PARTICULAR PETROGRAPHIC TYPES OF PEBBLES IN THE LOWER PLEISTOCENE GRAVELS OF THE COTMEANA PIEDMONT

CULESCU Flori, GHENCIU Monica

Abstract. There are very few petrographic studies on the Lower Pleistocene gravels of the Getic Piedmont and for those in the Cotmeana Piedmont this is the first. The study highlights an extremely varied range of petrographic types of pebbles. Among them, there are some petrographic types with particular mineralogical composition, very rare or without correspondent in the proximal Carpathian source area north of the piedmont. Three such petrographic types of pebbles are described in the paper: glaucophane rocks (actinolite and quartz type), olivine basalts and riebeckite trachytes. The same glaucophane rocks have recently been identified inside the Infragetic Complexe (Severin Nappe) in the Parâng Mountains. Theoretically speaking, the source of the riebeckite trachytes could be the Liassic dykes complex in the Făgăraș Mountains where riebeckite syenite and bostonite are mentioned. The source area of the olivine basalts seems to be farther away. Such rocks outcrop inside the Quaternary Volcanics in the Perșani Mountains.

Keywords: Cotmeana Piedmont, gravels, glaucophane, olivine, riebeckite.

Rezumat. Tipuri petrografice particulare de galeţi în pietrişurile pleistocen-inferioare din Piemontul Cotmeana. Sunt foarte puține studii petrografice pe pietrișurile Pleistocen inferioare din Piemontul Getic, iar pe cele din Piemontul Cotmeana acesta este primul. Studiul evidențiază o gamă extrem de variată de tipuri petrografice de galeți. Între acestea apar şi galeţi cu compoziţii mineralogice particulare, foarte rare sau fără corespondent în aria sursă de referinţă în nordul piemontului. În lucrarea de faţă sunt descrise trei astfel de tipuri petrografice de galeţi: roci cu glaucofan (actinolitice și cuarțitice), bazalte cu olivină și trahite cu riebeckit. Aceleași roci cu glaucofan au fost recent descrise în Complexul Infragetic (Pânza de Severin) din Munţii Parâng, la izvoarele Văii Lotru. Teoretic vorbind, sursa trahitelor cu riebeckit ar putea fi complexul filonian liasic din Munţii Făgăraş unde sunt menţionate sienite și bostonite cu riebeckit. Aria sursă a bazaltelor cu olivină pare să fie mai îndepărtată. Astfel de roci aflorează în cadrul vulcanitelor cuaternare din Munţii Perşani.

Cuvinte cheie: Piemontul Cotmeana, pietrișuri, glaucofan, olivină, riebeckit.

INTRODUCTION

The Cotmeana Piedmont is a subunit of the Getic Piedmont located between the rivers Argeș (to the east), Topolog (to the northwest) and Olt (to the west). To the north it is delimited by the Getic Subcarpathians and to the southeast by the Romanian Plain. The gravel deposits that form the piedmont are from the Lower Pleistocene age (e.g. GHENEA et al., 1971) and are known as the Cândești Beds or Cândești Gravels, the second term being very suitable for petrographic approaches.

The only systematic petrographic study on gravels from the Getic Piedmont refers to the gravels of the Cândești Piedmont (GHENCIU & STELEA, 2016). A second systematic petrographic study is in preparation and refers to the gravels from the Cotmeana Piedmont. In this paper we present only a few petrographic types of pebbles with particular mineralogical compositions. These are rocks with rarer minerals in their mineralogical composition, having index value for identifying their provenance area.

In our opinion, the petrographic nature of pebbles is a certain criterion for outlining the sources areas of the gravels in a piedmont. Certainly, the reference source area is the orogen at the base of which the piedmont was formed, in our case the crystalline basement of the Făgăraș Massif, in part also that of the South Carpathians to the east of the Olt River. This orogenic segment is the primary source area of the gravels in the Cotmeana Piedmont. Pre-Quaternary sedimentary formations, especially conglomerate deposits in the Getic Subcarpathians and intra-mountain basins are secondary source areas. As a result of erosion, the pebbles from these conglomerates entered a new sedimentation process and were reworked in the piedmont gravels. In relation to the Cotmeana Piedmont, both source areas, primary and secondary, are proximal areas.

