



*Supplement of*

**Active faulting, 3-D geological architecture and Plio-Quaternary structural evolution of extensional basins in the central Apennine chain, Italy**

**Stefano Gori et al.**

*Correspondence to:* Stefano Gori (stefano.gori@ingv.it)

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## Noise Horizontal to Vertical Spectral Ratio performed in Subequana Valley

With the aim to reconstruct the morphology of the bedrock buried under sediments of the Subequana Valley, NHVSR technique was performed to extract fundamental resonance frequency ( $f_0$ ).

Each measurement is divided into windows of signal, for each of which was calculated the value of the frequency corresponding to maximum value of the NHVSR curve. All values of frequency obtained are averaged to define the frequencies  $f_0$  and the standard deviation associated.

Table S1 shows values relative to the average of the  $f_0$ , the standard deviation ( $\text{std}f_0$ ) and the sediment thickness (ST) estimated at each measurement point (CODE). The bedrock elevation (BE) was obtained subtracting ST from elevation of the topographical surface (SE). Higher and lower limit of ST and BE estimates are obtained using the  $\text{std}f_0$  in equation (3) of the manuscript text.

CODE	LON (°E)	LAT (°N)	SE (m)	$f_0$ (Hz)	$\text{std}f_0$ (Hz)	ST (m)	ST+std (m)	ST-std (m)	BE (m)	BE+std (m)	BE-std (m)
CV35	13.745432	42.099074	554	1.53	0.23	79	67	95	475	487	459
CV36	13.749206	42.102086	536	0.97	0.07	137	126	150	399	410	386
CV37	13.751063	42.104265	527	0.92	0.16	146	121	182	381	406	345
CV50	13.744784	42.102911	550	0.96	0.19	138	111	179	412	439	371
CV51	13.747010	42.107504	519	6.48	0.57	14	13	16	505	506	503
CV52	13.755848	42.101649	538	1.62	0.28	74	61	92	464	477	446
CV54	13.741700	42.105100	558	0.91	0.11	147	128	171	411	430	387
CV55	13.736983	42.110967	557	0.68	0.05	209	194	227	348	363	330
CV56	13.742875	42.111837	510	1.37	0.17	91	79	106	419	431	404
CV58	13.734437	42.113263	517	0.66	0.05	217	197	240	300	320	277
CV59	13.738119	42.118129	497	1.27	0.19	98	83	119	399	414	378
CV60	13.727933	42.117433	515	0.63	0.04	231	213	251	284	302	264
CV70	13.722538	42.123003	503	0.54	0.03	279	264	296	224	239	207
CV71	13.730534	42.125283	477	3.75	0.66	27	22	34	450	455	443
CV72	13.728257	42.129289	479	888.00	0.00	0	0	0	479	479	479
CV80	13.723891	42.124848	494	0.50	0.10	307	247	399	187	247	95
CV81	13.718812	42.126598	503	0.47	0.06	328	285	385	175	218	118
CV82	13.717740	42.128352	504	0.90	0.14	150	126	184	354	378	320
CV86	13.730638	42.125227	477	3.69	0.17	27	26	29	450	451	448
CV87	13.716200	42.120100	538	0.95	0.10	140	123	160	398	415	378
CV90	13.723193	42.129504	488	26.38	3.07	3	2	3	485	486	485
CV91	13.714563	42.122521	534	1.07	0.11	121	107	138	413	427	396
CV93	13.722846	42.130133	514	888.00	0.00	0	0	0	514	514	514
CV94	13.718033	42.113633	545	2.68	0.15	40	38	43	505	507	502
CV95	13.725315	42.112908	552	0.91	0.10	147	130	168	405	422	384
CV96	13.739860	42.098806	605	1.70	0.20	69	61	80	536	544	525
CV97	13.738740	42.096178	612	3.40	0.25	30	28	33	582	584	579
C100	13.717526	42.124717	515	0.56	0.04	264	243	288	251	272	227
C101	13.718662	42.122055	517	0.58	0.10	255	212	317	262	305	200
C102	13.722836	42.118125	519	0.73	0.11	192	163	234	327	356	285
C103	13.707438	42.123308	586	1.02	0.12	129	151	112	457	435	474
C104	13.726197	42.119442	497	0.59	0.07	251	218	294	246	279	203
C107	13.720227	42.128971	495	25.03	2.16	3	2	3	492	493	492
C108	13.706522	42.132807	606	0.83	0.06	165	152	181	441	454	425

