IMPACT ORIGIN OF CHLORINE-BEARING MATERIALS OF SALTY SEA-WATER OF EARLY EARTH, COMPARED WITH THOSE ON MARS AND THE MOON. Y. Miura, Division of Earth Sciences, Graduate School of Science & Engineering, Yamaguchi University, Japan, 753-8512. yasmiura@yamaguchi-u.ac.jp

Introduction: There are few reports on major origin of salty sea water in composition. However sea water contains high amount "chlorine", together with sodium ion. Chlorine element of carbonaceous meteorite is higher than the crust of the Earth [1,2], though there are no chlorine-bearing mineral connected to major supply on the Earth. Recently auther found "chlorine-bearing minerals on fusion crust of meteorites" fallen to the Earth, not only found on with rocks on surface (Kuga, Carancas, and Mihonoseki) but also collected after air explosion by meteoritic shower without any mixing of rocks on the surface (Nio chondrite). If chlorine element is concentrated in meteoritic melting in air from primordial Earth with huge meteoritic impacts, then rain drop from warm atmosphere is considered to be mixing with such chlorine minerals on melted meteorites to produce salty ocean water finally [2], whereas chlorine is remained on Mars and the Moon. The purpose of the present paper is to elucidates chlorine from meteorites finally to produce salty ocean water of the Earth, as well as chlorine-bearing materials on Mars and the Moon .

Samples used in this study: Fusion crusts of four meteorites of the Nio, Kuga, Mihonoseki (in Japan) and Carancas (in Peru) are used in this study, taken by the FE-ASEM (Field-Emission Analytical Scanning Electron Microcopy) in Yamaguchi, Japan operated by author [1,2].

The Nio chondritic meteorite: Meteoritic spherules and fragments formed at explosion of 40km high in atmosphere by the Nio meteoritic shower found at the fallen sites of Niho, Yamaguchi, Japan (without contamination from the ground) reveal sporadic distribution of many Fe rosettes (flake) texture with chlorine, as shown in Fig.1 [1,2].

The Kuga iron meteorite: The Kuga iron meteorite found in Kuga, Iwakuni, Yamaguchi, Japan has "fusion-crust" (with melted layer during passing to atmosphere before impact to the ground) with Fe-Ni-Cl-bearing rosettes (flake) texture formed from meteorite melting in atmosphere, as shown in Fig.2 [1,2].

The Mihonoseki chondritic meteorite: The Mihonoseki chondritic meteorite has been found in the ground after passing through wooden house in Mihonoseki, Shimane, Japan. Minor fragments found in the ground are collected to observe texture by the FE-ASEM in this study. Sporadic distribution of the texture with 1μm in size can be also found in this sample, as shown in Fig.3

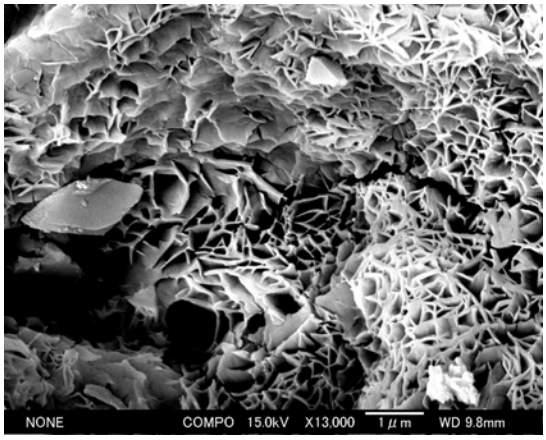

Fig.1. FE-SEM micrograph of Fe-Ni-Cl-rich flake texture of the Nio chondrite fallen in Yamaguchi, Japan.

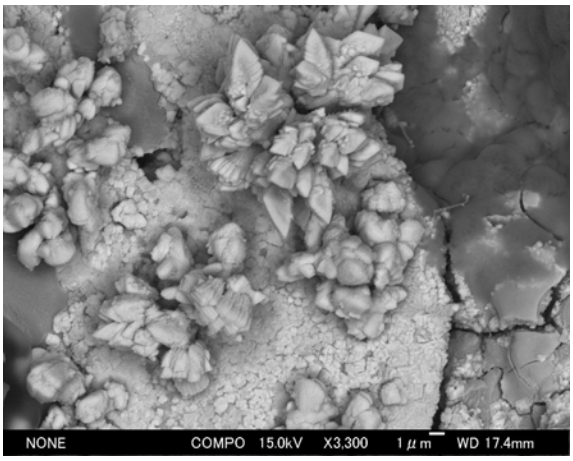

Fig.2. FE-SEM micrograph of Fe-Ni-Cl-rich flake texture of the Kuga iron meteorite found in Kuga, Iwakuni, Yamaguchi, Japan, taken by author [1,2].

