GEOLOGICAL STRUCTURE AND BIOSTRATIGRAPHY OF BURRELI DEPRESSION IN ALBANIDS

SHENJATARI Agim, PRIFTI Irakli, JAURRI Zeqir

Abstract. Burreli Depression is part of the system of intermountain depressions in the Mirdita zone. This extends north-westwards and originated in the Tortonian as a large intermontane lake basin. It stretches from Klosi town in the south to beyond Rresheni town in the north and structurally is a syncline-like structure with gently dipping flanks. Generally, the molasse section of Burreli Depression is 750 to 1150 m thick. The lithofacies are of lagoonal-lacustrine type. Based on the lithological facies and on the faunal data, the molasse section of Burreli Depression is divided into two formations, both of Tortonian age. Among macrofauna fossils there have been identified bivalves (*Isocardia, Psilunio*) and gastropods (*Melanopsis, Bythinela, Mellania*). According to the lithological and faunal data, an alternation of lacustrine and colluvial environments has been concluded.

Keywords: Burreli Depression, Tortonian, molasse sedimentation, lithostratigraphy.

Abstract. Structura geologică şi biostratigrafia Depresiunii Burreli în Albanide. Depresiunea Burreli face parte din sistemul intramontan de depresiuni din zona Mirdita. Aceasta se extinde spre nord-vest şi îşi are originea în Tortonian, când a funcţionat ca un bazin lacustru intramontan. Se extinde de la Klosi în sud până dincolo de oraşul Rresheni în nord şi, din punct de vedere structural, este un sinclinal cu flancuri care înclină uşor. În general, secţiunea de molasă a Depresiunii Burreli are grosimi cuprinse între 750 şi 1150 m. Litofaciesurile sunt de tip lagunar-lacustru. Pe baza faciesurilor litologice şi a datelor faunistice, secţiunea de molasă a Depresiunii Burreli este împărţită în două formaţiuni, ambele de vârstă tortoniană. Între macrofosile au fost identificate bivalve (*Isocardia, Psilunio*) şi gasteropode (*Melanopsis, Bythinela, Mellania*). Conform datelor litologice şi faunistice, rezultă o alternanţă a mediilor lacustre şi coluviale.

Cuvinte cheie: Depresiunea Burreli, Tortonian, sedimentare de molasă, litostratigrafie.

INTRODUCTION

Burreli Depression is part of the intermountain depressions system in the Mirdita zone. Terrigenous deposits like sandstones, argillites, clays, siltstones, sandstones, conglomerates, etc. are very developed (Figs. 1; 2).

According to their lithofacial data, the colour, the presence of horizons rich in macrofauna, the molasse deposits of Burreli Depression are divided into two formations: "Gurra e Vogël-Rripë" (GVR) and "Burreli" formations. GVR Formation extends over eroded volcanic rocks, while Burreli Formation is the youngest and lies upon GVR Formation.

Based on the faunal data, GVR Formation is assigned to the Early Tortonian, while Burreli Formation to the Late Tortonian. This dating is due to the existence of a horizon rich in macrofauna at the top of GVR Formation; Burreli Formation, which lies immediately above the horizon rich in macrofauna, starts with brown gravel stones that informally serves as the base of the Later Tortonian (SHENJATARI & JAURRI, 2000).

Based on the lithological and macrofauna data, also on the microscopic study of thin sections of different lithofacies, the description of the two formations is given below in the paper.

MATERIAL AND METHODS

The geological study is based on geological field surveys (geological surveying in standard scale 1: 25,000) and the taxonomic identification of macrofossils. These determinations were carried out by Pashko P. (retired) and Marku D. (both of Institute of Geological Research, Tirana).

LITHOLOGICAL DATA

1. Gurra e Vogël-Rripë (GVR) Formation (Early Tortonian-$N_1^3t_{(1)}$).

It is characterized by a relatively vast extension and accentuated lithological changes. It is characteristic for the lowest levels of Burreli Depression, having its full development in GVR region (Photo 1).

Three deposit types are part of this formation:

1.1. Breccia-conglomerate deposits;

1.2. Clay deposits;

1.3. Sandstone-Silstones-Conglomerate deposits.

1.1. Breccia-Conglomerate deposits. They lay transgressively over older formations of the basement and are characterized by an accentuated change of their thickness. They are developed mainly in the northeastern part of the depression, where they reach a thickness of 300 m, while toward the central and southern part they are reduced into a narrow band with a thickness of 15-20 m.