C109	13.715775	42.129429	514	0.86	0.15	159	131	199	355	383	315
C110	13.713288	42.127162	520	0.67	0.05	213	194	235	307	326	285
C111	13.713073	42.130940	527	0.70	0.07	203	172	244	324	355	283
C112	13.714536	42.128258	515	0.63	0.10	228	191	282	287	324	233
C113	13.708406	42.125860	564	0.76	0.07	184	165	207	380	99	357
C114	13.712050	42.130310	525	0.74	0.10	190	162	228	335	363	297
C115	13.707298	42.129003	561	0.81	0.09	171	151	197	390	410	364
C116	13.703097	42.131193	611	1.00	0.09	132	117	143	479	494	468
C117	13.708730	42.135905	572	888.00	0.00	0	0	0	572	572	572
C118	13.712253	42.134073	573	888.00	0.00	0	0	0	573	573	573
C119	13.716033	42.132110	555	888.00	0.00	0	0	0	555	555	555
C120	13.698258	42.140700	558	1.37	0.13	90	81	101	468	477	457
C200	13.697617	42.151798	609	2.47	0.25	44	39	50	565	570	559
C201	13.696123	42.148007	656	1.18	0.10	108	98	120	548	558	536
C202	13.696225	42.145946	635	1.36	0.15	91	80	105	544	555	530
C203	13.697865	42.140488	569	1.31	0.10	95	87	105	474	482	464
C204	13.697075	42.143255	597	1.45	0.09	84	78	91	513	519	506
C205	13.716855	42.140835	540	888.00	0.00	0	0	0	540	540	540
C206	13.712996	42.150955	554	888.00	0.00	0	0	0	554	554	554
C207	13.705846	42.145635	628	1.30	0.13	96	86	109	532	542	519
C208	13.727880	42.153963	448	7.90	0.76	11	10	12	437	438	436
C209	13.723415	42.156603	464	888.00	0.00	0	0	0	464	464	464
C210	13.719905	42.155585	475	2.69	0.16	40	37	43	435	438	432
C211	13.718920	42.152801	484	2.84	0.48	38	31	47	446	453	437
C212	13.726218	42.140116	587	1.53	0.09	79	75	85	508	512	502
C213	13.713383	42.147640	558	888.00	0.00	0	0	0	558	558	558
C214	13.696198	42.154213	627	2.25	0.35	50	42	61	577	585	566
C215	13.711580	42.138333	544	4.45	0.81	22	18	28	522	526	516
C216	13.699580	42.147238	646	1.16	0.09	111	102	121	535	544	525
C217	13.695946	42.134403	617	2.10	0.18	54	49	60	563	568	557
C218	13.735505	42.104333	533	1.62	0.22	74	63	88	459	470	445

Table S1. Noise measurements. CODE: code of the measurement. LON: longitude. LAT: latitude. SE: topographical surface elevation.  $f_0$ : average of the fundamental frequency of the NHVSR. std $f_0$ : standard deviation of  $f_0$ . ST: sediment thickness. ST+std: lower uncertainty limit of the sediment thickness. ST-std: higher uncertainty limit of the sediment thickness. BE: bedrock elevation. BE+std: higher uncertainty limit of the sediment thickness. BE-std: lower uncertainty limit of the sediment thickness. The value "888.00" in the column " $f_0$ " reveals a NHVSR flat curve and a sediment thickness = 0.

