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**SIGNIFICANT EARTHQUAKES IN 1998**

(Earthquakes that was felt in Hungary)

12 January 1998 - Balatonfűzfő

12 April 1998 - Slovenia

8 May 1998 - Budakeszi

29 September 1998 - Serbia

6 December 1998 - Hárskút

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## METHOD USED FOR ESTIMATION OF INTENSITY

The earthquake effects (macroseismic observations) are usually gathered on questionnaires. Based on these reports the intensity values were estimated by a computer algorithm (Zsíros et al, 1990 and Zsíros 1994).

The assigned intensities correspond to the *European Macroseismic Scale 1992 (EMS)* edited by Grünthal (1993). (APPENDIX A)

## 12 January 1998 - Balatonfűzfő

### HYPOCENTRE PARAMETERS

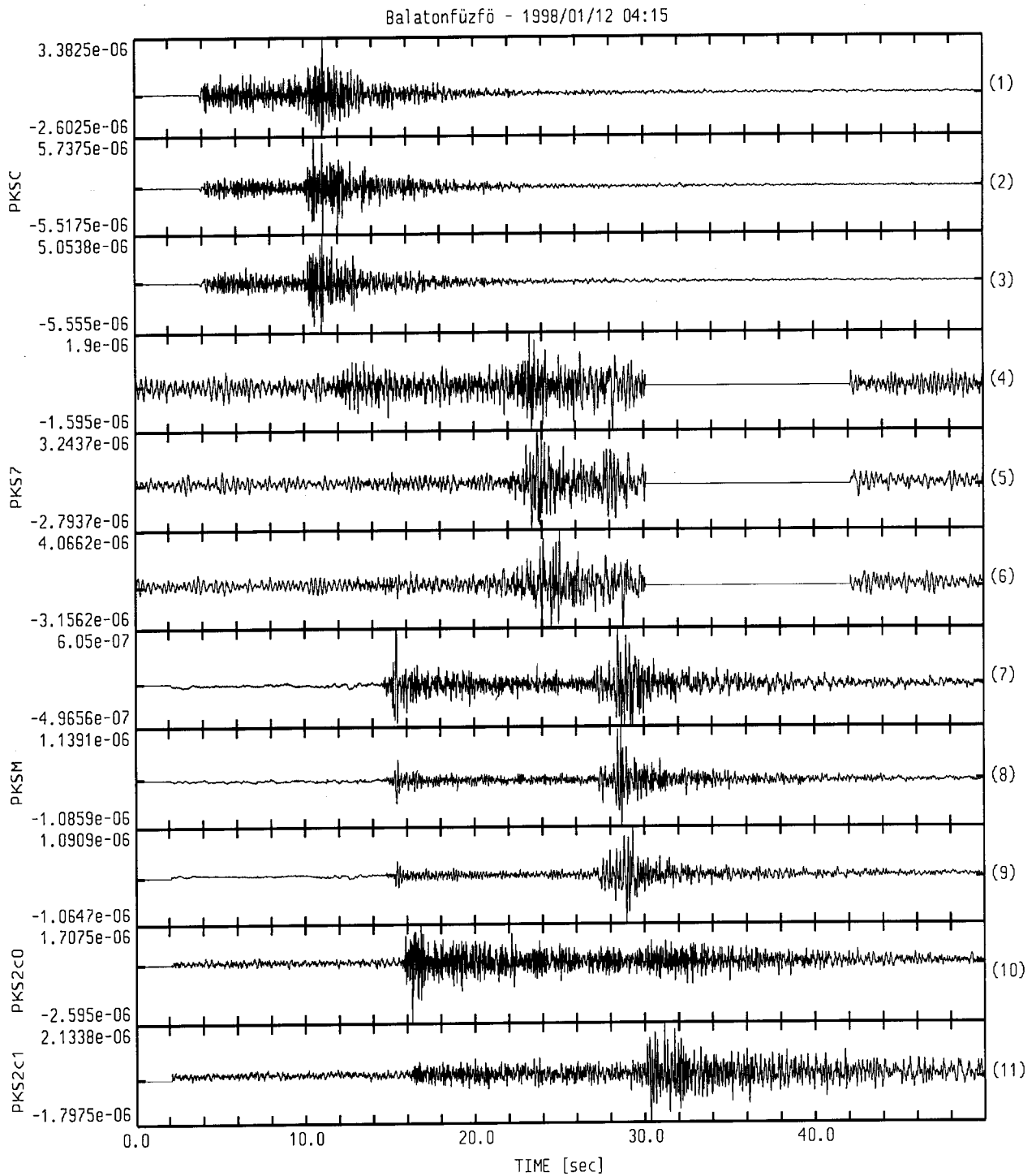
Date: 1998/01/12  
Origin Time: 04:15:45.9 UTC  
Latitude and Longitude: 47.050N 18.076E (S.D. 3.0km)  
Depth: 4.2 km (S.D. 45.8km)  
Magnitude: 2.0 ML  
Maximum Intensity: 3.5

### DISCUSSION

On January 12<sup>th</sup>, an earthquake with a magnitude of 2.0 ML was felt slightly at Balatonfűzfő and Berhida area, with a maximum intensity of 3-4 EMS.

The intensity distribution of the event is shown in Table 4.1. and Figure 4.2.

# 12 January 1998 - Balatonfűzfő



**Figure 4.1.** Seismograms of the Balatonfűzfő Earthquake 12<sup>th</sup> January 1998, 4:15:46 UTC. (PKSc, PKS7 and PKSm three components, PKS2 vertical and N-S components)  
The vertical axis is ground velocity in m/s.

