

## Zaplaz Formation, Central Slovenia

### Zaplaška formacija, osrednja Slovenija

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**Abstract:** Carbonate sequence in the Zaplaz (543 m) at Čatež area lying discordantly upon the Cordevolian dolomite and passing upwards gradually into the Main dolomite (Hauptdolomit) has been described in detail in this paper. Due to special development of the Julian-Tuvalian sedimentary succession in the Zaplaz at Čatež area we propose the name Zaplaz formation. As for the lithological composition is concerned and according to superposition the Zaplaz formation can be subdivided in nineteen lithostratigraphic units. From the geological point of view the investigated area belongs to the complicated structure of the Sava folds.

**Izveček:** V tem članku je natančno opisano zaporedje karbonatnih kamnin na območju Zaplaza (543 m) pri Čatežu, ki leži diskordantno na cordevolskem dolomitu in prehaja navzgor postopno v glavni dolomit. Zaradi posebnega razvoja julsko-tuvalskega sedimentnega zaporedja na Zaplazu predlagamo, da se poimenuje zaplaška formacija. Po stratigrafski legi in superpoziciji je zaplaška formacija razdeljena na devetnajst enot. V geotektonskem pogledu pripada raziskovano ozemlje zapleteni zgradbi Posavskih gub.

**Key-words:** Stratigraphy, lithostratigraphic subdivision, environment, Carnian, Sava folds, Slovenia.

**Ključne besede:** Stratigrafija, litostratigrafska razčlenitev, okolje nastanka, karnij, Posavske gube, Slovenija.

## INTRODUCTION

This work is in fact a detailed description of the Carnian stratigraphic sequence on Zaplaz (543 m) at Čatež, which lies northwest of Trebnje, including environment and the paleogeographic circumstances in that part of the Slovenian territory. The geological data for this work have been gathered by the author at systematic regional geological mapping for the Geological Map of Slovenia on the scale of 50.000 as well as at stratimetric measuring and

examination of the Zaplaz at Čatež geologic cross-section in the last two years.

The study area is characterized by variegated sedimentation and complicated structure. The Carboniferous beds are the oldest rocks in this region. The colourful Scythian rocks are exposed over a wide area. The Ladinian rocks change in composition and colour in all directions rapidly and very much. The

Triassic dolomites belonging to the Cordevolian and Norian are most extended rocks in the considered terrain. The Carnian prevalently carbonate sediments are considerably present in the geological structure of the area as well.

LIPOLD (1858) was the first who mapped this area. On the other hand, the geology of Dolenjska is represented on the Geological Map of Austria and neighbouring countries (VETTERS, 1933, 1937) as well. On the geological features of the transition zone between the Sava folds region and the Lower Carniolian Karst wrote GERMOVŠEK (1955). To the knowledge of the area contributed especially geologists of the Geological Survey of Slovenia, who systematically mapped the area and elaborated the geological map Ribnica on the scale 1:100,000 with corresponding explanatory text (BUSER, 1969, 1974).

## METHODS

This work is based on systematic regional geological mapping of the study area for the Geological Map of Slovenia on the scale of 1:50,000 as well as several detailed field surveys. On the other hand, detailed stratimetric measuring and precise sedimentologic and facies study of the Carnian rocks in this area have been performed. The stratigraphic relationships have been established by means of fossils, by lithology and analogy with the Carnian developments in wider neighbourhood. The carbonate rocks are classified according to FOLK'S (1959) practical petrographic classification of limestones and DUNHAM'S (1962) classification of carbonate rocks according to depositional texture. The rock colour was defined considering the Munsell's Rock Colour Chart.

