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Mineralogical-Petrographical Details on the Clastes of Rudites from Olistolithes Conglomerates Within Badenian Salt Breccia from Bădila (Buzău Valley)

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Abstract

Optical microscopy and X-rays diffraction analysis on some clastes within conglomerate blocks of the Badenian Salt Breccia Formation from Bădila (Buzău Valley) of Carpathian Foredeep motivates their diagnosis with implications in assessing source areas and palaeoenvironment details as well as basin evolution.

Key words: *conglomerate clastes diagnosis, Badenian salt breccia, palaeoenvironment, Buzău Valley*

Introduction

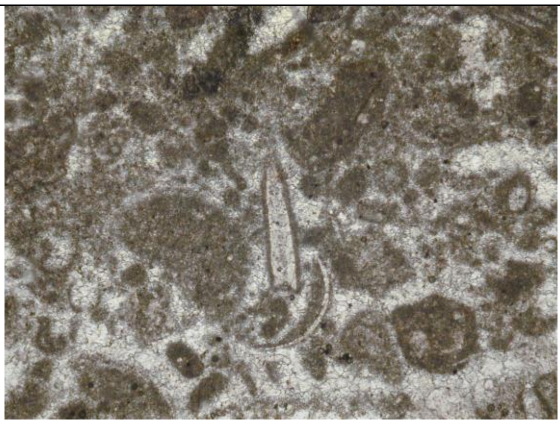
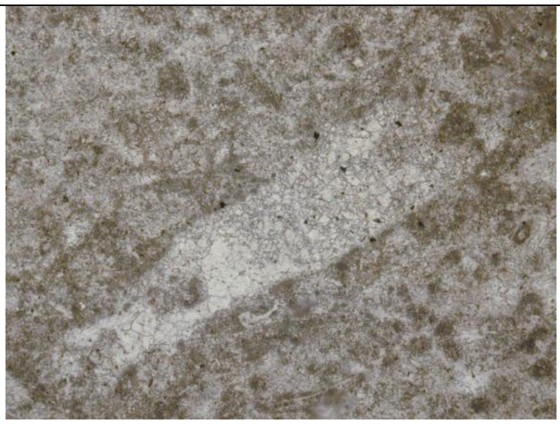
This paper aims at thoroughly analyzing the optical microscopy and X-rays diffraction of the clastes from conglomerates that appear as olistolithes in Badenian deposits of salt breccia from Bădila – Buzău Valley. As described in extenso in a previous paper (Frunzescu et al., 2009) salt breccia from Bădila (Cosmina Breccia = "the horizon of the salt breccia with salt") (Popescu, 1951; Olteanu, 1951) = *Evaporitic formations* having a lutitic grey-bluish-blackish marly-clayey matrix, pigmented with black bituminous substance, either residual or with hydrotroilite. It includes blocks of Mesozoic limestone or gigantic blocks of Miocene type conglomerates, whose mineralogical-petrographical investigation is going to be detailed hereunder.

Mineralogical-petrographical investigations

Towards the western extremity of the outcrop from Bădila, the clastes of green schistes included in the breccia record increased frequency, the diameter of the clastes increasing from 4-5cm to 1m. Blocks from Surducu Mare having volumes of 5000-6000 m3 look like layers of conglomerates that are rebuilt or have an 80º north-west inclination. They are connected with the blocks from Surducu Mic outlining a trap line. Most conglomerate blocks reveal the presence of submetrical rhythms of cobbles whose long axis inclination is about 20° to bedding. The maximum size of clastes reaches 50cm, 10cm on average, and mostly flattened clastes (10% isometric) are rounded up to subangular, with size ratio a/b/c = 10cm/7cm/4cm, and poor to very poor sorting. Matrix appears as greso-microconglomeratic, with calcareous-clay cement.

Observations of optical microscopy (see table 1) reveal carbonatic petrofacieses (calcite or dolomite in Malm, Tithonic or Superior Cretaceous), epiclastic, silicolithic, volcanoclastic and metaclastic, detailing the range of the previously described petrographic types.

Table 1.

No. sample	Facial characteristics	Diagnosis	Mineralogical-petrographical description
	SEDIMENTARY ROCKS		
2	**Petrofacies:** carbonatic **Lithofacies:** calcitic **Microlithofacies:** Malm	Intrapelsparite with *Nodosaria* sp., skeletical fragments of echinoderms, shells detached from ostracodes and accidentally, zoospore of planctonic algae *Globochaete* sp. Accidentally, authigenous quartz	Compositional characteristic: Intrapelsparite. Textural characteristic: mesocrystalline. *Packstone*. Microstructural characteristic: of chemical precipitation, organogenic, and diagenetic of recrystallization („grain diminution”). Mesoscopic: black limestone, diagenized, identical with the olistolithes of Ciuta. Violent reaction with HCl, in cold. Microscopic: Carbonatic components: allochems – pellets and micritic intraclastes, with peripherical cortex and a maximum diameter of 0.950mm, predominant and rare oolites with micritic, carved outer cover. Together with the above mentioned particles, there appear bioclastes represented by foraminifera – *Nodosaria* sp., detached shells of ostracodes and accidentally a zoospore of planktonic algae - *Globochaete* sp. Ortochema – sparitic calcite. Authigenous non-carbonatic components: authigenous quartz, prismatic, pyramid-shaped, with inclusions disposed in parallel lines with the crystallographical sides. The aggradating recrystallization leads to the growth of the crystals, while the degrading recrystallization takes place together with the relative decrease of the crystals size, which finally leads to „grain diminution” or to a „degenerative recrystallization”. The process can take place at low temperatures and pressures resulting in the formation of incrustante margins or micritic peripherical cortexes on the bioclastes and on the carbonated corpuscles, this way making them smaller (Chillingar et al., 1967).
 **Fig. 1.** Microphotograph: intrapelsparite. N(II), 10x.			
12	**Petrofacies**: carbonatic **Lithofacies:** calcitic **Microlithofacies:** Tithonic	Algolitic pelmicrosparite. Calcareous algae having the internal structure partially dimmed, *Salpingoporella* sp. Due to crystallization, rare foraminiferas	Compositional characteristic: Algolitic pelmicrosparite. Textural characteristic: crypto-micro-crystalline. *Wackestone*. Microstructural characteristic: of chemical precipitation, organogenic, diagenetic – of aggrading crystallization Mesoscopic. Fine and homogeneously crystallized limestone. Into a gap there grows a secondary formation of calcite which covers the interior side with euhedral, transparent crystals. Violent reaction with HCl, in cold. Microscopic. Carbonatic components: allocheme – pellets and bioclastes. Out of the last type we distinguish sections of calcareous algae which are partially recrystallized, with a partially dimmed internal structure – *Salpingoporella* sp., sections through the corals and rare foraminifera. Ortochema – microsparitic calcite. Authigenous noncarbonatic components: basal section through a prismatic crystal of euhedral quartz.
 **Fig. 2.** Microphotograph: algolitic pelmicrosparite. N(II), 10x			