## 12 January 1998 - Balatonfűzfő

**Table 4.1.** *Intensity distribution of the Balatonfűzfő Earthquake 12<sup>th</sup> January 1998, 4:15:46 UTC*

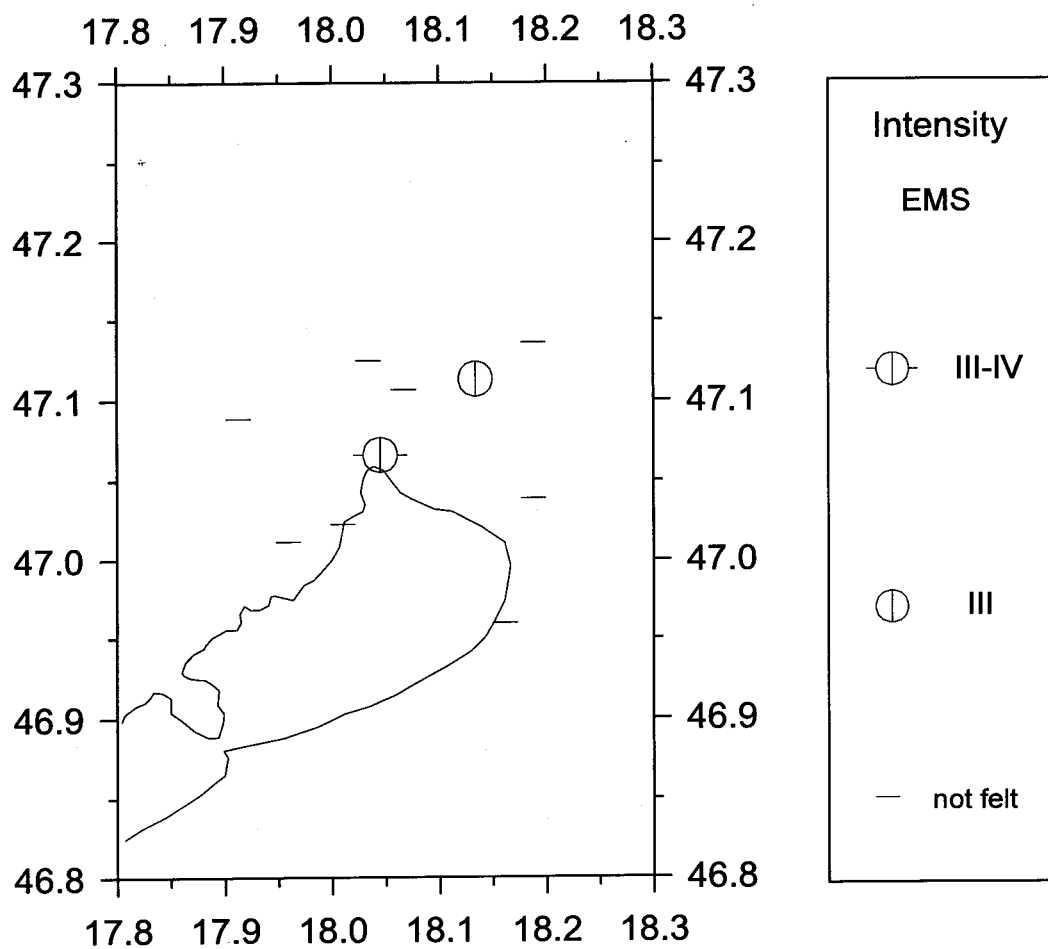
Location	Coordinates	I	R	N
1 Balatonalmádi	47.028 N 18.010 E	.0	0.0%	2
2 Balatonfűzfő	47.066 N 18.045 E	3.5	40.0%	2
3 Balatonvilágos	46.965 N 18.161 E	.0	0.0%	1
4 Berhida	47.113 N 18.134 E	3.0	33.0%	3
5 Csajág	47.044 N 18.188 E	.0	0.0%	2
6 Felsőörs	47.017 N 17.959 E	.0	0.0%	2
7 Ósi	47.141 N 18.188 E	.0	0.0%	2
8 Sóly	47.130 N 18.034 E	.0	0.0%	1
9 Veszprém	47.094 N 17.913 E	.0	0.0%	2
10 Vilonya	47.112 N 18.067 E	.0	0.0%	2

I - intensity

R - relative reliability

N - number of reports

## 12 January 1998 - Balatonfüzfő



**Figure 4.2.** Intensity distribution of the Balatonfüzfő Earthquake 12<sup>th</sup> January 1998, 4:15:46 UTC

**12 April 1998 - Slovenia**

### **HYPOCENTRE PARAMETERS**

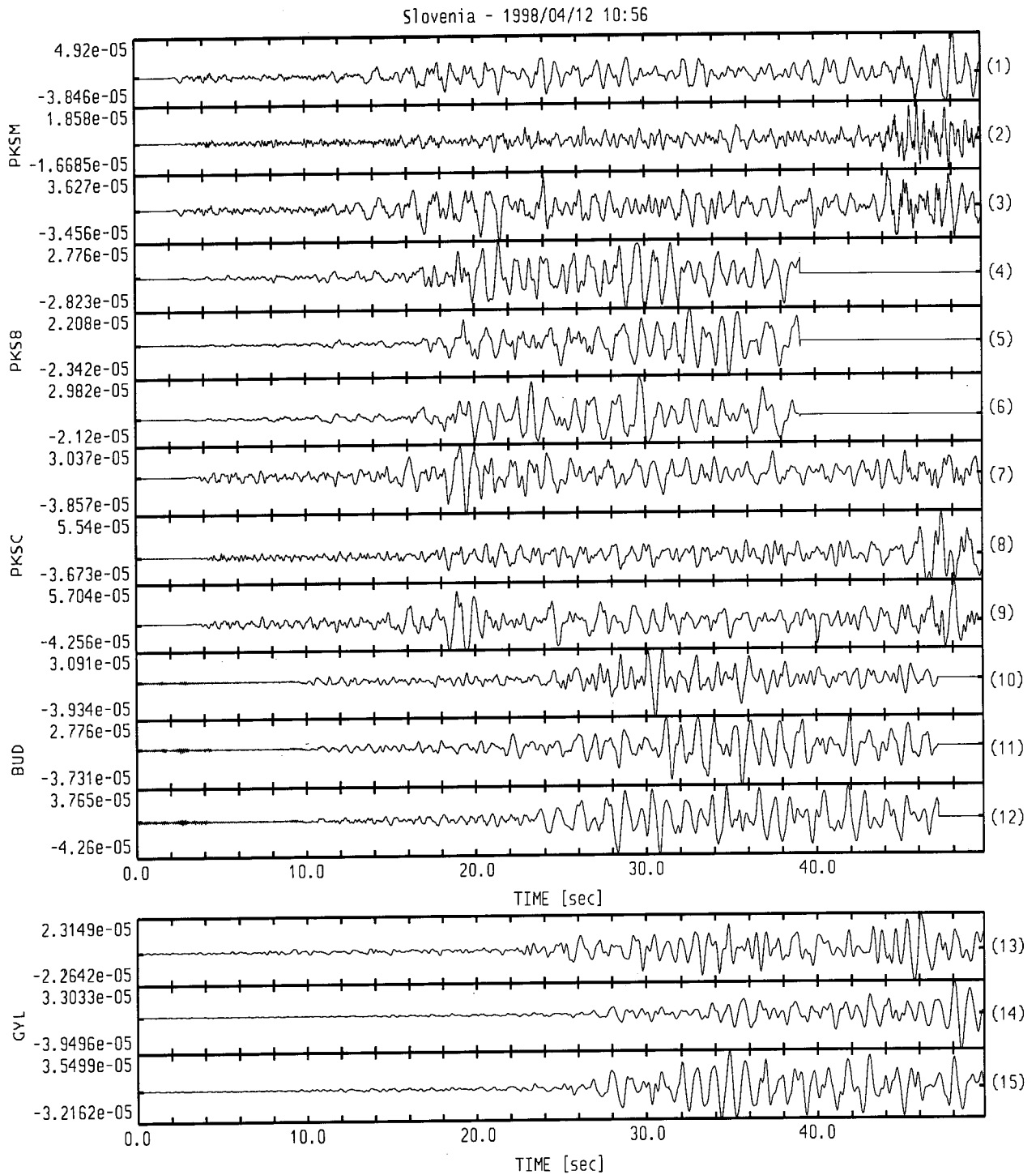
Date: 1998/04/12  
Origin Time: 10:55:32.5 UTC  
Latitude and Longitude: 46.245N 13.632E (NEIC)  
Depth: 10.0 km (NEIC)  
Magnitude: 5.6 ML (VIE)  
Maximum Intensity: 8 (3-4 in Hungary)