## ZAPLAZ AT ČATEŽ FORMATION

### General statement

The Zaplaz formation is denominated according to the hill Zaplaz (543 m) at Čatež lying to the northwest of Trebnje, where a special development of the Middle and Upper Carnian beds is composed predominantly of carbonate rocks. An alternation of marlstones and claystones interrupted by several oolite, oncolite and dolomite horizons can be seen there. Another carbonate development of the Carnian beds is exposed in the Velika Loka area. The Middle and Upper Carnian carbonate development at Velika Loka lies concordantly under the Main dolomite consisting of a dark grey to black micritic limestone with interbeds of biomicrite and grained limestone, greyish black fine- and/or medium-grained, bedded (10-35 cm) limestone breccia, medium grey, platy and stratified (5-25 cm) grained limestone, brownish and olive grey fine platy marlstone, stratified (20-35 cm) fine-grained dolomite breccia as well as medium grey, medium-grained limestone breccia with calcite cement and organic remains. The above-mentioned rocks alternate between themselves. The age of these rocks is defined according to lithology and stratigraphic position; namely, they underlie concordantly the Main dolomite (Haupt-dolomit) and overlie the Cordevolian dolomite.

### Lower and upper boundary

The Middle and Upper Carnian sedimentary succession of the carbonate rocks, we denominated the Zaplaz formation, lies discordantly upon the light grey to white, grained and in the upper part in some places locally

poorly stratified Cordevolian dolomite. Pretty variegated beds of the Zaplaz formation pass upwards gradually to the characteristically laminated and stromatolitic, stratified (20-50 cm) Main dolomite.

### Lithostratigraphic units

Regarding the lithological characteristics and stratigraphic position the Middle and Upper Carnian Zaplaz sedimentary succession is subdivided into nineteen lithological units and that (from the bottom to top):

#### 1. Basal oolite-oncolite

The basal oolitic-oncolitic limestone lies in the form of a thin layer upon the Cordevolian dolomite (GERMOVŠEK, 1955). BUSER (1974, 1976) established as well, that in the Zaplaz at Čatež area the Upper Carnian (Julian and Tuvalian) beds begin with up to three metres thick bed of a dark grey oncolitic limestone.

The oolitic and oncolitic rock consists of microsparitic and sparitic groundmass, oncoids, fossil remains (crinoids, echinoid spines, molluscs), ooids and rare quartz grains. The quartz grains are unglular or poorly rounded. Oncoids are more or less oblong. In the ooid core the fragments of echinoderms and echinoid spines are most common. Oncoids are up to 3 centimetres thick. They are at first sight pretty alike to the Upper Triassic algae *Sphaerocodium bornemanni* Rothpletz. However, coated-grains, oncoids respectively, are in the Outer Dinarides area most known from the Main dolomite (Hauptdolomit) formation (BUSER, 1966; OGORELEC, 1988; DOZET, 1989, 1991).

#### 2. Marlstone and claystone

Concordantly upon the basal oolitic and oncolitic limestone lies a dark grey and rarely greyish black platy marlstone with rare thin layers of claystone. With reference to larger or smaller contents of carbonate the marlstone is more or less compact. On the weathered surfaces the dark colour passes to olive or brownish grey. The basal oolite-oncolite is not a continuous unit, since at some places, the marlstone lies directly upon the Cordevolian dolomite.

#### 3. Second oolite-oncolite horizon

The basal marlstone with interlayers of claystone passes upwards into 7,5 metres thick succession of dark grey to greyish black, platy (3-10 cm) marly limestone and limy marlstone with several intercalations (0,5 m) of nodular limestone with numerous ooids and from 0,5 cm to 1,5 cm thick oncoids.

#### 4. Marlstone and claystone

Concordantly upon the second oolite-oncolite horizon lies repeatedly a lithologic unit, represented by a dark grey to greyish black platy marlstone and claystone. In fact, more and less compact marlstones alternate. Less compact marlstone disintegrates to very small pieces. On the other hand, the compact one decomposes into plates and leaves. However, the less compact marlstone decomposes faster and more thoroughly. Due to this fact, the compact marlstone is prominent in the relief. The thickness of the second marlstone and claystone unit, the fourth lithostratigraphic unit respectively, is 15 metres.

#### 5. Bedded dolomite

Upwards in the lithological column follows a unit, composed of medium and thick-bed-

ded (20-75 cm), grey to medium light grey dolomite with thin parallelepiped disintegration.

The thickness of the bedded dolomite lithologic interval is 20 metres.

