Spontaneous Selection of Peptide Groups In Prebiotic Evolution

HONDA, H., KOYAMA, A., NEMOTO, A., KIKUCHI, N., IMAI, E., HATORI, K. AND MATSUNO, K.

Department of BioEngineering, Nagaoka University of Technology (MailTo: hhonda@nagaokaut.ac.jp)

Summary

A few clusters including several sets of peptide groups were selected spontaneously from four selected amino acids by reacting with a flow reactor.

Methods

Glycine, Alanine, Valine and Aspartic acid were chosen as the starting materials for a flow reaction. HPLC analysis revieled tens of products depending on the run of a flow reactor. As the HPLC elution patters had both similarities and dissimilarities, it seemed relevant to evaluate quantitively the similarity. HPLC chart was taken for about 20 minutes, followed by their separation into 100 sequential intevals of 0.2 minutes and peak areas were quoted to correspondence intervals of the retention time. Thus, one HPLC pattern representing the solution component was to be expressed into one 100-dimensional eigenvector. All elution patterns were clustered by using neighbor-joining method according to either Euclidean distance or correlation metric to bring about essentially the same results.

Results & Discussions

The number of clusters abruptly increased within a few ten minutes upto about 10 followed by the gradual decreses downto 3 after 120 minutes (Figure 1).

Caliculating the distances for all components, each clusters was pronounced to be far separated forming a clear Gaussian distribution (Figure 2). Although only the four amino acids have been tested in this study, the result strongly indicate that the natural selection would be occured in the level of chemical evolution.

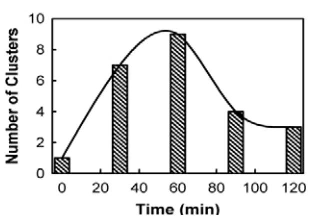

Fig. 1. Time developpment of a number of clusters

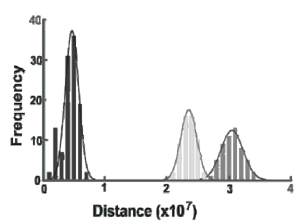

Fig. 2. Distances between clusters

References

1. Imai, E., Honda, H., Hatori, K., Brack, A. and Matsuno, K. (1999), *Science* **283**, 831-833.
2. Ogata Y., Imai E., Honda H., Hatori K. and Matsuno K., (2000), *Origins of Life and Evol. Biosph.*, **30**, 527-537.
3. Yokoyama S., Koyama A., Nemoto A., Honda H., Imai E., Hatori K. and Matsuno K., (2003), *Origins of Life and Evol. Biosph.*, in press.

Unusual noble gas compositions in polycrystalline diamonds from the Jwaneng kimberlite, Botswana

M. HONDA[1], D. PHILLIPS[2] AND J. W. HARRIS[3]

[1] Reserach School of Earth Sciences, The Australian National University, Canberra, Australia (masahiko.honda@anu.edu.au)
[2] School of Earth Sciences, The University of Melbourne, Melbourne, Australia (dphillip@unimelb.edu.au)
[3] Division of Earth Sciences, University of Glasgow, Glasgow, UK (J.Harris@earthsci.gla.ac.uk)

Research goals in noble gas geochemistry include understanding the structure of the Earth's mantle and the creation of a coherent model of its evolution. In this regard, noble gas compositions in mid-ocean-ridge basalts (MORBs) and ocean island basalts (OIBs) have provided very useful information on the mantle. However, virtually all these data are from samples that are effectively of zero-age, and therefore, they only give information about the present composition of mantle noble gases. If noble gas measurements are made on mantle-derived samples of different ages, these can allow further refinement of models concerning mass transport in the mantle.

Diamonds have unique characteristics which make them potentially very useful as sources of noble gases from the mantle: (1) most diamonds appear to be derived from 150 km to 200 km depth in the Earth, (2) diamonds cover a wide range of crystallization ages of between 1.0 and 3.5 billion years, and (3) diamonds have suffered little interaction with crust or atmosphere. Thus, diamonds provide a direct window into the ancient mantle.

As a pilot study, we have undertaken noble gas analyses of four polycrystalline framesite diamonds from the Jwaneng kimberlit pipe, Botswana. The most striking observation is the presence of crustal nucleogenic neon, released on graphitisation of the framesites. Neon of this composition can only have been produced in the crust and subsequently incorporated during formation of the framesites in the mantle. This may indicate that noble gases produced in the crust, such as nucleogenic neon, were introduced into the sub-continental mantle source during ancient subduction-related processes, and that some parts of the mantle contain significant quantities of crustal noble gases. Recent Re-Os analyses of eclogite xenoliths and eclogitic inclusions in diamonds from southern African kimberlites suggest that subduction-related crustal recycling may have been a viable process during continent formation in the Archean (~2.9 Ga) and resulted in widespread formation of eclogitic diamonds at that time. If this is true, then crustal noble gases could have been introduced into the mantle at a very early stage in Earth history.