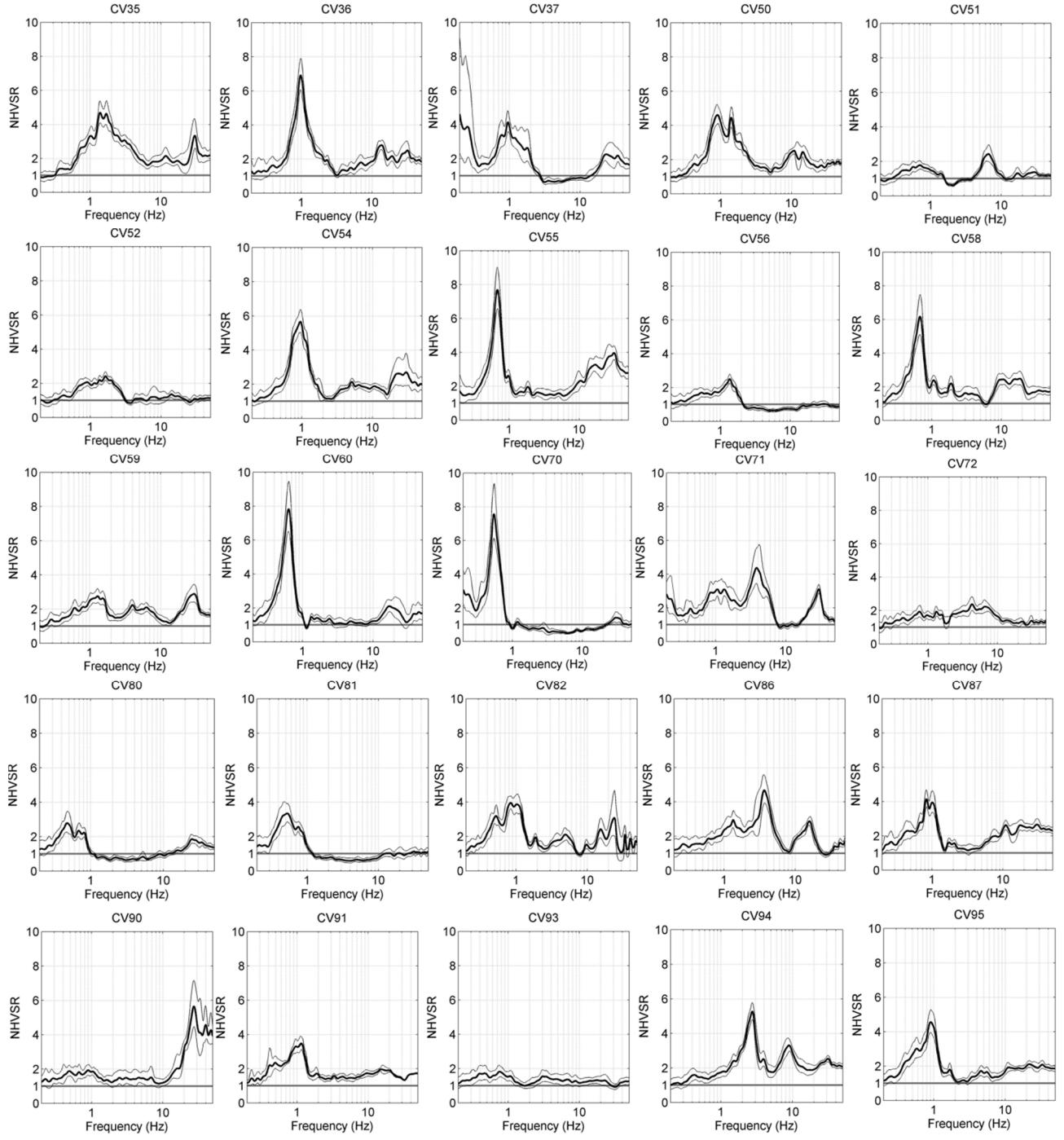


Figure S1. NHVSR curves at each measurement point. Title of each panel is the measurement code and refers to the first column “CODE” of the TABLE S1. The black solid lines represent the average amplitude of the NHVSR at each frequency and thin gray lines represent the standard deviation associated.

