Fatty-acids and their ^{13}C signatures in seep carbonates from hydrocarbon seeps on the upper (GC 185) and lower (AC 645) continental slope of the Gulf of Mexico

H.X. GUAN[1,2,3], D. FENG[2], N.Y. WU[1] AND D.F. CHEN[2]*

[1]Guangzhou Center for Gas Hydrate Research, Guangzhou Institute of Energy Conversion, CAS, 510640, China
[2]CAS Key Laboratory of Marginal Sea Geology, Guangzhou Institute of Geochemistry, CAS, Guangzhou 510640, China (*correspondence: cdf@gig.ac.cn)
[3]Graduate University of Chinese Academy of Sciences, Beijing 100049, China

We report the fatty-acids and their $\delta^{13}C$ values of the seep carbonates from hydrocarbon seeps of GC 185 (Bush Hill) at upper continental slope, and AC 645 at lower continental slope of the Gulf of Mexico (GOM), where the water depth is 540m and 2200m, respectively.

The fatty acids in two studied sites mainly consist of C_{12} to C_{28}, and C_{12} to C_{24} series compounds. Both compounds are maximized at C_{16} fatty acids. There is a clear even-over-odd carbon number predominance in carbon number range. The fatty acids are composed of n-fatty acids and Iso- / anteiso-fatty acids (C_{14}-C_{18}), the odd-numbered iso- /anteiso-fatty acids are predominant in Iso- / anteiso-fatty acids (C_{14}-C_{18}).

The $\delta^{13}C$ values of the n-fatty acids range from -26.52‰ to -39.99‰ PDB, while the $\delta^{13}C$ values of the unsaturated fatty acids fall in the range of -19.97‰ to -31.04‰, which is coincide with the $\delta^{13}C$ values of seep hydrocarbon (biodegraded crude oil here, $\delta^{13}C$: -25 to -35‰)[1]. It is suggested that n-fatty acids and unsaturated fatty acids are mainly originated from biodegraded crude oil. However, the extremely negative $\delta^{13}C$ values (-44.17 to -63.95‰) of odd-numbered iso-/anteiso-fatty acids (i-/ai-C_{13}-C_{17}) in both sites are the biomarkers originated from sulfate reducing bacteria, which suggests that the anaerobic methane oxidation occurred in hydrocarbon seeps in both upper and lower continental slopes of the GOM.

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[1] Roberts *et al*. (1994) *Geo-Mar Lett* **14**, 135-148.

Extreme heterogeneity in the subcontinental lithospheric mantle: Insights from the Lanzo peridotite

L. GUARNIERI[1], G.B. PICCARDO[1], E. NAKAMURA[2], N. SHIMIZU[3], R. VANNUCCI[4,5] AND A. ZANETTI[5]

[1]DIPTERIS, University of Genova, Genova, Italy (piccardo@dipteris.unige.it)
[2]ISEI - Okayama University, Misasa, Japan
[3]Woods Hole Oceanographic Institution, Woods Hole, USA
[4]Department of Earth Sciences, University of Pavia, Italy
[5]IGG - CNR, Pavia, Italy

The Lanzo Massif (Western Alps, NW Italy) represents a transect of lithospheric mantle that was exhumed from the sub-continental lithosphere and exposed at the sea-floor of the Late Jurassic Ligure-Piemontese oceanic basin. Highly variable peridotite types crop out consisting of: i) lithospheric mantle protoliths, ii) pyroxenite bands, iii) reactive spinel(Sp) harzburgites, iv) plagioclase(Plg) impregnated peridotites, and v) depleted Sp peridotites along replacive channels.

Cpx in mantle protoliths shows LREE (La_N/Sm_N: 0,25-0,28) and HREE (Gd_N/Yb_N: 2,0-2,2) fractionated patterns and display high $^{143}Nd/^{144}Nd$ values (0.513479-0.513493) and Proterozoic DM model ages. Cpx in reactive Sp peridotites shows LREE (La_N/Sm_N: 0,3-0,4) and HREE (Gd_N/Yb_N: 1,3-1,8) fractionation and isotope MORB signature. Cpx in Plg impregnated peridotites and pyroxenites shows relatively low $(La/Yb)_N$ ratios (0,10-0,20) and increase Yb_N (15-17xC1) values. Impregnated Plg peridotites show a significant range in $^{143}Nd/^{144}Nd$ ratios going from high (0,513514) values to lower (0,513144) values, typical of MORB. Cpx in the replacive peridotite channels shows LREE-enrichment and HREE-depletion (significantly high La_N/Yb_N values), that documents crystallization from melts with alkaline affinity, and show OIB-like signature ($^{143}Nd/^{144}Nd$ = 0.512830-0.512795). Cpx-Plg-WR Sm-Nd isochrons from impregnated pyroxenites yield Late Jurassic ages for melt impregnation.

In summary, the peridotite protoliths were accreted to the sub-continental lithosphere in Proterozoic times. They were intruded by asthenospheric melts (i.e. pyroxenite veining). They were exhumed to Sp-/Plg-peridotite facies conditions and were percolated by MORB-type melts during Late Jurassic times. They were infiltrated by OIB alkaline melts.

Our data describe the evolution of a mantle section from the Europe-Adria sub-continental lithosphere from early Proterozoic lithosphere accretion to late Jurassic exhumation during pre-oceanic rifting. The variable compositions of the melt-percolated peridotites suggest that percolating primary melts were formed from heterogeneous mantle sources.