

Isfjord *All Copies*
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UNIVERSITETET I BERGEN
JORDSKJELVSTASJONEN
(SEISMOLOGICAL OBSERVATORY)

SEISMOLOGICAL BULLETIN

~~ISFJORD, SPITSBERGEN~~

AUG. 1 — NOV. 15, 1958

BY

ANDERS KVALE

AND

MARKVARD A. SELLEVOLL

~~NOT~~
BERGEN

Bergen, Norway, 1959.

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S E I S M O L O G I C A L B U L L E T I N

ISFJORD, SPITSBERGEN

Aug. 1 - Nov. 15, 1958.

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ISFJORD SEISMOCLOGICAL OBSERVATORY

is located at the Isfjord Radiosonde Station, Spitsbergen.

The coordinates are:

78° 3' 33" N

13° 38' 25" E

Elevation = 5 m.

The station is established by the Seismological Observatory in Bergen, Norway. The building of the station and its maintenance is made possible by grants from Norges Almenvitenskapelige Forskningsråd (The Norwegian Research Council for Sciences and Humanities).

Dr. Markus Båth, Uppsala, has given very valuable advice and support to the plans for the station, especially during the early stages of the work.

Dr. H. Jensen and magister J. Hjelme, Copenhagen, generously put their experience from the Danish seismological stations in the Arctic at our disposal.

The station is equipped with a Willmore short period vertical seismograph. The seismometer is placed 400 m from the recorder, which is in the building of the meteorological station. This was necessary if the seismometer should be placed on solid rock and at a sufficient distance from the shore. The rock type is shale with beds of limestone. The shale is weathered to several meters below the surface, and the seismometer is therefore placed on a bed of limestone. It is completely covered in order to keep out water and snow, and it is also protected against wind.

The station was built under the supervision of cand.real. Markvard Sellevoll, research associate at the Seismological Observatory in Bergen. The first seismogram is of July 7, 1958, but the station was not brought into regular operation until August 1.

The present bulletin contains the recordings of all seismograms which could be sent to Bergen during the fall of 1958. Due to various technical difficulties, some of the seismograms are of inferior quality. These difficulties have later been overcome. The seismograms nevertheless contain records of 39 earthquakes during 78 days of registration. Of these 10 are local, occurring at distances of 80 to 220 km. In addition 2 nuclear explosions were recorded.

The seismograms also give evidence of various disturbances, probably of an electromagnetic character. The cause of these disturbances is now being investigated. They may partly be due to electric storms, partly to the activity at the Isfjord radion station. Because of these disturbances the magnification of the seismograph has in certain periods been reduced to 1/3. Most likely at least the major part of these disturbances will be successfully dealt with, and the seismograph is now being run at its maximum magnification. On account of the disturbances it has not been found advisable for the time being to have the P-phases telegraphed to Bergen.

The next shipment of seismograms will probably arrive in May 1959, and the next bulletin will be published during the summer.

1958

1.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A _N	A _E	A _Z	
			h.	m.	s.					
1	July 6	iPg	23	06	06				$\Delta = 115$ km Local	
		iPn			08					
		iSg			20					
		iSn			23					
2	7	iPn	01	24	11				$\Delta = 210$ km Local	
		i			13					
		Sn			36					
3	7	iP	05	25	15				$50\frac{1}{2}^{\circ}$ N 180 ¹⁸⁰ °W H: 05 16 04 (USCGS)	
4	Aug. 13	iP	20	22	07				51° N $177\frac{1}{2}^{\circ}$ W H: 20 13 00 (USCGS) Mariana Islands	
5	14	iP	02	40	31					
6	14	iP	11	00	10					
7	14	eP	11	35	30				Iran	
8	14	iP	15	04	10				Aleutene Islands	
		i			13					
9	14	eP	15	34	50				Iran	
		i			52					
10	15	iP	20	04	12				53° N $160\frac{1}{2}^{\circ}$ E H: 19 55 39 h = 60 km (USCGS)	
		i		05	03					
11	15	iP	22	42	10				$1\frac{1}{2}^{\circ}$ N 125° E H: 22 29 17 h = 200 km (USCGS)	

✓

1958.

2.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
12	Aug 16	iP	13	26	54				51 $\frac{1}{2}$ ^o N 176 ^o W H: 13 17 51 (USCGS)	
13	16	iP i	19	22	11 15				34 $\frac{1}{2}$ ^o N 48 ^o E H: 19 13 45 (USCGS)	
14	17	iPg iSg	02	34	16 30				Δ = 110 km Local	
15	17	iP(b) iSg	13	52	20 35				Δ = 125 km Local	
16	18	ePn ? i	21	01	08 39				Local	
17	19	iP	01	02	08					
18	20	iP	08	57	21				Near east coast of Formosa.	
19	24	P	20	06	20					
20	Sept. 3	iP	03	56	37				0 ^o 18 ^o W H: 03 44 24 (USCGS)	
21	3	iP i	08	20	15 41				40 $\frac{1}{2}$ ^o N 143 ^o E H: 08 10 26 (USCGS)	
22	5	eP iSg	01	29	56 20				Δ = 180 km Local.	
23	11	eP	18	15	36				7 ^o N 126 $\frac{1}{2}$ ^o E H: 18 01 45 (USCGS)	
24	30	iPn iSn	09	57	42 45				Δ = 1215 km Novaja Zemya Nuclear explosion	

1958.

