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THE LITHOLOGICAL INFORMATION OF RÂMNICU VÂLCEA SEISMIC SITE BASED ON DRILL CUTTINGS AND IMPLICATIONS IN SEISMOLOGY

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THE MAIN OBJECTIVE

The main purpose of the paper is to obtain the lithological profile of the Râmnicu Vâlcea borehole. To do that, the drill cuttings samples were analyzed using the grain size analysis. Lithological information associated with every seismic site helps us to better understand the local site effects that can play an important role in the intensity of ground shaking.

INTRODUCTION

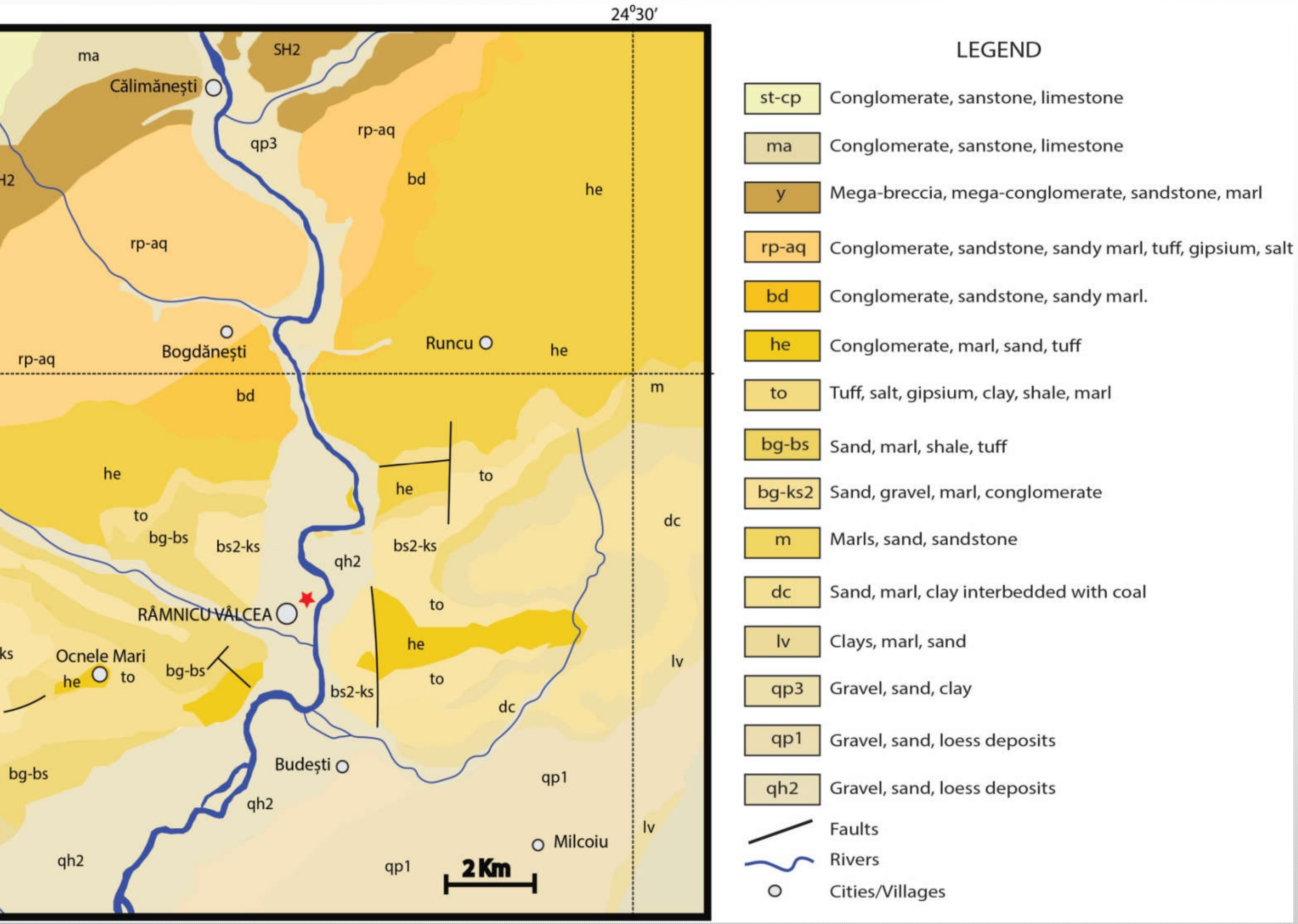
Table 2 IBC site class definitions using the average shear wave velocity to 30 m (International Code Council, ICC 2009)

