[PDF version]

Evolution in Ecosystem of Bubbles

-How atom organizes its electronic state to live –
The optimal electronic state of each atom is selected among possible states through mutual interactions with the surroundings. 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. The molecule that wore out is supplemented by the adaptability of atom in the system. It is the primitive metabolism.

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Evolution in Ecosystem of Bubbles

- How atom organize its electronic state to live -

[Index]

YouTube: Birth of the first creature "http://www.youtube.com/watch?v=_MSCbhzBoMM"
YouTube: The spirit of bubble "http://www.youtube.com/watch?v=7mLPULp-il8"
YouTube: Birth of the first cell "http://www.youtube.com/watch?v=oCm8ZrFBQgE"
YouTube: Evolution by bubbles "http://www.youtube.com/watch?v=mlUD1gP_xfM"
YouTube: Ecosystem in bubbles "http://www.youtube.com/watch?v=Udo_85hBGrs"

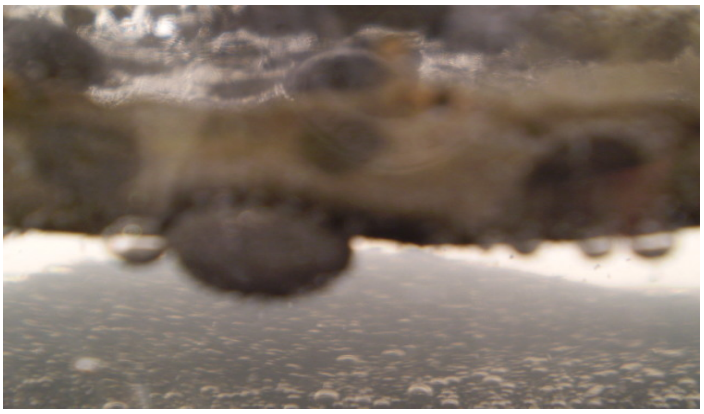
Introduction

The information that gene holds is not useful if there is not a cell system. It is considered that the cell system was born at first. The chemical evolution was carried out as the result of births and disappearances of the systems. The first life was born in such a ecosystem. The beginning of life is the beginning of the ecosystem of atoms. Every creature organizes chemical reactions in a body.

The electronic state of every atom in a body becomes the most suitable state for a situation through the interaction among the surrounding atoms. The carbon atom makes bond between various atoms, i.e. hydrogen atom and chlorine atom and metal atom. A branch in a molecule is formed by the inter-carbon bond of single or double or triple. Various atoms in carbonated water are able to make covalent bond with the carbon.

The seawater in the early earth was carbonated. The carbonated water was changed by oxidation of iron via the eruption of volcano. The electronegativity of carbon (C) is larger than that of hydrogen (H). So, the iron atom (Fe) takes oxygen atom (O) from CO_2. The free carbon atom bonds to iron atoms owing to the electronegativity. The product of iron carbide (Fe_3C) reacts with water. The reaction produces organic molecules and hydrogen molecules [1]. Those molecules form a bubble in the water.

As shown in the photograph on this introduction, bubbles are produced by mixing with iron and carbonated water. The reactions associated with oxidization of iron atom in carbonated water realized the production of bubbles. A chemical evolution was carried out as the result of ecosystem of bubble.



The bubbles those are produced by oxidation of iron in carbonated water
(Production of organic material from inorganic material)

[References]

[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, Apr. 26-29, League City, Texas, [Prebiotic Evolution: From Chemistry to Life Ⅱ],Apr.27, 2010.

Chap. 1 The fact that bubbles are produced by mixing of iron powder with carbonated water

1.1 The bubble that is produced by mixing of iron with carbonated water

1.1.a The materials those used for experiment

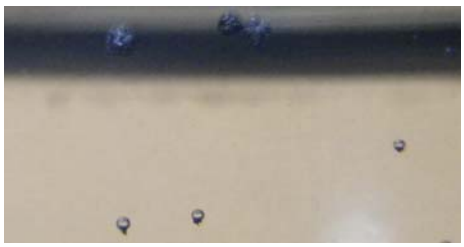
The material of iron that was used for experiments is shown in Fig.2 (a), and the carbonate water is shown in Fig.1 (b).

(a) The powder of iron **(b) The carbonated water**

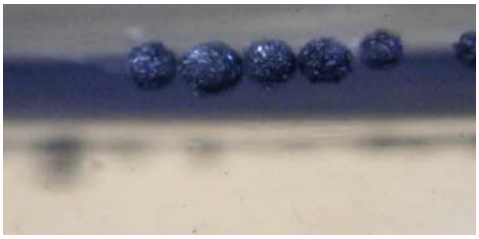
Fig. 1 Materials for experiments (Sodium is included 13ppm in the carbonated water)

1.1.b The bubbles produced in the carbonated water by mixing powder of iron for some time

After powder of iron was mixed with carbonated water, many bubbles are produced at the bottom of the water. Each bubble surfaces together with small solid material. The bubble explodes at the surface of the water at first. But according to accumulation of floating materials, the bubbles begin to stay on the surface of the water for some time. Fig.3 (a),(b),(c),(d),(e),(f) show the photographs of bubbles under the surface.

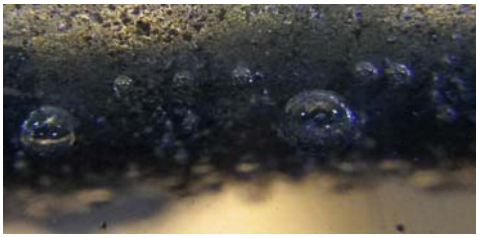


(a) after 86minites



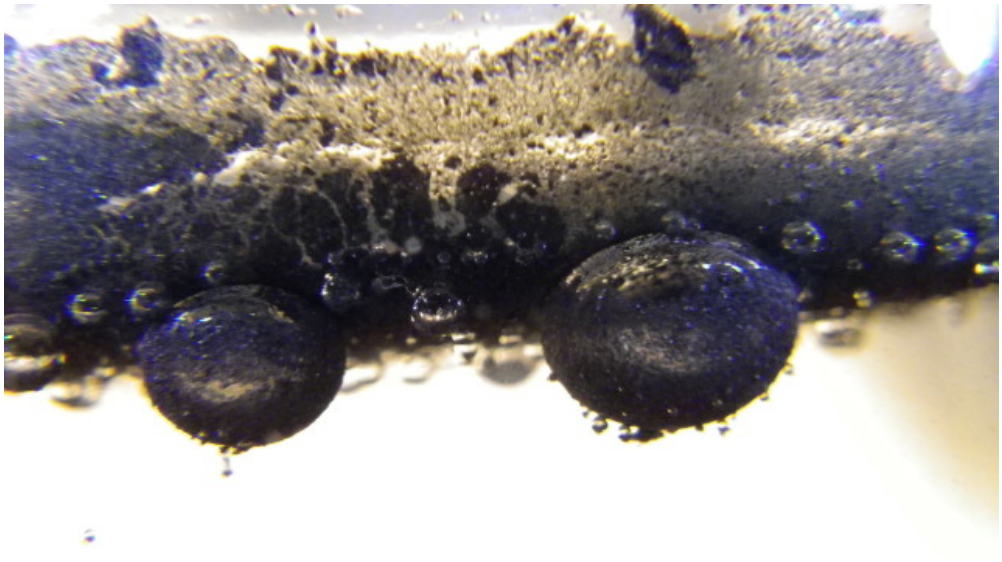
(b) after 2hours

(c) after 3hours 52minutes

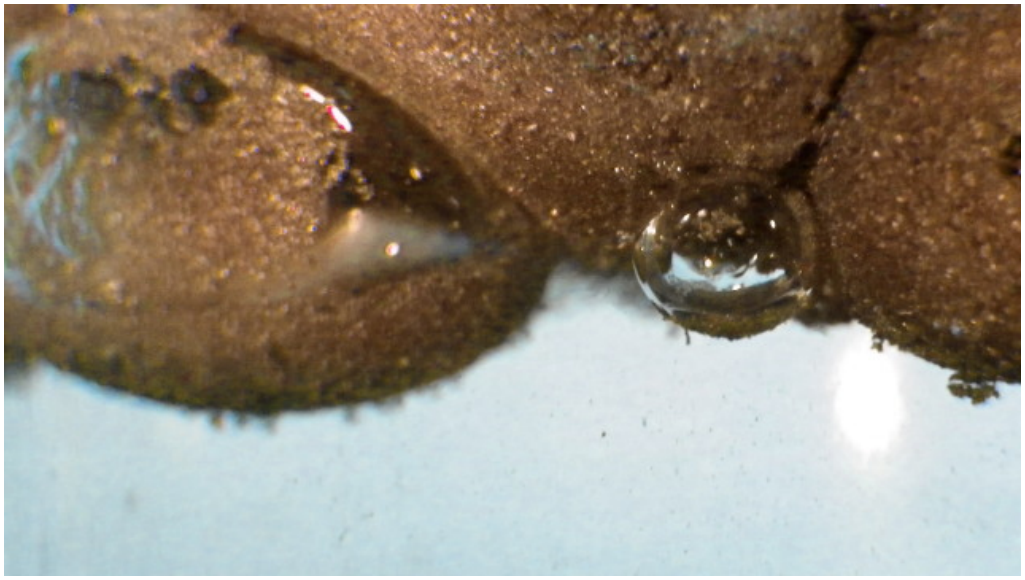


(d) after 4hours 45minutes

Fig.2 The bubbles those were made from the carbonated water (80cc), that is mixed with powder of iron (5g)



(e) after 5hours 30minutes



(f) after 13 hours 50 minutes

Fig.3 The substance that was formed on the surface of carbonated water (80cc) contained with 5g of powder of iron. Here, the container is sealing.