The breccia-conglomerate deposits in general are well cemented, have a mottled, light reddish colour that is related to the presence of iron oxides and hydroxides (Photo 4).

The composition of the breccia-conglomerate deposits depends on the surrounding source rocks of the depression. They are constituted of pebbles having different sizes, among which the size 5x10 cm is predominating, but in the region Dukagjin-Shlli the sizes reach up 15x20 cm. In general, well-rounded quartz pebbles predominate, being white, honey-like and dark grey in colour. Other pebbles are ultrabasic, basic, siliceous and, in smaller volume, carbonate rocks (SHENJATARI & JAURRI, 2000).

1.2. Clayey deposits. Clayey deposits have a considerable extent; approximately, in entire basal part of the Burreli Depression, they are accompanied by breccia conglomerate deposits. Its presence as an independent unit is based mostly on the lithological features. It must be pointed out that, in some cases, this unit lies directly on the older deposits, replacing the conglomerates. On the eastern flank of the Burreli Depression, in the contact with the ophiolitic rocks, the clayey deposits show the following structural elements: dipping azimuth 230-260º and dipping angle 18-20º. Its thickness varies from 4-5 m to 12 m. On the western flank of the syncline, their attitudes are: dipping azimuth 80-100º and dipping angle 45-50º; thickness 25-50 m with ultrabasic breccia conglomerate intercalation (Photo 1).

In the periphery of the basin, we distinguish clays in the northern and central part and argillites in the southern part.

Clayey formation contains clay granules with dimensions below 0.01mm. Generally, the clays are bedded, and they rarely form lens or bending. By microscopic studying, clay is presented as matrix. A distinct characteristic is the presence of charophyta algae in the clayey groundmass in such quantity that one may speak of charophytic clays, which denotes a lacustrine environment with high energy. Parts of the central canal of the charophyta algae are filled with clayey material with hematite pigments.

The clastic material of the clays is constituted mostly by quartz, feldspar, micas and fragments from magmatic rocks; quite often, chrome-spinel bearing rocks are present.

Dispersed organic matter, as well as organic and vegetal remains, is present also in the clayey deposits.

1.3. Sand-silt–conglomerate deposits. It has a relatively large extension and lies conformably over the clayey and breccia-conglomerate deposits, at times with sharp or gradual transition, with reciprocal intercalations. A characteristic feature of these deposits is the rhythmic deposition (Photo 2), which is an expression of independent processes of sediment accumulation and their stratification, the distribution of canal network of the rivers, the oscillation of the basin level, climatic pulsations, etc.

It must be pointed out that in the sandstones and siltstones, in particular in the last ones, macrofauna is present, which in one case constitutes a reach horizon, 1.5-2m thick; although sometimes, it is reduced in lens or pockets, in general, it preserves its thickness over wide surfaces. In the mineral constitution of the sandstones, we mention quartz, feldspar and rocky fragments up to 0.01, 0.5 and 1.5mm, rarely more; they are oligomictic and polymictic; the cement material is clayey, siliceous and carbonate; it often contains iron hydroxides.

Generally, siltstones are of the type of clayey siltstones. At times they are rich in siliciclastic material, particularly quartz and feldspar, which at times reaches 30-40% of the general groundmass. From the microscopic study it results that siltstones are constituted by fine grained material of the size 0.02-0.04mm, not perfectly rounded, polymictic, at times with clasts 0.05-0.06mm. Clayey fraction are of montmorillonit type having scaly forms similar with that of micas, and also a small percentage of chloritic material. Another characteristic is that in the groundmass there are present charophyta algae, which are very compressed; some alga stalks are replaced by micro quartz. The thickness of this formation reaches up to 850 m (SHENJATARI & JAURRI, 2000).

2. Burreli Formation (Late Tortonian-$N_1^3t_{(2)}$).

It has a considerable extension, in particular in the northern part of the Burreli Depression. It is present on the west of the Burreli town, as well as at Baz, at Burgajet, Rremull and more in the north of Mirëdita. Molasse deposits of the Burreli Formation lies on the sandstone-aleurite and conglomerate of GVR Formation. Based on the lithological data, the respective deposits are divided into two groups:

2.1- Gravel-clay-conglomerates deposits;

2.2- Ultrabasic-basic cobble deposits.

