CHEMICAL CHARACTERISTICS OF DALAT TEKTITES. R. Akhter, N. Shirai and M. Ebihara, Department of Chemistry, Tokyo Metropolitan University, Hachioji,Tokyo, 192-0397, Japan. E-mail: rabeya-akhter@ed.tmu.ac.jp.

Introduction: Tektites, products of meteoritic impacts on the earth, have drawn the attention of many researchers, making them assume that they may contain the information of the impactor. As the presence of meteoritic component in tektites can be estimated to be <<1%, chemical compositions of tektites are mainly reflected by the precursor material composition [1]. Such a small quantity is of great difficulty to detect unless considering the siderophile elemental abundances whose presences in chondritic or iron meteorites are much higher than those in terrestrial crustal rocks. Several attempts [2-5] have been carried out to find a clear evidence of the meteoritic impact, but no definite conclusions have been obtained so far.

Of the four strewn fields (Australasian, North American, Central Europe, Ivory Coast), Australasian strewn field is the largest one, spreading in Australia, Thailand, Laos, Cambodia, Vietnam, Indonesia, China and Philippines [6]. The elemental abundances of this strewn field tektites are of enormous variance depending on not only country but also locality [7-8]. In this study, we determined the elemental abundances of indochinite tektites of the Australasian strewn field, specially focusing on siderophile element compositions to verify the characteristic of these tektites.

Analytical method: We analyzed 13 splash form tektites collected from Dalat, Vietnam by instrumental neutron activation analysis (INAA). The samples were first cleaned with 1M HCl, deionized water and acetone. Then, surface was removed by using a router, and the samples were again cleaned with the three solvents. After cleaning, the tektites were carefully ground in clean agate mortars. Around 40-50 mg of each homogenized powder sample was taken for neutron irradiation for two different periods at Kyoto University Research Reactor Institute. Gamma-ray measurements were repeatedly done with four different cooling periods. JB-1 (a basaltic geological standard rock sample issued by Geological Survey of Japan) was used as standard reference material for determination of the elements except for Ni, for which the Allende meteorite was used.

Result and Discussion: Twenty nine elements were determined in Dalat tektites by using INAA. Our results for Dalat tektites are in good agreement with those of the previous study [8]. Figure 1 compares chemical composition of Dalat tektites with those of tektites obtained from other locations in Vietnam (Baoloc, NgheAn, Hanoi, Vinh and Saigon). Elemental abundances of tektites from different locations are normalized to average values of tektites found in Vietnam [7-9]. The shaded area in Fig. 1 represents the standard deviation (1σ) of the data from literatures [7-9]. Abundances of major elements (Na, Mg, Al, K, Ca, and Fe) in Dalat tektites are quite consistent with those from the other sampling locations in Vietnam, which indicates that source materials for tektites collectd in Vietnam have very close resemblance for major elements.

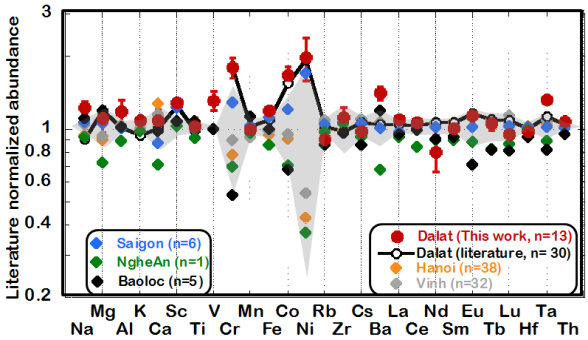

Figure 1: Elemental abundances of tektites collected from different localities in Vietnam. Data are normalized to the average of [7-9]. Shaded area represents the standard deviation (1σ) of the data from the literatures [7-9] and 'n' is the number of samples analyzed.

This similarity is also the case for trace element abundances except for Cr, Co and Ni. There appear to be wide variances in Cr, Co and Ni abundances with large standard deviations (46%, 33% and 76%, respectively, for 1σ). Dalat tektites from this study and [8] and Saigon tektites [8] have distinctly higher Cr, Co and Ni abundances than those for the other tektites found in Vietnam. The parent materials of tektites from the Australasian strewn field are assumed to be the post Archean Australasian shale (PAAS) [6,10,11]. Chromium, Co and Ni abundances in PAAS are around 110 ppm, 23 ppm and 55 ppm, respectively [12], whereas our average value for these three elements are 180 ppm, 26 ppm, 176 ppm, respectively. Chao et al. [2] worked on metallic (Ni-Fe) spherules of some Southeast Asian tektites and suggested the presence of meteoritic component in these tektites, whereas Wasson [13] found enrichments of Cr, Co and Ni in Southeast Asian tektites, and concluded that higher Cr, Co and Ni abundances for these tektites are due to the presence of ultramafic rich sediments in the parent material. Following these studies, we may consider two possibilities for Cr, Co and Ni enrichments in our Dalat tektites sam-

ples; an addition of meteoritic component and the presence of some mafic component in the parent materials.

