

## Microbiology of hydrates: Searching for the methane source term

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Hydrates in marine sediments contain an estimated 10 teratonnes of methane carbon. Stable isotope ratios of this carbon indicate that much of the methane is biogenic. Models to predict hydrate distribution or the amount of methane in the sediments account for methanogenesis but they lack reliable values for in situ microbial methane production rates. Our studies of hydrate-bearing sediments focus on 1) molecular characterization of the microbes and 2) estimation of realistic methanogenic rates. Sequencing of the unique, amplified 16S rDNA extracted from deep Nankai Trough sediments indicate the presence of diverse *Archaea* (Crenarchaeota, Euryarchaeota) and *Bacteria* (e.g., Proteobacteria, Actinobacteria, green non-sulfur) at various depths above, within, and below the hydrate stability zone. Many of these sequences (all of the *Archaea* and 90% of the *Bacteria*) are represented by unique groups or clades that are <95% similar to known cultured cells. In contrast, many of the 16S rDNA sequences from hydrate-associated sediments from the Gulf of Mexico and the Cascadia Margin (ODP Leg 146) were more similar to cultured organisms. While many studies do not detect obvious methanogens in the samples tested, including recent molecular studies conducted on samples from ODP Leg 204, viable methanogens have been enriched from hydrate sediments. Methanogenic activity was detected in all of the Nankai Trough sediments tested. However, the laboratory-measured methanogenic rates are possibly six orders of magnitude higher than what can be sustained under in situ conditions. By combining data on methanogen numbers at various depths and realistic methanogenesis rates for starved methanogens we hope to derive volumetric methanogenic productivity for models that predict hydrate distribution and formation rates in marine sediments.

## Andean subduction-related mantle xenoliths: isotopic evidence of Sr-Nd decoupling during metasomatism

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Spinel- and/or garnet-bearing ultrabasic mantle xenoliths brought to the earth's surface by intraplate alkaline basalts provide direct information on the nature and processes involved in the modifications of the subcontinental mantle lithosphere as mantle metasomatism. Problems in studying mantle xenoliths and processes related to mantle metasomatism arise from several areas. These areas include isotopic changing due to supergenic process, after the exposition of xenoliths to the surface and infiltration of host basalt into the xenoliths, which will tend to equalize xenoliths isotopic characteristics to the host magma isotopic composition.

Sr-Nd isotopic analysis were performed on 20 ultrabasic mantle xenoliths that came from 5 separate alkaline basalt centers in the Cenozoic to Recent volcanoes from the AVZ, SVZ and NVZ Andes volcanic areas. The disposal of these data on <sup>143</sup>Nd/<sup>144</sup>Nd vs. <sup>87</sup>Sr/<sup>86</sup>Sr graphic demonstrated that samples not affected by infiltration of the host basalt plot inside or to the right side of the MORB-OIB-BSE basaltic trend (mantle array). However, samples contaminated by the host basalts are displaced in the same trend of the mantle-derived magma trend from all Andean volcanic zones, and in the MORB-OIB-BSE trend. The disposition of some samples to the right side of the trend seems to characterize some kind of mantle process that ends up in enrichment of Sr radiogenic composition, without dramatically changing the Nd isotopic characteristic of the mantle. Such process could be considered as one kind of metasomatism that involves interaction between a depleted mantle and a metasomatic agent. Although carbonatitic melts have been proposed as a relevant metasomatic agent due to their high Nd/Sr ratios, xenoliths with well-known infiltration of carbonatitic melts from South America subcontinental lithosphere usually plot to the left side of the MORB-OIB-BSE trend. Our data suggest that metasomatism in the studied peridotites resulted in some kind of Sr and Nd decoupling that occurred possibly due to different Rb and Sm partition coefficient of some minerals present in the xenoliths, such as clinopyroxene, orthopyroxene and garnet. The same behavior has been observed in some xenoliths from Eastern China and North Atlantic.