

**Grains Formed by Impact Reaction Found at Spherules of Various Impact Craters, Meteorite Showers and Geological Boundaries.** Y.Miura, S. Fukuyama and A.Gucsik. Department of Earth Sciences, Faculty of Science, Yamaguchi University, Yamaguchi ,753-8512, Japan. E-mail: yasmiura@po.cc.yamaguchi-u.ac.jp

Abstract: New types of grains which show Fe-Ni-Si in composition formed by impact vapor/melt reaction are found from spherules and/or impact fragments of meteoritic craters of the Barringer, Wolf Creek, Odessa and Takamatsu in Japan, meteoritic showers of Niho, Kaba, Mocs and Mezo-Madaras, and geological boundaries of Denmark K/T, Hokkaido in Japan K/T, Spain K/T, El-Kef K/T, Hungary P/Tr and China P/Tr. There are characteristic spherules with Fe-Si or Fe-Ni-Si in composition from meteoritic showers formed by impact reaction the atmosphere, which are similar sizes and compositions to those of sea-sediments or geological boundaries. Spherules found on the Earth reported as cosmic or interplanetary dust origin should be checked by formation at Earth's atmosphere of meteoroids shower as impact reaction.

Introduction: Material evidences for impact are formation of (a) high-pressure phases of stishovite, coesite and diamond, (b) mixings of iron meteoritic compositions of platinum group elements (PGE) including Ir, and (c) shock metamorphosed materials of shocked quartz, graphite and calcite which are relict of high pressure [1,2,3]. As it is difficult to find so easily on impact materials on active planet of the Earth, the other indicator of impact should be established so well. One of the best candidates of other impact materials is spherule with Fe-Si composition formed at higher temperature by mixing with iron meteorite (projectile) and terrestrial evolved rock (target rock), especially melt and vapor compositions from Fe-Ni metals of meteorites after impact [4,5]. Spherules of Fe-Si composition which are found at deep-sea sediments and geological layers are considered to be cosmic dust originated from supernova or galactic molecular clouds. The main purpose of the present paper is to elucidate origin of spherules with Fe-Si composition found at terrestrial surfaces.

Impact grains in spherules Spherules of Fe-Si system in composition are found as the following impact samples by analytical scanning electron microscopy of Yamaguchi university:

- (a) Meteorite craters of the Barringer (USA), Odessa meteorite craters (USA) and Wolf Creek meteorite crater (Australia). candidate of impact crater of Takamatsu crater in Japan reported in this same LPS volume [6].
- (b) The Geological boundaries of the Cretaceous-Tertiary (K/T) from Denmark, Hokkaido in Japan, Spain, Tunisia (El-Kef), and Permian-Triassic (P/T) from China and Hungary (Bukk Mountains),
- (c) Spherules of meteorite showers from, Niho (Japan, H3), Mezo-Madras and Mocs(L3, L5/6 in

## Grains formed by Impact Reaction: Y. Miura et al.

Romania) and Kaba (CV3 in Hungary).

Various spherules (from ca.100 to ca.700 micrometers in size) of these craters, meteorite showers and geological boundaries include tiny grains (ca. 1 to 50 micrometers) with Fe-Ni-Si system in composition formed by impact reaction.

In order to obtain the similar spherules and grains of Fe-Si (-Ni) system in composition after artificial impact experiments, Barringer meteorite was broken by railgun impact apparatus (ca.7km/sec), ISAS, Japan. Highest Ni content in this experiment is 47.1%Ni after impact reaction of vapor condition Silica is also mixed with 8 wt.%. Higher chlorine from iron meteorite is also concentrated to 2.9%Cl as Ni content increases. It is found in this study that (a) Fe element is easily enriched in Si (as Fe-Si system in composition), whereas Ni element is relatively enriched with light elements of Cl or S, and (b) Ni content increases from 7% Ni (kamacite) to 49% Ni after impact experiment.

There are no spherules of the similar size and compositions from volcanic ashes from Unzen, Japan in this study. Spherules with Ni and Mn are clearly different with texture and composition of Mn-nodules from Pacific Ocean.

Summary: The followings are summary in this study.

- (1) New impact indicators of Fe-Si and Fe-Ni-Si grains are found at various natural and artificial impact craters.
- (2) Spherules of Fe-Si grains can be found at Meteoritic showers which are similar with those of meteoritic craters, sea-sediments and geological boundaries formed impact reactions.
- (3) Spherules found on the Earth reported as cosmic origin should be checked by probable formation at the Earth's atmosphere of meteoroids shower.

References:

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