深海調査研究船「かいれい」
 KR07-07 調査航海
 三陸沖日本海溝周辺海域
 クルーズレポート

2007年6月1日(岩手県釜石港) ~2007年6月8日(岩手県釜石港)

## Preliminary Report of the Kairei KR07-07 Cruise

June 1, 2007 (Kamaishi) $\,\sim\,$ June 8, 2007 (Kamaishi)

研究課題 三陸沖日本海溝のアウターライズの潜航調査 (Diving survey of the outer rise of the Japan Trench off Sanrik)

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#### Preface

A proposal of this cruise was applied to the JAMSTEC Deep-sea Research Program in 2006 and the cruise was realized in early June 2007 as the Kaire/KAIKO 7000 II KR07-07 cruise. The Kairei started from Kamaishi on June 1 and returned to the same port on June 8, 2007.

The cruise aims at diving surveys on the outer rise of the Japan Trench off Sanriku for three objectives. The first is diving surveys for 'petit spot' young volcanoes. Petit spot is a new type volcano recently found in the northeast Pacific Plate. The survey area of KR07-07 is one of the potential localities for another petit spot volcanic field. The primary objective of the dive is to get basalt rock samples from some knolls of these and to make sure that these knolls could be petit spot volcanoes.

The second objective is diving surveys in the source region of the 2005 M7.1 outer rise earthquake. The earthquake occurred on 15 November 2005 JST about 300 km east of the Pacific coast of Iwate Prefecture. The main interest in this earthquake is that it occurred on the outer rise of the Japan Trench just 100 km south the 1933 great M8.4 Sanriku-oki tsunami earthquake, one of the four most fatal earthquakes in Japan since 1920. The 2005 outer rise earthquake was the largest recorded off the Japan Trench since 1933 and one of the largest in the world since 1986. It was extremely well recorded in Japan and around the world. It was found that the earthquake has approximately the same mechanism of a normal fault with the 1933 tsunami earthquake. Therefore, the source region of the 2005 earthquake can be a good target for the study of tsunami earthquakes caused by normal faults in the outer rise. As Dr. Ryota Hino failed to join the cruise, I invited Dr. Stephen Kirby from USGS for this study.

The area of aftershocks of the 2005 earthquake is overlapped with the area where many petit spot-like knolls are recognized. The relationship between the two phenomena can be another interesting topic.

The third objective is renewal of acoustic seafloor benchmarks deployed on the outer rise. Three precision acoustic transponders (PXPs) were deployed in 2002 to observe the motion of the pacific plate near the subduction plate boundary. Unfortunately it seems that the batteries of these instruments have been exhausted earlier than expected. At least two PXPs should be replaced with new ones after cm-order relative positioning. The third PXP can be deployed from the surface with a mooring system.

All of these three objectives are important, but the cruise was planned for only six dives. I earnestly prayed for good weather, and fortunately we could carry out the six dives with a big success. The weather was good as if we were in an equatorial area. The KAIKO 7000 II worked well without any problem. The performance is much the same as the original KAIKO except for the maximum depth. The crew of the Kairei was really helpful.

I hope to express my sincere thanks to Captain S. Ishida and the crew of the Kairei, and Chief KAIKO Operator K. Hirata and the KAIKO Team for their skillful support. We owed much to Director M. Ida and Mr. M. Asanuma, Research Vessel Management and Operations Department, JAMSTEC, for preparing the cruise.

June 8, 2007

Chief Scientist

Hiromi Fujimoto

# **1. Cruise Log** Aoki Misumi (NME)

1. Cruise Log of Kairei/Kaiko 7000-II in R07-07

Da (Local=	ate & Time =GMT+9h)	Note	Remarks	Weather at noon
Fri	1-Jun-07			
	8:00	Boarding		bc/NNE/3/2/1/10
	9:00	Departure from Yokosuka		
	10:00-10:30	Briefing about ship's life and safety		
	10:30-11:00	Science meeting		
	13:47	Send wake-up command to the pressure sensor		
	13:52	Released		
	14:08	Surface		
	14:13	Ondeck		
	16:40	KONPIRA ceremony		
	18:00-18:30	Briefing about ROV KAIKO system		
	19:00-20:00	Science meeting		
Sat	2-Jun-07			Cloudy/North/4/3/1/12
	1:35	Start MBES mapping		
	5:47	XBT measurement		
	6:38	MBES		
	8:37	KAIKO on the surface	7K#388 dive	
	10:50	Touch the bottom (Depth=5,423m)	Choco Chip	
	14:18	Leave the bottom (Depth=5,207m)	Sea Mounts	
	16:03	Surface		
	16:14	On deck		
	16:55	Launch the Proton Magnetometer		
	17:05	Start geophysical survey		
	19:00-19:45	Science meeting		
	20:26	Recover the Proton Magnetometer		
Sun	3-Jun-07			bc/South/2/1/2/12
	7:01	Finish MBES mapping		
	8:27	KAIKO on the surface	7K#389 dive	
	10:41	Touch the bottom (Depth=5,433m)	Deployment of	
	13:31	Leave the bottom (Depth=5,422m)	Ocean Bottom	
	15:18	Surface	Station	
	15:29	On deck		
	16:14	Launch the Proton Magnetometer		
		and start geophysical survey		
	19:00-19:30	Science meeting		
	20:21	Recover the Proton Magnetometer		
Mon	4-Jun-07			c/SSE/3/2/4/12
	5:43	Finish MBES mapping		

	10:40	Touch the bottom (Denth= $5.504$ m)	Deployment of	
	12:42	Leave the bottom (Depth=5,503m)	Ocean Bottom	
	14:29	Surface	Station	
	14:40	On deck		
	15:20-16:15	Calibrate position of the ocean bottom station		
	16:18	Send release command		
	17:23	The buoys at surface		
	17:29	On deck		
	18:11-18:45	Wake up the ocean bottom stations		
	19:09-19:42	Surface buoy measurement		
	19:43-19:47	Send sleep command		
	19:51	Start MBES mapping		
	20:00-20:20	Science meeting		
<b>m</b>	F - I 07			h-/CCE/9/9/9/19
Tue	0-Jun-07	Einich MDES monning		DC/SSE/3/2/2/12
	0.00	Finish MBES mapping	7K#201 dimo	
	8-30 10-20	KAIKO on the surface	7 K#391 dive	
	10.38	Leave the bettern (Depth=5,340m)		
	14.32	Curface		
	10.18	Surface		
	10.20	On deck		
	10.00-10.50	Science meeting		
	19.00-19.30	Science meeting		
Wed	6-Jun-07			bc/South/3/2/2/10
	6:50	Finish MBES mapping		
	8:26	KAIKO on the surface	7K#392 dive	
	10:38	Touch the bottom (Depth=5,466m)		
	14:20	Leave the bottom (Depth=5,286m)		
	16:07	Surface		
	16:15	On deck		
	19:00-19:30	Science meeting		
Thu	7-Jun-07			bc/South/4/3/1/10
	8:30	KAIKO on the surface	7K#393 dive	
	10:38	Touch the bottom (Depth=5.286m)		
	14:22	Leave the bottom (Depth=5,105m)		
	16:06	Surface		
	16:13	On deck		
	19:00-20:00	Onboard seminer		
Fri	8-Jun-07			
	9:00	Arrive at Kamaishi port		

Wearther/Wind	direction/Wind spee	ed index/wave(m)/s	swell(m)/visibility
(nautical mile)			

Wearther	Wind speed index
f= fine bc= fine but	0 = 0 - 0.2 m/sec.
cloudy	1 = 0.3 - 1.5
c= cloudy	2 = 1.6 - 3.3
	3 = 3.4 - 5.4
	4 = 5.5 - 7.9
	5 = 8.0 - 10.7
	6 = 10.8 - 13.8
	7 = 13.9 - 17.1
	8 = 17.2 - 20.7
	9 = 20.8 - 24.4
	10 = 24.5 - 28.4
	11 = 28.5 - 32.6
	12 = 32.7 -

# 2. Shipboard Scientific Party

Name:	H. FUJIMOTO
Institute:	Tohoku University

Name: N. ABE Institute: IFREE/JAMSTEC

Name: Stephen Kirby Institute: US Geological Survey

Name: M. KIDO Institute: Tohoku University

Name: Y. OSADA Institute: Tohoku University

Name: Y. KOIKE Institute: JAMSTEC

Name: H. TSUSHIMA Institute: Tohoku University

Research Associate Name: M. AOKI Company: Nippon Marine Enterprises. Ltd. Journalist Name: R. NISHIYAMA Institute: Japan Image Production, Ltd.



#### 3. Objectives of the cruise

This cruise was proposed and accepted to carry out diving surveys for the following three objectives.

## **3.1 Purpose of the KAIKO 7000II Dive on petit spot** Natsue Abe (IFREE, JAMSTEC)

The purpose of the KAIKO 7000II Dives on three knolls (7KII Dive #388, 392 & 393) is to obtain hard rock samples of possibly erupted as young volcanoes; 'petit spot'. Petit spot is a new type volcano recently found in the northeast Pacific Plate (Hirano et al., 2006). According to Hirano et al. (2006), 'petit spot' is a unique volcanic type causing by oceanic plate flexure and the small amount of magma came from the asthenosphere through the fractures in the oceanic lithosphere. If the theory is correct, there are other localities of such small volcanoes in other part of the middle of the oceanic plate. The survey area of KR07-07 is one of the potential localities for another petit spot volcanic field. There are numerous small knolls considered to petit spot volcano in the range of 37°20'N to 38°10'N and 144°40'E to 145°50' (figure 1). Petit spot research group tried dredge sampling twice during KR04-08, however, they couldn't get hard rock samples except for some pumice and some possible drop stones from drift ices in this area. Therefore, the primary objective of the dive is to get basalt rock samples from any knolls of these and to make sure that these knolls could be petit spot volcanoes.

## 3.2 Motivation and Justification for Two Kaiko 7000 II Dives in the Source Region of the MJMA 7.1 Sanriku-oki Earthquake of 15 November 2005 (Japan Time) Stephen Kirby (USGS)

On 15 November 2005, a M<sub>JMA</sub> 7.1 earthquake occurred 300 km east of the Pacific coast of Iwate Prefecture. The maximum JMA earthquake intensity near the coast of Tohoku was 3 and hence damage was minimal in Tohoku, as expected for an event so far from shore. The main interest in this earthquake is that it occurred on the outer rise of the Japan Trench just 100 km south the great M8.4 Sanriku-oki of 1933, one of the four most fatal earthquakes in Japan since 1920. More than 3,064 persons were killed or missing. The 1933 event spawned giant, very destructive tsunami waves in northern Japan.

The 2005 outer rise earthquake was the largest recorded off the Japan Trench since 1933 and one of the largest in the world since 1986. It was extremely well recorded in Japan and around the world and generated small tsunami waves that were well recorded on the coastline of northern Tohoku. The source properties of this recent earthquake have been intensively investigated by Japanese and foreign seismologists based on seismic records on land and in 2007 by OBS deployments on the seafloor recording its aftershocks (Hino, personal communication). These data are in remarkable agreement. All investigators agree that this was a very shallow normal faulting earthquake having initially ruptured at a depth of 10-15 km with nodal planes parallel to the Japan Trench and that the trenchward-dipping plane was the active one. Its rupture dimensions based on waveform modeling and the OBS-recorded aftershocks were 45 km long and approximately 20-25 km down dip. An OBS study of its aftershocks investigated by Dr. Ryota Hino and his colleagues also suggests that there may have been two parallel normal-faulting ruptures planes that both strike at an

azimuth of about 7° and are spaced about 10 km apart. These would be indistinguishable from a single source based on seismic waves recorded hundreds of kilometers from the source. In summary, this well-studied 2005 earthquake occurred in a similar tectonic setting and had a nearly identical focal mechanism and hypocentral depth to the much larger 1933 event (Kanamori, 1972). However, we know much less about the earlier event and hence the 2005 shock may serve as a compact source model for the earlier earthquake, suitably scaled up in scalar seismic moment.

Diving on the seafloor of the source region of this earthquake with the Kaiko ROV will require new detailed SeamBeam and sidescan sonar mapping of the seafloor above the aftershock zone recorded by Hino's OBS deployments in order to identify possible fault scarps or other evidence of surfaced breaks. Especially valuable for scarp hunting would be maps of grazing incidence side-scan sonar illuminated from the west so that possible west-dipping scarps would show ups as bright reflectors. I propose that we do one cross-scarp transect on the first dive and return to the same scarp on the second dive and explore it in the along-strike direction. These dives would provide important information on this type of earthquake source, such as: (1) whether rupture reached the surface; (2) Whether rupture was compound (two or more planes); (3) Whether there is structural continuity of the surface expressions of faulting with those to the north closer to the 1933 source region; (4) Whether there is evidence for sediment gravity flows or slumps off the scarps due to strong ground motions associated with outer-rise earthquakes. If successful, this would be the first-ever ROV dive on an outer-rise earthquake source. (5) Whether there is some connection between normal faulting with "petit spot" volcanic seamounts.

### Addendum on 13:45 on 4 June 2007:

Additional processing of the SEABEAM bathymetry by Kido-san to 10 m contouring reveals two possible north-south features that are aligned with the north-south trend of the main aftershock belt and may represent normal-faulting truncations of the prominent NE-SW-trending ridges that are approximately parallel to magnetic anomalies in this area. One feature is near longitude 145°5.5' E and extends from 38°09' to about 39°20' N latitude. The other N-S feature is at 145°10.5' E longitude and extend from about 38°10.6' to about 38°19' N latitude. For both of these features, the east side is apparently down. If our interpretation of these ridge truncations is correct, they represent as much as 20 meters fault total vertical displacement. Slip modeling indicates that the fault throw of the 2005 earthquake was about 1.2 meters, far too small to detect with SEABEAM mapping. We are hopeful that rupture associated with this earthquake occurred on normal fault structures that have been activated repeatedly in the past and hence are detectible from bathymetry.

There are two significant uncertainties to these interpretations: (1) The N-S feature at 145°5.5' E is in the center of the SEABEAM track line and the onboard scientific team worries that the feature could be an artifact. An additional N to S SEABEAM line at 145°03' from 38°30' to 38°05' is scheduled for this evening. It is offset from the first feature by 2' W, so if it is an artifact, it should be missing from this new SEABEAM line. (2) The aftershocks of the 2005 event were located using an OBS array that was as much as 15 minutes longitude east of the apparent aftershock locations. This could lead to an eastward shift of the apparent locations compared to the actual locations by as much as 20% of array position error, or 20% X 15 minutes or 3 minutes too far west. Since the evidence cited earlier indicates that the active normal fault(s) dips west, the trace of the surface rupture should be on the eastern margin of the dense N-S zone of

#### aftershocks.

#### First Dive Target

Given these uncertainties, the scientific team decided to select as our first dive target a truncated ridge just east of the eastern N-S feature at 145°10.5' longitude. We want to start at 38°7'N latitude and head due E from longitude 145°10' E to 145°11.5' E, a Kaiko distance traveled of 1.5' in latitude or 1.2 nautical miles.

# 3.3 Geodetic Experiments for the Renewal of Acoustic Seafloor Benchmarks Hiromi Fujimoto (Tohoku University)

The pacific plate is estimated to be subducted at the Japan Trench of Sanriku at a speed of about 9 cm/y, but nobody knows its speed near the subduction where big earthquakes have occurred repeatedly. Tohoku University deployed three precision acoustic transponders (PXPs) at GJT1 site in the study area in 2003 to measure the speed in situ. Although cm-level relative positioning has not been attained due to limited chance of geodetic observations, the observed data are valuable. Unfortunately it turned out during the observation in 2005 that the geodetic observation at the site would be terminated; the amplitude of the acoustic signals from the PXPs was less than 20 % of the normal value presumably because of the exhausted batteries. We should deploy new PXPs and measure the relative positions of the new and old PXPs with 1 cm resolution in order to continue the geodetic observation. Diving operation is required for the job after the old PXPs are inactive. That is why we applied to the KAIKO diving surveys.

We plan to let the KAIKO 7K II carry a PXP in the payload space, deploy it on the seafloor side by side to an old PXP. Then we will measure the relative position between the two PXPs with the aid of visual images provided by cameras of the KAIKO. After the measurement, we will try to recover the old PXP with a rope connected to the KAIKO. Two dives are necessary to deploy two PXPs. We plan to deploy another PXP with a mooring system.

#### 4. Results of Diving Surveys

#### 4.1 Report on the Kaiko 7000 II Dive#388 on 2007/06/02 Natsue Abe, Yuki Koike (IFREE, JAMSTEC)

This dive started at depth 5423m, 37°57.80'N latitude, 145°00.87'E longitude and ended at depth 5207m, 37°57.1222'N latitude, 145°00.8067'E longitude. The target is one of Choco-chip knolls which is considered as a kind of petit spot volcano. The aim of this dive is to observe on the surface of this knoll and to take rock samples from this knoll. Some cryptic micro fault was expected before dive according to the multi-narrow beam seafloor survey, but any such feature couldn't be observed during this dive. Nine rock specimens were sampled during the dive including three basaltic samples; one high vesicular fresh basalt that looks similar to the petit spot rock, one highly altered massive lava and one fresh scoria. Some manganese crust and nodules, and pumice are collected. This is the first petit spot that is discovered except Yukawa knoll area and Kaiko knolls area and sampled fresh basaltic samples.

The dive record, dive log, list of samples, and the dive track chart are shown in Tables 4.1.1-4.1.3 and Fig. 4.1.1, respectively.

かいこう7	Π 0 0 0	潜航	記録	
<u>平成 19 年 KR07 07</u>	行動	記載者	瀬底 秀樹	
潜航年月日 <u>2007 年 06/02</u>			着底予定位置	
潜航回数 _1 回			緯 度 37*57.	80' N
通算潜航回数 388 回			橋 (東) 145°00.	87' E
潜 瓬 海 域 日本海溝沖	· <u></u>	 主祥	割 <sup>111</sup> 111111111111111111111111111111111	<u>i i</u>
潜航目的 調査潜航	 日本海溝沖アウ:	ーーー タータイズ上	の小海丘における	讀杏
調査主任 藤本博己	ź	i>≠+- PILOT	重竹調二	
所属、康北大学		PILOT	若松 誉	
	ce	DPILOT	瀬底秀樹	
作業経過時刻		晃 計	時間	
吊 揭 08:29		潜航時間	f 7:26	
着水 08:37		前回潜艇	t 2366:1	
離 脱 10:39		通算潜艇	t 2373:27	
着底 10:50	ケーブル使	用時間	ケーンが番号別(	使用時間
	1次使用時間	7:45	1次番号	2
福 台 14:33	1次前回時間	2462:24	1 次番号別前回時間 	1549:9
水 切   D:U3	一次進昇時间	24(0: 9		1990.94
1787 40C 7C J 10-14	2次前回時間	1073-34	- 4 44、1981 1万 2 次赤こ気前司际線	0 60-54
	2次通算時間	1077:26	2 次雪号录通算段展	73:46
海家・気象				
天候 風向	風力	波浪	うねり	視程
c North	4	3	1	12
最大潜航梁度 5423 m				
着底深度 <u>5</u> -423; m		離底深度	5207 m	
着底底質 マンガン礫		離底底質	マンガンクラス	<u></u> ጉ
記事 着底点周辺の等深線に 、分離曳航により北方	治って海底面の観 向へ登頂しながら	寢,試料採取 観察,試料採	gを行いながら航え 楽取を行った。	目した後

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日付<u>\_2007.6.2\_\_\_\_</u>KR <u>0707\_\_\_\_No.\_\_\_\_3es</u>\_\_\_\_

日付<u>2007.6.2</u> KR <u>0707</u> No. <u>3es</u> 調查種類<u>かにう評価務航</u>調查海域<u>日本有素沖もコケィア海丘群</u>

	時刻	深度	作業内容	緯度・	<u>経度</u>
	***37		着水 D= Minm	37-54 9937 143-01-3620	X; Y:
	مار:	150m	下降 開始 媚 tocom #2"	.3919	X: 170.0 X: 200.0
	10:39	5297R	VCL 魏胤	8357	X:66.0
	10 50	3423	義座		X: 74,0 V: 30, 2
	10:55	<u> </u>	泥岩採取(2個)资料①	1	X:
	11 ;09	5419	〃 (1個) 〃 ②	- 8366 240(	X: 7%3 X: 629
2	11:24	3417	大岩 視認 / ③	8645 8440	X://9.3 Y:-40 8
	$q: \mathfrak{V}$	5412	泥岩探取 (1個) * @	2032 -8167	X: 434.3 Y: -#3-3
	<u>(</u> ]:44	5402	岩石 援取 (* 個) * ①	- 8753 - 834 //	X: 139.3 Y:-40 c
	/2:03	5358	" (3個) 。 ④	,8970 ,2987	X:/79.3 Y: 38.7
	29	5330	" (1個)。 Ø	.9/17 .88+9	X: 206.7 X: 16.0
	13:00	5307	位置確認	. <u>9759</u> .8395	X: 325.3 Y- 52 0
	13 :35	.£>63	泥岩採取(1個)。⑧	58.0667	X:4933 Y-960
	14:02-	5247	熊手12\$3採花 "③	1222 8067	X: 594-0 Y:-102.0
	:18	5207	純点	1719	X: 688.0 V:-124.0
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No.