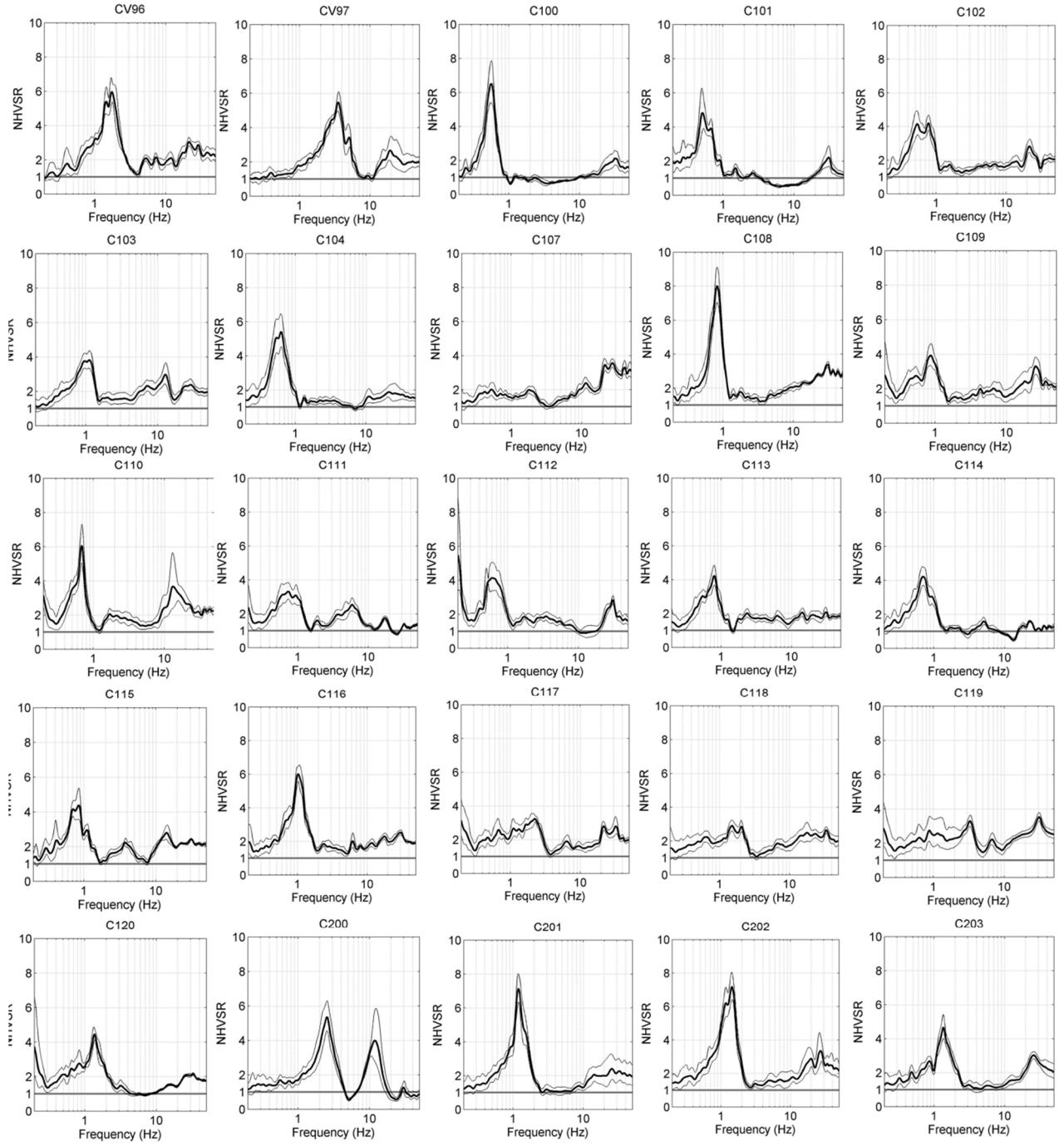


Figure S1 (continue). NHVSR curves at each measurement point. Title of each panel is the measurement code and refers to the first column “CODE” of the TABLE S1. The black solid lines represent the average amplitude of the NHVSR at each frequency and thin gray lines represent the standard deviation associated.

