

## BOSNIAN STOUN BALLS: SEISMIC GEKHEMICAL ANALISING

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Key words: *stone balls, spectrum of elastic waves, chemical composition, seismic noise spectrum*

### Stone spheres seismic research

These are stone spheres of the various size had find besides small city Zavidovichi. One of such spheres in diameter more than meter was investigated by registration of resonance frequency at excitation of a sphere by impact in radius direction and geochemical analyzing too.

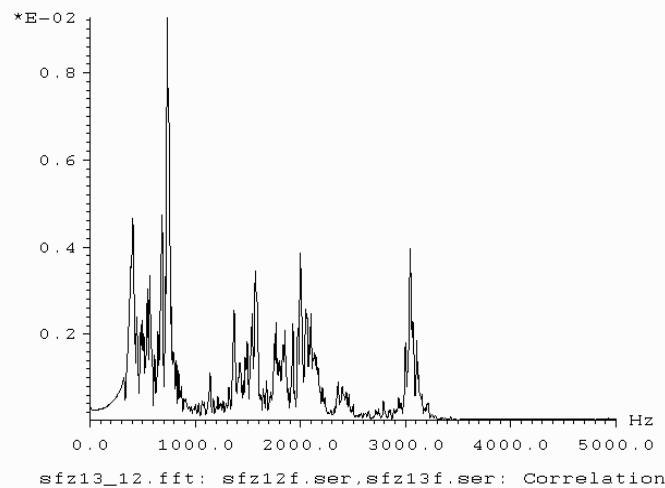
Registration was made with the help the seismometer such as SH10. Seismometer it was fixed sideways. Impacts on sphere were rendered from three mutually perpendicular sides since the opposite side. Record was carried out with frequency of analog-to-digital conversion 10 kHz. In result own (free) oscillations of sphere were received at all types of impacts. Peculiarity of these processing was it that at each type of impact different styles of spherical oscillations were raised. Further received spectra of the excited own fluctuations of sphere and determined their frequency in Hz. All the picks free oscillations are submitted in tab. 1.

**Table 1**

Spheroidal mode own vibrations of stone sphere received at three vertical mutually perpendicular impacts on sphere surface (in Hz)

${}_0S_2$	${}_1S_1$	${}_0S_3$	${}_0S_4$	${}_1S_2$	${}_0S_6$	${}_1S_4$	${}_0S_8$	${}_0S_9$	${}_1S_7$	${}_0S_{10}$	${}_0S_2$	${}_2S_7$	${}_3S_4$	${}_0S_{15}$
405	465	634	732	1001	1367	1572	1870	2065	2178	2285	2353	2739	2998	3071

Radial vibrations  ${}_0S_0$  have frequency 1997Hz. The example of a spectrum of the excited spheroid modes at vertical impact is shown in fig. 1.

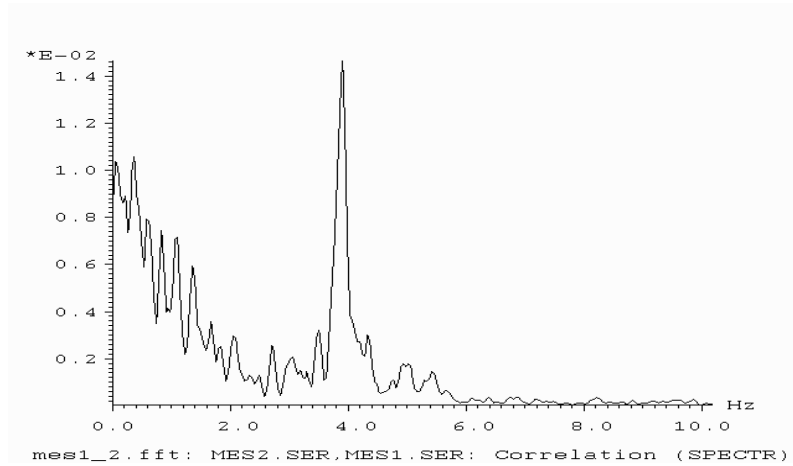


**Fig.1.** The spectrum of the excited spheroid modes of own vibrations of the stone sphere meter diameter for vertical impact

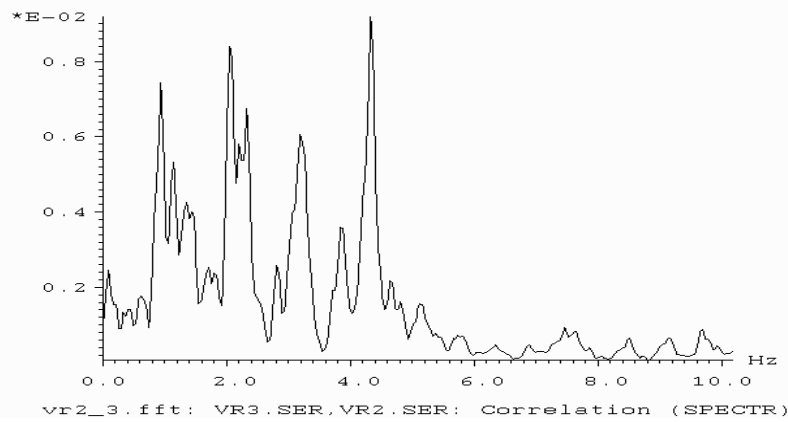
It is interesting, that frequency of radial vibrations of 1997 Hertz was raised at any impacts whereas other observably modes were raised not always.

