Oligocene – Lower Miocene

by

J. Haas

On the hill range extending east of Sümeg the Csatka Gravel Formation, a lithostratigraphic unit of Oligocene to Lower Miocene age common to the Bakony area, can be studied over a large area even in outcrop. The vicinity of Sümeg is of particular importance and of genetic value because it is here within the known area of the formation that pebbles and boulders of largest size can be found.

Exploration history

Information on the Sümeg-area occurrence of formations assigned to the Csatka Gravel Formation in earlier literature is scant.

Regarding even the extended neighbourhood, J. Böckh (1878) was the first to discuss this formation in detail in his work devoted to the southern Bakony Mountains, assigning it as "conglomerate and gravel" to the "younger Mediterranean" stage. However, under this collective term they grouped various gravel deposits, not only Oligocene to Lower Miocene, but also Middle and Upper Miocene and even Pannonian ones.

L. Lóczy (1913) in his Balaton monograph, attempted at subdividing the "Mediterranean" gravel formations of the Bakony on the basis of the elevation above sea level. Thus he singled out four different horizons. The three lower gravel horizons were proved to be littoral deposits—a fact evidenced by their fauna. Regarding the stratigraphy "of the large gravel sheets soaring above 400 m altitude on the plateau of the Nagybakony and around Városlőd-Ajka", he is of the opinion that it is a still open problem, but in summarizing the results he concludes: "I consider the gravel conglomerate of the Bakony ... to represent a terrestrial formation ... belonging, for a larger part or completely, already to the Sarmatian beds". He considered this terrestrial facies of highermost position to include the gravel formation found on the 360-m-high plateau of the "Csúcsos-hegy" (= Rendeki-hegy) as well.

F. Pávai Vajna and I. Maros (1937), in the map-supplement to their paper on questions of water prospecting, gave relatively exactly the extension of the "Mediterranean gravel" of the Csúcsos-hegy.

J. Noszky Jr. (1958) was also unable to solve reliably the problem of separation from one another of the different "Mediterranean" gravel formations of the Bakony, often juxtaposed or superimposed on one another as they are. The gravel formation with giant pebbles and boulders in it on the hilltop of the Rendeki-hegy was assigned by him—with an emphasis placed on his being uncertain—to the Miocene.

In the light of the geological mapping of the Transdanubian Central Range system and the processing of materials recovered from a great number of boreholes, by the end of the 1960's the principal features of the stratigraphy of the gravel formations of the Bakony and of their genetic conditions have been cleared.

In the summarizing paper, Á. Jámbor and L. Korpás (1971) considered the fluviatile sand, pebble and clay sequence, hitherto assigned to different stratigraphic horizons, to be of "Upper Oligocene (Lower Miocene?)" age—an assignment based on the mode of superposition and the facies relations.

P. Jakus (1970), during his surveying the Csabrendek quadrangle of a map of 1:25,000 scale shed a clear light, in the immediate vicinity of our study area, on the mode of superposition of the formation, its extension and most important sedimentological features.

A detailed description of the Csatka Gravel Formation is contained in a monograph by L. Korpás (1981). References concretely to the Sümeg area are few in this monograph, but, in evaluating the Sümeg deposits, we have taken into consideration the data concerning the unit as a whole, the facies analysis and the paleogeographic synthesis.

Csatka Gravel Formation

Extension, mode of superposition, geological features

The Csatka Gravel Formation is known from the Bakony Mountains and also from their northern and western forelands. It is composed of cyclicly alternating gravel-conglomerates, sands to sandstones, variegated clays, argillaceous marls, marls and siltstones. At its base, as a rule, grey clays, argillaceous marls, and carbonaceous clays are found (Szápár Lignite Member).

In the Sümeg area the surface extension of the formation is difficult to determine with precision owing to the lack of boreholes. Exposures suitable for a scrutinized examination are very rare, if any. All that which can generally be observed are "sporadical gravels" scattered over the surface. Whether these constitute outcrops of the Csatka Formation or represent pebbles redeposited from them subsequently, is difficult to decide.

A rather large and coherent gravel outcrop that is undoubtedly in its primary position is known from the hilltop level of the Rendeki-hegy. Here some boreholes have exposed the Csatka Formation too, which in this area overlies the upper member of the Szőc Formation without any remarkable angular unconformity. On the southwestern margin of the plateau of the Rendeki-hegy, the biggest boulders are known to occur, boulders which, judging by their position, may represent the basal part of the Csatka Formation. Set loose by erosion from the sandy rock, the boulders seem to have been exposed already prior to the Pleistocene. Their surface is usually polished bright and even "sharp, angular pebbles" are quite frequent.