13	**Petrofacies**: carbonatic **Lithofacies:** calcitic **Microlithofacies:** Cretaceous superior (Turonian, Senonian)	Micrite with pelagic foraminifera (*Hedbergella* sp., *Globotruncana* sp.)	Compositional characteristic: Micrite with pelagic foraminifera. Textural characteristic: cryptocrystalline. *Mudstone*. Microstructural characteristic: of chemical, organogenic precipitation Mesoscopic: angular element, very finely crystallized, with subangular split and sharp edges. It shows ochre pellicle on the exposed surfaces. Microscopic: Carbonatic components: allocheme – bioclastes, foraminifera with fine shell, *Hedbergella* sp. and *Globotruncana* sp. Ortochema – micritic calcite. Authigenous noncarbonatic components: plagioclase twinned feldspar, whitened with a diameter of max. 0.0465mm, euhedral quartz, basal section with a maximum diameter of 0.0558mm and granulated sulphurs.

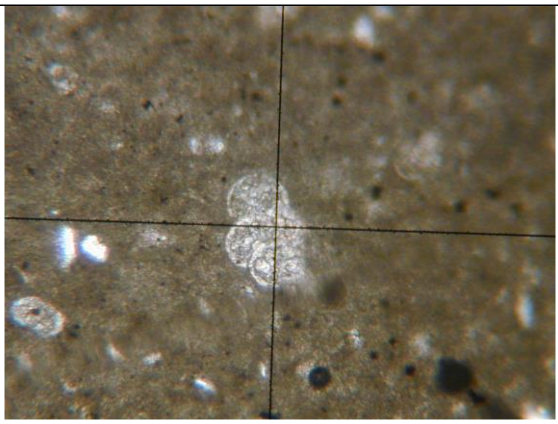


Fig. 3. Microphotograph: micrite with pelagic foraminifera. N(II), 25x

14	**Petrofacies**: carbonatic **Lithofacies:** calcitic	Pelmicrite with stylolitic micro-textures. Recent breaches with calcite of circulation intersect the stylolitic lines.	Compositional characteristic: Pelmicrite with stylolitic microtextures. Textural characteristic: crypto-micro-crystalline. *Mudstone*. Microstructural characteristic: of chemical precipitation, diagenetic, with phenomena of intralayer dissolving, stylolites and microlayered. Mesoscopic: a grey-black rock, very finely crystallized, crossed by white cleaves of calcite of circulation. On the exposed surfaces there appear black spots of oxides and on the surface cut into sections the microstratification can be distinguished. Violent reaction with HCl, in cold conditions. Through the binocular magnifying glass the rock looks like a mass of finely crystallized calcite, crossed by white fissures of saccharoid calcite. Microscopic: carbonatic components. Allocheme – pelletes, rare superficial ooides, with thin cortex and as a nucleus, there is crystal of calcite with a maximum diameter of 0.0775mm. There also appear beaches of sparitic calcite, secondarily. Authigenous noncarbonatic components: euhedral quartz, prismatic bipyramides. Postdepositional: microstilolitic stitching lines marked by iron hydroxides and clayey-oxydic minerals, representing a residue from limestone dissolving. On the route of one of these there came out a calcite fissure; more recent fissures, with calcite of circulation secondarily cross the stylolites. The stylolites together with the cone-in-cone structures represent the result of the dissolving under pressure („pressure solution”), a process due to the overloading pressure. When the dissolving takes place in a completely cemented rock, it produces irregular planes or stitched planes – stylolites. They are discontinuous, thin contacts, which have in sections winding or zigzag forms. The stylolites are usually indicators of stratification planes so that they can also be considered sometimes as „isobar”. From a genetical point of view, if the diagenetic stylolites affect ore deposits, these deposits can also be considered as having a diagenetic origin (Anastasiu, 1988).

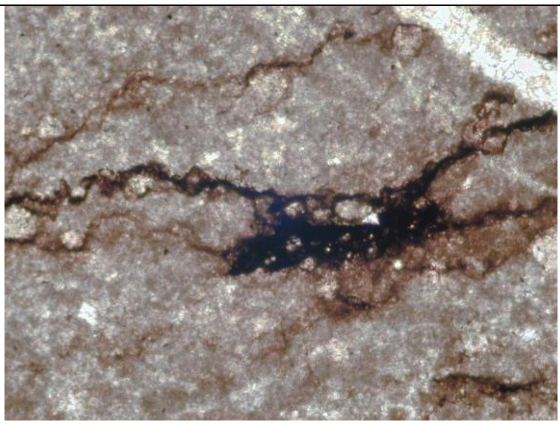


Fig. 4. Microphotograph: pelmicrite with stylolitic microtextures. N(II), 70x

1	**Petrofacies**: carbonatic **Lithofacies:** dolomitic	Dolosparite. Association of idiotopical, isometrical crystals, of dolomites, with overgrowth areas, clear, with a beach of calcedony	Compositional characteristic Dolosparite (*Dolostone*) secondarily, metasomatic. Texture characteristic: idiotopic and hipidiotopic, linear contacts and mesocrystalline. Microstructural characteristic: diagenetic-metasomatic, massive. Mesoscopic. Black-grey rock, with an angular breach and sharp edges, also heavy. On the exposed surfaces there are pellicles of hydrated iron oxides. Reaction with HCl, in cold, only in dust. Microscopic. The rock appears entirely formed of an association of isometrical, idiotopical and hipidiotopical crystals of dolomites, with a maximum diameter of 0.2310mm. In natural light the crystals look diffuse due to the inclusions that represent opaque powder/dust, relicts of the metasomatism process (dissolving and recrystallization). The term „metasomatism” introduced by Nauman in 1850 is especially applied to the formation of pseudomorphs, either of individual/particular minerals or the whole rock. It implies an atom by atom chemical replacement, without changing the form and volume of the rock and it obeys Lindgren’s „volume law”. It is a process which takes place at a low temperature and as a result of this, the sediment is enriched with outer elements, the ions or the original molecules being removed entirely or partially (Fairbridge, 1967). Generally, the diagenetic metasomatosa is considered a phenomenon of replacement corresponding to the general law about “the decreasing of the energy level”, considering that Mg^{2+} with Ek =109k can replace Ca^{2+} with Ek =200k (Auboin et al., 1975).

