IMPACT-RELATED INDICATOR OF GRAINS WITH AKAGANEITE COMPOSITION FOUND AT TAKAMATSU, KUGA, NIO (JAPAN) AND CARANCAS (PERU). Yasunori Miura, Inst. Earth Sciences, Graduate School of Science & Engineering, Yamaguchi University, Yoshida 1677-1, Yamaguchi, 753-8512, Japan, yasmiura@yamaguchi-u.ac.jp

Introduction: Grains of composition with Fe, Ni and Cl are reported as relicts of awaruite (in mafic minerals of olivine and serpentine from the interior of the Earth) [1] or meteoritic mixture found originally at the fusion crust melted in atmosphere [2, 3, 4]. Recently author (YM) discusses that carbon contents of these phases are significant to discuss the sources of Fe, Ni and Cl [2, 3, 4, 5].

The purpose of this paper is to elucidate chlorine (Cl)-bearing Fe and Ni phases originated from impact projectiles of meteoroids (Takamatsu, Nio, Kuga and Carancas) compared with awaruite (Dumont, Canada) by the FE-SEM with EDX analyzer (JEOL7000F), Yamaguchi, Japan [2, 3, 4, 5].

Carbon-bearing Fe and Ni grains in veins of terrestrial mafic rocks in Canada: Ni-rich Dumont dunite sample [1] contains Fe and Ni grains (as awaruite composition) "without chlorine contents" (i.e. not akaganeite composition in this study for comparison), though serpentine vein has significant chlorine contents, whereas significant carbon content are found in Ni, Fe, Mg-rich grains [5].

Chlorine-bearing Fe and Ni akaganeite grains from Takamatsu, Kagawa, Japan: Sample from Takamatsu is buried crater at Busshozan-Cho, Takamatsu City, Kagawa Prefecture (in center site) which are reported by (a) geophysical data, (b) shocked data and (c) broken by tectonic movement during the Japan islands formation [6, 7, 8, 9], where sample used in this study is mixed sample of impacted and volcanic later-uplifted from the crater bottom (Fig.1).

Significant Cl-contents (ca.2wt%Cl) of Fe and Ni-rich grains (with akaganeite composition, Fig. 2) on melted glasses with granitic composition are found at the southern rim of the buried crater structure, where crystalline shape with 2x3x4 micrometers (Fig.3). The texture and composition of sample are melted of basement rocks of granite and found at mountain rim side lifted from deeper crater bottom, which are estimated from relict composition of grain with Na, Ca, K, Si and Al contents.

Table 1 shows that crystalline grain with akaganeite composition (shown in Fig.3) is secondary mineral formed at melting condition to form granitic grasses after impact event which is lifted masses during Japan islands formation [7, 8, 9].

It is found in the FE-SEM analyses with in-site sample observation (to avoid mixture from sample preparation) that significant carbon-contents can be obtained in the melted samples,

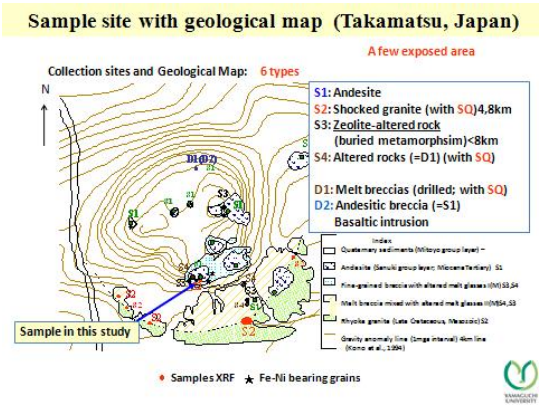

Fig.1. Sampling site of Cl-bearing Fe-Ni-rich grain (as shown by arrow) in gravity anomaly line of 4km (as inner ring) after broken and buried activities from original 8km line found by shocked data [6, 7, 8, 9].

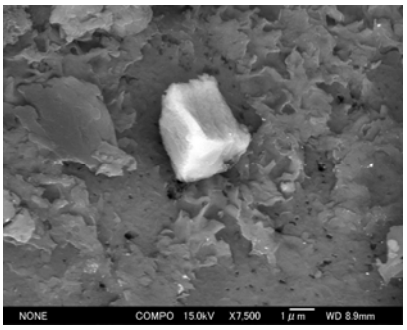

Fig.2. FE-SEM electron micrograph of Cl-bearing Fe, Ni grain with crystalline shape of glasses from Takamatsu, Kagawa, Japan [5].

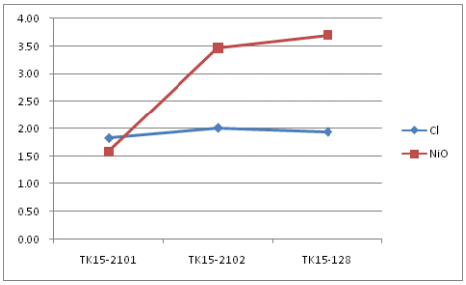

Fig.3. Ni and Cl contents (wt.% values) of Fe, Ni-rich grains with akaganeite composition by the FE-SEM electron microanalyses from Takamatsu, Kagawa, Japan [5].