The boulders are composed (listed in their order of frequency) of meta-sandstone, gravelly meta-sandstone, breccia and conglomerate of very low-grade metamorphism (meta-breccia and meta-conglomerate), yellowish-white to grey quartzite, tourmaline-bearing quartzite, dark grey sandstone, andesite, in lesser quantity, red sandstone (Permian), quartz-porhyry, dark grey limestone, white spongiolite, quartz-phyllite, and biotite-quartz mica-schist.

A thin section analysis of type samples of the boulders was carried out by Gy. Lelkes-Felvári. Upon examining the gravelly meta-sandstone type predominant within the gravels, she came to the conclusion that it had undergone but a very slight metamorphism. Its detrital grains: quartz, feldspar, muscovite, biotite and rock debris. The grains show a faint orientation, the original roundness not being recognizable owing to recrystallization of the matrix between the grains.

Presenting the habit of lydite when viewed with an unaided eye, the dark grey quartzite boulders are of metamorphic origin, being heavily mylonitized. They do not exhibit the layered texture typical of lydite.

In the type sample of the tourmaline-bearing quartzite gravel, the rock texture was breccious; in addition to angular quartzite detritus, sandstone debris and recrystallized, acidic effusive detrital material were recognizable in it. The debris are cemented by tourmaline.

In the quartz-phyllite gravel the predominant quartz mineral could be shown to be associated with muscovite and, as accessories, tourmaline and zircon. Muscovite is oriented according to schistosity.

The sandstone gravel samples are medium- to coarse-grained, being composed predominantly of quartz grains. The matrix is very poor, being constituted by silica and sericite-muscovite. In addition to quartz, the detrital grains are: albite, microcline, muscovite and rock debris. The percentage of feldspar is 10 to 15%.

Described megaloscopically as quartz porphyry, the gravel was identified with rhyolite tuff and quartz-porphyry tuff. The porphyric impregnations are represented by quartz and mafic silicates (mainly rhombic pyroxenes). The matrix has altered to microcrystalline quartz.

Similarly from the top of the Rendeki-hegy derives the boulder which, as found by Cs. Ravasz, is made up of decomposed acidic effusives of rhyolite and dacite. From its phenocrysts, only quartz is preserved intact. The place of the mafic silicates is occupied by chlorite, prehnite and ore minerals. The glass phase of the groundmass is recrystallized, the feldspars are argillitized, the mafic constituents are chloritized. Primary ore minerals: magnetite, titanomagnetite; secondary minerals: hematite, limonite and leucoxene.

The boulders at the top of the Rendeki-hegy are 40 to 50 cm in size. The biggest boulder ever found in the study area was observed there. It measured 85 cm in length, 45 cm in width and 35 cm in height. The material constituting it is andesite (Plate XLVIII, Fig. 1). Each boulder is strongly rounded (K = 3–4 in terms of Rukhin's 5-division scale).

Information on the thickness of the Oligocene to Lower Miocene gravels covering the top level of the hill and on its geological features is furnished by a few boreholes spudded for the purpose of prospecting for construction raw materials. The borehole M-1/F exposed a formation made up of argillaceous, sandy gravels of 8 m thickness above the Szőc Limestone. The pebbles vary from 1 to 4 cm in size with a maximum of 25 cm. Well-rounded (K = 3–4), they are composed in 25% of Cretaceous limestone, in 25% of Eocene limestone, the remaining 50% being represented by meta-sandstone, mica-schist, quartzite, siliceous shale and chert.

The thickness of the formation on the hilltop of the Rendeki-hegy is estimated at a maximum of 20 m.

In the area between the Rendeki-hegy and the Hárs-hegy–Hajnal-hegy range there are two narrow belts of northeast-southwest trend in which the typical gravels of the Csatka Formation are recognizable at every step, but whether we have to do with an outcrop in primary position or with redeposited gravels is particularly difficult to decide there. In the neighbourhood of the minor clearing at the southwest foot of the Rendeki-hegy boulders are found in abundance, for the

most part in mounds accumulated as a result of farming. The boulders are composed of white, grey or, sometimes pinkish quartzite, meta-sandstone, meta-conglomerate, siliceous shale, chert (radiolarite, spongiolite), quartz porphyry, sandstone and quartz-phyllite varying between 10 and 40 cm and a maximum of 45 cm in size. Their roundness is fair (1–3).

Based on measurements of 77 pebbles or boulders, respectively, the size and roundness data are presented in Fig. 75.