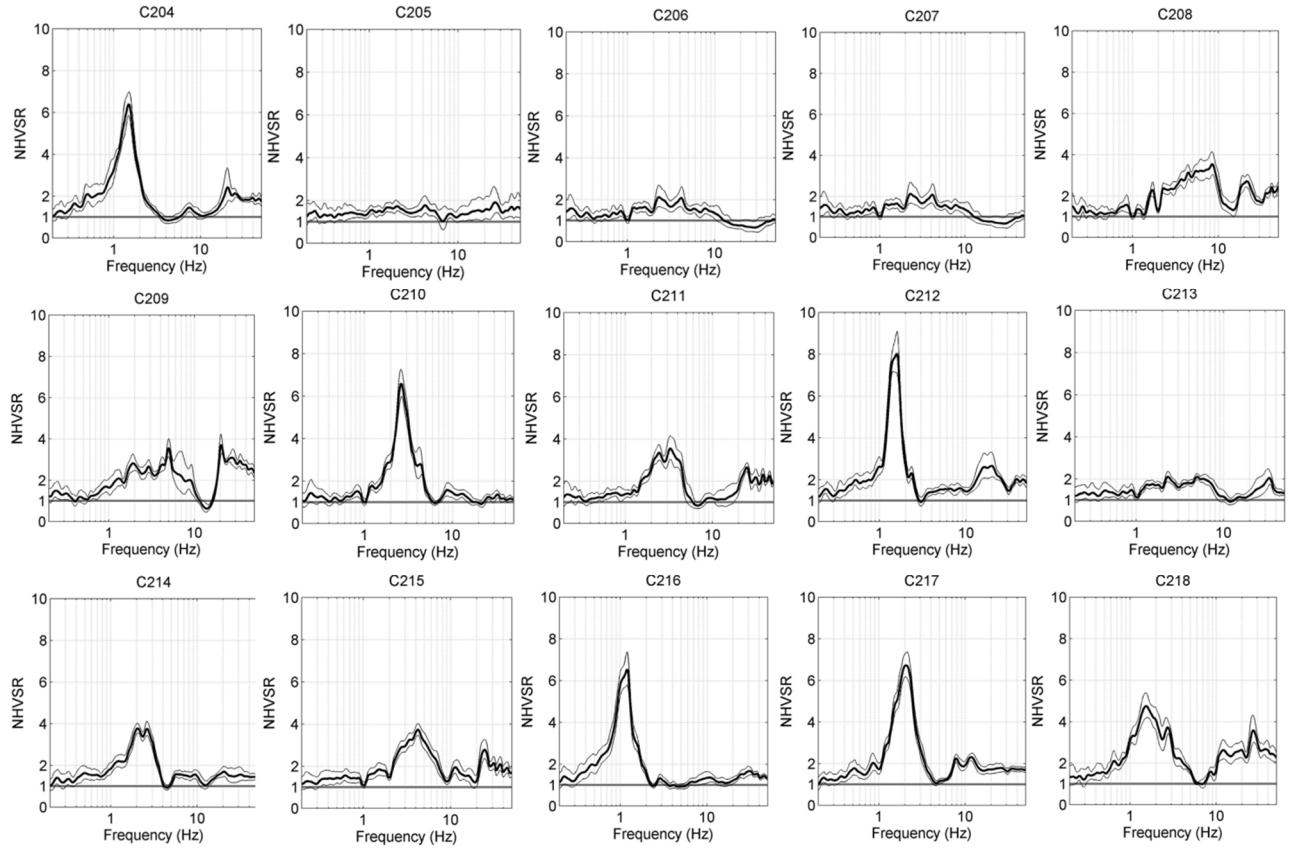


Figure S1 (continue). NHVSR curves at each measurement point. Title of each panel is the measurement code and refers to the first column “CODE” of the TABLE S1. The black solid lines represent the average amplitude of the NHVSR at each frequency and thin gray lines represent the standard deviation associated.

