Lower Cretaceous in the Munella Mountains (Mirdita Zone, northeastern Albania)

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Abstract: The Munella Mountain is located in the Mirdita area, in the northeastern part of Albania. Berriasian, Valanginian deep-water flysch deposits (breccia, conglomerate, sandstone, marl, marly limestone) and Barremian-Aptian shallow-water deposits lie transgressively over various ophiolitic rocks (spilite, keratophyre, diabase, gabbro, gabbrodiabase, norite, plagiogranite etc.) in the Munella section and the surrounding area of the Mirdita zone.
Unsorted breccias, including large blocks of ophiolites and Triassic limestones lie at the base of the Berriasian. Marls, sandstones, conglomerates with rare limestone intercalations characterize the upper part of the Berriasian. Sandstones and marls with abundant molluscs form the base of the Barremian-Aptian deposits. The highest part of the section consists of platform limestones in Urgonian facies. An interruption in sedimentation during the Hauterivian was caused by the Mirditean orogeny.

Keywords: Berriasian, Valanginian, Barremian-Aptian, Stratigraphy, Palaeogeography, Munella Mountain, Northeastern Albania

1. INTRODUCTION

The Munella Mountain is famous for its great resources of copper and its natural beauty. It is located in the northeastern part of Albania, within the Mirdita zone. This region is mainly built up by volcanic rocks: spilites, keratophyres, diabase and gabbrodiabase, which form the oldest rocks in this region. Important geological components in this area are Berriasian and Valanginian flysch and flyschoidal deposits and Barremian-Aptian carbonates in Urgonian facies; both lie transgressively on the oldest rocks and over each other. The Lower Cretaceous deposits of the Munella Mountain reach a composite thickness of about 1000 meters. This paper focuses on the Berriasian, Valanginian and Barremian-Aptian deposits of this region.

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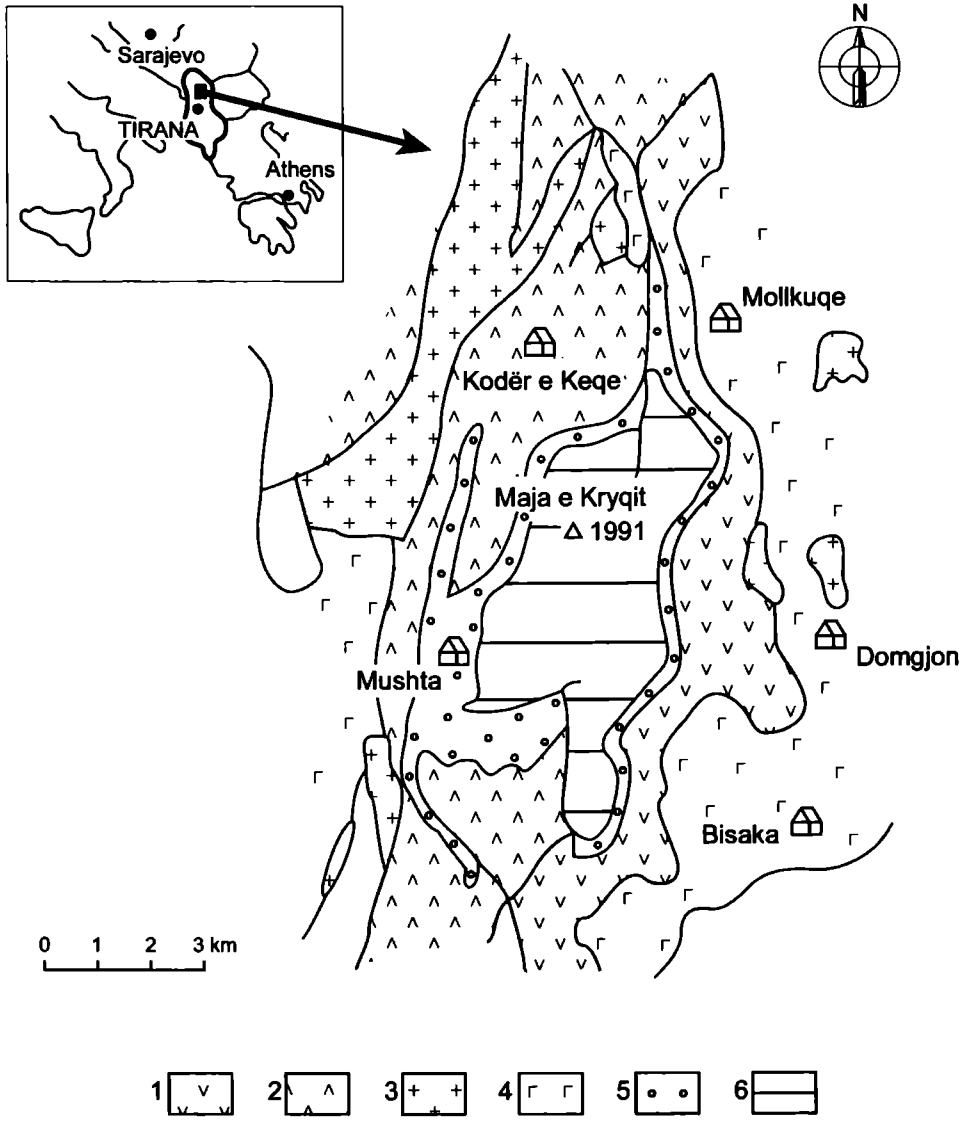

