CARBON-BEARING MATERIALS ON EARTH, THE MOON, MARS AND ASTEROIDS BY MICRO RAMAN METHOD. Y. Miura, Yamaguchi University, Yamaguchi, 753-0074, Japan. Al. I. Cuza University. yasmiura50@gmail.com

Introduction: Among volatile elements and molecules of water and fluids, carbon-bearing materials are considered to be remained as any materials states of vapor, liquid and solid (called as VLS). This suggests that sources of carbon-bearing materials are not only carbon graphite or fullerene but also carbon-bearing materials (carbides and/or carbonates).The purpose of the present study is to elucidate dynamic process of micro to nano-carbon-bearing materials (including nano-diamonds) by the Raman spectral method [1-6].

Micro-diamond carbon by explosive method: Artificial micro-diamond formed by explosive process (as dynamic standard in this study) shows clear shapes with carbon-rich composition (and Si etc.) obtained by the FE-SEM data and micro-Raman spectral patterns as shown in Fig.1 [1, 2] as follows:

1) Artificial diamond shows two main Raman peaks of 1347 and 1587 (cm^{-1}).
2) Volcanic breccias of Yamaguchi (Japan) shows main Raman peaks of 1321 (diamond), 1355 and 1558 (graphite), 1085 and 1440 cm^{-1} (calcite) 47.
3) Natural formation of carbon-rich samples with mixed compositions is checked by the FE-SEM (as carbon-rich) and micro-Raman spectral pattern (as diamond, graphite and calcite peaks).

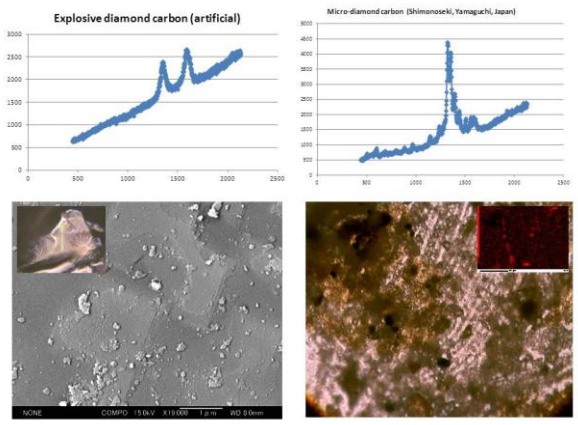

Fig.1. Micro-Raman and SEM data of two carbon-bearing diamond samples [1, 2].

Application for extraterrestrial materials: Carbon-bearing materials by mixed composition and minerals can be applied to extraterrestrial samples from the Moon, Mars and the Asteroids [4-6], together with terrestrial outcrops of Arkansas (U.S.A.) diamond carbon.

The interior and surface by melting processes: Carbon-bearing material (*i.e.* MC_{total}) is classified as elemental concentrations by any melting processes of terrestrial materials (*i.e.* MC_{Earth}) and impact melting of extraterrestrial materials (*i.e.* MC_{ET}) as follows:

$$MC_{total} = MC_{Earth} + MC_{ET} \quad (1)$$

The Earth's carbon-bearing deposits in water-planet shown as MC_{total} in the equation (1) are carbon-bearing materials under gas-fluid condition at higher pressure and temperature [2]. Complicated Earth with the MC_{total} includes complicated carbon sources expressed by the following primordial MC_{ET01} and present $MC_{Earth01}$:

$$MC_{Earth} = MC_{Earth01} + MC_{ET01} \quad (2)$$

Summary: The results are summarized as follows:
1) Gem-crystals of diamonds of carbon-bearing materials can be also related with shallow carbon sources of carbonatite (or calcite) by reaction within ring dikes, where are compared with artificial impacts, meteorites of the Moon, Mars and Asteroids and volcanic breccias of Arkansas (U.S.A.) diamonds.
2) Localized carbon-bearing breccias at the interior triggered initially by shock wave process can be formed at shallow sites during long and complicated geological history.
3) The present results might be applied to terrestrial and extraterrestrial fields at surface and interior sites.

Acknowledgements: Author thanks for Dr. Toshio Kato and many scientists discussed for this topics.

References: [1] Miura Y. (2008): EOS-Trans, AGU, 89(53), MR33B-1861(SG). [2] Miura Y. (2013): JPO-Patent No.4945758. [3] Miura Y. and Fukuyama S. (1999) *Journal of Materials Processing Technology* (Elsevier), 85, pp.192-193. [4] Miura Y. (2012) *Met. Soc. Meet* 75th (Cairns), abstract #5115. [5] Miura Y. (2012) *Proc. DLR Lunar Symposium* (Berlin) 69-72. [6] Miura Y. (2013) *LPS XXXXIV*, abstracts #1654, #3098.