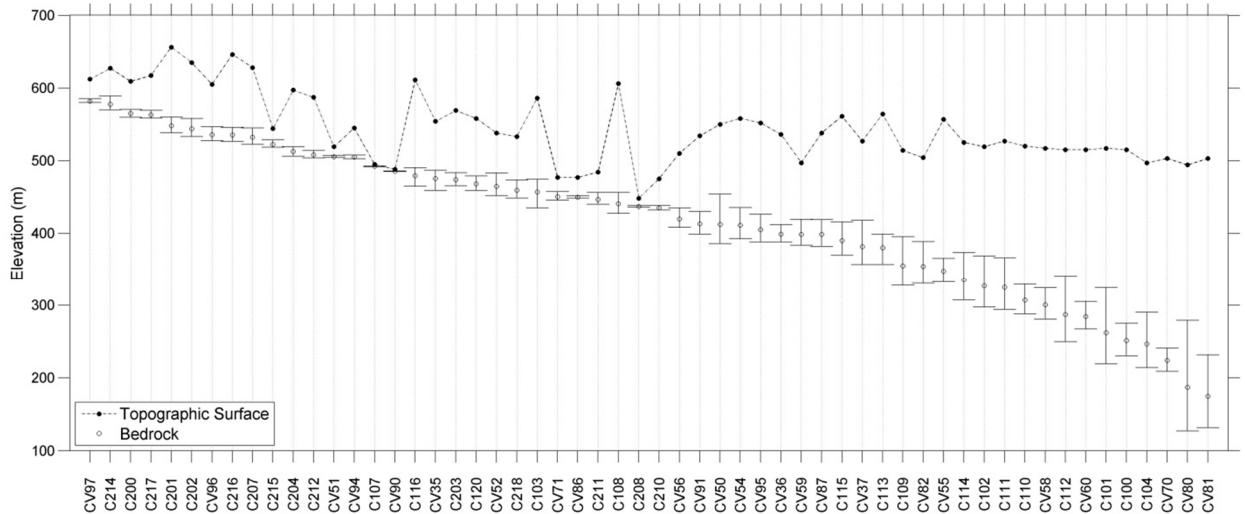


Figure S2. Errors associated to bedrock elevation estimates. Black dot: topographic surface elevation of each measurement point. Open circles: bedrock elevation estimates. Black bars: error associated to bedrock elevation estimates. Values refer to the Table S1 (columns: SE, BE, BE+std, BE-std). X-axis labels: codes of measurements.