### **DISCUSSION**

On April 12<sup>th</sup>, an earthquake with a magnitude of 5.6 ML occurred near to the Austrian - Slovenian border. One person died of a heart attack at Bovec, Slovenia. Maximum intensity (VIII) in the Bovec-Kobarid area, Slovenia, where damage to buildings and landslides left 700 people homeless. Minor damage at Arnoldstein, Austria. Felt strongly throughout Slovenia and northeastern Italy. Felt throughout Austria and in parts of Croatia, Germany and Hungary.

The intensity distribution of the event in Hungary is shown in Table 4.2. and Figure 4.4.

# 12 April 1998 - Slovenia



**Figure 4.3.** Seismograms of the Slovenia Earthquake 12<sup>th</sup> April 1998, 10:55:33 UTC (PKSM, PKS8, PKSC, BUD and GYL three components)  
The vertical axis is ground velocity in m/s.

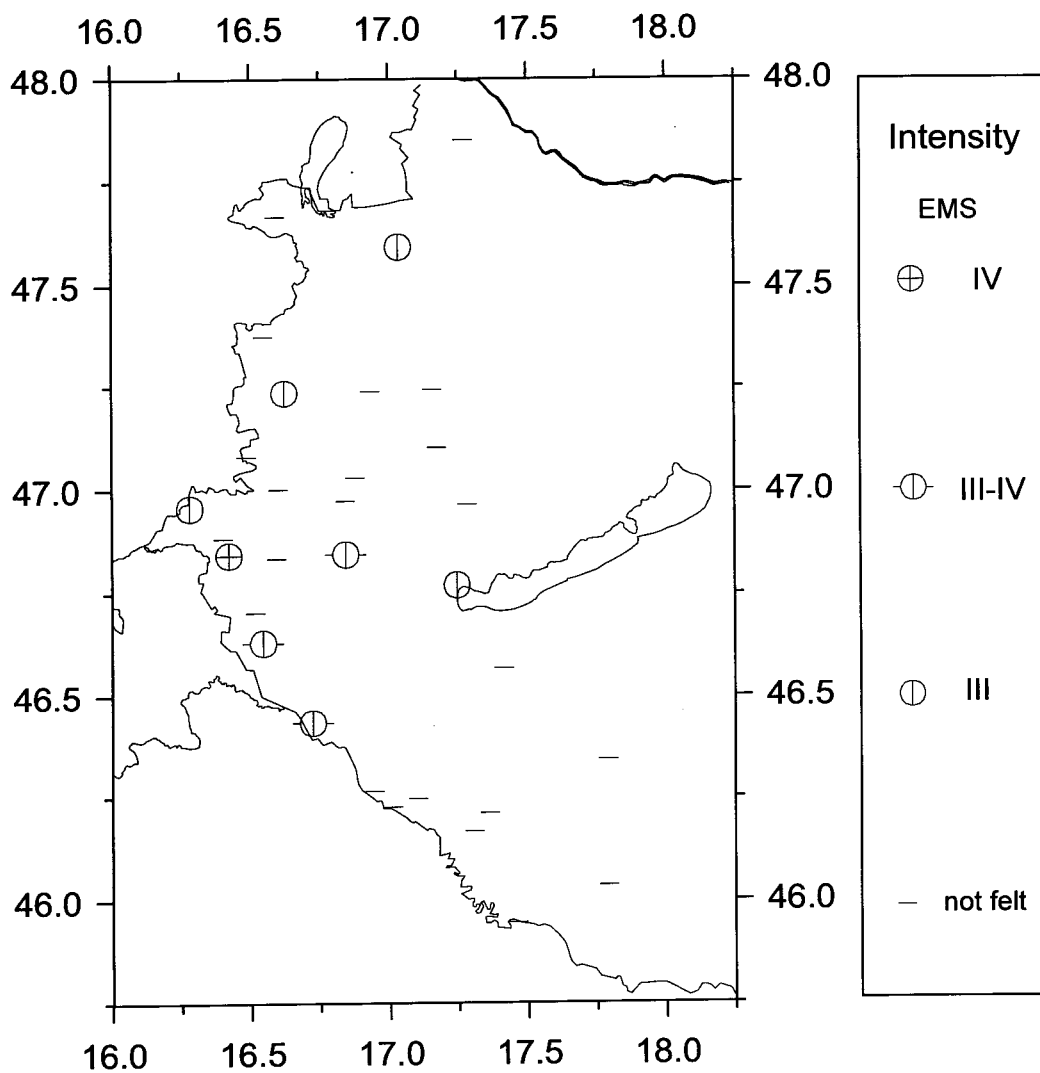


**Table 4.2.** *Intensity distribution of the Slovenia Earthquake 12<sup>th</sup> April 1998, 10:55:33 UTC*

	Location	Coordinates	I	R	N
1	Balatonalmádi	47.028 N 18.010 E	.0	0.0%	2
2	Barcs	45.961 N 17.463 E	.0	0.0%	2
3	Celldömölk	47.259 N 17.158 E	.0	0.0%	2
4	Csesztreg	46.719 N 16.517 E	.0	0.0%	1
5	Csurgó	46.262 N 17.103 E	.0	0.0%	3
6	Gyékényes	46.242 N 17.013 E	.0	0.0%	2
7	Győrvár	46.989 N 16.843 E	.0	0.0%	1
8	Jánosháza	47.117 N 17.174 E	.0	0.0%	1
9	Kaposvár	46.357 N 17.791 E	.0	0.0%	3
10	Kapuvár	47.593 N 17.036 E	3.0	38.0%	3
11	Keszthely	46.769 N 17.246 E	3.0	36.0%	3
12	Kondorfa	46.898 N 16.402 E	.0	0.0%	2
13	Körmend	47.017 N 16.601 E	.0	0.0%	3
14	Kőszeg	47.390 N 16.548 E	.0	0.0%	2