Fig. 1: Geological sketch map of the Munella Mountain, scale 1:100 000 (After the geological map of Albania, 1983). 1-basic volcanites (diabase, spilite), 2-Gabbros, gabbrodiorite, 3-plagiogranite, 4- medium acid volcanics, 5-breccia and flysch deposits (mainly Berriasian-Valanginian), 6-limestones

2. PREVIOUS STUDIES

The first data on the geology of the Munella Mountain were given by NOPCSA (1929). He described conglomerates, sandstones, marls and platy limestones of the Lower Cretaceous. Grey sandstones with *Nerinella* belonging to the Aptian or Gault were also mentioned. In a summary of the results of the geological mapping of the region, SHALLO (1966) reported about the presence of Tithonian and Lower and Upper Cretaceous deposits on Munella Mountain. KONDO & MEÇE (1969) argued that all sedimentary deposits on this mountain belonged to the Barremian-Aptian. PEZA et al. (1971) divided the sedimentary cover in the Munella Mts. into Hauterivian-Barremian, Aptian-Albian, Cenomanian and Cenomanian-Turonian. YLLI (1974) divided the section of the Munella Mts. into 6 groups of deposits, beginning with the Tithonian and ending with the Turonian.

New data on the stratigraphy and palaeogeography of this region were given in PEZA et al. (1980, 1981). Their described section begins with Berriasian-Valanginian flysch and flyschoidal deposits with *Calpionella* above an unconformity. After a gap in sedimentation follow Barremian-Aptian sediments in Urgonian facies, which overlie partly the Berriasian and Valanginian sediments and partly the ophiolitic rocks. This was the first indication of a Hauterivian stratigraphical gap in the area and the first indication of the Mirditean orogeny in the Albanides (PEZA et al., 1981, 1983).

3. THE MUNELLA MOUNTAIN SECTION

The basement (unit 1 of Fig. 2) of the Cretaceous Munella Mountain section comprises mainly different kinds of volcanic rocks: spilites, keratophyres, diabase, gabbro, gabbrodiabase, norites, plagiogranites. Generally they are fragmented into large tectonic blocks and slices.

The sedimentary cover of the Munella Mountain is divided into the following units: Berriasian-Lower Valanginian (including the *Calpionellopsis* Calpionellid zone), Valanginian (*Calpionellites darderi* zone) and Barremian-Aptian in Urgonian facies.

3.1. Berriasian-Lower Valanginian

The Berriasian deposits form the oldest sedimentary rocks in the Munella Mountain, overlying the volcanic basement unconformably. The Berriasian-Lower Valanginian section of the studied area is divided into a lower brecciated unit and an upper flysch unit.

At the base of the Berriasian deposits lie coarse breccias (unit 2 of Fig. 2) with blocks of different sizes, mainly ophiolitic rocks (spilite, keratophyre, diorite, porphyre, gabbro, gabbrodiabase, plagiogranite). The pebbles and cobbles are unsorted and angular; some of them reach a diameter of several meters. In addition there are rare blocks of Triassic-Middle Jurassic limestones. In some cases gravelly sandstones are interbedded between the breccias. Sporadic layers of calcarenitic limestone and reddish radiolaritic marly limestones are also present. The general thickness of this interval is about 350 meters.

The upper part of the Berriasian-Lower Valanginian deposits consists of alternations of thin layers of biomicruditic and biocalcarenitic limestones, sandstones, turbidites,

serpentinitic sandstones and green siliceous-chloritic marls (unit 3 of Fig. 2). Graded bedding is observed throughout the interval. The sandstone layers are normally 1–5 cm thick, up to a maximum of 15 cm, whereas the limestone layers are thicker and reach a thickness of 30 cm. In rare cases, very thin coal lenses (generally 0.8 cm thick and 30–40 cm long) are present between the sandstone and siltstones. In the Munella Mountain these deposits were found in the areas of Gëzoll, Domgjon, Kodra e Keqe, Molla e Kuqe, Sollomon. These strata have a general thickness of 140 m.

