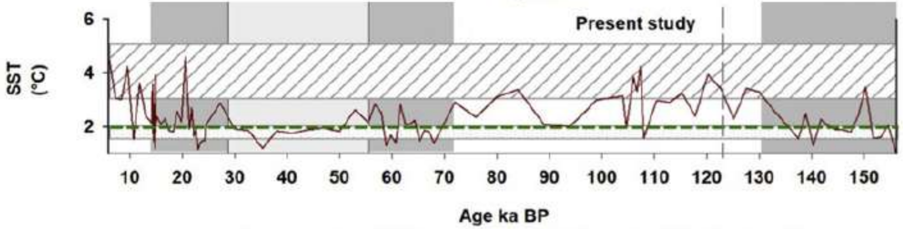


Study area showing core site SK 200/33 location (red square)

At present time, core SK 200/33 is located in the POOZ, north of the SACCF and WSI edge but 2–3° of latitude to the south of the southern APF (Fig. 1). The most recent diatom assemblages, dated from the early-mid Holocene, preserved in the core are strongly dominated by the POOZ diatom group (Fig. 3c), with few percent of SAZ diatoms (Fig. 3d), and the absence of sea-ice diatoms (Fig. 3a). These assemblages resulted in SST estimates of ~4 °C (Fig. 3g), which are ~2 °C higher than the modern regional SST of ~2 °C. These results are in agreement with previous studies showing warmer conditions during the early-mid Holocene than during the late Holocene in the Indian sector of the SO from Antarctica (Masson et al., 2011), coastal Antarctica (Cremer et al., 2007; Verleyen et al., 2011), Polar Frontal Zone (Katsuki et al., 2012; Xiao et al., 2016) to SAZ (Crosta et al., 2005b; Nair et al., 2019) realms. Very similar diatom assemblages were recorded in core

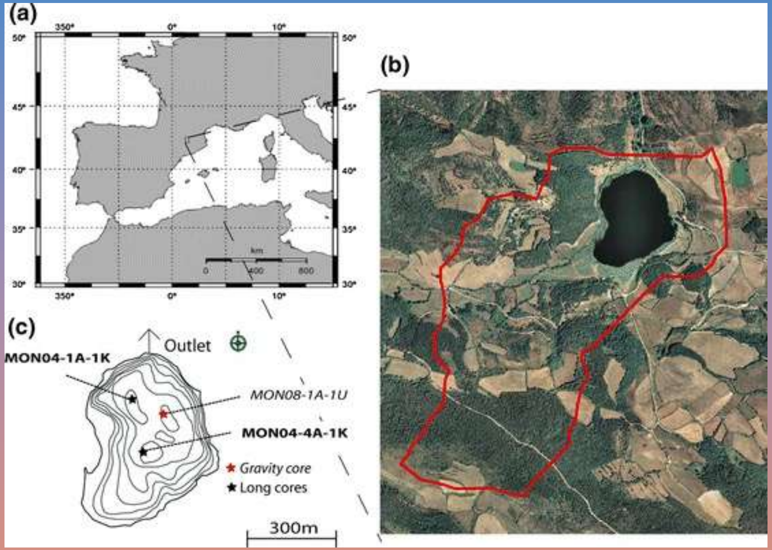
The summer SST values vary between 1 and 4 °C over the last 156 ka (Fig. 3h). Summer SST of 2 to 4 °C were estimated during the interglacial periods while SST of 1 to 2 °C were generally estimated during the glacial stages, except for the short-lived warmer peak at 20 ka BP during the MIS 2. The interglacial SSTs were higher than the modern SST (2 °C) at the core site.