3.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks.
							AN	AE	AZ	
			h.	m.	s.					
25	Oct. 3	eP i ₁ i ₂	07	29	17 19 29				Local	
26	• 6	iP	19	01	09				55½°N 162½°E H: 18 52 40 (USCGS)	
27	• (10)	iP	<i>2.08</i> 03	38	53					
28	11	e	07	56	05				Weak	
29	• 12	iP	15	29	16				27½°N 125½°E H: 15 18 42 h = 250 km (USCGS)	
30	22	e	08	23	40				Novaja Zemya Nuclear explosion	
31	27	e	08	24	29					
32	27	ePn eSg iSn?	04	45	55 46 09				$\Delta \sim 90$ km Local	
33	27	iP	07	56	05					
34	28	iPg eSg	09	23	47 56				$\Delta \sim 80$ km Local	
35	• 28	iP	10	56	20				Southern Tibet	
36	• 29	iP i	07	53	11 14				Aleutian Islands	
37	Nov. 3	iPg iSg	16	35	21 38				$\Delta = 135$ km. Local	

✓

481

1958.

4.

No.	Date	Phase	time (GMT)			Amplitude μ			Remarks
						A _N	A _E	A _Z	
			h.	m.	s.				
38	Nov. 6	iP	23	07	36				44½°N 148½°E
		i			39				H: 22 58 10
39	8	iP	09	31	32				h ~ 100 km (USCGS)
		i			35				Kurile Islands
40	10	iPn	03	42	05				$\Delta = 220$ km
		iPb			07				Local
		i			13				
		iSn			32				
41	15	eP	05	52	23				37½°N 21½°E
									H: 05 42 40 (BCIS)



Isfjord

451

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S E I S M O L O G I C A L B U L L E T I N

(Nov. 17, 1958 - July 1, 1959)

ISFJORD, SPITSBERGEN

Coordinates: $78^{\circ}03'33''$ N, $13^{\circ}38'25''$ E. Elevation 5 m.Instrument: Willmore Z, $T_g = 1/4$ sek., $T_s = 1$ sek.

§§§§§§§§§§

*Local.

The shocks marked *Local, occurred at distances from 10 to 120 km. The origin of these shocks is not always clear. The recordings can easily be distinguished from those of instrumental disturbances.

Addendum.

According to later information, numerous explosions were carried out in the period March 18-22 to break the ice in Greenfjord, 20-30 km east of Isfjord. The 5 shocks marked *Local and the 19 shocks at distances of 20-35 km during these days probably are recordings of these explosions.

We have no information of explosions which would explain the other shocks marked *Local.

S E I S M O L O G I C A L B U L L E T I N

(Nov. 17, 1958 - July 1, 1959)

ISFJORD, SPITSBERGEN

Coordinates: $78^{\circ}03'33''$ N, $13^{\circ}38'25''$ E. Elevation 5 m.Instrument: Willmore Z, $T_g = 1/4$ sek., $T_s = 1$ sek.

§§§§§§§§§§

*Local.

The shocks marked *Local, occurred at distances from 10 to 120 km. The origin of these shocks is not always clear. The recordings can easily be distinguished from those of instrumental disturbances. Most of them are probably due to movements in the N-S trending Tertiary fault zone, which runs for 300 km along the west coast of Spitsbergen, and which lies 5 km west of Isfjord. Some of the shocks may, however, be caused by movements of glaciers, and the possibility of large explosions cannot be excluded, although we have no information on such explosions.

1958

1.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A _N	A _E	A _Z	
			h.	m.	s.					
42	Nov. 17.	iPn	13	10	39				$\Delta \sim 460$ km	
		Pb			46					
		iSn		11	29					
43	18.	eP	07	54	24					
		i ₁			26					
		i ₂		55	13					
44	18.	i	08	05	36					
45	19.	(i) ₁	11	03	23					
		(i) ₂			34					
46	20.	ePg	03	02	23				$\Delta = 110$ km	
		iSg			36					
47	20.	i	06	45	22					
48	25.	ePn	17	31	11				$\Delta = 180$ km	
		e			31					
		iSg			34					
49	27.	i ₁	17	13	53				*Local	
		i ₂			54					
		i ₃		14	29					
<p>Cut of work from 27/11-58 to 14/1-59.</p>										

1959

2.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_F	A_Z	
			h.	m.	s.					
1	Jan. 15.	iPn	15	20	07				$\Delta \sim 550$ km	
		$i_1!$			09					
		iSn		21	04					
		i_2			25					
		iSg			35					
		i_3			57					
2	16.	e	03	40	18				*Local	
		i			21					
3	17	iPcP	09	37	14				Mindanao	
		e			21					
4	17.	iPg	22	45	28				$\Delta \sim 40$ km	
		iSg			33					
5	18.	e	22	41	20					
6	19.	i	04	19	42				*Local	
7	19.	i	19	50	32				*Local	
8	19.	ePg	21	07	57				$\Delta \sim 115$ km	
		iPn			58					
		i_1		08	03					
		iSg			10					
		i_2			12					
9	20.	ePg	02	01	50				$\Delta \sim 80$ km	
		eSg			59					
10	22	ePg	01	23	33				$\Delta \sim 115$ km	
		iSg			47					

1959

3.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A _N	A _E	A _Z	
			h.	m.	s.					
11	Jan. 22.	iP	05	20	42				Japan $\Delta = 6750$ km	
	✓	i!			47					
		(PP)		22	38					
		iS		28	56					
		ScS		30	32					
		eSS		32	56					
12	✓ 22.	e	09	56	50				*Local	
13	23.	i ₁	03	11	57				*Local	
		e		12	04					
		i ₂			11					
		i ₃			16					
14	23.	iPg	03	19	43				$\Delta \sim 205$ km	
		i			45					
		i!Sn		20	07					
		eSg			12					
15	23.	i	14	12	51				*Local	
16	23.	i	18	21	40				*Local	
17	✓ 24.	eP	05	18	44				Japan	
		i			46					
		ipP		19	18					
18	✓ 24.	e	20	03	31				Azores Islands	
		i			35					
19	25.	e	00	04	51				*Local	

1959.

