

Recording of earthquakes and tremors in the Vestman Islands

Jan. 23, - April 11, 1964

by

Gudmundur Pálmason
State Electricity Authority
Department of Natural Heat

In the first Surtsey Research Progress Report from February 1965 it was mentioned that a provisional seismograph was operated in the Vestman Islands from Jan. 23, to April 11, 1964. The seismograms have now been read and the results are given in this report together with a few remarks on the relation between seismic events and the course of the eruption during this period.

Instrumentation.

The seismograph consisted of three seismometers and a Visicorder recorder, whose galvanometers were connected without amplification to the seismometers. The seismometers were a Willmore vertical component, nat. freq. about 1 c/sec, an ABEM vertical component, nat. freq. 6 c/sec, and a three component Hall-Sears seismometer, nat. freq. 4.5 c/sec. One channel of the recorder was connected to a chronometer, whose time signals were corrected by comparison with WWV radio signals. The galvanometers had a natural frequency of 40 c/sec and a sensitivity of 0.18 mm/microvolt.

The damping of the seismometers was not critically adjusted as the main objective was to collect information on the frequency of seismic events in relation to the course of the eruption. The Willmore seismometer was only slightly damped, but the others were fairly well damped.

The equipment was installed in a house in the Vestman Islands town at a distance of 22.3 km from the main crater of Surtsey.

Seismic Events and their Relation to the course of the Eruption.

The seismic events on the records are mainly of two types, sudden shocks, and a more or less continuous tremor. The frequency of shocks during the recording period was by far the largest on February 1, when over 20 shocks were recorded. On that day eruption started with a fountain activity in the crater, which was later to become the main crater.

The tremor occurred every now and then during most of the recording period. The main indication of its relation to the eruption is from the first days of April. No tremors were recorded from the beginning of April until at 21:15 on the evening of the 3rd. Then tremor started and continued for about six days. The lava flow from the main crater was observed for the first time on the 4th of April. It is therefore probable that the tremor in this case is associated with the beginning of the flow of the lava from the main crater.

The seismic events as read from the seismograms are given in the following table. E denotes a sudden shock and T a more or less continuous tremor. Amplitudes are read from the trace of the Willmore seismometer. Events with trace amplitudes less than about 2 mm are not included. Due to insufficient damping of the seismometer, these amplitudes do not represent actual earth motion.

Acknowledgements.

The Icelandic Meteorological Office supplied a Willmore seismometer and the Physical Laboratory of the University of Iceland supplied a chronometer for these measurements. The rest of the equipment was from the State Electricity Authority. Mr. Sveinbjörn Björnsson assisted in setting up the equipment in the Vestman Islands.

TABLE

Date 1964	Hour GMT	Max. trace amplit. mm	Remarks
23/1	11 06 21	32	E
"	11 06 33	ca 50	"
"	11 06 45	10	"
"	11 06 53	9	"
"	11 07 01	10	"
"	11 07 - 11 09	6	T
"	14 00 00	6	E
"	14 20 27	3	"
"	14 20 31	6	"
"	14 20 42	46	"
"	16 35 - 16 58	3	T
"	23 45 51	3.5	E
24/1	00 36 - 00 41	3.5	T
"	00 43 15	4.5	E
"	01 53 - 01 55	3	T
"		ca 2	Minor tremor most of the day
"		" 2	
25/1	04 30 - 05 00	5	T
"	08 30 - 08 40	3	T
"	11 08 - 11 48	6	Strong tremor
26/1	06 37 - 06 40	3.5	T
"	15 15 - 15 20	2.5	T
27/1	01 55 - 02 05	3.0	T
"	08 20 - 08 50	4	T
28/1	02 47 - 03 33	4.5	T
"	06 57 - 07 25	6.5	T
"	13 28 - 14 04	7	T

