SIDEROPHIELE ELEMENT FRACTIONATION IN IMPACT GLASS FROM THE WABAR IMPACT CRATER.

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Introduction: Siderophile elements such as Co, Ni and PGE are depleted in crustal materails because these elements are strongly partitioned into core. In contrast, these element abundances of extraterrestrial materials such as chondrites and iron meteorites are several orders of magnitude higher than those for crustal materials. Therefore, the elevated siderophile element abundances in implact-related rock samples are due to the incorporation of meteoritic components into crustal materaials. Individual chondrites and iron meteorites have characteristic absolute and relative abundances of siderophile elements. Thus, siderophile elements have been used for the detection and identification of projectile materials [e.g., 1]. Recent studies indicated that there is a possibility of elemental fractionation during impact events [e.g., 2-4]. However, processes of elemental fractionation and interaction between projectile and target materials during impact events are poorly understood. Thus, elemental fractionation lead to a difficulty in indentifying projectile metarials. Both projectiles and impact-related materials were collected from small and young craters such as Kamil Crater of Egypt [5] and Wabar crater of Saudi Aravia [6]. In this study, elemental abundances of impact glass from Wabar cater were determined by using instrumental neutron activation analysis (INAA) and instrumental photon activation analysis (IPAA) in order to constrain the processes of elemental fractionation during impact event.

Experiments: Impact glass from Wabar crater was received from NIPR and roughly ground into small pieces. Black and white melts were separated by using tweezers and analyzed by using INAA and IPAA. INAA and IPAA were performed at Institute for Integrated Radiation and Nuclear Science, Kyoto University for the determination of elemental abundances of impact glass. For INAA, sample was irradiated for 10 sec and 4 hrs at the pn-3 and pn-2, respectively. For IPAA, the irradiation was carried out using the linear accelerator operated at 20 MeV electron beam energy and 102 μA current for 36 hrs.

Results and Discussion: Our analytical results of black and white melts are consistent with the previous studies [2,6,7]. As observed by [7], black melt has higher abundances of Co, Ni, Ir and Au than those of white melt. Black melt contains 300 ppm for Co, 3710 ppm for Ni, 336 ppb for Ir and 5.72 ppb for Au. Mass fractions of Wabar iron in the black melt analyzed in this study were estimated to be 4 to 6% based on Co, Ni and Ir abundances for Wabar iron [2] and black melt [this study]. Assuming that target material has similar siderophile element abundances to those of upper continental crust, impact-related material having 4 to 6% mass fraction of projectile has similar chemical characteristics of siderophile elements. Figure compares siderophile elements abundances of black melt with those of bulk Wabar iron. Siderophile element abundances were normalized to Ni and those for bulk Wabar iron. Black melt has higher Co/Ni ratio and lower Ir/Ni and Au/Ni ratios compared with those of bulk Wabar iron. For comparison, siderophile element abundances of kamacite and taenite from Wabar iron are shown in Fig. Ir/Ni ratio of black melt fall in the range between those of kamacite and taenite. However, Au in black melt are highly depleted compared with kamacite and taenite. Based on our analytical results of INAA and IPAA, projectile could not be simply incorporated into target material. Other siderophile elements abundances such as Ru, Rh, Pd and Pt will be determined and the detailed fractionation among siderophile elements will be discussed.

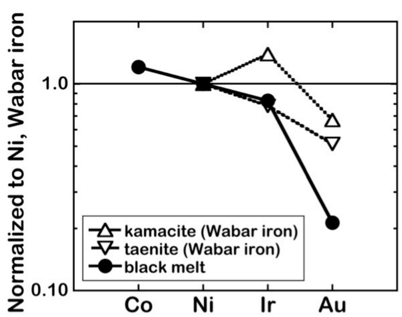

Fig. Siderophile elements of black melt (this work) and kamacite and taenite from Wabar iron (Mullane et al. [8]).

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