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Erosion and Sedimentation in The Hungarian Basin During the Cenozoic Era.

By Alexander Jaskó.

The Hungarian Basin lies between the Carpathians, the Alps and the Dinarides forming geological and geographical unity. On its territory, excepting Croatia, there were no important Tertiary crustal movements; it is therefore most fit for paleogeographical examination. Research is hampered by the Quaternary cover which hides most of its territory. The author has collected about 500 boring logs and deals with his subject on basis of these data.

In the Eocene Period the Hungarian Basin was for the most part a fiat continent on the borders of which marine limestones and lignit bearing marsh deposits were formed. Sediments thus formed nowhere exceed 300 m. Lack of coarse pebbles indicate feeble erosion. In contrast to this Eocene flysch of 3000 m thickness was deposited at the base of the Carpathians. Here the upfolding of the Carpathians provoked intensive erosion and simultaneously sedimentation in the foreland of the mountain range was also increased.

The thickness of the Oligocene Flysch is less, 1000 m on the average.

In the Oligocene Period a series of sediments of 1500—2000 m thickness were deposited on the S-border of the NW-Carpathians as well, from Budapest to Miskolc. On the other hand, Oligocene sediments are entirely lacking from the western

promontories of the Alps over the Balaton District and the middle of the Great Plain straight to the Bihar Mountains.
In the Oligocene a flat continent extended here from E to W. South of this central continent another marine belt existed at the base of the Dinarids. Oligocene deposits of Flysch type were forced between the Drave and Save rivers, and in the Fruska-Gora Mountains lignitiferous Oligocene beds of Sotzka type were deposited.

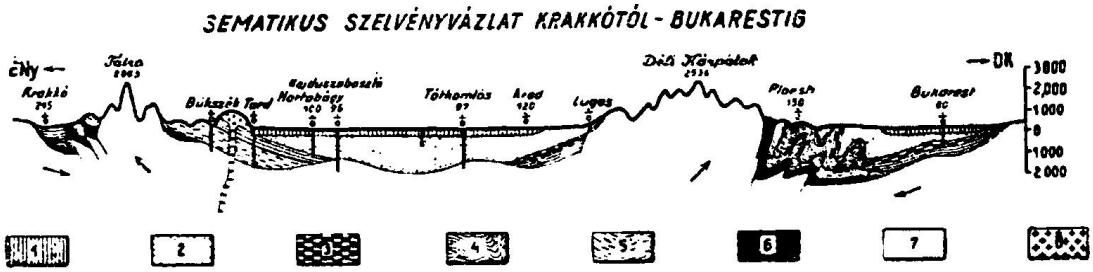

Fig. 1. Outline cross section from Cracow to Bucharest.
1. Quarternary, 2. Pliocene, 3. Sarmatian, 4. Mediterranean, 5. Oligocene, 6. Eocene, 7. Mesozoic and Palaeozoic, 8. Volcanic rocks.

In the Lower and Middle Miocene conditions did not change: the Central Continent extended from E-W, bordered in the S by two sea belts. The northern sea belt extended from Vienna to Máramarossziget (Sighet) and a series of beds of 2000 m thickness was deposited in it.

Lower and Middle Miocene deposits of the Southern marine belt are known in following thicknesses: 1500 m near Graz, 1200 m near Pécs, 600 m near Szekszárd and more than 300 m near Belgrade.

In the Upper Miocene the Central Continent became an island surrounded by the marine belt containing brackish water already. Sarmatian beds have following thicknesses: 1000 m near Vienna, 600 m in Croatia (Restari), 800 m in Transylvania.

A Hungarian Basin may only be spoken of since the beginning of Pliocene times, then the Central Continent sank in completely and the unitary kettle shaped basin was formed between Carpathians, Alps and Dinarids.