Fig. 5. Microphotograph: dolosparite (association of idiotopical crystals of dolomites, with a beach of chalcedony). N (+), 10x

17	**Petrofacies**: carbonatic **Lithofacies:** dolomitic	Dolomicrosparite. Association of clear crystals, hipidiotopical and xenotopical of dolomite, inequigranular. Authigenous components: idiomorph quartz	Compositional characteristic: Dolomicrosparite (*Dolostone*), with quartz and feldspar, authigenous. Texture characteristic: hipidiotopic and xenotopic, inequicrystalline Microstructural characteristic: diagenetic – metasomatic, microstratified. Mesoscopic: Rounded cobble, yellow and smooth. On the surface cut for sectioning, the rock is grey, finely crystallized and shows a vaguely defined microstratification. Reaction with HCl in cold, only in the dust. Microscopic: The base mass – an association of clear crystals, inequicrystalline, hipidiotopical and xenotopic of carbonate. In this mass there are widely dispersed automorph crystals of authigenous quartz, with a maximum diameter of. 0.0496mm and of feldspar (albite). There can be found irregular beaches with authigenous sulphurs, microcrystalline. The criteria for recognizing the authigenous crystals are the following: euhedral contours, inclusion areas parallel with the crystal sides, which sometimes mark successive growing phases of the crystal and finally their microcrystalline dimensions (Encyclopedia, 1978). The authigenous feldspar from some limestones is pure albite, while in others it is pure pothasic feldspar. So far it was not found an explanation for this difference (Pettijohn, 1957).

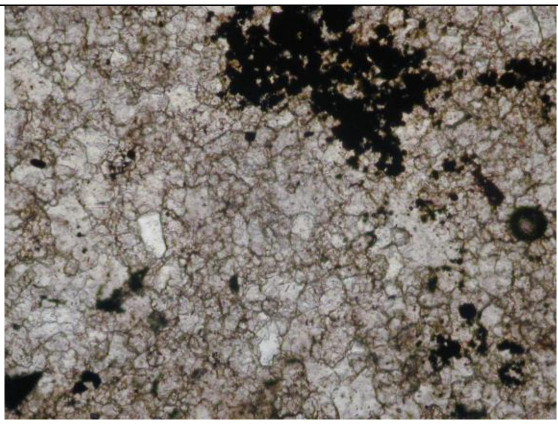
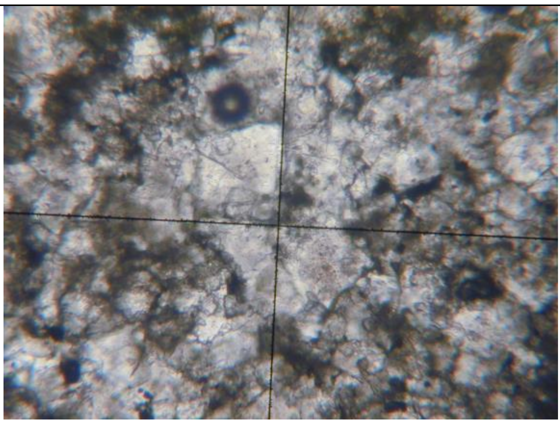
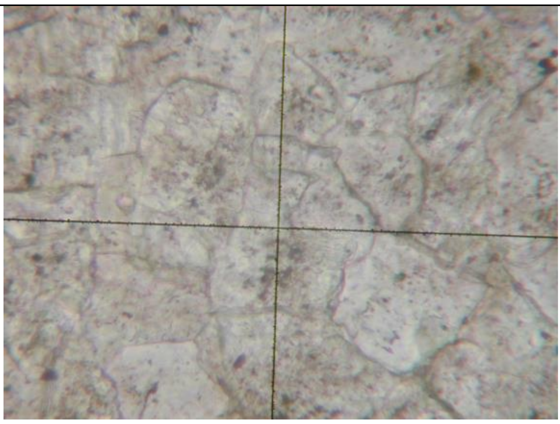
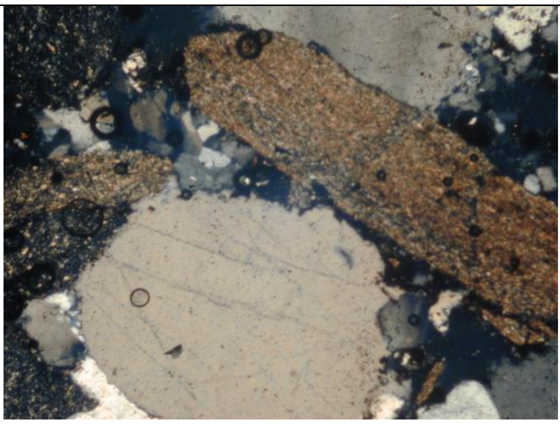
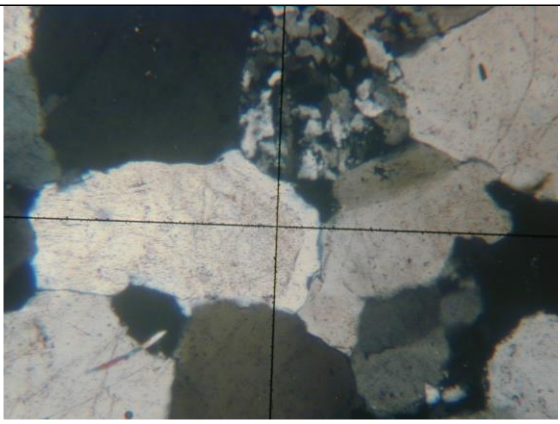


Fig. 6. Microphotograph: dolomicrosparite with quartz and plagioclase feldspar. N(+), 10x