1.1.c Changes on materials produced from carbonated water by oxidation of iron for months of time

Fig.4 shows change of materials after months. The bubbles were produced by mixing with ion powder and carbonated water. The mixing was carried out by shaking the sealed bottle. After a while, small bubbles appeared and those surfaced as shown in Fig.4 (a). The bubbles combined together and became big bubbles. Those bubbles and floating substances gathered on the surface of the water. Even the substance that falls from the surface was seen. We can break the bubbles by shaking the bottle intensively. The iron and carbonated water produces iron carbide. And the iron carbide and water

produce iron oxide, organic substances and hydrogen gas. So, it is estimated that the component of the gas in the bubble is hydrogen gas.

Thin membrane adhered to the glass wall. The structural color due to interference of light on the membrane of the wall was shown. The floating substance becomes brown when it was touching air for long time. It is considered that the color of brown is caused by oxide of iron.

The photograph shown in Fig.4 (b) is a sight after 2 months of the mixing. The bubbles disappeared. Brown substances remained to the glass wall of the upper part from the surface of the water. The substance that floats underwater remained also.

Fig.4(c) was photographed after 5 months from mixing iron and carbonated water. This sample was irradiated by ultraviolet rays during a few days at beginning of the period. The a little bit thick membrane formed to the glass wall came off and it was seen. It is indicated that organic matter was produced.

(a) after 15hours **(b) after 3 months** **(c) after 5 months**

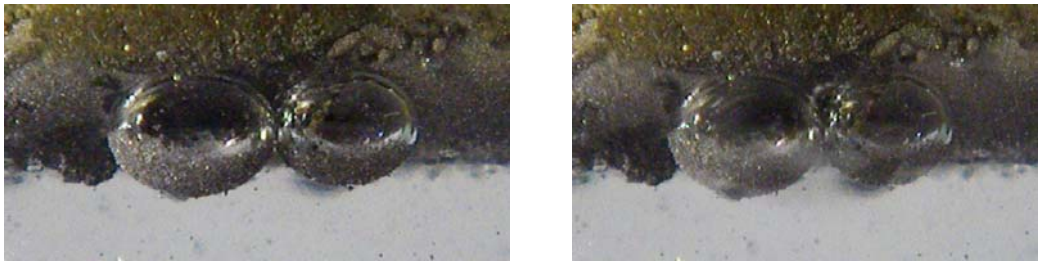
Fig.4 Changes after months of time. Those were produced by mixing with science laboratory ion powder 5g and carbonated water 90cc of which impurity is Na=13ppm.

1.2 Characteristics of the bubble produced by mixing with iron and carbonated water

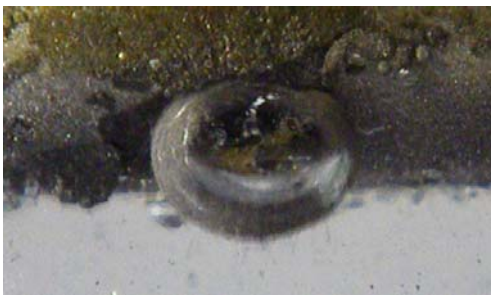
1.2.a Unification of two bubbles within period of about 0.1 seconds

The changes in a short time those break out at unification of 2 bubbles are shown in Fig..5 (a),(b),(c),(d).

The couple of bubbles were produced in 50cc of carbonated water (H2O+ CO2) in which 5g of powder of iron (Fe) and 5g of calcium sulfide (CaSO4) were mixed. The necessary condition to keep bubbles is neutral acidity (pH=7). The photographed after 12 hours of the mixing.



(a) start **(b) after 1/30 seconds**

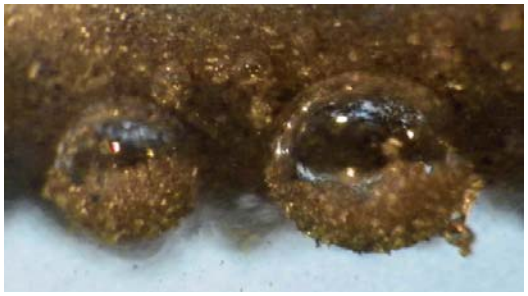
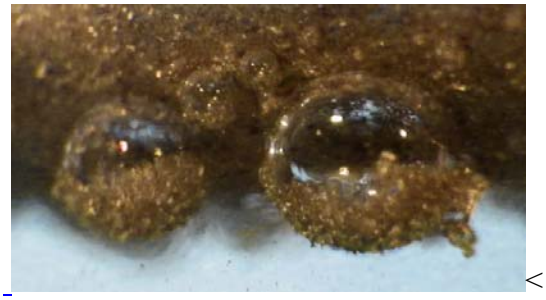
(c) after 2/30 seconds **(d) after 3/30 seconds**

Fig.5 The process that unifies two bubbles.

1.2.b The rearrangement of substances in membrane of a bubble

An arrangement of substances in membrane of a bubble that breaks out as shown in Fig.7 (a) and Fig.7 (b). TA solid substance in right side of the central is moving downward. The substance that was included in the membrane moves in a bubble slowly. The time difference between two pictures is 13 seconds. Moreover we can recognize enlargement of the bubbles by comparing from two photographs shown in Fig.7. It indicates the facts that the solid substance in membrane of the bubble continues the reactions.

There is a transparent portion in a bubble. The conceivable reasons for the effects form a structure in membrane of a bubble are as follows. A heavy solid substance transfers to the lower part of the bubble. A light solid substance adheres to the surface.

(a) at 4hours 42minutes 36seconds **(b) at 4hours 42minutes 49minutes [13 second after (a)]**

Fig.6 Rearrangement of solid substances in a bubble [mixed with carbonated water (H2O+CO2) and powder of iron (Fe)]

1.2.c Outline of the mechanism that bubbles are produced by the reaction between carbonated water and iron

At first, bubbles are born from surface of iron particles in the bottom. Each bubble surfaces and it expands by approaching to the surface. Most of bubbles break at the surface. When a bubble explodes, the substance that adheres to the bubble falls downward. Some of falling substances reverse upward in way of the descent. There are surfacing bubbles and falling substances concurrently. After about an hour, the bubbles those are covered with rugged substances appear in the water. Increase of bubble that stays at the surface is promoted by the floating substances.

A large bubble is made from new surfacing bubble and old staying bubble. For some time, the surface of the water is covered with the floating substances. [Please click here, a movie is presented].

[Summary]

When powder of iron is mixed with carbonated water, many of bubbles those accompany with solid material surface. Those bubbles are changed by the interactions between surroundings. The membrane was formed to the glass wall of container. Those are the evidence that the organic substance is made from inorganic substances.

[References]

[2] S. Karasawa, "Systematization of the chain reaction in membrane of the organic molecule that is produced with the reduction by iron from the sea water that includes carbon dioxide plentifully", [This article is an English translation of the abstract written in Japanese], Astrobiology Workshop 2008, Shonan international village center, Dec. 20-21, 2008.

Chapter 2 Analyses of the substance that forms bubble

2.1 Preparation of the specimen for analyses

2.1.a Materials used for analyses

Photographs of materials used for analyses are shown in Fig.7. As for the impurity of iron, calcium (Ca) and also silicon (Si) were included in the surface to steel wool.

(a) steel wool

(b) glass container

(c) materials for specimen

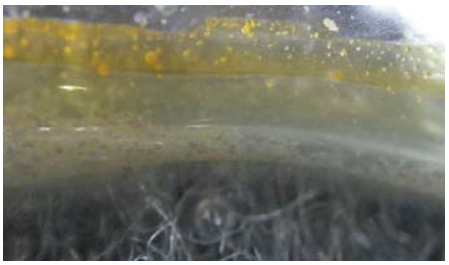
Fig.7 Glass container, steel wool and materials for specimen The maker of steel wool reports that calcium atoms and silicon atoms adhered to the surface of steel wool through manufacturing process.

2.1.b Preparations for analyses

Changes of the carbonated water with steel wool is shown in Fig.8. Comparing with the results of iron powder, the color of the solution is brown. It is considered that the differences caused by the effects of calcium (Ca) and silicon (Si).