Date 1964	Hour GMT		Max. trace amplitude mm	Remarks
29/1	00 04	- 00 42	5	T
"	11 40	- 11 55	3	"
"	12 35	- 13 20	3	"
"	14 25	- 15 22	2.5	"
"	20 00	- 20 35	2.5	"
"	21 00	- 01 00 30/1		T most of the time
30/1	01 00	- 21 00		T most of the time
"	14 00	- 15 00	2-3	T
"	18 15	- 20 30	2-3	T
"	20 27 33		3	E
"	21 43	- 21 55	2.5	T
"	22 37	- 22 41	2.5	T
"	22 48	- 22 55	2.5	T
31/1	01 15	- 01 22	3.5	T
"	02	- 03	2.5	T most of the time
"			2.5	E
"	13 42 16		14	"
"	17 51 35		3	"
"	17 51 44		14	"
"	21 46 40		10	"
1/2	00 03 17		10	"
"	00 03 26		62	"
"	01 21 43		ca 10	"
"	02 02 40		20-30	"
"	02 02 49		ca 50	"
"	02 56 45		14	E
"	02 56 51		97	"
"	02 58 23		9	"
"	03 42 38		11	"

Date	Hour	GMT	Max. trace amplitude mm	Remarks
1964				
1/2	03	43 29	5	E
"	03	43 38	35	"
"	06	42 55	12	"
"	06	43 03	64	"
"	07	14 08	5	"
"	07	28 24	33	"
"	07	28 33	95	"
"	07	39 07	9	"
"	08	57 03	ca 50	"
"	08	57 12	100	"
"	11	36 31	6.5	"
"	11	40 01	9	"
"	11	40 11	50-60	"
"	14	51 29	12	"
"	14	51 38	89	"
"	15	54 21	11	"
"	15	55 00	11	"
"	15	55 10	35	"
"	15	54 09	4.5	"
"	16	17 38	5	"
"	16	57 39	5	"
"	16	57 43	28	"
"	16	57 48	69	"
"	17	38 52	6	"
2/2	00	30 - 01 00	3	T
"	01	00 - 06 00	3	"
"	21	00 - 24 00	2	"
3/2	13	05	2.5	T
"	14	00	2.5	"
"	00	00 - 24 00	2.5	Continuous tremor most of the day

Date 1964	Hour GMT		Max. trace amplitude mm	Remarks
4/2	21 45	- 22 45	2.5	T
5/2	05 48	- 06 25	2.5	T
"	09 25	- 09 26	2.5	T
"	16 04	- 16 05	4	T
6/2	00 00	- 21 00	2	Almost no tremor most of the day
7/2	13 24	- 14 10	3-6	Seven minor shocks
8/2	00 00	- 21 00	2	Minor tremor
"	09 15	- 09 20	2.5	T
"	12 50		3.5	E, small
"	14 33	- 14 34	2.5	T
"	17 11		3.0	E, small
9/2	01 00		4.0	E, small
"	02 07	- 02 13	2.5	T
"	05 05	- 05 24	2.5	"
"	07 50	- 07 51	2.5	"
"	12 33		2.5	E, small
"	12 22	- 14 21	3.5	Five minor shocks
"	16 03		4.0	E, small
"	17 41	- 18 06	2.5	T
10/2	01 55		3.0	E, small
"	16 34		3.0	" "
"	21 05	- 21 47	2-4.5	Four minor shocks
"	23 54	- 23 55	3.0	T
11/2	09 38		4.0	E, small
"	10 59	- 11 03	4.0	Two minor shocks
"	15 09	- 15 20	3.0	T
"	17 19	- 17 30	2.5	T
12/2	00 30	- 00 43	4.5	T
"	02 48	- 02 49	2.5	"