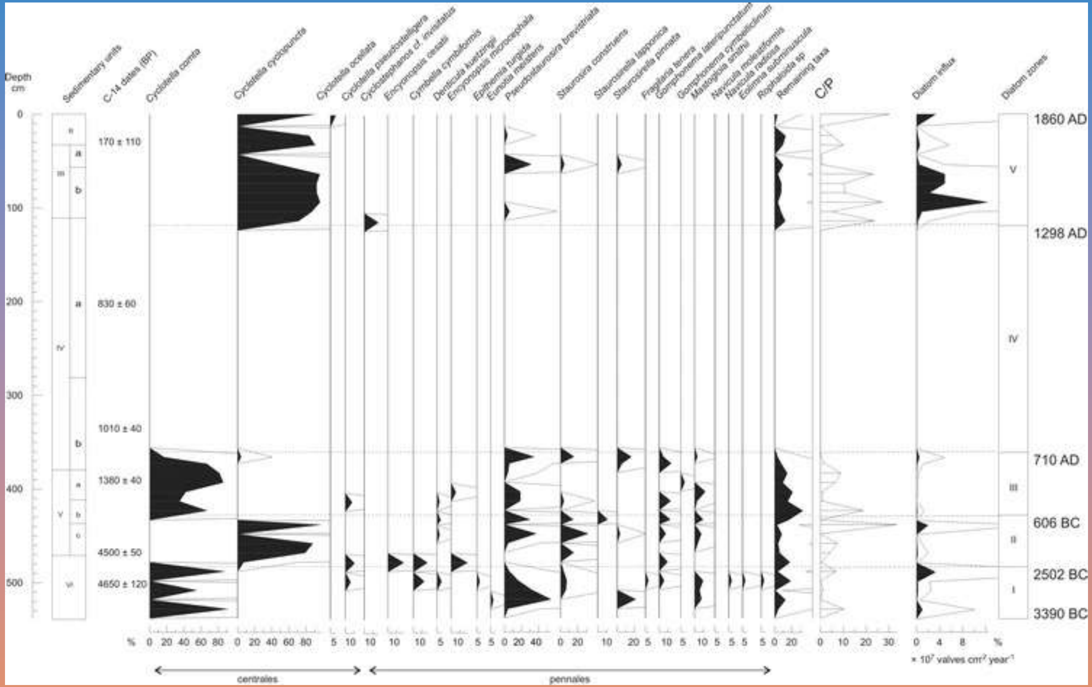




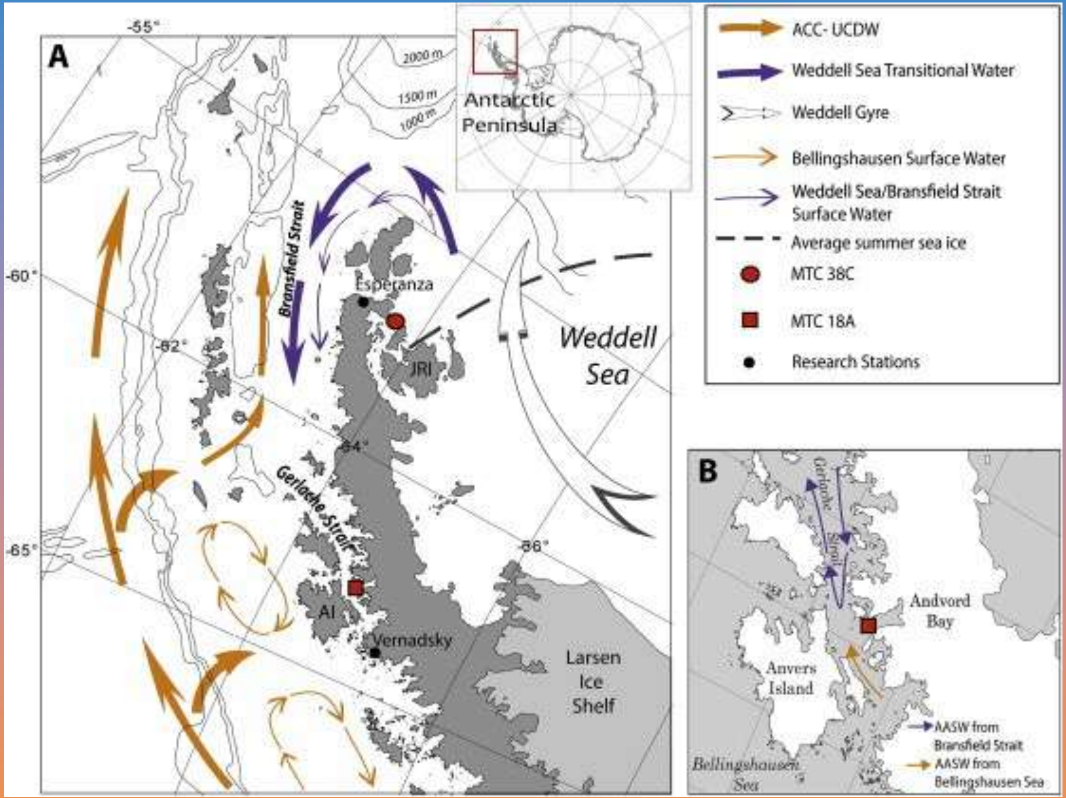
summer sea-surface temperature (SST) records from the Indian sector of the Southern Ocean.
green line symbolizes the modern temperature at the respective core sites.

Ghadi et al. 2020: la temperatura del Índico Austral era 4 °C más cálida hace 20.000 años





Scussolini et al. 2011: los niveles de lago Montcortés (Pirineos) fueron más bajos durante un intervalo seco pronunciado de 2360 a 1850 a.C.



Barbara et al. 2013: entre 1935-1950 el hielo retrocede, y después no hay una tendencia reconocible (Península Antártica).

- La tendencia al calentamiento no es ni mucho menos generalizada a escala mundial
- En aquellas zonas donde se verifica un calentamiento reciente, este no se ve acelerado por la actividad antrópica
- No hay evidencias de variaciones recientes que excedan en magnitud las fluctuaciones naturales registradas históricamente