7K II #	<b>‡388</b>	R-	0/		Described I	by	Jun Abe &	e 2, 2007 Koike
Sample Size: X Weight: Mn coating: Color (Inside): Alteration: Vesicularity: Lithology: Occurrence:	≓om, ) <u></u> m lark_britan o week s Monomiet or pol massives lavas	f=cm 2 im A trong i ymlot volcaniclasti	n, Z= 2∼6 <sub>c 3</sub> X / cs sedime	om '{:	<u>SKET</u>	СН	<u>!</u>	
gneous & Ultran Volcanic: basalt Thickn Pheno Plutonic: gabbr Crysta Ultramafic: lerzolit Crysta	nafic Rocks basaltic ande ess of glass; crysts= diorite qua ls= e harzburgite ls=	site andesi mn %, artz diorite ç %, dunite p %,	te dacite n %, granite %, yroxenite %,	nhyolite % others %				
edimentary roc Fragments comp. Rock type: Grain size (mm) : Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	ks & others ( mono or p <1-2-4-4 well	characteris poly 3 – 16 – 32 – none unlithified	stic of the 64 – 128 – : -poorly –angular matrix supp- -reve	256 < 256 s				
Remarks Mn	nokdule	e.						

7K <b>Ⅱ</b> #	388 R-	02.		Described by _	June 2, 2007 Abe & Koike
Sample Size: X= Weight: Mn coating: Color (inside): Alteration: Vesicularity: Lithology: m: Occurrence: m: Igneous & Ultran: Volcanic:	= <u>13</u> em, Y= <u>8</u> <u>395</u> 9 <u>1</u> mm d(2)-k known 50 strong 50 % strong 50 % bomot or polymiet estives lavas ⊲ofoanti basatic andesite ar	_cm, Z= <u>6</u> , Zestico sediments rdesite dacite n	çım s others rhyalite	SKETCI	<u>H</u>
Thickne Phenoc Plutonic: gabbro Crystal: Uitramafic: lerzolite Crystal: Others: Sedimentary roci	ses of glass:%, diorite quartz diorit s= %, ≥ harzburgite dunite s= %, ks & others (charac	_mm %, e granite %, pyroxenite of %, teristic of the c	% thers % <b>!asts</b> )		
Fragments comp.: Rock type: Grain size (mm) : Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	mono or poly <a href="https://weil</td> <td>32 – 64 – 128 – 25 —poorly —angular  matrix support  revers</td> <td>-8 &lt; : ::::::::::::::::::::::::::::::::::</td> <td></td> <td></td>	32 – 64 – 128 – 25 —poorly —angular matrix support revers	-8 < : ::::::::::::::::::::::::::::::::::		
Remarks Sc	onia.?				

7K II #3	88 R- 03	Described by _	June 2, 200 _ <u>Abe &amp; Koike</u> _
Sample Size:     X=       Weight:     K???       Mn coating:     Bhr       Color (inside):     Bhr       Alteration:     no       Vesicularity:     Ithology:       Lithology:     monor       Occurrence:     massh	31_om, Y=_24_cm, Z=_13_cm       45g       1000 mm       1000 mm	<u>SKETCH</u>	<u>1</u>
Igneous & Ultramatie Volcanic: basalt bas Thickness of Phenocrysti Plutonic: gabbro d Crystals= Ultramafic: lerzolite + Crystals= Others: Sedimentary rocks & Fragments comp.: mo	Crocks Saltic andesite andesite dacite rhyali of glass:mm s= %, %, %, % lorite quartz diorite granite %, %, % narzburgite dunite pyroxenite others %, %, %	e	
Rock type:       Grain size (mm) :       Sorting :       We       Roundness :       rou       Fabric:       Grading :       nor       Matrix :	- 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256 < IIpoorly Ind	-	

7KII#388 R- 04	Described by _	June 2, 2007 <u>Abe &amp; Koike</u>
Sample Size:       X=       12 orn, Y=       6 orn, Z=       6 orn, Z=	<u>SKETCI</u>	<u> </u>
Igneous & Ultramafic Rocks Volcanic: basalt basaltic andesite andesite dacite rhyolite		
Thickness of glass:mm Phenocrysts= %, %, % Plutonic: gabbro dlorite quartz diorite granite Crystals= % % %		
Ultramafic: lerzolite harzburgite dunite pyroxenite others Crystals= %, %, %		
Sedimentary rocks & others (characteristic of the clasts) Fragments comp.: mono or poly Rock type:		
Grain size (mm):         < 1 - 2 - 4 - 8 - 16 - 32 - 54 - 128 - 256		
Grading: normal—nonereverse Matrix : silt sand others: Lithic: Lithified or unlithified		
Remarks Breccia	<u>.    .                               </u>	

7K 🗉	#388 I	<b>R-</b> 05		Described by _	June 2, 2007 Abe & Koike
Sample Size: Welght: Mn coating: Color (inside): Alteration: Vesicularity: Lithology: Occurrence:	X= <u>13</u> cm, Y <sup>2</sup> <u>1</u> min dary 3rey no week cer <u>5</u> monomict or poly massives davab	= <u>II</u> cm, Z= m mict volcaniclastics sec	බ . iom diments other	<u>SKETCI</u>	<u>1</u>
Igneous & Ultr	amafic Rocks			v	
Volcanic: bas	alt dasatic andes	ite andesite da	acite rhyolite		
Thic	kness of glass:	<u> </u>			
Phe	nocrysts= 71 20	0%, %,	%		
Plutonic: gab	bro diorite quar	rtz diorite granite			
Cny	stals=	%, %,	%		
Ultramatic: lerz	olite harzburgite	dunite pyroxen	ite others		
Gry	stals=	<i>%</i> 0, %0,	50		
Cineis:	naka 8 athawa (a				
Seamentary n		characiensoc or	the clasts)		·
Rock time:	np. mono or po	or <b>y</b>			
Grain size (mm	$1$ $3 = \frac{1}{2} = \frac{1}{2} = \frac{1}{2} = \frac{1}{2} = \frac{1}{2} = \frac{1}{2}$	-16 - 32 - 64 - 12	8 - 256 <		
Sortina :	well		200		
Roundness :	round	angula	ar		
Fabric:	clast-support	matrix s	support		
Grading :	normal	none	-reverse		
Matrix :	slit sand othe	ers:			
Lithic:	Lithified or	unlithified			
Remarks	strangly al	ltered, ppd	disin alter	ed phenoclyst.	

7K II #3	88 R- <sub>D</sub>	Descri	bed by <i>j</i>	June 2, 2007 Abe & Koike
Sample Size: X= Weight: I' Mn coating: Color (inside): Maration: Vesicularity: Lithology: monon Occurrence: massiv	8 cm, Y= <u>7</u> cm, Z= <u>4</u> 10 g <u>mm</u> <u>k https://mm</u> week strong % nlct or polymict res lavas voicaniclastics sedimed	_cm <u>SKi</u>	<u>ETCH</u>	
Igneous & Ultramafic Volcanic: basalt bas Thickness o Phenocryste Plutonic: gabbro di Crystals= Ultramafic: lerzolite h Crystals= Others:	CROCKS         saltic andesite       addesite         of glass:      mm         saltic andesite       mm         saltic andesite       %,         forite       quartz diorite         granite       %,         %,       %,         narzburgite       dunite         %,       %,         %,       %,	rhyolite % • % others %		
Sedimentary rocks & Fragments comp.: mol Rock type: Grain size (mm) : <1 Sorting : wel Roundness : rou Fabric: clas Grading : nor Matrix : silt Lithic: Lith	Cothers (characteristic of the no or poly           -2-4-8-16-32-64-128-3           III	<i>clasts)</i> 256 ≺ ort erse 		
Remarks Laye	ered. Mr chust			

7K <b>Ⅱ</b> #	388 R	08		Described by _	June 2, 2007 _Abe & Koike
Sample Size: X= Weight:	- <u>24    cm, Y=    13</u> - <u>1650      </u> g	2_cm, Z=	cm	SKETCH	<u> </u>
Mn coating:	<u>(0</u> mm				
Color (inside):	arer prown 1	Rale brown			
Atteration: no Vecievlarity:	Need strong				
lithology: m	20 70				
Occurrence: ma	assives (lavas volca	niclastics sedim	ents others		
Janeoue & Liltram	afic Packs				
Volcenic Kasali	have nound	ondeelte decite	- rhyolite		
Thickne	ss of plass: 8	mm	s myune		
Phenoc	$rvsts = 01 \overline{2} \%$	%.	%		
Plutonic: gabbro	diorite quartz dio	rite g <b>ran</b> ite			
Crystals	s≔ <u>%</u> ,	<b>%</b> ,	%		
Ultramafic: lerzolite	e harzburgite dur	ite pyroxenite	others		
Crystals	\$≓ %,	%,	%		
Others:			<u> </u>		
Sedimentary rock	ts & others (chara	cteristic of the	e clasts)		
Fragments comp.:	mono or poly				
Kock type: Crain also (mm) :	<u>-1 0 4 0 10</u>	20 44 400	050 -		
Grain size (mm) : Earting :	< 1-2-4-0-10	- 32 - 64 - 126 -	- 200 ~		
Boundness :	round	poony			
Fabric:	roundless total				
Grading :	Grading: normal				
Matrix :	silt sand others:				
Lithic:	Lithified or unl	ithified			
Remarks					
0.	an hite				
1 20	. pr. 1 ; c-				
Ii	1				

7K II #388 R- 09	Described by _	June 2, 2007 Abe & Koike
Sample Size: X=cm, Y=cm, Z=cm Weight:bDg ?~5cm X & Mn coating:mm Color (inside):darkbrown Atteration:% Atteration:% Uesicularity:% Lithology:monomict or polymict Occurrence:avas volcaniclastics sediments others	<u>SKETC</u>	<u>+</u>
Igneous & Ultramafic Rocks         Volcanic:       basalt       basaltic andesite       andesite       dacite       rhyolite         Thickness of glass:      mm      mm      mm      mm         Phenocrysts=       %,       %,       %         Plutonic:       gabbro       diorite       quartz diorite       granite         Crystals=       %,       %,       %       %         Ultramafic:       lerzolite       harzburgite       dunite       pyroxenite       others         Crystals=       %,       %,       %       %       %		
Sedimentary rocks & others (characteristic of the clasts)         Fragments comp.:       mono         Fragments comp.:       mono         Grain size (mm):       <1-2-4-8-16-32-64-128-268		
Romarks Man nodules	<u></u> .	

<b>7K</b> Ⅱ‡	#388 R-	UN		Described by _	June 2, 200 Abe & Koike
Sample Size: X Weight: Mn coating: Color (inside): Alteration: n Vesicularity: Lithology: n	K=crn, Y= 9 mm <u>dot + U Laton</u> week strong % nonomict or polymict	cm, Z= 1∼4cm	cm	<u>SKETCI</u>	<u>H</u>
Occurrence:	nassives lavas volca	niclastics sedim	ents others	5	
Igneous & Ultran Volcanic: basalt Thickr Phene	mafic Rocks basaltic andesite ness of glass:	andesite dacite mm	e rhyolite w		
Plutonic: gabbro Cryste	o diorite quantzdio als= %.	mite granite %.	ەر %		
Ultramafic: lerzoli Crysta	te harzburgite dur ils= %,	ite pyroxenite %,	others %		
Others:			<u> </u>		
Fragments comp. Rock type:	אז אסט אסט איז	cteristic of th	e clásts)		
Grain size (mm) : Sorting : Roundness :	<pre>&lt; 1 - 2 - 4 - 8 - 16 well round</pre>	– 32 – 64 – 128 – ——poorly ——angular	256 <		
Fabric: Grading : Matrix : Lithic:	ciast-supportno normalno silt sand others: Lithified or unl	matrix sup nerev ithified	port /erse		
Matrix : Lithio:	silt sand others: Lithified or uni	ithified	• •		



#### 4.2 Report on the Kaiko 7000 II Dive #389 on 2007/06/03

Hiromi Fujimoto, Motoyuki Kido, Yukihito Osada, Hiroaki Tsushima (Tohoku University)

Three precision acoustic transponders (PXPs) are deployed on the outer rise of the Japan Trench at the GJT1 site in the study area to measure the motion of the Pacific plate near the subduction plate boundary. Because the battery of each instrument is estimated to be exhausted, we should deploy a new PXP and measure the relative positions of the new and old PXPs with 1 cm resolution in order to continue the geodetic observation. Diving operation is required for the job after the old PXPs are inactive.

The Kaiko 7K II carried a PXP in the payload space, deployed it on the seafloor side by side to an old PXP, and we measured the relative position between the two PXPs with the aid of visual images; the direction of cameras and images of the 4 cm by 4 cm meshes of the PXP's bottom frame were useful to measure the direction and the length of line connecting the two instruments. The PXP DJ8 was deployed at 38-22.8622 N, 144-53.3923 E, depth 5438.8 m. After the measurement, the old PXP was recovered with a rope connected to the Kaiko.

Judging from a multi-narrow beam bathymetric map, the old PXP was deployed in the middle of a flat belt of the seafloor. The belt was a NW-SE trending depression about 15 km wide and bounded by gentle slopes on both sides. Therefore we observed the seafloor along a E-W line of about 500 m before the deployment of the new PXP. The results of observation with 5 cameras of the vehicle and the side-scanning sonar of the launcher show that the seafloor is quite flat without any indication of local reliefs.

The dive record, dive log, and the dive track chart are shown in Tables 4.2.1-4.2.2 and Fig. 4.2.1, respectively.

かいこう 7	0 0 0 I	潜航	記録	
平成 19 年 KR07-07	行動	記載者	瀬底 秀樹	
潜航年月日 2007 年 D6/03			着底予定位置	
潜航回数 2回			緯度 38-22.	86'N
通算潜航回数 389 回			経度 [144°53.	73'E
潜航海域 日本海溝	三陸沖アウターライズ	. <b>–</b>	测地系¥C\$-8∉	<u> </u>
潜航目的 調査激航	海底地殼変動觀	 測に使用して	いる音響トランス	ポント
	ダーの交換			
調 査 主 任 藤本 博己	·	525+- PILOT	重竹武部二	
所 屈 <u>東北大学</u>		PILOT	若松 誉	
	с	орісот	瀬底 秀樹	
作業経過時刻		累 計	時間	
吊 揭 08:27		潜航時間	n 6:45	
着水 08:33		前回潜的	t 2373:27	
離 脱 10:30		通算潜艇	t 2380:12	
着底 10:41	ケーブル使	三用時間_	ケーブル番号別(	更用時間
離 底 13:31	1次使用時間 	7:2	1次番号	2
結合 13:42	1次前回時間	2470: 9	1 次番号X(前回時間	1556:54
水切 15:18	1次通算時間	2477:11	1次相号所通算時間	1563:55
<u> 揚 収 完 了 15:29</u>	2次使用時間	3:12	2 次 岙 号	5
	2.次前回時間	1077:26	2.次哲岩斯前回时间 ————————————————————————————————————	73:46
	2次通算時間	1080:38	2.次瘤号別通算時間	76:58
海象   気象				
天候    風向	<u>風力</u>	波浪	うねり	視程
			<u> </u>	12
最大潜航课度 5442 m				
若底深度5433 m		離底深度	5442 m	
着 底 底 質 <u>泥</u>		離底底質	泥	
記事 海底を観察しながら分離曳航で約450m西へ航走。既設トランスボンダーとの 相対位置を把握できるよう新規トランスボンダーを設置。既設品を回収した。				

# 6月3日 div 389 海底局 (DJ6-> DJ8) リプレイス

時間(JST)	
10:25	かいこう 下降終了
10:32	ビークル 離脱
10:41	ビークル 着底 (水深 5432m)
10:46	Sonar(レンジ150m)で海底はフラットなのを確認
	母船 270° に 0.2 もしくは 0.3 knot で移動
12:01	Sonar に金属反応らしいものあり(2個)
12:08	海底局 (DJ6) 目視で確認
12:10	着底
12:23	ビークルを流れの向きに合わせるため離底(視界は良くないため)
12:43	着底
12:49	PXP(DJ8)ビークルにより設置
	DJ6 の設置状況
	鉄フレームと FRP にずれあり、2002 年設置時のフレーム回収時に
	ずれたか(?)もしくは設置時の衝撃でずれたかは不明
12:50	2 つの海底局の方位を決める 縦:79°
12:56	水平:140°
13:12	フックを DJ6 に引っかける
13:31	ビークル離底 5503m



 $\mathbf{24}$ 

#### 4.3 Report on the Kaiko 7000 II Dive #390 on 2007/06/04

Hiromi Fujimoto, Motoyuki Kido, Yukihito Osada, Hiroaki Tsushima (Tohoku University)

We carried out the second experiment following the Kaiko dive 389. The Kaiko 7K II carried PXP DJ7 in the payload space, deployed it on the seafloor side by side to an old PXP, and we measured the relative position between the two PXPs with the aid of visual images taken from the Kaiko in the same way as the previous dive. The PXP DJ7 was deployed at 38-23.8165 N, 144-47.3371 E, depth 5499.0 m. After the measurement, the old PXP was recovered with a rope connected to the KAIKO.

The dive record, dive log, and the dive track chart are shown in Tables 4.3.1-4.3.2 and Fig. 4.3.1, respectively.