15	Lenti	46.630 N 16.545 E	3.5	39.0%	3
16	Letenye	46.433 N 16.724 E	3.5	42.0%	3
17	Marcali	46.584 N 17.414 E	.0	0.0%	1
18	Mosonmagyaróvár	47.866 N 17.272 E	.0	0.0%	3
19	Nagyatád	46.227 N 17.363 E	.0	0.0%	1
20	Oszkó	47.045 N 16.879 E	.0	0.0%	1
21	Óriszentpéter	46.842 N 16.423 E	4.0	41.0%	1
22	Sárvár	47.255 N 16.935 E	.0	0.0%	3
23	Sopron	47.682 N 16.593 E	.0	0.0%	2
24	Sümeg	46.980 N 17.284 E	.0	0.0%	2
25	Szentgotthárd	46.956 N 16.283 E	3.0	42.0%	2
26	Szentpéterfa	47.096 N 16.488 E	.0	0.0%	2
27	Szigetvár	46.051 N 17.793 E	.0	0.0%	2
28	Szombathely	47.235 N 16.624 E	3.0	36.0%	1
29	Tarany	46.183 N 17.307 E	.0	0.0%	1
30	Zalaegerszeg	46.844 N 16.844 E	3.5	42.0%	3
31	Zalalövő	46.850 N 16.594 E	.0	0.0%	2
32	Zákány	46.281 N 16.946 E	.0	0.0%	1

I - intensity  
R - relative reliability  
N - number of reports

# 12 April 1998 - Slovenia



**Figure 4.4.** Intensity distribution of the Slovenia Earthquake 12<sup>th</sup> April 1998, 10:55:33 UTC

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## 8 May 1998 - Budakeszi

### HYPOCENTRE PARAMETERS

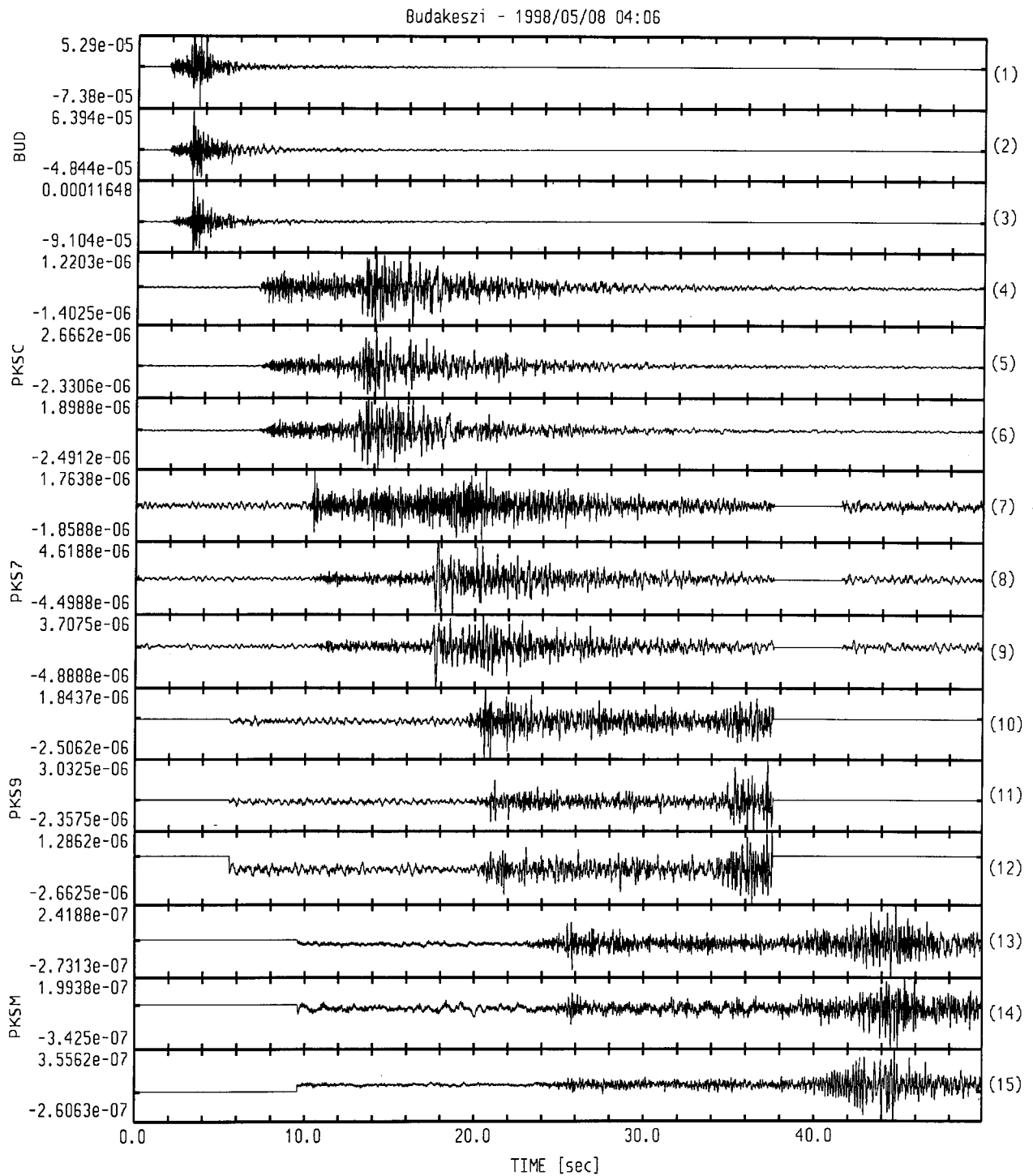
Date: 1998/05/08  
Origin Time: 04:06:54.2 UTC  
Latitude and Longitude: 47.513N 18.930E (S.D. 2.9km)  
Depth: 10.0 km (S.D. 1.5km)  
Magnitude: 2.0 ML  
Maximum Intensity: 3

### DISCUSSION

The Budakeszi earthquake of 8 May with a magnitude of 2.0 ML was slightly felt at the epicentre area. The macroseismic survey carried out at the time of the event resulted a maximum intensity of 3 at the epicentre.

