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60. *Crustal Structure in the Western Part of Japan Derived from the Observation of the First and Second Kurayosi and the Hanabusa Explosions (Continued).*

Part 1. Observation of Seismic Waves Generated by the First and Second Kurayosi and the Hanabusa Explosions (Continued).

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Abstract

For the further study of the crustal structure in the western part of Japan, about three tons of explosives were fired in a shaft of Hanabusa Mine, Gifu Prefecture at 1h 07m, November 2, 1966 and the seismic waves generated by this explosion were observed in order to obtain additional data. The experiment is described and the data observed at sixteen temporary stations are presented in this paper.

1. Introduction

The observation of seismic waves generated by the first and second Kurayosi and the first Hanabusa explosions were conducted in 1963 and 1964. The observed data[1] and the crustal structure derived[2] were already presented. As mentioned in the previous paper, the density of observation sites was fairly small in the first Hanabusa explosion and the quality of data at distant stations for the first Hanabusa explosion was not so good as that for the Kurayosi explosions. Therefore, in order to derive a more definite model of the crustal structure, an additional explosion in Hanabusa mine, Gifu Prefecture, was fired at 1h 07m on November 2 in 1966. In this experiment, the second Hanabusa explosion, the observation sites were set up especially at long distances in comparison with those of the first Hanabusa explosion.

1) RESEARCH GROUP FOR EXPLOSION SEISMOLOGY, *Bull. Earthq. Res. Inst.*, **44** (1966), 89.

2) M. HASHIZUME, O. KAWAMOTO, S. ASANO, I. MURAMATU, T. ASADA, I. TAMAKI AND S. MURAUCHI, *Bull. Earthq. Res. Inst.*, **44** (1966), 109.

2. Shot and observation sites

Three tons of dynamite were put into the shaft with a depth of 23 m in the mine, which was filled with water for tamping. The shot hole and its relative location to the other levels were shown in Fig. 2 in the previous paper.[3] Data of the shot point are given in the following.