#### 6. *Marlstone and claystone*

Between the grey, bedded dolomite and the third oolite-oncolite horizon lies only 7,5 metres thick lithological interval, composed of dark grey, greyish black and if weathered olive grey and brownish grey, platy marlstone and claystone with a disintegration into very small splinter of wood-like fragments.

#### 7. *Third oolite-oncolite horizon*

As third oolite-oncolite horizon is designated 12,5 metres thick rock succession, which in the lower part consists of greyish black, bedded (25-40 cm) oolitic-oncolitic limestone and in the upper part of dark grey to greyish black marly limestone and marlstone being terminated by a layer of a nodular oncolitic limestone.

#### 8. *Marlstone and claystone*

The eighth lithostratigraphic unit is composed of dark grey to greyish black, if weathered olive and brownish grey, more or less limy marlstone and claystone. The thickness of the considered unit is about 30 metres.

#### 9. *Fourth oolite-oncolite horizon*

The fourth oolite-oncolite horizon is represented by greyish black, bedded (10-25cm), grained more or less marly limestone with numerous oblique up to 2 centimetres oncoids. The thickness of fourth oolitic-oncolitic horizon is 5 metres.

#### 10. *Marlstone and claystone*

Concordantly upon the fourth oolitic-oncolitic limestone horizon lies without any signs of interruption of sedimentation about 25 metres thick succession of dark grey to greyish black, platy, more or less limy marlstone and claystone.

The thickness of the marlstone and claystone upon the fourth horizon of oolitic-oncolitic limestone is about 25 metres.

#### 11. *Fifth oolite-oncolite horizon*

Concordantly upon the greyish black limy marlstone with thin interlayers of claystone lies the fifth oolite-oncolite horizon consisting of platy and bedded (5-10 cm, 10-20 cm), dark grey, dark brownish grey and greyish black, grained, nodular, marly limestone with numerous interlayers of oolitic-oncolitic limestone. Up to 3 cm thick oncoids are most commonly oblique and rarely roundish by shape. In the oncoid cores the fragments of crinoids, molluscs, rocks and echinoid spines can be most commonly seen. Here and there the oncoid core is composed of micrite. Beside oncoids rare ooids and intraclasts are present in the rock. The groundmass in the limestone is microsparite or sparite.

The thickness of the fifth oolitic-oncolitic limestone is 10 metres.

#### 12. *Marlstone and claystone*

In the pretty large quarry at the road Razbore-Čatež is well exposed the twelfth lithostratigraphic unit, represented by stratified (10-50 cm) and platy (5-10 cm), black, greyish black and dark grey marlstone and claystone. The main characteristic of both rocks is that they are shaly being decomposed in numerous plates and leaves. The thickness of this unit is about 35 metres.

### 13. *Bioclastic limestone*

In the bedded and platy marlstone behind the house of the mentioned quarry there is about 2,5-3,5 metres thick interbed of stratified (10-25 cm), greyish black, if weathered brownish grey, grained limestone with numerous mollusc fragments. Beside accumulated skeletons of decayed molluscs there are up to 1 cm thick oncoids, rare ooids and intraclasts in the rock.

### 14. *Marlstone and claystone*

Upon the bioclastic limestone with oncoids and ooids a greyish black to dark grey marlstone and claystone are developed. The marlstone is somewhat less limy than that one lying under the bioclastic limestone; therefore, it weathers fastly and more intensively.

In the lower part of this unit the marlstone is more compact, hard and resistant. The thickness of this lithologic unit is about 35 metres.

### 15. *Dolomite and dolomitic breccia*

The dark grey succession of marlstones and claystones is followed by 35 metres thick column of medium light grey, light grey and very light grey, stratified (20-60 cm) dolomicrite and dolosparite passing laterally and vertically into a thin-grained tidal dolomitic breccia, fenestral dolomite and stromatolitic dolomite.

### 16. *Dolomite, oolite, oncolite and marlstone*

The sixteenth lithostratigraphic unit is the most heterogeneous of all having two different developments.