Date	Hour GMT		Max. trace amplitude mm	Remarks
1964				
12/2	04 15	- 04 47	2.5	T
"	05 05	- 05 10	3.0	"
"	06 27	- 06 37	2.5	"
"	07 42	- 07 47	3.5	"
"	10 12	- 10 14	3.0	"
"	12 36	- 12 45	3.5	"
"	13 10	- 13 15	3.5	"
"	14 16	- 14 35	2.5	"
"	15 22	- 15 30	3.0	"
"	19 21	- 19 22	2.5	"
"	20 35	- 20 40	2.5	"
"	21 47	- 22 09	4.0	"
13/2	03 07	- 03 08	4.0	T
"	05 08	- 05 22	2.5	"
"	07 10	- 07 16	3.5	"
"	09 30	- 09 40	3.5	"
"	12 30	- 13 05	3.0	"
"	13 57	- 14 05	2.5	"
"	15 27	- 15 33	5.0	"
"	15 56	- 16 10	2.5	"
"	17 30	- 17 33	2.5	"
"	19 06	- 19 12	3.0	"
"	20 01		2.5	E, small
"	20 30	- 20 45	2.5	T
"	00 00	- 20 45	2.0	Continuous tremor most of the day
"	21 26	- 21 27	3.0	T
"	23 14	- 23 20	5.5	"
"	23 52	- 00 02 (14/2)	3.0	"
14/2	00 33	- 01 10	2.5	"
"	02 49	- 02 58	4.5	"
"	04 57	- 05 00	2.5	"

Date	Hour GMT		Max. trace amplitude mm	Remarks
1964				
14/2	07 36	- 07 50	3.0	T
"	08 23	- 08 45	2.5	"
"	10 06	- 10 15	2.5	"
"	10 43	- 10 48	3.5	"
"	15 44	- 16 14	2.5	"
"	17 43	- 17 47	3.0	"
"	17 59	- 18 02	3.0	"
"	18 52	- 20 25	3.0-4.5	"
"	22 38	- 22 50	4.5	"
15/2	00 11	- 00 22	4.0	T
"	01 50	- 01 53	3.5	"
"	03 08	- 03 21	5.0	"
"	04 36	- 04 40	3.5	"
"	06 23	- 06 31	3.0	"
"	08 32	- 08 45	8.5	"
"	10 57	- 11 14	3.5	"
"	13 10	- 13 29	3.0	"
"	15 02	- 15 13	3.0	"
"	17 13	- 17 26	4.5	"
"	19 15	- 19 30	2.5	"
"	21 00	- 21 08	3.0	"
"	22 00	- 23 00	2.5	"
"	23 50	- 00 15 (16/2)	2.5	"
16/2	03 14	- 03 23	5.0	"
"	05 30	- 05 37	4.0	"
"	07 14	- 08 07	3.0	"
"	09 52	- 09 59	3.0	"
" ca	11 01		5.5	E
"	12 13	- 12 34	4.5	T
"	14 33	- 14 41	3.0	"
"	17 26	- 17 38	3.0	"
"	00 00	- 24 00	2.5	Tremor groups most of the day

Date 1964	Hour GMT		Max. trace amplitude mm	Remarks
16/2	20 07	- 20 08	4.5	T
"	21 55	- 21 57	3.0	"
"	22 27	- 22 41	5.0	"
17/2	05 30	- 05 44	5.0	T
"	09 15	- 10 52	3-3.5	"
"	13 39	- 13 57	3.0	"
"	19 11	- 19 12	4.5	"
18/2	00 00	- 24 00	2.5	Many tremor groups
"	01 06	- 01 08	3.0	T
"	01 57	- 01 58	3.0	"
"	03 55	- 04 05	4.0	"
"	06 27	- 06 39	5.5	"
"	09 00	- 09 11	4.5	"
"	12 28	- 12 39	3.5	"
"	15 13	- 15 14	3.0	"
"	20 58	- 21 10	3.0	"
"	21 37	- 21 45	3.0	"
"	23 52	- 23 59	3.5	"
19/2	02 16	- 02 21	3.0	T
"	00 00	- 24 00		Almost no tremor
20/2	00 00	- 24 00		- " -
21/2	09 46	- 10 00	2.5	T
"	15 24	- 15 44	3.0	"
"	16 00	- 18 00	2.5	"
"	21 03	- 21 19	7.5	"
"	23 38	- 23 46	3.5	"
22/2	03 10	- 03 19	6.5	T
"	04 05	- 04 07	3.0	"
"	06 35	- 06 50	4.0	"
"	08 00	- 08 05	4.5	"
"	09 30	- 10 30	5.0	"