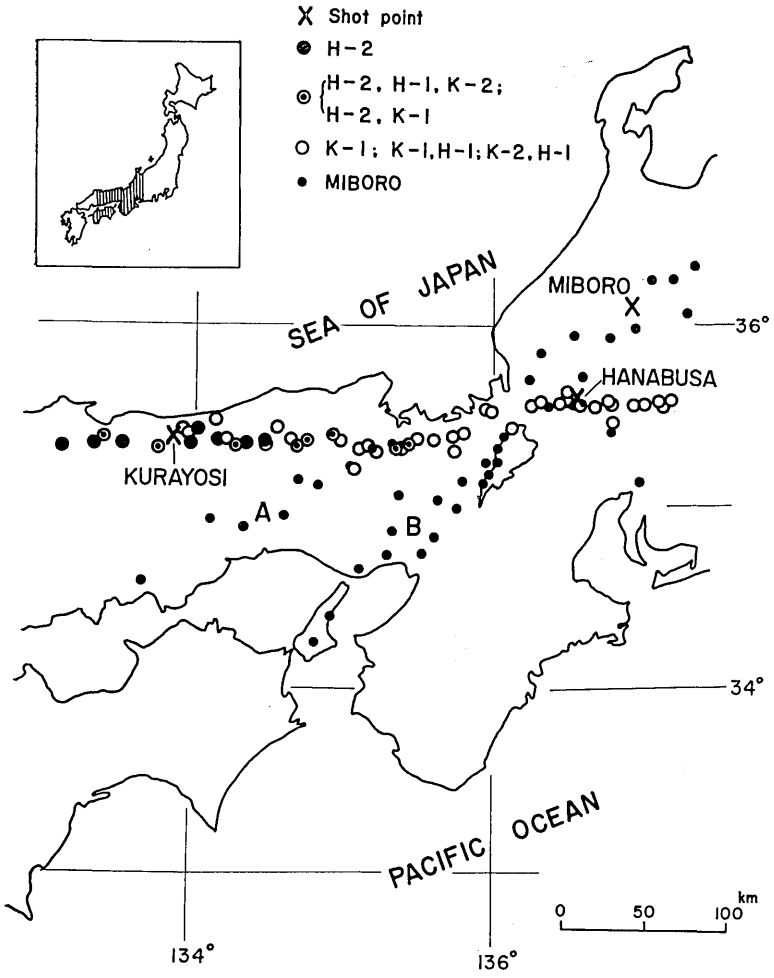

Fig. 1. Shot and observation points for the second Hanabusa explosion together with those for the Kurayosi and the first Hanabusa explosions. Also shot and observation points are shown for the Miboro explosions. A and B mean profile A and profile B of Miboro explosions respectively. K-1: the first Kurayosi explosion, K-2: the second Kurayosi explosion, H-1: the first Hanabusa explosion, H-2: the second Hanabusa explosion.

3) RESEARCH GROUP FOR EXPLOSION SEISMOLOGY, *loc. cit.*, 1).

Table 1. Data of observation sites for the second Hanabusa explosion

Station No.	Observation site	Latitude (N)	Longitude (E)	Height	Δ(km)	Azimuth	Observers
1	Hanabusa (Shot point)	35°36′14.4″	136°32′14.9″	260 m	pu.1=92 m pu.2=140		K. Ichikawa, S. Iizuka, T. Asada, A. Okada
2	Yatuai	35 21 38.9	135 24 24.7	160	106.077	N104°.73W	E. Mochizuki, S. Kashihabara, M. Homae
3	Ankokuzi	35 20 16.6	135 18 31.6	100	115.345	104.83	N. Nakajima
4	Wadayama (C)	35 23 11.9	134 53 54.6	220	150.634	99.21	K. Yamamoto, K. Kudo, T. Hasegawa
	(B)	35 23 07.7	134 54 06.9	210	150.327	99.16	
	(A)	35 23 39.5	134 53 56.4	410	150.589	98.87	
5	Miyagaki	35 21 57.5	134 43 03.6	160	167.216	99.09	Y. Ichinose, T. Odaka
6	Ōya (A)	35 20 02.0	134 39 52.2	260	172.597	100.00	K. Oike, H. Ii
	(B)	35 19 57.3	134 39 54.6	165	172.532	99.99	
7	Wakasa	35 20 38.7	134 27 38.8	445	190.645	98.70	S. Naruse, T. Oida, I. Fujii
8	Iwabuti	35 21 15.3	134 19 26.3	140	202.755	97.85	T. Kumagai, H. Suzuki, H. Yasosima
9	Hunaoka	35 19 49.9	134 16 02.1	200	207.800	98.31	M. Hashizume, S. Yabe
10	Kawahara	35 22 04.0	134 08 58.8	150	218.230	96.90	T. Moriya, N. Sakajiri, T. Igarashi
11	Kōti	35 24 43.1	134 01 16.7	210	229.226	95.33	H. Shimamura, T. Yoshikura, I. Furuya
12	Kannokura (B)	35 20 54.1	133 58 02.2	695	234.944	96.93	K. Noritomi, M. Nogoshi, T. Hō
	(A)	35 21 03.3	133 57 56.7	〃	235.044	96.86	
	(C)	35 20 54.0	133 57 41.5	〃	235.462	96.92	
13	Sekigane	35 19 27.2	133 44 26.1	315	255.724	96.97	Y. Motoya, T. Maki, H. Okada
14	Mizoguchi (A)	35 21 03.6	133 29 35.3	430	277.665	95.80	H. Watanabe, M. Nakamura, A. Kuroiso
	(B)	35 19 32.4	133 25 44.4	80	283.791	96.24	
15	Aimi	35 22 23.1	133 21 31.0	20	289.545	95.07	M. Yanagisawa, Y. Suzuki, Y. Shiraishi
16	Hakuta (A)	35 21 15.3	133 17 43.2	70	295.486	95.38	S. Asano, Y. Okada, M. Imaizumi
	(B)	35 20 58.1	133 18 06.6	77	295.094	95.49	
17	Hirose (A)	35 19 06.3	133 05 05.0	260	314.968	95.78	I. Muramatu, Y. Sasaki, H. Usutomi
	(B)	35 19 01.3	133 04 56.6	250	315.189	95.80	

shot time: 1h 06m 59.082s, November 2, 1966
location of shot point: 35°36′14.4″N
136°32′14.9″E
height of shot point: 260 m