Site class	Soil profile name	Average properties in top 30 m Soil shear wave velocity, V_s (30), (m/s)
A	Hard rock	$V_s(30) > 1500$
B	Rock	$760 < V_s(30) \le 1500$
C	Very dense soil and soft rock	$360 < V_s(30) \le 760$
D	Stiff soil profile	$180 \le V_s(30) \le 360$
E	Soft soil profile	$V_s(30) < 180$

Table 3 Turkish Building Code soil groups (TBC 1998)

Soil group	Description of soil group	Shear wave velocity (m/s)
(A)	1. Massive volcanic rocks, unweathered hard metamorphic rocks, stiff cemented sedimentary rocks………	>1000
	2. Very dense sand, gravel………	>700
	3. Hard clay, silty clay………	>700
(B)	1. Soft volcanic rocks such as tuff and agglomerate, weathered cemented sedimentary rocks with planes of discontinuity………	700–1000
	2. Dense sand, gravel………	400–700
	3. Very stiff clay, silty clay………	300–700
(C)	1. Highly weathered soft metamorphic rocks and cemented sedimentary rocks with planes of discontinuity………	400–700
	2. Medium dense sand and gravel………	200–400
	3. Stiff clay, silty clay………	200–300
(D)	1. Soft, deep alluvial layers with high water table………	<200
	2. Loose sand………	<200
	3. Soft clay, silty clay………	<200

GEOLOGY OF THE STUDY AREA



logical map of studied area (From 1:200000 Geological map L-34-XXV of the logical Institute, 1968), and the location of borehole (red star)

- Getic Depression is the most internal and deformed part of the South Carpathians foreland
- It's latest Cretaceous to Late Miocene sediments are buried beneath the post-tectonic cover of the Dacian basin, subsurface data show that these were thrust over the Moesian platform.
- The basement of Getic Depression is Moesian type (Wallachian sector) and is bended nearby Southern Carpathians .
- The Getic Depression is covered by an Upper Miocene-Quaternary post-tectonic cover which extend southwards overlying the Moesian foreland. These formations are mainly composed by: claystones, sands, coals, gravels, marls and loess deposits (Figure 1).

METHODS

composite samples that reflect the various lithologies drilled over a 3 m interval (from 0 to 36 m)
composite samples that reflect the various lithologies drilled over a 1 m interval (from 36-40 m).

- sampling and packaging of drilling samples

Grain Size Analysis

1

ples of ~100g
e whole sample was
he original sample
ry well mixed and
random bulk sample
ken (~100g)

2

- The bulk samples were dried over 24 hours in the oven at around 70 °C in order to remove the water

3

- Weigh the samples

4

gravel >2mm

sand(0.0625-2mm)

- Wet Sieve Analysis
- From 16 bulk samples resulted 32 sample (16 gravel samples and 16 sand samples)

5

Repeat the steps 2 and

6

- Maximum grain size measurements

7

Nr.prob	depth	cent.dept	ph. Uscat	gravel	sand	mud	G%	S%	M%	Max. size
1	3	1.5	64.69	32.89	24.69	7.11	50.84	38.17	10.99	10.5
2	6	4.5	155.07	91.75	25.48	37.84	59.17	16.43	24.40	15.4
3	9	7.5	73.69	10.58	41.71	21.4	14.36	56.60	29.04	10
4	12	10.5	81.3	8.54	26.27	46.49	10.50	32.31	57.18	15.3
5	15	13.5	58.1	7.96	14.04	36.1	13.70	24.17	62.13	12.9
6	18	16.5	53.46	3.57	20.99	28.9	6.68	39.26	54.06	10.1
7	21	19.5	57.73	7.82	26.97	22.94	13.55	46.72	39.74	15.4
8	24	22.5	33.72	3.16	11.5	19.06	9.37	34.10	56.52	7.9
9	27	25.5	49.91	4.33	23.16	22.42	8.68	46.40	44.92	10.3
10	30	28.5	43.25	7.54	21.01	14.7	17.43	48.58	33.99	12.7
11	33	31.5	45.14	4.06	27.6	13.48	8.99	61.14	29.86	6.1
12	36	34.5	81.76	46.18	28.18	7.4	56.48	34.47	9.05	17.5
13	37	36.5	33.92	9.17	17.06	7.69	27.03	50.29	22.67	13.7
14	38	37.5	52.94	14.74	27.87	10.33	27.84	52.64	19.51	10.7
15	39	38.5	32.83	6.87	16.36	9.6	20.93	49.83	29.24	12.6
16	40	39.5	60.11	19.53	25.05	15.53	32.49	41.67	25.84	14.34

- Data base development
- The mass of fine fraction presented in all samples was represented by soft, hydratable, and washable clays/silt that was calculated mathematically from dry sample minus the sum of dry arenitic and ruditic fractions.