### Seismic noise research

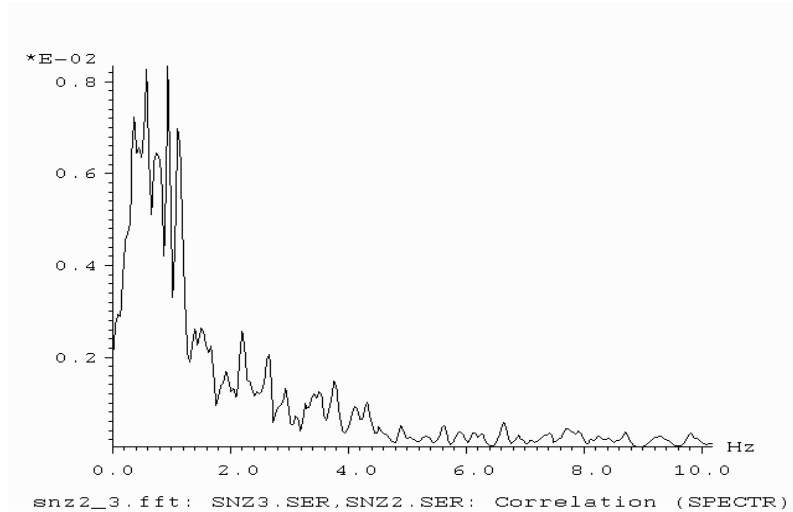
At Bosnia besides on the bottom of “Month” pyramid in Vratnitze and in Zavidovichy about spheres records of seismic noise with the help high-sensitivity chemotronic seismometer were carried out. In result power spectra for all these places were received and submitted on fig. 2 (a, b, c).



2a



2b



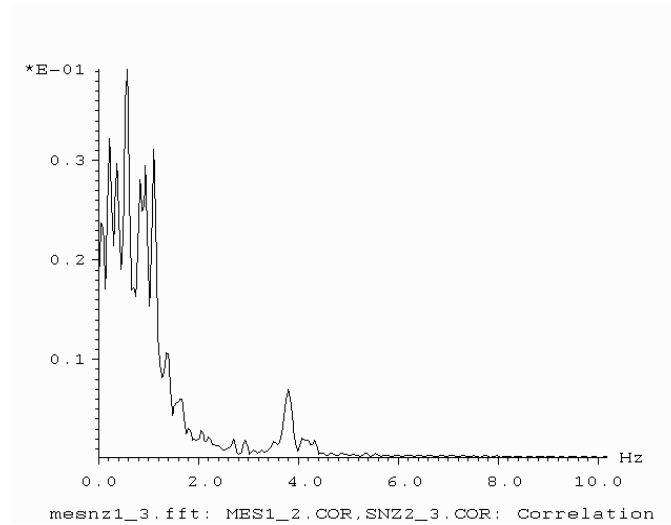
2c

**Fig.2.** Power spectra of the seismic noise received from bottom of a Vratnitze pyramid of Month and at besides spheres on Zavidovichy

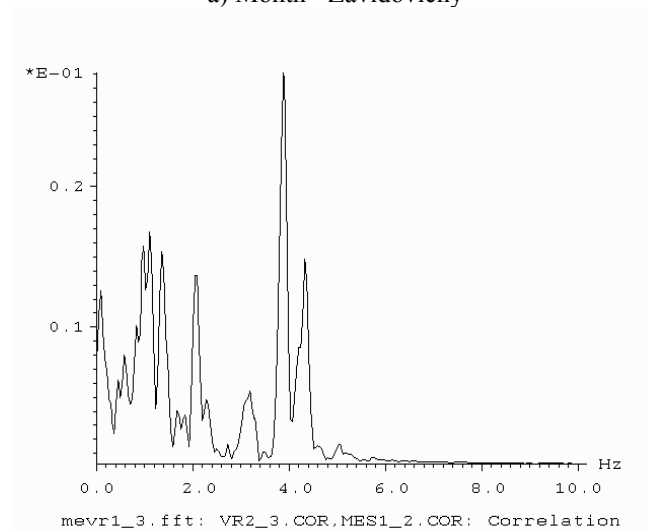
The spectrum of noise on a pyramid of Month (2a) has strongly pronounced harmonic frequency about 4Hz. Similar harmonic frequencies were observed in 2007y. on frequencies 1Hz, 13Hz (near to a pyramid of the Month). The signals nature of these frequencies is unknown. Only it is possible to assume presence auto generated noise on slopes of a pyramid caused by preparation of a landslide.