Sixteen observation sites were distributed along the profile at a distance farther than 100km from the shot point. These observation sites are shown in Fig. 1 together with those of the first Hanabusa explosion. The name, location, azimuth, distance and observers for each observation site are listed in Table 1. In this experiment, almost all observation sites were selected carefully by the same scientists although, in the past, a chief of each observation site usually had responsibility for selection of observation site concerned. This was done to save the expense as well as to find a good observation site efficiently and consistently, resulting in obtaining a good signal to noise ratio for most of the observation sites. All observation sites were equipped with magnetic tape recorders of FM type as before.

3. Results

Seismograms obtained are of good quality, most of which give clear onsets. In Fig. 2, the record section is shown, in which seismograms of the first Hanabusa explosions are included. Analogue filtering was applied during reproducing at a few observation sites for improving signal to noise ratio if necessary.

The same classification of the quality of each phase including first arrivals was adopted as that in the previous paper.[4] That is, the following four grades qualify the accuracy of each phase identified:

A: very clear first arrivals
B: good first and late arrivals
C: fairly good first and late arrivals
D: accuracy of identification worse than 0.1 sec, or doubtful phases.

In Table 2, time of the first and late arrivals, classes of these phases, etc. are given. The travel time graph is shown in Fig. 3 for the first and second Hanabusa explosions. The results of analysis of these data are given in Part 2 under the same title.[5]

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4) RESEARCH GROUP FOR EXPLOSION SEISMOLOGY, *loc. cit.*, 1).

5) Y. SASAKI, S. ASANO, I. MURAMATU, M. HASHIZUME AND T. ASADA, *Bull. Earthq. Res. Inst.*, **48** (1970), 1129.

Table 2. The travel time of the second Hanabusa explosion

Shot time: 1966 Nov. 2, 1 h 06 m 59.082 s

Station No.	Observation site	Δ (km)	P*	Class	$P-O$**	$P-O$**$-\frac{\Delta}{6}$	P(Later phases)***			
			1 h 07 m				1 h 07 m			
2	Yatuai	106.077	17.s17+	A	18.s09	0.s41	17.s40 B,	18.s46 C,	19.s96 C	
3	Ankokuzi	115.345	18.65+	A	19.57	0.35	18.83 D,	19.42 C,	19.68 C,	20.40 C
4	Wadayama (A)	150.589	24.37−	B	25.29	0.25	25.06 C,	25.67 D		
5	Miyagaki	167.216	27.08+	D	28.00	0.13	27.14 C,	27.39 C		
6	Ōya (A)	172.597	28.05+	D	28.97	0.20	28.16 B,	28.23 C,	28.98 D,	29.65 C
7	Wakasa	190.645	30.38+	B	31.30	−0.47	30.66 C,	30.95 B,	32.80 D	
8	Iwabuti	202.755	31.86+	C	32.78	−1.01	32.12 B,	32.82 C,	33.40 B,	33.68 D
9	Hunaoka	207.800	32.56+	A	33.48	−1.15	32.83 C,	33.39 D,	34.09 D,	35.74 D
10	Kawahara	218.230	33.86+	C	34.78	−1.59	34.07 C,	34.74 D,	35.34 C	
11	Kōti	229.226	35.04+	C	35.96	−2.24	37.39 B,	37.98 C,	40.30 C	
12	Kannokura (A)	234.944	35.94+	B	36.86	−2.30	36.73 D,	37.69 C,	38.43 D,	39.44 D
13	Sekigane	255.724	38.64+	C	39.56	−3.06	40.34 D,	41.15 D,	42.10 D	
14	Mizoguchi (A)	277.665	41.89	D	42.81	−3.47				
15	Aimi	289.545	42.85+	C	43.77	−4.49	43.47 D,	45.88 D,	46.86 D,	
							48.11 D,	48.83 D		
16	Hakuta (B)	295.094	43.25+	D	44.17	−5.01	43.48 B,	43.84 C,	44.62 C,	48.46 D
17	Hirose (B)	315.189	45.64	D	46.56	−5.97	45.75 C,	46.10 B,	52.17 C,	52.88 C,
							53.72 D,	54.76 C		