15	**Petrofacies**: carbonatic **Lithofacies:** dolomitic	Dolomite with relict islands of micrite (micritic limestones incompletely dolomitized)  **Fig. 7.** Microphotograph: dolomite with relict islands of micritic calcite. N(II), 10x	Compositional characteristic: Micritic, dolomitized limestone. Texture characteristic cryptocrystalline relict and idiotopic, inequicrystallin Microstructural characteristic: diagenetic – metasomatic, massiv. Mesoscopic: yellow-beige cobble, rounded, smooth, very compact, heavy. Subconcoidal breach. Moderate reaction with HCl, in cold. Through the binocular magnifying glass, there is a glassy mass of fine crystals on the breach. Microscopic: The base mass presents an association of transparent idiotopic and hipidiotopic crystals of carbonate. There is distinguished dolomite idiotops, with a porfiroblastic characteristic, with a diffuse center filled with relict inclusions of calcite and with a clear periphery. There are still preserved islands of brown, micritic calcite, with a relict characteristic, with diffuse, irregular limits which allow the transition to dolomites.
5	**Petrofacies**: epiclastic	Conglomerate elements of dolomite, quartz and green schists with arenitic-calcitic binding material.  **Fig. 8.** Microphotograph. Conglomerates claste of dolosparite. N(II), 25x	Compositional characteristic: Conglomerate with elements of dolomites, epimetamorphic – green schists and granoclastes of quartz, with arenitic-calcitic binding material. Texture characteristic: arenitic-ruditic. Microstructural characteristic mechanical-clastic. Mesoscopic: Conglomerate containing a rolled element, smooth, coloured dark grey, and compact, with a maximum diameter of 0.0245m, isometric, of carbonate, together with numerous lithic elements of green schists, from discoidal to lamellar. The binding material, grey-greenish, is made up of rolled granoclastes of quartz, fine lamellar elements of green schists and carbonate (calcite). Violent reaction with HCl, in cold. Microscopic: Element from the conglomerate: dolomite. In section, it looks made of an association of idiotopic and hipidiotopic crystals of dolomite, with fine, opaque inclusions which give them a diffuse aspect, having a maximum diameter of 0.1925mm. Accidentally, siliceous concretion, of opal, with clear limits from the host rock. Postdepositional: A microstylolitic connecting line marked by argilo-oxidic minerals and epigenetic, fissures of secondary calcite, of circulation. The binding material of the conglomerate is an arenitic, fine matrix which, in dust, in emersion, looks formed of quartz granoclastes, lithoclastes of green schists, phyllosilicates – fine lamellas of chlorite, fragments of dolomite crystals, calcite micritic calcite and heavy minerals – zircon.
3	**Petrofacies**: epiclastic	Microbreccia, low cemented with epimetamorphic elements from the series of the green schists	Compositional characteristic: Microbreccia, low cemented, with elements of epimetamorphic from the series of the green schists. Texture characteristic: arenitic-ruditic. Microstructural characteristic: mechanic-clastic. Mesoscopic: Low cemented rock mainly made of

 **Fig. 9.** Microphotograph: microbreccia with elements of the green schists and regenerated quartz. N(+), 10x.			flattened, satined, lamellar elements of green schists and subordinated are those of round granoclastes of quartz. The binding material, in a very small quantity is a matrix in which there can be distinguished only spatic crystal sides. Without a reaction with HCl, in cold. <u>Microscopic</u>: The detrital fraction consists mainly of lithoclastes of epimetamorphites from the series of the green schists, with a blast-lutitic structure and a maximum diameter of 0.80mm. Accidentally, an element of silicolite, jasper with radiolarite. Subordonated, granoclastes of regenerated quartz, with overgrowths, a maximum diameter of 11.55mm, and a crystal fragment of plagioclase feldspar and twinned polysynthetically. The binding material, in a much reduced quantity, consists of acicular micas, of neoformation, opal eyes and post depositional, iron hydroxides and secondary gypsum, of circulation.
11	**Petrofacies:** epiclastic	Quartzose sandstone (improperly named ortoquartzit) predominant quartz some granules present overgrowths, in optical continuity, others show rolling extinction.  **Fig. 10.** Microphotograph: quartzose sandstone with quartz presenting overgrowths. N(+), 10x	<u>Compositional characteristic</u>: Quartzose sandstone (improperly named ortoquartzit) (Anastasiu, 1977). <u>Texture characteristic</u>: arenitical-ruditical, with a high sorting rank. <u>Microstructural characteristic</u>: mechanic-clastic, massive-compact. <u>Mesoscopic</u>: glassy rock homogeneously crystallized formed of granules/grains of quartz closely joined. <u>Microscopic</u>: quartz present in a proportion of about 98%, in grains with a maximum diameter of 1.235mm, closely joined. Some of them present rolling extinction (have a metamorphic origin) and others present regenerations, overgrowth of authigenous quartz in optical continuity with the initial granule. It is separated from this one by a line of fine inclusions which give contour to the limit if the initial crystal. The granules present joining contacts and a pelicular cement which joins them, making them hard to identify. This type of quartzose sandstone shows an advanced maturity grade which reflects a reshuffle and a sorting in several stages of the sedimentary process.
18	**Petrofacies:** epiclastic	Lithic sandstone (subgraywacke). Lithoclastes, granoclastes, primary matrix of sericite and chlorite (an aspect of pellicle and pores) and secondary cement, calcite (aspect of pores)	<u>Compositional characteristic</u>: Lithic sandstone (*subgraywacke*) (Pettijohn, 1957) <u>Texture characteristic</u>: siltic-arenitic. <u>Microstructural characteristic</u>: mechanic-clastic, massive-compact. <u>Mesoscopic</u>: Fine sandstone, homogenous grey-greenish. Irregular breach. Weak reaction with HCl, in cold. Through the binocular magnifying glass one can

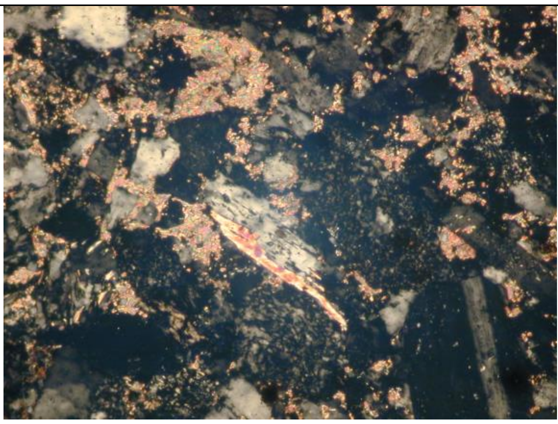


Fig. 11. Microphotograph: Lithic sandstone (subgraywacke). N(+), 25x

notice small, glassy granules of quartz, rare white and milky elements of feldspars and fine lamellas of yellowish, colourless micas.
Microscopic: Lithoclastes, predominantly: detrital chert, cryptocrystalline; eruptive quartz, with magmatic corrosions, with a maximum diameter of 0.1925mm; quartz with overgrowth originating in ortoquartzites, with a maximum diameter of 0.2464mm; metamorphic quartz, with rolling extinction, with a maximum diameter of 0.3850mm.
Granoclastes, subordonated: angular and subangular quartz, with a maximum diameter of 0.3424mm; plagioclase, twinned feldspar, divided into zones, with a maximum diameter of 0.4520mm; transformed potassic feldspar, with a maximum diameter of 0.2480mm.
Binding material: primary matrix– sericite and chlorite, with an aspect of pellicle and pores and secondary cement-calcite with pores characteristic.

