

GROUND-BASED OBSERVATION OF POST-HAYABUSA MISSION TARGETS. M. Abe¹, K. Kitazato^{1,2}, Y. Sarugaku^{1,2}, Y. Kawakatsu¹, and D. Kinoshita³. ¹Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, 3-1-1 Yoshinodai, Sagami-hara, Kanagawa 229-8501, Japan (abe@planeta.sci.isas.jaxa.jp), ²Graduate School of Science, The University of Tokyo, ³Institute of Astronomy, National Central University.

Introduction: One of the important goals in the study of compositional characterization of asteroids is to understand the relationship between asteroids and meteorites. The asteroids are classified into some groups with similar spectral characteristics. The Japanese sample return mission, HAYABUSA, the spacecraft explored its target, near Earth asteroid (25143) Itokawa. The taxonomic type of Itokawa is S-type, and the spectrum of this type asteroid is similar to that of the ordinary chondrites [1]. The purpose of our observation is to obtain the information about taxonomic type and rotational status of the candidate target of the next asteroid sample return mission (post-HAYABUSA mission). This information is useful for mission targets selection and helpful for raising the technical feasibility of the exploration. Our goal is to find some primordial type asteroid, C-type and D-type, in our candidate objects. Considering several mission plans, we chose about 300 asteroids from NEAs as the candidate objects of the post-HAYABUSA mission. As the taxonomic types of more than 200 candidates are unknown, we have performed the colorimetric observations in order to obtain its taxonomic type information.

Observations and Data reductions: We have observed 14 near-Earth asteroids (NEAs) during December 2005 – December 2006, using the 1.05-m Kiso Schmidt telescope with 2kCCD in Japan, and the Lulin One-meter Telescope with PI1300B in Taiwan. Including our previous results [2], 32 NEAs had been observed during 2003-2006. The observational log is summarized in Table 1. We made multicolor photometry at clear-stable nights, using broadband filter, B, V, R, and I.

Classification: We classified our objects in broad groups, C-type group, S-type group, D-type group, and X-type group. We obtained BVRI photometry data for 21 mission candidates, and classified 19 objects in broad groups. Out of 19 candidates, we found that 5 asteroids are classified in C-type group. Obtained spectra of observed C-type group asteroids are shown in Figure 1.

Selection of mission targets: Combining our results and previous studies of spectroscopic observation for mission targets [3], we selected ten C-type group asteroids, which are suitable for sample return mission as shown in Table 2. As for most accessible asteroid in

Table 2, we performed mission design for asteroid 1999 JU3. The mission time schedule is shown in Table 3.

Observational campaign of 1999 JU3: Asteroid 1999 JU3 is a current Hayabusa-2 mission target. This asteroid is observable this year. We will perform observational campaign of this asteroid. If you are interested in this campaign, please contact us and join our observational campaign.

References: [1] Abe et al. (2002) *LPS XXXIII*, Abstract#1666. [2] Nishihara et al. (2006) *LPS XXXVII*, Abstract#2352. [3] <http://smass.mit.edu/>

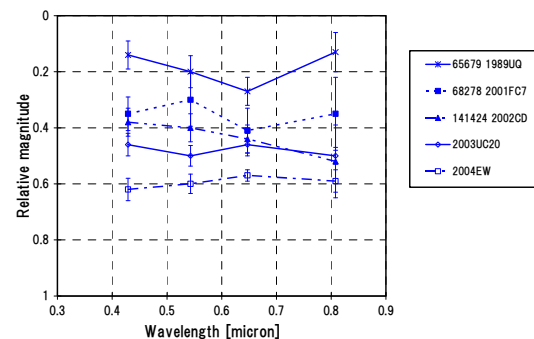


Figure 1: Obtained spectra of observed C-type group asteroids.

Table 2: Selected C-type group asteroids suitable for sample return mission.

Asteroid	delta-V [km/s]
1999 JU3	3.238
65679 1989 UQ	4.937
101955 1999 RQ36	5.232
2004 OB	5.562
2004 EW	5.829
68278 2001 FC7	6.158
136564 1977 VA	6.200
1996 FG3	6.884
2003 UC20	7.125
141424 2002 CD	7.223

Table 3: Hayabusa-2 mission time schedule.

Launch	2010/09/01
Earth Swing-by	2011/12/01
1999 JU3 Arrival	2013/07/01
1999 JU3 Departure	2014/03/29
Earth Arrival	2016/01/05

Table 1: Observational log. Observatory mark L: Lulin Observatory in Taiwan, K: Kiso Observatory in Japan.

Asteroid	Date Observed (observatory)	Filter used
3361 Orpheus	2005/10/14(K), 2005/11/28(L)	BVRI
5797 Bivoj	2005/10/24(K), 2005/12/22,24,26,28(K), 2006/2/4(K)	BVRI
25143 Itokawa	2001/3/26,29,31(K) 2001/4/1(K), 2001/8/22,23,24(K), 2003/12/1,2,3,4(K), 2004/1/19,20,21(K), 2004/4/10,11,12(K), 2006/11/24,25,28(K), 2006/12/18,19,20,21,22(L)	R
65679 1989UQ	2003/9/26,29,30 (K)	BVRI
65803 Didymos	2003/12/1,3,4 (K), 2004/1/20 (K)	BVRI
68278 2001FC7	2003/9/26,29,30 (K), 2006/2/4,5(K)	BVRI
68359 2001OZ31	2005/10/24(K)	RI
85585 Mjolnir	2003/9/28,29,30 (K)	BVRI
89136 2001US16	2004/4/10,11,12 (K)	RVI
98943 2001CC21	2003/9/29 (K), 2003/12/2 (K)	RVI
103066 1999XO141	2005/8/31 (L), 2005/9/11 (L)	R
11284 Belenus	2005/10/25(K), 2005/11/25,26,27(L), 2005/11/29,30(K), 2005/12/1(K)	BVRI
136618 1994CN2	2006/3/29(L)	BVRI
137799 1999YB	2005/11/25,26,27 (L), 2005/11/29,30(K)	BVRI
138404 2000HA24	2006/4/24,28,29(K)	BVRI
141018 2001WC47	2006/11/28(K), 2006/12/18,19,20,21,22(L)	BVRI
141424 2002CD	2004/4/10,11,12) (K), 2006/3/28(L)	BVRI
142348 2002RX211	2005/8/29 (K), 2005/9/11 (L), 2005/11/25,26 (L), 2005/11/30(K), 2005/12/22,24,26,28(K)	BVRI
2000QK25	2005/11/25,28 (L), 2005/11/29(K), 2005/12/14,28(K)	BVRI
2002CE10	2003/9/26,28 (K)	R
2002TD60	2006/11/24,25(K)	R
2003UC20	2003/12/3,4 (K), 2005/11/26 (L), 2006/2/5(K)	BVRI
2003CY18	2005/6/3 (K), 2005/9/11 (L), 2005/10/24 (K)	BVRI
2003RB	2003/9/28,29,30 (K)	BVRI
2003SD220	2003/12/1,2,3 (K), 2006/11/25,28(K), 2006/12/21,22(L)	BVRI
2004DK1	2004/4/11 (K)	RVI
2004EW	2005/3/5(L), 2005/3/7,8(K), 2005/5/5 (L), 2006/3/28,29(L)	BVRI
2005ED318	2005/6/3 (K)	R
2005JU108	2005/8/29,31 (K)	R
2005TF	2005/11/30(K), 2005/12/26,27,28(K), 2006/2/5(K)	BVRI
2006GB	2006/4/25,27,28,29(K)	BVRI