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# OCCURRENCE OF METAMORPHIC TUFFS AND TUFFITES IN THE VEPORIDE CRYSTALLINE COMPLEX OF THE CENTRAL WEST CARPATHIANS

*(Fig. 1—7)*

Abstract: I found metamorphic tuff to tuffite occurrences in crystalline schists of the Kráľova hoľa zone. They occur on several localities and represent products of acid volcanism. They are syngenetic with the crystalline schists. These rocks are macroscopically fine-grained, of white, white grey colour and distinct oriented structure underlined by preferred orientation of biotite flakes. Their texture is blastoporphyroclastic with granoblastic to granoblastic-lepidoblastic matrix. In addition to feldspar porphyroclasts also aplite granite rock fragments appear in these rocks, as well as fragments of metamorphic quarzite rocks. The matrix of crystalloblastic development is made up of quartz, potassium feldspars and plagioclases, few biotite, sometimes muscovite. Their mineral composition reminds leptites described by P. Eskola (1914) from the region of Orijärvi in Finland. Proceeding on this aspect I also denominate them leptite gneisses (without ascribing them any stratigraphical significance). Their presence made it possible to differentiate from the Jarabá Group another separate complex, which I denominated Čierny Balog Group (E. Krist in press). Being in mutual tectonic position with the underlying Hron complex, its stratigraphical age cannot be definitely interpreted. The results of palinologic and geochronological studies will probably throw light on this problem.

Резюме: В кристаллических сланцах зоны Кралева голя нашел автор статьи обнажения метаморфических туфов и туффитов. Эти породы находятся на многих местах в изучаемой области и представляют продукты кислого вулканизма. Они сингенетичны с кристаллическими сланцами. Микроскопически породы представлены тонкозернистыми типами, белой до белосерой окраски с выразительно упорядоченной текстурой. Выразительность этой текстуры подчеркнута ориентацией зерен биотита. Структура бластопорфирокластическая с гранобластическо-лепидобластической основной массой породы. Кроме порфирокластов полевых шпатов в описанных породах находятся обломки аплитовых гранитовых пород и метаморфических кварцитовых пород. Основания масса с кристаллобластической стуктурой состоит из кварца, щелочных полевых шпатов и плагиоклазов, небольшого количества биотита, иногда и мусковита. Минеральный состав ответствует лептитам, которых характеристику дал П. Эскола (1914) из области Orijärvi (Финляндия). Основываясь на характеристике пород вышеупомянутой области автор статьи описывает породы как лептитовые гнейсы (не придадавая этому никакого стратиграфического аспекта). Их присутствие помогло отделить от серии Яраба самостоятельный комплекс названный как серия Черны Балог (Е. Крист, в печати). Стратиграфическое отношение к подстилающему гронскому комплексу нельзя определить из-за тектонического контакта обоих комплексов. Воставшую проблематику можно будет точнее объяснить на основании палинологического и геохронологического изучений.

## *Introduction*

In field work in the Veporide crystalline complex I found metamorphic tuff to tuffitic material in crystalline schists of the Kráľova hoľa zone. Its presence as a synsedimentary member of crystalline schists has been established in the Kamenistá valley and Čierny Balog region. The presence of leptite rocks in the crystalline schists

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of the Kráľova hoľa zone is an important and significant indicator not only of magmatism and volcanism development, but it is also an eminent factor enabling the differentation of the so far uniform Tatric Group (V. Z o u b e k — M. M á š k a 1961) or Jarabá Group in sense of J. K a m e n i c k ý (in M. M a h e ľ et al., 1968).

*A short petrographical characteristics of leptite gneisses and their accompanying country rocks*

The leptite gneisses are part of the crystalline schists of the Kráľova hoľa complex (A. K l i n e c 1966). They appear in close genetic relation along with biotite gneisses, micaschists gneisses to micaschists and phyllite rocks. It follows from field study that they are a synsedimentary member. Slight alternation of pelitic and tuff up to tuffaceous material is the prove of it.

