$\delta^{15}N$ and $^{230}Th_{ex}{}^{0}$-normalized fluxes record fluctuations in paleoproductivity and nutrient utilization within the western Pacific warm pool

E.- F. YU

Department of Earth Sciences, National Taiwan Normal University, Taipei 117, Taiwan, R.O.C. (efyu@cc.ntnu.edu.tw)

The equatorial western Pacific is characterized by the warmest sea surface temperature (SSTs, >28°C), intensively high rainfall, and seasonal monsoon patterns. The fluctuations in the marine biogeochemical processes within the WPWP are thus influenced by these ocean environmental and climatic systems. Sediment records of $\delta^{15}N$ and $^{230}Th_{ex}{}^{0}$-normalized fluxes of carbonate, biogenic opal, and organic carbon in core MD012380, collected from the water depth of 3232 m within the Banda Sea, were reconstructed to examine nutrient utilization and paleoproductivity responses to glacial-interglacial climatic changes in the region of the western Pacific warm pool. The proxies of paleoproductivity were clearly responded to glacial-interglacial alternations with higher values during the glacial periods, and the nitrogen isotopic records of the core showed lower values correlated with those periods of glacial stages. Examining the C_{org}/N atomic ratios and δ^{13} C values of the core, the variations of within range between 5.7~11.6 and 20~23 ‰, respectively, clearly indicate the signals of its marine origin for organic matters. Correlation between sedimentary $\delta^{15}N$ versus total nitrogen content is not significant in the core implying that early diagenetic processes within the sediment core have no overprint on the variations of sedimentary $\delta^{15}N$ in the core. Moreover, no evidences of the lacking of oxygen in the study area exist, thus regional denitrification is unlikely occurred; however, reported global fingerprints of denitrification from the Arabian Sea or east Pacific Ocean may not be excluded totally. Lower sedimentary $\delta^{15}N$ values along with higher glacial productivities thus suggest either resulted in the increased nitrogen inventory during the glacial time, or resulted in glacial increases of the input of deep-water source or changes in input of advective transport into region of the Banda Sea. The later two suggest that higher glacial wind-related mixing and upwelling intensity would have increased primary productivity and new nutrient supply within the western Pacific warm pool during the glacial periods when the Asian monsoon was more developed.

Trace element partitioning between natural clinopyroxene, garnet and plagioclase under liquidus condition

JINHAI YU [1] AND Y S O' REILLY [2]

[1]Department of Earth Sciences, Nanjing University, Nanjing, 210093, P.R. China (jhyu@nju.edu.cn)

[2]GEMOC National Key Centre, Department of Earth and Planetary Sciences, Macquarie University, Sydney, N.S.W. 2109, Australia (sue.oreilly@mq.edu.au)

A suite of megacrystic aggregate xenoliths from Leizhou basalts, South China, which contain clinopyroxene (cpx), garnet (gt), plagioclase (pl) and ilmenite (ilm), were studied using LA-ICP-MS to confirm the trace element partitioning between natural liquidus minerals, and to assess the factors effecting on the partitioning coefficients. These megacrystic aggregates have igneous texture and high temperature (1130~ 1290°C relative to the geotherm constructed by the meta-pyroxenites, and are believed the liquidus phases. Cpx in the aggregates are characterized by high Al_2O_3 (7.97~11.58%), Na_2O (2.15~2.63%) and low Mg^o (0.48~ 0.62); gt also have low Mg^o (0.28~0.49) but high CaO (6.83~ 8.16%); pl exhibit low CaO contents (An20-35).

All minerals have low HREE contents, and cpx and gt are relatively depleted in Ti, Zr and Sr, which were caused by the fractional crystallization of cpx, gt, pl and ilm.

Compared with the experimental data (Green et al, 2000), $D_{cpx/gt}$ of this study are high in LREE, Sr, Nb, Zr and Hf, and similar in HREE and Y. Most $D_{cpx/gt}$ are also higher than those of HP-LT eclogites (Sassi et al, 2000) by one order of magnitude, but similar to those of HP-HT eclogitic asemblages from diamond cavities (Dobosi et al, 2002), which imply that these partition coefficients are most principally controlled by temperature.

Table 1. trace element partitioning between cpx, gt and pl

	cpx/gt	gt/pl	cpx/pl		cpx/gt	gt/pl	cpx/pl		cpx/gt		cpx/gt
Ti	3.26	8.75	28.9	Nd	5.33	2.85	15.9	Tb	0.29	Lu	*0.064*
Ga	2.1	0.55	1.16	Sm	1.4	28.9	39.5	Dy	0.17	Hf	4.16
Sr	229	0.0003	0.06	Eu	0.86	3.16	2.79	Ho	0.11	Ni	7.63
La	*76.5*	0.024	1.81	Y	0.104	*1044*	*125*	Er	0.074	Sc	0.62
Ce	28.9	0.16	4.64	Zr	1.71	*316*	*611*	Tm	0.061	Nb	*12.1*
Pr	12.3	0.76	9.58	Gd	0.5			Yb	0.055		

Italic numbers have large error, which is caused by analytical uncertainty resulting from very low contents in some mineral or both.

$D_{gt/pl}$ and $D_{cpx/pl}$ are much important to modeling partial melting of lower crust and fractional crystallization of mafic magma, but rarely studied. This study indicates that most trace elements preferentially enter cpx and gt, except for Sr (Rb and Ba) in mafic magma system. Thus, pl crystallization will lead to residual melt more enriched in most incompatible elements than cpx and gt, including Eu.

References

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