Supplement of

Calcification response of planktic foraminifera to environmental change in the Western Mediterranean Sea during the industrial era

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                RADIOCARBON CALIBRATION PROGRAM*
                           CALIB REV8.2
             Copyright 1986-2020 M Stuiver and PJ Reimer
        *To be used in conjunction with:
        Stuiver, M., and Reimer, P.J., 1993, Radiocarbon, 35, 215-230.

Muestra 4
Lab Code
Description
Radiocarbon Age BP   1980 +/-   63
  Delta R = -163.0 +/-    93.0
Calibration data set: marine20.14c               #Heaton et al. 2020
  % area enclosed       cal BP age ranges            relative area under
                                                 probability distribution
  68.3 (1 sigma)     cal BP 1408 - 1692                  1.000
  95.4 (2 sigma)     cal BP 1287 - 1839                  1.000
  Median Probability:  1557

 References for calibration datasets:
Heaton TJ, Köhler P, Butzin M, Bard E, Reimer RW, Austin WEN, Bronk Ramsey C,
Hughen KA, Kromer B, Reimer PJ, Adkins J, Burke A, Cook MS, Olsen J, Skinner LC
2020.
Marine20-the marine radiocarbon age calibration curve (0-55,000 cal BP).
Radiocarbon 62. doi: 10.1017/RDC.2020.68.



Comments:
* This standard deviation (error) includes a lab error multiplier.
** 2 sigma = 2 x square root of (sample std. dev.^2 + Delta R uncertainty ^2)
where ^2 = quantity squared.
[ ] = calibrated range impinges on end of calibration data set
0* = cannot calibrate due to nuclear testing C-14.
1955* or 1960* denote influence of nuclear testing C-14

NOTE:  Cal ages and ranges are rounded to the nearest year which
       may be too precise in many instances.  Users are advised to
       round results to the nearest 10 yr for samples with standard
       deviation in the radiocarbon age greater than 50 yr.
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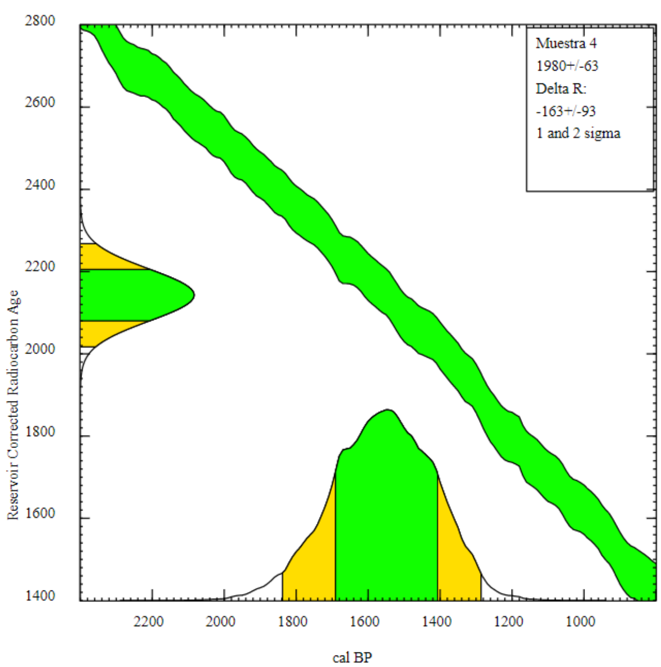

Supplementary figure 1. Calibration details from CALIB program for sample 14-14.5 cm from MR 3.1.A sediment core. Before calibration, this sample displayed a 14C age of 1980 years BP. After correcting the marine reservoir and local reservoir effects, the calibrated age was 1560 cal. years BP. The 14C dating was carried out on *G. bulloides* individuals.

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          1
                    RADIOCARBON CALIBRATION PROGRAM*
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Minimum Ag
Lab Code
Description
Radiocarbon Age BP    603 +/-   60
  Delta R = -165.0 +/-    95.0
Calibration data set: marine20.14c              #Heaton et al. 2020
  % area enclosed       cal BP age ranges           relative area under
                                                probability distribution
  68.3 (1 sigma)     cal BP 83 - 344                     1.000
  95.4 (2 sigma)     cal BP 0 - 435                      1.000
  Median Probability:   227

 References for calibration datasets:
Heaton TJ, Köhler P, Butzin M, Bard E, Reimer RW, Austin WEN, Bronk Ramsey C,
Hughen KA, Kromer B, Reimer PJ, Adkins J, Burke A, Cook MS, Olsen J, Skinner LC
2020.
Marine20-the marine radiocarbon age calibration curve (0-55,000 cal BP).
Radiocarbon 62. doi: 10.1017/RDC.2020.68.



