ANALELE ŞTIINŢIFICE ALE UNIVERSITĂŢII "AL. I. CUZA" IAŞI
Geologie. Tomul LI, 2005

CONTRIBUTIONS TO THE MORPHOMETRIC STUDY OF MOBILE DEBRIS FROM BĂLĂBĂNEŞTI

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KEY WORDS: debris morphometry from Balabanesti; sedimentologic significations

The zone that we take into study is situated in the southern part of Barlad Platform.

The geologic researches upon this sector are few. The first geologic observations were made in 1907 and done by R.Sevastos, then N.Macarovici's studies from 1929. In 1960 V.Sficlea separated for the first time "the Balabanesti strata" that belong to the last period of sedimentation from Miocen – Quaternary from Barlad Platform. Later, the same author studied in 1972 and 1973 the same area but without any sedimentologic aspect.

Morphometric analysis

The analyzed samples are from exposures located at Hanu Conachi and Balabanesti. There were collected aprox 800 pebbles to which we measured their axes.

The morphometric analysis was made after classic methods: Zingg – 1935, Cailleux – 1945; Corey – 1949, Sneed, Folk – 1958, Dobkins and Folk – 1970.

Through direct measurements, by calipers, we obtained the values of the three axes (a, b, c) for each pebble.

The debris morphometry was described on the basis of the three axes and curvature amplitude of the sharpest corner (r_i) from the maximum projection plan (ab plan) of the pebble.

On the basis of b/a and c/a rapports there had been established the form of the pebbles and their morphometric cube derived classification:

- isometric class (b/a and c/b> 0,67)
- prismatic class (b/a < 0,67; c/b<0,67)
- planar – lamellar class (b/a and c/b<0,67)
- planar – disk class (b/a > 0,67; c/b < 0,67)

The distribution of the 800 pebbles in four classes (Zingg – 1035) is:

- isometric class: 187
- prismatic class: 206
- planar – lamellar class: 125
- planar – disk class: 282.

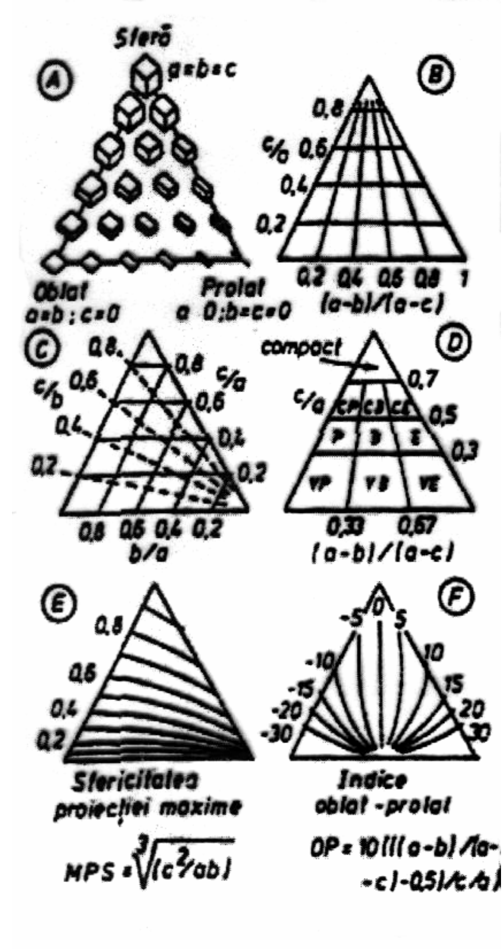
In order to determine the dimensions, shape and surface aspect of the 800 pebbles there were aleatory chosen 10 measured pebbles.

The results and the morphometric value indices of these pebbles are found in table no. 1.