Taking into account the changes of the hydrographic network in the orogenic area, we also considered an influx of clastic material from distal source areas on the middle course of the Olt River. These are the Perșani Mountains, as a primary source area, and the conglomerate formations in the southern Transylvania Basin, as a secondary source area. The present course of the River Olt was formed at the beginning of the Quaternary by capturing a northern proto-Olt, whose sources were provided by the Băiașu River, by a southern proto-Olt emerging from the Lotru springs (de MARTONNE, 1907; POPESCU-VOITEȘTI, 1918).

MICROSCOPIC STUDY

The microscopic study of the samples presented in the paper was done with the Jenapol microscope (Carl Zeiss-Jena), consulting various guide-books for the optical properties of minerals, especially that of Heinrich (1976). The microphotographs were taken under the same microscope, with the Optika digital camera. The field researches in the Cotmeana Piedmont and the proximal source areas, as well as the preliminary microscopic study, were made within the project PN 16 06 04 04/2016 of the Geological Institute of Romania, financed by the Ministry of Research and Innovation. For the geological formations of interest inside the distal source areas, the geological maps published by the Geological Institute of Romania were consulted, especially those at a scale of 1:50 000. From the particular petrographic types of pebbles identified in Cotmeana Piedmont, we chose two pebbles of glaucophane rocks, a pebble of olivine basalt and a pebble of riebeckite trachyte.

Glaucophane rocks. In the pebbles taken from the gravel deposits on the Geamăna Valley, a left tributary of the Olt River in the north-western part of the Cotmeana Piedmont, two glaucophane rocks were identified, one with predominantly actinolitic composition (sample 3750C) and another with predominantly quartzitic composition (sample 37C-2).

Sample 3750C is a very fine-grained rock with relatively massive texture. It consists of a microgranular matrix of actinolite and chlorite which contains completely recrystallized aggregates of quartz and albite, including microblastic hematite. At the contact with the quartzo-feldspathic aggregates, the actinolite matrix was replaced by glaucophane in static conditions. The glaucophane has grown as small crystals, randomly oriented, inside the quartz-albite aggregates (Fig. 1a, b). The generalized recrystallization processes led to the obliteration of the initial metamorphic texture of the rock. Its mineralogical composition suggests that it was an actinolite schist.

Sample 3755C-2 is a fine-grained quartzitic rock with mylonitic texture. It consists of flattened quartz grains, separated by melanocratic alignments with varying thicknesses, small on the long edges of quartz grains and larger at their ends (Fig. 1c, d). All the quartz grains contain albite inclusions. The intergranular melanocratic alignments consist of opaque masses of iron oxides, quartz sub-grains, apatite clasts, and acicular hematite crystals, usually oriented perpendicular to the flattening direction. The glaucophane is post-kinematically crystallized as subhedral to euhedral grains, including small hematite crystals.

