Geochemistry of Proterozoic basic-ultrabasic volcanics from the west of Yangtze Plate: Implications for the crust-mantle evolution

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Introduction

Many Proterozoic intraplate basic-ultra basic rocks were found in the west of Yangtze Plate, which can provide important information on Proterozoic crust-mantle evolution. Proterozoic within-plate basic-ultra basic volcanic rocks have been studied for their trace element and isotopic compositions in order to understand mantle geochemistry and crust-mantle evolution.

Discussion and Conclusion

Palaoproterozoic mafic volcanics pose EMI features and are thought to be formed in island arc-back arc setting related to the plate subduction of pre-Tethys Proterozoic Ocean Plate beneath paleo-Yangtze Plate. Geochemistry of the middle Proterozoic Caiziyuan peridotites shows that the formation of the peridotites is associated with the epicontinental basin at the ocean-land boundary or intracontinental rift basins. These observations suggest that the mantle source could have been metasomatized by the subduction-related dehydration fluids. In response to the Palaoproterozoic subduction, Neoproterozoic epicontinental or intracontinental rifts were formed, accompanied by formation of intra-plate hot-spot Dahongshan diabase. Whole-rock Sm-Nd isochron age of 1066 ± 110 Ma was obtained for the diabase. The enrichments of incompatible elements and radiogenic Nd isotope of the diabase suggest that their mantle source could have been affected by the primary volatile from asthenosphere and mantle plume.

Carbon cycling in the Gulf of Mexico gas hydrate systems: A review

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The Gulf of Mexico has abundant gas hydrates and hydrocarbon seeps. Geochemical evidence indicates that anaerobic oxidation of hydrocarbons, including methane, plays an important role in carbon cycling and the development of biological communities in gas hydrate systems. The following summarizes our current knowledge and understanding of anaerobic hydrocarbon oxidation in the Gulf of Mexico.

1. Lipid biomarkers and stable carbon isotopes suggest that anaerobic methane oxidation is mediated by consortia of sulfate-reducing bacteria and Archaea.
2. 16S rDNA indicate the presence of diverse bacterial species including sulfate-reducing bacteria and a limited diversity of Archaea, all of which are related to methanogens.
3. As a result of anaerobic hydrocarbon oxidation, large amounts of ^{13}C-depleted carbonates precipitate on the bottom of ocean floor, which provide a favorable surface for the establishment of chemosynthetic communities in the deep sea.
4. Abundance of archaeal biomarkers and stable isotope signatures are similar to those of the Mediterranean mud volcanoes but are distinct from those of the Hydrate Ridge or Cascadia Ridge, suggesting variation in microbial communities or methane oxidation kinetics associated with different geological settings.
5. Anaerobic oxidation of oil hydrocarbons ($>C_{15}$) also occurs in the Gulf of Mexico, which has not been well studied, but may contribute significantly to carbon cycling in the Gulf of Mexico.

Our future research is focused on identification of microbial species and quantification of the processes of hydrocarbon oxidation, which link closely to macrofauna ecology. We will also develop conceptual models of carbon cycling coupled to other geochemical reactions in the Gulf of Mexico. Such studies should enhance our understanding of microbial biocomplexity in the deep-sea ecosystem and may shed light on the microbial evolutionary pathways in cold, hydrocarbon-rich extreme environments.

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