2.1. Gravel-clayey conglomerate deposits. It has a considerable extension in the northern part of the Burreli Depression and a less one in the southern part. They are clearly distinguished in the field by the light brown colour of the gravels. In general, the Late Tortonian beds have a very rough surface contrasting with the underlying sky-blue Early Tortonian siltstones. The conglomerates beds show a varying thickness of 4-6 m. Sandstones are represented by more regular beds alternating with clay layers. Sandstone thickness varies from 1.5 to 4-6m.

Clays have a dark grey and homogeneous colour. In these deposits, there have been found concentrations of macrofauna, which certify very well the Tortonian age.

2.2. Ultrabasic-basic cobble deposits. They characterize the uppermost part of the Tortonian over the eastern flank and the southern part of the Burreli Depression. The weathering crust of the ultrabasic cobbles makes it easy distinguishable during the field survey. The respective thickness varies from 6-10m up to 50-60m. It lies directly over the older deposits of GRV Formation. The cobble deposits are related with alluvial-colluvial continental environment (Photo 3).

In the composition of these deposits take part coarse grained, cobble deposits transported by potent water currents, with concentration in those parts where the topography was adequate. Sediment transportation was occurring by the most highly kinetic energy for mechanic sedimentation accompanying, strong underwater impulses.

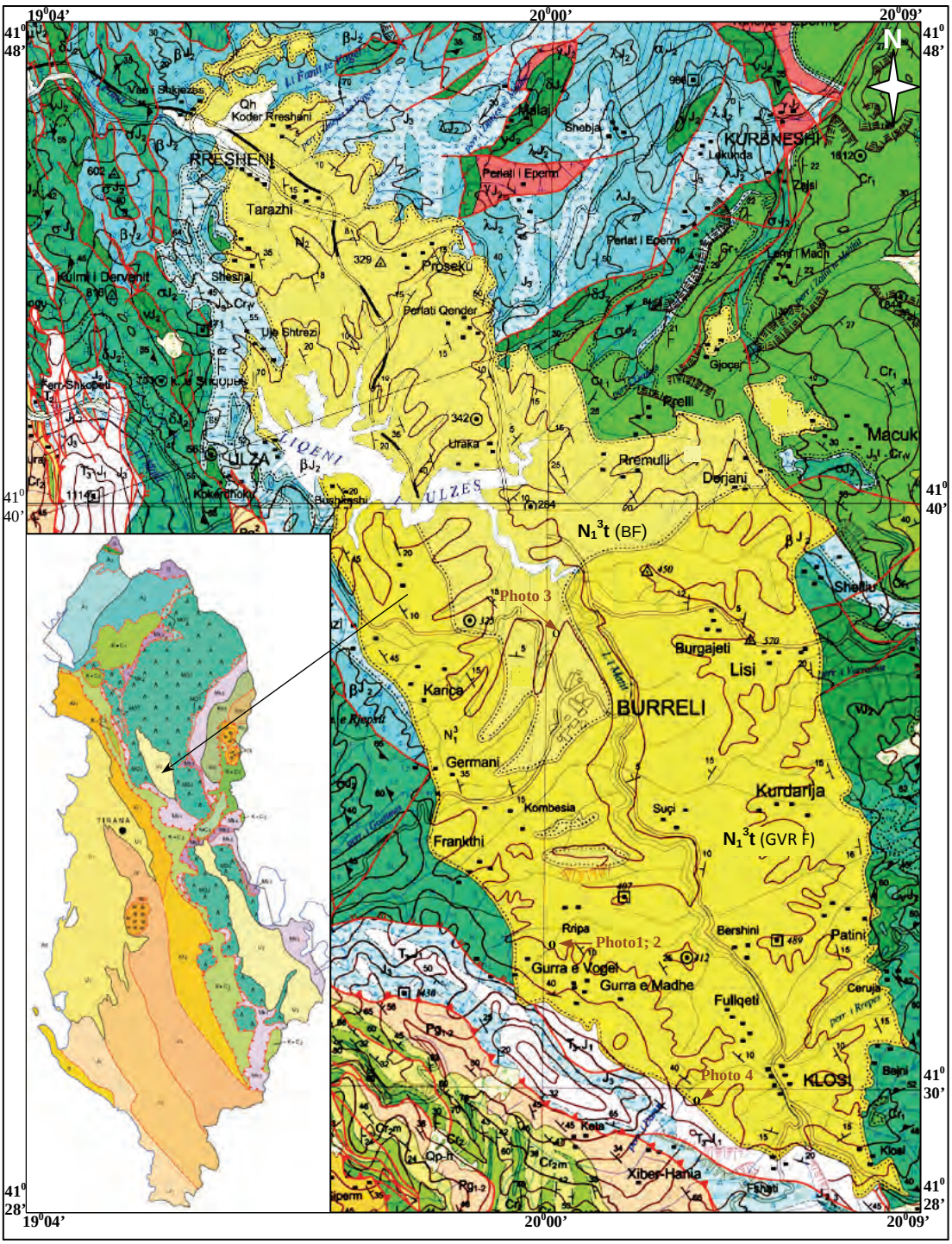

Figure1. Geological map of the Burreli Depression, 1/200,000 (VRANAJ et al., 2002).