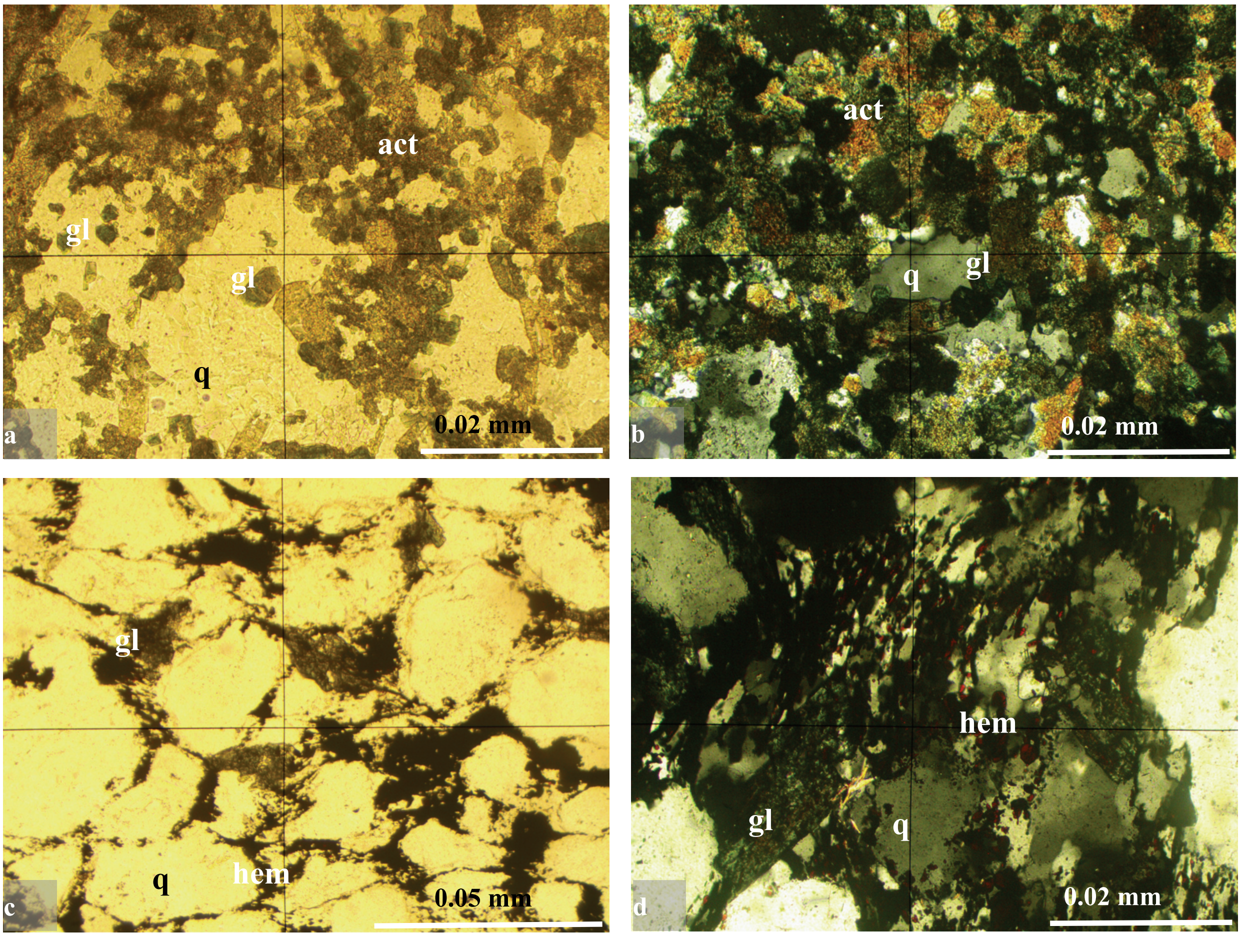

Figure 1. Photomicrographs of the glaucophane rocks. **a,b**) Actinolitic type: subhedral glaucophane (**gl**) post-tectonically replacing the actinolite-chlorite matrix (**act**) near the recrystallized quartz-albite aggregates (q); **c, d**) Quartzitic type: **c**) mylonitic texture with flattened quartz grains (q) and intergranular melanocratic bands with subhedral to euhedral glaucophane (gl) and hematite (hem); **d**) detail in a melanocratic aggregate with glaucophane (gl) and hematite (hem). NII (a, c); N+ (b, d). Details in text.

Olivine basalt. A pebble of olivine basalt (sample 3755D) was also identified in the same gravel deposit on the Geamăna Valley. The rock has an intergranular texture, consisting of unaltered plagioclase microlites, anhedral clinopyroxene (augite?) and magnetite grains between the plagioclase microlites (Fig. 2a, b). Clinopyroxene is partially chloritized.