Carancas chondrite in Peru: The Carancas chondritic meteorite fallen in Peru recently [1,3] shows Fe-Ni-Cl-bearing flake texture formed at impact reaction at ground) , taken by author.

Formation of rosettes textures with chlorine: The rosettes (flake) texture with meteoritic Fe, Ni, Cl-bearing composition of four meteorites reveals sporadic distribution, where chlorine element can be found during dynamic reaction of impact with melting, which is also proved by artificial experiments of slag melting composition with chlorine element, as listed in Table 3 [1,2].

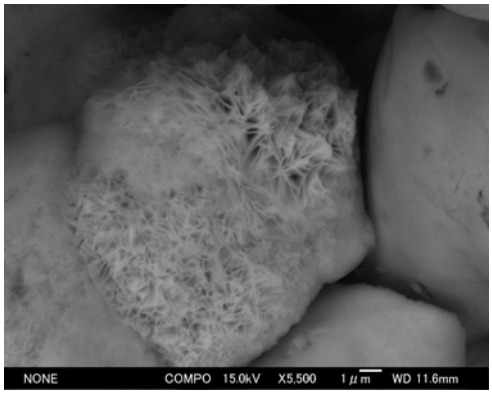

Fig.3. FE-SEM micrograph of Fe-Ni-Cl-rich rosettes (flake) texture of the Mihonoseki chondritic meteorite fallen in Mihonoseki, Shimane, Japan [1,2].

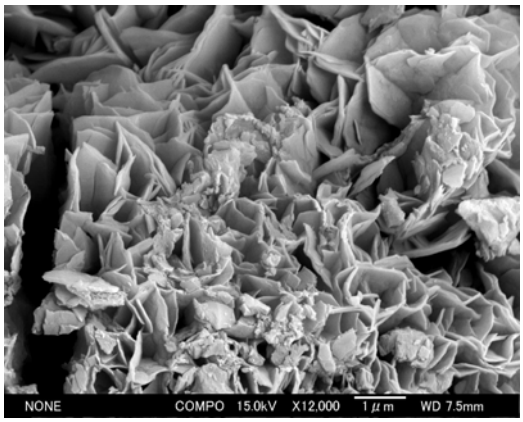

Table 3. Rosettes (flake) textures with Fe, Ni, Cl, O–bearing compositions in the Carancas meteorite in Peru [1,3].

In short, the detailed comparison of chemistry and texture indicates that the rosettes texture with chlorine elements is formed by dynamic impact reaction of meteorite melting to the Earth.

Table 1. Comparison of meteorite with chlorine [1,2].

Sample	Formation
1) Nio chondrite	Explosion as shower in air
2) Kuga iron meteorite	Fusion crust melting in air
3) Mihonoseki chondrite	Melting fragment in air
4) Carancas chondrite	Melting fragments in air
5) Artificial slag melts	Melting glasses

Application of chlorine-bearing materials on the Moon and Mars: On the Apllo 16 samples, mineral akaganeite (β-FeOOH) with chlorine (Cl) is reported [4]. Recent exploration data of Mars include chlorine-bearing minerals on Martian impact materials [5]. Both minerals are not mixed with water to form salty ocean water on the Moon and Mars.

Formation of salty sea water: Chlorine-bearing fusion crusts of meteorites fallen to the surface on primordial Earth are reacted with water from rain-falls to form ocean water finally on the Earth. This meteorite melting process is origin to produce chlorine in sea water in this study as shown in Fig.4 [1,2]:

1) Chlorine (Cl) concentration:
Fusion crusts of Meteorites
(in Air of Earth; craters on Mars,
& meteorite fragments on the Moon)

↓

2) Distribution to the surface:
Huge impacts to collect Cl over surface
(in Air of Earth; craters on Mars)

↓

3) Rain-fall to form salty ocean water:
Rain-fall by cooling from hot vapor, &
Melting to salty ocean water
(mainly on the Earth)

Fig.4. Process to form salty sea-water from meteoritic origin of chlorine element on Earth, Mars and the Moon.

Summary: The present study is summarized as follows [1,2]:

1) Four meteorites of the Nio, Kuga, Mihonoseki and Carancas show rosettes (flake) textures with Fe, Ni and Cl elements to concentrate chlorine elements, which is proved by artificial experiments of slag glass with chlorine reveal Fe-Cl-bearing flake texture at high temperature melting with quenching reaction.

2) Salty ocean water is to form to chlorine concentration of meteorite impact process in air with rain-fall, resulted in ocean water with chlorine on Earth, whereas chlorine elements are found on Mars and the Moon.

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