Comments:
* This standard deviation (error) includes a lab error multiplier.
** 2 sigma = 2 x square root of (sample std. dev.^2 + Delta R uncertainty ^2)
where ^2 = quantity squared.
[ ] = calibrated range impinges on end of calibration data set
0* = cannot calibrate due to nuclear testing C-14.
1955* or 1960* denote influence of nuclear testing C-14

NOTE:  Cal ages and ranges are rounded to the nearest year which
       may be too precise in many instances.  Users are advised to
       round results to the nearest 10 yr for samples with standard
       deviation in the radiocarbon age greater than 50 yr.
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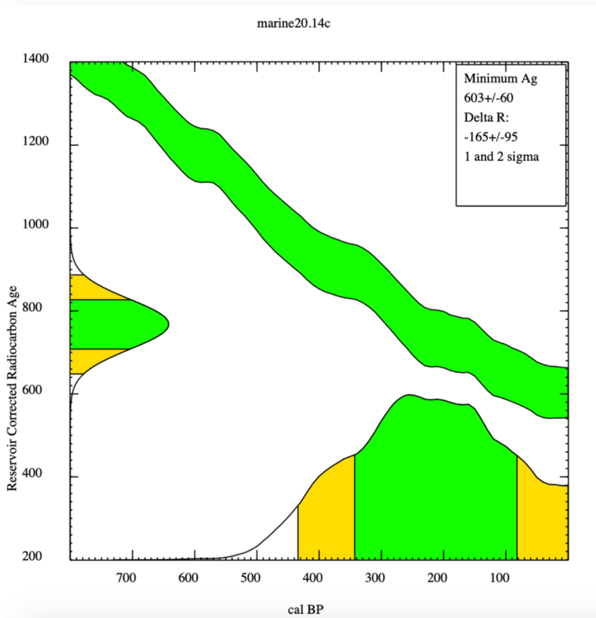
marine20.14c



Supplementary figure 2. Calibration details from CALIB program for the most recent ^{14}C age accepted to be corrected: 603 years BP. The same marine and local reservoir corrections as the previous sample were applied. After the calibration, the calibrated age displayed was 227 cal. years BP.

Supplementary table 1. Detailed results of the ^{14}C dating carried out on the three samples.

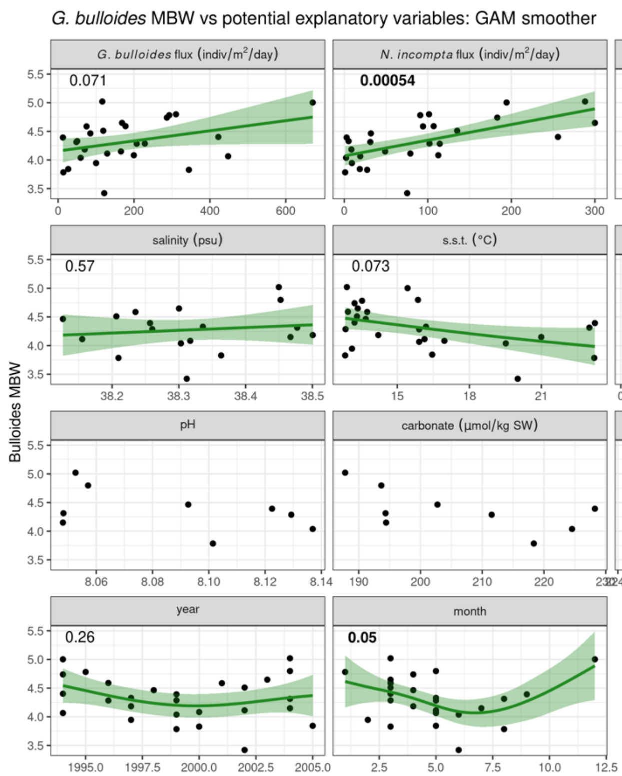
Label	Sample label	^{14}C counts	$^{14}C/^{12}C$ (10^{-12})	+- (%)	$^{13}C/^{12}C$ (%)	sigma(%)	$F^{14}C$	+- (%)	sig (%)	age (y)	+- (y)	$\delta^{13}C$ (‰) by AMS
1	LCD 0.5-1	43,257	1.1075	0.48	1.1024	0.02	0.9443	0.74	0.47	**460**	**59**	-2.8
3	PLA 0.5-1	43,117	1.1174	0.48	1.1094	0.01	0.9410	0.74	0.54	**489**	**59**	3.5
4	MR3.1.A 14-14.5	33,309	0.9206	0.55	1.1041	0.03	0.7815	0.78	0.55	**1,980**	**63**	-1.3