In the frequency order, plagioclase phenocrysts, rounded olivine grains and subhedral clinopyroxene appear in the matrix, all of them being more or less magmatically corroded. Plagioclase is partially substituted by sericite, aggregates of clay minerals and microgranular epidote. It has unaltered more acid borders (Fig. 2b). Olivine has discontinuous iddingsite rims and contains inclusions of finely crystallized microlitic matrix (Fig. 2a). The small olivine grains are completely substituted by iddingsitic aggregates (hematite, goethite, chlorite).

Riebeckite trachyte. In addition to common eruptive rocks, in the gravel deposits on the Tutana Valley, a right tributary of the Argeş River in the north-eastern part of the piedmont, a pebble of riebeckite alkalic trachyte was also identified (sample 2914H-3). The rock has a typical trachytic texture, with flowing fascicles of alkali feldspar microlites, predominantly quantitative, and acicular prisms of riebeckite (Fig. 2c, d). Between the microlites there are subhedral grains of riebeckite and magnetite, rarely deformed phenocrysts of alkali feldspar with diffuse edges. Quartz occurs very rarely as small aggregates, isometric or elongate on cracks. Vermiculite and goethite appear as alteration products of riebeckite and magnetite.

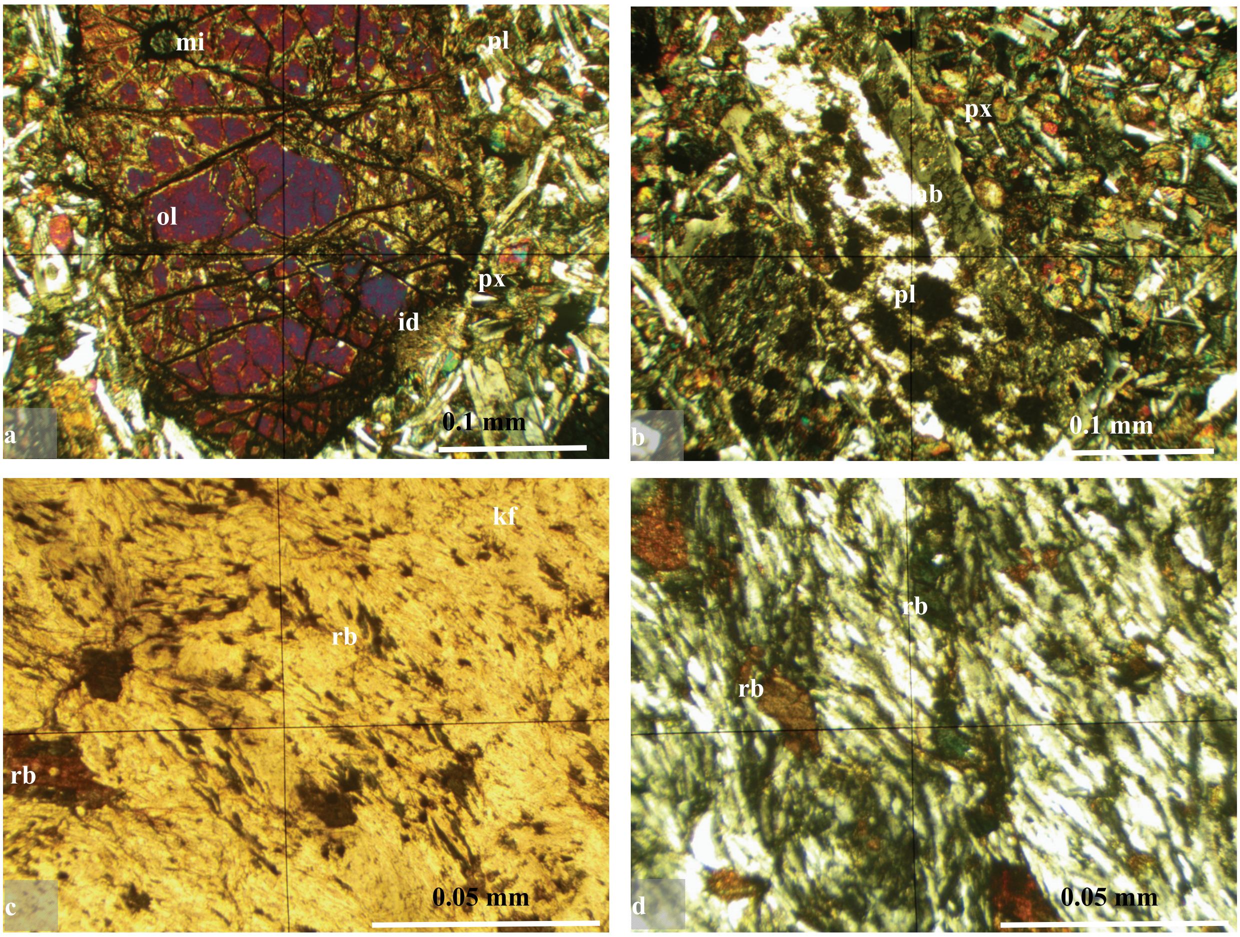

Figure 2. Photomicrographs of the olivine basalt (**a, b**) and the riebeckite trachyte (**c, d**). **a**) Rounded olivine phenocryst (ol) with iddingsite partial rim (id) and a small inclusion of finely crystallized matrix (mi) in a microlitic matrix of plagioclase (pl) and clinopyroxene (px); **b**) plagioclase phenocryst (pl) with more acid border (ab); **c, d**) acicular prisms and subhedral grains of riebeckite (rb) in trachytic matrix of alkali feldspar (kf). N+ (a, b, d); NII (c). Details in text.

DISCUSSIONS AND CONCLUSIONS

Both types of glaucophane rocks, actinolitic and quartzitic, appear as intercalations or lenses in the greenschists complex of the Severin Nappe in the Parâng Mountains, outcropping at the springs of the Lotru River. The glaucophane rocks in this complex were recently described by STELEA & GHENCIU (2019), the paragenesis with sodium amphibole being attributed to a burial metamorphism in the glaucophane greenschists facies. The quartzitic petrotype, resistant to alteration and transport, was also found in the alluvial deposits of the Lotru River, the largest tributary of the Olt River in the South Carpathians.

