Osumilite-like Grains in Chondrules of Chondritic Meteorites. Y. Miura, Yamaguchi University, Yamaguchi, 753-0074, Japan

Introduction:

Primordial minerals with various cation substitutions in composition are formed originally by dynamic collisions from the solar nebular space to show different compositions and formation process from substituted cations. Among the primordial minerals, the osumilite-group minerals are considered to be mixed compositions of feldspar and mafic minerals (pyroxene) and so on [1]. The main purpose of this paper is to elucidate classification of osumilite-group minerals on meteorites and terrestrial rocks and its application to osumilite-group minerals of the Nio chondrite (H3/4) fallen in Niho, Yamaguchi, Japan [2-7].

Classification of osumilite-group minerals:

The osumilte-group silicate-minerals on terrestrial and meteoritic samples are classified by major cations of K, Ca, Na, Fe and Mg as the following osumilites-group minerals (Table 1)

$$(K,Na,Ca)(Fe,Mg)_2(Al,Fe)_3(Si,Al)_{12}O_{30}$$

1) K-Fe type osumilites-group minerals: merrihueite, sugilite named by author group [2, 3], klochite, and almarudite etc.

2) K-Mg type osumilites-group minerals: chayesite, trattnerite and friedrichbeckeite.

3) Na-Mg type osumilites-group minerals: eifelite, yagiite and roedderite.

4) Ca-K type osumilites-group minerals: milarite.

5) Na-Fe, Ca-Fe, Ca-Mg type osumilites-group minerals: Few reports in terrestrial rocks. (Reported in the Nio meteorite [2,3]).

Therefore, K, Fe-rich osumilites are strongly characteristic in granitic rocks of the Earth.

However, extraterrestrial osumilite-group minerals in composition1 have been reported as tiny Mg-rich type and new Ca-Mg type in the Nio meteorite by using normal EPMA analyses more than1 μ m electric beam-size [1].

Analytical SEM analyses of Nio osumilites:

In-situ observation with nano-scale has been performed with special analytical SEM analyses (with FE-SEM technique) [4-7], which is clearly focused less than 1μm in size which cannot be observed by normal optical microscopy. In order to discuss nano-grains formed at the primordial ages of the solar subsystem, some kinds of osumilite-group minerals in composition are obtained in the Nio chondrite as follows (Table 1).

1) Ca-Mg and Na-Fe types osumilites: New osumilite types in composition are obtained in granular and barred pyroxene chondrules with K-rich matrix.

2) Na-Mg type osumilite: Similar terrestrial type osumilites-group mineral is found in the matrix of pyroxene chondrule, but the Nio chondrule has Na-Mg type with less K and Mg compared with terrestrial minerals in composition.

Formation of the Nio osumilite-group grains:

Pyroxene chondrule with K-bearing matrix shows tiny grains of Ca-Mg type osumilite in the matrix of albite plagioclase (glassy) and needle shaped K-rich orthoclase (crystalline), as shown in Figs.1, 2 and 3. The K-bearing chondrule is mainly found in pyroxene chondrule, by showing Ca-Mg type osumilite (new osumilites-type in composition), K-feldspar and albite plagioclases. Na-Fe type osumilite with K and Ca is found in the matrix with taenite Fe-Ni grains of barred pyroxene chondrule.

The present analytical results indicate that there are osumilte-group minerals in the Nio chondrules which are formed by pyroxene and Ca, Na, K-rich fluids of plagioclase composition to form separately in the matrix of chondrule during formation of chonditic asteroids with melting process.

Table 1. Osumilite-group minerals in composition

1) *Terrestrial osumilite-group types:*
K-Mg, Fe; Na-Mg and Ca (K) types

2) *Extraterrestrial osumilite-group types:*
Ca-Mg, Na-Fe and Na-Mg types
(found in the Nio (H3/4) chondrite)

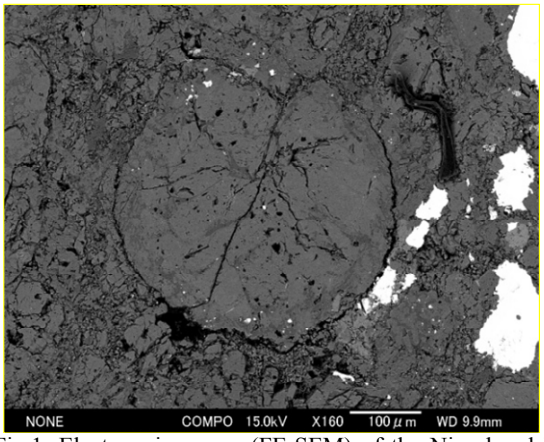

Fig.1. Electro-microgram (FE-SEM) of the Nio chondrite (H3/4) fallen in Yamaguchi, Japan. Back-scattering electron image.