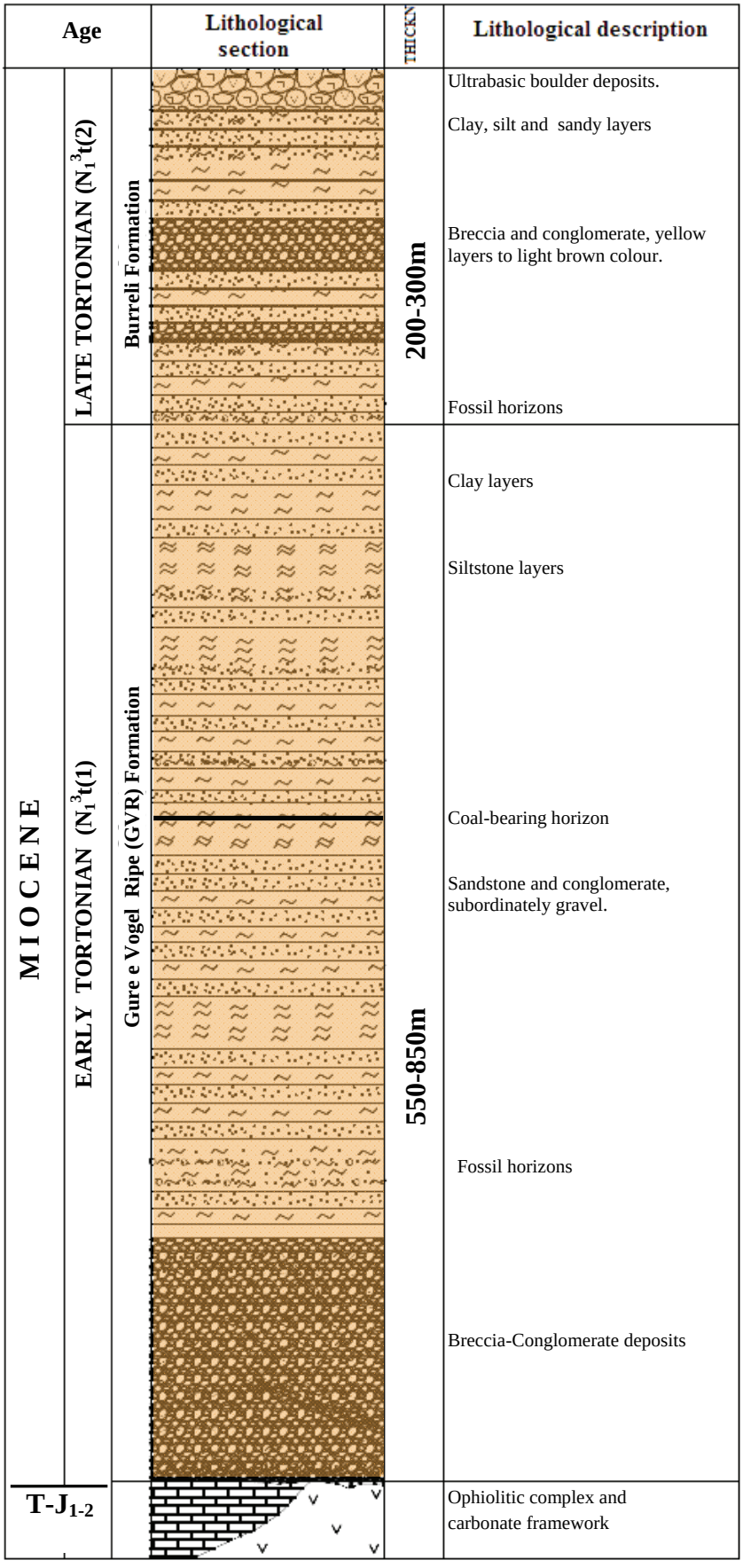

Figure 2. Lithological column of the Burreli Depression.