4.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks		
							A _N	A _E	A _Z			
			h.	m.	s.							
20	Jan. 25.	iPg	03	32	46					$\Delta = 60$ km		
		i									49	
		iSg									50	
21	25.	i	07	59	00					*Local		
22	25.	Pn	22	38	57					$\Delta \sim 170$ km		
		i									39	00
		iSn									18	
23	26.	i ₁	15	58	40					*Local		
		i ₂									54	
		i ₃									55	
24	26.	iPcP	21	54	19					Ryukyu Island		
25	27.	ePn	03	31	27					Jan Mayen		
		i ₁									30	
		i ₂									36	
26	28.	iP	14	10	09					Japan		
		i									15	
27	29.	e	00	17	49					*Local		
		i									51	
28	29.	iPg	01	06	29					$\Delta \sim 110$ km		
		Pn									31	
		iSg									41	
		Sb									43	
		iSn									44	



1959

5.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A _N	A _E	A _Z	
			h.	m.	s.					
29	Jan. 29.	iPg eSg iSn	01	24	15 27 30				$\Delta \sim 100$ km	
30	29.	i	09	44	32				*Local	
31	29.	iPn eSn i	23	26	23 41 25				Norwegian Sea outside Vesterålen $\Delta \sim 780$ km	
32	30.	iPg i iSg	00	36	16 18 19				$\Delta \sim 30$ km	
33	30.	i	07	55	37				*Local	
34	30.	Pg i Sg	09	45	56 57 00				$\Delta = 35$ km	
35	30.	i	14	19	16				Local	
36	30.	ePKP iPP i	18	28	16 56 10				Kermadec Islands	
37	30.	i	21	38	49				*Local	
38	30.	e	22	26	28				Hokkaido, Japan	
39	31.	ePg iSg	00	55	04 19				$\Delta \sim 120$ km	

1959

6.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
40	Feb. 1.	iPn	01	59	12				$\Delta \sim 160$ km	
		e_1			21					
		iSg			31					
		e_2	02	00	41					
41	✓ 1.	iP	03	21	53					
		i			57					
42	3.	iPg	03	47	05				$\Delta = 120$ km	
		iSg			19					
		i_1			20					
		i_2			23					
43	3.	i	21	07	30					
44	4.	i_1	08	46	00				Local	
		i_2			06					
45	✓ 5.	P	01	13	05				Alaska	
46	✓ 5.	e(P)	10	16	09				Near east coast of Honsu.	
47	5.	e	18	44	34				*Local	
		i		45	02					
48	6.	iPg	13	52	30				$\Delta = 65$ km	
		iSg			37					
		i			42					
49	6.	iPg	20	35	02				$\Delta = 80$ km	
		iSg			11					
		iSn			16					

1959.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
50	Feb. 7.	iP	09	50	21				Peru	
		i		51	41					
		eSKS	10	00	55					
51	7.	iP	10	24	07				16°N 146°E (USCGS)	
		iPcP			10					
52	7.	e	20	16	23				38°N 21°E (USCGS)	
53	8.	eP	01	09	12				North Atlantic Ocean	
54	8.	iP	03	44	51					
55	9.	iPn	07	36	53				$\Delta = 265$ km	
		ePg		37	00					
		iSg			30					
56	10.	iPg	09	45	13				$\Delta = 115$ km	
		iSg			27					
57	11.	e	14	28	50				*Local Strong mic.agit.	
		i			54					
58	11.	i_1	15	22	45				*Local	
		i_2			54					
		i_3			59					
59	11.	iPg	17	10	40				Southern coast of Jan Mayen.	
60	11.	e	23	03	51				*Local	
		i			56					

1959

8.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
61	Feb. 12.	iPg	h.	m.	s.				$\Delta = 65$ km	
		iSg	05	54	08					
		eSn			15					
62	12.	iPg	21	57	02				$\Delta = 120$ km	
		iSg			17					
		i			22					
63	13.	iPn	04	51	37				$\Delta = 200$ km	
		iPb			39					
		i_1			43					
		i_2			49					
		iSn		52	01					
		iSg			04					
64	13.	iPg	05	17	59				$\Delta \sim 50$ km	
		i		18	00					
		iSg			05					
								Out of work from 20/2 - 1/3.		
65	Mar. 3.	i	02	10	32				*Local	
66	✓ 4.	iP	01	01	40				Kamchatka	
67	4.	iPg	13	52	26				$\Delta = 105$ km	
		iSg			38					
		iSb?			39					
		i_1			44					
		i_2			50					
68	5.	iP?	03	07	27					
69	✓ 5.	e	14	19	08				Kurile Islands	

1959

9.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
70	Mar. 5.	eP	23	08	13				2°N 98°E (USCGS)	
71	8.	ePg iSg	04	25	19 26				$\Delta = 65$ km	
72	9.	P	18	54	10				Near north coast Honshu	
73	10.	e i	06	50 51	57 00				*Local	
74	10	i ₁ i ₂	08	26	38 41				*Local	
75	10.	i ₁ i ₂	08	54	07 10				*Local	
76	10.	i ₁ i ₂	09	23	10 12				*Local	
									Out of work 11/3	
77	12.	iPg iSg i	07	00	41 45 47				$\Delta \sim 35$ km	
78	12.	i	09	15	34				Out of work from 14/3 - 15/3.	
79	17.	iP i	08	36	32 42				27½°N 130°E (USCGS)	

1959

10.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
80	Mar. 17.	iP i	22	02	10 24				Jan Mayen region	
81	✓ 18.	eP i	00	52	30 39				27°N 129°E (USCG)	
82	18.	ePn iSn i ₁ i ₂	06	19	48 21 14 24 48				$\Delta \sim 830$ km	
83	✓ 18.	eP	07	36	54				32°N 141°E (USCG)	
84	18.	ePg iSg	11	29	47 30 01				$\Delta \sim 125$ km	
85	18.	i ₁ i ₂	19	51	16 19				*Local <i>Explosion</i>	
86	19.	iPg iSg	00	02	04 11				$\Delta = 55$ km	
87	19.	ePg iSg	01	38	26 29				$\Delta = 25$ km	
88	19.	i	03	31	29				*Local	
89	19.	i	05	25	25				*Local	
90	19.	e	05	36	04				*Local	
91	19.	e	06	59	51				Local	
92	✓ 19.	Pg Sg	07	08	25 28				$\Delta \sim 30$ km Weak	

Explosions

1959.