Table 1. Akaganeite (Fe, Ni, Cl-rich) compositions at Takamatsu, Nio, and Kuga (Japan) and Carancas (Peru) [2, 3, 4, 5, 6, 7, 8, 9].

Sample	Texture	Remarks
Takamatsu	Crystalline shape	Re-crystallized
Nio	Fine needle	Rosettes, FC*
Kuga	Fine fiber	Rosettes, FC
	Nanobacteria shape	Round, FC
Carancas	Fine needles	Rosettes, FC
Artificial	Crystalline shapes	Crystallized

*****FC: Fusion crust (melted rim) of meteorite

Akaganeite from the Nio chondritic meteorite in Japan: 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 any contamination from the ground) reveal sporadic distribution of many Fe, Ni-rich rosettes (flake) texture with small chlorine (*i.e.* akaganeite composition) on fusion crusts formed at melted layer formed during explosion in air (Tabe 1) [2, 3, 4, 5].

Akaganeite from the Kuga iron meteorite in Japan: 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 texture (*i.e.* akaganeite composition) formed from meteorite melted in atmosphere (Table 1) [2, 3, 4, 5].

Akaganeite from the Carancas chondrite in Peru: The Carancas chondritic meteorite fallen in Peru recently [3] shows Fe, Ni, Cl-bearing flake texture (as akaganeite composition) formed at impact reactions at ground by double explosions (Table 1)[2, 3].

Formation of chlorine-bearing akaganeites: Micro-texture with meteoritic Fe, Ni, Cl-bearing akaganeite composition are found in the three meteorites (in fusion crusts) with quenched and sporadic distribution, where heating process of these fine textures are considered to be formed "crystalline" shape of growth grains as in Takamatsu sample in Japan. The re-crystallization process by heating should be is checked by artificial experiments of melting composition with chlorine and iron elements, as listed in Table 1 [5, 10, 11].

Artificial formation of chlorine fixing to irons. Artificial chlorine fixings on large iron plates have been carried out at author's laboratory to compare with natural chlorine-bearing minerals by an in-site observation by the FE-SEM with EDX analyzer to avoid any contamination of carbon from sample preparation. Consequently, it is found in this study that chlorine-bearing materials are fixed mainly as crystalline growth shape as shown in Fig.4 (Table 1) [5, 10].

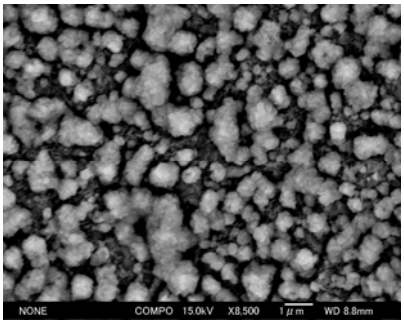

Fig.4. FE-SEM electron micrograph of chlorine-fixed with Fe (as akaganeite composition) in Yamaguchi University, Yamaguchi, Japan [5, 10,11].

Summary: The present results are summarized as follows:

1) The first report of chlorine-rich grains (as akaganeite composition) formed in volcanic glasses in the Takamatsu buried crater (Kagawa, Japan) are compared with direct quenched akaganeites of the Nio, Kuga and Carancas samples, which are not awaruites.

2) The first artificial syntheses of chlorine-bearing materials fixed as akaganeite composition by heating process to form growth pattern indicate that akaganeites of the Takamatsu are re-crystallized by heating after impact process during the Japan islands formation.

Acknowledgements: Author thanks to Dr. T. Kato, Yamaguchi University, for sample data interpretation.

References:

[1] Miura Y., Rucklidge J. and Nord G. Jr. (1981), *Contrib. Mineral. Petrol.* 76, 17-23.
[2] Miura Y. (2008): *Early Solar System Bombardment* (LPI), abstract #3001.
[3] Miura Y. (2008): *LPS XXXIV*, abstract #1391.
[4] Miura Y. (2008): *Meteoritics & Planetary Science*, 43-7, #5203.
[5] Miura Y. et al. (2008): *Earth Planet Sci. Assoc. Japan* (Hakata), Japanese abstract #101.
[6] Kono Y.et al. (1994): *Report of Kaken B (Japan)*, 36pp.
[7] Miura Y. Ed. (2000): *IFIE'00 Forum paper abstract volume* (Yamaguchi, Japan), 30pp.
[8] Miura Y. (2006): *LPS XXXII*, abstract #1239.
[9] Miura Y. (2005): *LPS XXXI*, abstract #2394.
[10]Miura Y.(2008): *AOGS Meeting* (Busan) , Abstract # PS07- ST31-A22.
[11] Miura Y. (2007): *ISTS Issue of Japan Society for Aeronautical and Space Science (JSASS)*, Paper #2008-c-46. pp.4. www.senkyo.co.jp/ists2008/