Sandy-clay sediments serve as cement for gravels. Gravels dimensions vary from bigger gravel with dimensions of 15x25cm to smaller gravel with dimensions of 2x3cm (Fig. 2). The thickness of the formation is up to 250 m (SHENJATARI & JAURRI, 2000).

AGE OF THE DEPOSITS IN BURRELI DEPRESSION

The previous authors that worked on the molasse deposits of the Burreli Depression have assigned them different ages. Thus, authors of "Geological map of Albania" have considered them as being Pliocene (VRANAJ & al, 2002). LIKO (1960), who studied the north-western part of Burreli Depression - Skanderbeg Mountain and its periphery, has considered them of Tortonian age (SHENJATARI & JAURRI, 2000).

Taking into account the above mentioned contradictions, we have paid special attention to collect fossils (Photo 5). On the basis of the fossil study we may conclude as follows:

a. The flora and fauna distribution is more concentrated on the western flank of the depression; among the plants, the caduceus trees dominate; the leaves are stamped in the siltite deposits. In general, carbonized twigs and trunks are met; sometimes, they form authentic coal horizons along the periphery of the western depression flank.

b. The high distribution of the flora remains on the western flank, by its pigment, determined the green to dark grey colour of the siltstones and clayey sandstones.

c. It is worth to point out the relation of the macrofauna association with the siltite deposits, in particular on their top, as well as at the floor of the gravel sandstones. On the basis of some features, the fauna association related to sandstones and conglomerates is considered as reworked.

d. In thin sections, it was observed the presence of *Charophyta* algae and a total missing of microfauna so important for dating and biostratigraphical correlations. The presence of *Charophyta* denotes a shallow fresh-water lacustrine environment.

From the study of macrofossils we can conclude that the fossil assemblage is indicative of brackish-water deposits. Fauna is represented by a very small number of fossil genera. There is the general association of *Isocardia cor*, *Psilunio* cf. *otavus, P. trapesoidalis, P. odettus, Psilunio* sp.*; Melanopsis bouei rarispina*, *M. bouei trispina, Bythinella* cf. *vitrellaeformis, Mellania escheri* (PASHKO, 1968).

The middle and upper parts of the molasse section in the Burreli Depression yield *Melanopsis bouei trispina, Melanopsis bouei rarispina* as well as *Psilunia odettus* and *Psilunia trapesoidalis*, etc., a number of these occurring also in the Tortonian deposits of the Adriatic Basin. Consequently, the Burreli Depression molasse is assumed to be Tortonian in age (MEÇO & ALAJ, 2000).

As it is evident, this association is characterized by two bivalve genera (*Isocardia, Psilunio*) and three gastropods (*Mellania, Melanopsis, Psilunio*), both groups including nine species (Photos 5; 6).

As regards the age assignment, there are the following arguments:

1. The association *Mellania - Mellanopsis - Psilunio* is very similar to mollusc association of the Pannonian of the Paratethys. According to the most recent correlation, the main part of the Pannonian is part of the Tortonian.

2. According to the data collected from the eastern Adriatic Basin, the association of *Mellania - Melanopsis* - robust *Unionids*, which is very approximate to our association, is dated as Tortonian.

3. It is a well-known fact that in Manza coal bearing deposits (Durrës region), in Kërrabë (Tirana) and in Lushnje region, *Melanopsis bouei rarispina* together with *M. bouei trispina* date the Tortonian age (GURI S., et al. 2002).

On the basis of the above mentioned arguments we are of the opinion that our fossil assemblage dates the Tortonian age.

The high number of specimens, their relatively big size, species impoverishment, the relatively robust shells, together with the characteristic association of *Mellania-Melanopsis-Psilunio*, proves delta brackish waters of a depth between low and high tides, even below the low tide (10-20m). On the basis of all the above mentioned data, the age of Burreli Depression sediments is no older then the Early Tortonian and no younger than the Late Tortonian.

SHORT DATA ABOUT GEOLOGICAL STRUCTURE

Sedimentary formations represented by clays, sandstones and conglomerates alternations, constitute the principal lithological bulk of the Burreli Depression. The deposits are represented by undisturbed beds with transgressive contacts over older deposits, namely of Triassic, Jurassic and Cretaceous ages. At times, depending on the nature of the palaeotopographic features of underlying rocks, the contacts are of overlap type or sharp ones (Photo 6). It is worth mentioning that the dipping angle of the Miocene deposits near the contact varies from 15-20^{O} to 40-50^{o}.