In a tectonically down-faulted block on the southeast side of the Rendeki-hegy, the borehole Ck-167 exposed, above the Eocene Szőc Limestone, a 20-m-thick sequence of the formation. The exposed formation is represented by argillaceous, sandy gravels. The boulders or pebbles vary from 0.5 to 20 cm in size, being made up of meta-sandstone, meta-conglomerate, quartzite, siliceous shale, dark grey limestone and radiolarite. In the Kozma-tag subarea the Senonian Ugod Limestone (e.g. in the borehole Ck-176), the conglomerate member of the Eocene Darvastó Formation (e.g. boreholes Ck-18, -30, -37, -109) and various members of the Szőc Limestone Formation (Ck-165, -166 and -181) are respectively overlain by rocks assignable to the Csatka Formation.

The sequence is well represented by the section of the borehole Ck-176 in which the Ugod Limestone is overlain by a 13-m-thick sequence of the Csatka Formation. At the very base there are sandy, gravelly variegated clays, followed higher up the profile by clay beds with pebbles. The pebbles vary between 3 and 15 cm in size, being composed of quartzite and meta-sandstone. At the top, gravelly red clays are found.

For a chronostratigraphic assignation, no directin formation is available. As far as the mode of superposition is concerned, all that which we know is that the youngest formation is the Middle

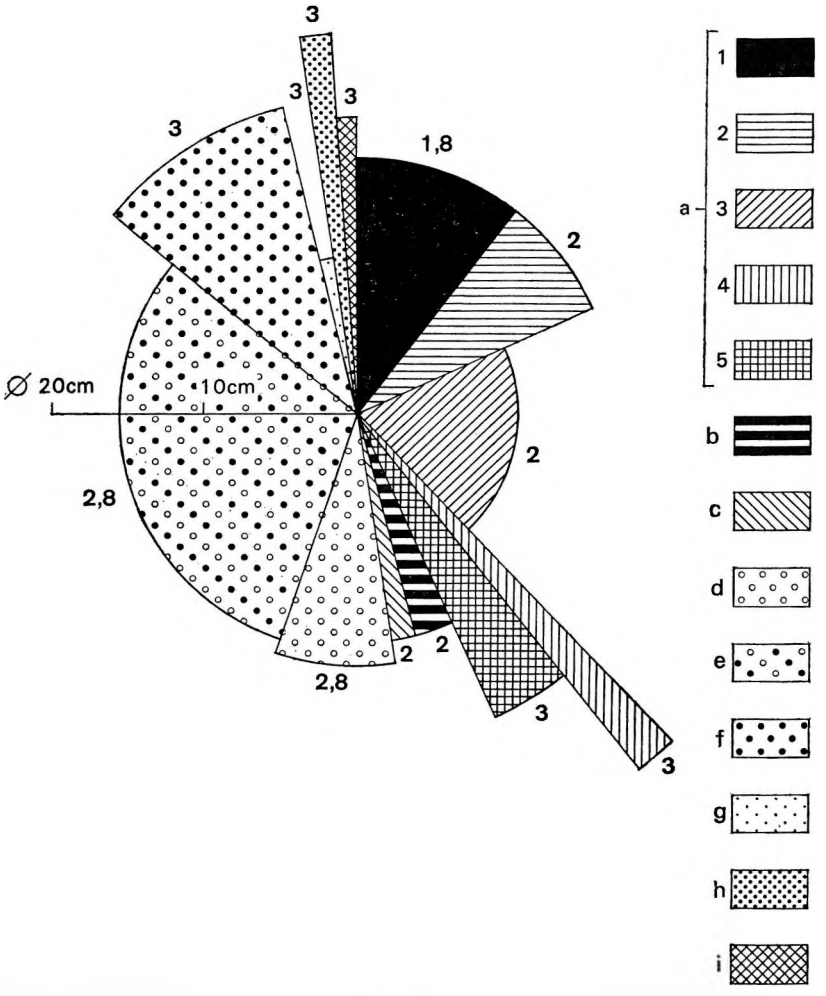

Fig. 75. Boulders sampled in the southwestern foreland of the Rendeki-hegy: size, roundness and lithologic composition

a) Quartzite: 1. dark grey, 2. light grey, 3. white to yellowish-white, 4. red, 5. brown to brownish-grey, *b)* chert, *c)* black shale, *d)* sandstone, *e)* metasandstone, *f)* metabreccia, *g)* metasandstone breccia, *h)* quartz—porphyry, *i)* pulverulent dolomite. — Fat numerals indicate degree of roundness (RUKHIN's scale)

to Upper Eocene Csabrendek Marl Formation (Fig. 67), Badenian gravels being regarded as oldest overburden rock. The chronostratigraphy of the formation is controversial elsewhere in the Central Range as well.