かいこうで	000⊥ 潜航記録
<u>平成 19 年 KR07-D7</u>	行動 記載者 斑底 秀樹
<b>海航年月日 <u>2007 年 06</u>/04</b>	着底予定位置
潜航回数 3 回	編度 38 <sup>-</sup> 23.81 <sup>-</sup> N
通算潜航回数 390 回	経 度 144 <sup>*</sup> 47.33'E
	測地系 NGS-84
高机海域 日本海道	
潜航目的 調査潜航	□海浜地殻変動観測に使用している音響トランスポン ■ダーの変換
調査主任 藤本 博己	ランテャー PILOT 重竹 誠二
所 属 東北大学	PILOT <u>諸松_</u> 蒼
	COPILOT 旗底 秀樹
作業経過時刻	案 计 畦 間
吊 楊 08:25	浴 航 時 間 5:58
着水 08:31	前 国 浩 航 2380:12
離 脱 10:28	通算潜航 2386:10
若底 10:40	ケーブル使用時間「ケーブル番号別使用時間
麗 底 12:42	1次使用時間 6:15 1 次 香 号 2
結合 12:52	1 次前回時間 2477:11 ※表表XIAIDE(10) 1563:56
<u>水 切</u> 14:29	1 次通算時間 2483:26 ※考5 Mian Spieleral 1570:11
揚収完了 14:40	2 次使用時間 2:24 2 次 番 号 5
	2 次前回時間 1080:38 2次をそれからは16 76:58
	2 次通算時間 1083:2 <u>2 ※###3130 % ##</u> 79:22
海 象 · 気 象	
天侯 風向	風力 波浪 うねり 祝程
C SSE	3 2 1 12
最大潜航深度 <u>5504</u> m	
蓋底深度5504_m	離底深度 <u>5503</u> m
着底底翼 泥	離底底資泥
	至近に新規 <b>トラシ</b> スポンダーを設置し、設置状況を正確 ランスポンダーを回収した。

いいこう7000m 満航記録

# 6月4日 div 390 海底局 (DJ5->DJ7) リプレイス

時間(JST)				
10:22	かいこう 下降終了			
10:29	ビークル 離脱			
10:40	ビークル 着底 (水深 5504m)			
	Sonar に 0°, 330°に強い反射あり			
11:01	ビークルを一度着底点に戻し,装置の確認をやり直す.			
	3 個強い反射ある.			
11:36	正面に強い反射ある.			
11:49	着底したが目視で装置確認できず			
11:50	離底し、違う物体を確認することにする			
12:02	DJ5 目視で確認			
12:05	海底に着底(水深 5504m)			
12:12	PXP(DJ7)ビークルにより設置			
	DJ5の設置状況			
	昨日のDJ6とは鉄フレームとFRPにずれなし.			
12:19	2 つの海底局の方位を決める 縦:250°			
12:21	木平:142°			
12:29	フックを DJ5 に引っかける			
12:42	ビークル離底 5503m			
12:44	DJ5 離底			



### 4.4 Report on the Kaiko 7000 II Dive #391 on 2007/06/05 Stephen Kirby, (USGS)

This dive started at depth 5340 m depth at position 38°07' N latitude and 145° 10'E longitude and ended at depth 5289 m and approximate position 38°07' N and 145° 11.75' E. The target on this west-to-east course approaching a gentle ridge was possible fault disturbance of the seafloor caused by the M7.1 earthquake of 15 November 2005 (Japan Date) based on the hypothesis that vertical displacements of NE-SW ridges are caused by cumulative normal-fault displacements on the same fault by many earthquakes similar to the most recent event in 2005. Three or possibly four such ridges were identified along a north-south SEABEAM track at longitude 145°10' E where the SW segment of each ridge was lower in relief that the NE segment by 10 to 20 m. The seafloor along the Kaiko course was only composed of fine-grained soft sediment and <u>no evidence of disturbance of the seafloor caused by recent faulting was</u> found during the dive. To the contrary, the seafloor was remarkably smooth and the only noteworthy feature about the seafloor was that it displayed scattered rocks on the surface. Six rocks were sampled by Kaiko and all proved to be low-density pumice. According to Dr. Natsue Abe, such a scattered field of rocks is unusual in deeply sedimented areas. The area traversed by this dive was in the "near field" of the 15 November 2005 earthquake where seismic intensity probably exceeded JMA intensity 5. The 2005 earthquake was of the normal faulting type and hence vertical accelerations could have exceed 1 g. This might explain why these volcanic rocks could have been accelerated into the water column. This hypothesis does not explain how these rocks ended up in soft sediment in the first place. Natsue Abe suggests floatation of these low-density rocks rafted from some other source, perhaps an island arc such as the Izu-Bonin system.

The failure of this dive to discover any seafloor disturbance associated with the 2005 earthquake using the search hypothesis described above argues for using a different, more efficient approach to find seafloor evidence of recent faulting for Kaiko ROV dives during future cruises. Future inversions of seismic arrival-time data from Dr. Ryoto Hino's present-day OBS deployment *above* the locations of the aftershock zones of the 2005 event should make it easier to narrow down the surface trace of the fault(s), especially if relocations could be used using methods like double-difference and if poorly located events are not included in the analysis. Dr. Natsue Abe suggests that further refinement of surface expressions of these faults could result from observations using deep-tow camera systems or deep tow side-scan sonar that has much longer profile lengths than the Kaiko ROV. All of these approaches could be applied in future cruises when these data and other tools could be used to narrow down the target areas for Kaiko ROV investigations.

It is therefore suggested that the second Kaiko dive for this cruise planned for the search for seafloor disturbance of the 2005 earthquake be postponed to a later cruise and that, instead, this second dive target one of the "petit spot" volcanic centers in the north-south volcanic chain that Dr. Natsue Abe is studying. The author of this report proposes that the ROV Kaiko dive on the volcanic edifice near 38°08' N and 145° 01.3' E, approaching it from its steep eastern side. This ROV course would involve as much as 1000 m of seafloor relief. It is hoped that fresher rock exposure will be found on those steep eastern slopes could be useful to Dr. Abe and that perhaps recent faulting could have produced that slope. Some apparent aftershocks in the western N-S band determined from Dr. Hino's first OBS deployment occurred below the vicinity of this volcanic target.

The dive record, dive log, list of samples, and the dive track chart are shown in Tables 4.4.1-4.4.3 and Fig. 4.4.1, respectively.

かいこう7000Ⅱ 潜航記録 平成 19 年 XR07-07 行動 記載者 瀬底 秀樹 潜航年月日 2007 年 D6/45 着底予定位置 38°10, 60°N 糛 度 潜航回数 4 🛛 絟 寛 145°10, DO'E : 391 🛛 通算潜航回数 測地系 ¥GS-84 潜航海域 日本海溝 海溝海側地震震源域 |三陸沖海溝海側地震震源域において海底面の観察を 行う 潜航巨的 憲査潜航 調査主任 薩本 博己 PILUT 重竹 誠二 ランチャー 所 属 東北大学 PILOT 若松 誉 COPIEOT 瀬底 秀樹 作 経 過 畤 刻 菜 累 計 盱 間 帯 揭 08:25 潜航時間 7:48 蓿 08:30 水 前回潜航 2386:10 艄 10:25 通算潜航 2393:58 駾 右 底 10:38ケーブル使昂時間 ケーブル 巻号別使用時間 酲 底 14:32 1次使用時間 8:1 1 次番号 2 結 合 14:44 1次前回時間 2483:26 ·次委号别的回時間 1570:11 1 次通算時間 2491:27 1578:12 次营营制通道時間 水 切 16:18 揭以完了 16:26 2.次使用時間 4:19 2 π 畨 号 5 2 次前回時間 1083: 2 79:22 2.次 御骨別前回時間 2.次通算時間 1087:21 2.次委号别通真時間 83:41 海 윭 気象 天儀 風向 風力 波浪 うねり 視程 bc  $\overline{2}$ SSE 3 2 12 最大潜航深度 5341 m 着底深度 5340 m 離 底 深 度 5284) IT: 着底底篮 泥 離底底質 泥 ł 分離曳航で東に航走しながら、長距離に渡る海底面の観察および岩石のサンプ・ リングを行った。 記事

日付<u>2007.6.5</u> KR <u>0707</u> No. <u>391</u> No. 調査種類<u>がいこう調査溶瓶</u> 調査海域<u>日本海港湾 2005年海溝海側地震震</u>振成

時刻	深度	作業内容	緯度 ・ 経度
08:30		着水 わ-5337m	38-10.5792 X: 145-10-0202 Y:
-2i	-50.00	下降關館 深度为2000	10.6510 X: 47 M. 7263 Y:-20.5
10:25	.52~9 in().)	· · · · · · · · · · · · · · · · · · ·	10.600 X-100
- R	5340m	着家	10. 5092 X: 13.3 10. 5092 X: 13.3
िःदेव	יךייי ג'י	G-70° 移動動格	X:
: 54	5	泥炭减取(100)贫效的	10.6115 X:013 10.6611 Y:78 7
: 9 <u>1</u>	10	ц « Ø	6193 X: 32.0 6520 Y: 160
11-215	56N ( 64		ుజకని X:-ఎ్టి జరిగి Y: 21 వ
13:48	5304	岩石採取(1個) 。④	10.5162. X: 30.0 11.2.985 Y:1896.0
<i>19</i> -07	5294	〃 (1 個) 〃 ③	6061 X:11.3 4710 Y:2148.0
:26	5289	// (1爸) * @	5076 X: 140 6016 Y: 2388.
:32	5284	颤压	6198 X: 36.9 6920 Y: 24909
: :		VCL结合	X: Y:
:	i		X: Y:
:		· · · · · · · · · · · · · · · · · · ·	X: Y:
:			X: Y:
			X: Y
:	_		X: V-
- : I		· · · · · · · · · · · · · · · · · · ·	X: Y:
:		· · · ·	
:	i	· · · · ·	X: V-
:	۰۴: ا		X:
:			X:
	r		<u>Υ:</u> X:
:			<u>Y:</u> X:

	391 R-	0/	, D	escribed by	Abe & Koike
Sample Size: X= Weight: Mn coating: Color (inside): Alteration: nc Vesicularity:	= <u>1</u> cm, Y= <u>b, 5</u> <u>560</u> g mm <u>mm</u> <u>by</u> week strong - <u>%</u>	.cm, Z= <u>9</u> 0 07i	. •	<u>SKETC</u>	1
Lithology: ma Occurrence: ma	onomict or polymict	etine) sedimente	othere		
Igneous & Ultram Volcanic: basalt Thickne	basaltic andesite and	esite dacite r	hyolite		
Phenoc Plutonic: gabbro Crystais	crysts= %, diorite quartz diorite s= %.	%, granite %.	% %		
Ultramatic: lerzolite Crystals Others:	e harzburgite dunite s≕ %,	рутохепіte ot %,	hers %		
Sedimentary rock Fragments comp.: Rock type:	ks & others (characte mono or poly	ristic of the c	lasts)		
Grain size (mm) : Sorting : Roundness :	< 1 - 2 - 4 - 8 - 16 - 32 well	– 64 – 128 – 256 —poorly –angular	3 <		
Fabric: Grading : Matrix : Lithic:	clast-supportnone normalnone sitt sand others;	matrix support	<del>9</del>		
Remarks Pu	mitter with n	mol			

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7KII#391 R- 02	June 5, 2007 Described by <u>Abe &amp; Koike</u>
Sample Size:     X=     14- cm, Y=     11- cm, Z=     10- cm       Weight:	<u>SKETCH</u>
Occurrence: massives lavas volcaniclastics sediments of	hers ,
Igneous & Ultramafic Rocks Volcanic: basalt: basaltic andesite andesite dacite rhyol Thickness of class: mm	lite
Phenocrysts= %, %, % Plutonic: gabbro diorite quartz diorite granite	% ^ .
Ultramafic: lerzolite harzburgite dunite pyroxenite others Crystals= %, %, %	70 5 %
Sedimentary rocks & others (characteristic of the clast Fragments comp.: mone or poly Book type:	_ ts)
Grain size (mm):         < f = 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256	_
Fabric: clast-supportrangerer Gradien : pomal	
Matrix: silt sand others:	_
Remarks DUM (Q.	

7K II #	\$391 F	२- ०	3		Described by	June 5, 2007 Abe & Koike
Sample Size: X= Weight: Mn coating: Color {inside}: Alteration: Vesicularity: Lithology:	= <u>1</u> , cm, Y= <u>7377</u> g mm uhiti <u>755 grow</u> week stro onomict or poly	<u>15 </u> cm, 	z=})	cm	<u>SKETC</u>	H
Occurrence: ma	assives lavas v	olcaniciastic	s, sedime	nta others	1	
<b>Igneous &amp; Ultram</b> Volcanic: basalt Thickne Bianoc	bafic Rocks basaltic andesi ess of glass:	ie andesite	dacite	rhyolite		
Plutonic: gabbro Crystak Ultramatic: lezzolite	diorite quart s= a harzburnite	∞, zdiorite gra %, dunite nov	70, anite %,	70 %		
Others:	s=	%,	%,	%		
Sedimentary rock	ks & others (ci	haracterist	ic of the	clasts)		
Fragments comp.: Rock type:	mono or po	У				
Grain size (mm) ;	<1-2-4-8-	16 - 32 - 6	4 - 128 -	256 <		
Sorting :	well	·Ę	boorly			
Roundness	round	{	angular			
Fabric:	clast-support	m	atrix supp	ort		
Grading :	normal	none	rev	erse		
Lithic:	Lithified or	unlithified	-			
Remarks Pur	ຫໄປ					
,						

ГК Ш #3	<b>31 IX-</b> 0%		Described by _	Abe & Koik
Sample Size: X= <u>1</u> 나	om, Y= <u></u> om, Z=	<u>/ð</u> em	SKETCH	1
Mo coation: <u>7870</u>	<u>&gt; g</u>			
Color (inside):	73 6124			
Alteration: no w	eek strong			
Vesicularity:	%			
Lithology: monomi	ct or polymict			
Occurrence: massive	is lavas volcaniciastics sed	liments others		
Igneous & Ultramafic I	Rocks			
Volcanic: basalt basa	altic andesite andesite dat	cite rhyolite		
Phenocoasts=	glass:mm _ 04_ 04	94		
Plutonic: gabbro dig	rite quartz diorite oranite	20		
Crystals=	%, %,	%		
Ultramafic: lerzolite ha	arzburgite dunite pyroxonil	te others		
Crystals=	%, %,	%		
Others:	- 41	44		
Framents comp i moor	outers (characteristic of	ine clasis)		
Rock type:	5 61 poly .			
Grain size (mm) : <1-	-2 - 4 - 8 - 16 - 32 - 64 - 128	8-256 <		
Sorting well-	poorly			
Roundness : round	dangula	if .		
Fabric: clast-	-support matrix su	upport		
Metrix norm	sand others:	réverse		
1911 C. SIL 3	ied or unlithified			
LITNIC: I ITNI				

7K II #	391 R- 05	C	Described by _	June 5, 2007 <u>Abe &amp; Koike</u>
Sample Size: X=_ Weight: Mn coating: Color (insido): Alteration: no Vesicularity: Lithology: mor Occurrence: mas	$\frac{2.5}{2.5} \text{ cm, } Y = 16 \text{ cm, } Z = 17$ $\frac{9.5}{2.5} \frac{9}{2.5} \text{ mm}$ $\frac{7.75}{3.5} \frac{7.69}{7.5} \frac{9.769}{7.69}$ week \$trong week \$trong 5.5 milet - 5.5	_cm	<u>SKETCH</u>	<u>1</u>
Igneous & Ultrama Volcanic: basalt Thicknes Phenocery Otystals= Ultramafic: lerzolike Crystals= Others: SedImentary rocks Fragments comp.: r Rock type: Grain size (mm) : - Sorting : c Roundness : r Fabric: c Grading : t Matrix : c Lithic: I	the Rocks         basaltic andesite       andesite         basaltic andesite       andesite         s of glass:       mm         glorite       mm         diorite       quartz diorite         glorite       quartz diorite         harzburgite       dunite         basaltic andesite       dunite         harzburgite       dunite         basaltic and or poly       mm         <1-2-4-8-16-32-64-128-	e rhyolite % others % e clas(s) -256 < 		



# 4.5 Report on the Kaiko 7000 II Dive#392 on 2006/06/06

Natsue Abe and Yuki Koike (IFREE, JAMSTEC)

This dive started at depth 5450m, 38°04.250'N latitude, 145°01.2500'E longitude and end at depth 5286m, 38°04.4048'N latitude, 145°01.6085'E longitude. The target knoll has a large crater which is thought to be made by volcanic eruption. This is also one of Chocochip knolls which is considered as a petit spot type volcano. The aim of this dive is to observe on the surface of this knoll and to take rock samples especially from inside of the caldera and caldera wall. The bottom of the caldera is almost flat and the slop of the wall grows steep towards the top of the hill. There is the criff at the edge of the wall top and pillow lava like structure was observed there. Large columnar joint like structure was observed on the way to the edge of the wall. 17 rock specimens were sampled during the dive including fresh dense basaltic samples and one doleritic hypabyssal rock. One of them shows high vesicularity.

The dive record, dive log, list of samples are shown in Tables 4.5.1-4.5.3, respectively. The dive chart and dive track are shown in Figs. 4.5.1-4.5.2.
かいこう7	000 II	潜航	記録	
<u>平成 19 年</u>	7 行動	記載者	瀬底 秀樹	
潜航年月日 <u>200</u> 7 年 06/06	_		着底予定位置	
港航回数 5 回			緯度 36.04	. 25' N
通算潜航回数 392 回			羅 度 145'01	. 25'E
潜 航 海 域 旧本海溝沖		后联	測地系  10S-8	4
潜前日的 丽香湖	」 <u>・ コー・ / / / / / / / / / / / / / / / / / / /</u>	━ <u>┉</u> 」 ӯ━╕ィӡ҃Ӻ	の小海らにちける	- 10 A
	を行う			
調 賓 主 任 藤本 博己		ົ ົ ⊅⊅ቻŧ− PIL01	重竹藏二	1
所 属 東北大学		PILOT	若松、誉	
	с	OPILOT	瀬底 秀樹	
作業経過時刻		累計	時間	
吊 揚 08:21		  浩 航 時 『	7:41	
着水 08:26		前回潜的	1 2393:58	
離 脱 10:23		通算潜艇	t _ 2401:39	
着底 10:38	ケーブル値	<b>用時間</b>	ケーンル番号別	使用時間
離底 14:20	1次使用時間	7:54	1 次 番 号	2
結 14:32	1次前回時間	2491:27	:次番号別前醫時間	1578:12
<u>·水 切 16:07</u>	1 次递算時間	2499:21	"次番号別通算時間 	1586: 6
<u> 揚収完了</u> 16:1 <u>5</u>	2.次使用時間	4: 9	2 次 番 号	5
	2次前回時間	1087:21	2次沿导双前回转机	<b>8</b> 3:41
	2 次通算時間	1091:30	2次番号及通算编员	87:50
海象・気象			_	
天候 風向		波浪	うねり	視程
bc South	3	<u>2</u>	2	[ 10 ]
最大減航深度 <u>5466</u> m				
着底深度 <u>5466</u> m	-	離底深度	j 5286 <sup>i</sup> m	
着底底質 泥		離底區質	je	
記事 カルデラ内部に若底後 行った。登頂後は東側	&、北東方向に急度 」に頂上部を観察・	を上昇し、 満 試料採取を行	底面の観察と岩 いながら航走した	「採取を と。

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日付<u>2007.6.6</u> KR <u>0707</u> No. <u>392</u> 調査種類<u>がいこう調査搭航</u> 調査海域<u>日本海</u>海沪 右コ先い海丘群

	時刻	深度	作業内容	緯度 経度
	8:26		着水 わ-5309m	38-03.9259 X: 145-01.6399 Y:
	:42	150 m.	下陸開始 深度ち/00mまで	040992 X-165.0 01,3359 Y: 38.0
	10:23	5327(4)	VCL離院	2181 X: 52.0 1609 Y: 28.0
	:38	5466	着廊	-2152 X: 46.7 1590 Y-30.7
	:41	"	泥岩株取(1個) 資料①	// X: // Y:
	11:00	5445	位置磁設	2650 X:138.7
	:05	544.2	泥岩採取(1個) 貧料 ②	21/07 X: /49.3
.)	:07	11	岩石採取(1個) "3	, X: " Y:
	:15	5436	" (2個) ″ み,6	-2981 X: 200.0 -1289 Y:-1/2.7
	:28	32.32	位置確認	-2996 X:202.7/ -1335 Y:-68.0
	:54	5410	岩石採取(1個) " O	2960 X:196.0 2502 Y:102.7
	12:07	5408	n ([19]) n ()	. 2859 X: 177.3 . 2867 Y: 156.0
	:07	5	1 (119) 4 🔗	* X: * Y:
	:/0	5409	۶ (11B) ۴ G	. 2902 X: 1853 . 2829 Y: 1833
	:B	٧	· (110) ' @	4 X: 6 Y:
)	: Z2	5390	) (HE) " D	2902 X: 185,5 3195 Y: 204,0
	:23	7	) (]1[£]) (@	2 X:
	:33	5362	* (11@) * Ø	.2924 X:789,3 .3423 Y:237,3
	:43	5339	4 (112) 4 D	.3082 X:218.7 .3323 Y:222.7
	:44	*	" (1個) " ①	7, X: 7, Y:
	:47	. 4	" (11@) » D	4 X: 1/ Y:
	13:09	5311	熊手による挨取 // ①	-3435 x:2840 -3532 x:2533
	14:20	5286	避底	404  X:396.0 .6632 Y:706.7
	: 32		VCL结合	.4648 X:397.3 .6085 Y:526.7
	: 34		一家ケーアル意取開始	X: "Y:
	:		浮上	
-		;	·	I

No.