11

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
93	Mar. 19.	ePg iSg	07	26	04 07				$\Delta \sim 30$ km Weak	Explosions
94	19.	ePg iSg	07	43	43 46				$\Delta \sim 30$ km Weak	
95	19.	iPg iSg	08	14	27 31				$\Delta \sim 30$ km Weak	
96	19.	iPg iSg	08	26	09 12				$\Delta \sim 30$ km Weak	
97	✓ 19.	P	08	34	36				$35^\circ N$ $36^\circ W$ (USCGS)	
98	19.	iPg iSg	08	45	40 43				$\Delta \sim 30$ km	Explosions
99	19.	iPg iSg	08	45	53 56				$\Delta \sim 30$ km	
100	19.	ePg iSg	10	09	20 24				$\Delta = 35$ km	
101	19.	ePg Sg	10	22	54 57				$\Delta = 35$ km	
102	19.	iPg iSg	10	38	27 31				$\Delta = 30$ km	
103	19.	ePg iSg	10	56	18 22				$\Delta \sim 30$ km	
104	✓ 19.	ePg ePb iSg	10	56	36 38 40				$\Delta \sim 35$ km Weak	

1959

12.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
105	Mar. 19.	ePg iPb iSg	11	51	15 17 19				$\Delta \sim 35$ km Weak	} Explosions
106	✓ 20.	eP i	01	11	32 35				$52^\circ N$ $159^\circ E$ (USCGS)	
107	20.	ePg ePb iSg	06	30	15 17 19				$\Delta = 35$ km Weak	} Explosions
108	20.	iPg iPb iSg	06	40	01 03 05				$\Delta = 30$ km Weak	
109	20.	Pg Pb Sg	07	08	23 25 27				$\Delta = 30$ km Weak	
110	20.	Fg Fb Sg	07	11	47 49 50				$\Delta = 30$ km Weak	
111	20.	ePg Pb Sg	07	20	15 17 19				$\Delta = 35$ km Weak	
112	22.	e i ₁ i ₂	22	24	51 07 12				*Local	
113	22.	i ₁ i ₂	22	46	59 13					

1959.

13

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A _N	A _E	A _Z	
			h.	m.	s.					
114	Mar. 23	e	06	20	34					
		i			48					
115	24.	iPn	20	54	32				$\Delta = 210$ km	
		iSn			57					
		e		55	06					
116	25.	iPg	12	34	55				$\Delta \sim 120$ km	
		iSg		35	10					
117	25.	i	18	19	11				*Local	
118	26.	iPg	19	18	29				$\Delta = 20$ km	
		iSg			31					
119	26.	ePg	19	54	53				$\Delta = 50$ km	
		iSg			58					
120	27.	P	07	13	11				17°N 61°W (USCGS) Cut of work from 28/3 - 29/3	
121	31.	ePn	19	23	12				$\Delta = 220$ km	
		iPg!			17					
		iSn			38					
		i!Sg			42					
122	Apr. 1.	P	00	43	42				Canary Islands	
		i			49					
123	5.	iPn	17	33	18				$\Delta = 220$ km	
		i			39					
		iSn			43					

1959

14.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
124	Apr. 6.	iPg	01	26	12				$\Delta = 90$ km	
		iSg			22					
		iSn			26					
125	6.	ePn	14	08	40				$\Delta = 200$ km	
		iSn		09	03					
		iSg			07					
		i			09					
126	9.	iPn	08	28	15				$\Delta \sim 160$ km	
		iPg			17					
		iSb?			34					
		iSg			35					
127	9. ✓	eP?	17	19	04				India-Burma border	
		i			12					
128	9. ✓	iP	17	48	46				$7^\circ N$ $82^\circ W$ (USCGS)	
129	10.	iPg	02	03	35				$\Delta = 120$ km	
		iSg			50					
130	10. ✓	PKP	06	05	40				$25^\circ S$ $128\frac{1}{2}^\circ E$ (USCGS)	
		ePP		07	43					
131	10.	i	13	42	54				*Local	
132	10.	i	13	58	00				*Local	
									Out of work from 11/3, 20 ^h 21 ^m to 12/3, 10 ^h 36 ^m .	
133	12. ✓	i	12	46	47				*Local	

1959

15.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h	m.	s.					
134	Apr. 13.	i	05	50	04				*Local	
135	✓ 13.	iPcP?	18	42	48				India-Burma border	
		i		43	03					
136	✓ 14.	e	07	30	35				Alaska Peninsula	
137	✓ 15.	P	00	25	04				Near south coast of	
		i_1			17				Hokkaido	
		i_2			44					
138	15.	iPb	02	59	23				$\Delta \sim 140$ km	
		i_1			29					
		i_2			38					
		i!Sg			39					
		$i_3!$			43					
139	✓ 15.	P	19	19	51				Near east coast of Kamchatka	
140	✓ 16.	iP?	16	26	40				Mariana Island region	
		i			54					
141	17.	i	18	25	27				*Local	
142	17.	iPb?	19	15	53				$\Delta \sim 125$ km	
		iSg		16	07					
143	19.	i	12	18	48				Local	
144	✓ 19.	P	15	11	33				Near Kodiak Island, Alaska	