(a) after 13minutes(凹 is due to container)

(b) after 15hours6minutes



(c) after 21hours3minites

(d) after 26hours38minutes

Fig.8 Changes of carbonated water after steel wool was input

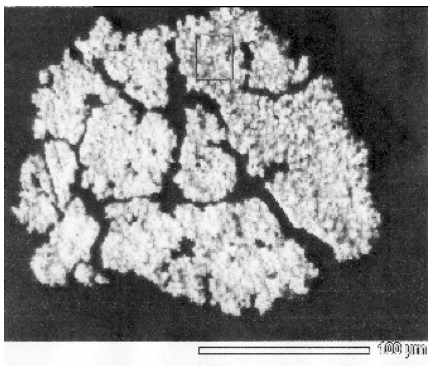
2.1. c Specimens for analyses

The specimen for analyses was caught by a net from surface of the liquid that is shown in Fig.8(c), because the floating materials on the surface escape from the spoon

of stainless steel. The substance on the glass wall is the membrane that brings a structural color. Fig. 9 (a) and also Fig. 9 (b) are photographs of dried specimen on a laboratory dish. The photograph captured by an optical microscope is shown in Fig.10 (a). We can recognize tow types of compounds. One is black particles. And the other is yellow membrane of transparency. The photograph captured by a scanning electron microscope (SEM) is shown in Fig.10 (b).

(a) dried floating materials **(b) dried floating materials (expanded)**

Fig,9 Dried floating materials made from mixing carbonated water and steel wool



(a) pictured by an optical microscope(x 600) **(b) pictured by a SEM**

Fig.10 Photographs on specimen those were captured by microscope

2.2. Infrared spectroscopic analysis

2.2.a The principle of infrared spectroscopic analysis

What type of chemical bond is found in the material on surface of the water? The molecular bonds vibrate depending on the type of bonds. So, the infrared spectroscopy (Fourier Transform Infrared Spectroscopy: FT-IR) is used as a tool to identify chemical bond. At first, the identification is difficult in case of unknown specimen. But, the absorption peak of vibration due to expansion and contraction on the connection of the carbon atom and hydrogen atom in paraffin is in 3000 cm^{-1}. We can check whether or not the absorption peak turns up.

2.2.b The result of infrared spectroscopic analysis

The graph shown in Fig.11 is a result of FT-IR on substances those float on the surface.

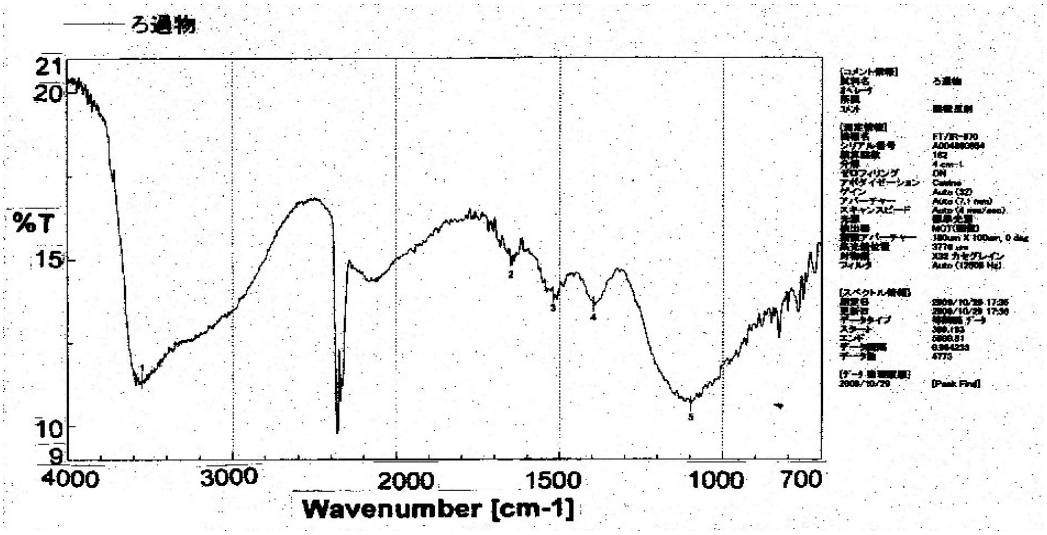


Fig.11 Result of FT-IR on the floating substances (after 1 week from the mixing)

Fig.12 is result of FT-IR on floating substances. As the results, we can not find out remarkable absorption peak that identifies C-H types of chemical bonds. There is absorption in nearly 4000 cm^{-1} wave numbers that is short of wavelength area on the substance on the glass wall. The fact means that there are hard bonds in the membrane on the grass wall.

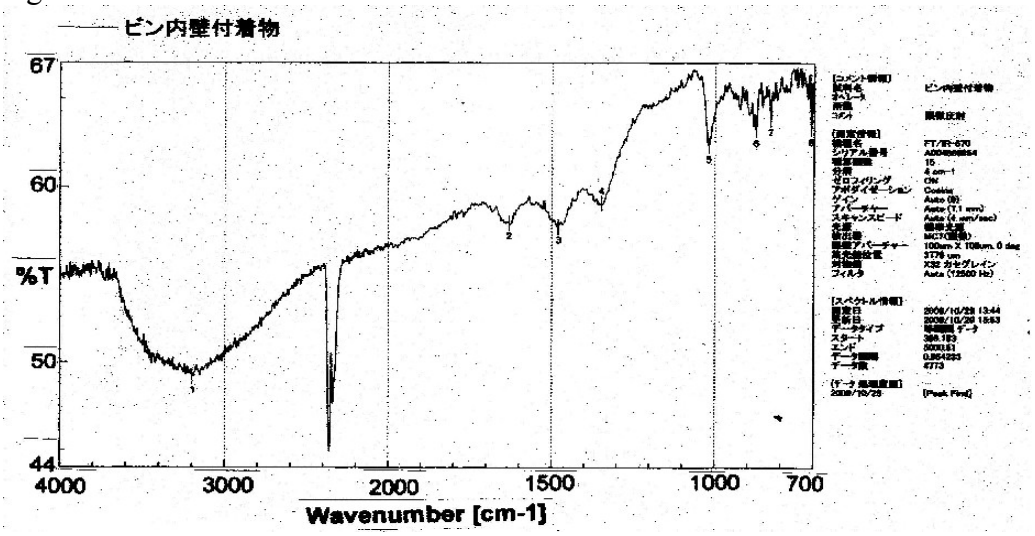


Fig.12 Result of FT-IR on the substances (on glass wall, after 1 week from the mixing)

2.3 Energy dispersive X-ray analysis (EDS)

2.3.a The principle of EDS

What kinds of atom are found in the material on surface of the water? Energy dispersive X-ray spectroscopy is an analytical technique that is used for the elemental analysis.

The analysis of X-ray spectroscopy is conducted to determine the atomic constituents.

The device is commonly equipped with scanning microscope. The scanning microscope carries out the mapping for the X-ray spectroscopy as shown in the photograph.

The results were presented graphs as shown Fig.13. The analyses were carried out several days after the input of steel wool in carbonated water.

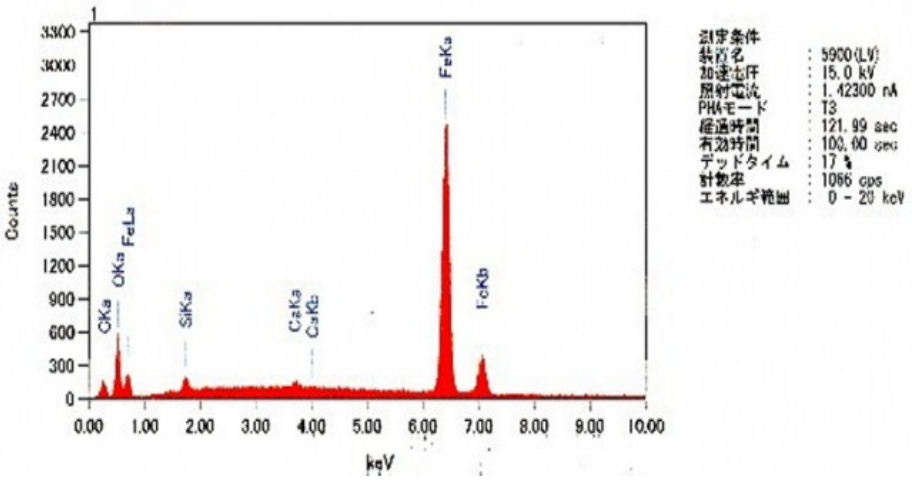


Fig.13 A result of Energy dispersive X-ray analysis.

2.3.b What kinds of atom are found in the floating material?

EDS data obtained from different places by shifting the positions are listed in table 1, 2, 3.