Presence 4x spectral noise peaks (Vratnitza) (2b) apparently, specifies lamination of observably geologic structures and this lamination and explains formation of such spectrum of noise. The spectrum of Zavidovichy noise basically is concentrated in a range 0.3 – 2Hz and in general speaks about geology of this region.

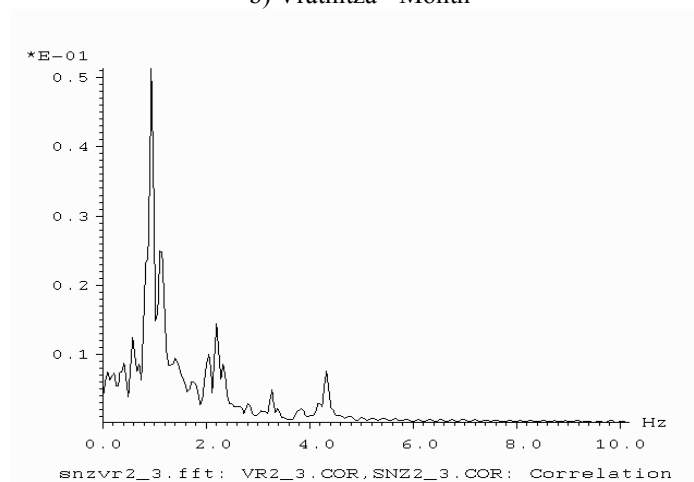
Spectra of seismic noise in all specified places completely different, however by reception of mutual spectra it is possible to reveal some coherence between various processes causing seismic noise in different places. In fig. 3 (a, b, c) mutual spectra are submitted between next: a) a pyramid of Month - Zavidovichy, b) Vratnitza - Month, c) Zavidovichy – Vratnitza.



a) Month - Zavidovichy



b) Vratnitza - Month



c) Zavidovichy – Vratnitza

**Fig.3.** Mutual spectra for objects: a) a pyramid of Month - Zavidovichy, b) Vratnitza - Month, c) Zavidovichy – Vratnitza

Despite of dissimilarity of mutual spectra, we shall notice, that there are peaks in area of 1 and 4 Hertz on all spectra. About what its carry the information is not so clearly especially this set of peaks in mutual spectrum Zavidovichy – Vratnitza. The estimation of seismic speeds of a stone material of sphere shows that

Laboratory measurements of seismic speeds of a stone material of sphere show that longitudinal waves on three mutual - perpendicular directions have values 4350, 4500, 4600m/s and the S - wave has speed in 1.5 times less. The above-stated seismic researches are not yet the decision of a question but it already pawns a basis for continuation of more directed works. The data on geochemical structure of sphere also have brought a lot of unusual that demands more careful studying (see tab.2). For example the percentage Lanthanide elements exceeds norm in 100 time.

**Table 2**

Results of determination of the probe composition by X-ray analysing (mass %)

Component	№1	№2	№3
Na2O	1,36	1,51	1,60
MgO	0,88	0,78	1,02
Al2O3	9,42	8,11	8,61
SiO2	64,23	64,70	63,72
P2O5	0,155	0,137	0,124
SO3	0,18	0,22	0,25
Cl	0,087	0,020	0,162
K2O	1,36	1,32	1,11
CaO	16,62	16,41	17,70
TiO2	0,47	0,34	0,34
MnO	0,626	0,725	0,704
Fe2O3	4,48	4,16	4,54
Rb	0,010	0,010	0,011
Sr	0,017	0,019	0,018
Y	0,004	0,000	0,004
Zr	0,039	0,042	0,048
Ba	0,069	0,059	0,054
La		1,45	
Cs		0,034	

### Conclusion

We can't give any definite conclusion, because we made just the first preliminary observations to plan the next research of interest, not only in Zavidovici site, but to include another site too.

Geologists and the geochemists studying structure of spheres did not come to a common opinion about the mechanism of their origin. There are researchers who suppose their artificial origin. But the new discoveries of two stone balls in diferent places outside Zavidovici (Brnjic, Kakanj, 15 km north from Visoko and Banovici, cca 300 km north from Visoko) with carved unknown prehistoric signs very simmlar as in tunnel Ravne Visoko, preliminary titled „Proto-script Visoco, indicate that they belong to the same cultural layer of Bosnian pyramid builders. It means, that this discovery supports the opinion that the stone spheres have the artificial origin.