In the deposits of this unit microfossils are abundant: *Calpionella elliptica* CADISCH, *Calpionellopsis oblonga* (CADISCH), *C. simplex* (COLOM), *Tintinnopsella longa* (COLOM), *T. carpathica* (MURGEANU & FILIPESCU), *Remaniella cadischiana* (COLOM); the algal taxa *Lithocodium aggregatum* ELLIOT, *Cayeuxia annae* DRAGASTAN; the foraminiferal taxa *Trocholina alpina* (LEOPOLD), *T. elongata* (LEOPOLD); radiolarians and sponge spicules. The fossil assemblage testifies a Berriasian-Early Valanginian age (PEZA et al., 1980, 1981, 1985, PEZA, 1988, BLAU & GRÜN, 1999, HOUŠA,1987).

3.2. Valanginian

The Valanginian deposits (unit 4 of Fig. 2) consist of thin-bedded marls, limestones and sandstones, intercalated rarely by thin conglomerate layers. They continue conformly from the underlying deposits. In these deposits *Calpionellites darderi* (COLOM), *Calpionellopsis oblonga* (CADISCH), *C. simplex* (COLOM). *Tintinnopsella carpathica* (MURGEANU & FILIPESCU), *Amphorellina subacuta* COLOM, *Calcisphaera* sp. and radiolarians are present. This unit can be referred to the Berriasian-Lower Valanginian (PEZA et al., 1980, 1981, 1985, PEZA, 1988, POP, 1997, REMANE, 1985, PEZA E. 2000). These Valanginian deposits reach a thickness of 25 m and are exposed in the areas of Kodra e Keqe, Mushta brook and Molla e Kuqe.

3.3. Barremian-Aptian

Barremian-Aptian deposits are widespread on Munella Mountain. After a break in sedimentation, they lie transgressively over either Berriasian-Valanginian deposits or various volcanic rocks of the basement. The lower part consists of conglomerates, sandstone and marls whereas the upper part consists exclusively of limestones. The pebbles originated mainly from ophiolitic rocks, except for a small percentage of pebbles which derived from Triassic and Berriasian-Valanginian marly limestones (PEZA et al., 1980, 1981).

The Barremian-Aptian part of the Munella Mountain section is divided into four units: Conglomerates, sandstones and rarely marly limestones (unit 5 of Fig. 2) constitute the lowest 45 meters of the Barremian-Aptian deposits. In the sandstones some layers with *Actaeonina* and *Ostrea* have been observed. Besides *Trocholina friburgensis* (GUILLAUME & REICHEL), *Trocholina* sp., *Orbitolina* sp., *Pseudocyclammina* sp., *Requienia* sp., *Actaeonina syriaca* WHITEFIELD and *Microschiza* (*Coronatica*) *heybrocki* DELPEY are found in these deposits.

In the eastern parts of the Munella Mountain, e.g. at Gëzoll and Sollomon, this unit is not present and deposits of the following units are in direct contact with the underlying flysch (PEZA et al., 1981).