Leptite rocks may be macroscopically characterized as fine-grained sporadically even aphanitic, as it is the case with the sample from the southern slopes of Hálna hora conspicuously showing the character of metamorphic tuffaceous material. Rock structure is in the majority of cases schistose. The sample from the southern slopes of Hálna hora is of unconspicuous schistosity of white or white grey colour.

The rock texture is blastoporphyroclastic with granoblastic to granoblastic-lepidoblastic matrix, holding as porphyroclasts plagioclases and potassium feldspars, often rounded fragments of aplitic granite rocks, as well as quartzites and sporadic larger quartz grains with features of magmatic corrosion.

The basic crystalloblastic mass of leptite gneisses is made up of quartz, plagioclases and potassium feldspars, a little biotite and muscovite.

Potassium feldspar porphyroclasts are represented by microcline, less often by orthoclase. In both cases they are of perthite development.

Quartzite and aplite granite rock fragments are sporadic, strongly elongated and rolled out in the schistosity plane.

From the minerals participating in the composition of the matrix biotite should be mentioned, developed in minute xenoblasts forming also smaller cumuloblasts. It is marked for intensive pleochroism. It has preferred orientation tracing thus the rock schistosity.

The chemical analysis of leptite gneiss from Kamenistá valley ,north of the forest-keeper's house Čierny potok gave the following values of the individual oxids: $SiO_2 = 75{,}05\ \%$, $TiO = 0{,}16\ \%$, $Al_2O_3 = 10{,}48\ \%$, $Fe_2O_3 = 1{,}69\ \%$, $FeO = 3{,}60\ \%$, $MnO = 0{,}02\ \%$, $MgO = 0{,}89\ \%$, $CaO = 0{,}35\ \%$, $Na_2O = 3{,}90\ \%$, $K_2O = 3{,}17\ \%$, $P_2O_5 = 0{,}05\ \%$, $+H_2O = 0{,}62\ \%$, $-H_2O = 0{,}21\ \%$.

From brief macroscopical and microscopical description may be stated that by mineral composition and chemism they correspond well with the description of leptites from the region Orijärvi in Finland given by P. E s k o l a (1914). From this aspect I denominated the described rocks leptite gneisses, though any stratigraphical importance is lacking.

In the ~~region~~ of Pohnilá, micaschistgneisses, biotite and sericite-muscovite phyllites appear in close genetic relation with the leptite gneisses.

Biotite and sericite-muscovite phyllites alternate with micaschist gneisses, whereby no gentle transitions may be found between them.

Macroscopically phyllite rocks are rather fine-grained, noted for fine schistosity, with straight schistosity planes. Biotite phyllites are of brown, sericite-muscovite phyllites of light-grey colour.