From the structural point of view, the terrigenous deposits of the depression form an asymmetric syncline, with specific features in different sectors. Thus, on the eastern flak, they are in transgressive contact over ultrabasic rocks of Bulqiza Massif, presents overlapped and uniform contact from the north to south, dipping westwards at an angle of 20-25^{o}.

The western flank presents a different situation, as there are overlapped or sharp contacts, with dipping angles of 20-25^{o}, in particular cases up to 85-88^{O}. The axis of the Burreli Depression follows the valley of the Mati River, with a general north-south trend, but in the central and northern part of the depression it deviates westwards.

CONCLUSIONS

The studied region is part of the intermountain depression system with considerable development of terrigenous sediments such as conglomerates, sandstones, siltstones, clays. The total thickness is from 750 to 1150 m.

On the basis of the lithological and facial data, the molasse deposits of the Burreli Depression are divided into two formations: Gurra e Vogël - Rripë (GVR) Formation, Early Tortonian, and Burreli Formation, Late Tortonian.

The sediment infill of Burreli Depression lies transgressively, with overlapped or sharp contact, over the older formations, always depending on the palaeotopography of the underlying rocks.

The two formations that constitute Burreli Depression build an asymmetric syncline like structure with pericline closures toward south and north-northeast.

The age of the molasse deposits of the Burreli Depression is no older than the Early Tortonian and no younger than the Late Tortonian.

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PLATE I

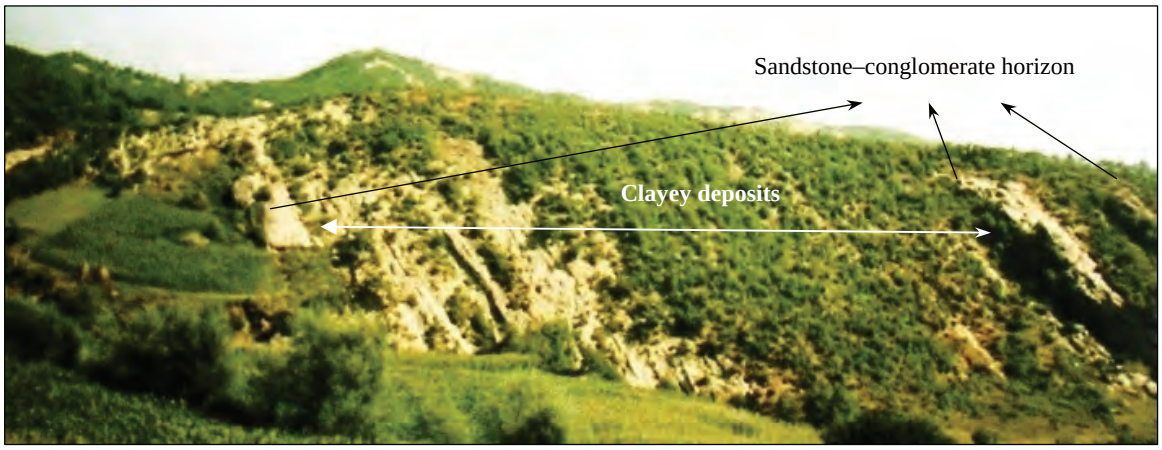

Photo 1. Formation of "Gurra e Vogël - Rripa", Gurra e Vogël village.

