

# Evolution in Ecosystem of Bubbles

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## Chemical evolution due to adaptability of electronic structure

Each atom possesses individual adaptability. Owing to the adaptability, atoms form a reproduction via forming a mould of molecule. DNA and RNA were formed by atoms. The mass production depended on adaptability of carbon atom.

Adaptability of carbon forms many kinds of compounds.

- Allotropes (diamond, graphite and amorphous carbon).
- C—C bond, C=C bond, and C≡C bond of carbon.
- Hydrocarbon (CH<sub>4</sub>), and carbohydrate (C(H<sub>2</sub>O)<sub>n</sub>).
- Organometallic compounds (calcium carbide CaC<sub>2</sub>)
- Carbon dioxide (CO<sub>2</sub>), carbon chloride (CCl<sub>4</sub>)

The electronic state of each atom will be shifted to fit to the environment of gathered molecule. **The optimal electronic state of each atom is selected among possible states through mutual interactions with the surroundings.** The adaptability of atom forms a copy of molecule by forming a mould to the molecule. The set of atoms forms a molecule and the molecule interacts. That is, the chemical evolution.

## What was the first structure of a life?

The molecular configuration of a membrane is the most primitive structure for a creature. The membrane forms a bubble.

There had been a lot of carbonated water and iron in the early earth. The bubble is made by the oxidization of iron in carbonated water (H<sub>2</sub>O + CO<sub>2</sub>) [1].



The photographing is after 6 hours from mixing of powder of iron (Fe) with carbonated water. Many bubbles are produced and those bubbles surface.

Fig.1 Oxidation of iron in carbonated water forms bubbles

The appearance of stable bubbles needs long time. It is considered the time for chemical evolution. The membrane must be the first stage on chemical evolution for the first life birth.

## Why the iron carbide bubble was formed?

(1) The iron atom takes oxygen atom from carbon dioxide.



Electronegativity of carbon is larger than that of hydrogen.

(2) The released free carbon atom connects with iron atom and compound of iron carbide (Fe<sub>3</sub>C) is made.



Electronegativity of iron is smaller than that of hydrogen.

(3) The iron carbide reacts with water, and produces Fe<sub>2</sub>O<sub>3</sub> and free atom of hydrogen and that of carbon.



These free atoms and iron carbide in the water are able to form the bubble in which hydrogen gas is covered with organic molecules.

**Production of organic material by deoxidation of carbonated water is achieved via oxidation of iron.**

## How did molecule evolve with bubble?

The plane macro structure of membrane is able to put atoms regularly side by side. The membrane of bubble is able to collect atoms selectively by interaction among the other atoms owing to its adaptability.

The structure of membrane is able to organize chemicals.

The arrangement of molecule in membrane of the bubble is destroyed when the bubble disappears. The life span of bubble is equal to the existence of bubble. In such ecosystem of bubbles, the evolution of bubble together with organic molecules goes on, if the molecule that makes the membrane of bubble strong is synthesized.

It is considered that the ecosystem of bubbles was the environment for the first life birth.

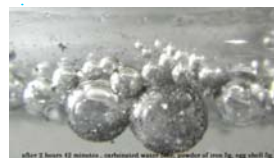
## The catalyst of calcium ion for the bubble

Calcium ion helps to form the bubbles. Bubbles with complex structure were easily formed under the existence of calcium ions.

(1) A calcium atom takes oxygen atom from carbon dioxide.

(2) The released free carbon atom connects with calcium atom and the compound of calcium carbide (CaC<sub>2</sub>) is made.

(3) The calcium carbide reacts with water, and the reaction produces acetylene (C<sub>2</sub>H<sub>2</sub>). The calcium ion dissolves in the water again.



The photographing is after 2 hours from the mixing of  
Carbonated water ; 50cc  
Powder of iron ; 5g  
Egg shell of CaCO<sub>3</sub> ; 5g.

Fig.2 The calcium ion has the effect to strength of the membrane.

The bigger bubbles are found under the small bubble, because the surface of the water is hard to keep.

## Complex structure of iron carbide bubble

The bubble has the structure in which the lower part differs from the upper part. And there is the structure that was formed later inside of the membrane.



Fig.3 Small bubbles in a bubble

The photographing is after 11 days from the mixing of  
Carbonated water ; 50cc  
Powder of iron ; 5g  
Egg shell of CaCO<sub>3</sub> ; 5g

## Materials those adhere to silica of off water

The bubble has the tendency to adhere to silica.



Fig.4 The substance adhered on the glass wall off water

The photographing is after 48 hours from the mixing of  
Carbonated water ; 50cc  
Powder of iron ; 5g  
Egg shell of CaCO<sub>3</sub> ; 5g



Fig.5 Fe<sub>2</sub>O<sub>3</sub> and SiO<sub>2</sub> adhered on the glass wall at off water

The photographing is after 3 months from the mixing of  
Carbonated water ; 40cc  
Powder of iron ; 4g  
Desert sand SiO<sub>2</sub> ; 4g

## Effects of calcium sulfate on the bubble

The iron carbide bubbles are generated, even if we add calcium sulfate. The necessary condition to produce the bubble in carbonated water by oxidation of iron is neutralized acidity (pH=7).

Although there are iron oxides and rocks of sulfite salt in Mars, it is expected to get the knowledge on chemical evolution in the project that will take back rocks from Mars.

## Conclusion

**The adaptability of atoms is able to make replica by forming the mould of the environment. The environment for the first life is the ecosystem of bubbles made from carbonated water and iron.**

## Reference

[1] S. Karasawa, "Inorganic production of membranes together with iron carbide via oxidization of iron in the water that includes carbon dioxide plentifully", Astrobiology Science Conference AbSciCon2010, Evolution and life, League City, Texas, [Prebiotic Evolution: From Chemistry to Life II], Apr.27, 2010.