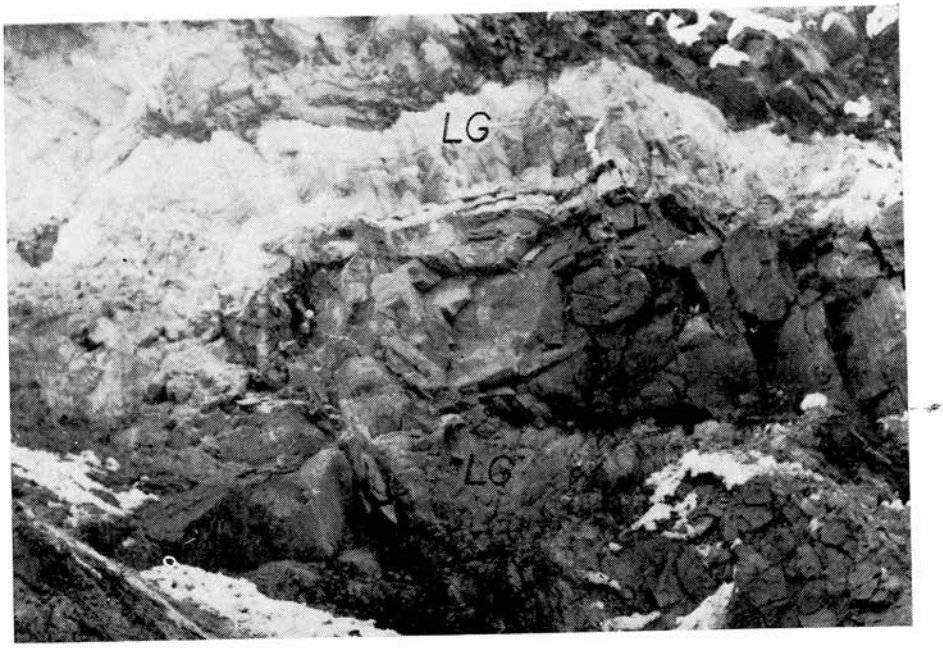


Fig. 1. Leptite gneisses (LG) occurring along with biotite paragneisses. Quarry behind the bridge near the elev. point 556,0, south of the village Vydrovo (Čierny Balog) approx. 850 m.

Fig. 2. Leptite gneiss of fine-banded structure being a consequence of the alternation of very thin biotite layers with quartz-feldspar beds. Separate sample. Quarry near the elev. point 556,0 behind the bridge south of the village Vydrovo (Čierny Balog) approx. 850 m.

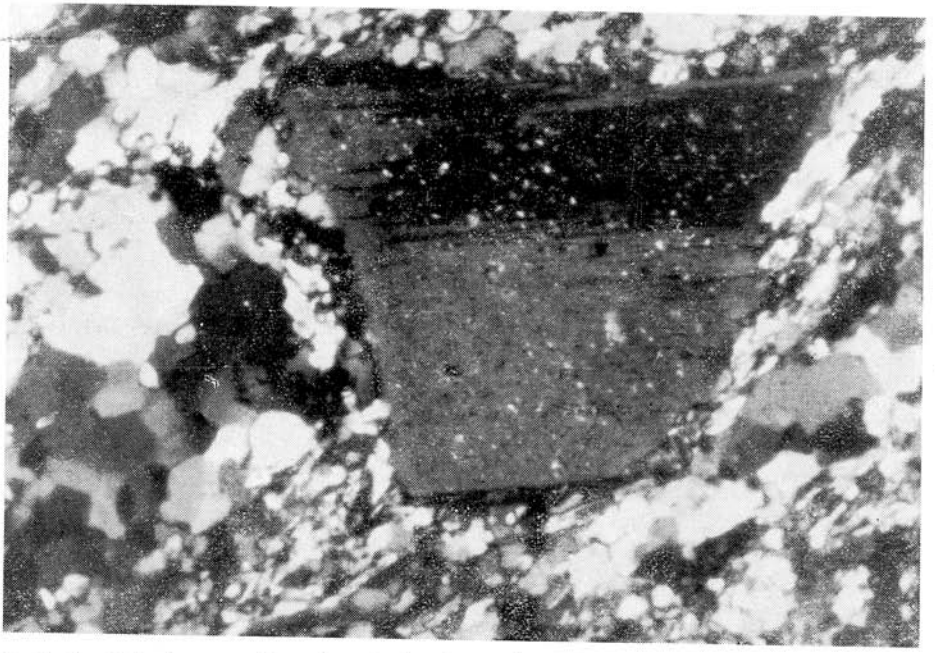

Fig. 3. A plagioclase porphyroclast in leptite gneiss. Kamenistá valley, a small artificial exposure in front of the forester's house Čierny potok. X nicols, magnif. 58 ×.