	391 K-	0/	2.pieces	Described by	Abe & Ko
Sample Size: X=_ Weight:	<u>––– — c</u> m,−Y⇒ <u>–                                    </u>	_cm, Z=	∼.6 (τ≥. <u>—</u> 0m	<u>SKETC</u>	<u>H</u>
Mn coating:	<u> </u>				
Alteration: no	week strong				
Vesicularity:	%				
Lithology: moi	nomict or polymict	lettine pedies	anta athana		
	ssives lavas voicarric. Sie Dooke	asics seulin			
Volcanic: basalt	basaltic andesite and	desite dacite	s rhyolite		
Thicknes	s of glass:	_mm	,		
Phenoon Plutonic: gebbro	ysta= %, diorite quartzidiorite	%, aranita	%		
Crystals	= %,	s granne %,	%		
Ultramafic: lerzolite	harzburgite dunite	pyroxenite	others		
Crystals:	= %,	%,	%		
Sedimentary rock	s & others (charact	eristic of the	e clasts)		
Fragments comp.:	mone or poly	chatte of the	Ф <i>С</i> і <b>цэ</b> цэј		
Rock type:					
Grain size (mm) : ··· Sorting :	≤ I – 2 – <b>4</b> – 5 – 16 – 3 well	-z - 04 - 126 -	- 206 <		
Roundness :	round	angular			
Fabric:	clast-support	matrix supp	port		
Grading :	normalnone- eilt eand othere:	rev	/erse		
Lithic:	Lithified or unlithi	fied			
Romarks ()	1.				
	2				
<b>7ΚΠ</b> #	2 391⁄ R-	02			June 6,
7K II #	₂ 391∕ R-	02		Described by	June 6, Abe & Ko
<b>7KI#</b>	2 391∕ R-	() 2 _cm. z=	cm	Described by	June 6, Abe & Ko H
<b>7KI#</b> Sample Size: X= Weight: Mn costing:	2 391∕ R- 	() 2 _cm. z=	cm	Described by <u>SKETC</u>	June 6, Abe & Ko <u>H</u>
<b>7KII#</b> Sample Size: X= Weight: Mn coating: Color (inside):	2 391 R- 	() 2 _cm. z=	cm	Described by <u>SKETC</u>	June 6, Abe & Ko <u>H</u>
<b>7KII#</b> Sample Size: X= Weight: Mn coating: Color (inside): Alteration: Veeloularty	2 391 R- 	() 2 _cm. z=	cm	Described by <u>SKETC</u>	June 6, Abe & Ko <u>H</u>
<b>7KII</b> Sample Size: X= Weight: Mn coating: Color (inside): Alteration: Vesloularity: Lithology: mo	2 3917 R- 	() 2 _cm. z=	cm	Described by <u>SKETC</u>	June 6, Abe & Ko <u>H</u>
<b>7KII</b> Sample Size:         Weight:         Mn coating:         Color (inside):         Aiteration:         Vesicularity:         Lithology:         Occurrence:	2 <b>391<sup>7</sup> R-</b> <u>sv</u> g <u>mm</u> <u>chvk broaut</u> <u>week</u> strong <u>week</u> strong <u>mm</u> <u>chvk broaut</u> <u>sives</u> lavas volcanic	 _cm. z=	cm	Described by <u>SKETC</u>	June 6, Abe & Ko <u>H</u>
<b>7KII#</b> Sample Size: X= Weight: Mn coating: Color (inside): Alteration: Nesloularity: Lithology: Doccurrence: ma gneous & Ultrama	2 <b>391</b> R- <u>sv</u> g <u>mm</u> <u>dv b b b o old</u> <u></u> week strong <u>%</u> nomict or polymict ssives lavas volcanic <b>atic Rocks</b>	02 _cm. z=	cm	Described by <u>SKETC</u>	June 6, Abe & Ko <u>H</u>
<b>7KII</b> Sample Size: X= Weight: Mn coating: Color (inside): Alteration: no. Vesloularity: Lithology: mo Occurrence: ma gneous & Ultrame Volcanic: besait	2 <b>391</b> / <b>R</b> - <u>so</u> g mm <u>dvvb</u> <u>by 0 alld</u> week streng % nomict or polymict sives lavas volcanic <b>atic Rocks</b> basaltic andesite an	 cm. z= lastics sedim desite dacite	cm ents <u>cothers</u> e rhyolite	Described by SKETC	June 6, Abe & Ko <u>H</u>
<b>7KII</b> Sample Size:         Weight:         Mn coating:         Color (inside):         Aiteration:         No         Vesloularity:         Lithology:         Mocoting:         Color (inside):         Aiteration:         No         Vesloularity:         Lithology:         Mocotine:         Volcanic:         basait         Thicknes         Phenocy	2 <b>391</b> / <b>R</b> - <u>so</u> g <u>mm</u> <u>dvvb byoalit</u> . <u>week streng</u> <u>%</u> nomict or polymict seives lavas volcanic <b>affic Rocks</b> basaltic andesite an so of glass: wester <u>%</u>	 cm. z= llastics sedim desite dacite nm	cm ents <u>cothers</u> e rhyolite %	Described by <u>SKETC</u>	June 6, <u>Abe &amp; Ko</u> <u>H</u>
7KII#         Sample Size:       X=         Weight:       Mn coating:         Color (inside):       Alteration:         Alteration:       no.         Vesloularity:       Interation:         Lithology:       mo         Occurrence:       ma         Velcanic:       basait         Thicknes       Phenocr         Phutonic:       gabbro	2 <b>391</b> / <b>R</b> - <u>so</u> g <u>mm</u> <u>so</u> g <u>mm</u> <u>so</u> g <u>mm</u> <u>so</u> g <u>mm</u> <u>so</u> g <u>mm</u> <u>so</u> g <u>sives</u> lavas volcanic <b>sives</b> lavas volcanic <b>so</b> diglass: <u>so</u> g <u>so</u> diglass: <u>so</u> di di diglass: <u>so</u> d	cm. z= _cm. z= lastics sedim desite dacite nm %, e granite	cm ents <u>cothers</u> e rhyolite %	Described by <u>SKETC</u>	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7KII</b> #         Sample Size:       X=         Weight:       Min coating:         Color (inside):       Min coating:         Atteration:       no.         Veloularity:       Min coating:         Lithology:       mo         Occurrence:       ma         gneous & Ultrama       Volcanic:         Volcanic:       basali         Thicknes       Phenocr         Plutonic:       gabbro         Crystals:       Crystals:	2 <b>391/ R-</b> <u>streng</u> <u>week streng</u> <u>week streng</u>	_cm. z= _cm. z= lastics sedim- desite dacite _mm %, e granite %,	cm ents <u>cothes</u> e rhyolite %	Described by <u>SKETC</u>	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7KII</b> Sample Size:       X=         Weight:       Mn coating:         Color (inside):       Aiteration:         Aiteration:       no.         Vesloularity:       Lithology:         Lithology:       mo         Occurrence:       ma         Volcanic:       basali         Thicknes       Phenocr         Plutonic:       gaboro         Crystals:       Ultramafici lerzoitie         Crystals:       Ultramafici lerzoitie	2 <b>391</b> / <b>R</b> - <u>so</u> g <u>mm</u> <u>so</u> g <u>mm</u> <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>so</u> g <u>sives</u> lavas volcanic <b>affic</b> Rocks basaltic andesite an ss of glass: ysts= %, diorite quartz diorite = %, harzburgite dunite = %,	cm. Z= _cm. Z= lastics sedim desite dacite _nm %, e granite _%, granite _%, granite _%,	cm ents <u>cothers</u> e rhyolite % others %	Described by <u>SKETC</u>	June 6, <u>Abe &amp; Ko</u> <u>H</u>
7KII#         Sample Size:       X=         Weight:	2 <b>391/ R-</b> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>source</u> <u>s</u>	Cm. Z= _cm. Z= desite decite _mm %, e granite %, pyroxenite _%,	ents <u>cothes</u> e rhyolite % others %	Described by <u>SKETC</u>	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7KII</b> Sample Size:         Weight:         Mn coating:         Color (inside):         Atteration:         Atteration:         No         Vesleularity:         Lithology:         ma <b>Gneous &amp; Ultrams</b> Volcanic:       basali         Thicknes         Phenocr         Plutonic:       gabbro         Crystals:         Ultramafic:       lerzolite         Crystals:         Uttrasf:         Cothers:	2 <b>391/ R-</b> <u>step</u> <u>step</u> <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>sives</u> lavas volcanic <b>aftc Rocks</b> basatito andesite an sso of glass: <u>yestes</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u> <u>step</u>	() 2 _cm. Z= lastics sedim- desite dacite _mm %, e granite %, pyroxenite %, pyroxenite %,	cm ents <u>{othecs</u> e rhyolite % others % e clasts)	Described by <u>SKETC</u>	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7KII</b> Sample Size:         Weight:         Mn coeting:         Color (inside):         Atteration:         Atteration:         No         Vesleularity:         Lithology:         mo         Occurrence:         Manage:         Volcanic:         basait         Thicknes:         Phenocr         Plutonic:         gabbro         Crystals:         Ultramafic:         Uitramafic:         Cothers:         Sedimentary rocks:         Fragments comp:	2 <b>391/ R-</b> <u>cm, Y=</u> <u>g</u> <u>mm</u> <u>dwth</u> <u>by 0 aut</u> <u>- week</u> streng <u>- week</u> streng <u>sives</u> lavas volcanic <b>ab</b> baaltic andesite an sives lavas volcanic <b>b</b> baaltic andesite an <b>b</b> baaltic an <b>b</b> baaltic andesite an <b>b</b> baaltic andesite an <b>b</b>	() 2 _cm. Z= lastics sedim- desite dacite _mm %, e granite %, pyroxenite %, pyroxenite %,	cm ents <u>others</u> e rhyolite % others % e clasts)	Described by <u>SKETC</u>	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7KII</b> Sample Size:         Weight:         Mn coating:         Color (inside):         Aiteration:         Note and the second s	2 <b>391/ R-</b> <u>standown</u> <u>standown</u> <u>standown</u> <u>streng</u> <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>streng</u> <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>week</u> streng <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>week</u> <u>streng</u> <u>streng</u> <u>streng</u> <u>streng</u> <u>streng</u> <u>streng</u> <u>streng</u> <u>s</u>	() $()$ $()$ $()$ $()$ $()$ $()$ $()$	cm ents <u>others</u> e rhyolite % others % e clasts) - 256 <	Described by <u>SKETC</u>	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7KII#</b> Sample Size:       X=         Weight:       Mn coeting:         Mn coeting:       Color (inside):         Color (inside):       Mn coeting:         Aiteration:       no.         Veeloularity:       Intichology:         Lithology:       mo         Occurrence:       ma         gneous & Ultramation:       Phenocr         Plutonic:       gabbro         Crystals:       Others:         Stationentary rocks       Fragments comp.:         Rock type:       Grain size (mm):         Sorting :       Sorting :	2 3917 R- 372 g mm CAVE braint. week strong week s	() $()$ $()$ $()$ $()$ $()$ $()$ $()$	cm ents <u>cothers</u> e rhyolite % others % e clasts) - 256 <	Described by SKETC	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7 K II #</b> Sample Size:       X=         Weight:       Mn coating:         Color (inside):       Mn         Alteration:       no.         Vesloularity:       Mn         Lithology:       mo         Occurrence:       ma         gneous & Ultrama       Crystals:         Volcanic:       besait         Thicknes:       Phenocr         Plutonic:       gabbro         Crystals:       Ultramafic: lerzoite         Others:       Sodimentary rocks         Fragments comp.:       Rock type:         Grain size (mm) :       Sorting :         Roundness :       Echeint :	2 3917 R- 30917 R- 30917 R- 300 P OUM Week strong Week strong 	2 _cm. Z= lastics sedim- desite dacite _mm %, e granite %, pyroxenite %, teristic of th $\frac{52-64-128-2}{$	cm ents <u>others</u> e rhyolite % others % e clasts) - 256 <	Described by SKETC	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7 K II #</b> Sample Size:       X=         Weight:       Mn coating:         Color (inside):       Mn         Alteration:       no.         Veloularity:       Mn         Lithology:       mo         Occurrence:       ma         Veloanic:       besait         Thicknes:       Phenocr         Plutonic:       gabbro         Crystals:       Ultramafic: lerzolite         Ultramafic:       lerzolite         Fragments comp.:       Rock type:         Grain size (mm):       Sorting :         Roundness :       Fradric (mm):         Sorting :       Roundness :	2 391/ R- 52 9 mm Multic by Bulk week strong week	2 _cm. Z= desites sedime desite dacite _mm %, e granite %, pyroxenite %, teristic of th $\frac{122-64-129-}{36}$ , teristic of th $\frac{122-64-129-}{36}$ ,	cm ents <u>Others</u> e rhyolite % others % e clasts) - 256 <	Described by SKETC	June 6, <u>_Abe &amp; Ko</u> <u>H</u>
<b>7 K II #</b> Sample Size:       X=         Weight:       Mn coating:         Color (Inside):       Mn         Alteration:       no.         Velocanic:       besait         Thicknes:       Phenocr         Volcanic:       besait         Thicknes:       Phenocr         Voltarnic:       gabbro         Crystals:       Ultramafic:         Ultramafic:       lorzoites:         Sedimentary rocks:       Fragments comp.:         Rock type:       Grain size (mm) :         Sorting :       Roundness :         Fabric:       Grading :         Matrix :       "	2 391/ R- 52 9 mm 52 9 mm 52 9 mm 52 9 mm 52 9 mm 52 9 mm 52 9 mm 52 9 mm 52 9 mm 54 0 by 80/4 54 or polymict 54 or polymict 54 or polymict 54 or polymict 54 or polymict 55 0 and 10 and	O 2 _cm. Z= desites sedime desite dacite _mm %, e granite %, pyroxenite %, feristic of th x2 - 64 - 129 -  teristic of th x2 - 64 - 129 -  matrix supp rev	cm ents <u>cothers</u> e rhyolite % others % e clasts) - 256 < port werse	Described by SKETC	June 6, <u>Abe &amp; Ko</u> <u>H</u>
<b>7 K II #</b> Sample Size:       X=         Weight:       Mn coating:         Color (inside):       Mn coating:         Alteration:       no.         Veloularity:       Lithology:         Lithology:       mo         Occurrence:       ma         Veloanic:       basait         Thicknes:       Phenocr         Plutonic:       gabbro         Crystals:       Ultramafic: lerzolite         Veloanic:       basait         Thicknes:       Fragments comp.:         Roudness:       Fragments comp.:         Rock type:       Grain size (mm) :         Sorting :       Roundness :         Fabric:       Gracing :         Matrix :       Lithic:	2 391/ R- 3091/ R- 3091/ R- 3091/ R- 300 300 300 300 300 300 300 300 300 30	() 2 _cm. Z= desites sedime desite dacite _mm $%_{0}$ , e granite $%_{0}$ , pyroxenite $%_{0}$ , teristic of th 32 - 64 - 128	cm ents <u>Cithers</u> e rhyolite % others % e clasts) - 256 <	Described by SKETC	June 6, <u>Abe &amp; Ko</u> <u>H</u>

7K II #	<b>391</b> 2 <b>R-</b> 03	Described bv	June 6, 2007 Abe & Koike
Sample Size: X= Weight: Mn coating: Color (inside): Alteration: Vesicularity: Lithology: Docurrence:	<u></u>	SKETCH	 <u>1</u>
gneous & Ultran	afic Rocks		
Volcanic: basalt	basaltic andesite andesite dacite rhyolite		
Phenoc Plutonic: gabbro Crystal: Ultramafic: lerzolite Crystal: Others:	rysts= %, %, % diorite quartz diorite granite = %, %, %, % harzburgite dunite pyroxenite others s= %, %, %		
Sedimentary roci	(s & others (characteristic of the clasts)		
Fragments comp.:	mono or poly		
Rock type; Grain size (mm) :	< 1 - 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256 <		
Sorting :	well-poorly		
Roundness :	roundangular		
Fabric:	clast-support matrix support		
Grading : Matrix	normalreverse		
Lithic:	Lithified or unlithified		
<b>Remarks</b> ри	mlle .		
	2		
			June 6, 2007

[ <b>7K II #391 R-</b> 0∕	Described by	Abe & Koike
Sample Size:       X= $/ 3$ cm, Y= $// cm$ , Z= $/ cm$ Weight: $/ 550$ g         Min coating: $/ 2$ mm         Color (inside): $dark + arcm/$ Alteration:       no         Vesicularity: $m$ Lithology:       monomict or polymict         Occurrence:       massives' lavas volcaniclastics sediments others	<u>SKETCI</u>	<u>H</u>
Igneous & Ultramafic Rocks		
Volcanic: (Gasalt) basaltic andesite andesite dacite myolite		
Phenocrysts= $\hat{\mu}/\mathcal{L}$ %. %.		
Plutonic: gabbro diorite quartz diorite granite		
Crystals= %, %, %		
Crystals= % % %		
Others:		
Sedimentary rocks & others (characteristic of the clasts)		
Fragments comp.: mono or poly		
Rock type: Crain size (rom): <1, 2, 4, 8, 16, 32, 64, 128, 258 c		
Sorting ; well		
Roundness : roundangular		
Fabric: clast-support matrix support		
Grading : normalnonereverse		
Matrix : sit sand others:		
	·	
Remarks Crack		

7K II #	391	<b>R-</b> 03	⊥. \$≯ )	Described by	June 6, 2007 Abe & Koike
Sample Size: X: Weight: Mn coating: Color (inside): Alteration: Vesicularity: Lithology: Occurrence: </td <td>=<u>23</u> cm, Y <u>3,500</u> g <u>(srk inturn /</u> <u>week</u> 2 st <u>momist or poly</u> assives <u>lav</u>as</td> <td>=<u>/.S</u>om, z m <u>lock at sy</u> rong mict volcaniclastics</td> <td>e<u>  /  ()    </u>em sediments <b>o</b>th</td> <td><u>SKETC</u></td> <td><u>H</u></td>	= <u>23</u> cm, Y <u>3,500</u> g <u>(srk inturn /</u> <u>week</u> 2 st <u>momist or poly</u> assives <u>lav</u> as	= <u>/.S</u> om, z m <u>lock at sy</u> rong mict volcaniclastics	e <u>  /  ()    </u> em sediments <b>o</b> th	<u>SKETC</u>	<u>H</u>
gneous & Uffram Volcanic: Dabalt Thičkim Phenoc Plutonic: gabbro Crystal Ultramafic: lerzolik Crystal Others: Crystal Sedimentary rock Fragments comp.	iafic Rocks >basaltic anders sss of glass: diorite que s= harzburgite a harzburgite (s & others ( mono or p	site andesite <u>&lt;</u> 5mm rtz.diorite gran %, dunite pyra %, characteristic oly	dacite rhyoll %, 9 hite %, 9 xenite others %, 9 cof the clast	te 6 6 6 5	
Rock type: Grain size (mm) : Sorting : Roundness : Fabric: Grading : Matrix :	< 1 – 2 – 4 – 8 well clast-support – normal sitt sand oth	– 16 – 32 – 64 ро гла лопе́ ers: 	– 128 – 256 < orly igular tix support reverse	_ 	