1959

16.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
✓ 145	Apr. 19.	P	17	46	37				Near west coast of Greece	
		i			53					
146	21.	i	12	30	35				*Local	
147	21.	i	17	35	02				*Local	
148	21.	iPn	20	05	29				$\Delta = 590$ km	
		i_1			33					
		iPb			39					
		i_2			42					
		iSn		06	30					
		i_3			38					
149	21.	iPn	21	22	12				$\Delta \sim 590$ km	
		iSn		23	12					
150	22.	iPg	04	39	14				$\Delta = 70$ km	
		i			21					
		iSg			22					
151	22.	iPg	05	23	00				$\Delta = 20$ km	
		i_1			01					
		iSg			02					
		i_2			03					
									April 22, out of work from 10 ^h 42 ^m to 13 ^h 49 ^m .	
152	23.	iPg	18	36	08				$\Delta \sim 110$ km	
		iSg			22					
✓ 153	24.	PKP	18	18	19				Kermadec Islands	
		i			23					

1959

17.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
154	Apr. 25.	iP	h.	m.	s.				Turkey	
		i	00	35	31					
155	25.	iP	01	14	33				Turkey	
156	25.	iPb	05	47	10				$\Delta = 125$ km	
		iPn			11					
		i_1			14					
		i_2			19					
		Sg			25					
		Sn			27					
157	26.	iPg	18	02	59				$\Delta = 30$ km	
		i			59					
		iPb		03	01					
		iSg			02					
158	26.	P	20	51	35				Near northeast coast of Formosa	
		ipP		52	08				$\Delta = 7550$ km	
		i			58				$h = 140$ km	
		iPP		54	00					
		PPP		55	55					
		eS	21	00	01					
		(ScS)		01	09					
		iLQ		08	58					
159	30.	iPb or							April 28, out of work from 10 ^h 47 ^m to 16 ^h 17 ^m	
		Pg	00	23	59				$\Delta = 125$ km	
		iSg		24	13					
		i			18					

481

1959

18.

No.	Date	Phase	Time (GMT)			Period	Amplitude μ			Remarks
							A_N	A_E	A_Z	
			h.	m.	s.					
160	Apr. 30.	iPb	02	21	36				$\Delta = 125$ km	
		iPn			37					
		iSg			51					
161	30.	iPn	22	40	53				Arctic Ocean, west of Spitsbergen	
		i_1			56				$\Delta = 210$ km	
		i_2		41	05					
		iSn			18					
162	May 1.	eP	08	32	08				Near north coast of Iran	
		i		34	01					
163	4.	iP	07	24	16				Near east coast of Kamchatka	
164	4.	iPn	23	15	59				$\Delta = 415$ km	
		i		16	02					
		iSn			43					
165	5.	iPg	02	53	47				$\Delta = 40$ km	
		iSg			52					
166	6.	iP	14	01	01				Out of work from 7/5, 10 ^h 41 ^m to 8/5, 10 ^h 41 ^m	
167	8.	iP ca. 11	11	43	43				Near east coast of Kamchatka	
									Time-marking out of work	
168	12.	P	05	06	06				Komandorskie Islands	

1959

19.

No.	Date	Phase	Time (GMT)			Amplitude μ			Remarks
						A _N	A _E	A _Z	
			h.	m.	s.				
									May 12, out of work from 10 ^h 05 ^m to 10 ^h 44 ^m
									Out of work from 12/5, 10 ^h 44 ^m to 13/5, 10 ^h 32 ^m
									Out of work from 13/5, 10 ^h 32 ^m to 16/5, 16 ^h 28 ^m
169	May 18.	P	07	33	03				Aleutian Islands
170	20.	P	16	44	42				Out of work from 19/5, 22 ^h 26 ^m to 20/5, 10 ^h 36 ^m
171	20.	i	19	57	07				Dodecanese Islands
172	21.	eP	07	00	33				Aleutian Islands
173	22.	iPg iSg	08	01	22 34				$\Delta = 100$ km
174	24.	iP	19	29	32				Caxaca, Mexico Strong microseism. agit.
175	26.	iP	04	23	56				Ryukyu Islands
176	26.	i	05	38	59				Leeward Islands
177	26.	eP	06	44	35				Northern Afghanistan Tadzhik border

1959

20.

No.	Date	Phase	Time (GMT)	Period	Amplitude μ			Remarks
					A _N	A _E	A _Z	
			h. m. s.					
								Partly out of work from 26/5, 10 ^h 36 ^m to 29/5, 10 ^h 34 ^m
								Out of work from 29/5, 10 ^h 34 ^m to 2/6, 15 ^h 45 ^m
								June 4, partly out of work from 10 ^h 37 ^m to 16 ^h 30 ^m
178	June 5.	i ₁	18 09 34					*Local
		i ₂	37					
		i ₃	46					
179	5.	i	18 43 43					*Local
180	6.	iPg	20 52 05					$\Delta \sim 110$ km
		iSg	17					
181	10.	iP	04 24 03					
182	14.	iPb or						
		iPg	20 14 18					$\Delta = 120$ km
		iSg	33					
183	17.	i	07 03 50					Local
184	18.	P	15 38 55					Kamchatka
								Out of normal work from 19/6, 12 ^h 30 ^m to 20/6, 08 ^h 00 ^m
								Out of work from 25/6, 08 ^h 33 ^m to 2/7, 10 ^h 33 ^m

UNIVERSITETET I BERGEN
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JULY 1, 1959 — DEC. 31, 1960

BY
MARKVARD A. SELLEVOLL
AND
KARSTEN STORETVEDT



Bergen, Norway, 1963.

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Bergen, Norway 1963.

S E I S M O L O G I C A L B U L L E T I N

ISFJORD, SPITSBERGEN

July 1, 1959 - Dec. 31, 1960.