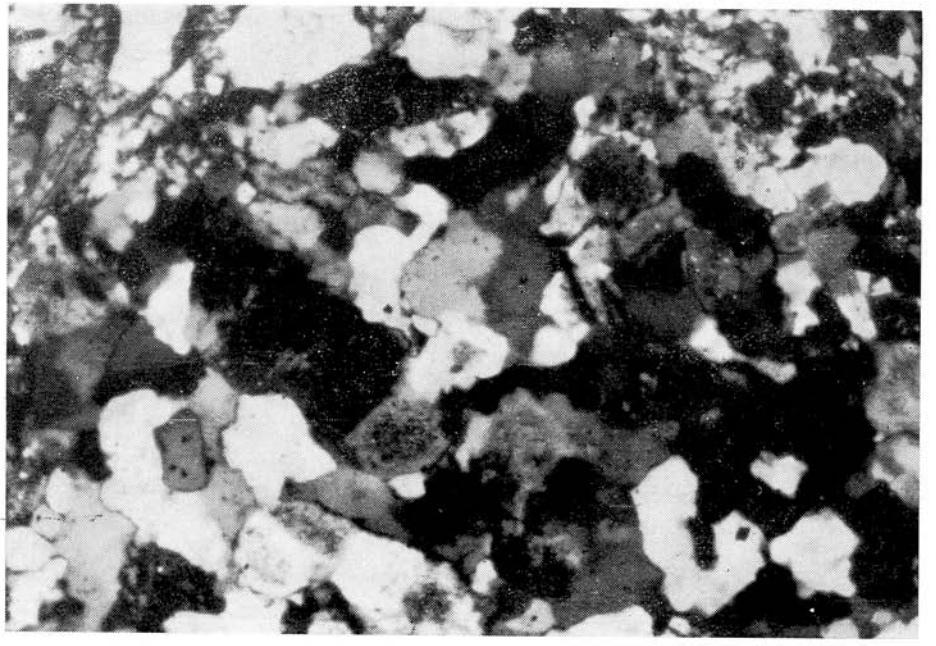

Fig. 4. A part of an aplite granite fragment in leptite gneiss. Kamenistá valley, artificial exposure in front of the forester's house Čierny potok. X nicols, magnif. 58 ×.

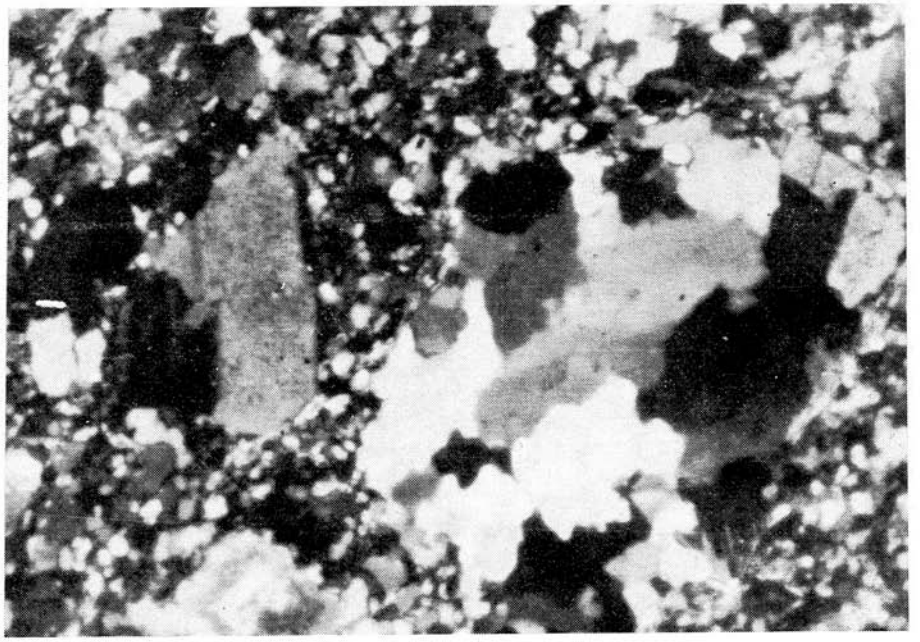

Fig. 5. A quartzite fragment as relict in leptite gneiss. Kamenistá valley, artificial exposure in front of the forester's house Čierny potok. X nicols, magnif. 58 ×.