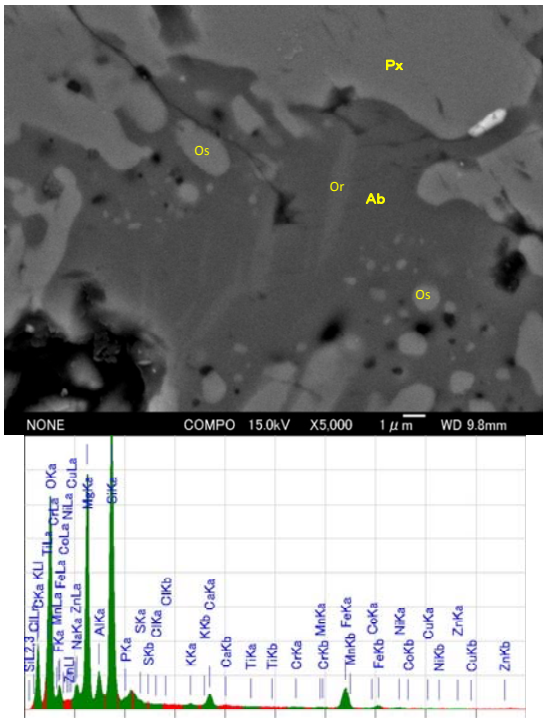

Fig.2. Ca-Mg type osumilite-group grains (shown as Os) in the Nio chondrite (H3/4). PX: pyroxene. Or, Ab: K or Na feldspar. Back-scatting image of the FE-SEM micrograph (above). The EDS data (below) show Ca-Mg type osumilites of the Nio chondrite.

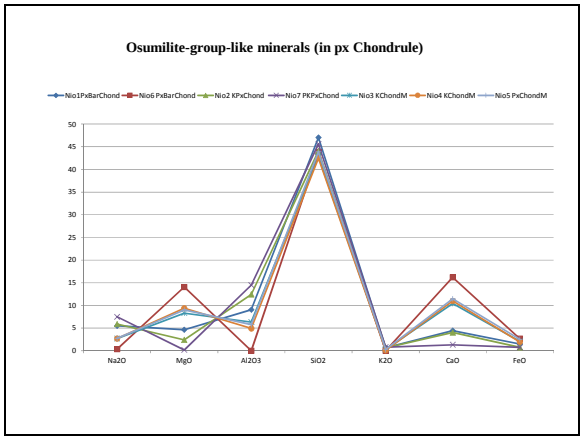

Fig.3. In-situ analytical data of osumilite-group grains of the Nio chondrite (H3/4) fallen in Yamaguchi, Japan, as shown in Fig.2

Compositional changes from chondrule to crust:

Carbon contents of the in-situ FE-ASEM analyses indicate as follows [4-7]:

1) Amounts of Na, Na, Ca, Mg and Fe in the chondrules are clearly decreased in the fusion crust formed by meteoritic shower in terrestrial air.

2) Carbon contents are slightly increased in the fusion crust due to meteoritic shower burring in terrestrial air.

3) The Nio meteorite shower exploded above ca.40km in terrestrial air contains terrestrial carbon only the fusion crusts (without terrestrial rocks), but carbon in chondrite interior is considered to be a remnant of meteoroids formation.

Summary:

The present results are summarized as follows:

1) The Nio chondrite contains new types of osumilite-group grains with Ca-Mg and Na-Fe types in composition.

2) Ca-Mg type osumilite grains are formed by melting with pyroxene and Ca, Na, K-rich fluids of plagioclase composition during formation of chondritic asteroids.

3) Carbon contents are increased in the fusion crust due to meteoritic shower evaporation in the air.

References:

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