Date	Hour GMT		Max. trace amplitude mm	Remarks
1964				
22/2	12 01	- 12 13	4.0	T
"	12 32	- 12 34	3.5	"
"	14 00	- 15 00	4.0	"
"	17 32	- 18 22	3.5	"
"	00 00	- 20 00	2.5	Continuous tremor most of the day
"	20 14	- 20 28	5.0	T
"	22 09	- 22 33	3.0	"
"	23 16	- 23 18	3.5	"
"	23 48		5.0	E, small
23/2	02 18	- 02 23	7.5	T
"	05 13	- 05 40	3.0	"
"	01 00	- 07 45	2.5	Almost continuous tremor
"	18 45	- 19 18	2.5	T
24/2	00 42	- 01 12	3.0	"
"	03 04	- 03 09	3.5	"
"	03 40	- 03 51	3.5	"
"	05 00	- 06 15	3.5	"
"	07 30	- 08 15	2.5-3.0	"
"	11 02	- 11 18	3.0	"
"	13 00	- 14 15	3.5	"
"	15 58	- 16 36	4.5	"
"	18 34	- 19 25	7.5	"
"	20 34	- 20 50	3.5	"
"	23 05	- 23 33	4.0	"
25/2	00 45	- 01 30	5.0	T
"	02 45	- 03 27	3.0	"
"	05 50	- 05 56	5.5	"
"	08 50	- 08 56	5.5	"
"	13 08	- 13 12	3.0	"
"	17 14	- 17 41	7.0	"

Date	Hour GMT		Max. trace amplitude mm	Remarks
1964				
25/2	18 58	- 19 20	3.0	T
"	20 25	- 20 51	4.0	"
"	22 11	- 22 16	3.0	"
"	23 45	- 00 00	2.5	"
26/2	02 50	- 03 15	2.5	"
"	04 27	- 04 33	4.0	"
"	06 30	- 07 33	2.5-5.0	Almost continuous tremor
"	14 30	- 14 41	3.0	T
"	16 40	- 17 56	3.5	"
"	19 06	- 19 09	3.5	"
"	21 19	- 21 30	4.5	"
27/2	02 47	- 03 10	4.5	"
"	05 00	- 05 40	4.0	"
"	07 12	- 07 15	2.5	"
"	08 00	- 08 09	5.0	"
"	09 03	- 10 30	4.0	"
"	13 13	- 13 25	3.0	"
"	16 32	- 16 55	3.0	"
"	19 27	- 19 30	5.0	"
"	20 18	- 20 20	10.0	T (E ?)
"	21 08	- 21 09	9.0	- " -
28/2	02 45	- 03 17	11.0	T (E ?)
"	03 45	- 09 00	4-6.0	Almost continuous tremor
"	09 06	- 10 20	7.5	- " -
"	11 00	- 15 35	6.5	- " -
"	19 53	- 19 55	2.5	Disturbance
"	20 21	- 20 30	5.0	T
29/2	03 26	- 03 29	4.0	T
"	11 36	- 12 15	7.5	"
"	18 02	- 18 10	5.0	"
"	20 44	- 20 45	3.0	"

Date 1964	Hour GMT		Max. trace amplitude mm	Remarks
1/3	04 08	- 04 11	3.0	T
"	09 14	- 09 49	5.0	"
"	17 33	- 17 34	4.0	"
"	18 05		4.5	E, small
"	22 15	- 22 21	2.5	T
2/2	05 24	- 05 26	5.0	T
"	06 05	- 06 07	5.0	"
"	07 06	- 07 54	3.5	"
"	16 44	- 16 47	4.0	"
"	22 30	- 22 49	5.0	"
3/3	09 24	- 09 45	2.5	"
"	10 32	- 10 36	3.0	"
"	13 49		3.0	"
"	23 07		3.0	"
4/3	00 39	- 00 50	3.0	T
"	01 27	- 01 38	4.5	"
"	04 33	- 04 40	5.0	"
"	11 49	- 12 20	3.0	"
"	16 09	- 16 51	2.5	"
"	17 49	- 18 11	3.0	"
"	19 00	- 19 30	2.5	"
"	20 15	- 21 00	5.5	"
"	22 20	- 22 40	3.5	"
5/3	11 53	- 12 30	3.0	T
"	13 18	- 13 26	5.0	"
"	16 24	- 16 30	3.0	"
"	21 57	- 22 02	3.0	"
6/3	07 31		3.0	"
"	10 00	- 13 40	5.0	"
7/3	02 28		3.0	"
"	12 15	- 13 00	4.0	"