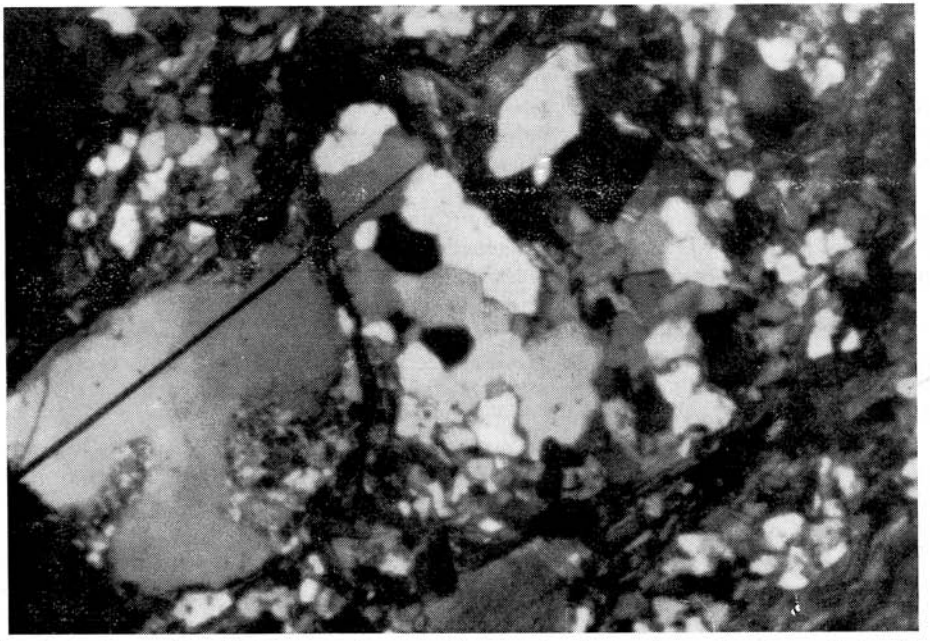

Fig. 6. Quartz grain with features of magmatic corrosion in leptite gneiss. Kamenistá valley, artificial exposure in front of the forester's house Čierny potok. X nicols, magnif. 58 ×.