RESULTS

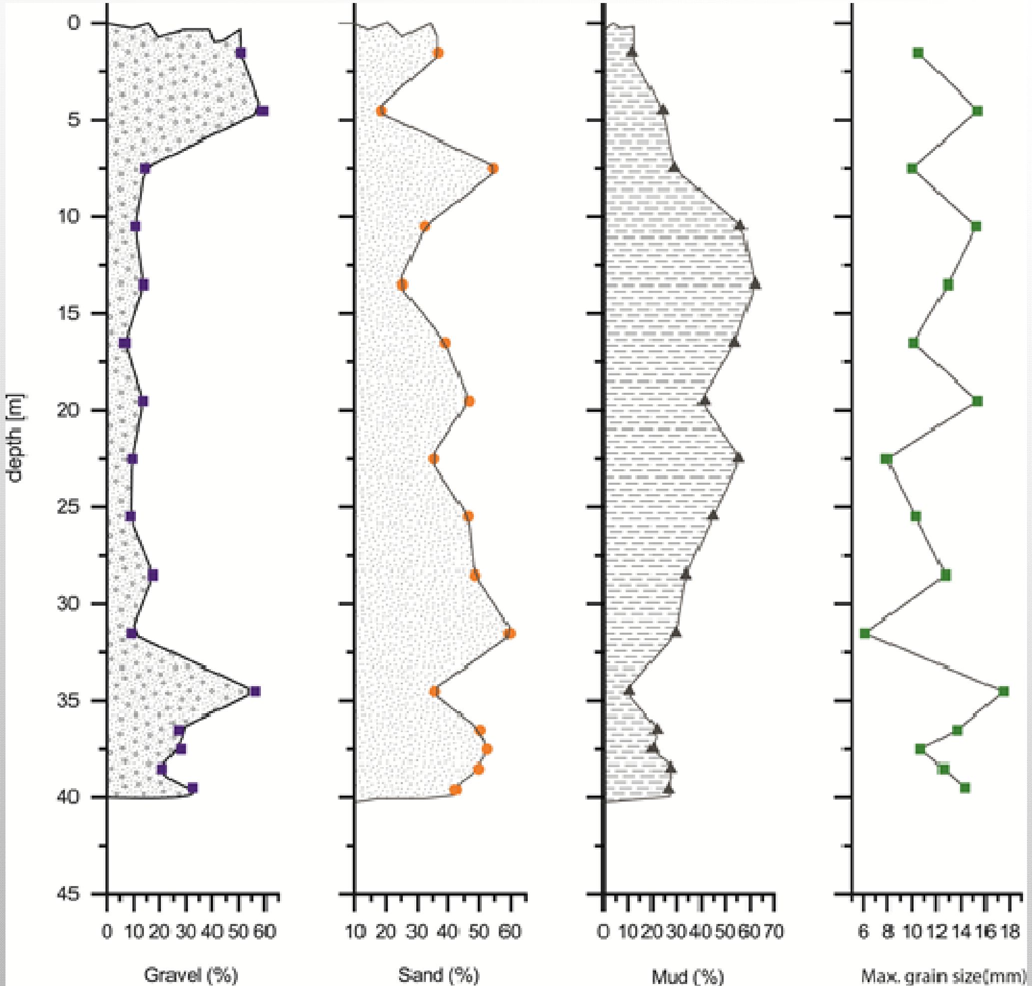


Figure 2 Mass percentage of gravel, sand, mud and the maximum grain size.

- In the upper part of the section, the total gravel content is between 50 and 59%.
- Between 6 m and 33 m, the gravel content decreases to 7-1
- The maximum grain size seems to match with gravel conte when the percentage of gravel increases, also the grain size increases.
- The sand content variate from 61 to 16% and doesn't look t follow a pattern. The highest peaks in sand content are noti after the gravel decreases and before the gravel increases
- The grain size depends on the type of depositional environ The high content of gravel is settled in fluvial processes tha include the motion of sediment and erosion or deposition o river bed.