Table 1 A result of elemental analysis by energy dispersive X-ray analysis (1)

φ(ρz)法 簡易定量分析
フィッティング係数 : 0.2972

元素	(keV)	質量%	誤差%	原子数%	化合物	質量%	カチオン数	K
C K	0.277	3.14	0.11	11.70				0.8682
O K	0.525	4.94	0.10	13.83				12.9303
Si K	1.739	0.77	0.13	1.23				0.5125
Ca K	3.690	0.47	0.17	0.53				1.6441
Fe K	6.398	90.68	0.48	72.71				91.1759
合計		100.00		100.00				

Table 2 A result of elemental analysis by energy dispersive X-ray analysis (2)

φ(ρz)法 簡易定量分析
フィッティング係数 : 0.2890

元素	(keV)	質量%	誤差%	原子数%	化合物	質量%	カチオン数	K
C K	0.277	3.75	0.10	12.61				1.0536
O K	0.525	9.30	0.09	23.46				24.2005
Si K	1.739	1.33	0.13	1.91				0.8927
Ca K	3.690	0.61	0.17	0.62				2.1178
Fe K	6.398	85.00	0.46	61.41				84.4449
合計		100.00		100.00				

Table 3 A result of elemental analysis by energy dispersive X-ray analysis (3)

φ(ρz)法 簡易定量分析
フィッティング係数 ： 0.2784

元素	(keV)	質量%	誤差%	原子数%	化合物	質量%	カチオン数	K
C K	0.277	7.19	0.09	22.01				2.1554
O K	0.525	9.74	0.09	22.38				24.7077
Si K	1.739	1.23	0.11	1.61				0.8617
Ca K	3.690	0.52	0.16	0.48				1.8350
Fe K	6.398	81.32	0.43	53.52				83.2015
合計		100.00		100.00				

Here, hydrogen atom does not measured by EDS. Capable compounds are iron carbide, iron oxide, carbon dioxide, and water. The main constituent of the floating material is iron. More than 50% of atoms are iron. It is considered that the material includes iron carbide. The iron carbide is intermediate chemicals. The ratio among iron atoms and carbon atoms is not fixed. Molecule of iron carbide possesses a polarity and it is able to form a thin membrane.

[Summary]

It is the result of analyses that iron carbide was produced by oxidation of iron atom in carbonated water. The organometallic molecule of iron carbide forms a membrane in the carbonated water.

-Additional descriptions for the summary-

The iron carbide was investigated to assist Fischer-Tropsch reactions for synthesizing hydrocarbon. It is considered that, the black particle is made of iron carbides. The yellow membrane of transparency was made by synthesizing reaction of iron carbide and water as shown in the picture.

[References]

[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, #5168, League City, Texas, [Prebiotic Evolution: From Chemistry to Life □], Apr.27, 2010.

Chapter 3 Explanation of the production of bubble with iron carbide

3.1 The organic substance which is a product of an ecosystem of carbon atom

3.1.a Outline of the explanation

Why carbonated water with iron produces iron oxide and iron carbide. The electronegativity of carbon atom is larger than that of hydrogen atom. Then, the iron atom takes oxygen atom from carbon dioxide as described in Equation (3.1). The released free carbon atom connects with iron atom and compound of iron carbide (Fe_3C) is made as described in Equation (3.2).

$$2Fe^{3+} + 3\{H_2O + CO_2\} \rightarrow 3Fe_2O_3 + \{3C + 6H\} \quad \textbf{(3.1)}$$

$$2Fe^{3+} + \{3C + 6H\} \rightarrow 3Fe_3C + 3H_2 \quad \textbf{(3.2)}$$

The carbon atom is able to change the bonding partner from oxygen atom to iron atom. The iron carbide reacts with water, and produces oxide of iron and free atom of hydrogen and that of carbon as described in Equation (3.3).

$$2Fe_3C + 9H_2O \rightarrow 3Fe_2O_3 + \{C_2H_2\} + 8H_2 \quad \textbf{(3.3)}$$

The free atoms and water are able to form the bubble in which hydrogen gas is covered with membrane made of organic substance.

3.1.b Characteristics of carbon atom

The types of carbon compounds are listed in Table 4.

Table 4 A classification of carbon compounds

(1) Carbon atoms forms allotropes such as diamond, graphite and amorphous carbon.
(2) Carbon atoms form simple bond, double bond, and triple bond between the carbon.
(3) Carbon atoms form hydrocarbon and carbohydrate.
(4) Carbon atoms form organometallic compound such as calcium carbide.
(5) A carbon atom forms carbon oxide and carbon chloride.

Electrons of carbon occupy the electronic state that fits to its circumstance among possible states. That is the ecosystem of atom in which each electronic state of atom is adapted to its environment. So, the mineral or material tells the environment in which it was formed.

3.1.b Solubility of carbon dioxide to the water

The volumes of gas (cc) that dissolves in the water (1cc) at 0 ℃, 1atm are shown in Figure 14 [2]. The data tell that carbon dioxide and acetylene dissolve in water well.

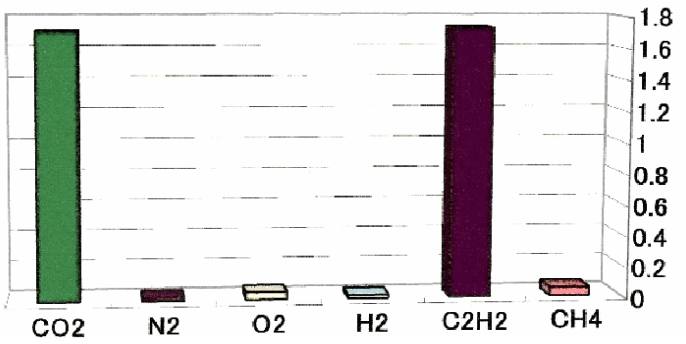


Fig.14 Solubility of typical molecule to the water (1cc) at 0□ 1atm

The temperature dependency on the solubility of carbon dioxide to the water is shown in Fig. 15 [6]. The solubility of carbon dioxide decreases when the temperature goes up.

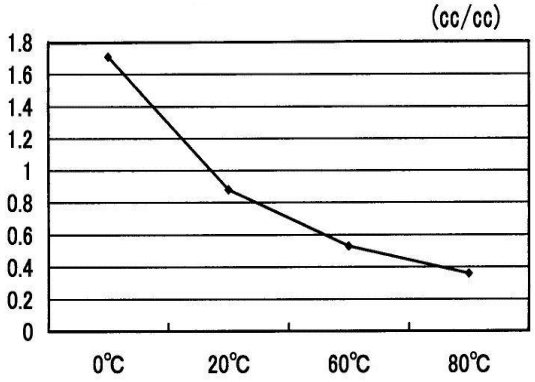


Fig.15 Temperature dependency on the solubility of carbon dioxide to the water

3.1.c Comparison of electronegativity among typical atoms

Electronic state changes at the circumstances. Then, the electronegativity changes by the situation. Even so, the value of electronegativity was given by the results empirically. Comparison of the numerical value of electronegativity indicates how strongly each atom attracts an electron in compound. Fig.16 shows the value of electronegativity given by L. Pauling.

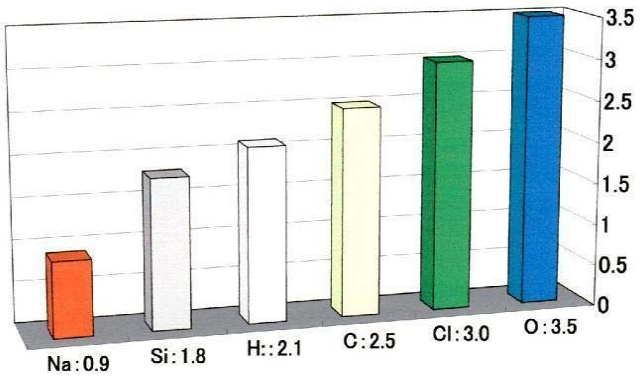


Fig.16 Electronegativity (from L. Pauling)

The atom of iron takes oxygen from carbon atom in the carbonated water, because the carbon atom is electrically negative compared with hydrogen atom. The free carbon bonds to the atom of iron instead of hydrogen atom by ionization tendency.

Here, let us explain the origin of electronegativity about NaCl as follows. The chemical reaction on NaCl breaks out among p-orbit of chlorine and s-orbit of sodium. Here, s-orbit is sphere, and p-orbit is spheroid. The s-orbit of Na atom is invaded by p-orbit of Cl atom. The p-orbit of Cl atom invades into the sphere of Na atom. The value of electronegativity on p-orbit becomes large and that of s-orbit becomes small. So, the valence electrons occupy p-orbit of Cl atom and it and become closed shell structure and the valence electron of Na becomes empty and forms a closed shell structure.

But, it is the model of ionic bond. In fact, the valence electron does not transfer to the Cl atom. The electronic state of compound is different from that of isolated atom. The valence electron in NaCl receives pull force from nucleus Cl more than that of Na.

3.2 Reactions of carbon atom

3.2.a A battery is made in carbonated water by using electrode of iron and carbon

As shown in Fig.16 (a),(b), an electromotive force is generated by the battery that is made of iron electrode and carbon electrode in carbonated water. Here, the iron is the negative pole and as the carbon is positive pole. The electric motive force is given by oxidation of iron. When the atom of iron oxidizes by using the oxygen of carbonated water, the anions are transferred toward the electrode of iron in the carbonated water. So, electrons are transferred to the charcoal electrode from the iron electrode in the circuit of outside. That is, the iron electrode becomes a negative electrode.

(a) at the beginning (0.17mA, 0.3V) (b) after 5hours (0.05mA, 0.1V))

Fig.17 The battery where carbonated water is used for the electrolyte, a charcoal is used for the positive electrode and a steel wool is used for the negative electrode.

The voltage gradually decreased from current=0.17mA to opened voltage=0.1V, shorted current=0.05mA. The reason is a result of the reaction.

