Prebiotic oligomerization of amino acids in lipid vesicles in hydrothermal environments

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Introduction

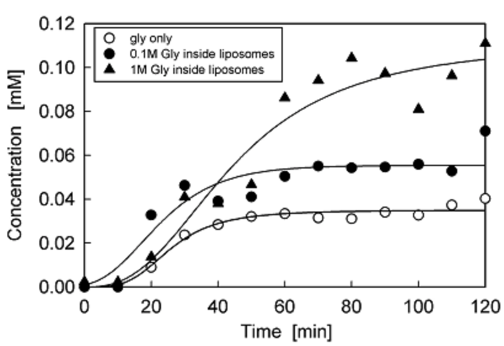
We already attempted an experimental model simulating geological conditions in the vicinity of hydrothermal vents in the primitive ocean. We then experimentally examine a possibility of oligomerizing amino acids on or inside lipid vesicles in a simulated hydrothermal environment.

Methods

We used a flow reactor that was constructed for simulating the pressure and temperature conditions of the hydrothermal vents. In the flow reactor, a high-temperature high-pressure fluid at 180°C and at 24 MPa was injected into a low temperature chamber that was maintained at about the same high pressure as the fluid. We encapsulated various concentrations of glycine into DPPC liposomes in the solution of 100mM glycine. Phospholipid DPPC was used as an experimental model for making lipid vesicles. Identification of the oligomeric products was made with the aid of an HPLC analysis.

Results and Discussion

Time developments of the synthesis of diglycine with DPPC liposomes are demonstrated in Figure. Increase of the products diglycine in the presence of DPPC liposomes demonstrates enhanced oligomerization of glycine inside the liposomes. Similar enhancement of oligomerization was also observed with fatty acid vesicles(oleic acid).



Comparison of the yields of diglycine

Conclusions

Once lipid vesicles are formed and amino acid molecules are encapsulated there, enhancement of their oligomerization would naturally follow.

References

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Geochemical Map of Japan

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The scheme and technical problems of making geochemical map covering whole country of Japan are described. The elements are 53 including toxic elements of As, Be, Cd, Cr, Hg, Mo, Sb and Pb. The sample used in this work is fine stream sediment collected from river. About 1kg of the stream sediments are collected, then dried in room temperature and sieved to minus 80 meshes. The sample was analyzed by atomic absorption spectrometry and inductively coupled plasma atomic emission and mass spectrometry (ICP-AES and ICP-MS). The total number of samples is about 3,000 and the sampling density is one sample/10 x 10 km.

The geochemical map of Cr in Japan is shown in Fig. 1. The software of GIS system making this map is ESRI ArcGIS. High Cr concentration along the Median Tectonic Line in Shikoku and Kii Peninsula and along the center line (tectonic line) in Hokkaido is clearly shown, which is thought to be caused by the ultramafic rocks (serpentinite) distributed in this region. The geochemical maps of As, Zn, Cu, Pb, Cd and Sb show the high concentrations in ore deposits. The concentrations of K and Na are high in the area where acidic rocks (granite and rhyolite) are mainly distributed, and the high concentrations of other major elements of Ca, Mg, Fe, Ti, P are high in concentration in the area where basic rocks (basalt) are distributed.

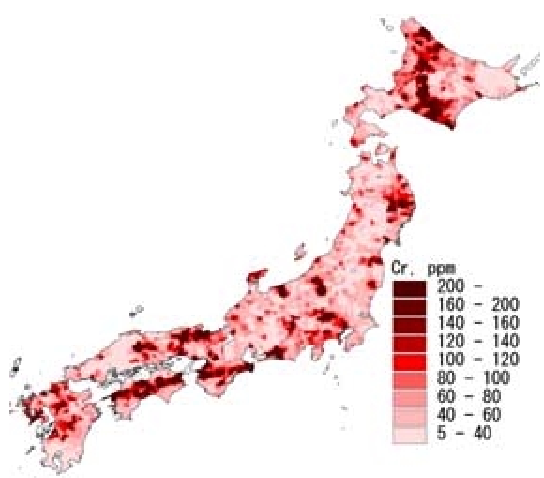

Fig. 1 Geochemical map of Cr in Japan