22 **Petrofacies:** epiclastic

Lythic sandstone (subgraywacke). Lithoclastes and granoclastes. Secondary, cement with pores' characteristic and made of iron hydroxides resulted on the basis of the mafic elements

Compositional characteristic: Lythic sandstone (subgraywacke) (Pettijohn, 1957).
Texture characteristic: arenitic.
Microstructural characteristic: mechanic-clastic, massive.
Mesoscopic: Reddish rock, granulated from fine to medium, homogenous, rough to the touch. Irregular breach on which there can be distinguished paillettes of muscovite. No reaction with HCl in cold.
Microscopic: Lithoclastes, predominant: metamorphic quartz, with rolling extinction, with a maximum diameter of 0.760mm; quartz with overgrowth, originating in ortoquartz elements, with a maximum diameter of 0.5390mm; silicolite, with the maximum diameter of 0.6391mm; quartzo-feldspar rocks; blast-lutites schists from the epimetamorphic series of the green schists, with numerous opaque inclusions and a diameter of maximum 0.5390mm.
Granoclastes, subordinated: fine twinned feldspar (albite), transformed, microcline (recent), with a maximum diameter of 0.1550mm; phyllosilicates – muscovite.
Binding material: secondary cement, with pores aspect, made up of iron hydroxides which were formed on the elements that contain iron (chlorite, biotite).

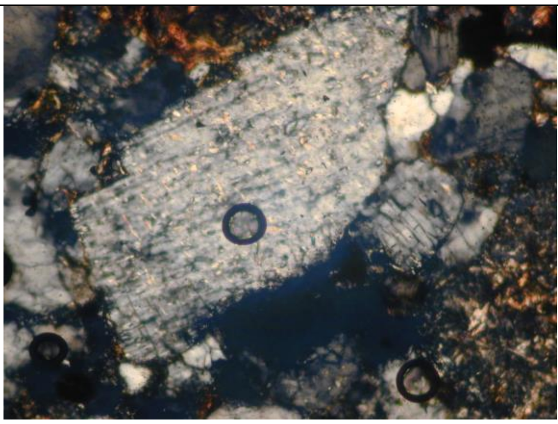


Fig. 12. Microphotograph: Lithic sandstone (subgraywacke). N(+), 25x

23 **Petrofacies:** epiclastic

Calcitic sandstone. Cobble with a cortex of iron hydroxides

Compositional characteristic: Calcitic sandstone. Cobble with a cortex of iron hydroxides
Texture characteristic: arenitic.
Microstructural characteristic: mechanic-clastic and of the chemical precipitation of the binding material.
Mesoscopic: Disk-shaped cobble, flattened, smooth, which presents, due to the long exposure, a brown-

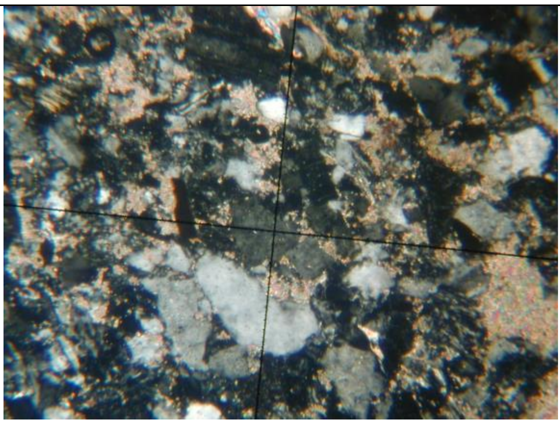


Fig. 13. Microphotograph. Calcitic sandstone with cortex of iron hydroxides. N(II), 10x

reddish cortex of hydrated iron oxides. On the fresh surface, cut for the division into sections, the rock is grey, finely and homogenous granulated, on which there are also noticed tiny paillettes of micas. Moderate reaction with HCl, in cold.

Through the binocular magnifying glass, there appears a glassy mass of white and smokey quartz granules.

Microscopic: Granoclastes, predominant: quartz, angular and subangular; feldspar plagioclase, twinned polysynthetic, the maximum diameter of 0.1240mm; phyllosilicates, muscovite and heavy minerals, staurolite, with a maximum diameter of 0.1085mm. Lithoclastes, sporadic: quartzite made of joined granules with joining contacts.

Cement: calcite, with characteristics of pores and pellicle, iron hydroxides with aspect of pores.

16	**Petrofacies:** epiclastic	Fine carbonatic sandstone (calcite/dolomite) (siltite), with fissures of iron hydroxides	Compositional characteristic: Siltite with carbonatic cement (calcite/dolomite), and fissures of iron hydroxides.

Texture characteristic: siltic, well sorted out.

Microstructural characteristic: mechanic-clastic.

Mesoscopic: Finely granulated rock, light-grey, with rolling elements, tabular, greenish, with maximum dimensions of 0.005-0.025m, with black pellicles on their surface. Rare paillettes of muscovite. Reaction with HCl, in cold conditions, only in the dust.

Microscopic: Granoclastes, predominantly: well sorted quartz, with a maximum diameter of 0.0616mm; phyllosilicates, rare paillettes of muscovite and accidentally, heavy minerals – tourmaline and zircon.

Cement: Micritic carbonate with basal and pores characteristics; iron hydroxides, brown, with a pellicle aspect, which delimits the elements of the rock, all having the same composition.

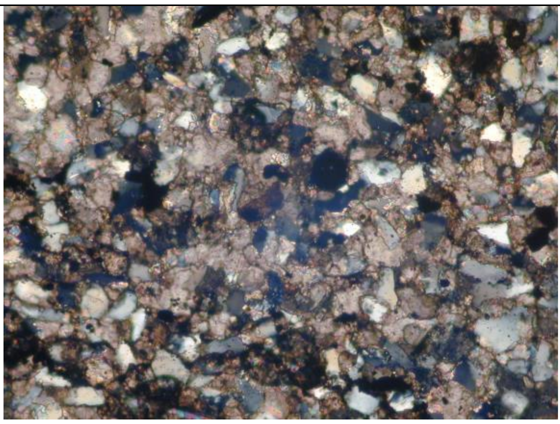


Fig. 14. Microphotograph: carbonatic siltite with fissures of iron hydroxides. N(II), 25x

4	**Petrofacies:** epiclastic	Argillite with porphyroblastes of dolomite (clayey shales)	Compositional characteristic: Argillite with porphyroblastes of dolomite (clayey shale)

Texture characteristic: crypto-micro-crystalline and porphyroblastic.

Microstructural characteristic: diagenetic, of recrystallization and metasomatic.

Mesoscopic: Almost spherical cobble, coloured grey-greenish. On the sectioned surface there are distinguished elements with almost circular contours, with one or more envelopes. The rock looks finely crystallized, finely saccharoidal. Very weak reaction with HCl, in cold, only in dust.