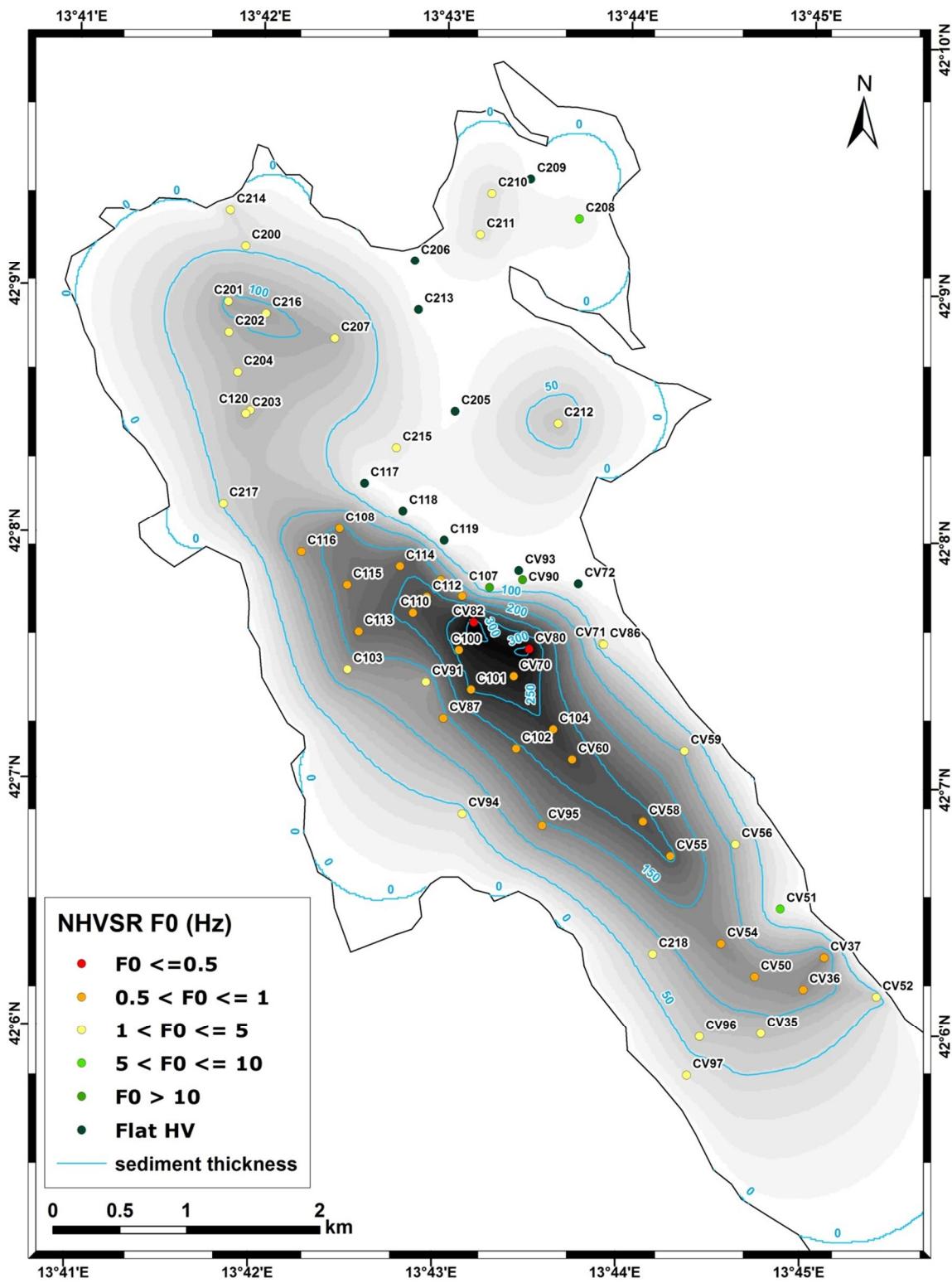


Figure S3. Detailed map of NHVSR and sediment thickness. Labels of each point show the code of the measurement. Blue contour lines and gray scale background show sediment thickness obtained from interpolation of values calculated in each measurement (column ST in Table S1). Color points: fundamental frequencies (column  $f_0$  in Table S1).