Regarding the olivine basalt, in the proximal source area it is represented by the crystalline basement of the Făgăraş Massif where we only found pebbles of pyroxene basalt. They appear relatively frequently in the alluvial deposits of some rivers on the southern slope of the Făgăraş Mountains, such as the Argeş River, Stan Valley River, right tributary of the Argeş River, and the Băiaşu River, left tributary of the Olt River. Olivine basalts, of the Lower

Pleistocene age, are known only in the Olt River Gorge in the Perşani Mountains (ex. POPESCU et al., 1976). This region represents the distal source area of the olivine basalt pebble from the Cotmeana Piedmont.

The primary source area of the riebeckite trachyte is the southern slope of the Făgăraş Massif, where a volcanic complex of lamprophyres is outcropping (ANTON & CONSTANTINESCU, 1978). It is the same volcanic complex of Liassic age studied by MANILICI (1956) in the eastern part of the massif. In addition to lamprophyres, the author described dikes of basalts, alkaline trachytes and quartz syenites with riebeckite. Later, DIMITRESCU (1964) identified riebeckite in a bostonite dike, a porphyric type of trachyte.

The secondary source area of the alkaline trachytes is represented by the detrital sedimentary formations in the Subcarpathian area of the Făgăraş Mountains. In the Oligocene-Lower Miocene conglomerates that outcrop on both sides of the Argeş Valley in the Căpăţâneni-Corbeni sector we identified pebbles of alkaline trachytes and andesites. Pebbles of eruptive rocks from these conglomerates could be easily reworked in the gravel deposits of the Cotmeana Piedmont. Pebbles of trachytic and andesitic ignimbrites were also found in the alluvial deposits of the Sălătrucel and Băiaşu rivers, right tributaries of the Olt River. Like the Olt, these rivers cross-cut the thick deposits of Lower Miocene, Paleogene and Upper Cretaceous conglomerates in the Călimăneşti and Brezoi-Titeşti sedimentary basins (POPESCU et al., 1977; ŞTEFĂNESCU et al., 1985).