Microscopic: In the section there is an aphanitic mass of acicular micas, of neoformation and having a certain orientation. They belong to a diagenised argillous sediment, and by the pressing of the material, together with the water loss and the porosity modification, this sediment recrystallizes, forming acicular micas. In this mass there are distinguished idioblastes of dolomite characterized by a centre filled with inclusions that give a dim aspect, and a clear crystal periphery due to

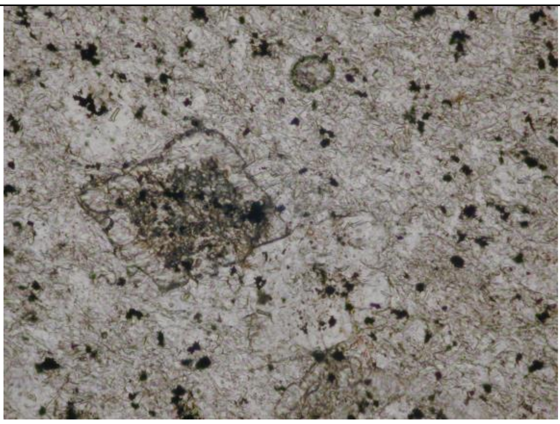


Fig. 15. Microphotograph: argillite with porphyroblastes of dolomite. N(+), 25x.

			the sintaxial growth with one or more levels. Apart from these, there appears micritic calcite that contours eyes of circular microquartz, with a maximum diameter of 0.77mm and which are probably at the origin of the dolomite porphyroblasts. In the late diagenesis, the process of making compact the argillous sediments, determines a textural reorganization (such as the parallel orientation of the phyllites), with the porosity loss and the transformation of the initial claystone into argillite or „shale" (Chamley, 2000). There are considered argillites the rocks without an obvious orientation, formed mainly of several argillous minerals. The condition for argillisation sedimentary process is for them to be mixed with clastic granules, sufficiently fine, which is why they are called sandy argillites. Though they do not cause effervescence, they can contain negligible quantities of carbonate (Auboin et al., 1975).
21	**Petrofacies:** silicolithic	Siliceous accident (silex) crossed by quartz fissures, with the „dents des chien" structure and bordered by „cotton rock" (the patina of the silex)	Compositional characteristic: siliceous accident (silex), crossed by quartz fissures and bordered by „cotton rock". Texture characteristic: crypto-micro-crystalline. Microstructural characteristic: diagenetic, of substitution. Mesoscopic. Grey-black stone, in a regular succession, opaque, very finely crystallized, translucent and crossed by fissures of smoky, microcrystalline quartz. The rock is bordered by a white material, friable, pulverulent, and porous, the „cotton rock" zone or the patina of the silex. Microscopic. The base mass, homogenous: cryptocrystalline silica – calcedonic quartz, with lithic, relict, silicified element, having a maximum diameter of 2.66mm. This mass is crossed by a wide fissure of secondary silica. The post depositional components: quartz fissure with a „dents des chien" structure, with an opaque powder in the middle of the crystals. Prepared in immersion, in nitrobenzene (index n=1.550) from the white, pulverulent material. It contains elements of calcedonic quartz, accidentally quarts granoclastes, an idiomorphous carbonate crystal and rare paillettes of micas.

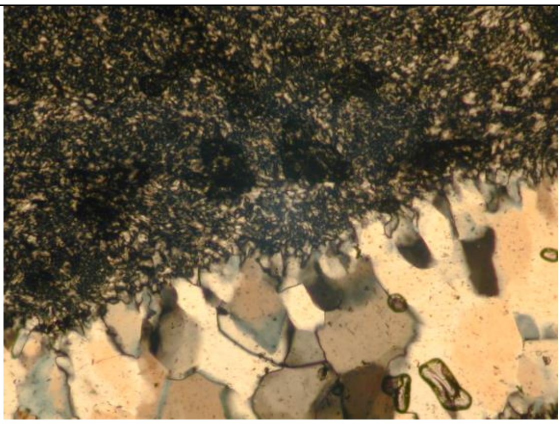


Fig. 16. Microphotograph: siliceous accident crossed by quartz fissures. N(+), 25x.

19	**Petrofacies:** volcanoclastic	Vitroclastic tuff of acid composition (volcanoclastic material)	Compositional characteristic: Vitroclastic tuff of acid composition (volcanoclastic material, McPhie et al., 1993). Texture characteristic: vitroclastic. Microstructural characteristic: mechanic-clastic. Mesoscopic. White-grey rock, very fine, opaque, light, rough at touch, with a subconcoidal breach, with sharp edges. Porous, catches the tongue and absorbs the acid. No reaction with HCl, in cold. Through the binocular magnifying glass there are distinguished tiny paillettes of biotite. Microscopic: The basal mass is made entirely of an isotrop, glass powder. In immersion, with an index liquid n=1.490, the fragments of isotrop glass have an acid composition. Rare crystals of angular quartz, with a maximum diameter of 0.0899mm and rare paillettes of biotite.

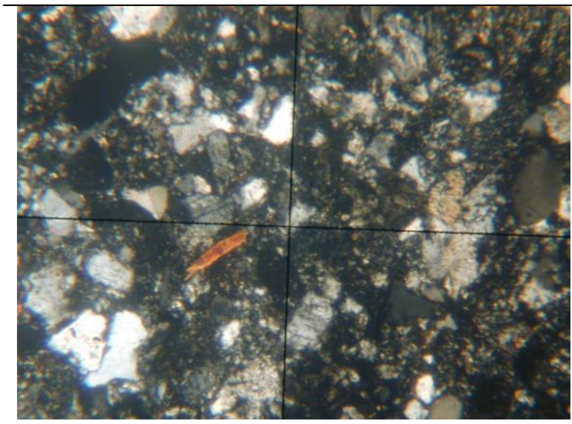


Fig. 17. Microphotograph: Vitroclastic tuff of acid composition. N(+), 25x.

7	**Petrofacies:** volcanoclastic	Tuffite (sedimentary deposit, volcanogenic)	

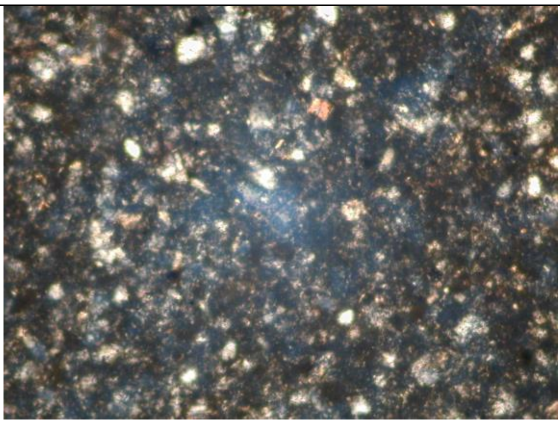


Fig. 18. Microphotograph: tuffite. N(+), 25x.