Nickel and Cr abundances are plotted against Co abundances for Dalat tektites in Fig. 2. Nickel and Cr abundances increase with increase of Co abundance. Two component mixing lines are shown using meteoritic component (CI chondrite [14]) and ultramafic component [13] for one end member having higher Cr, Co and Ni abundances. A Dalat tektite [8] which has the lowest Cr, Co and Ni abundances was chosen for another end member. We calculated Co, Cr and Ni abundances of the mixture of two end members by changing their mixing ratios. Calculated values are also shown in Fig. 2. Although, mixture of meteoritic or ultramafic components can explain the relations among Cr, Co and Ni. Dalat tektites tend to be closer to the mixing line tied to the ultramafic component, suggesting that the presence of ultramafic component is more likely for explaining high abundances of Cr, Co an Ni in Dalat tektites.

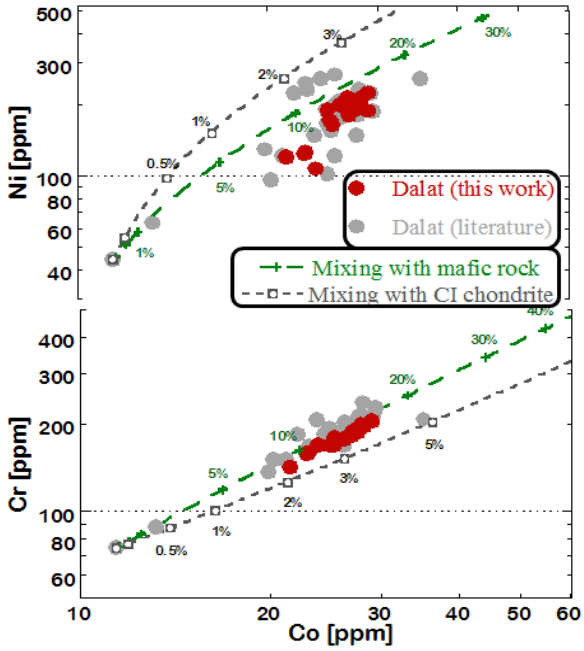

Figure 2: Co abundances versus Ni and Cr abundances for Dalat tektites from this work and literature [8]. The green and black lines are mixing lines of one common end member (a tektite with the lowest Co, Cr and Ni [8]) and another end member (ultramafic rock [13] for green line and CI chondrite [14] for black line).

Considering that both meteorites and ultramafic rocks are considerably rich in Mg compared with Dalat tektites, Mg abundances are compared with Ni, Co and Cr abundances in Fig 3, similarly Fig. 2, two component mixing lines are also drawn. As seen in Fig. 3, there is no correlation between Mg and any of Ni, Co and Cr for their abundances in Dalat tektites. In fact, most of the data fall between the two mixing lines. Thus, no conclusive evidence to identify the source material for enhancing Cr, Co and Ni abundances in Dalat tektites can be obtained from Fig. 3.

As the upper crustal material has large variation in chemical compositions, it is highly difficult to clarify the chemical characteristics of the parent material of

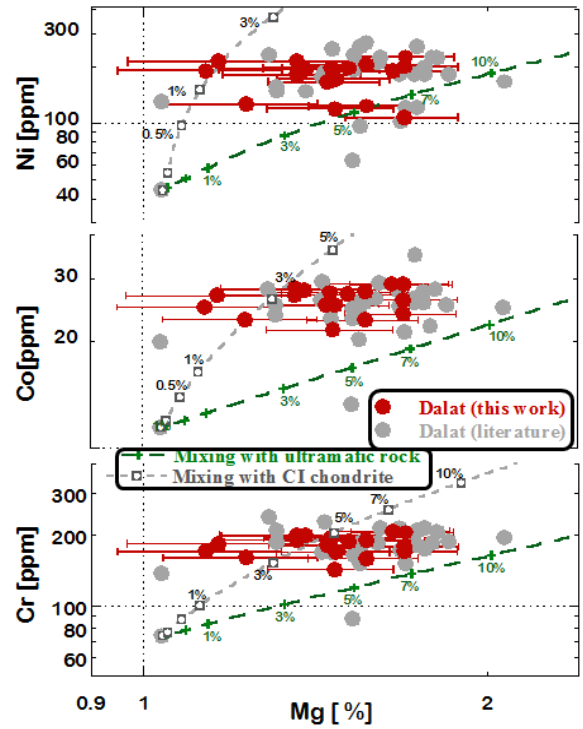

Figure 3: Mg abundances versus Ni, Co and Cr abundances for Dalat tektites from this work and literature [8]. The green and black lines are mixing lines of one common end member (a tektite with the lowest Co, Cr and Ni [8]) and another end member (ultramafic rock [13] for green line and CI chondrite [14] for black line).

tektites from Dalat, Vietnam. Determination of highly siderophile elements like platinum group elements may bring a breakthrough in the study of tektites, especially Dalat tektites.

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