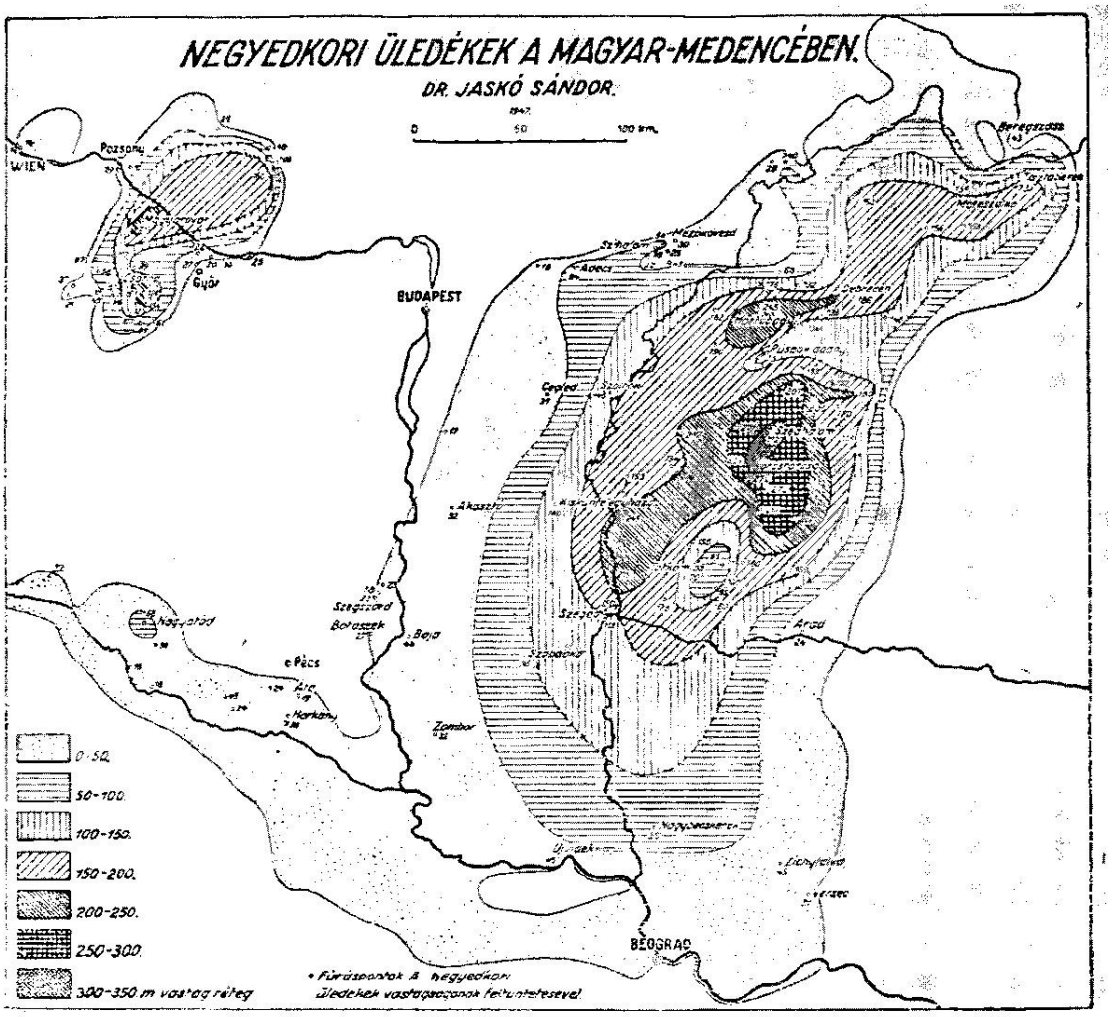

Fig.2 Quaternary sediments of the Hungarian Basin

Since that period thickest deposits have been formed not at the base of the mountain ranges but in the middle of the basin. The thickness of Pliocene beds exceeds in some places even 2000 m. In the Quaternary three independent areas of sedimentation were formed, the largest of which slopes toward the River

Tisza. Here the thickness of Quaternary beds exceeds 350 m. (Fig. 2.)

Zones of sedimentation are shifted according to a certain law. It is generally known that the areas of sedimentation and those of subsequent movements of the earth crust have been gradually shifted outward in the Carpathians.

At the base of the ancient masses sediments were accumulated during Mesozoic times, in the Flysch belt from the Upper Cretaceous to the end of the Oligocene Period, in the Sub-carpathian zone in the Neogene Era. As soon as one zone was uplifted by the upheaval of the mountains its foreland sagged. Erosion products of the uplifted mountains accumulated in the sea basins at the base of the range.

The same law may be observed on the inward side of the Carpathians. The members of the inner system of basins don't range, according to the periods of their formation, into such regular series as the zones of the Carpathians or of the Dinarides. However, an inward or southward sequence may be observed as shown by sediments filling up the basins.

Older basins were uplifted again and rivers cut their beds therein, denuding the surface. The newer basins lie deeper and are still being filled up. First the Palóc (North border of the Hungarian Plain) and the Mármarossziget basins and the northern part of the Transylvanian basin were formed. Afterwards the Graz basin and the south, of the Transylvanian basin sank in. Last the Small and the Great Hungarian Plain subsided where sedimentation is still going on.