N

7K II #39	912R-06	Described by	June 6, 2007 Abe & Koike
Lange Size: X= <u>/</u> 2- Welght: <u>39</u> 2 Mn coating: <u>5000</u> Color (inside): <u>5000</u> Atteration: no we Vesicularity: <u>inconside</u> Lithology: monomic Occurrence: massives Igneous & Ultramafic R Volcanic: basait basai Thickness of g Phenocrysts= Plutonic: gabbro diori	Com, Y= <u>2</u> om, Z= <u>6</u> om <u>a</u> g <u>b</u> mm <u>davi</u> <u>is tran</u> <u>to r</u> polymict <u>is lavas votoaniolastice</u> sediments other <b>Rocks</b> Itic andesite andesite dacite rhyolite plass:mm <u>%</u> , %, %, % ite quartz diorite granite	SKETCI	<u> </u>
Crystals=	%, %, %		
Crystals=	∠ourgite dunite pyroxenite others % % %		
Others:			
Sedimentary rocks & o Fragments comp.: mono Rock type:	thers (characteristic of the clasts) or poly		
Grain size (mm) : < 1 - :	2-4-8-16-32-64-128-256 <		
Roundness: round	poorly angular		
Fabric: clast-a	support matrix support		
Grading : norma	alreverse		
Matrix: silt s	and others:		
Lithite	ea ar unimmed		
<b>Remarks</b> pumi	i ( 2-		

7K II ;	#39 <i>1</i> ∑F	<b>२-</b> 07	<u>ት</u> '	» be cuit . Described by	Abe & Koike
Sample Size: ) Weight:	(= <u>2%</u> om, Y=	<u>- 15 o</u> m, z= <u>13</u> Wavy	_cm	SKETCI	<u> </u>
Mn coating: Color (inside):	mm	1 · · · /			
Alteration: r	to wn≊ek stro ∞	ng			
Lithology: r	nonomict or polyr nassives lavas v	nict /olcaniclastics_sedim	ents others		
neous & Ultra	nafic Rocks				
Volcanic: Volcasal Thicki	⊭- basattic andesi ness of glass:	te andesite dacite	e rhyolite		
Pheno Plutonic: gabbr	ocrysts= o diorite quart	%. %, tz.diorite granite	%		
Crysta	als=	%, %, dupite pyrovepite	%		
Othernatic, terzon Crysta Others:	als=	%, %,	others %		
edimentary roo	cks & others (cl	haracteristic of th	e clasts)		
Rock type:		"y			
Grain size (mm) Sorting :	: < 1 - 2 - 4 - 8 - well	- 16 - 32 - 64 - 128 - pootly	- 256 <		
Roundness : Eabric:	round	angular	bort		
Grading :	normal		verse		
Matrix : Liffnic:	silt sand othe Lithified or	unlithified			
<b>7Κ Π</b> -	4204 6		ज ¥	be cut	June 6, 2007
7KⅡ‡	#394 <b>∠</b> F	<b>२-</b> <i>0</i> 8	भं फे	be cat Described by _	June 6, 2007 Abe & Koike
7KI	<b>#394∠F</b> :=_ <u>⊃6 cm, </u> y=	<b>₹-</b> 08	∦`te <u>∕</u> cm	becat Described by _ SKFTCI	June 6, 2007 Abe & Koike
<b>7KI</b> Sample Size: > Weight: Mn coating: _	<b>#394∠F</b> :=_ <u>`26 cm, Y=</u> 9 9mm	<b>R-</b> 08 <u></u> cm, z=_7	∦`te ?_cm	becat Described by _ SKETCI	June 6, 2007 _Abe & Koike 
<b>7KI</b> Sample Slze: Neight: Mn coating: Color (inside): Alteration:	<b>#394</b> 2 <b>F</b> = <u></u>	<b>R-</b> 08	∦'te ∑.cm	be cat Described by _ SKETCI	June 6, 2007 _Abe & Koike 
<b>7KI</b> Sample Size: Neight: An coating: Color (inside): Heration: Heration: Heration:	# <b>391</b> 2F =_ <u>}6</u> cm, Y=  	<b>R-</b> 08 <u>1.1 cm</u> , Z= <u>7</u> inecary	∦rite 2_cm	be cat Described by _ SKETCI	June 6, 2007 _Abe & Koike
<b>7KI</b> Sample Size: A Neight: An coating: Color (inside): Atteration: Vesicularity: Uthology: p Docurrence:	#3942F = <u>}</u> 6 cm, Y=  mm dark_ grad ponomic or polym nassives tavas v	<b>R-</b> <i>OS</i> <u>2.1 cm, z=</u> incoury mg nict rotoaniclastics sedime	∦∕†e ∑_cm ents others	be cat Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u> -
<b>7KI</b> Sample Size: X Weight: An coating: Color (inside): Mercularity: Juhology: m Decurrence: X Hearons & Unarch	#394 F = <u>}</u> 6 cm, Y= .9 .9 .9 .9 .9 .9 .9 .9 .9 .9	<b>R-</b> <i>OS</i>	¥ أت ∑_cm ents others	be cat Described by _ SKETCI	June 6, 2007 _ <u>Abe &amp; Koike</u> ─ <mark>/</mark>
<b>7KII</b> Sample Size: X Weight: An coating:	#394 F =	<b>R-</b> <i>OS</i> <u></u> cm, Z= <u></u> incom, Z= <u></u> mg nict rolcaniclastics sedimu te andesite dacits	2_cm 2_cm ents others ≈ rhya]ite	be cat Described by _ SKETCI	June 6, 2007 _Abe & Koike_ _/
<b>7KI</b> Sample Size: A Neight: Uncoating: Color (inside): Alteration: T Jesicularity: D Decurrence: T neous & Ultrar Volcanic: (bassif Thick Thick Plutonle: gabbr	#394≥F = <u>}</u> 6 cm, Y= .9 mm davk= ayaw ba week stro- 	<b>R-</b> <i>OS</i> <u>1000000000000000000000000000000000000</u>	, tre , cm ents others s rhyalite %	be cat Described by _ <u>SKETC</u>	June 6, 2007 <u>Abe &amp; Koike</u> -/
<b>7KII</b> Sample Size: X Weight: Un coating: - Color (inside): Atteration: T Voicularity: - Jithology: T Docurrence: (basgif Thickr Phence Plutonic: gabbo Crysta Ulframafic: lerzoid	#394 F =	<b>R</b> - <i>O</i> <i>L</i> cm, Z= <u>/</u> <i>incomy</i> mict tolcaniclastics sedime te andesite dacite <i>%</i> , <i>%</i> , <i>%</i> , <i>%</i> , <i>w</i> , <i>w</i> , dunite pyroxenite	¥ te 2_cm ents others ⇒ rhyalite % others ~	be cat Described by _ SKETCI	June 6, 2007 _Abe & Koike_ _ <del>_</del>
<b>7KII</b> Sample Size:         Weight:         Mn coating:         Color (inside):         Alteration:         Incoating:         Color (inside):         Alteration:         Intology:         Inthology:         Poccurrence:         Wolcanic:         Volcanic:         Phenc         Plutonic:         gabbn         Crysts         Others:	#394 F = <u>6</u> cm, Y= 9 - mm dark - gray wo weak stro- ponomic or polym nassive lavas v matic Rocks baseltic andesit ress of glass baseltic andesit ress of glass ress of glass of glass ress of glass ress of glass ress of glass r	<b>R</b> - <i>O</i> <i>J.J.</i> cm, Z= <u>/</u> <i>inconvy</i> micl volcaniclastics sedime te andesite dacite <u>%</u> , %, dunite pyroxenite %, <u>%</u> ,	2_cm 2_cm ents others e rhyalite % others %	be cat Described by _ <u>SKETCI</u>	June 6, 2007 _Abe & Koike_ _/
<b>7KI</b> Sample Size: Weight: Min coating: Color (inside): Alteration: Neecularity: Lithology: Mecus & Ultranafic: Plutonic: Discurrence: Thickr Pheno Plutonic: Crysta Ultramafic: lerzoli Crysta Others: Crysta	#394 ≥ F = <u>}</u> 6 cm, Y=       	<b>R</b> - <i>L</i> cm, Z= <i>incony</i> mict volcaniclastics sedimute te andesite dacite %, %, %, dunite pyroxenite %, %, heracteristic of the	2_cm ents others rhyalite % others % e clasts)	be cat Described by <u>-</u> <u>SKETCI</u>	June 6, 2007 _ <u>Abe &amp; Koike</u> _ <u>-</u> /
<b>7 K II</b> Sample Size:         Woight:         Mn coating:         Color (inside):         Atteration:         Thickr         Vesicularity:         Lithology:         Docurrence:         Volcanic:         (basali         Thickr         Pheno         Crystz         Ultramafic:         Lezoit         Crystz         Others:         Sample Size:         Okrain size (mm):	#394 F =	<b>R</b> - $\sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n}$	★ te 2 cm ents others a rhyalite % others % e clasts) -258 <	be cat Described by _ SKETCI	June 6, 2007 _ <u>Abe &amp; Koike</u> <u>−</u>
<b>7 K II</b> Sample Size:         Weight:         Mn coating:         Color (inside):         Alteration:         Veicularity:         Lithology:         Incoating:         Discurrence:         Volcanic:         (baselit         Thickr         Pheno         Crysta         Ultramafic:         Lexprents comp         Crysta         Others:         Crysta         Chers:         Crysta         Chers:         Crysta         Chers:         Crysta         Chers:         Crysta         Chers:         Constantiation         Crysta         Chers:         Constantiation         Constantiation	#394 F =	<b>R</b> - $\sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n}$	× ite 2_cm ents others ⇒ rhyalite % others % e clasts) -258 <	be cat Described by _ SKETCI	June 6, 2007 _Abe & Koike 
<b>7 K II</b> Sample Size:         Woight:         In coating:         Color (inside):         Alteration:         Alteration:         Mologit:         Ultranic:         Volcanic:         Dasgli         Thickr         Pheno:         Crysta         Ultramafic:         Lithology:         Crysta         Ultramafic:         Crysta         Others:         Crysta         Grain size (mm):         Sorting:         Roundness:         Fabric:	#394 F =	<b>R</b> - $O$ $i_1 e e a v y$ $i_2 = 0$ $i_3 = 0$ $i_4 = 0$ $i_1 = 0$ $i_1 = 0$ $i_2 = 0$ $i_1 = 0$ $i_2 = 0$ $i_2 = 0$ $i_3 = 0$ $i_4 = 0$ $i_5 $	× tr con ents others ents others s rhyalite % others % e clasts) 258 <	be cat Described by SKETCI	June 6, 2007 _Abe & Koike_ _/
<b>7KII</b> Sample Size: Noight: Min coating: Color (inside): Color (inside): Color (inside): Color (inside): Color (inside): Color (inside): Color (inside): Color (inside): Color (inside): Decurrence: (inside): Decurrence: (inside): Decurrence: (inside): Decurrence: (inside): Plutonic: passat (inside): Crysta Differs: Grading: Matrix: Matrix:	#394 F = <u></u>	<b>R</b> - <i>L</i> cm, Z= <i>inconvy</i> mict volcaniclastics sedime te andesite dacite %, %, %, dunite pyroxenite %, %, heracteristic of the y - 18 - 32 - 64 - 128 - 	× Tr 2_cm ents others ents others % others % e clasts) 256 < port erse	be cat Described by <u>-</u> <u>SKETCI</u>	June 6, 2007 _ <u>Abe &amp; Koike</u> _ <u>-</u>

7K Π #204 D /2		June 6, 2007
/кш#3942к-0/	Described by _	Abe & Koike
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	<u>SKETC</u>	<u>1</u>
aneous & Ultramafic Rocks		
Volcanic: Masalty basaltic andesite andesite dacite rhyolite	1	
Thickness of glass:mm		
Phenocrysts= $P / > \%$ , %, %		
Plutonic: gabbro diorité quartz diorite granite		
Crystals≔ %, %, %		
Ultramafic: lerzolite harzburgite dunite pyroxenite others		
Crystals= %, %, %		
Others:		
Sedimentary rocks & others (characteristic of the clasts)		
Fragments comp.: mono or poly		
Rock type: $(-1, 2, 4, 9, 18, 32, 84, 128, 358, 4)$		
Sation : well- $x = 4 - 6 - 10 - 52 - 64 - 126 - 250 \times 100$		
Boundness : roundangular		
Fabric: clast-support matrix support		
Grading : normalnonereverse		
Matrix: silt sand others:		
Lithic: Lithified or unlithified		
Remarks Crack		

7K II #3912 R- / ()	Described by _	June 6, 2007 Abe & Koike
Sample Size: X= <u>/ 5</u> cm, Y= <u>/ 3</u> cm, Z= <u>3</u> , cm Weight: <u>9000</u> g	SKETCI	
Mn coating: mm		
Color (inside): <u>dayk graw</u>		
Alteration: no week strong		
Vesicularity:		
Occurrence: massives lavas volcaniclastics sediments other	15	
Innanue & Illtremetic Pocks		
Volcanic: (bealt) basaltic andesite andesite denite thuslite		
Thickness of class: / mm		
Phenocrysts $\frac{b}{7\%}$ , %, %		
Plutonic: gabbro diorite quartz diorite granite		
Crystals= %, %, %		
Ultramafic: lerzolite harzburgite dunite pyroxenite others		
Crystals= %, %, %		
Oners:		
Ereaments comp : mono or poly		
Rock type:		
Grain size (mm): $<1-2-4-8-16-32-64-128-256 <$		
Sorting : wellpoorly		
Roundness : roundangular		
Fabric: clast-support matrix support		
Grading : normalnonareverse		
Matrix: silt send others;		
Lithic: Lithined of Unithined		
Romarks glass		

7K II #394₂	<b>R-</b> / /	Described by _	June 6, 2007 Abe & Koike
Sample Size: X=(cm, `` Weight: m Color (inside): n Color (inside): n Atteration: n Vesicularity: y Lithology: monomict or po Occurrence: nasilyes lavas	Y= <u>/7</u> cm, Z= <u>/</u> cm hm atrong 6 hymict volcaniclastics sediments oth	<u>SKETCI</u>	<u>1</u>
igneous & Ultramafic Rocks Volcanic: <u>Sasal</u> , basaltic ande Thickness of glass: Phenocrysts= P / Plutonic: gabbro diorite qu Crystala= Ultramafic: lerzolite harzburgite Crystals=	esite andesite dacite myoli 	e ,	
Sedimentary rocks & others           Fragments comp.: mono or         Rock type:         Grain size (mm) : <1 - 2 - 4	American Structure         America	;)	
Remarks high vestor	larity		

7K II #391₂R- / 2-	Decoribed by	June 6, 2007
	Described by _	_ADE & KOIKE
Sample Size:         X = cm, Y = cm, Z = cm           Weight:         g           Mn coating:         mm	<u>SKETCI</u>	<u>-</u>
Color (inside): <u>davk grav</u>		
Alteration: no dreeko strong		
Lithology: monomict or polymict		
Occurrence: massives lavas volcaniclastics sediments other	5	
Igneous & Ultramatic Bocks		
Volcanic: Tasalp basalfic andesite andesite dacite rhvolite		
Thickness of glass:mm		
Phenocrysts= / 🦿 %, %, %		
Plutonic: gabbro diorite quartz diorite granite		
Crystals= %, %, %		
Ultramafic: lerzolite harzburgite dunite pyroxenite others		
Crystais= %, %, %		
Others:		
Sectimentary rocks & others (characteristic or the crasts)		
Programments complete from on poly Back bridge		
Grain size (mm) $\leq 1 - 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256 \leq$		
Sortion : well		
Roundness : roundangular		
Fabric: clast-support matrix support		
Grading : normalnonereverse		
Matrix; silt sand others;		
Lithic: Lithified or unlithified		
Romarke		

7K II	<b>#391 R-</b> /3	Described by _	June 6, 2007 Abe & Koike
Sample Size: Weight: Mn coating: Color (inside): Alteration:	X=cm, Y=cm, Z=cm 9 mm m	<u>SKETCH</u>	1
Vesicularity: Lithology: Occurrence:			
<b>Igneous &amp; Ultr</b> Volcanic: base Thic Phe	amafic Rocks alt basaltic andesite andesite dacite rhyolite kness of glass:mmr mocrosts=% % %		
Plutonic: gab. Crys Ultramafic: lerz	bro diorite quantzi ciorite granite stals= %, %, %, % olite harzburgite dunite pyroxenite others		
Others: Sedimentary ro	ocks & others (characteristic of the clasts)		
Fragments con Rock type: Grain size (mm Sorting : Roundness : Fabric: Grading ; Matrix : Lithic:	np.: mone or poly i): <1-2-4-8-16-32-64-128-256 < wellpoorly roundmatrix support normal		
Remarks			

7K II #	<b>#391 R-</b> 74	Described by _	June 6, 2007 Abe & Koike
Sample Size: X: Weight: Mn coating: Color (inside): Alteration: no Vesicularity: Lithology: Occurrence:	=cm, Y=cm, Z= gmm o week strong % nonomicit or polymict lassives lavas voicaniclastics sediments	cm <u>SKETCI</u>	<u> </u>
Igneous & Ultran Volcanic: basalt Thickn Phenoc Plutonic: gabbro Crystal Ultramafic: leizoliti Crystal Others:	$\begin{array}{llllllllllllllllllllllllllllllllllll$	rhyalite % % thers %	
Sectimentary roci Fragments comp.: Rock type: Grain size (mm) : Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	ks & offhers (characteristic of the c mono or poly < 1 - 2 - 4 - 8 - 18 - 32 - 64 - 128 - 25 wellpoorly roundpoorly roundnonerevers silt sand others: Lithified or unlithified	lasts) 6 < :	
Remarks			

