GSA Data Repository 2020171

Yang, Y., et al., 2020, Is the upward release of intermediate ocean heat content a possible engine for low-latitude processes?: Geology, v. 48, https://doi.org/10.1130/G47271.1

1. STABLE ISOTOPIC AND Mg/Ca ANALYSES

For Mg/Ca analysis, planktonic foraminiferal shells were cleaned following the standard cleaning protocol developed by Barker et al. (2003). A majority of the crushed planktonic foraminiferal samples then underwent sequential ultrasonic cleaning in alternation with washes in Milli-Q water and methanol, before the removal of organic matter using a 1-2% H_2O_2 solution, a weak acid leaching using 0.001 M HNO_3 and, finally, being dissolved in 0.075 M HNO_3. Samples were centrifuged to remove any remaining insoluble particles and then diluted with Milli-Q water and measured using inductively-coupled plasma atomic emission spectroscopy (ICP-AES) at the Key Laboratory of Ocean and Marginal Sea Geology, Chinese Academy of Sciences. The instrumental precision of the ICP-AES was monitored using analysis of an external, in-house standard solution with a Mg/Ca ratio of 4.44 mmol/mol after every three samples. The relative standard deviation of the external standard solution was 0.63%. Analytical reproducibility was estimated using replicate measurements that revealed a standard deviation of 0.42%. The value of the Mn/Ca ratio was ~0.01 mmol/mol, and the value of the Fe/Ca ratio was ~0.15 mmol/mol, indicating that there was no significant contribution of Mg from Mn-Fe-oxide coating.

The remaining crushed planktonic foraminiferal samples set aside for oxygen and carbon isotope analysis also underwent ultrasonic cleaning in alternation with

washes in Milli-Q water and methanol. Oxygen isotope measurements were performed on a Thermo Finnigan MAT 253 mass spectrometer with a Kiel III automatic carbonate preparation device at the Key Laboratory of Ocean and Marginal Sea Geology, South China Sea Institute of Oceanology, Chinese Academy of Sciences. The standard error of the isotope analyses was < 0.05‰. Isotope results were reported relative to the Vienna Pee Belemnite (VPDB) and calibrated using the National Bureau of Standards (NBS) 19 standards.

2. UPPER OCEAN HEAT CONTENT (OHC) ESTIMATES

We calculated SCS OHC for the 700-300 m, 300-100 m and ≤100m depth intervals using the following equation:

$$OHC=\rho VCp\int_{h}^{0} T$$

where OHC is the ocean heat content (in joules), ρ is the seawater density (1024 kg/m^2), V is the area of the SCS (6.963×10^{12} m^2) (http://ngdc.noaa.gov/mgg/global/etopo1_ocean_volumes.html), Cp is the seawater heat content (4,000 joules/ºC/kg), and T is the water temperature at different depths (ºC).

REFERENCE AND CITED

Barker, S., Greaves, M., and Elderfield, H., 2003, A study of cleaning procedures used for foraminiferal Mg/Ca paleothermometry: Geochemistry, Geophysics, Geosystems, v. 4, no. 9, p. 20.

Yang, Y. P., Xiang, R., Liu, J. G., and Tang, L. G., 2019, Inconsistent sea surface temperature and salinity changing trend in the northern South China Sea since 7.0 ka BP: Journal of Asian Earth Sciences, v.171, p.178-186.

Table S1. AMS^{14}C ages and converted calendar ages for Core S0204B in the northern SCS.

Sample no.	Depth	Material	Measured AMS^{14}C age /a BP	2 sigma age /a BP	Error	Calendar years /a BP
S0204B22*	22	Mixed foraminifera	480	395-605	±30	495
S0204B37*	37	*N.dutertrei+G.sacculifer*	1,690	1,515-1,800	±30	1,635
S0204B52*	52	Mixed foraminifera	2,110	1,970-2,315	±30	2,135
S0204B97*	97	*N.dutertrei*	3,620	3,825-4,100	±30	3,960
S0204B153*	153	*N.dutertrei*	5,530	6,205-6,430	±30	6,300
S0204B201	201	*N.dutertrei+G.sacculifer*	8,080	8,950-9,235	±30	9,025
S0204B221	221	*N.dutertrei*	8,900	9,885-10,185	±30	10,110
S0204B261	261	*N.dutertrei+G.sacculifer*	9730	10,975-11,215	±40	11,125
S0204B301	301	*N.dutertrei*	11,590	13,285-13,470	±40	13,375
S0204B341	341	*N.dutertrei*	12,720	14,895-15,280	±40	15,130
S0204B373	373	*N.dutertrei*	15,720	19,065-18,780	±60	18,910
S0204B413	413	*N.dutertrei*	17,410	20,740-21,075	±50	20,915

*The AMS^{14}C data were previously published by Yang et al. (2019).