Table no.1

No.	Sample	a [mm]	b [mm]	c [mm]	Morphometric indices used for pebbles shape quantification									
					R_0	P	Ap	As	c/a	OP	DC	MPS	Sr	CSI
1	10	53.82	34.98	19.42	0.28	9.80	2.28	0.62	0.36	1.3	0.54	0.58	0.61	0.44
2	40	34.57	20.09	17.09	0.61	7.02	1.59	0.65	0.49	6.7	0.82	0.74	0.65	0.64
3	88	33.33	22.22	18.34	0.37	7.18	1.51	0.70	0.55	4.38	0.74	0.76	0.71	0.67
4	204	17.69	16.82	12.13	0.48	5.29	1.42	0.80	0.68	-5.00	0.15	0.79	0.86	0.70
5	495	23.55	8.54	6.57	0.81	4.65	2.37	0.73	0.28	14.05	0.89	0.60	0.47	0.47
6	548	36.58	35.73	15.55	0.23	10.75	3.38	0.67	0.22	5.7	0.62	0.45	0.48	0.31
7	693	6.24	5.97	4.64	0.42	2.65	1.31	0.50	0.74	-4.47	0.16	0.83	0.97	0.76
8	720	36.00	19.91	16.14	1.28	7.10	1.73	0.61	0.44	7.00	0.81	0.71	0.62	0.60
9	779	80.67	30.47	15.16	0.21	10.71	3.66	0.72	0.18	14.79	0.76	0.45	0.41	0.30
10	791	20.22	15.20	13.06	0.32	5.35	1.35	0.43	0.64	3.14	0.70	0.82	0.78	0.74

For the determination of circularized index there had been used Wentworth formula (1933), and for flatting, carrying capacity and asymmetry indices there had been used Cailleux formulae (1945, 1947). For the determination of oblat-prolat, disk-cylinder, roundness of the maximum protection, roundness after Krumbein Corey's shape indices there were used the relations from table no.2.



Oblat - prolat index	$OP = \dfrac{10\left(\dfrac{a-b}{a-c} - 0.5\right)}{\dfrac{c}{a}}$	Dobkins & Folk (1970)
Disk-cylinder index	$DC = \dfrac{a-b}{a-c}$	Sneed & Folk (1958)
Shape rapport	$R = \dfrac{(CP-CE)+2(P-E)+4(VP-VE)}{2N}$ CP = % compact CE = % compact elongate P = % plat E = % elongate VP = % very plat VE = % very elongate	Sneed & Folk (1958)
Maximum roundness projection	$MPS = \sqrt[3]{\dfrac{c^2}{ab}}$	Sneed & Folk (1958)
Krumbein's roundness index	$Si = \sqrt[3]{\dfrac{cb}{a^2}}$	Krumbein (1941)
Carey's shape index	$CSI = \dfrac{c}{\sqrt{ab}}$	Carey (1949)
Riley's roundness index	$S_r = \dfrac{D_i}{d_c}$ Di = dc =	Riley (1953)

Table no 2
Triangular diagrams (after Sneed, Folk, 1958; Benn, Ballamyne, 1993):
A – Apex definition and idealized shapes; B – Sneed and Folk diagram (1958);
C – Hookey diagram (1970); D – Descriptive Sneed and Folk classes (1958)
E – Isolines of maximum roundness projection; F – Isolines of oblat – prolat index

The final form of the pebbles expressed through circularized (Ro), roundness (MPS) and flatting (Ap) indices, appears dependant on the inner structure of pebbles and less on their mineral composition.

For roundness index there were obtained values between 0,21 and 0,28.

The values of circularized (MPS) denotes an increasing tendency of its values from 0,45 to 0,83 and it shows the rapport between maximum protection surface of a pebbles and that of o sphere with the same volume (Sneed, Folk – 1958). This index depends on the petrographic nature of pebble.

For asymmetry index (As) there were obtained values between 0,43 and 0,80, and for carrying index (P) values between 2,65 and 10,75.

For oblat-prolat (OP) and disk cylinder (DC) indices represent quantitative indices pebble shape with another type of variation, in comparison with the other indices.

Thus, oblat-prolat index varies from -4,47 to 14,79 while disk-cylinder index presents a variation between 0,15 – 0,89.