Compositional characteristic: Tuffite (sedimentary deposits, volcanogenic, McPhie et al., 1993).
Texture characteristic: arenitic-vitroclastic.
Microstructural characteristic: mechanic-clastic, microstratified.
Mesoscopic. Finely granulated rock, grey-white, microstratified. On the stratification edges - paillettes of micas. No reaction with HCl, in cold.
Microscopic. The base mass – volcanoclastic material made of a fine powder of glass and ash, devitrified, isotrop and with rare structure traces. Crystals of quartz, widely dispersed; epiclastic material made of phyllosilicates, short blades of muscovite and chlorite, zoned plagioclase feldspar, with a maximum diameter of 0.2826mm, plagioclase, twinned polysynthetic feldspar, with a maximum diameter of 0.2695mm.

METAMORPHIC ROCKS

8	**Petrofacies:** epimetamorphic	Metaquarzite (quartzite with muscovite)	

Fig. 19. Microphotograph: metaquarzite (quartzite with muscovite). N(+), 25x

Compositional characteristic: Metaquartzite (quartzite with muscovite) - element from the conglomerate.
Texture characteristic: grain-blastical.
Microstructural characteristic: massive.
Mesoscopic. Conglomerate with disc-shaped and lamellar elements, angular, of medium dimension of green schists and an almost isometric, rolled, smooth element of quartzite, which resisted sectioning.
Microscopic. In the section there appear only big crystals of quartz, with joined contacts and rolling extinction. Between these, rare lamellas of greenish muscovite, which are crushed and laminated between the quartz crystals.

9	**Petrofacies:** epimetamorphic	Quartzitic-micaceous schist.	

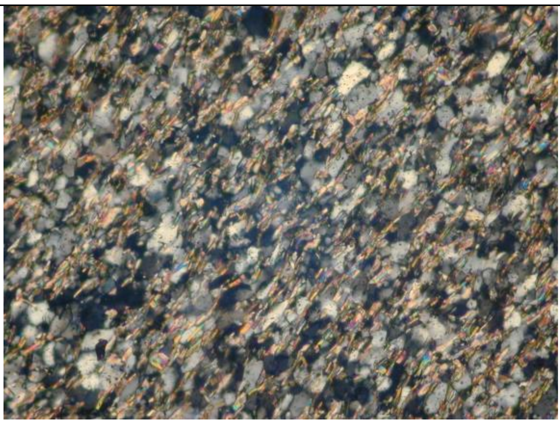


Fig. 20. Microphotograph: epimetamorphic rock (quartzitic-micaceous schists) from the series of the green schists. N(+), 25x.

Compositional characteristic: Epimetamorphic rock (quartzitic-micaceous schists) from the series of the green schists. Epimetamorphic rock with small granulation and schistosity clearly expressed: micas and quartz disposed parallel with the phyllosilicates orientation.
Texture characteristic: blast-siltical.
Microstructure characteristic: orientated, fine schistose.
Mesoscopic. Grey-greenish rock, satined, very homogenous, with subconcoidal breach, finely oriented.
Microscopic. Mass of oriented and finely crystallized minerals. There are distinguished crystals of quartz with a maximum diameter of 0.062mm and phyllosilicates: chlorite in grown lamellas and muscovite in fine, birefringent, oriented lamellas. Accidentally, an oriented calcite crystal, with a maximum diameter of 0.1860mm.

10	**Petrofacies:** epimetamorphic	Quartzitic-micaceous schist	Compositional characteristic: Epimetamorphic rock (quartzitic-micaceous schists), microfolded. Texture characteristic: blast-siltical. Microstructural characteristic: orientated, finely schistous, microfolded. Mezoscopic. Grey-greenish cobble, satined, finely crystallized, oriented and microfolded. Microscopic. Quartz crystals disposed in rows parallel with the general orientation of the phyllosilicates. They present a maximum diameter of 0.1549mm. Together with these, there are lamellas of chlorite, less clearly contoured and of muscovite with parallel disposition. Rarely dispersed calcite crystals and granules of authigenous sulphurs.

Fig. 21. Microphotograph: epimetamorphic rock microfolded. N(+), 25x.

20	**Petrofacies:** mesometamorphic	Amphibolite with quartzo-feldsparic metasomatose	Compositional characteristic: Amphibolite with quartzo-feldsparic metasomatose Texture characteristic: fibro-grain-blastical. Microstructural: orientated. Mesoscopic. Greenish-grey cobble. On its surface there are distinguished greenish, fibrous elements, in a grey, very finely crystallized mass. Microscopic. In the section there appear fibrous, green-bluish crystals of amphiboles, with straight extinction, widely developed, frequently invaded by clear, secondary formations of quartz and feldspar, with fresh aspect and, more rarely, of calcite.

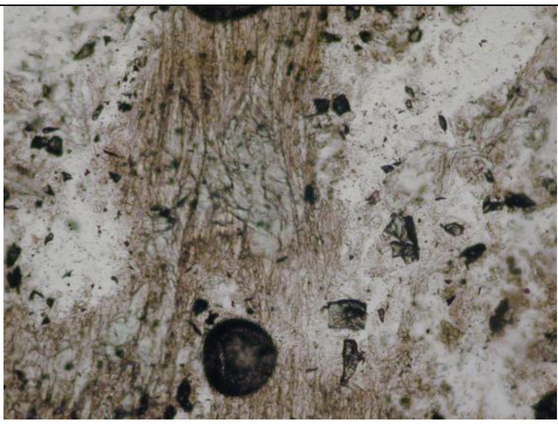


Fig. 22. Microphotograph: Amphibolite with quartzo-feldsparic metasomatose. N (II), 25x.

X-rays diffraction analysis on the samples of volcanoclastic petrofacies (sample 7 and 19), which were optically analyzed previously, confirm the prior diagnosis and optimize the identification of petrographic types assigned to the breccia salt formations.

Interpreting qualitative phase made with DIFFRAC^{plus} EVA software (fig. 23) revealed a relatively similar composition of both samples: quartz, albite, clinochlore and muscovite/biotite.

The quantitative phase interpretation made with DIFFRACplus TOPAS 4.1 software (fig. 24) minerals in the two tuff samples had the following percentage composition: sample 7 (quartz – 52,42%, albite – 8,37%, clinochlore – 10,79%, muscovite – 5,38%) and sample 19 (quartz – 53,96%, albite – 10,49%, clinochlore – 10,80%, biotite – 3,66%).