L. Korpás (1981) believes that it encompasses the Oligocene as a whole or possibly even the lower part of the Miocene. T. Báldi (1976), however, is of the opinion that it is confined to the Upper Oligocene only.

Paleoenvironment

The outcrops in the Sümeg area of the Csatka Formation have provided important data for a paleogeographical interpretation of this widespread formation as a whole, primarily as far as the location of the source area, its geology and characteristics are concerned.

The largest amount of information was furnished by the analysis of the boulders. L. Korpás (1981) considers what he refers to as "giant gravel" facies to have been the stream-load of mountainous rivers that flowed into an Oligocene main stream. On the basis of the size of the boulders (the maximum being, as observed by him, 30 cm), he postulates a transport for a maximum distance of 30 km. Since in the Sümeg area boulders outnumbering two and even three to one the maximum size observed by L. Korpás have become known, the transport by streams of upper-course type and the supposition of small transport distances and great differences in altitude have been convincingly corroborated by facts. That from among the Central Range outcrop areas of the Csatka Formation the Sümeg area must have lain nearest to the mountain's source area cannot be doubted either. In the gravels there are representatives of rocks (Lower Paleozoic quartz-phyllite, Permian red sandstone, quartz-porphyry and Eocene andesite) that seem to have derived, by all probability, from a ridge (the Pelsonian Ridge) that lay in the area of what is now Lake Balaton or farther south, representing an emergent landmass at the time of accumulation of the deposits. That ridge may have lain at a distance of 30 to 35 km away.

It is from the southern marginal zone of the Central Range syncline that the other boulders and pebbles made up of crystalline rocks may be derived, though the fact that the commonest constituents of the gravels—meta-sandstones and meta-conglomerates—are for the moment still unknown from the area does certainly pose a problem.

For an interpretation of the finer-grained detrital and pelitic rocks, the analysis of the Sümeg area does not give any new contribution.

From the diversified mode of superposition of the formation, it may be concluded that, in post-Eocene and pre-Csatka Formation times (Pyrenean phase), the study area was block-faulted and tilted to the north (with the Rendeki-hegy block faulted to a deeper position) and eventually the disrupted blocks would slide down the underlying rocks. It was upon this surface of "décollement" that the predominantly fluviatile alluvium would be deposited in Oligocene time.

BIBLIOGRAPHY

Báldi T. 1976: A Dunántúli Középhegység és Észak-Magyarország oligocénjének korrelációja. (Correlation between the Transdanubian and N-Hungarian Oligocene.) — Földt. Közl. 106 (4).

Böckh J. 1875–78: A Bakony déli részének földtani viszonyai. II. — Ann. Inst. Geol. Publ. Hung. 3 (1).

Jakus P. 1970: Csabrendek. — Magyarázó a Bakony-hegység földtani térképéhez. 25 000-es sorozat.

Jámbor A.–Korpás L. 1971: A Dunántúli-középhegység kavicsképződményeinek rétegtani helyzete. (Stratigraphische Lage der Schotterbildungen im Transdanubischen Mittelgebirge.) — Rélations Ann. Inst. Geol. Hung. (1969).

Korpás L. 1981: A Dunántúli-középhegység oligocén—alsó-miocén képződményei. (Oligocene–Lower Miocene Formations of the Transdanubian Central Mountains in Hungary.) — Ann. Inst. Geol. Publ. Hung. 64.

Lóczy L. (sen.) 1913: A Balaton környékének geológiai képződményei és ezeknek vidékek szerinti telepedése. — A Balaton Tud. Tanulm. Eredm. I. (1). Budapest.

Lóczy L. (sen.) 1916: Die geologischen Formationen der Balatongegend und ihre regionale Tektonik. — Resultate der wissenschaftlichen Erforschung des Balatonsees. I. (1). Wien.

Noszky J. (jun.) 1958: Jelentés a „Bakonyi csoport" 1957. évi Sümeg és Csabrendek környéki térképezési munkájáról. — Data Base of the Hung. Geol. Inst. Manuscript.

Pávai Vajna F.–Maros I. 1937: Sümeg és Ukk községek vízellátása. (Die Wasserversorgung der Ortschaften Sümeg und Ukk.) — Rélations Ann. Inst. Geol. Hung. (1929–32).

Fig. 76. **Extension of the Middle Miocene (with the post-Miocene formations peeled off)**