/K II I	1391 R. 11-		June 6, 2007
отх <u>да</u> 7	1994 INT / S	Described by _	Abe & Koike
ample Size: X	= <u></u> cm, Y= <u></u> cm, Z= <u></u> cm	SKETC	4
reignt: In costing:	<u>4368 g</u>		<u> </u>
olor (inside):	rellowish aroun		
Iteration: n	week atrong		
esicularity: _	¥		
ithology: m	enemiet or polymiat		
CCULLENCE: 18	assives lavas voicaniclastics sediments other	\$	
eous & Ultran	afic Rocks		
olcanic: basalt	basaltic andesite andesite dacite rhyolite		
Pheno	essolgiass:mm		
lutonic: oabbro	diorite quartz diorite granite		
Črysta	$s = p \sqrt{50} - \frac{1}{50} + \frac{1}{5$	)	
Iltramafic: lerzolit	e harzburgite dunite pyroxenite others "	·	
Crysta	s= %, %, %		
Ithers:	L A		
umentary roc	KS & others (characteristic of the clasts)		
ragments comp. Jock type:	mono or poly		
Grain size (mm) -			
Sorting :	wellpoorly		
Roundiness :	roundangular		
abric:	clast-support matrix support		
Grading :	normalreverse		
viatrix:	şiri, sand others:		
-1(1)1(2.			· ··
	_		
	<u>م</u>		luno 6, 2007
7KⅡ#	<b>i397 R-</b> 76	Described by	June 6, 2007 Abe & Koike
7K II #	<b>13917 R-</b> 76	Described by	June 6, 2007 Abe & Koike
7KI#	<b>1391 R-</b> / 6	Described by	June 6, 2007 Abe & Koike
7KII #	<b>1391 R-</b> /6	Described by	June 6, 2007 _Abe & Koike -/
<b>7KII</b> ample Size: X Veight: In coating:	<b>1391 R-</b> /6 = / & cm, v= <u>/ / cm</u> <u>\$ % c0 g</u> w/ mm	Described by	June 6, 2007 _Abe & Koike -/
<b>7KI</b> ample Size: X Keight: In coating: olor (inside): <u>-</u> (keration: n	<b>1391 R-</b> /6 <b>(8 cm, y= <u>/2 cm, z= // cm</u>) <b>(1 mm)</b> <b>(1 mm)</b> <b>(2 mm)</b> <b>(2 mm)</b> <b>(2 mm)</b> <b>(2 mm)</b> <b>(3 mm)</b> <b>(3 mm)</b> <b>(3 mm)</b> <b>(3 mm)</b> <b>(3 mm)</b> <b>(4 mm)</b> <b>(4 mm)</b> <b>(5 mm)</b> <b>(5 mm)</b> <b>(5 mm)</b> <b>(6 mm)</b> <b>(5 mm)</b> <b>(6 mm)</b> <b>(7 mm)</b> <b>(</b></b>	Described by	June 6, 2007 _Abe & Koike -/
<b>7KI</b> sample Size: X Veight: In coating: color (inside): literation: veiscularity:	<b>391 R-</b> /6 (Second yread yr	Described by _ SKETCI	June 6, 2007 _Abe & Koike -/
<b>7KI</b> ample Size: X reight: in coating: olor (inside): <u>r</u> iteration: n esicularity: ithology: r	<b>391 R-</b> / 6 (8 cm, Y= <u>^2</u> cm, Z= <u>//</u> cm <u>stark grav</u> week strong week strong - 1 % onomict or polymict	Described by _ <u>SKETCI</u>	June 6, 2007 _Abe & Koike -/
<b>7KI</b> ample Size: X deight: in coating: olor (inside): 4 desicularity: ithology: 7 becurrence: 8	<b>391 R-</b> /6 (8 cm, Y=_7 cm, Z=_// cm (8 cm, Y=_7 cm, Z=_// cm (9 c/ mm terk grav (9 cm terk grav (9 cm (10 cm) (10 cm) (	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u>
<b>7KII</b> ample Size: X deight: in coating: olor (inside): iteration: n esicularity: ithology: recurrence: recours & U <u>itran</u>	<b>1391 R-</b> <b>Control R-</b> <b>Start R-</b> <b>Start R-</b> <b>G</b> <b>Start R-</b> <b>Start R- <b>Start R-</b> <b>Start R- <b>Start R-</b> <b>Start R-</b> <b>Start R-</b> <b></b></b></b>	Described by _ <u>SKETCI</u>	June 6, 2007 _Abe & Koike 
ample Size: X deight: In coating: - olor (inside): - Iteration: - n esicularity: - ithology: - recurrence: - recurrence: - recurs & Ultran olcanic: - 	<b>1391 R-</b> /6 <b>1391 R-</b> /6 <b>1</b> & cm, Y= <u>7</u> cm, Z= <u>7</u> cm <b>1</b> & cm	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u>
<b>7KI</b> ample Size: X keight: In coating: - olor (inside): - literation: - esicularity: - ithology: - recurse. Witran Folcanic: - Dasgli Thickn Thickn	<b>391 R</b> -/6 <b>See</b> g <b>See</b> g	Described by _ SKETCI	June 6, 2007 <u>Abe &amp; Koike</u>
<b>7KII</b> ample Size: X keight: in coating: olor (inside): iteration: iteration: iteration: recurrence: recurrence: recurrence: recurrence: toicanic: Thickn Pheno Retration: Pheno Retration: Pheno Retration: Pheno Retration: Pheno Retration: Pheno Retration: Pheno Retration: Pheno Retration: Retratio	<b>391 R</b> -/6 (391 <b>R</b> -/6 (Com, Y=_72 cm, Z=_// cm <u>twik grav</u> week strong <u>4</u> % onomict or polymict <u>assing</u> lavas volcaniclastics sediments other hastic andesite andesite dacite rhyolite ess of glass:mm crysts= FY %, %, %	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u>
<b>7KII</b> ample Size: X deight: in coating: olor (inside): itheration: n escularity: ithology: n becurrence: a thickn recourrence: a thickn Pheno Pheno Pheno Crysta	<b>1391 R</b> - / 6 = / 8 cm, Y= <u>/ 2</u> cm, Z= <u>/ / cm</u> <u>5 % co</u> g <u>&lt; / mm</u> <u>tark grav</u> o week strong <u>&gt; 4 %</u> onomict or polymict <u>assive</u> s lavas volcaniclastics sediments other <u>hafic Rocks</u> basattic andesite andesite dacite rhyolite ess of glass: <u>mm</u> crysts= F/ %, % %	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u>
<b>7KII</b> ample Size: X deight: in coating: olor (inside): di iteration: n esicularity: iteration: n esicularity: n tolcaric: baselit recurrence: g terous & Ultran folcaric: baselit recurrence: g tolcaric: coasi phono lutonic: gabbro Corpsta Ditramafic: lezzolit	<b>1391 R</b> - / 6 <b>391 R</b> - / 6 <b>1</b> <i>g g g g g g g g g g</i>	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u>
<b>7KII</b> ample Size: X deight: olor (inside): in coating: olor (inside): ithology: m iccurrence: @ recurrence: @ recurren	<b>1391 R</b> -/6 <b>391 R</b> -/6 <b>S C C C C C C C C C C</b>	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u> <u>-</u>
<b>7KII</b> iample Size: X Veight: In coating: Color (inside): Viteration: resicutarity: ibiology: m resours & Ultran Poccurrence: M resours & Ultran Poccurrence: M Pheno Plutonic: gabbro Crysta Ultramafic: lerzolit Crysta Dthers:	<b>139 1 R</b> - / 6 <b>1 2</b> cm, Y= <u>7</u> cm, Z= <u>//</u> cm <b>1 2 6</b> cm, Y= <u>7</u> cm, Z= <u>//</u> cm <b>1 2 6</b> cm, Y= <u>7</u> cm, Z= <u>//</u> cm <b>1 2 6</b> cm, Z= <u>//</u> cm <b>1 2</b> cm, Z= <u>// cm</u> <b>1 2</b> cm, Z= <u>// cm, Z= <u>// cm}</u> <b>1 2</b> cm, Z= <u>// cm, Z= <u>// cm} <b>1 2</b> cm, Z= <u>// cm, Z= <u>// cm} <b>1 2</b> cm, Z= <u>// cm, Z= <u>// cm} <b>1 2</b> cm, Z= <u>// cm, Z= <u>// cm} <b>1 2</b> cm, Z= <u>// cm, Z= <u>// cm} <b>1 2</b> cm, Z= <u>// cm, Z= <u>// cm, Z= <u>// cm} <b>1 2</b> cm, Z= <u>// cm, Z= <u>// cm} <b></b></u></u></u></u></u></u></u></u></u></u></u></u></u></u></u></u>	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u>
<b>7KII</b> ample Size: X Veight: In coating: color (inside): ithology: ithology: recurs & Ultran Folcanic: Pheno Putonic: pasple Ultranafic: lerzoiti Crysta Ultranafic: lerzoiti Crysta Ditamatic: lerzoiti Crysta Ditamatic: lerzoiti Crysta Ditamatic: lerzoiti Crysta	<b>391 R</b> -/6 <b>Second</b> g <b>Second</b> g <b>Sec</b>	Described by _ <u>SKETCI</u>	June 6, 2007 _ <u>Abe &amp; Koike</u> 
<b>7KII</b> ample Size: X Veight: In coating: in coating: interation: n ithology: m lecurrence: m reous & Ultran rolcanic: Dasgle Thickn Pheno Pheno Crysta Ultramafic: lezzolit Crysta Ultramafic: lezzolit Crysta Ultramafic: comp. Caberton Compositioned and a comp. Constantioned and a com	<b>1391 R</b> -/6 <b>391 R</b> -/6 <b>Strop</b> g <b>C</b> /mm <u>twk grow</u> week strong <b>C</b> /% onomict or polymict <u>assing</u> s lavas volcaniclastics sediments other <b>basatic andesite</b> andesite dacite rhyolite ess of glass:mm crysts= F/%, %, % e harzburgile dunite granite s= %, %, % e harzburgile dunite pyroxenite others s= %, %, % <b>ks &amp; others (characteristic of the clasts)</b> ; mono or poly	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u> <u>-</u>
<b>7KII</b> ample Size: X Veight: In coating: olor (inside): iteration: iteration: rescularity: iteration: rescularity: rescularity: rescularity: rescularity: rescularity: Pheno Phe	<b>391 R</b> -76 <b>Solution Solution R</b> -76 <b>Solution Solution Solut</b>	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u>
TKIL ample Size: X Veight: In coating: - iolor (inside): - isloration: - asicularity: - resicularity:	<b>391 R</b> -76 <b>391 R</b> -76 <b>391 R</b> -76 <b>5</b> $\frac{18}{200}$ g <b>6</b> $\frac{18}{200}$ g <b>7</b> $\frac{19}{200}$ mm <b>1</b> $\frac{19}{200}$ strong <b>6</b> $\frac{19}{200}$ strong <b>7</b> $\frac{19}{200}$ strong <b>6</b> $\frac{19}{200}$ strong <b>7</b> $\frac{19}{200}$ strong <b>6</b> $\frac{19}{200}$ strong <b>7</b> $\frac{19}{200}$	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u>
ample Size:       X         Veight:       In coating:         In coating:       In coating:         ithology:       In result         recurrence:       By         rolcanic:       Dasplit         rolcanic:       Crysta         uthers:       Crysta         dimentary roc       Fragments comp.         radin size (mm):       Sorting :         Roundness:       Sorting :	<b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b> <b>S</b>	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u> <u>-</u>
<b>7KII</b> ample Size: X Veight: In coating: in coating: in coating: color (inside): ithology: ithology: recurse: ithology: ithology: recurse: ithology: ithology: ithology: recurse: ithology: itholo	$\begin{array}{c c} & & & & \\ \hline \textbf{$391$' R- / 6} \\ \hline \textbf{$$500$' g} \\ \hline \textbf{$$500$' g} \\ \hline \textbf{$$600$' g} \\ \hline \textbf{$$700$' g} \hline \hline \textbf{$$700$' g} \\ \hline \textbf{$$700$' g} \hline $	Described by _ SKETCI	June 6, 2007 <u>Abe &amp; Koike</u>
<b>7KII</b> ample Size: X kight: In coating: literation: n ithrology: rr ithology: rr ithol	$\begin{array}{c} & & & \\ \hline \textbf{$391$ R-76} \\ \hline \textbf{$391$ R-76} \\ \hline $1000000000000000000000000000000000000$	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u> <u>-</u>
<b>7KII</b> ample Size: X Veight:	<b>391 R</b> -76 <b>391 R</b> -76 <b>C</b> $(\delta_{cm}, Y = \underline{72}, cm, Z = \underline{76}, cm)$ <b>S</b> $(\delta_{c}, \sigma)$ <b>S</b> $(\delta_{$	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u> <u>-</u>
<b>7KII</b> iample Size: X Veight: Sin coating: color (inside): ithology: ithology: ithology: reous & Ultran Volcanic: reous & Ultran Pheno Plutonic: corysta Ditramafic: lerzolit Crysta Ditramafic: lerzolit Crysta Ditramafic: lerzolit Crysta Ditramafic: lerzolit Grista size (mm) : Sorting :	<b>391 R</b> -76 <b>391 R</b> -76 <b>C</b> $(S_{cm}, Y = \underline{72}, cm, Z = \underline{77}, cm)$ <b>S</b> $(S_{cm}, Y = \underline{72}, cm, Z = \underline{77}, cm)$ <b>S</b> $(S_{cm}, Y = \underline{72}, cm)$ <b>S</b>	Described by _ <u>SKETCI</u>	June 6, 2007 <u>Abe &amp; Koike</u> <u>-</u>
<b>7KII</b> Fample Size: X Veight: An coating: Color (inside): 4 Vieration: n fesicularity: ithology: fr boccurrence: 10 feous & Ultran folcanic: baseli Thickn Pheno Putonic: gabbre Crysta Ditramatic: lezzolit Crysta Ditransize (mm): Sorting : Rock type: Grain size (mm): Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	<b>1391 R</b> -/6 <b>S C C C C C C C C C C</b>	Described by <u></u> SKETCI	June 6, 2007 <u>Abe &amp; Koike</u> <u>-</u>

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7KⅡ#391⁄2R-77	Described by _	June 6, 2007 Abe & Koike
Sample Size:       X=cm, Y=cm, Z=cm         Weight:      k60g         Mn coating:      greey         Color (inside):      dreey         Alteration:       nmm         Color (inside):      dreey         Alteration:       no         vesicularity:      %        %       monomict or polymict.         Occurrence:       massives lavas volcaniclastics sediments others         igneous & Ultramafic Rocks      mm         Volcanic:       basaltic andesite         Volcanic:       gabbo         gabbo       diorite quartz diorite granite         Crystals=       %, %, %         Plutonic:       gabbo         gabbo       diorite quartz diorite granite         Crystals=       %, %, %         Ultramafic: leizolite       harzburgite         dunite       pyroxenite       others:         Crystals=       %, %, %         Sedimentary rocks & others (characteristic of the clasts)         Fragments comp.:       mono         Fragments comp.:       mono         Grain size (mm):       <1-2-4-8-16-32-64-128-256	<u>SKETC</u>	<u>+</u>
Remarks pumice with this mangamese. In god ule		

7K II #	1391 R- UN /	Described by _	June 6, 2007 Abe & Koike
Sample Size: X <sup>±</sup> Weight: Min coating: Color (inside): Alteration: Vesicularity: Lithology: Occurrence:	=om, Y=om, Z=om g mm % ronomict or polymict rassives lavas volcaniclastics sediments others	<u>SKETC</u>	1
Igneous & Ulfram. Volcanic: besalt Thilokne Pienoc Plutonic: gabbro Crystal: Ultramefic: lerzolik Cthers: Seclimentary rocl Fragments comp.;	bits       bits       andesite       andesite       daoite       rhyolite         bits       bits       mm       mm </td <td></td> <td></td>		
Rock type: Grain size (mm) : Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	< 1 - 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256 < well		
Remarks			

7K II #	391 R- (///	12	Described by	June 6, 2007 Abe & Koike
Sample Size: X= Weight: Mn coating: Color (inslde): Alteration: no Veslcularity: Lithology: mm Occurrence: ma	- <u></u>	cm ~-3 cm	<u>SKETCH</u>	!
Igneous & Ultram Volcanic: basait Thickne Phenac Crystals Ultramafic: lerzolite Crystals Others: Sedimentary rock Fragments comp.;	bafic Rocks basatic andesite andesite dac iss of glass:mm yrsts=%, %, diorite quartz diorite granite g=%, %, a harzburgite dunite pyroxenite 3=%, %, ts & others (characteristic of t mono or poly	vite rhyolite % e others % <b>the clasts</b> )		
Rock type: Grain size (mm) : Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	< 1 - 2 - 4 - B - 16 - 32 - 64 - 128 well	) – 256 < , ,upport reverse		
Remarks				

Sample Size:       X=	
Alteration:       no       week       strong         Vesicularity:	
Occurrence:       massives       lavas       volcaniclastics       sediments       others         Igneous & Ultramatic Rocks       Volcanic:       basalt       basalt       basalt       basalt       others         Volcanic:       basalt       basalt       andesite       andesite       dacite       myolite         Thickness of glass:      mm      mm      mm      mm      mm         Phenocrysts=       %,       %,       %      mm         Crystals=       %,       %,       %         Ultramatic:       larzburgite       dunite       pyroxenite       others         Crystals=       %,       %,       %       %         Others:	
gneous & Utramatic Rocks         Voloanic: basalt basaltic andesite andesite dacite rhyolite         Thickness of glass:      mm         Phenocrysts=       %, %, %         Plutonic: gabbro diorite quartz diorite granite      mm         Crystals=       %, %, %         U!tramafic: larzofite harzburgite dunite pyroxenite others      m%, %, %         Others:	
Plutonic: gabbro diorite quartz diorite granite Crystals= %, %, % Ultramafic: larzolite harzburgite dunite pyroxenite others Crystals= %, %, % Others: Sodimantary rocks & others (characteristic of the clasts)	
Ultramatic: lerzolitie harzburgite dunite pyroxenite others Crystais= %, %, % Others:	
Sedimentary rocks & others (characteristic of the clasts)	
Fragments comp.: mono or poly Rock type:	
Grain size (mm): < 1 - 2 - 4 - 8 - 18 - 32 - 64 - 128 - 258 < Sorting: well	
Fabric: clast-support matrix support	
Grading: normal—nonereverse Matrix: silt sand others: Lithic: Lithifed pr unlithified	
Remarks	





#### 4.6 Report on the Kaiko 7000 II Dive#393 on 2006/06/07

Stephen Kirby (USGS) and Natsue Abe (IFREE, JAMSTEC)

This dive started at depth 5320m, 38°08.1000'N latitude, 145°02.0000'E longitude and end at depth 5207m, 38°08.1346 latitude, 145°01.3265E longitude. The target is one of Chocochip knolls which is considered as a kind of petit spot volcano. The aim of this dive is to observe on the surface of this knoll and to take rock samples from this knoll. There is slightly large crater on the top unexpectedly. 15 rock specimens were sampled during the dive including 10 basaltic and high vesicular fresh basalt that looks similar to the petit spot rock, and some pumice and manganese crusts. This is the second petit spot that is discovered except Yukawa knoll area and Kaiko knolls area and sampled fresh basaltic samples.

The dive record, dive log, list of samples are shown in Tables 4.6.1-4.6.3, respectively. The dive chart and dive track are shown in Figs. 4.6.1-4.6.2.

かいこう7000Ⅱ 潜航記録 平成 19 年 KR07-07 行動 記載者 瀬底 秀樹 潜航年月日 2007 年 06/07 着底予定位置 27 度 38°08, 10' N 潜航回数 **1**€ ⊡ 綷 廔 145° 02, 00' E 通算潜航函数 393 回 測地系 WGS-84 潜 航 海 域 旧本海溝沖 チョコチップ海丘群 日本海湾沖アウターライズ上の小海丘における調査 潜 航 目 的 調査潜航 を行う 調査主任 藤本 博己 ランチャー PILOT 重竹 誠こ 屆 東北大学 所 PILOT 潜松 營 .\_ . . . . . . . COPILOT 湖底 秀樹 作 業経過時刻 罴 āt 時 間 吊 揚 08:24 潜航時間 7:36 08:30 着 水 前回潜航 2401:39 通算灌航 10:23 2409:15 蕑 脱 底 10:38 ケーブル使用時間 着 ケプ♪番号別健用時間 鼪 14:22 1次使用時間 7:49 1 次 番 号 底 2 "次番号别时回時間 14:36 2499:21 1586: 6 結 合 1次前回時間 1593:55 16:06 〔次通算時間 2507:10 1.次拼号引戴廓珊剧 7次 切 16:13 傷 収 完 了 2次使用時間 4:132 次 番 号 5 2次前回時間 1091:30 2 次 开号 別前間 時間 87:50 1095:43 2.次番号引资序時間 2 次通算時間 92: 3 海象 気象 天候 風向 風力 波浪 うねり 視程 bc 4 1 South 3 10 最大潜航深度 5286 m 着 底 深 度 5286 m 離底深度 5105 m 着底底質泥 離底底質礙 断層地形を探しながら小海丘麓の平坦部を航走、小海丘斜面と山頂部にて露頭 観察と岩石試料採取を行った。 記事

調査種類 <u>かにう調査滞航</u> 調査海域 日本海湖市 チョンチッア 海丘学

	時刻	深度	作業内容	緯度	経度
	08:3 <b>0</b>		着水 Ð=5303m.	38-09.9804N 145-02.0632E	X: Ye
	:48	150m	下降開始 深度 5000 m #2	08.0786	X:-2.7 ж Х:-2.7 ж
	10:23	5143 M (L)	VCL離鼠	1245	X:45.3
	:38	5286	着底		<u>x:a/</u> X:34.7
	11:26	5:254			Y; 5,3 X: <del>1</del> 6.7
	:36	\$241		<u>01.7865</u> -1228	Y:-312.0 X: 53.3
		k 194	- 九田1131へ() 泉木1010-	<u>,7291</u> .127/ <del>4</del>	<u>Y:-398.7</u> X:50.7
	-10 .EQ	UZZ]	100 m (2 la) " (3,00	.6943 .360	Y:-446.7 X: 66.7
	:50	5172	"(1個)。⑤	.6185	Y:-557.3
	12:18	5/7/	光岩侯殷(1個) 9 0	.6076	<u>Y-5733</u>
	:2/		若石揆取(1個) 1 ⑦	? 	X: Y: 1
	:27	5/60	<u></u>	-1544 -6021	X: 100.0 Y:=581.3
	35	5148	り (1個) り ()	,1447 	X: 72.7 Y:-589.3
	:54	5/27	/ (1個) / 10	. 1447 . 5090	X: 82.7 Y:-717.3
	13:09	5/23	泥岩採取(1個) "②	1447	X: 32.7 Y=7400
İ	:30	5116	岩石採取(1/11)。③	.1879	X: 162.7 X-790.7
	:31	4	泥岩採取(1個) 《 图		X: *
	14:04	5177	岩石探取(4圈)。图	-1778	X: /440
	: 2.2	5105	<u>御</u> (京	.1346 726	X: 64.0
	:				<u>Y:-789.0</u> X:
	• •	· · ·	<u> </u>		Y: X:
				· · · · · · · · · · · · · · · · · · ·	Y: X:
	-				Y: X:
	;   ;	' il			<u>Ý:</u>
	;				Y:
	;				X: Y:
	; ;			•	X: Y:

No.