* + sign means that the direction of ground motion is upwards and −sign, downwards.

** O means the shot time.

*** A, B, C and D after numbers stand for the class of phases. For example, 2.62C means that the class of phase at 2.62 s is C.

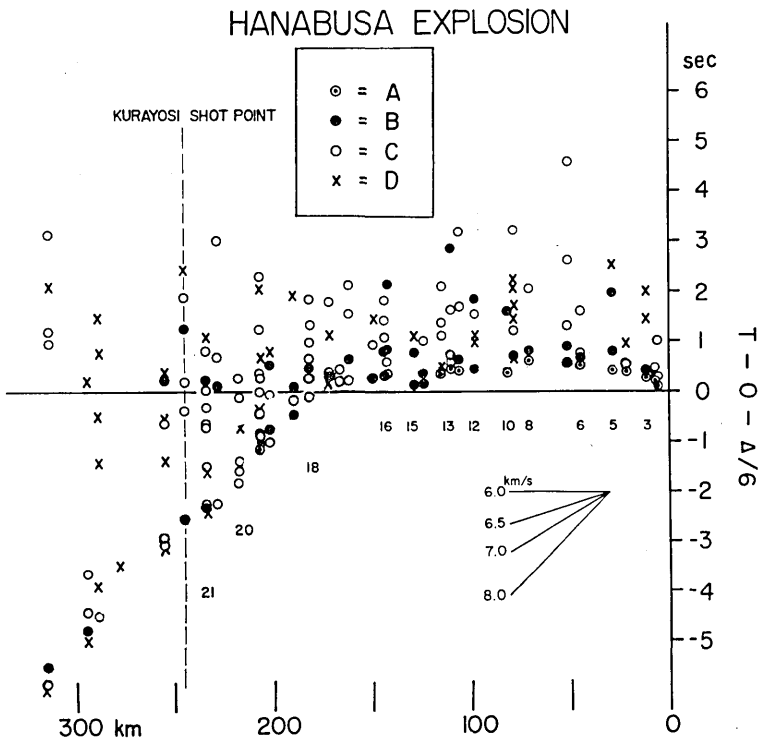

Fig. 3. Travel time graph for the first and the second Hanabusa explosions. The number under some of plots shows the station number in the first Hanabusa explosion.