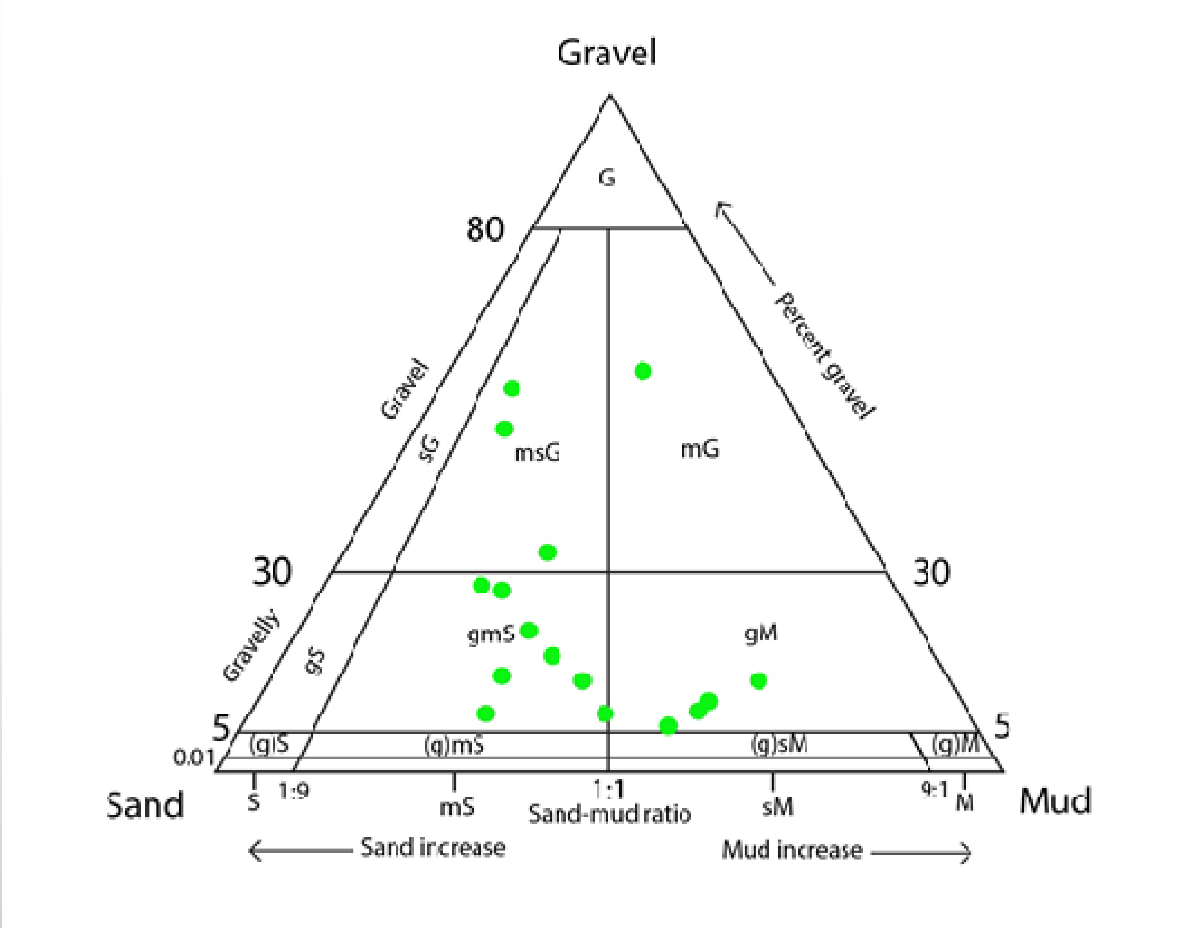


Figure 3. Triangular diagram showing grain-size composition of 15 naturally occurring sediments (textural classes of Folk, 1954, 1980) based on weight percent of their aggregates content (mud, sand, and gravel) as determined by grain-size analysis. The threshold for the recognition of gravel is greater than or equal to 0.01 weight percent. The gravel axis is shown to scale except for the 0.01 value. The sediment classes: M, mud; m, muddy; S, sand; s, sandy; G, gravel; g, gravelly; (g), slightly gravelly

CONCLUSION

- The main purpose of this study was to obtain lithological information of Ramnicu Valcea seismic site by analysing the drill cuttings. The chosen method was the grain size analysis because it was the most reliable method to get lithological information from the soft quaternary sediments high mixed by the drilling process. Th results show the mass concentration of gravel, sand, and mud of all sampled intervals from 0 to 40 m depth. To see the predominant lithology of analysed samples, the results were plotted in a Folk triangular diagram.
- Lithological information associated with every seismic site helps us to better understand the local site effects tha can play an important role in modifying the intensity of ground shaking. The analysed samples of Ramnicul Valcea borehole contain soft and loose formations with the highest number of samples located in gmS (gravelly muddy sand) class and gM (gravelly mud) class. According to IBC class**,** the Ramnicu Valcea lithological profi can be included in class E (soft soil profile).
- The lithological information obtained in this study will be correlated with the future seismic measurements to define a better dynamic and elastic properties of the Quaternary sedimentary strata of Ramnicu Valcea seismic site**.**

THANK YOU FOR YOUR ATTENTION !!!

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