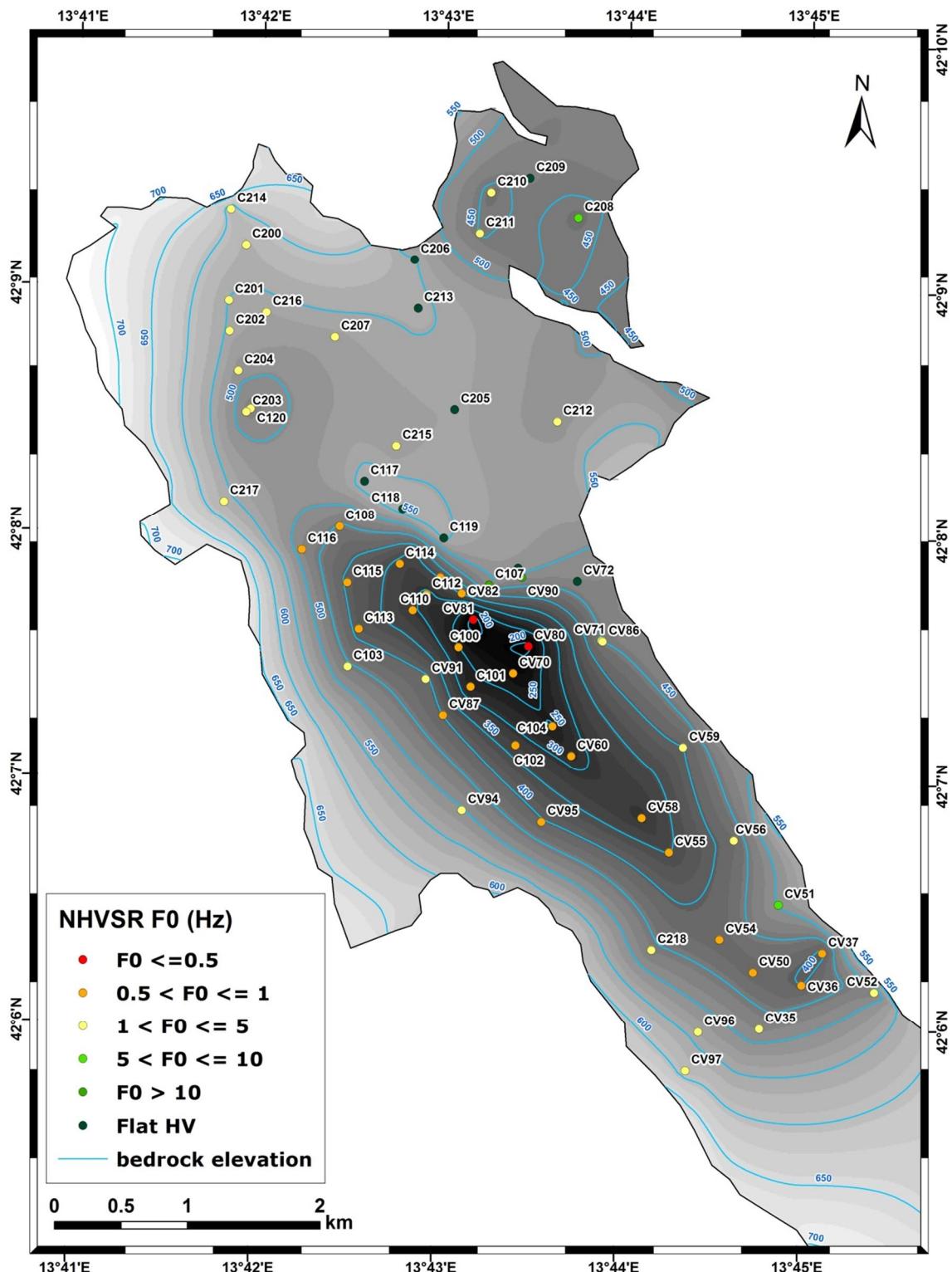


Figure S4. Detailed map of NHVSR and bedrock elevation. Labels of each point show the code of the measurement. Blue contour lines and gray scale background show elevation of the bedrock obtained from interpolation of values calculated in each measurement (column BE in Table S1). Color points: fundamental frequencies (column  $f_0$  in Table S1).