4. Acknowledgement

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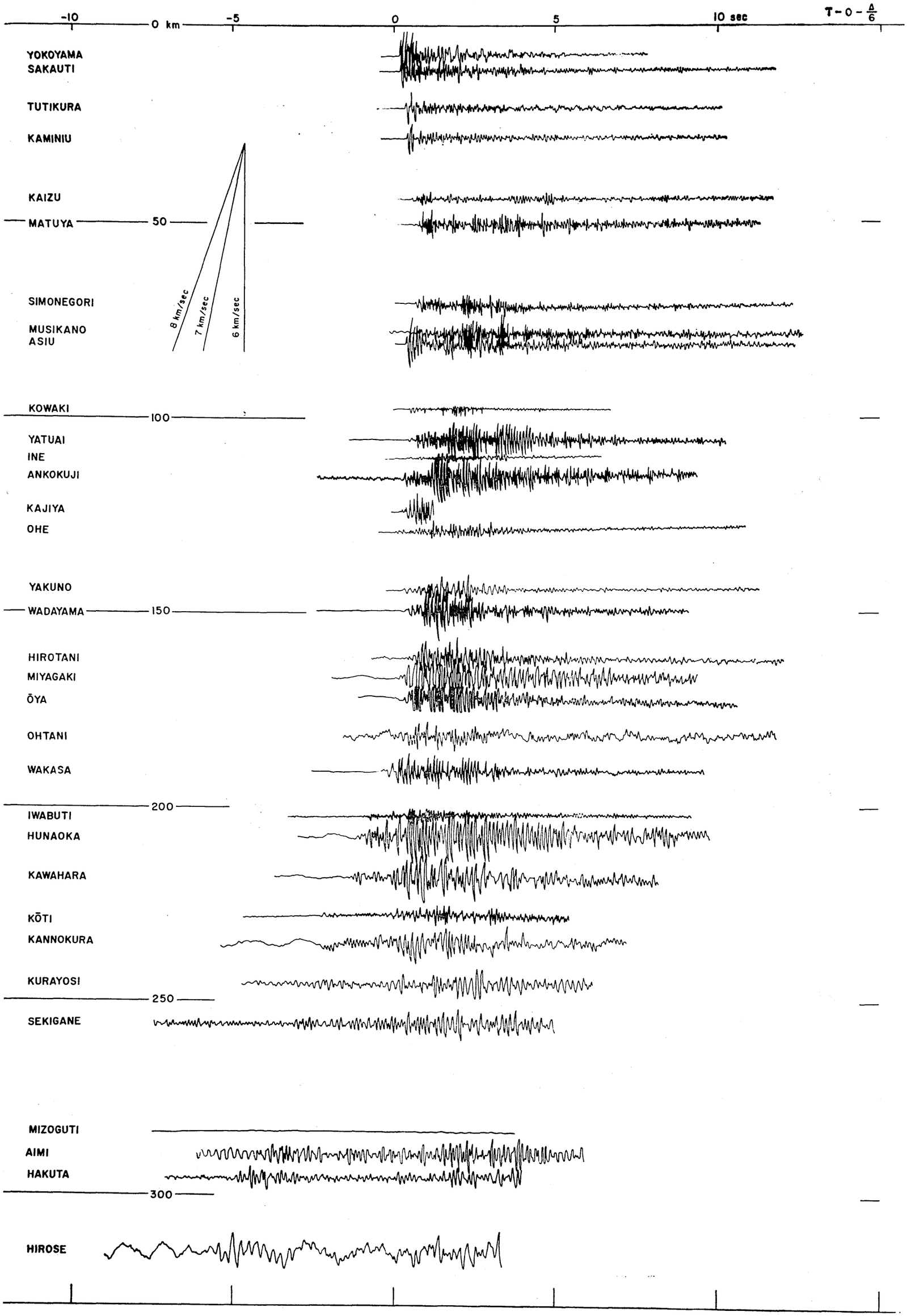

Fig. 2. Record section of the first and the second Hanabusa explosions.

60. 第1回，第2回倉吉爆破及び花房爆破観測より得られた西部日本の地殻構造（続）

第1部　第1回，第2回倉吉爆破及び花房爆破地震動の観測（続）

爆破地震動研究グループ

昭和41年11月2日，岐阜県の花房鉱山の廃坑を利用して約3屯の火薬の爆発を実施した．この第2回花房爆破は昭和39年に行なった第1回と同一の廃坑で行ない，遠方観測点に重点をおいて16点で観測した．全観測点において周波数変調磁気録音方式によって観測を実施し，全体的に極めて良好な記録を得た．本報告では，実験について述べ，得られた資料が与えられている．なお，この実験は国際地球内部開発計画人工地震部門経費，文部省科学研究費，地震研究所特別事業費によって実施された．記して謝意を表する．