The intensity distribution is shown in Table 4.3.

# 8 May 1998 - Budakeszi



**Figure 4.5.** Seismograms of the Budakeszi Earthquake 8<sup>h</sup> May 1998, 4:06:54 UTC (BUD, PKSC, PKS7, PKS9 and PKSM three components). The vertical axis is ground velocity in m/s.

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## 8 May 1998 - Budakeszi

**Table 4.3.** *Intensity distribution of the Budakeszi Earthquake 8<sup>th</sup> May 1998, 4:06:54 UTC*

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	Location	Coordinates	I	R	N
1	Buda	47.508 N 18.989 E	3.0	35.%	2

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I - intensity  
R - relative reliability  
N - number of reports

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**8 May 1998 - Budakeszi**

## HYPOCENTRE PARAMETERS

Date: 1998/09/29  
Origin Time: 22:14:49.7 UTC  
Latitude and Longitude: 44.194N 20.037E (NEIC)  
Depth: 10.0 km (NEIC)  
Magnitude: 5.1 ML  
Maximum Intensity: 8 (5 in Hungary)

## DISCUSSION

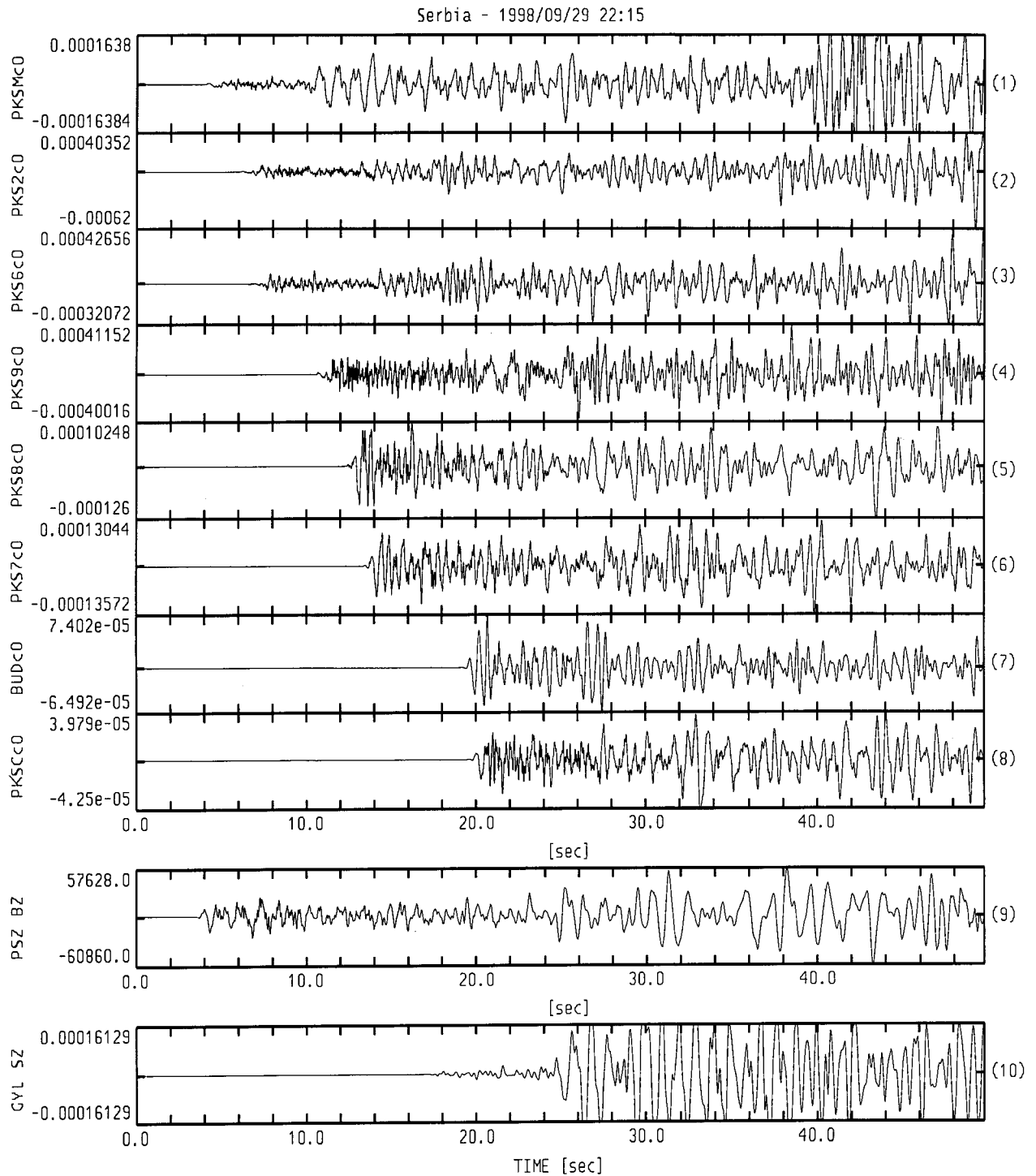
The Serbia earthquake of 29 September had intensity about 8 at the epicentral area. One person died from a heart attack, 17 injured and damage in the Valjevo-Belgrade area, Yugoslavia. Felt in much of central Yugoslavia and in the Vidin area, Bulgaria. Also felt in the Sarajevo area, Bosnia and Herzegovina as well as in parts of Croatia, Hungary and northern Greece.

The event produced reports of intensity 5 EMS from the border region in Hungary.

The intensity distribution of the event (only in Hungary) is shown in Table 4.4. and Figure 4.7.

At a strong motion recorder site at Algyó (Szeged), 238 km from the epicentre, the peak acceleration on soft site was 4-5 mg on the horizontal components with 1.5-2.0 Hz spectral peaks. The macroseismic survey resulted intensity 5 at that locality.

# 29 September 1998 - Serbia



**Figure 4.6.** Seismograms of the Serbia Earthquake of 29<sup>h</sup> September 1998, 22:14:50 UTC (PKSM, PKS2, PKS6, PKS9, PKS8, PKS7, BUD, PKSC, PSZ and GYL vertical components).  
The vertical axis is ground velocity in m/s.