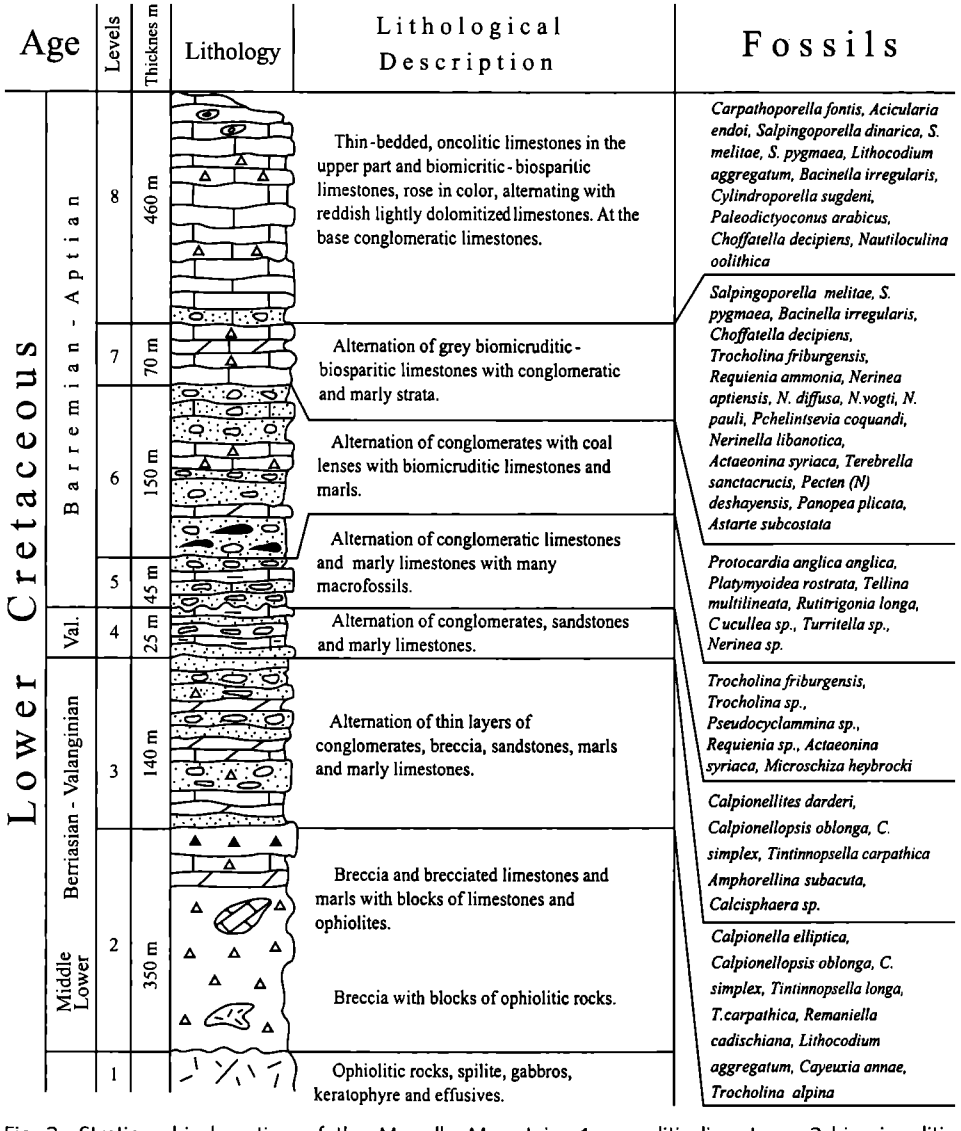

Fig. 2: Stratigraphical section of the Munella Mountain. 1- oncolitic limestone, 2-biomicruditic limestone, 3-conglomeratic limestone, 4-marls, 5-coal lenses, 6-marly limestone, 7-breccia, 8-exposed surface.

The following unit (unit 6 of Fig. 2) comprises a 150 m thick succession of conglomerates, sandstones and conglomeratic, biocalcarenitic, biopelmicritic and marly limestones with coal lenses. The coal lenses are 30–35 cm thick and 3–4 m long. In the Molla e Kuqe area, partly silicified coalified trunks of wood are present. The coal lenses are of very good quality (on average 5000–8000 cal), with a low content of sulphur and ash. In the upper part of this unit, carbonate pebbles are common and between them ophiolitic pebbles are found.

These deposits contain *Protocardia anglica anglica* WOODS, *Platymyoidea rostrata* (AGASSIZ), *Tellina multilineata* COQUAND, *Rutitrigonia longa* (AGASSIZ), *Cucullea* sp., *Corbula* sp., *Turritella* sp., *Nerinea* sp. This macrofaunal association testifies Barremian-Aptian developed in the Urgonian facies (DELPEY, 1940).

The overlying alternations of biomicritic, biosparitic and biocalcarenitic grey limestones with layers of conglomeratic limestones (unit 7 of Fig. 2) are 70 m thick. In these deposits many fossils have been found: the algal taxa *Salpingoporella melitae* (RADOIČIĆ), *Salpingoporella pygmaea* (GÜMBEL), *Bacinella irregularis* RADOIČIĆ, *Acicularia* sp.; the foraminifera taxa *Choffatella decipiens* SCHLUMBERGER, *Choffatella* sp., *Orbitolina* sp., *Trocholina friburgensis* (GUILLAUME & REICHEL), *Pseudocyclammina* sp., miliolids, texturalids, valvulineids; the rudist taxa *Requienia ammonia* (GOLDFUSS), *Polyconites* sp.; the gastropod taxa *Nerinea* cf. *aptiensis* DELPEY, *N. diffusa* DELPEY, *N. coquandi* D'ORBIGNY, *N. chloris* COQUAND, *N. vogti* DE MARTILLET, *N. pauli* COQUAND, n.sp., *Nerinella libanotica* DELPEY, *Diozoptyxis renauxi* (D'ORBIGNY), *Nerinella* sp., *Actaeonina* cf. *syriaca* WHITFIELD, *Tylostoma* sp., *Terebrella sanctacrucis* (PICTET & CAMPICHE), *Ampullospira* sp.; the bivalve taxa *?Pseudomellania clio* PICTET, *Pecten* (*Neithea*) *deshayensis* MATHERON, *Panopea plicata* SOWERBY, *Astarte subcostata* D'ORBIGNY; and the brachiopod taxon *Belbelkella* sp. This fossil assemblage testifies Barremian-Aptian in Urgonian facies (PEZA et al., 1980, 1981, 1985, PEZA, 1988, 1989, DELPEY, 1940, MASSE, 1989, BASSOULLET et al. 1978, SARTORIO et VENTURINI,1988).