3.2.b Movement of ion due to electric field in carbonated water

Hydrogen ion of proton exists a lot in carbonated water, because carbonic acid is weak acid. The proton possesses electric charge and it moves by electric field. But hydroxyl ion $(OH)^{-1}$ does not move due to the external electric field, because the

negative ion of OH^{-1} is collaborating with hydrogen ion in carbonated water. If electric current is flowed by using carbon electrodes, the hydrogen ion of proton transfers to the negative electrode. The hydrogen ion that obtained an electron from the negative pole becomes hydrogen gas and it produces bubbles as shown in Fig.18. By electric current for a period of 40 hours, with 24V, while irradiating the ultraviolet rays, the positive electrode of high conductive charcoal becomes black as shown in Fig.18.

The carbon atom that adhered on the positive electrode is explained as follows. The carbon atom in carbonated water touches to the positive electrode, and it adheres to the carbon electrode owing to the energy given from ultraviolet light. This evidence supports the following idea. It is conceivable that a carbon atom behaves as an anion.

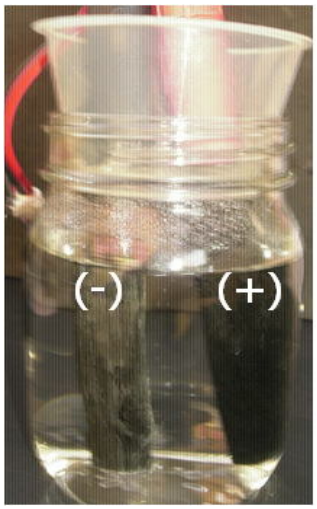


Fig.18 Hydrogen gas is produced by electric current where carbon electrodes are used in carbonated water.

3.2.c Production of iron carbide by an electrode reaction of carbon and iron in water

The experiment was carried out in order to confirm the fact that iron carbide is produced in the water. The floating substances are produced by an electrolysis processing of water solved with iron by using carbon electrodes. This reaction is an electrode reaction, because production of the floating substances is promoted remarkably by agitation.

It is considered that the same substance similar to the products from carbonated water mixed with iron powder was produce, because it is made from the same material through similar water. At the beginning of this process, many small bubbles appear at negative electrode. The hydrogen ions are produced by oxidization of iron atoms and the protons for the bubbles at the negative electrode.

After some hours, iron atoms adhere to the negative electrode of carbon. On the other hand, the exhaustion on positive electrode of carbon is large amount, and the temperature of the water becomes high. Although there is the possibility related to the nature of charcoal electrode, we consider the exhaustion is caused by the oxidation of charcoal electrode, and the carbon oxide reacts with iron.

Fig.19 shows the result of the experiment. Here, the electric current was carried out by voltage of 24 bolts, a period of 4 hours, setting the rotating magnet for agitation. The

floating substance includes bubbles a lot. So the floating substance decreases after the reaction.

Fig.19 The products of electrolysis processing of water solved with iron by using carbon electrodes are similar to the products in carbonated water mixed with iron powder.

[Summary]

The iron carbide is produced from the carbonated water that mixed with iron. The carbon dioxide dissolves in water well. Here, the electronegativity of carbon is lager than that of hydrogen atom, and electronegativity of iron atom is smaller than that of hydrogen atom. So, iron atom takes oxygen atom from carbon atom and the carbon atom connects to iron atom.

[References]

[2] National Astronomical Observatory, "Rika Nenpyo (Chronological Scientific Tables 2008), pp. 503, 2007.

Chapter 4 The necessary condition to keep bubbles in the water

4.1 Effects of calcium ion for the production of the bubble

4.1.a The existence of calcium ion that is detected by electrode reaction in carbonated water

The processing of electrolysis was carried out on the carbonated water that was mixed with egg shells of calcium carbonate ($CaCO_3$) by using high conductive charcoal electrodes. As a result, white material appeared on negative electrode by the electrode reaction as shown in Fig.20.

Fig.20 An electrode changes by electric current in the carbonated water with calcium carbonate.

When it exchanges the polarity of the carbon electrodes, the white material transfers it to the electrode of negative of the opposite side. The white material transfers it to the negative electrode again, when the direction of electric current is opposite again. Thus, the existence of calcium ion in carbonated water was detected by an electrode reaction of carbon.

$$\{ Ca^{2+} + 2(OH)^{-1}\} + 2CO_2\} \qquad CaCO_3 + H_2CO_3 \qquad \textbf{(4.1)}$$

Calcium carbonate ($CaCO_3$) is produced, if calcium atom is included in carbonated water ($H_2O + CO_2$). The calcium carbonate exists as limestone. Here, if free carbon atom is produced by oxidation of iron atom in carbonated water, it bonds to calcium atom and calcium carbide (CaC_2) is produced.

The calcium carbide reacts with water and it produces acetylene. Acetylene dissolves in water a lot. The dissolved acetylene becomes materials of organic substance. Those organic materials contribute to improve the strength of membrane. The bubble that increased strength is useful to check the nature of bubble.

$$CaC_2 + \quad 2H_2O \rightarrow \quad Ca(OH)_2 + C_2H_2 \qquad \textbf{(4.2)}$$

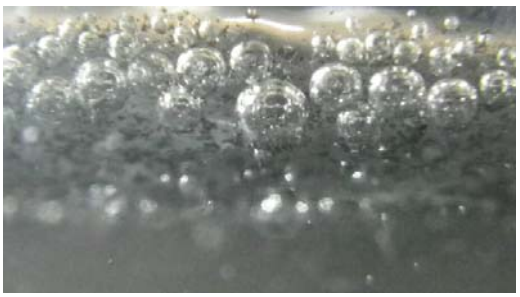
4.1.b Effects of calcium carbonate (CaCO3) to the iron carbide bubble

Variations of bubbles in the carbonated water that was mixed with the iron powder and calcium carbonate Photographs of the bubbles those were produced in the carbonated water with iron powder and eggshell are shown in Fig.21. The bubbles with double layered complex structure were formed.

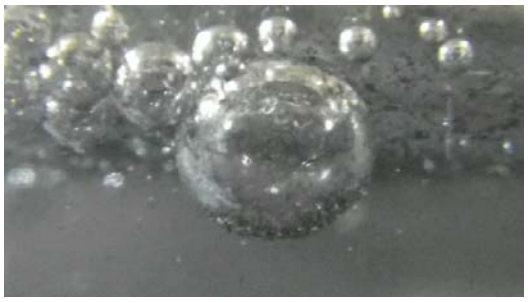
It is conceivable that the existence of calcium ion has effect to strength of membrane. That is, it is conceivable that the existence of calcium has effect to chemical evolution

for birth of life.

(a) after 31minutes



(b) after 1hour 59minutes



(c) after 2hours 32minutes

(d) after 2hours 48minutes

(e) after 3hours 19minutes

(f) after 28hours 30minutes

Fig.21 Formation of bubbles in the carbonated water (50cc) that was mixed with iron powder (5g) and calcium carbonate ($CaCO_3$: 5g)

4.1.c Effects of calcium sulfite ($CaSO_4$) to the iron carbide bubble

The sulfuric acid is included to sea water. So, calcium sulfite of $CaSO_4$ is formed by the chemical bond between calcium and sulfuric acid. It is considered that the first life was born in the sea. We checked the effect of calcium sulfite for the first life as follows. The calcium sulfite ($CaSO_4$: 5g) was mixed with the carbonated water (50cc) that includes with iron powder (5g). The result of this experiment is shown in Fig.23.

The bubbles are produced similarly to the case without calcium sulfite. The calcium sulfite hardly changes the reaction of the carbonated water and iron. It is concluded that the chemical evolution by the bubble is possible in case of neutral acidity. So, although there are lots of rocks of sulfide salt in Mars, it is expected to get the knowledge on chemical evolution in the project that takes back rocks from Mars.

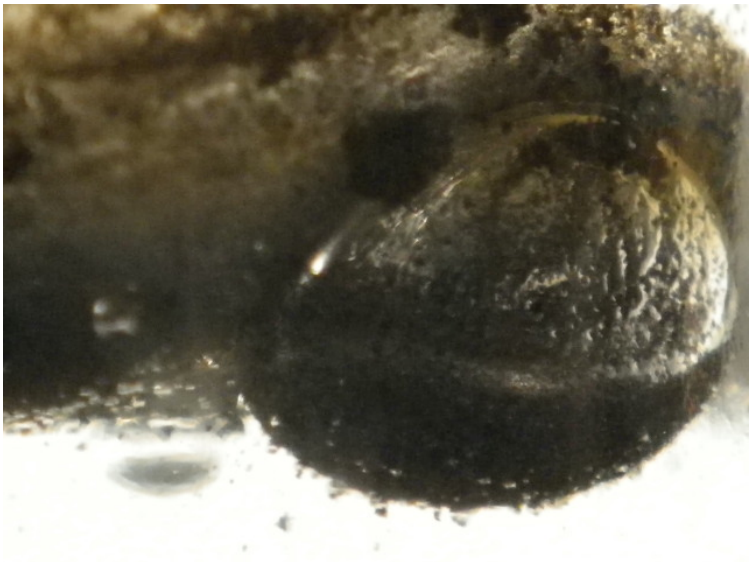


Fig.22 Formation of bubbles in the carbonated water (50cc) that was mixed with iron powder (5g) and calcium sulfite ($CaSO_4$: 5g) [after 12 hours from the start]

4.1.d Effects of calcium oxide (CaO) to the iron carbide bubble

The water becomes cloudy when powder of calcium oxide (2g) is put into the carbonated water (50cc) that is mixed with iron (5g). After a while, the water becomes clear and the substance is deposited at the bottom of the bottle.