In the identification of Balabanesti pebble shape there was also calculated Corey's shape index that varies between 0,41 and 0,97 (table no. 2).

By the help of data, there were elaborated three diagrams for the distribution of disk-cylinder index (figure no.1), oblat-prolat index (figure no.2) and the circularized maximum protection index (figure no. 3). To obtain an image upon the statistic distribution of parameters determined b the 800 diameter measurements, there were established 11 classes from the smallest one (5,57) till the largest (67,66), using the class interval d_k obtained b statistic calculation (table no. 3).

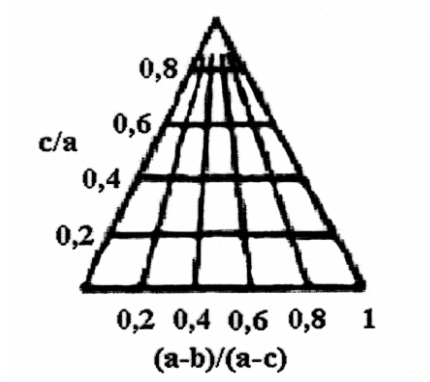


Figure no. 1 Disk - cylinder index

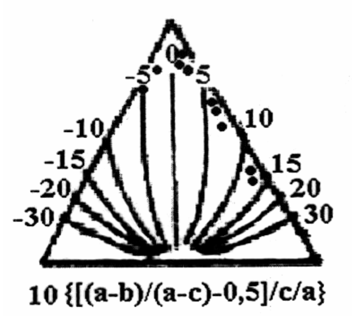
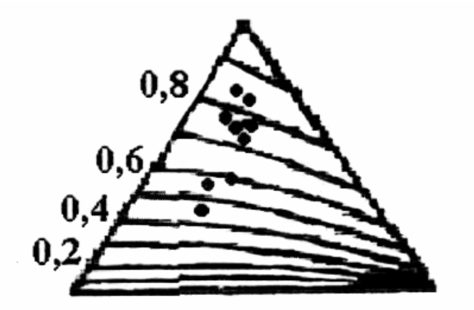


Figure no. 2 Oblat – prolat index



$$\sqrt[3]{\frac{c^2}{a \cdot b}}$$

Figure no. 3 Maximum roundness projection

$$d_k = \frac{x_M - x_m}{1 + 3.333 \log N}$$

In which: x_M = maximum diameter;
x_m = minimum diameter;
N = number of pebbles (800).

Thus: $d_k = \frac{67.64 - 5.57}{1 + 3.333 \log 800} = 5.80$

The final data are presented in table no. 3

Table no.3
Values of the statistic analysis for pebbles

Class no.	class	No. of pebbles	Frequency [%]
1	5.57 – 11.37	10	1.2
2	11.37 – 17.17	132	16.5
3	17.17 – 22.97	391	48.6
4	22.97 – 28.77	191	23.8
5	28.77 – 34.57	57	7.1
6	34.57 – 40.37	8	1
7	40.37 – 46.17	1	0.1
8	46.17 – 51.97	1	0.1
9	51.97 – 57.77	5	0.6
10	57.77 – 63.57	2	0.2
11	63.57 – 69.37	2	0.2

By the help of these statistic data there could be represented the pebble frequency histogram on classes (figure no. 4).