	#393 R- 0/	Described by _	Abe & Koik
Sample Size: Weight: Mn coating:	X°cm, Y=cm, Z=cm 9 mm	<u>SKETCI</u>	1
Color (inside): Alteration: Vesicularity:	na week strong	i	
Lithology: Occurrence:	monomict or polymict massives lavas volcaniclastics sodiments other	ens	
Volcanic: basa Thic Phen Plutonic: gabt Crys Ultramafic: lerze Crys Others:	Interface ROCKS It basaltic andesite andesite dacite rhyolite kness of glass:mm pocrysts= %, %, % pro diorite quartz diorite granite tals= %, %, %, % bilite harzburgite dunite pyroxenite others tals= %, %, %, %	3	
Sedimentary ro Fragments com Rock type: Grain size (mm Sorting :	icks & others (characteristic of the clasts)           p.: mono         or         poly           <1-2-4-8-16-32-64-128-256		
Roundness : Fabric: Grading :	roundangular clast-support matrix support pormalnonereverse		
Motriv :	an aand D(IIBI\$,		

7K II #393 R-02	June 7, 2007 Described by <u>Abe &amp; Koike</u>
Sample Size: X=m, Y=m, Z=m, Y=m, Z=Weight:9 mrt futof:mm futof: Color (inside):week strong Vesleularity:% Lithelogy: monomic or polymict Occurrence: massives lavas volcaniclastics sediment Igneous & Ultramatic Rocks Volcanic: basaltic andesite andesite dacite Thickness of glass:mm Phenocrysts=mm M, Plutonic: gabbro diorite quartz diorite granite Crystals=%, %, Ultramatic: lezolite harzburgite dunite proxenite o Crystals=%, %, Others:%	rhyolite
Setumentary rocks & others (characteristic of the t Fragments comp.: mono or poly Rock type:       Grain size (mm):       Sorting :       well	56 <

7K II #	<b>393 R-</b> 03	Described by _	June 7, 2007 Abe & Koike
Sample Size: X= Weight: Mn coating: Color (inside): Alteration: Vesicularity: Lithology: Mc Occurrence:	= <u>9</u> cm, Y= <u>9</u> cm, Z= <u>S</u> cm <u>180</u> g <u>this</u> mm <u>dark browv</u> week strong <u>40</u> % ponomict or polymict assives levas volcaniclastics sediments others	<u>SKETCH</u>	1
Igneous & Ultram Volcanic: basalt Thickne Phenoc Plutonic: gebbro Crystals Ultramafic: lerzolite Crystals Others:	afic Rocks       andesite       dacite       rhyolite         basaftic andesite       andesite       dacite       rhyolite         ses of glass:      nm		
Sedimentary rock Fragments comp.: Rock type: Grain size (mm) : Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	ks & others (characteristic of the clasts) mono or poly <		
<b>Remarks</b> part	agante. (64)		

7K II #393 R- 04	June 7, 2007 Described by <u>Abe &amp; Koike</u>
Sample Size: X= $/\perp$ cm, Y= $2$ cm, Z= $3$ cm Weight: $\dots \dots	<u>SKETCH</u>
Vasicularity:         40         %           Lithology:         monomict or polymict         Occurrence:         massives laves volcentclastics sediments other	ərs.
Igneous & Ultramatic Rocks Volcanic: basaft basatic andesite andesite dacite rhyolite Thickness of glass:nm Phenocrysts= p/ 2- %. %. %	÷ .
Plutonic: gabbro diorite quartz diorite granite Crystals= %, %, %, Ultramafic: letzolite harzburgite dunite pyroxenite ofthers	
Others:         70, 70           Sedimentary rocks & others (characteristic of the clasts)           Fragments comp.: mono or poly	)
Rock type:           Grain size (mm) :           Sorting :           well	-
Roundness : roundangular Fabric: clast-support markix support Grading : normalnaneraverse Matrix sitt sand others:	
Lithic: Lithified or unlithified Remarks large yeasetyst (al) up to 700	

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7K II #	<b>393 R-</b> 05		Described by	June 7, 2007 Abe & Koike
Sample Size: X= Weight: Mn coating: Color (inside): Alteration: no Vesicularity:	$\begin{array}{c c} \underline{/3} & \text{cm, } Y= \underline{//} & \text{cm, } Z= \underline{\\ \underline{/3} & g \\ \underline{/2} & 20 & \text{mm} \\ \underline{arl}_{k} & \underline{brut}^{r/n} \end{array}$ $\begin{array}{c} & \text{veck} & \text{strong} \\ \underline{-\underline{/2}} & & \text{veck} \\ \underline{-\underline{/2}} & & \text{veck} \end{array}$	<u>. 9</u> cm	<u>SKETCH</u>	!
Occurrence: ma	nomict or polymict ssives ∕laves∑volcaniclastics> se	diments others		
Igneous & Ultram Volcanic: basalt Thickne Phenoc Plutonic: gabbro Crystals Ultramafic: lerzolite Crystals Others: Sedimentary rock	afic Rocks basaltic andesite andesite d ss of glass:mm ysts= c! / %, <sup>1</sup> /y < / %, diorite quartz diorite granite = %, %, harzburgite dunite pyroxer = %, %, s & others (characteristic o	lacite rhyolite % nite others % f the clasts)		
Fragments comp.: Rock type: Grain size (mm) ; Sorting : Roundness : Fabric: Grading : Matrix ; Lithic:	meno or poly < <u>1-2-4-</u> 8-16-32-64-1 well	28 – 256 < v lar support —reverse		
Remarks				

7K II #393 R- 06	Described by _	June 7, 2007 Abe & Koike
Sample Size:     X= <u>i</u> <u>b</u> cm, Y= <u>i</u> <u>b</u> cm, Z= <u>b</u> cm       Weight: <u>260</u> g       Mn coating: <u>mm</u> thin       Color (Inside): <u>derth</u> brown       Alteration: <u>no</u> week strong       Vesicularity: <u>32</u> %       Lithology:     monomict or polymict       Orcurrence: <u>cettersize</u> large: <u>cettersize</u> large:	SKETCH	1
greous & Ultramafic Rocks       Volcanic: (basalt) basaltic andesite andesite dacite rhyolite       Thickness of glass:    mm       Phenocrysts=     2     %, A/     %       Plutonic:     gabbro diorite quartz diorite granite       Crystals=     %, %, %       Ultramafic:     lerzolite     harzburgite dunite       Crystals=     %, %, %       Others:     %, %, %		
Sedimentary rocks & others (characteristic of the clasts)         Fragments comp.: mono or poly         Rock type:         Grain size (mm): $< 1 - 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256 <$ Sorting :         well         Roundness :         round         Fabric:       clast-support         Grading :       normal         matrix :       silt sand others:         Lithic:       Lithified or unlithified		
Remarks tiny Wehrlitz Xeroliths, Xemorrysts crack		

.

7K II #	<b>393 R-</b> 07	Described by	June 7, 2007 Abe & Koike
Sample Size:X=_Weight:	<u>/∂_</u> cm, Y= <u>/é_</u> cm, Z= <u>_/a_</u> cm <u>/√&gt;-</u> mm <u>aris brows</u> week strong	<u>SKETCH</u>	<u>l</u>
Lithology: mor Occurrence: mas	nomict or polymict sives lavas volcaniclastics sediments (other	>	
laneous & Ultrama	fic Rocks	~	
Volcanic: basalt Thicknes	basaltic andesite andesite dacite rhyolite s of glass; mm		
Phenocry Plutonic: gabbro	rsts≖         %,       %,      %,       % diorite quartz diorite granite		
Crystals=	%, %, %		
Ultramatic: terzolite	narzourgne dunke pyroxenke otners		
Others:	70, 70, 70		
Sedimentary rocks Fragments comp.: r Rock type:	<b>&amp; others (characteristic of the clasts)</b> hono or poly		
Grain size (mm) : <	1 - 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256		
Sorting: v	vel]poorly		
Roundness : r	oundangular		
Gradino : r	nati-support		
Matrix : s	silt sand others:		
Lithic: L	ithified or unlithified		
Remarks MA	Crust		
L			

7K II #	393 R-08	June 7, 2007 Described by <u>Abe &amp; Koike</u>
Sample Size: X= Weight: Mn coating: Color (inside): Alteration: rg Vesicularity: Lithology: ma Occurrence: ma	: <u>/ )</u> cm, Y= <u>/ 8</u> cm, Z= <del>_20</del> cm <u>- &amp; 5&gt;55</u> g / 8 <u>- / 8 / 8</u> <u>- / 8 / 8</u> (ark: Errpu) / 8 (ark: Errpu)	<u>SKETCH</u>
Igneous & Ultram Volcanic: basalt Thickne Plutonic: gabbro Crystals Ultramafic: lerzolite Crystals Others:	afic Rocks       .         basaltic andesite       andesite       dacite       rhyolite         ses of glass:      mm       .       .       .         nysts= $\mathcal{O}/\sim \infty$ $\mathcal{N}, \mathcal{P} < \mathcal{O} / \mathcal{N}, - \mathcal{N}$ .       .         diorite       quartz diorite       granite       .       .       .         s= $\mathcal{N}, - \mathcal{N}, - \mathcal{N}, - \mathcal{N}, - \mathcal{N}$ .       .       .         s= $\mathcal{N}, - \mathcal{N}, - \mathcal{N}, - \mathcal{N}, - \mathcal{N}, - \mathcal{N}$ .       .       .         s= $\mathcal{N}, - \mathcal{N}, - $	3
Sedimentary rock Fragments comp.: Book type:	(s & others (characteristic of the clasts) mono or poly	
Grain size (mm) : Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	<1-2-4-8-16-32-64-128-256	
Remarks C	racks, poperite	

Sample Size:     X=_7_cm, Y=_4_cm, Z=_5_cm     Sample Size:       Weight:     10_g     mm       Color (inside):     dark     brown       Alteration:     00: week strong     Vesloularity:       Vesloularity:     40_%     %       Lithology:     monomict or polymict	KETCH	!
Occurrence: massives < <u>lavaos,vo</u> ica <u>niciastic</u> s sediments others		
Igneous & Ultramatic Rocks Volcanic: (basal) basaltic andesite andesite dacite rhyolite		
Thickness of glass: < <u>&lt;,</u> mm		
Phenocrysts= $\partial / \geq \%$ , %, %		
Plutonic: gabbro diorite quartz diorite granite		
Ultremetic hamburaite dunite numuanite ethem		
Coveraise and During a second pyroxemite contens		
Others:		
Sedimentary rocks & others (characteristic of the clasts)		
Fragments comp.: mono or poly		
Rock type:		
Grain size (mm) : < 1 - 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256 <		
Sorting: Weil		
Roundness : roundanguiar Fabric: clast-support matrix support		
Gradina ciase support — matrix support		
Matrix silt sand others		
Lithic: Lithified or unlithified		

7K II #393 R-/D	June 7, 2 Described by <u>Abe &amp; Koik</u>
Sample Size: X= <u>35</u> cm, Y= <u>26</u> cm, Z= <u>/</u> 9 cm Weight: g(電心、杂計線)2 Mn coating: mm	<u>SKETCH</u>
Color (Inside): while the strong	
Vesicularity: 40 %	
Lithology: monomict or polymict	
Occurrence: massives lavas volcaniclastics sediments o	thers
Igneous & Ultramafic Rocks	
Volcanic: basalt basaltic andesite andesite dacite (fiyo	blite
I hickness of glass: mm	 av
Phenocrysts= 70, 70.	76
Crvstals= %. %.	%
Ultramafic: lerzolite harzburgite dunite pyroxenite other	ns -
Crystals= %, %,	%
Others:	
Sedimentary rocks & others (characteristic of the clas	its)
Fragments comp.; mono or poly Rock type:	
Grain size (mm) $\leq 1 = 2 = 4 = 8 = 16 = 32 = 64 = 128 = 256 \leq 100$	
Sorting : wellBaorly	
Roundness : roundangular	
Fabric: clast-support — — matrix support	
Grading : normalnonereverse	
Matrix : Silt Sano others:	—

	Described by Abe a Kolk
Sample Size:       X = _ / e _ cm, Y = _ / cm, Z = S _ cm         Weight:       _ d 2 e _ g         Mn coating: $< / O _ mm$ Color (inside):       _ d ark _ brow n         Alteration:       _ no _ week strong         Vesicularity:       _ k _ no         _ cmomonic or polymict       _ momonic or color and strong interaction of the strong interactin of the strong interactin of the strong i	<u>SKETCH</u>
Igneous & Ultramatic Rocks	
Thickness of glass:mm Phenacrysts= 01 Z %. %, %	
Plutonic: gabbro diorite quartzidiorite granite Crystals= %, %, %	
Ultramafic: lerzolite harzburgite dunite pyroxenite others Crystels≃ %, %, %	
Others:	
Sedimentary rocks & others (characteristic of the clasts)	
Fragments comp.; mono or poly Book huma	
Grain size (mm): $\leq 1 - 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256 \leq$	
Sorting ; wellpoorly	
Roundness: roundangular	
Fabric: clast-support — matrix support	
Grading : normalnonereverse	
Matrix: silt sand others:	

		June 7, 2007
/KI#393 K-//	Described by _	Abe & Koike
Sample Size: X=m, Y= <u>/+</u> cm, Z= <u>_/J</u> _cm Weight:g Min coating:20mm Color (inside):drak_grav_12_de/sk_braws Alteration: no vetek≥ strong	<u>SKETCI</u>	1
Vesicularity: <u>25</u> %		
Occurrence: massives (avas) volcaniclastics sediments other	3	
Igneous & Ultramafic Rocks		
Volcanic: basalt basaltic andesite andesite dacite myolite		
Thickness of glass:mm		
Phenocrysts= %. %, %		
Plutonic: gabbro diorite quartzidiorite granite		
Ultramatic lavalita havabumila dunka mutanta ita atkara		
Ordarnalic: reizolite narzburgite dunite pyroxenite otners		
Others 76, 76, 76		
Sedimentary rocks & others (characteristic of the clasts)		
Fragments comp.: mono or poly Rock type:		
Grain size (mm): <1-2-4-8-16-32-64-128-256 <		
Sorting : wellpoorly		
Roundness : roundangular		
Fabric: clast-support matrix support		
Grading : normal—nonereverse		
Matrix : silt sand others:		
Lithic: Lithified or unlithified		
Remarks thick Min crust		
crack.		

л ι τ π	393 R- <i>⊭</i> /3	Described by _	June 7, 2007 _Abe & Koike
Sample Size: X=_ Weight: Mn coating: Color (inside): Alteration: no Vesicularity: Utbology:	<u>/} cm, Y=_/∞ cm. Z=_/3 cm</u> <u>∃≥∞g</u> <u>+tkin</u> mm r <u>cu/</u> √geek_> strong <u>3.9</u> % powiet en polymiet	<u>SKETCI</u>	1
Occurrence: ma	saives lavas volcaniclastics sediments others		
Volcanic: basalt Thicknes Phenocr Plutonic: gabbro Crystals Ultramafic: lerzolite Crystals: Sedimentary rock: Fragments comp.:	and rooks besaltic andesite andesite derive rhyolite so of glass:mm ysts=mm diorite quartz diorite granite =%, %, % harzburgite dunite pyroxenite others =%, %, % barzburgite dunite pyroxenite others =%, %, % s & others (characteristic of the clasts) mono or poly		
Rock type: Grain size (mm) : Sorting : Roundness : Fabric:	< 1 - 2 - 4 - 8 - 16 - 32 - 64 - 128 - 256 < weilpoorly roundangular clast-support matrix support		
Grading : Matrix : Lithic:	normalnonereverse silt sand others: Lithified or unlithified		

7K II #	<b>#393 R-</b> +314	June 7, 2 Described by <u>Abe &amp; Koil</u>
Sample Size: X Weight: Mn coating:	= <u>Lo</u> cm,Y= <u>//_</u> cm,Z= <u>/∂</u> cm <u>/⊳9∞</u> g < /0mm	<u>SKETCH</u>
Color (inside): Alteration: n	pale_brown o_wegkstrong	
Vesicularity: _	40%	
Lithology: m	ionomict or polymict	rn
		15
Volcanic: basalt	hasattin andasita andasita danita rhvolita	
Thickn	ess of class: mm	
Pheno	crysts= %, %, %	
Plutonic: gabbro	diorite quartz diorite granite	
Crysta	s= %, %, %	
Ultramafic: lerzolit	e harzburgite dunite pyroxenite others	
Otherry	S= %, %, %	
Sedimentery roc	ke & others (characteristic of the claste)	
Eragments comp	mono or poly	
Rock type:	meno or poly	
Grain size (mm) :	< 1-2-4-8-16-32-64-128-256 <	
Sorting :	wellpoorty	
Roundness :	roundangular	
Fabric:	clast-support matrix support	
Grading :	normalronereverse	
Miatrix :	sit sand others:	
	Litrined or Unitrined	
Remarks	pumice	
	r	

7K II	#393 R-	15 *	Meed	to <i>be</i> describe Described by _	⊘ June 7, 2007 _Abe & Koike
Sample Size: Weight: Mn coating: Color (inside): Alteration: Vesicularity: Lithology: Occurrence:	X= <u>3S</u> cm, Y=_// g चt₀ (‡ mm no week strong manomilet or polymiat massives lavas volcar	<u>o</u> m, Z= <u>/∠</u> के†क्री) idastics sedimer	_om /a.	<u>SKETCF</u> rqe_sample.	to be cut
Igneous & Uit Volcanic: bas Thi Pho Plutonic: gat Cry Ultrainafic: lers Cny Others	ramafic Rocks salt basaltic andesite a ckness of glass:	andesite dacite mm %, ite granite %, te pyroxenite %,	rhyolite % % others %		
Sedimentary i Fragments col Rock type: Grain size (mr Sorting : Roundness : Fabric: Grading : Matrix : Lithic:	n): <a href="https://www.commons.com">cocks &amp; others (chara</a> mp: mono or poly n): <a href="https://www.charace.com">con</a> round	32 64 128 :          poorty          angular          matrix support	<b>clasts)</b> 256 < 256 second		
Remarks	coverded with	Mh crust		<u>-</u>	





## 5. Results of Other Observations

# **5.1 Underway Geophysics** Motoyuki Kido, Hiromi Fujimoto (Tohoku University) Stephen Kirby (USGS), and Natsue Abe (IFREE, JAMSTEC)

## (1) Summary of observations

The target region of this research is known to upward bending of the subducting Pacific plate, called outer rise, where systematic positive gravity anomaly is observed due to dynamically supported excess topography and horst-graben structure is developed due to extensional stress field. This specific tectonic setting produces normal fault earthquakes, some of large one results disastrous tsunami waves attacking the Japanese east coast. Moreover, initiation of the upward bending starts with compressionanl plate surface due to the opposite bending. This may cause the petit-spot activities in this region, however, their origin is still controversial. The region of transition between the bending and unbending is a key to understand the above mentioned phenomenon.