As for bubbles, most of the bubbles disappear right away at first. After the certain period, the bubbles appear only on the glass wall as shown in Fig. 23.

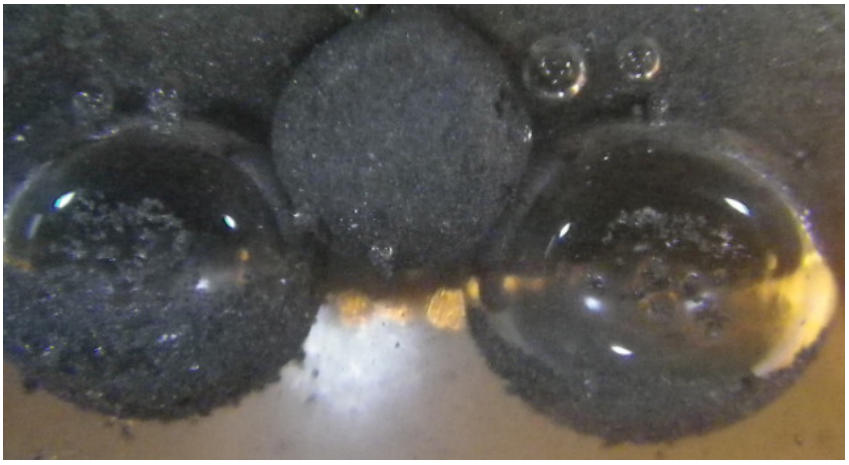


Fig.23 Formation of bubbles in the carbonated water (50cc) that was mixed with iron powder (5g) and calcium carbonate (CaO: 2g) [after 23hours from the start]

Moreover, those bubbles disappeared after 3days as shown in Fig 24. This reaction can be understood as follows. At first, the calcium oxide reacts with water and calcium hydroxide {$Ca(OH)_2$} is made. The water changed to alkalinity due to calcium hydroxide. So, membrane of bubble dissolved in the water. But the calcium hydroxide reacts with carbonate water. The calcium carbonate ($CaCO_3$) is made. The water gradually changes towards neutral. It is considered that the neutralization does not accomplish in this case of Fig.23, and 24.

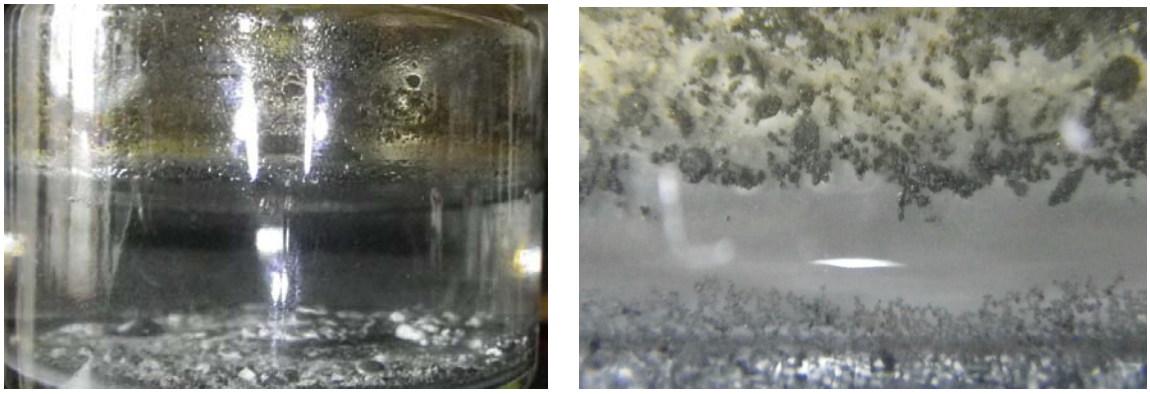
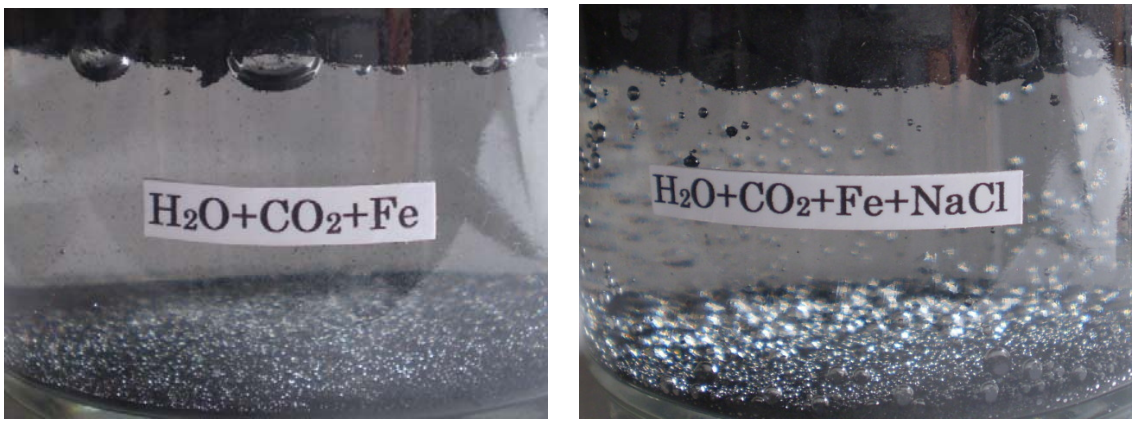


Fig.24 Effects of calcium carbonate (CaO: 2g) on the carbonated water (50cc) that was mixed with iron powder (5g) and [after 3 days from the start]

4.2 Effects of sodium ion for the production of the bubble in carbonated water with ion

4.2.a Effects of NaCl to the iron carbide bubble

It is considered that the first life in early earth was born in the sea. The sea water includes salt (NaCl). So, the effect of salt to the iron carbide bubble was investigated. Fig.25 (a) is the photograph on the pure iron carbide bubble as a reference. Fig.25 (b) is the photograph of iron carbide bubble in the water in which NaCl (2g) was added.

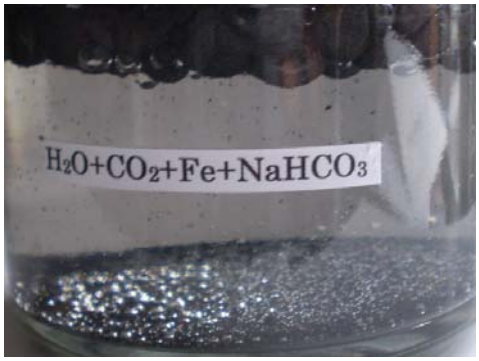


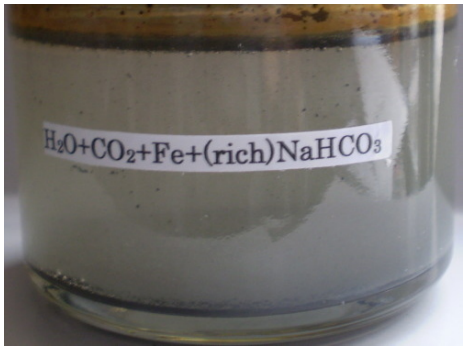
(a) pure iron carbide bubble **(b) addition of NaCl (2g)**

Fig,25 Effects of salt (NaCl) on the iron carbide bubble

4.2.b Effects of NaHcO3 to the iron carbide bubble

Fig.26 (a) is the photograph of iron carbide bubble in the water in which $NaHCO_3$ (2g) was added. Fig.26 (b) is the photograph of iron carbide bubble in the water in which $NaHCO_3$ (7g) was added plentifully. The production of bubble changes drastically in the case of (b). It is explained by the acidity of the water. The bicarbonate of soda is weak alkalinity and hydroxyl group of (OH^-) exists a lot. The hydroxyl group makes chemical bond with the hydrogen atom and carbon atom. So, the components of the bubble and the membrane disappear.





(a) addition of $NaHCO_3$ (2g) **(b) addition of $NaHCO_3$ (7g)**

Fig,26 Effects of salt carbonate of soda ($NaHCO_3$) to the iron carbide bubble Here, carbonated water is 90 cc, iron powder is 5g. Photographing is after 15 hours from the mixing

4.2.c Effects of caustic soda (NaOH) to the iron carbide bubble

In order to check the influence of alkalinity, caustic soda (2 g of NaOH) is added to the carbonated water (90cc) with iron powder (5g). When NaOH is added to the water, it will be alkalinity water.

The situation of iron carbide bubble in immediately after the mixing is shown on the left side of Fig. 25. The bubble has disappeared right away as soon as it was born, because the membrane of bubble will react with the hydroxyl group.

The situation of the water after 20 hours is shown on the right side of Fig. 27. The color of iron powder in the bottom becomes brown, and the bubble stops occurring. The hydroxyl group of OH^- functions as oxidizing agent.