As ^{14}C ages from the samples dated from PLA CT (490 years BP) and LCD SC (460 years BP) are more recent than the minimum age accepted, they lie out of the range of calibration. In order to have an estimation of the time span that could be covered, the most recent age accepted for calibration by CALIB 8.2 (Supplementary figure 2) (i.e. 603 ^{14}C years BP) has been used as a reference value (227 cal. years BP with a very low possibility of being posterior to 1950) with the same marine and local reservoirs previously considered. Then, the difference in ^{14}C ages between the minimum sample and our sample has been included (our sample are 110 to 140 years more recent in ^{14}C years BP). Finally, as the $F^{14}C$ was below 1 for all our samples (Supplementary table 1), this implies that, despite the fact that our ages fall out of the calibration range, the bomb carbon does not dominate our samples. Therefore, we estimate that our samples could be dated between 110 and 50 cal. years BP. We then consider them post-industrial.

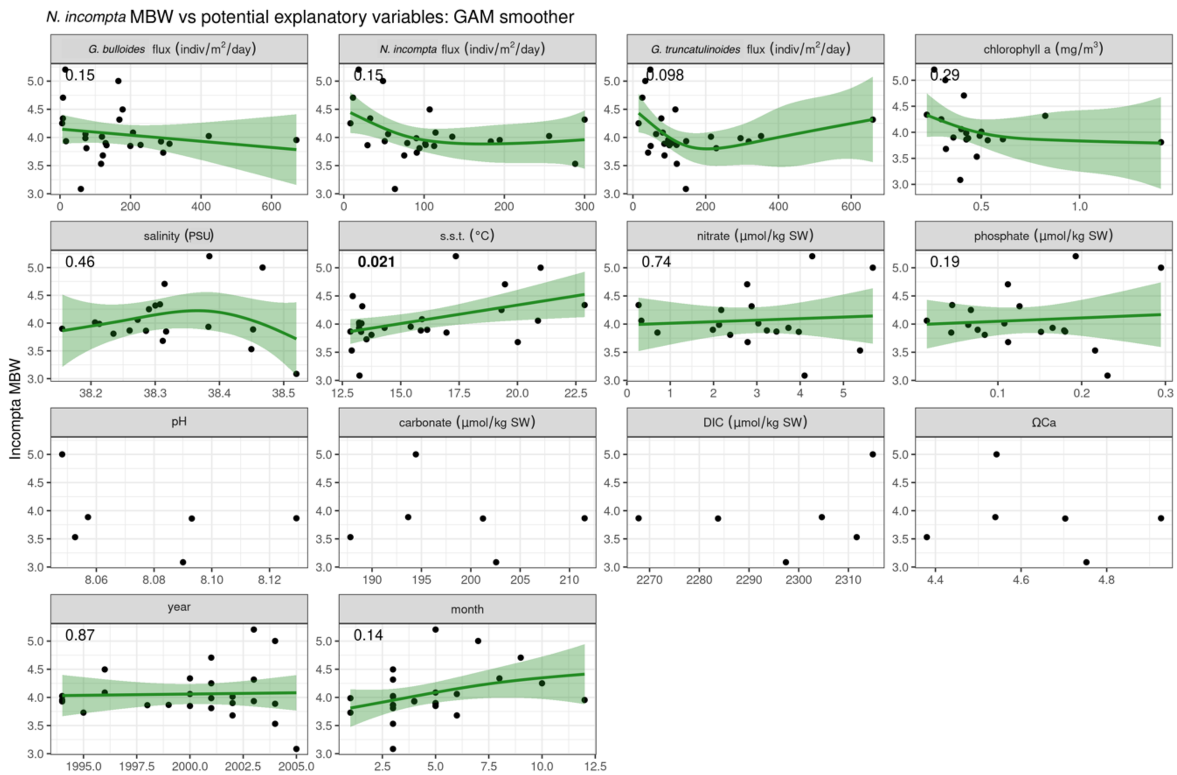
Supplementary table 2. Detailed seasonal correlations of the three species mean monthly MBW_{area} and all the environmental parameters.