## 29 September 1998 - Serbia

**Table 4.4.** *Intensity distribution of the Serbia Earthquake 29<sup>th</sup> September 1998, 22:14:50 UTC*

	Location	Coordinates	I	R	N
1	Baja	46.182 N 18.958 E	3.5	35.%	2
2	Barcs	45.961 N 17.463 E	3.5	40.%	2
3	Bácsalmás	46.127 N 19.328 E	4.0	34.%	1
4	Békés	46.774 N 21.128 E	5.0	33.%	2
5	Békéscsaba	46.675 N 21.081 E	3.5	50.%	1
6	Budapest	47.500 N 19.051 E	3.0	63.%	3
7	Fegyvernek	47.252 N 20.521 E	.0	0.%	2
8	Hercegszántó	45.954 N 18.942 E	3.5	50.%	2
9	Hódmezővásárhely	46.420 N 20.312 E	4.0	36.%	1
10	Izsák	46.801 N 19.354 E	5.0	51.%	1
11	Jászkisér	47.460 N 20.212 E	.0	0.%	2
12	Kalocsa	46.527 N 18.987 E	.0	0.%	2
13	Kaposvár	46.357 N 17.791 E	.0	0.%	2
14	Kecskemét	46.909 N 19.693 E	4.0	28.%	3
15	Kiskőrös	46.622 N 19.287 E	.0	0.%	2
16	Kiskunhalas	46.426 N 19.486 E	3.5	45.%	2
17	Kunhegyes	47.374 N 20.634 E	.0	0.%	1
18	Makó	46.222 N 20.471 E	5.0	30.%	1
19	Marcali	46.584 N 17.414 E	.0	0.%	1
20	Mezőtúr	47.007 N 20.623 E	.0	0.%	2
21	Mohács	45.989 N 18.683 E	4.0	34.%	2
22	Mórahalom	46.220 N 19.883 E	.0	0.%	2
23	Nagyatád	46.227 N 17.363 E	.0	0.%	2
24	Paks	46.628 N 18.861 E	3.5	42.%	2
25	Pápa	47.331 N 17.467 E	.0	0.%	1
26	Pécs	46.088 N 18.245 E	3.5	33.%	2
27	Pilis	47.286 N 19.545 E	.0	0.%	2
28	Siklós	45.857 N 18.302 E	3.5	30.%	2
29	Siófok	46.904 N 18.055 E	.0	0.%	2
30	Solt	46.805 N 18.992 E	.0	0.%	2

## 29 September 1998 - Serbia

**Table 4.4.** *Intensity distribution of the Serbia Earthquake 29<sup>th</sup> September 1998, (cont.) 22:14:50 UTC*

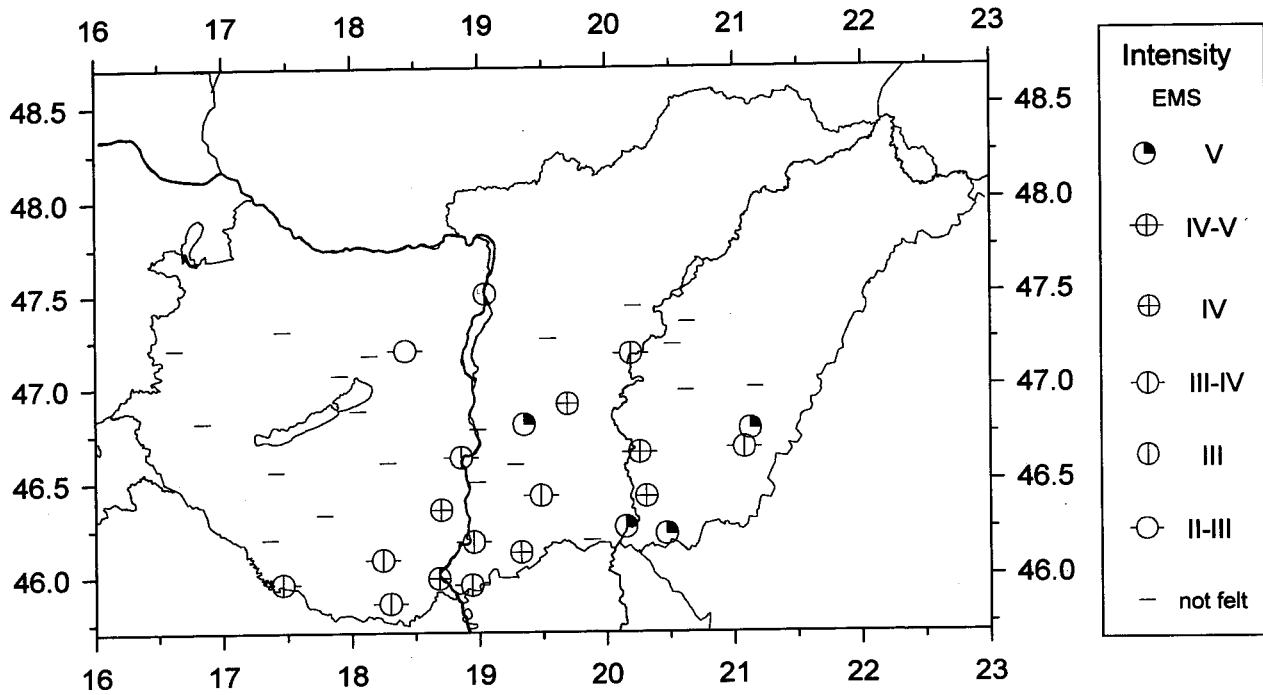
	Location	Coordinates	I	R	N
31	Szeged	46.259 N 20.152 E	5.0	47.%	3
32	Szeghalom	47.022 N 21.169 E	.0	0.%	1
33	Szekszárd	46.352 N 18.702 E	4.0	32.%	4
34	Székesfehérvár	47.196 N 18.423 E	2.5	42.%	2
35	Szentes	46.652 N 20.261 E	4.5	36.%	1
36	Szolnok	47.176 N 20.193 E	3.5	42.%	2
37	Szombathely	47.235 N 16.624 E	.0	0.%	1
38	Tamási	46.631 N 18.287 E	.0	0.%	2
39	Várpalota	47.199 N 18.145 E	.0	0.%	2
40	Veszprém	47.094 N 17.913 E	.0	0.%	2
41	Zalaegerszeg	46.844 N 16.844 E	.0	0.%	1