For this purpose, the surface mapping of the bathymetry using a multi-narrow-beam system and acoustic reflection intensity using a side-scan sonar are strong tools to reveal such signals efficiently with an uniform resolution. It is reasonable to conduct proton-magnetmeter survey along with them. The magnetic signature originated in the petit-spot is too small to detect at the sea surface, though, iso-chron identification in this oldest seafloor is important as lack of the data in this region. However, it found that this region is popular fishing area in this season and many fishing boats were there, possibly with towing fishing net. To make a proton survey in such area has large risk to lose the proton sensor. So we abandon the proton survey at this time.

# (2) Track chart

Here is the ship track entire of this cruise (Fig.5.1-1), starting at Kamaishi. Basically we made stationary surveys for diving in the day-time and track surveys for seabeam in the night-time.



Fig.5.1-1. Entire ship track of the survey (top) and closed view in the survey area (bottom)

## (3) Bathymetric maps

We have conducted seabeam topographic mapping for five nights (1st, 2nd, 3rd, 4th, and 5th June) during this research cruise. To save fuel consumption, ship speed was limited upto 10 knot using a half engine. This shorten our track length, however, improve data quality. Coupled with stably calm sea condition, we have obtained high quality bathymetric data. Fig. 5.1-2 is a colored bathymetric relief with an illumination from the north-east compiled all the data obtained during all the night surveys, superimposed with ship track. The figure clearly illustrates the initiation of horst-graben structure in the east and small seamounts distributed in the middle to the west. Most of normal faults are developed NNE-direction, perpendicular to the iso-chron or abyssal hill associated with seafloor spreading more than 100Ma ago, rather than N-S direction parallel to the trench. Some seamounts have crater at their top. The prominent feature is a couple of series of seamounts alignment. They do not necessary to have the same orientation. Identification whether each seamounts are petit-spot or old hot spot may help comprehensive explanation of such alignment together with stress field in the plate.

We also provide here a contour map for the same bathymetric data in Fig. 5.1-3, for the visibility in detail in other point of view. The contour interval is 20m and drawn thick contour every 100m.

The system simultaneously provide side-scan image along the track, whose swath width is wider than that multi-narrow beam. The side-scan image is useful to evaluate seafloor condition. This region is mostly covered with thick abyssal sediments, on the other hand the seamounts are has no. This is clearly be seen in the side-scan image that seamounts are appeared as dark image or strong reflection intensity (Fig.5.1-4). Side-scan data is also helpful to identify sharp cliff or fault nevertheless it is large or not. The normal faults in the east of the region is clearly illustrated. The only the limitation is that the intensity depends elevation angle of swash beam.

These figures are too small to investigate each feature. Then we provide selected two regions of closed view. The first one is south-east region (Fig.5.1-5), where cluster of seamounts is destructing by couple of normal faults on the other hand the alignment of seamounts is obvious along the line on 145 degree longitude. The other is the extent of this alignment (Fig.5.1-6), where three of our dive surveys were conducted (Dive #388, #392, and #393). The side-scan image of the same area is also shown for comparison. An artificial linear pattern is getting apparent with this scale, which originate a kind of aliasing during filtering process of the raw data. Technique of data processing is a further problem.



Fig.5.1-2. Bathymetric relief obtained during this research cruise. Track lines are also indicated with dots every 10 pings.



Fig.5.1-3. Contour plot of the same data in Fig.5.1-2. Contour interval is 20m for thin lines and 100m for thick lines.



Fig.5.1-4. Side-scan image of the region.



Fig.5.1-5. Close-up view of the southeast region of Fig. 5.1-2.



Fig.5.1-6. Close-up view around the dive sites for petit-spot surveys. A side-scanning sonar image is also shown for comparison.

#### 5.2 Experiments on seafloor geodesy

## (1) Deployment of an acoustic transponder with a mooring system Yukihito Osada, Hiroaki Tsushima, Hiromi Fujimoto (Tohoku University), and Misumi Aoki (NME)

Large earthquakes occurred around northeastern Japan associated with subduction of the Pacific plate. Seismic coupling on the subduction plate boundaries is a key factor for the study of the large earthquakes. The GPS/A (GPS/Acoustic) observation at the GJT1 site started in 2002. Precise plate motion at the site still remains to be determined, because this site has been visited only a few times. It turned out during a cruise last year that the acoustic signals from the PXPs (precise acoustic transponders) were exceptionally weak presumably due to the lifetime of the batteries. Therefore we have tried to replace the PXPs at GJT1 site during the KR07-07 cruise. Two PXPs in glass sphere housing were replaced with KAIKO 7000 II (Dive #389, #390). One PXP in titanium-alloy pressure housing was deployed with a moored system as is shown in Fig. 5.2.1.

On June 4, 2007 we deploy the PXP (DJ3) using the moored system at the GJT1 site where an old PXP DJ4 had been deployed. After the dive #390 for deployment of another PXP, we calibrated the position of the mooring system. We collected the acoustic signals within 1000 m in the horizontal distance from the point of the deployment (Fig. 5.2.2), because the maximum range of the slant range was limited to 6500 m for an acoustic recovery unit.



Fig. 5.2.1 (a) Outline of the moored system for deployment of a PXP in titanium alloy pressure housing. An acoustic releaser was set 10 m above the PXP. The bottom frame of the PXP is 1-m square. (b) A photograph of deployment of the PXP. (c) The moored system after the recovery.


Fig. 5.2.2 The results of the calibration of the position of the mooring system.

### (2) Test of a new acoustic ranging unit Motoyuki Kido and Hiromi Fujimoto (Tohoku University)

We are developing now a new acoustic ranging buoy for automatic and continuous GPS/Acoustic seafloor positioning, and it will be a future application to the seafloor network cable system, DONET. In this system, acoustic unit is completely separated with other parts, such as GPS data acquisition unit, and is packed in a glass sphere with an acoustic transducer. It contains batteries, an acoustic amplifier, and a microprocessor to control the measurement and acoustic data recording. In March 2007, we have made an initial test for this acoustic unit in outside of the Shimizu port and obtained high quality ranging data although a transponder was deployed at shallow depth in a short distance. In this cruise, we extend the test into long distance with practical transponders, which are also installed in this cruise.

First, we transmitted a wakeup signal to newly installed three transponders using an old system (Fig.5.2.3a), which is not required in the future cabled measurement because of its long-term continuous measurement. Transmitting the wakeup signal, we sustained a cabled transducer from the side deck and kept it at a depth around five to ten meters so that a signal can directly travel under the ship's bottom to the transponder behind the ship. There was a difficulty to wake up transponders probably because of strong acoustic reflection from the ship's side wall or the bottom. However after trials for up to 30 minutes, all of the three transponders responded.

Then we set the new all-in-one acoustic unit to repeatedly make ranging every 30 seconds starting at 19:18 and ending at 19:40 for about 20 minutes. The data acquisition interval was set to 10 seconds to match the two-way travel time of the slant

range to the 5500m deep transponders. The acoustic unit itself has buoyancy of 14 kg in water, so we simply kept it with a rope of 20 meter. Unfortunately due to a wind and current condition, the acoustic unit did not apart from the ship with enough distance (Fig.5.2.3d). However, it still had a possibility to communicate with foreside transponder. Therefore we kept the test as it was. A ping sound was quite large so that we can hear even from the bridge of the Kairei. After we confirmed that the pinging stopped at 19:40 as was set, we recovered the acoustic unit.



Fig. 5.2.3. (a) The old acoustic system used for the wakeup test. (b) The nre all-in-one acoustic unit, which was deployed from the side deck (c) and floated by buoyancy itself (d).

45 times of ranging data were recorded. However, no clear response signal was found in the data other than the transmitted signal itself. The Fig. 5.2.4 is an example of the recorded wave signal. There were some signals looked like a response signal, however, these were found to be noise resulting from the correlation analysis.

The transponders respond only when they recognize a frequency tag in the transmitted data. So we expect the tag was contaminated with significant noise by strong reflection from the ship even for the forehand direction transponder. Moreover, the acoustic unit is designed for cable system in the Kumano-nada region with relatively shallow depth of 2000m, so the signal amplitude is not strong enough for the deep ocean in the Japan trench. Then the test for the new acoustic unit resulted in just confirmation to work properly. However, we have ensure the availability of the new transponders installed in this cruise using the wakeup test with old system.



Fig.5.2.4. An example of the recorded acoustic signals. The transmitted signal is at the beginning of the graph. Signal at 9 sec in (a) looked like a reply from a transponder, however its cross correlation with the transmitted signal is quite low (b), so this must be a noise, not a reply.

#### (3) Recovery of an ocean bottom pressure recorder

## Yukihito Osada, Hiroaki Tsushima, Hiromi Fujimoto (Tohoku University)

We have started the study on the region of 2005 Miyagi-Oki earthquake since 2006. In July 2006, we deployed an OBP (Ocean Bottom Pressure recorder) to monitor the vertical movement in case of a big earthquake. We recovered the OBP (Fig.5.2.5) along the way to the study area for the diving survey. The OBP had recorded pressure variation for 11 months (the total data is 76050 samples) at the sampling interval of 10 sec (Fig. 5.2.6).



Fig. 5.2.5 A photograph of the OBP after the recovery.



Fig. 5.2.6 Time series of depth calculated from OBP data.

### 6. Discussions and Summary

6.1 Preliminary Seismo-Tectonic Discussion of the Outer Rise Region Investigated by the Cruise KR07-07 (1-8 June 2007) from 37°40' to 38°30' N and from 144°40' to 145°25' Stephen H. Kirby, Research Geophysicist and Senior Scientist, U.S. Geological Survey, Menlo Park, California, USA and Invited Shipboard Scientist, JAMSTEC R/V Kairei

In addition to SEABEAM bathymetry, side scan sonar imaging, and Kaiko 7000 II dive information, the cruise benefited from the availability of preliminary 2007 OBS earthquake data made available from Dr. Ryota Hino of Tohoku University. Dr. Hino's deployment was motivated by interest in monitoring aftershocks of the M7.1 outer-rise normal-faulting earthquake of 15 November 2007. Detection of some of the smaller events may have succeeded in documenting background seismicity as well. A redeployment of OBS instruments to the area directly above the aftershocks promises in near future to provide improved accuracy of hypocenter distribution. Accordingly, this report is labeled "Preliminary". However, this is an unusual opportunity to comment upon the deformation of the outer-rise region off the Japan Trench in light of completely new and independent information.

Two morphological features appear to correlate with earthquake distribution from Dr. Hino's OBS study. First, SEABEAM bathymetry indicates the presence of more than 20 small seamounts that were considered by Dr. Natsue Abe for investigation during this cruise These seamounts occur in three sharply chains, one roughly north-south chain near longitude 145°00'. Three seamounts in this chain were selected for Kaiko dive targets. She has confirmed that the northern and southern seamounts are of the "petit spot" type (see Figure 1). A prominent north-south band of earthquakes occurs under this chain (Figure 6.1.1), including under all three Kaiko dive sites.

A second interesting seafloor feature is a NNW escarpment bounding another chain of small seamounts in the SW corner of the study area. The seafloor SW of the escarpment is a few hundred meters deeper than the other side. About a dozen earthquakes occurred under the part of the escarpment near 37°55'. The NNW trend of this escarpment parallels one of the two trends of several "zig-zag" grabens further north that on average are parallel to the trench. The other trend is approximately parallel to the Pacific-Plate magnetic anomalies. Such "zig-zag" grabens become increasingly common along the outer-rise/outer-trench-wall further to the south as the azimuth of the trench increases and approaches the azimuths of the seafloor magnetic anomalies.

It is believed that "petit-spot" volcanic edifices near the Japan Trench are not active magmatic systems, and are at least several million years old (Natue Abe, personal communication). The alignment of bands of earthquakes therefore probably represents exploitation of zones of weakness in these seamount chains during bending of the Pacific Plate.

The main trend in the OBS earthquake map (Fig. 6.1.2) is parallel to the NNE-orientation of nodal planes of numerous investigations of the focal mechanisms for the 15 November 2005 earthquake. This trend is approximately parallel to the trench at the same latitude. No other morphological features on the seafloor correspond to this trend.



Figure 6.1.1: Bathymetric map of the study area based on largely new SEABEAM data. The contour interval is 10 meters.



Figure 6.1.2: Earthquake epicenter map plotted on a grey shaded relief map base. Data made available by Dr. Ryoto Hino of Tohoku University.

## 6.2 Summary

Hiromi Fujimoto (Tohoku University) and Natsue Abe (IFREE, JAMSTEC)

## Summary of petit spot dives

Totally three dives (7KII Dive #388, 392 & 393) during KR07-07 were taken on small knolls and the petit spot rock samples were sampled from two of them. These two knolls are absolutely 'petit spot' type volcanoes, though the age and the place of the eruptions are not known at the moment. These knolls are the first finding petit spot knolls other than Kaiko knolls and Yukawa knolls both in the same flow line of one age transect line. This discovery implies that there could be other places of petit spot volcanic fields in the any place of the oceanic plate where it is bending.

The other knoll has a caldera on the top and inside it has steep cliff with dolerite and pillow lava outcrops. The samples taken from these outcrops are very fresh MORB-like basalt and dolerite. Therefore, the caldera may be cross section of the upper part of the oceanic crust between layer 2a and layer 2b. To make sure this speculation, post cruise research on the rock samples should be taken petrologically and geochemically.

### Summary of expedition in the source region of the 2005 M7.1 earthquake

The main trend in the aftershock distribution of the 2005 M7.1 earthquake is parallel to the NNE-orientation of nodal planes of numerous investigations of the focal mechanisms for the earthquake. This trend is approximately parallel to the trench at the same latitude. There was no prominent topographic feature indicating repeated normal faults. Therefore further surveys are necessary for fine topographic mapping with a deep-towed system.

The smaller band in the western part of the aftershock distribution coincides with one roughly north-south chain of small seamounts near longitude 145°00'. The newly found two "petit spot" type knolls are in this chain. It is believed that "petit-spot" volcanic edifices near the Japan Trench are not active magmatic systems. The alignment of bands of earthquakes therefore probably represents exploitation of zones of weakness in these seamount chains during bending of the Pacific Plate.

#### Geodetic experiments for the renewal of acoustic seafloor benchmarks

The KAIKO 7K II carried a precision acoustic transponder (PXP) in the payload space, deployed it on the seafloor side by side to an old PXP, and measured the relative position between the two PXPs with visual monitoring. Two PXPs were renewed in this way. Another PXP was deployed nearby an old one with a mooring system. Now we can continue the seafloor geodetic measurements in order to measure the motion of the Pacific plate near the subduction plate boundary.

# 7. Data list

## 7.1 List of Movie Data Misumi Aoki (NME)

List of movie data obtained by the cameras of the Kaiko 7000 II is shown in Table 7.1.

# List of Movie Data KR07-07

				Record	ded Time	Distribution		
Date	Dive No.	Camera		Start	End	Tohoku Univ.	JAMSTEC	USGS
2007.06.02	#388	No.1Camera	1/2	10:37	12:37	DVD-R	DVD-R	
		/HDTV	2/2	12:37	14:23	DVD-R	DVD-R	
		No.3 Camera	1/2	10:37	12:37	DVD-R	DVD-R	
			2/2	12:37	14:23	DVD-R	DVD-R	
2007.06.03	#389	No.1Camera	1/2	10:32	12:32	DVD-R	DVD-R	
		/HDTV	2/2	12:32	13:42	DVD-R	DVD-R	
		No.3 Camera	1/2	10:32	12:32	DVD-R	DVD-R	
			2/2	12:32	13:42	DVD-R	DVD-R	
2007.06.04	#390	No.1Camera	1/2	10:30	11:30	DVD-R	DVD-R	
		/HDTV	2/2	11:30	12:46	DVD-R	DVD-R	
		No.3 Camera	1/2	10:30	11:30	DVD-R	DVD-R	
			2/2	11:30	12:46	DVD-R	DVD-R	
2007.06.05	#391	No.1Camera	1/2	10:33	12:33	DVD-R	DVD-R	
		/HDTV	2/2	12:33	14:33	DVD-R	DVD-R	
		No.3 Camera	1/2	10:33	12:33	DVD-R	DVD-R	
			2/2	12:33	14:33	DVD-R	DVD-R	
2007.06.06	#392	No.1Camera	1/2	10:25	12:25	DVD-R	DVD-R	
		/HDTV	2/2	12:25	14:25	DVD-R	DVD-R	
		No.3 Camera	1/2	10:25	12:25	DVD-R	DVD-R	DVD-R
			2/2	12:25	14:25	DVD-R	DVD-R	DVD-R
2007.06.07	#393	No.1Camera	1/2	10:30	12:30	DVD-R	DVD-R	
		/HDTV	2/2	12:30	14:25	DVD-R	DVD-R	
		No.3 Camera	1/2	10:30	12:30	DVD-R	DVD-R	DVD-R
			2/2	12:30	14:25	DVD-R	DVD-R	DVD-R

\*1: video signals are NTSC

PDP arrangement :

Vew finder of Digital Still Camera	No.2 Camera
No.3	No.1Camera
Camera	or HDTV



# 7.2 List of Digital Data (XBT, MNBES, CTD etc.) Misumi Aoki (NME)

# List of digital data obtained in this cruise is shown in Table 7.2.

List of Dive Data / KR07-07

Dive No.	CTD Data*1	Vehicle Log	Acoustic Navigation	SOQ	SOJ	Seabeam data	Magnetometer	Gravity
KAIKO7K#388	07060201.DAT		dive.388.csv	07006012200_01.soq	07006012200_01.soq	sb200706020805_e.mb41	070601.dat	2007060100.grv
(07/06/02)	07060201.CFG					-		
	07060201.AVG					sb200706022034_e.mb41		
	07060201.HDR							
KAIKO7K#389	07060301.DAT	LOG06-03-0_001.xls	dive.389.csv	07006022200_01.soq	07006022200_01.soq	sb200706030700_e.mb41	070602.dat	2007060200.grv
(07/06/03)	07060301.CFG	-				-	P070602.dat	
	07060301.AVG	LOG06-03-0_052.xls				sb200706032220_e.mb41		
	07060301.HDR							
	07060301.SUM							
KAIKO7K#390	07060401.DAT	LOG06-04-0_001.xls	dive.390.csv	07006032200_01.soq	07006032200_01.soq	sb200706041051_e.mb41	070603.dat	2007060300.grv
(07/06/04)	07060401.CFG	-				-	P070603.dat	
	07060401.AVG	LOG06-03-0_045.xls				sb200706042100_e.mb41		
	07060401.HDR							
	07060401.SUM							
KAIKO7K#391	07060501.DAT		dive.391.csv	07006042200_01.soq	07006042200_01.soq	sb200706050735_e.mb41	070604.dat	2007060400.grv
(07/06/05)	07060501.CFG					-		
	07060501.AVG					sb200706052102_e.mb41		
	07060501.HDR							
	07060501.SUM							
KAIKO7K#392	07060601.DAT		dive.392.csv	07006052200_01.soq	07006052200_01.soq		070605.dat	2007060500.grv
(07/06/06)	07060601.CFG							
	07060601.AVG							
	07060601.HDR							
	07060601.SUM							
KAIKO7K#393	07060701.DAT	LOG06-04-0_001.xls	dive.393.csv	07006062200_01.soq	07006062200_01.soq		070606.dat	2007060600.grv
(07/06/07)	07060701.CFG	-						
	07060701.AVG	LOG06-07-0_047.xls						
	07060701.HDR							
	07060701.SUM							
1	1	1	1	1	1	1	1	1

Others	Readme_CTD.txt	Readme_VehicleLog.xls	0705292200_01.soq	0705292200_01.soq	KR0707_100.grd	070531.dat	2007053102.grv
			0705312340_01.soq	0705312340_01.soq	KR0707_200.grd	三成分フォー マット.xls	
			SOQformat.xls	SOJformat.xls	sb200706011635_e.mb41		
					sb200706011802_e.mb41		
					sb200706011837_e.mb41		
					sb200706012005_e.mb41		