Parameters			Planier site data								DYFAMED site data					
			G. bull. MBW_{area}	*N. inc.* MBW_{area}	*G. truncat.* MBW_{area}	*G. bull.* Fluxes	*N. inc.* Fluxes	*G. truncat.* Fluxes	Chl-a	SST	Salinity	$[NO_3]$	$[PO_4]$	pH	$[CO_3]$	$[CO_2]$
Planier site data	MBW_{area}	*G. bull.*		-0.232	0.167	**0.012**	**0.027**	0.152	0.318	-0.320	-0.163	0.292	0.330	0.096	-0.189	0.243
		N. inc.	-0.232		**0.667**	-0.582	-0.407	-0.405	-0.484	**0.688**	0.368	-0.272	-0.235	-0.350	0.474	-0.280
		G. truncat.	0.167	**0.667**		**-0.905**	-0.725	**-0.666**	**-0.585**	**0.672**	-0.299	-0.258	-0.512	-0.113	**0.732**	-0.541
	Fluxes	*G. bull.*	0.012	**-0.582**	**-0.905**		**0.911**	**0.861**	**0.773**	**-0.755**	0.264	0.338	0.526	0.213	**-0.748**	0.548
		N. inc.	0.027	-0.407	**-0.725**	**0.911**		**0.953**	**0.817**	**-0.621**	0.364	0.329	0.391	0.103	**-0.700**	**0.596**
		G. truncat.	0.152	-0.405	**-0.666**	**0.861**	0.953		**0.739**	**-0.707**	0.446	**0.586**	**0.590**	-0.012	**-0.801**	**0.714**
		Chl-a	0.318	-0.484	**-0.585**	**0.773**	0.817	**0.739**		**-0.702**	-0.004	0.190	0.277	0.501	-0.428	0.255
		SST	-0.320	**0.688**	**0.672**	**-0.755**	-0.621	**-0.707**	**-0.702**		0.047	**-0.688**	**-0.696**	-0.416	**0.649**	-0.410
DYFAMED site		Salinity	-0.163	0.368	-0.299	0.264	0.364	0.446	-0.004	0.047		0.305	0.420	**-0.714**	**-0.604**	**0.733**
		$[NO_3]$	0.292	-0.272	-0.258	0.338	0.329	**0.586**	0.190	**-0.688**	0.305		**0.876**	-0.183	**-0.682**	**0.620**