 Coordinates: $78^{\circ}03'33''$ N, $13^{\circ}38'25''$ E. Elevation 5 m.

 Instrument: Willmore Z, $T_g = 1/4$ sek., $T_s = 1$ sek.

1959.

No.	Date	Phase	Time (GMT)	Remarks
	July 3.	eP	04 47 35	Local.
		i	44	
		i	51	
4.		e	07 42 35	
4.		e	14 51 27	Local?
		e	31	
5.		iP _n	03 25 43	$\Delta \sim 365$ km
		i	49	
		i	26 13	
		iS _n	23	
5.		eP	14 34 47	Local.
		i	50	
5.		iP	19 00 09	Local.
		i	24	

1959

3.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
j	July 5.	iP	20	53	43	local
		i.			57	
		i		54	01	
		i			06	
	18.	iP	20	06	46	0: 19 45 45 (USCGS) 15 1/2°N, 120 1/2°E (USCGS) h ~ 200 - 300 km (USCGS)
		S		16	28	
	24.	e	22	06	51	Local
	24.	e	22	53	01	Local
	26.	ePn	00	31	02	Δ = 250 km
		i			06	
		i			17	
		iS _n			31	
	26.	ePn	02	59	50	Δ = 215 km
		i			52	
		i	03	00	00	
		i			05	
		iS _n			15	
	Sept. 8.	iP	07	19	31	local
		i			42	
		i			48	
	16.	iP	06	23	01	local
		i			07	
		i			15	
		i			27	
	24.	iPn	05	47	21	Δ = 235 km
		i			25	
		iS _n			48	

1959

4.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Sept. 25.	iP	02	48	15	0: 02 36 48(USCGS) 22°N, 112°E (USCGS)
		i			35	
	26.	iPn	06	06	07	Δ = 225 km
		i			09	
		i			13	
		i			18	
		i			22	
		iSn			33	
	26.	e	08	30	37	
	26.	iPn	12	22	44	Δ = 445 km
		i			52	
		iSn		23	31	
		i			40	
	27.	iP	00	24	18	'local
		i			32	
	27.	iP	17	18	18	local . .
		i			20	
		i			24	
	28.	iPn	01	12	33	0: 01 11 20(USCGS) 81 1/2°N, 26°E (USCGS) Δ = 490 km
		i			43	
		iSn		13	24	
	30.	P	16	20	04	local
		i			15	
		i			18	
	30.	iP	22	30	59	local
		e		31	06	
		i			13	
	Oct. 1.	i P	15	33	45	local
		i		34	04	

1959

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Oct. 2.	i	22	58	07	
	7.	iP	08	37	56	O: 08 30 41 (USCGS) 41°N, 20°E (USCGS)
	27.	iPn	14	13	14	Δ = 230 km
		i			26	
		iSn			41	
		i			45	
	28.	iP	08	28	46	
		i		29	06	
	Nov. 13.	iP	03	58	15	local
		i			16	
		i			27	
	15.	P	17	16	25	O: 17 08 41 (USCGS) 37 1/2°N, 20 1/2°E (USCGS)
	19.	e	14	08	04	Local ?
	19.	eP	22	16	28	local
		i			41	
		i			43	
	19.	iP	23	44	56	local
		i		45	08	
	20.	P	15	37	33	local
		e			37	
	21.	e	16	27	43	Local
		i		28	04	
	22.	e	19	52	34	O: 19 34 35 (USCGS) 21 1/2°S, 178 1/2°W (USCGS)

1959

6.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Nov. 23.	P ?	20	07	53	local ?
		i		08	20	
		i			22	
	23.	eP	21	51	47	local
		i			54	
	26.	e	23	22	51	
	Dec. 4.	eP	13	22	20	local ?
		i			21	
		i			33	
		i			36	
	Dec. 12.	iP	00	20	17	local
		i			33	
		i			36	
	14.	eP	08	51	53	Δ ~ 120 km
		i			54	
		e		52	07	
		i			10	
						Out of work: Dec. 7, 11 ^h 40 ^m - Dec. 25, 11 ^h 48 ^m

1960

7.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Jan. 3.	e	01	49	22	Instr. disturbances ?
	4.	iP	07	44	49	local
		i			53	
		i			56	
		i		45	04	
	5.	P	07	52	33	local
		e			48	
	6.	e	08	59	53	
		i			54	
	9.	iP	07	32	20	O: 07 23 50 (USCGS) 36°N, 69°E (USCGS) h ~ 150 km (USCGS)
						Out of work: Jan. 13, 14 ^h Jan. 19, 11 ^h 35 ^m
						Out of work: Jan. 20, 11 ^h 35 ^m - Jan. 26, 11 ^h 35 ^m
	31.	iP	16	37	25	local
		i			38	
		i			41	
		i			43	
						Out of work: Feb. 6, 00 ^h - Feb. 8, 03 ^h .
	Feb. 8.	ePKP	13	05	10	O: 12 45 34 (USCGS)
		i			16	58°S, 67°W (USCGS)
	8.	eP	17	47	06	local
		e			22	
	11.	iP	23	32	45	local
		i			33 05	

1960

8.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Feb. 12.	(i)	04	21	01	Local blast
	15.	P e	22	57	39 53	local
	16.	eP	05	12	27	0: 05 00 14 18 1/2°N, 146°E (USCGS)
	17.	e	10	36	05	Local blast ?
	17.	iP i	23	53	18 33	local
	18.	e	05	58	07	
	18.	iP i	21	43	52 58	0: 21 35 11 52 1/2°N, 160°E (USCGS)
	18.	iP e	22	56	06 17	local
	19.	iP ipP	10	45	11 59	0: 10 36 46 36°N, 70 1/2°E (USCGS) h ~ 200 km (USCGS) h = 220 km
	22.	eP	05	19	10	0: 05 17 18 71 1/2°N, 2 1/2°E (USCGS)
	23.	eP	02	18	08	0: 02 09 42 36°N, 70°E (USCGS)
	23.	P	07	42	04	0: 07 34 30 39°N, 20°E (USCGS)
	23.	P	09	34	01	0: 09 23 37 34 1/2°N, 139 1/2°E (USCGS) h ~ 100 km (USCGS)