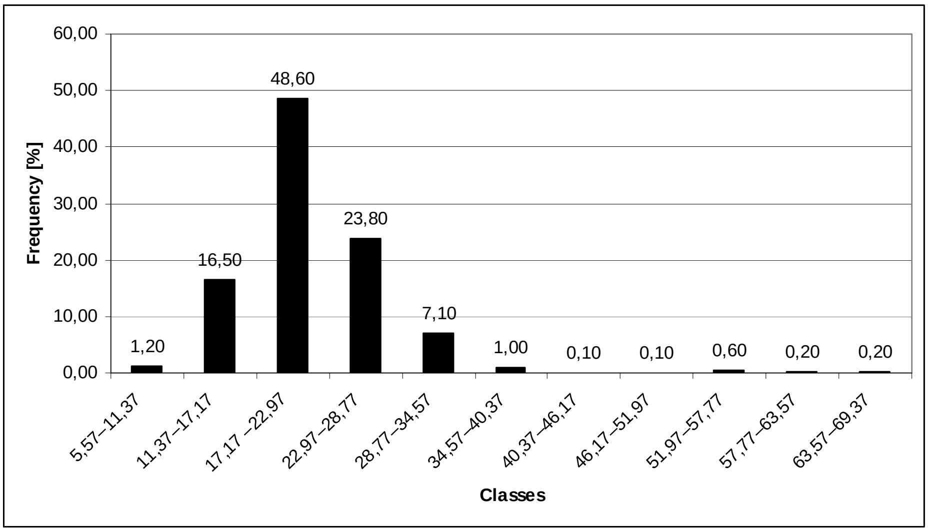


Figure no. 4 The histogram of pebble diameter frequency on classes

The statistic work of data permitted a graphical representation of morphometric characteristic (a, b, c) (figure no. 5).

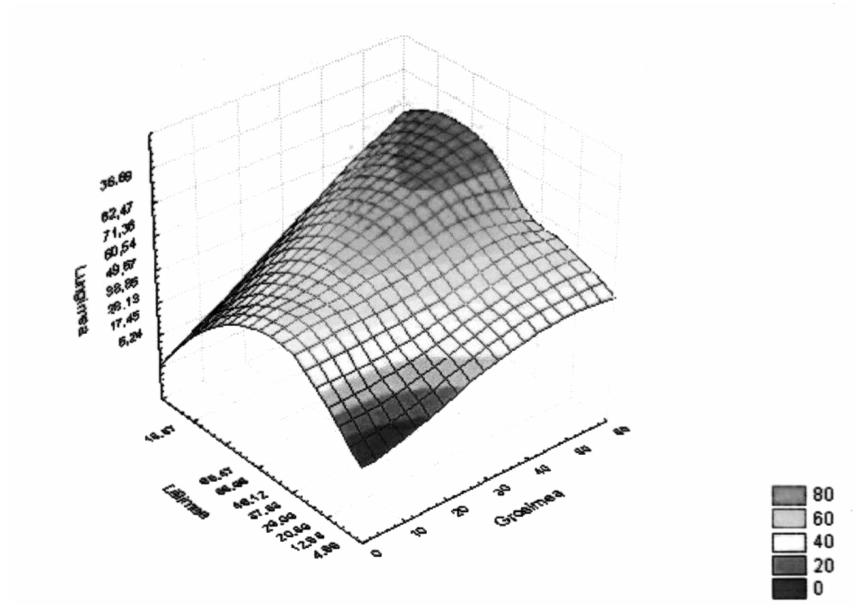


Figure no. 5 The surface distribution of pebbles depending on length, wideness and thickness.

Conclusions

References regarding the age and the origin of Balabanesti debris were made since 1960 by V.Sficlea that considered them of fluvial-lacustrine origin formed in Villafranchian level on a large area in the southern Moldavia, and transported by a Carpathian hydrographic network on NW-SE direction.

There are also some opinions which admit that this debris contains crystalline schists, and they were deposited by Siret and Bistrita rivers, and also with platform elements transported by Prut.

The small quantity of platform elements leads to the presumption that the Balabanesti debris transport from the Carpathian part was made on a plane surface with low slope.

The platform element contribution is established also by the terrace deposits of the valleys, to whose origin is Balabanesti debris. The terrace deposits contain also Sarmatian platform elements (calcareous less hard sandstones).

According to the morphometric analysis results that the transport was done linearly, on a low slope and by a hydrographic network (the fact that the majority of pebbles are located in planar-prismatic class – 282 pebbles, and prismatic class – 206 pebbles).

The mixture of Carpathian and platform elements denotes as source the NW and NE part, the sedimentary material massively accumulated in the southern part of the Barlad Platform, affected by an active subsidence process due to the neo-tectonic Quaternary stir.

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