Date 1964	Hour GMT		Max. trace amplitude mm	Remarks
8/3	05 35	- 05 50	3.0	T
"	07 39	- 08 03	3.5	"
"	11 05	- 11 31	4.5	"
"	13 11	- 13 20	3.0	"
"	14 45	- 15 47	3.5	"
"	17 05	- 17 38	4.5	"
"	18 54	- 19 02	3.0	"
9/3	06 15	- 06 45	4.0	T
"	08 48	- 09 10	6.0	"
"	10 54	- 11 15	3.5	"
"	16 55	- 17 45	4.0	"
10/3	01 15	- 01 58	5.0	T (E, small)
"	09 10	- 09 45	3.5	"
"	15 15	- 15 35	4.0	"
"	16 30	- 17 15	5.5	"
"	17 59	- 18 30	3.5	"
"	21 10	- 21 20	3.5	"
11/3	02 46	- 02 57	5.0	T
"	05 35	- 06 08	5.0	"
"	15 25	- 16 30	4.5	T (E, small)
12/3	00 05	- 00 45	3.0	T (E, small)
"	02 05	- 02 19	3.0	T
"	14 31	- 14 51	6.0	"
"	15 34	- 16 03	6.0	"
13/3	03 18	- 04 43	4.5	T
"	08 39	- 09 10	3.0	"
"	13 25	- 13 30	3.5	"
14/3	06 52	- 07 10	3.0	T
"	09 54	- 10 01	3.5	"

Date 1964	Hour GMT		Max. trace amplitude mm	Remarks
15/3	05 42	- 06 15	7.5	T
"	15 38	- 15 50	5.5	"
16/3	00 15	- 00 50	3.5	T
"	00 00	- 24 00	2.5	Almost no tremor
17/3	01 30	- 11 30	2.5-8.0	Many small tremor groups or shocks
18 /3	03 30	- 04 23	3.5	T
"	06 30	- 19 00	2.0-3.0	Many small tremor groups
"	21 03	- 21 30	6.0	T
19/3	01 59	- 02 02	3.0	T
"	10 12	- 10 19	3.5	"
"	18 20	- 18 28	3.0	"
"	01 00	- 20 00	2-3.0	Many small tremor groups
20/3	10 58	- 11 10	4.0	T
"	20 25	- 22 00	3.5	"
21/3	06 30	- 08 00	2.5	T
22/3	00 00	- 24 00	2.5	Minor tremor groups
23/3	00 00	- 24 00		Minor tremor groups
24/3	21 00	- 01 00 (25/3)	3.0	Minor tremors
25/3	00 00	- 24 00		Quiet
26/3	08 15	- 08 35	5.0	T
"	17 00	- 19 00	2.5	Minor tremors
27/3	00 00	- 24 00		Quiet
28/3	00 00	- 24 00		Quiet

Date	Hour GMT		Max. trace amplitude mm	Remarks
1964				
29/3	23 11	- 23 17	3.0	T
30/3	01 05	- 01 42	3.0	Minor shocks, otherwise quiet
31/3	ca 18 00	- 22 00	2.0-2.5	T
1/4	00 00	- 24 00		Quiet
2/4	00 00	- 24 00		"
3/4	00 00	- 20 15		"
"	20 15	- 24 00	2-2.5	Continuous tremor
4/4	00 00	- 24 00	2.5	" "
5/4	00 00	- 24 00	2.5	" "
6/4	00 00	- 24 00	2.5	" "
7/4	00 00	- 24 00	2.0	" "
8/4	00 00	- 24 00	2.0	
9/4	00 00	- 24 00	2.0	Minor tremor
10/4	00 00	- 24 00		Almost quiet
11/4	06 30	- 09 00	2.5	Minor tremor
"	14 50	- 17 00	2.5	" "