1960

9.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
23	Feb. 23.	iPn eSn	11	03	45 04 24	$\Delta = 360$ km
24	24.	P	00	14	23	O: 00 03 00 21 1/2°N, 142°E (USCGS) h ~ 300 km (USCGS)
25	24.	Pn i eSn	19	11	16 17 59	$\Delta = 400$ km
26	25.	P	02	20	28	
27	25.	i i	13	21	59 22 05	Local
28	25.	eP i i i	14	23	57 58 59 24 11	Local
29	25.	ePn iSn	14	46	47 47 16	$\Delta = 250$ km
30	25.	e i	19	40	24 25	Local
31	29.	P	23	49	05	Out of work: Feb. 26, 11 ^h 33 ^m - Feb. 29, 11 ^h 36 ^m O: 23 40 12 30°N, 9°W (USCGS)
32	Mar. 4.	P	04	03	36	O: 03 53 00 31°N, 129°E (USCGS) h ~ 100 km (USCGS)
33	4.	eP i	16	27	13 15	O: 16 25 25 72°N, 1 1/2°W (USCGS)

1960

10.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Mar. 4.	eP	21	18	03	0: 21 05 45 7 1/2°N, 94°E (USCGS)
	5.	iP	14	02	44	0: 13 49 16 1°N, 129°E (USCGS)
	5.	iP	19	09	48	Local
		i			51	
		i		10	03	
		i			05	
	7.	P	05	26	24	0: 05 13 10 1 1/2°N, 125 1/2°E (USCGS)
	7.	iP	06	20	11	0: 06 11 38 52°N, 153°E (USCGS) h ~ 150 km (USCGS)
	7.	i	21	23	32	
	8.	iPKP	16	51	57	0: 16 33 38
		i		53	13	16 1/2°S, 168 1/2°E (USCGS)
		iPKKP	17	02	22	h ~ 250 km (USCGS)
		e		05	08	
		e			53	
		e		06	08	
	9.	iP	09	29	04	local
		i			21	
	10.	P	14	41	48	0: 14 32 39
		ePcS		46	42	47°N, 152°E (USCGS) h ~ 100 km
	10.	eP	19	07	55	0: 18 55 55 14 1/2°N, 91 1/2°W (USCGS) h ~ 100 km (USCGS)
	14.	ePPP	01	05	55	0: 00 52 57 42 1/2°N, 143°E (USCGS)

1960

11.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
45	Mar. 14.		02	02	37	
46	17.	iP e e	06	48	00 08 15	local
47	17.	iF i iS	07	13	00 01 17	local
48	20.	i i i	12	02	02 04 06	
49	20.	P i	17	17	22 29	O: 17 07 30 40°N, 143 1/2°E (USCGS) h ~ 60 km (USCGS)
50	21.	P	00	44	43	O: 00 34 50 39 1/2°N, 143°E (USCGS)
51	21.	P	09	28	17	O: 09 18 22 40°N, 143°E (USCGS)
52	22.	P	02	00	13	O: 01 48 24 16°N, 97 1/2°W (USCGS)
53	22.	iP i	11	57	57 11	local
54	22.	iP i i	20	18	08 09 16	local
55	22.	iP i	23	03	56 58	local
56	23.	P i	00	33	20 23	O: 00 23 22 39 1/2°N, 143°E (USCGS)
57	23.	iP	01	17	14	O: 01 07 15 39 1/2°N, 143°E (USCGS)

1960

12.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Mar. 23.	P ?	02	19	06	
	23.	P	08	56	39	0: 08 46 44 40°N, 142 1/2°E (USCGS)
	23.	P	10	38	52	0: 10 20 01 39 1/2°N, 143°E (USCGS) h ~ 100 km (USCGS)
	23.	iP	12	01	00	0: 11 51 00 39 1/2°N, 143°E (USCGS)
	23.	eP	16	11	06	0: 16 01 13 39°N, 144°E (USCGS) h ~ 100 km (USCGS)
	23.	P	20	13	41	0: 20 03 47 32 1/2°N, 103 1/2°E (USCGS)
	23.	eP	22	32	39	0: 22 22 36 39 1/2°N, 143°E (USCGS)
	27.	eP	20	27	33	0: 20 15 46 20°N, 104 1/2°W (USCGS)
	27.	e	21	30	24	
	27.	PKP	23	47	20	0: 23 28 04
		ePP		50	23	37 1/2°S, 177°E (USCGS)
	28.	P	00	26	10	0: 00 13 38 7 1/2°N, 82°W (USCGS)
	29.	ePP	06	50	53	0: 06 30 54 17°S, 167°E (USCGS)
	29.	iP	16	45	20	local
		i			35	
	30.	P	13	01	57	0: 12 58 57 69°N, 17°W (USCGS)

1960

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Mar. 30.	e	16	10	07	
	31.	Pn	00	51	44	$\Delta = 250$ km
		iSn		52	13	
		iSg			19	
	31.	P	03	12	05	O: 03 02 03 39 1/2°N, 143°E (USCGS)
	31.	iP	08	12	02	local
		i			10	
		i			19	
	31.	Pn	11	10	30	$\Delta = 235$ km
		i !			32	
		iSn			58	
		i		11	00	
	31.	P	20	07	37	O: 19 56 14
		i			43	26°N, 110°W (USCGS)
		iPcP			57	
	Apr. 1.	iP	20	24	40	local
		i			57	
		i			59	
	1.	P	21	36	57	local
		i			58	
		iS			59	
	2.	P	22	44	31	O: 22 36 08 36°N, 50°E (USCGS)
	4.	P	20	04	21	O: 20 52 15 15°N, 119 1/2°E (USCGS)
	4.	e	22	02	03	