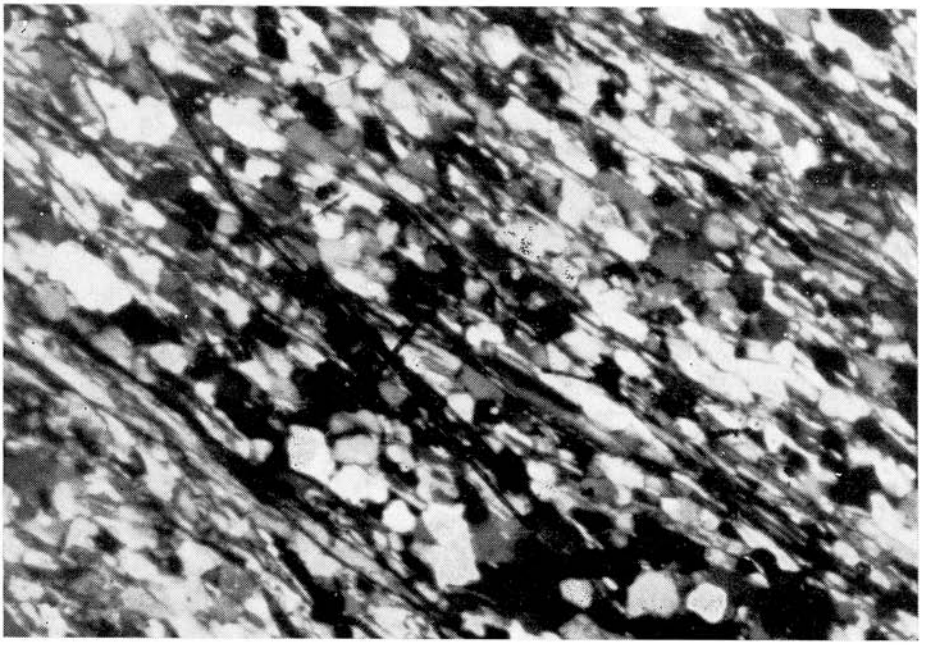

Fig. 7. Lepidoblastic-granoblastic texture of the leptite gneiss matrix. Kamenistá valley, artificial exposure in front of the forester's house Čierny potok. X nicols, magnif. 146 ×. Photo E. Krist.

Microscopically biotite phyllites are of lepidoblastic-granoblastic texture. A texture type was found, however, with elongated quartz eyes in the lepidoblastic matrix. These are made up of uneven size quartz individuals or by fine-grained quartz debris. In the sericite-muscovite type these eyes are rather irregular.

Biotite phyllites are made up of more or less short lathy flakes of strong pleochroic biotite ($\alpha$ = strawcolored, light yellowishbrown, $\beta$, $\gamma$ = brown) and quartz. Quartz appears in irregular very thin and incoherent beds, or in the form of separate flat grains in the schistosity plane. Besides these two essential components zoisite and a Fe-ore component is present in accessory amount.

Sericite, muscovite and quartz are the essential minerals in the sericite-muscovite type. Biotite was present originally too, it suffered by baueritization, however, during strong tectonic reworking of the rock. In this type comparatively large flakes of transversal mica-muscovite may be found.

Muscovite-biotite-plagioclase schists occurring along with the described rocks are medium-grained, light brown to brown rocks with well recognizable essential minerals-feldspars, quartz and muscovite. The presence of biotite was established only by microscopical inspection.

The rock texture is heteroblastic. This rock type was also affected by cataclastic processes which are reflected by undulatory extinction of quartz, as well as by slight contortion of mica flakes. Baueritization and starting chloritization of biotite are likely allied with this process. By microscopical investigation of the rock, biotite accumulation in irregular cumuloblasts may be observed in micas.

Feldspars are represented by plagioplaces, by oligoclase to oligoclase-albite. They form irregular xenoblast and are not marked by any important secondary alteration.

With regard to so far possible notions:

1. the unobserved gradual transitions between micaschist gneisses and phyllites along with the leptite gneisses may by in all probability regarded as rocks of progressive regional alteration, affected by a tectonic process of prevalently cataclastic nature during a later development stage of this area.

## *Conclusion*

The prove of metamorphic tuff to tuffaceous material as a synsedimentary member of crystalline schist in the region of Čierny Balog and Kamenistá valley indicates the existence of acid volcanism in time of the sedimentation of the Kráľova hoľa complex. Whether volcanism operated in the sedimentation basin of the Kráľova hoľa complex may not be difinitely proved, as its effusive or other subsurface rocks were not established so far in the Kráľova hoľa complex.

The alternative may be, however, considered, that this acid volcanism might have been part of former emerged crystalline mass, from which the material was imported to the sedimentation basin of the Kráľova hoľa complex. This probability may be inferred based on the presence of aplite granite rock and quartzite fragments in the leptite gneisses.

Finally it may be stated that the crystalline schists of the Kráľova hoľa complex represent with great probability either a separate complex, or even a separate group denominated by E. K r i s t (in press) Čierny Balog Group. Its relation to the underlying Hron complex (A. K l i n e c 1966) the age of which was established to be Early Paleozoic Silurian to Low Devonian (A. K l i n e c — E. P l a n d e r o v á — O. M i k o (1975) cannot be determined definitely for the time being, as both complexes are mutually in tectonic position.

Translated by L. MINÁRIKOVÁ.

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