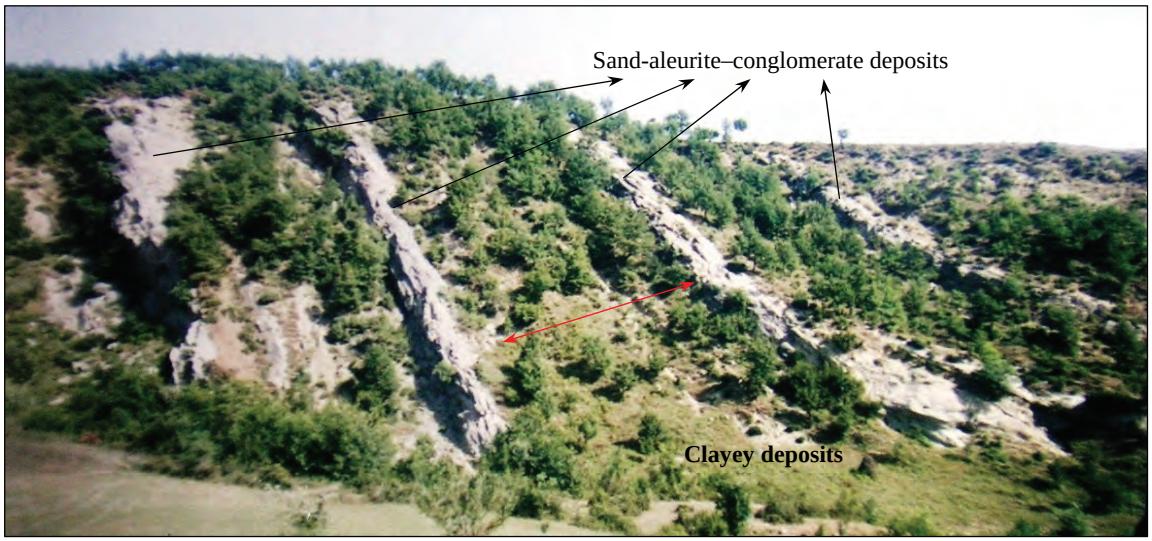

Photo 2. Formation of "Gurra e Vogël - Rripa", Gurra e Vogël village.

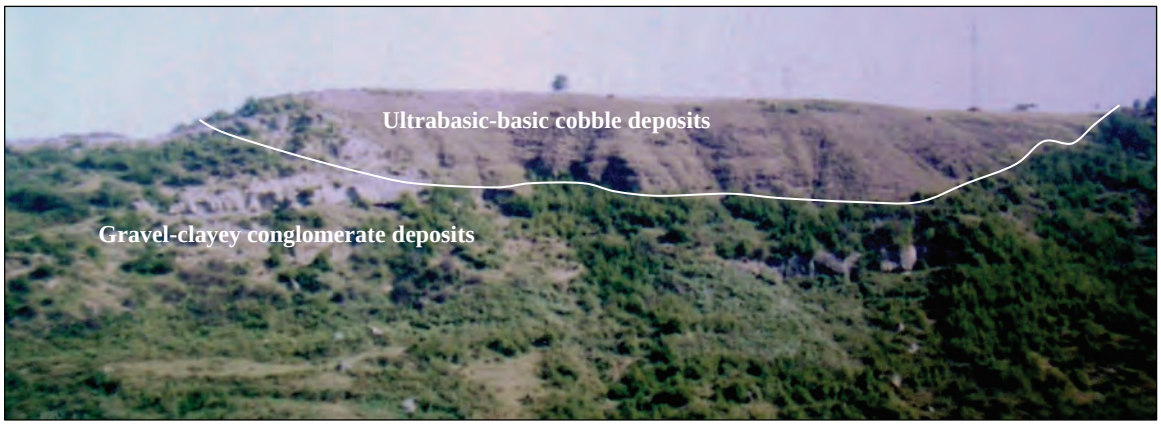

Photo 3. Burreli Formation ($N_1^3t_{(2)}$). Ultrabasic-basic cobble deposits, northern part of the Burreli town.