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Apr. 11.	Pg iSg	14	04	42 47	$\Delta \sim 50$ km
	12.	P	04	30	24	0: 04 22 35 Western Turkey
	12.	P	20	49	16	0: 20 41 10 46 1/2°N, 96°E (USCGS)
	13.	eP	12	49	42	0: 12 37 38 15 1/2°N, 92 1/2°W (USCGS)
	13.	iP i i i	14	23	33 50 53 55	local
	15.	iP i	04	20	15 31	local
	20.	iP i	09	28	45 29 00	local
	23.	i	09	32	52	Local blast ?
	24.	iP	03	35	00	0: 03 22 23 6°S, 113 1/2°E (USCGS) h ~ 600 km (USCGS)
	24.	iP	12	23	53	0: 12 14 26 28°N, 54 1/2°E (USCGS) Out of work: Apr. 28, 17 ^h 58 ^m - May 2, 23 ^h 04 ^m Partly out of work: May 3, 11 ^h 42 ^m - May 9, 11 ^h 33 ^m and May 11, 11 ^h 37 ^m - May 15, 11 ^h 36 ^m .

1960

15.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	May 18.	i !	09	19	48	
	19.	iP	02	15	28	0: 02 07 00 36°N, 71°E (USCGS)
	19.	ePn iSn	15	19	51 20 46	Δ = 530 km
	22.	iPKP	19	30	05	0: 19 11 20 38°S, 73 1/2°W (USCGS)
	24.	iPKP i	15	06	13 27.	0: 14 46 34 44 1/2°S, 167 1/2°E (USCGS)
	25.	P ?	08	53	59	
	26.	iP	05	17	30	0: 05 10 05 40°N, 20°E (USCGS) Out of work: May 27, 11 ^h 35 ^m - May 29, 19 ^h Out of work: May 30, 13 ^h 30 ^m - June 19
	June 20.	e	13	18	49	0: 12 59 40 39 1/2°S, 73°W (USCGS)
	25.	P	14	06	07	0: 13 53 37 6 1/2°N, 72 1/2°W (USCGS)

1960

16.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
						Out of work: July 3, 11 ^h 37 ^m - July 4, 23 ^h 39 ^m
	July 4.	ePn iSn	09	53	04 25	$\Delta \sim 180$ km
	6.	iP	05	25	08	O: 05 16 44 36 1/2°N, 70 1/2°E (USCGS) h ~ 200 km
	8.	P	13	02	04	O: 12 51 21 31°N, 130 1/2°E (USCGS)
	10.	eP i	00	18	16 21	O: 00 05 18 0°, 98°E (USCGS)
	11.	eP i i i i	13	13	06 09 13 32 36	
	11.	Pg iSn iSg	21	35	58 36 26	$\Delta \sim 240$ km
	12.	iP i eS	13	41	13 19 28	local
	13.	e	11	47	02	
	13.	e	16	36	13	
	13.	e	22	26	44	Local?
	14.	e	00	42	32	
	14.	e	01	07	24	
	14.	e e	01	29	05 09	Local

1960

17.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	July 14.	e	06	19	21	
		e			22	
	14.	e	10	26	12	
	14.	e(P)	10	40	02	O: 10 26 58 5°N, 127 1/2°E (USCGS)
	14.	e(P)	22	19	46	O: 22 11 06 36°N, 70°E (USCGS) h ~ 100 km
	15.	e	13	45	25	
	16.	(i)(P)	17	29	06	O: 17 17 44 21 1/2°N, 143°E (USCGS)
	16.	e	18	15	52	
	19.	e	13	05	54	
	20.	e	09	39	47	
	29.	P	17	41	31	O: 17 31 39
		i			32	40°N, 142°E (USCGS) h ~ 50 km
	29.	iPg	19	44	01	local
		i			13	
		i			17	
						Out of work: Aug. 2, 18 ^h - Aug. 3, 19 ^h
	Aug. 6.	e	20	46	11	
	6.	e	20	51	24	
		e			38	
	8.	eP	20	44	18	O: 20 36 28 36°N, 27°E (USCGS) h ~ 87 km

1960

18.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Aug. 9.	e	00	27	57	Local
		i		28	11	
		i			17	
	9.	iP	02	19	08	Local
					23	
	9.	e	06	30	05	
	9.	e(P)	07	49	34	0: 07 39 23 40°N, 126°6 W (USCGS) h ~ 25 km
	9.	e	10	06	06	
	9.	eP	10	30	40	Local
		iS			54	
	13.	i	05	59	29	Local
		i			33	
		i			45	
		i			50	
	13.	e	14	34	02	
	13.	e	15	34	02	
	20.	i	07	51	42	
	26.	e	21	05	23	Disturbances ?
					34	
						Out of work: Aug. 27, 17 ^h - Sept. 1, 11 ^h 32 ^m
	Sept. 16.	i	07	21	34	Disturbances ?
		i			38	

1960

19.

No.	Date	Phase	Time (GMT)			Remarks
			h.	m.	s.	
	Oct. 5.	P	04	22	59	local
		i		23	13	
	7.	P	03	24	18	local
		i		24	30,2	
	7.		04	38	14	Disturbances?
	8.	P	06	01	48	0: 05 53 01
		i			52	40°N, 129, °7 (USCGS)
		i		08	55	h 608 km
	9.	P	09	10	18	0: 09 00 42
						40, °8 N, 141 °2 E (USCGS)
						h 155 km
	11.	i	11	45	14	(local)
	12.	i	01	28	46	Disturbances?
	November.					Out of work.
	December.					Out of work.