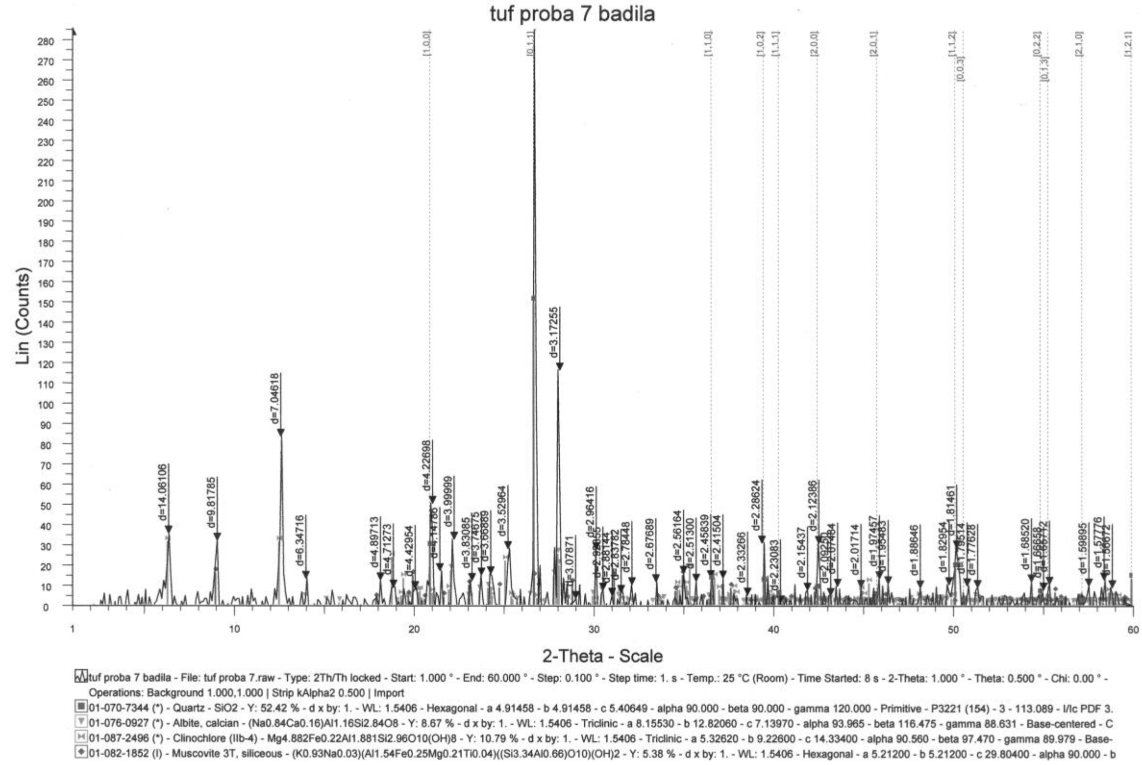


Fig. 23. Diffractogram of sample 7.

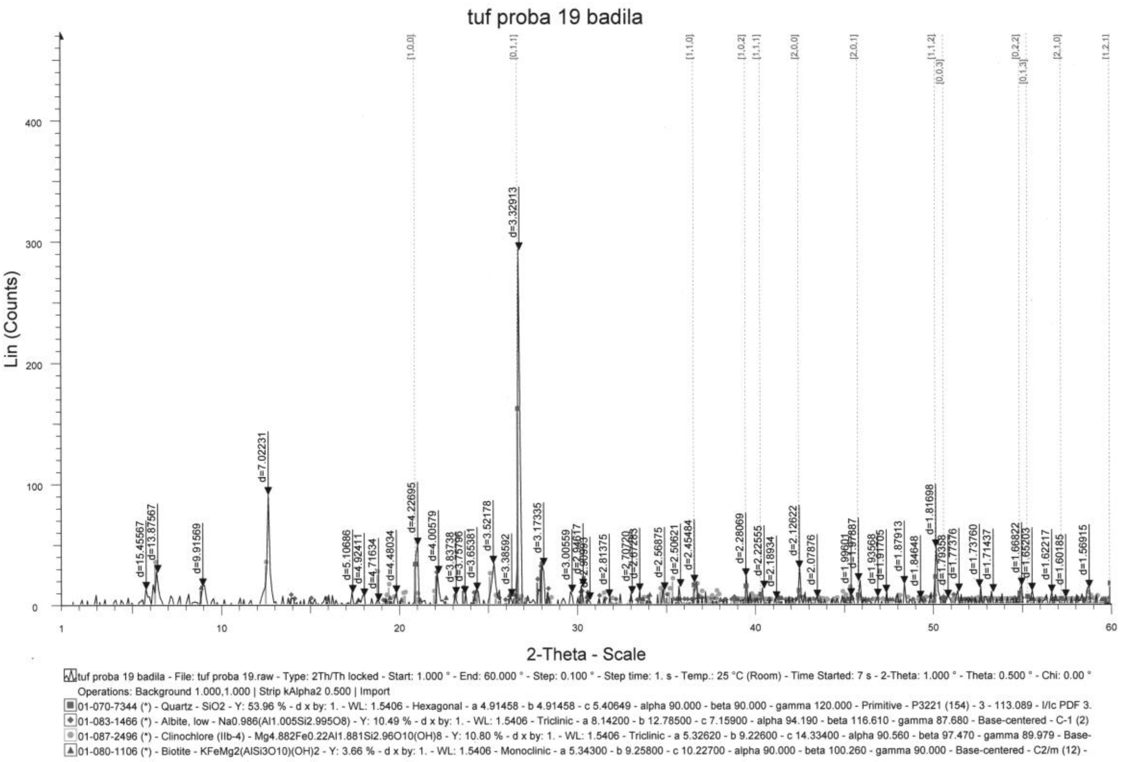


Fig. 24. Diffractogram of sample 19.

Conclusions

The entire material under observation highlights a weight of 72.7% sedimentary rocks (according to their frequency, there exist carbonatic petrofacies followed by epiclastic and silicolithic petrofacies), 18.2% metamorphic exotic rocks and 9.1% volcanoclastic rocks.

The carbonatic petrofacieses incorporate calcitic lithofacieses (in their turn including microlithofacieses from Malm, Tithonic, Turonian-Senonian) and Mesosoic dolomitic lithofacieses. Epiclastic petrofacieses refer to conglomerates, microbreccias, quartz sandstone, lithic sandstone = subgraywacke, calcitic sandstones, fine carbonatic sandstones, argilites with dolomite porphyroblastes. Silicolithic petrofacieses refer to siliceous cracked accidents with secondary envelope. It was proven that volcanoclastic petrofacieses originate from acidic vitroclastic tuffs and tuffite whose origins must be sought in the Miocene basis, Oligocene-Miocene respectively. Epimetamorphic petrofacieses incorporate metaquartzites, quartz-micaceous schists, and amphibolites with quartz-feldspathic metasomatosa.

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Detalii mineralogo-petrografice asupra clastoruditelor din blocurile de conglomerate din brecia sării de la Bădila (Valea Buzăului)

Rezumat

Analizele de microscopie optică şi difracţie RX asupra unor claste din blocurile de conglomerate ale formaţiunii breciei sării din Badenianul de la Bădila (Valea Buzăului) al Avanfosei Carpatice motivează diagnosticul acestora cu implicaţii în precizări de arii sursă şi aprecieri de paleomediu precum si a evoluţiei de bazin.