PLATE II

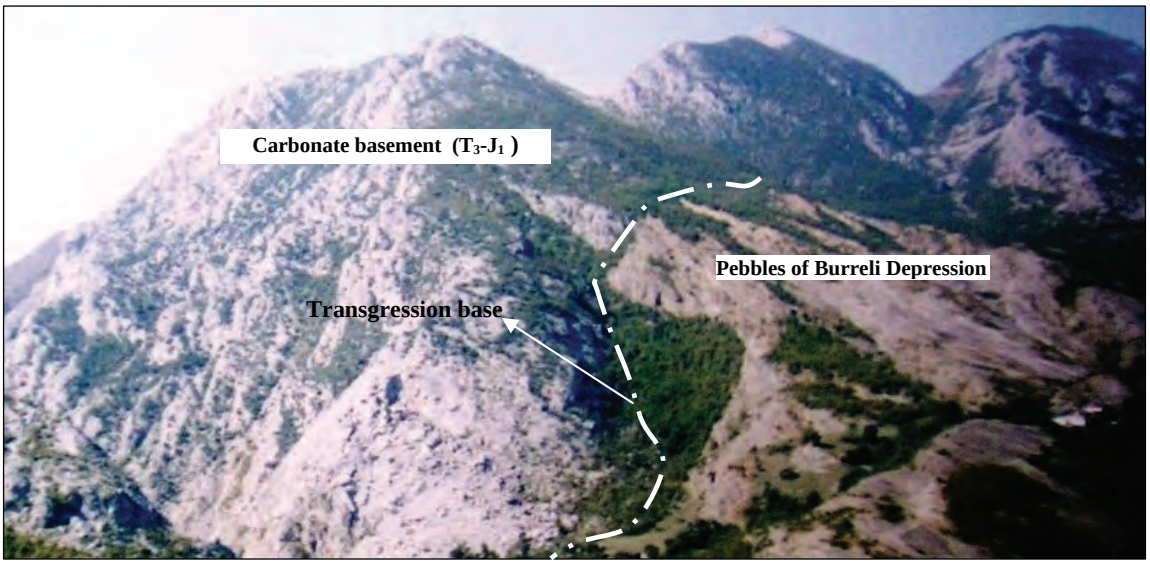

Photo 4. Transgression base of the Burreli Depression in the southern part.

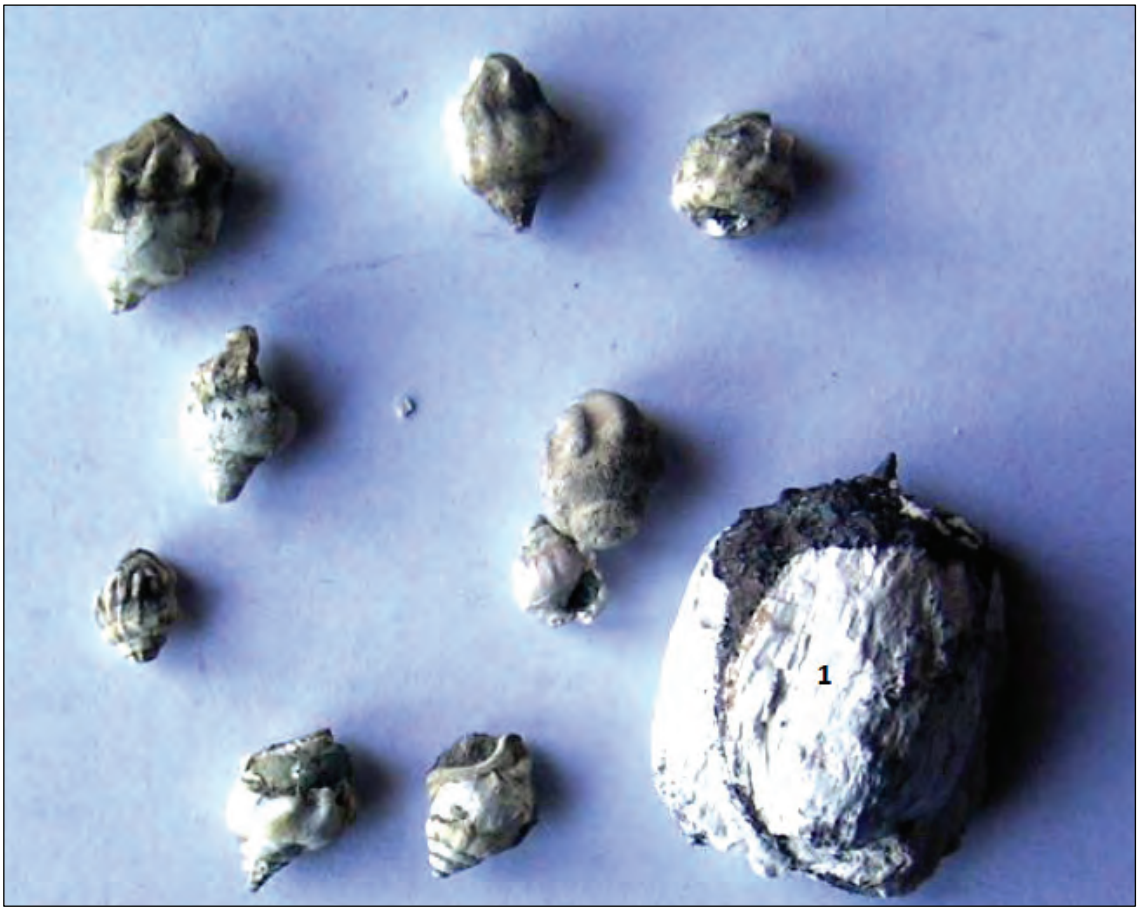

Photo 5. *Psilunio trapesoidalis* (1). *Melanopsis bouei* (8 specimens).

PLATE III

Photo 6. *Melanopsis bouei rarispina*, 27 specimens; *Bythinella* cf. *vitrellaeformis*, (1); *Psilunio* cf. *otavus*, (2).