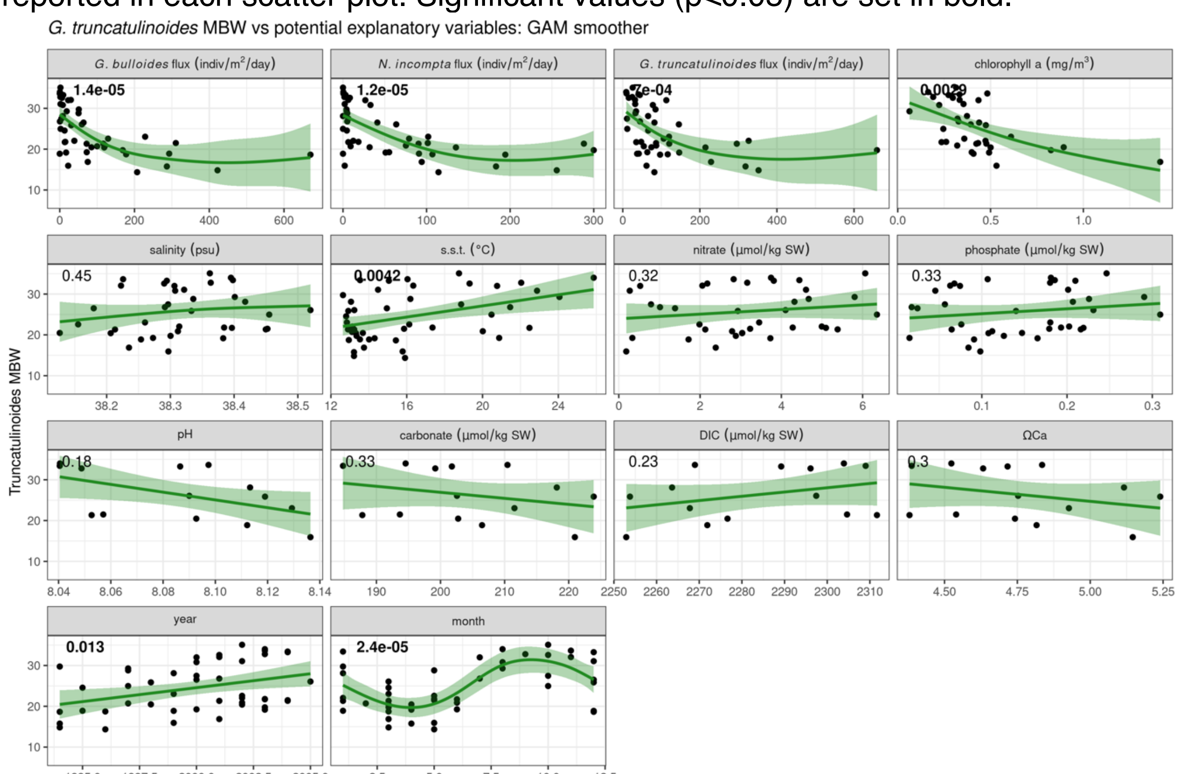
$[PO_4]$	0.330	-0.235	-0.512	0.526	0.391	**0.590**	0.277	**-0.696**	0.420	**0.876**		-0.162	**-0.834**	**0.709**
pH	0.096	-0.350	-0.113	0.213	0.103	-0.012	0.501	-0.416	**-0.714**	-0.183	-0.162		0.338	**-0.596**
$[CO_3]$	-0.189	0.474	**0.732**	**-0.748**	**-0.700**	**-0.801**	-0.428	**0.649**	**-0.604**	**-0.682**	**-0.834**	0.338		**-0.939**
$[CO_2]$	0.243	-0.280	-0.541	0.548	**0.596**	**0.714**	0.255	-0.410	**0.733**	**0.620**	**0.709**	**-0.596**	**-0.939**	



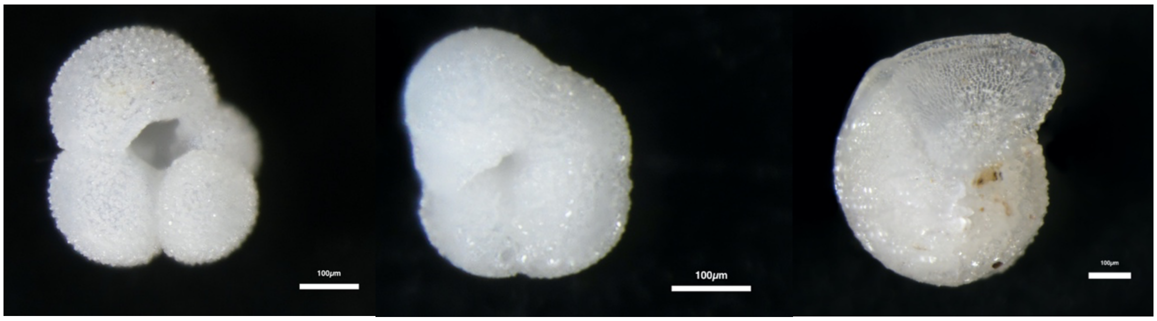
Supplementary figure 3. GAM results for *G. bulloides* MBW_{area} (μg) and the environmental parameters from Planier and DYFAMED sites. The p-value is reported in each scatter plot. Significant values ($p<0.05$) are set in bold.



Supplementary figure 4. GAM results for *N. incompta* MBW_{area} (µg) and the environmental parameters from Planier and DYFAMED sites. The p-value is reported in each scatter plot. Significant values ($p<0.05$) are set in bold.



Supplementary figure 5. GAM results for *G. truncatulinoides* MBW_{area} (μg) and the environmental parameters from Planier and DYFAMED sites. The p-value is reported in each scatter plot. Significant values ($p<0.05$) are set in bold.



Supplementary figure 6. Pictures of *G. bulloides*, *N. incompta* and *G. truncatulinoides* specimens from the MIN 3.1.A sediment core after the process of ultrasonication cleaning.