I - intensity

R - relative reliability

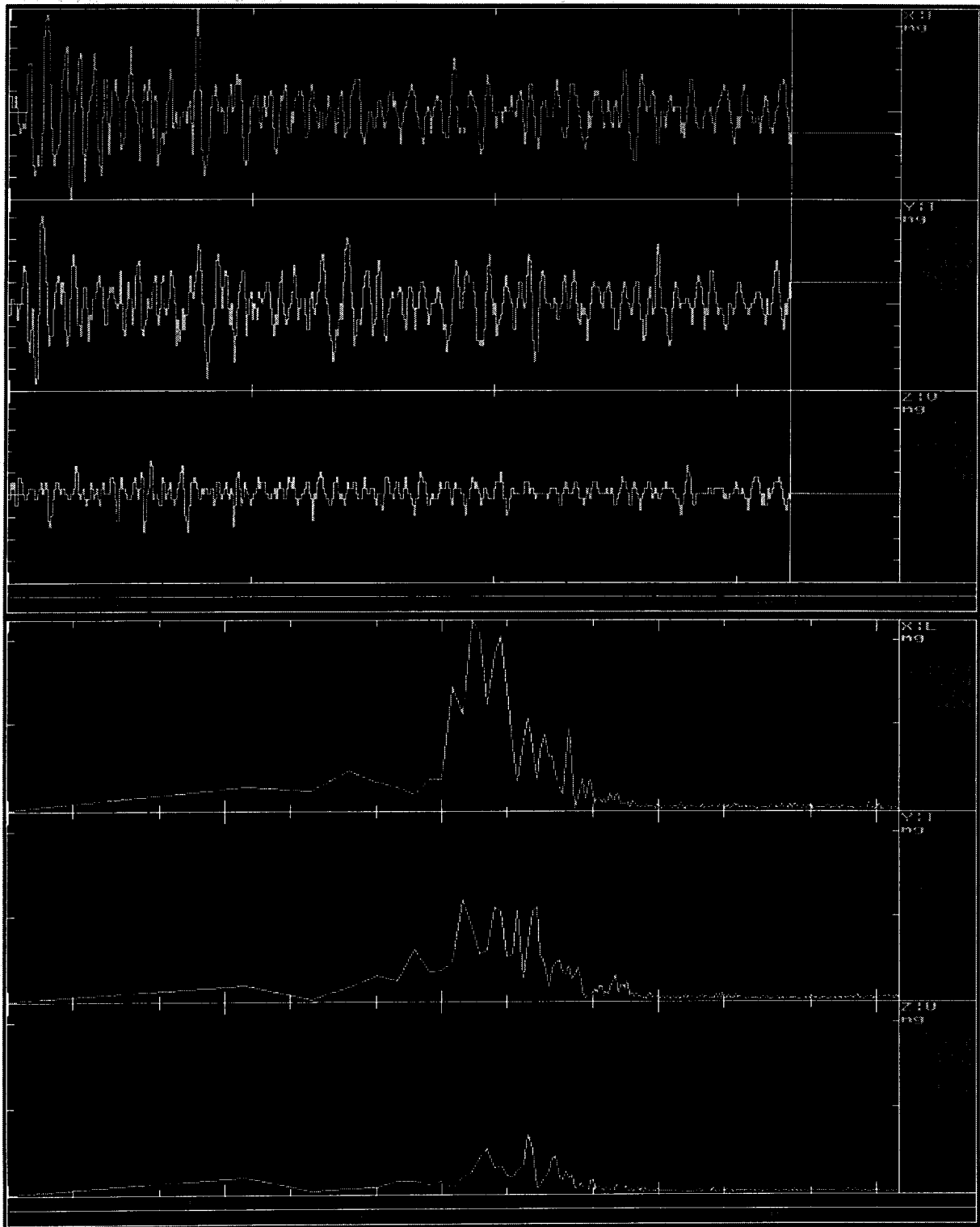
N - number of reports

## 29 September 1998 - Serbia



**Figure 4.7.** Intensity distribution of the Serbia Earthquake of 29<sup>th</sup> September 1998, 22:14:50 UTC

## 29 September 1998 - Serbia



**Figure 4.8.** Strong motion accelerogram and its spectra of the Serbia Earthquake of 29<sup>th</sup> September 1998, 22:14:50 UTC (ML=5.1) recorded at Algyó (Szeged) at a distance of 238 km from the epicentre

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## 6 December 1998 - Hárskút

### HYPOCENTRE PARAMETERS

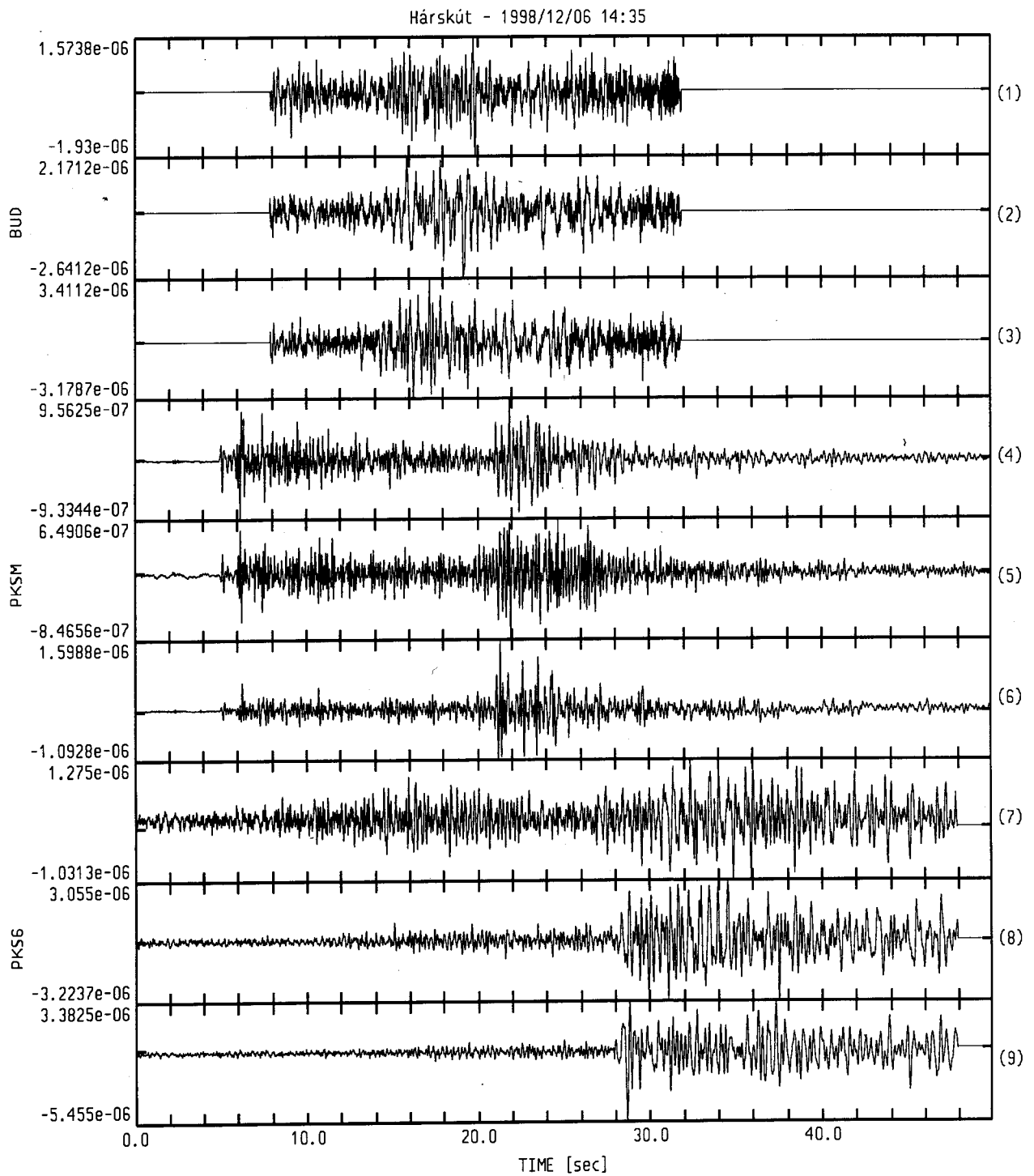
Date: 1998/12/06  
Origin Time: 14:35:03.8 UTC  
Latitude and Longitude: 47.206N 17.828E (S.D. 2.8km)  
Depth: 6.3 km (S.D. 3.2km)  
Magnitude: 2.6 ML  
Maximum Intensity: 3-4