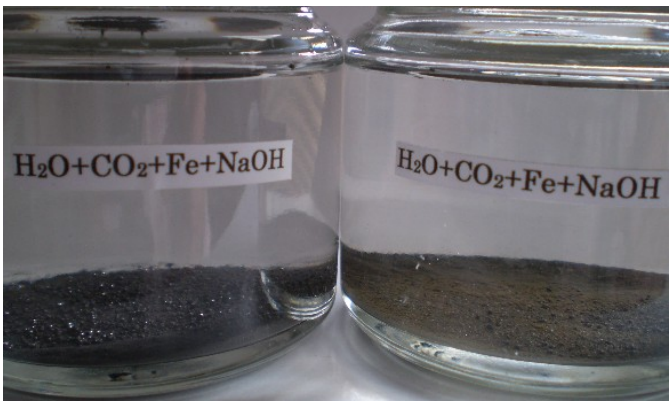


Fig.27 Effects of caustic soda (NaOH: 2g) to the carbonated water (90g with iron powder (5g). The situation after 20 hours shown on the right side is compared with that of the beginning shown on the left side.

[Summary]

The necessary condition to keep bubbles in the water is neutral acidity. Although proton in the water is able to repair the bubble that was about to break, existence of hydroxyl group of OH consumes the proton. It is conceivable that the existence of calcium ion has the effect to strength of the membrane, because the bubbles with double layered complex structure were formed under the calcium ion.

Chapter 5 Internal structure of the bubble made by iron carbide

5.1 Evolution by ecosystem of iron carbide bubbles

5.1.a The evolution through generation with selective disappearance

Although bubbles are produced by mixing of iron powder into carbonated water, those bubbles disappear soon. After hours of time, materials appear on the surface of water, and bubbles come to be seen.

The molecule structure of the membrane that is formed at the interface of the bubble differs from that of liquid. A new connection of molecules is produced with different situation of the interface. The result of new compound produces the additional new situation. The appearance of stable bubble needs long time. It is considered the time for chemical evolution.

The ecosystem of bubble is an environment of chemical evolution. That is, the molecular structure of interface is possible to organize new chemicals. The situation of membrane on the bubble is able to collect the molecule selectively by assist of its adaptability, and it organizes those molecules by assist of the characteristics of bubble. The water pressure decreases by approaching to the surface. So, the volume of bubble is enlarged by surfacing. The enlarged volume accompanies with expansion of the membrane.

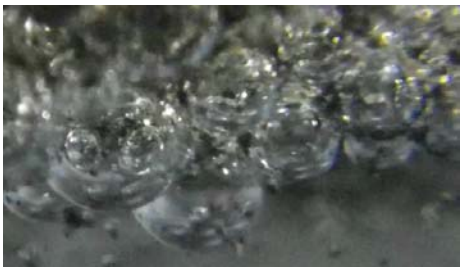
At the surface of water, the situation that touches with the membrane is changed from water to air. The many of bubbles explode by this change. The arrangement of molecule in membrane of the bubble is destroyed when the bubble disappears. During such repetitions, a chemical evolution by the bubbles goes on, if the molecule that makes the membrane of bubble strong is synthesized.

5.1.b A formation of the bubble that includes with many bubbles

The contact among bubbles induces inclusion of bubbles. Fig.28 shows such structure of the bubble. Here, there exist no small bubbles newly made from iron carbide on the surface of the water. So, it is considered that the bubble that is inside of a bubble is made from the inclusion. The various materials are included at the unification.

The replacement of materials in a new membrane takes place by assist of gravity, and new molecule is synthesized in the membrane by assist of adaptability of carbon atoms. Such bubble exists under the rule of natural selection. So, existence of the molecule that makes a stable membrane increases. The improvement of a system accompanies with evolution of constituents.

(a) after 2 hours 43 minutes

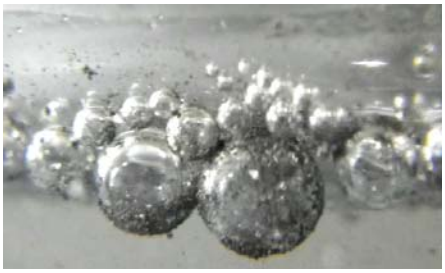


(b) after 3 hours 21 minutes

Fig.28 The iron carbide bubble of complicated structure made from carbonated water(50cc), powder of iron (Fe:5g) and egg shell ($CaCO_3$: 5g)

5.1.c A systematic arrangement of bubbles

The arrangement of bubble group becomes similar, because the method to form bubble is the same. That is, a small bubble is produced at the bottom of water. The bubble becomes bigger owing to production of hydrogen gas. Those bubbles are surfacing. The surfacing bubbles are unified at the bottom of layered bubble. But the surface of water is hard to keep. So, the big bubble is formed under the small bubbles. Fig.29 shows the systematic arrangement of bubbles.



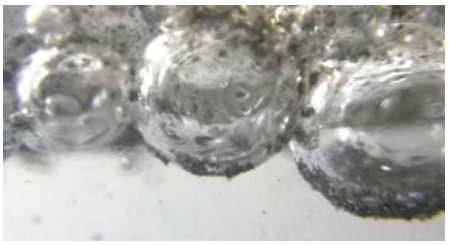
(a) after 2hours 42miniutes

(b) after 11days

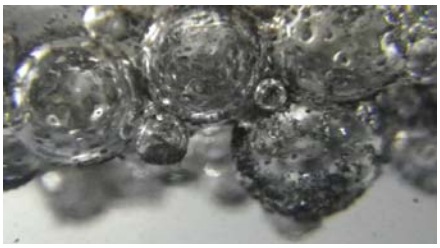
Fig.29 The systematic arrangement of bubbles those were made from carbonated water (50cc) with iron powder (5g) egg shell ($CaCO_3$:5g)

5.1.d Formation of the bubbles by iron carbide in the membrane after days

The reaction of iron carbide and water produces hydrogen gas and organic materials. The reaction generates a bubble. The reaction takes place even in the membrane. So, the bubble that is composed with many small bubbles is formed. This structure is robust to destruction. Then, such bubbles increase, even if its structure is complicated.

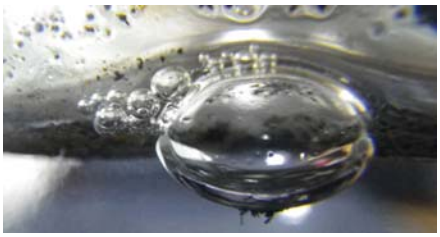


(a) after 75 hours 13 minutes



(b) after 75hours 16 minutes

(c) after 11days



(d) after 11days

Fig.30 The iron carbide bubble of complicated structure those were made of iron carbide in carbonated water (50cc) with powder of iron (Fe:5g) and egg shell ($CaCO_3$: 5g)

[Summary]

The appearance of stable bubble needs long time. It is the time for chemical evolution. The structure of membrane possesses the function for synthesizing of chemicals. Bubbles are included in a bubble, if there are many bubbles. New molecules will be synthesized

in the new membrane by assist of adaptability of carbon atoms. The structure composed with many small bubbles is robust to destruction. Such bubble exists under the rule of natural selection. So, the molecule that makes a stable membrane increases.

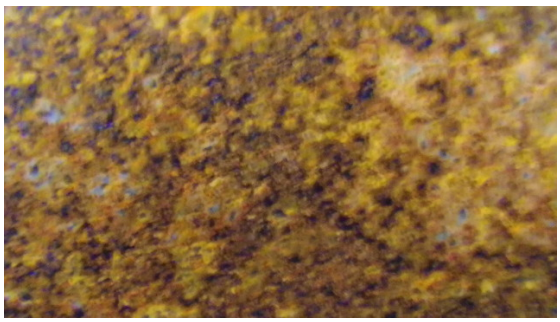
Chapter 6 The catalysis of silica for production of the iron carbide bubble

6. 1 The catalysis of silica for reduction of carbon dioxide by oxidation of iron

6.1.a Oxidization of iron powder on the glass wall by carbon dioxide

The crust of earth is made of rocks. The principal component is silica of SiO_2, i.e. the same as glass. The iron carbide bubble has the tendency to adhere on glass wall. So, effects of glass on the production of iron carbide bubble are investigated.

Although oxidation of iron does not occur, when powder of iron puts in a glass container, oxidation of iron takes place at the glass wall, if powder of iron put together with carbon dioxide (CO_2) in a glass container. Photographs of the iron oxide on the glass wall by the carbon dioxide are shown in Fig.31.



(a) Fe mixed with CO_2 in a glass container (b) iron oxide on the glass wall

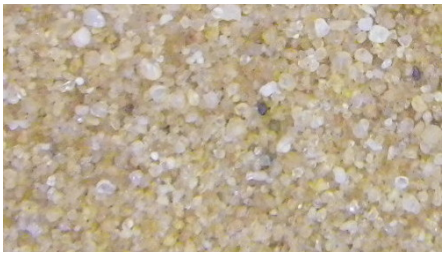
Fig.31 The iron oxide that was made on the glass wall by carbon dioxide

The reason that the oxide of iron is produced on the glass wall by dry ice is explained as follows. Oxygen atoms are put out at the surface of glass wall. The iron atom fit to oxygen atom more than carbon atom. Then, the iron atoms are arranged on the glass wall, and the electronic state of iron atom is adapted to the silica. The electronic state of iron is adjusted to SiO_2 that is similar to CO2. The state of iron atom becomes fit to make reaction with carbon dioxide. The silica functions as a catalyst for the oxidization of iron by carbon dioxide.