Triassic alkaline trachytes (Ladinian), without riebeckit, also outcrop in the Perşani Mountains (POPESCU et al., 1976), from where they could be brought in the piedmont by the Olt River, directly from outcrops or from secondary source areas such as the Miocene conglomerates inside the southern Transylvanian Depression. In this region, we identified only rhyolites and dacites in the conglomerates near Tălmaciu, but this does not mean that there can be no trachytes.

REFERENCES

ANTON L. & CONSTANTINESCU R. 1978. Observaţii asupra lamprofirelor din Munţii Făgăraş. *Dări de Seamă ale Şedinţelor Institutului de Geologie şi Geofizică*. Bucureşti. **64**: 53-76.

DIMITRESCU R., 1964. Studiul geologic şi petrografic al părţii de est a Masivului Făgăraş. *Anuarul Comitetului Geologic*. Bucureşti. **23**: 153-212.

GHENEA C., BANDRABUR T., MIHĂILĂ N., GHENEA ANA, GIURGEA P. 1971. *Harta Cuaternarului din România, scara 1:1 000 000*. Institutul Geologic al României. Bucureşti.

GHENCIU MONICA. & STELEA I. 2016. The petrographic study of the gravels within Cândeşti Piedmont. *Oltenia. Studii şi comunicări. Ştiinţele Naturii*. Muzeul Olteniei Craiova. **32**(2): 7-13.

HEINRICH E. W. 1965. *Microscopic identification of minerals*. McGraw-Hill Book Comp. New York. 414 pp.

MANILICI V. 1956. Studiul petrografic al rocelor eruptive mezozoice din regiunea Poiana Mărului-Şinca Nouă. Teză de doctorat. *Anuarul Comitetului Geologic*. Bucureşti. **29**: 5-75.

MARTONNE de E. 1907. *Recherches sur l'évolution morphologique des Aples de Transilvanie (Karpates Méridionales)*. Traducere în limba română. Editura Academiei, 1981. Bucureşti. 271 pp.

POPESCU B., SZASZ L., HANN H.P., SCHUSTER A. C. 1977. *Harta geologică a României scara 1:50000, foaia Călimăneşti*. Institutul Geologic al României. Bucureşti.

POPESCU ILEANA, MIHĂILĂ N., PELTZ S., ŢICLEANU N., ANDREESCU I. 1976. *Harta geologică a României scara 1:50 000, foaia Racoş*. Institutul Geologic al României. Bucureşti.

POPESCU-VOITEŞTI I., 1918. Pânza conglomeratului de Bucegi în Valea Oltului. *Anuarul Institutului Geologic al României*. Bucureşti. **8**: 1-171.

STELEA I., GHENCIU MONICA, 2019. Contributions to knowledge of glaucophane rocks in the Parâng Mountains (South Carpathians). *Oltenia. Studii şi comunicări. Ştiinţele Naturii*. Muzeul Olteniei Craiova. **35**(2): 7-12.

ŞTEFĂNESCU M., HANN H.P., GHEUCA I., SZASZ L., ŞTEFĂNESCU M. 1982. *Harta geologică a României scara 1:50000, foaia Titeşti*. Institutul Geologic al României. Bucureşti.

Culescu Flori
Geological Institute of Romania
1 st Caransebeş Street Bucharest, Romania
E-mail: m_flori_m@ yahoo.com

Ghenciu Monica
Geological Institute of Romania
1 st Caransebeş Street Bucharest, Romania
E-mail: monica ghenciu@yahoo.com

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