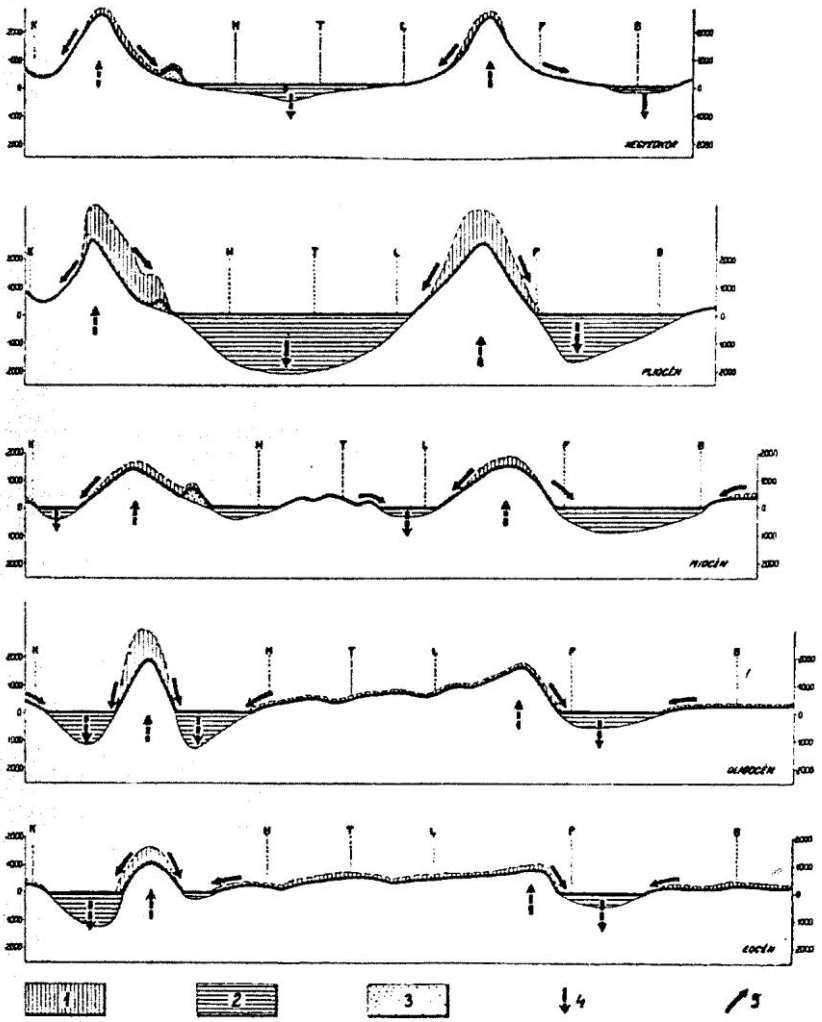

Fig. 3. Diagrammatic sections along the Krakow – Bucharest line.
1. Eroded rocks, 2. Deposited sediment, 3. Volcanic rocks, 4. Direction of crustal movements , 5. Direction of sediment transport.

Fig. 3. gives a diagram of the degree and of the shifting of the areas of sedimentation and erosion. The series of diagrammatic sections are taken along the cross section Krakow - Bucharest shown on (Fig. 1).

On the inner border of the Carpathians the shifting of the area of sedimentation was not so uniform as on the outer border of the range, because the cratogenic Hungarian Mass sank in along lines of fracture and did not follow the strike of the mountain main. Main fractures are parallel to the Tertiary border fractures of the Variscan mountain relics of Central Europe.

From the mass of the sediments conclusions may be drawn to the degree of erosion. We obtain the quantity of sediments by multiplying the area of the basin with the thickness of deposits.

A mass denuded in a certain epoch is equal to the mass deposited in the same time. The average thickness of the denuded rock is obtained by dividing the denuded volume by the area of the eroded territory. Maximum error limits due to lack of data may be assumed as follows: 25% in Quaternary, 50% in Pliocene, 120% in Sarmatian times.

Of older periods knowledge of areas of sedimentation and of erosion and of the thickness of deposits is insufficient and estimates within very wide error limits can only be given. Data of erosion and of sedimentation in the Hungarian Basin are tabulated as follows:

Period (million years)	Period or Epoch	Area of sedimentation (km^2)	Accumulated sediments (km^3)	Denuded Area (km^2)	Thickness of denuded rock	Yearly detritus (km^3)
0,6-0,8	Quaternary	94 000	8 224 000	482 000	17 m	10-13
1,6-4,0	Pliocene	203 000	213 928 000	482 000	570 m	50-130
1,5	Sarmatian	123 000	29 729 000	482 000	65 m	20

At present the yearly sediment carried away by the Danube and its tributaries may be estimated at 1 km^3.

Erosion and sedimentation increased thus rapidly from Sarmatian to Pliocene and has decreased gradually since the Pliocene period to our times.

Even it we admit a certain error due to insufficient knowledge of the time periods, decline is most apparent. This is due to the almost complete cessation of crustal movements and of volcanic activity in our days.

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