The topmost unit of the Munella section consists of approximatively 460 m of biomicruditic-biosparitic thick-bedded limestones alternating with rare conglomeratic limestones and red biopelmicritic-biomicrocalcarenitic limestones (unit 8 of Fig. 2). The uppermost part consists of thick-bedded to massive micruditic and sparitic limestones alternating with red limestones, including oncolitic limestone at the very top of the Munella Mountain, at Maja e Kryqit.

In the deposits of this unit, the following microfossils occur: the algal taxa *Carpathoporella fontis* (PATRULON), *Acicularia endoi* PATRULON, *Salpingoporella dinarica* (RADOIČIĆ), *Salpingoporella melitae* (RADOIČIĆ), *Salpingoporella pigmea* (GÜMBEL), *Lithocodium aggregatum* ELLIOT, *Bacinella irregularis* RADOIČIĆ, *Teutloporella* sp., *Permocalculus* sp., *Cylindroporella sugdeni* ELLIOT, *Cayeuxia* sp.; the foraminifera *taxa Paleodictyoconus arabicus* HENSON, *Choffatella decipiens* SCHLUMBERGER, *Nautiloculina oolithica* MÖHLER, *Orbitolina* sp., *Pseudocyclammina* sp., *Trocholina* sp., miliolids, textularids; rare ostracoda sp.; *Favreina* sp., *Aeolisaccus* sp., skeletal parts of corals and echinoid spicules (similar to *Cidaris* sp.), testifying the presence of the Barremian-Aptian (Urgonian facies) (SARTORIO & VENTURINI, 1988).

4. PALAEOGEOGRAPHY

During the Upper Jurassic, the northern part of the Mirdita area had been exposed. The sea transgressed during the early Berriasian over the subsequent area of the Munella Mountain and the neighbouring part of the Mirdita zone. During the earlier period of transgression the Munella area was close to the coast. In the lowermost part of the section, breccia and large blocks of the ophiolites and Triassic limestones are common. The grain size of sediments decreased progressively, indicating ongoing deepening of the basin. During the late Berriasian and Valanginian, deep-water flysch-type sediments, commonly with graded bedding, were deposited (PEZA et al., 1981, 1985, PEZA, 1988).

The Mirdita area was again uplifted during the Hauterivian as a result of the Mirditean tectonic movements (PEZA et al., 1981, 1983, 1985, 1992, PEZA, 1988, 1995, 1999). The influence of this orogeny was very strong in the internal part of the Albanides, which were strongly deformed and finally were uplifted above sea level. During the early Barremian the Mirdita area was covered again by the sea. In the Munella area the section ends with the Aptian. In the surrounding area Upper Cretaceous deposits are widely distributed (PEZA et al., 1985, PEZA, 1988, 1989).

CONCLUSIONS

Berriasian, Valanginian and Barremian-Aptian deposits are exposed on Munella Mountain and in the surrounding areas of the Mirdita zone (northeastern Albania). Volcanic rocks like spilite, keratophyre, diabase, gabbro, gabbrodiabase, norites, plagiogranites, variolite etc. and Triassic-Lower Jurassic carbonates comprise the basement of the Cretaceous deposits. Breccia and large blocks of ophiolite and Triassic limestone form the basal Berriasian deposits. Marls, sandstones, conglomerates with rare limestone intercalations form the upper part of these deposits. Sandstones and marls with abundant molluscs form the base of the Barremian-Aptian deposits. Platform limestone in Urgonian facies builds up the upper part of the section in the Munella Mountain. There is evidence of an interruption in sedimentation during the Hauterivian caused by the Mirditean orogeny in this area, which is also known from other areas of the Internal Albanides.

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