### DISCUSSION

On December 6<sup>th</sup>, an earthquake with a magnitude of 2.6 ML was felt over a small area of 100-150 km<sup>2</sup> with a maximum intensity of 3-4 EMS.

The intensity distribution of the event is shown in Table 4.5. and Figure 4.10.

# 6 December 1998 - Hárskút



**Figure 4.9.** Seismograms of the Hárskút Earthquake 6<sup>th</sup> December 1998, 14:35:04 UTC (BUD, PKSM and PKS6 three components).  
The vertical axis is ground velocity in m/s.

## 6 December 1998 - Hárskút

**Table 4.5.** *Intensity distribution of the Hárskút Earthquake 6<sup>th</sup> December 1998, 14:35:04 UTC*

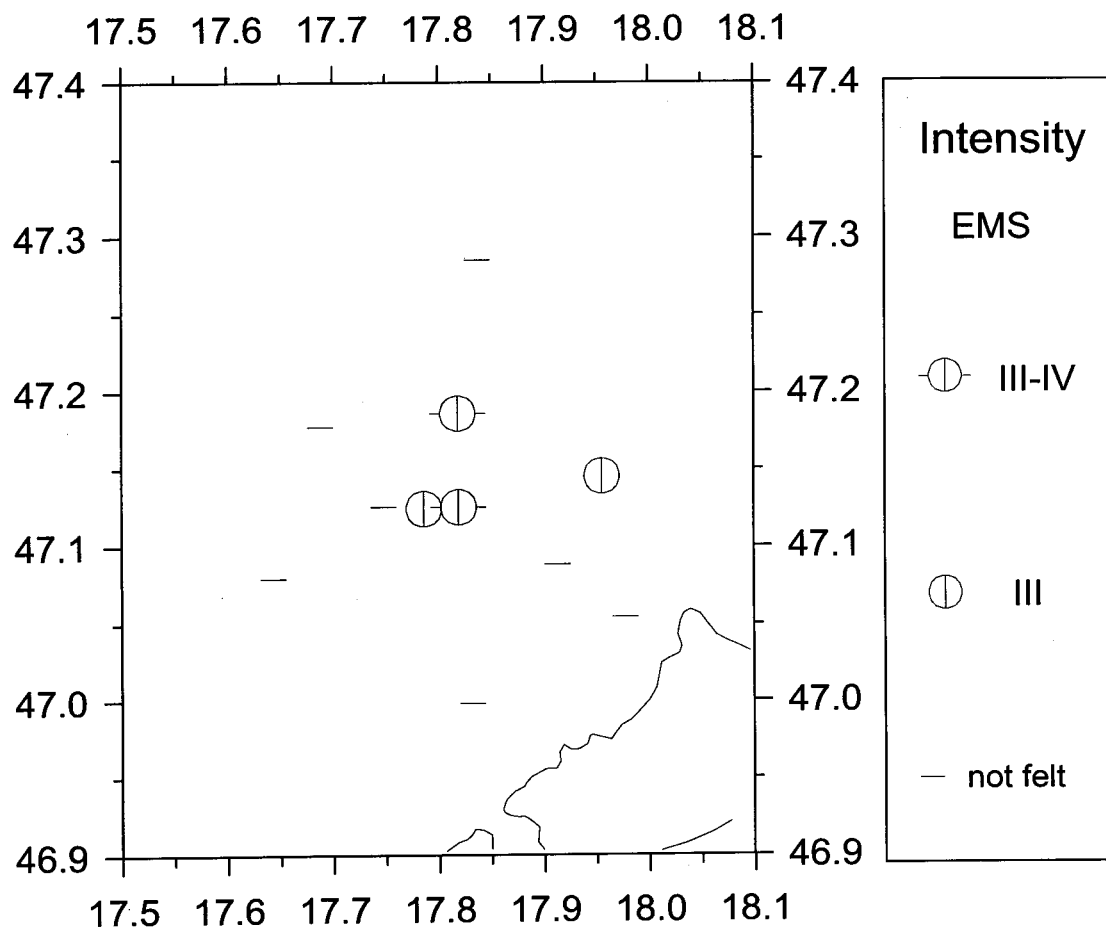
Location	Coordinates	I	R	N
1 Bánd	47.124 N 17.786 E	3.0	31.%	1
2 Borzavár	47.291 N 17.837 E	.0	0.%	1
3 Csehbánya	47.183 N 17.688 E	.0	0.%	1
4 Gyulafirátót	47.145 N 17.955 E	3.0	38.%	1
5 Hárskút	47.186 N 17.818 E	3.5	32.%	2
6 Herend	47.131 N 17.748 E	.0	0.%	1
7 Hidegkút	47.004 N 17.832 E	.0	0.%	2
8 Márkó	47.125 N 17.819 E	3.5	37.%	2
9 Szentkirályszabadja	47.060 N 17.977 E	.0	0.%	1
10 Úrkút	47.085 N 17.643 E	.0	0.%	2
11 Veszprém	47.094 N 17.913 E	.0	0.%	1

I - intensity

R - relative reliability

N - number of reports

## 6 December 1998 - Hárskút



**Figure 4.10.** Intensity distribution of the Hárskút Earthquake 6<sup>th</sup> December 1998, 14:35:04 UTC