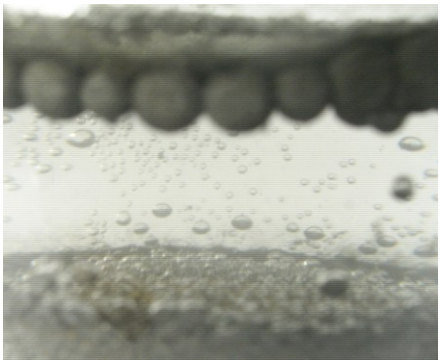
6.1.b Catalysis of silica for production of the iron carbide bubble

In order to know how the silica affects to the production of the iron carbide bubble, the desert sand that is shown in Fig.32 (a) was added to the carbonated water which included iron powder. As shown in Fig.32 (b), (c), the iron carbide bubbles were produced a lot more than

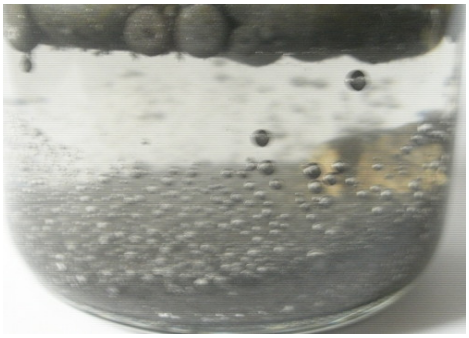
in the case without desert sand. Even in the carbonated water, the silica works as the function of the catalyst on oxidation of iron by carbon dioxide.

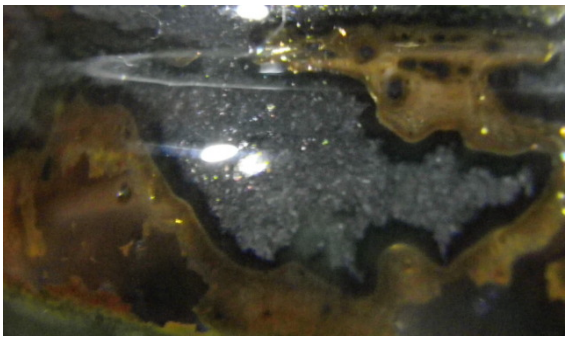


(a) desert sand (expanded picture)



(b) carbonated water with Fe and Si_2O





(c) $H_2O + CO_2 + Fe + Si_2O + CaCO_3$ (d) upper part of glass container off water

Fig.32 The reaction that occurs in the carbonated water. Here, powder of iron, desert sand and fossil were put in the carbonated water.

6.2 The iron carbide bubble that adheres to a glass wall

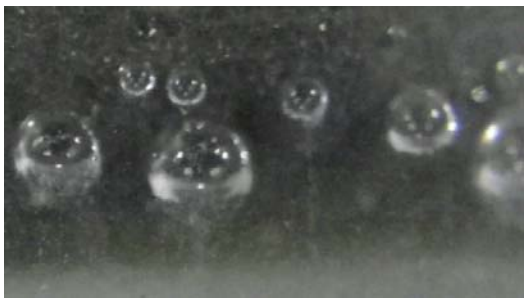
6.2.a Trace of the bubble that adheres to a glass wall

The bubble is produced repeatedly at the same place of a glass wall. So, the concentric circle of traces that adhere to a transparent part of glass is observed. When the container vibrates, a part of bubble that adhered to glass is fixed, but the other parts are moved with water. Those traces are shown in Fig.33.

Fig. 33 The substance that adhered to a glass wall (the photographing is after 10 hours 27 minutes from the mixing, iron powder and $CaCO_3$ were mixed with carbonated water)

6.2.b Effects of calcium oxide for adherences to a glass wall regarding the iron carbide bubble

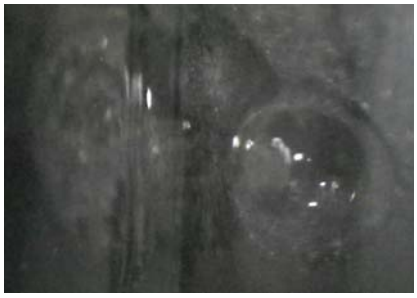
As shown in Fig.34 (a)～(d), bubbles are produced on a glass wall. Here, calcium oxide powder (CaO) was added into the carbonated water that was mixed with iron powder.



((a) after 7 hours 45 minutes

(b) after 8 hours 43 minutes

(c) after 23 hours (front view)



(d) after 23 hours (side view)

Fig.34 Bubbles on a glass wall. Here, CaO (2g) was added into the carbonated water (50cc) that was mixed with iron (5g).

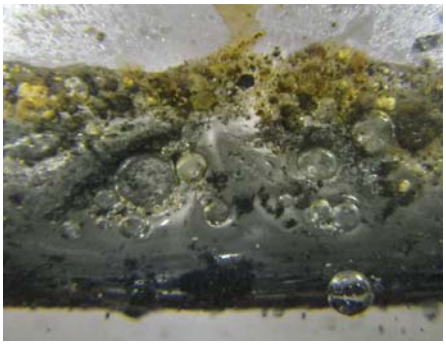
6.3 The substance that was made from the iron carbide bubble on the glass wall off water

6.3.a The substances on the glass wall off water that was made from the carbonated water that was mixed with powder of iron and $CaCO_3$

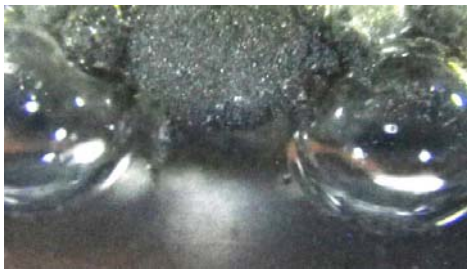
As shown in Fig.35, the substance on the glass wall of the upper part from the surface of the water increases by progress of time.

Fig.35 Substances on the glass wall off water at 3 days after. Here, powder of $CaCO_3$ (5g) and iron (5g) were added into the carbonated water (50cc)

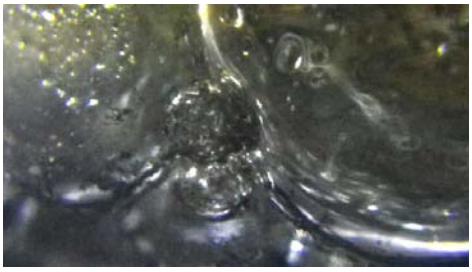
The production of bubbles was stopped after several days. The bubbles disappeared. But sediments remained at the bottom, floating matters remained on the surface, and substances remained on the glass wall of the upper part from the surface of the water. There are various substances on the glass wall off water as shown in Fig.36 (a)~(e).



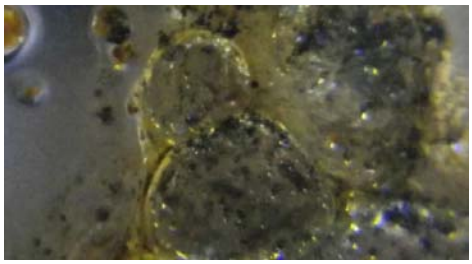
(a) bubbles and substances around surface of the water
[photographing was after 48 hours]



(b) Two kinds of bubbles



(c) bubble that gives distortion to other bubbles



(d) distribution of small substances

(e) bubble that varied in the inside

Fig.36 Substances around surface of the carbonated water that was mixed with powder of iron and that of calcium carbonate

[Summary]

The membrane of iron carbide bubble adheres to the silicate such as glass and rock. Also, the substance that was included in the bubble adheres to the glass wall of the upper part from the surface of the water. The color of iron carbide bubble on the glass wall is changed by chemical reaction if it touches with the air for long time. It is conceivable that chemistry evolution for the first creature was advanced by assist of a catalyst of silica in the ecosystem of iron carbide bubbles.

Epilogue

The iron carbide was made with the reaction of carbonated water and iron. The iron carbide reacts with water and produces free atoms of hydrogen and carbon. Those atoms make a bubble. The surfacing bubble includes the iron carbide that produces iron carbide bubble.

The characteristic of an atom depends on the electronic state. The electronic state of an atom depends on the situation. The nature of the atom differs by the situation. The situation of the atom is changed, if it makes a reaction. The optimal electronic state of each atom in the membrane of bubble is selected among possible states through mutual interaction with the surroundings. Those atoms form a molecule and the molecule interacts to the other molecules. The electronic state of each atom will be changed to fit to the environment of gathered molecule.

The adaptability of atoms forms a molecular copy by forming a mould of the molecule. The molecule that wore out is supplemented by the adaptability of atom. It is a primitive metabolism. The system that is fit to the environment exists long. The existence of long time makes possible to form the system that makes the same existence. Then, the mass production was produced. The molecule that is necessary in the optimal system was evolved by the natural selection.

In this website has presented the explanation in which the foundation for the first life was formed in the ecosystem of bubbles.