On the main road one kilometre south of Čatež there is exposed the first development, represented by dark brownish grey, greyish

black and black, stratified (15-55 cm) marly dolomite intercalated by dark brownish grey to dark grey sandy marlstone, grained biointrasparitic limy dolomite with rare and small (0,5 cm) oncoids and rare thin interlayers of limestone-quartz sandstone. The considered succession of carbonate sediments is 10 to 15 metres thick.

The second development is exposed on the winding of the main road at Razbore, where concordantly upon the light grey, grained, massive, sometimes poorly stratified dolomite lies about 20 metres thick succession of platy (2-10 cm), dark olive grey to dark grey, sandy, bituminous dolomite with thin interlayers of black, if weathered dark olive and even red marlstone and claystone.

At seventh metres of the cross-section there is about one metre thick horizon of oncolite composed of dark grey dolomite groundmass and up to one centimetre extremely strongly hematitized oncoids.

### 17. *Dolomite*

Upon the both developments of the sixteenth lithostratigraphic units lies concordantly firstly platy (5-10 cm) and then stratified (10-30 cm), light grey to very light grey grained dolomite. The thickness of the considered sediment varies from 15 to 25 metres.

### 18. *Bedded limestone*

Above the platy and stratified dolomite rests a thick-bedded (20-45 cm), medium light grey, greyish black and black, micritic, biomicritic and biointrasparitic (mollusc fragments) limestone. The thickness of the bedded limestone does not exceed 15 metres.

### 19. Dark grey bituminous dolomite

The bedded limestone passes upwards into the medium dark grey to greyish black, thick-bedded (25-100 cm), very fine-grained bituminous dolomite with fine parallelepiped disintegration, that we range conventionally still into the Carnian stage. The stack of the dark grey thick-bedded dolomite is from 35 to 50 metres thick.

Still higher follow the beds of the light grey to very light grey, stratified (20-50 cm), micritic, grained, fine-laminated and stromatolitic Main dolomite.

### FOSSILS AND AGE

Fossil remains are in the considered beds rather rare but quite enough for separation of the Julian-Tuvalian beds from others. In the lowermost part of the Julian-Tuvalian beds in the Zaplaz at Čatež area GERMOVŠEK (1955) found the pelecypod *Myophoria inaequicostata* Klippstein as well as numerous echinoid spines of the genus *Cidaris*. The greater part of the discovered fauna has not been determined yet. In the considered marlstones and limestones beside above-mentioned fauna often remains of algae, foraminifers, echinoderms and molluscs can be obtained.

For the Julian-Tuvalian age of the considered sedimentary succession testify beside fossils typical lithologic composition and the stratigraphic position between the Cordevolian and the Main dolomite as well.

### ENVIRONMENT

According to sedimentological properties and fossil remains we conclude, the described sediments originated in a rather quiet and shallow marine environment. The beds of breccias, which interrupt a pretty monotonous sedimentation of limestones, indicate episodically supratidal and intertidal sedimentation. Dessiccation pores and stromatolites indicate an intertidal and supratidal environment. On the other side, ooids and oncoids originated in tidal channels area.

### CONCLUSIONS

- The succession of carbonate sediments on the hill Zaplaz (543 m) in the Čatež area lying concordantly between the Cordevolian and the Main dolomite is designated with the name Zaplaz formation.
- The Zaplaz formation consists of carbonate and clastic sediments. This previously carbonate succession is characterized by an alternation of thinner and thicker packets of marlstones and claystones as well as oolitic and oncolitic limestones and dolomites.
- Superpositionally and according to lithological composition the Zaplaz formation is subdivided into 19 lithostratigraphical units, namely: 1 – basal oolite-oncolite, 2 – marlstone and claystone, 3 – second oolite-oncolite horizon, 4 – marlstone and claystone, 5 – bedded dolomite, 6 – marlstone and claystone, 7 – third oolite-oncolite horizon, 8 – marlstone and claystone, 9 – fourth oolite-oncolite horizon,

10 – marlstone and claystone, 11 – fifth oolite-oncolite horizon, 12 – marlstone and claystone, 13 – bioclastic limestone, 14 – marlstone and claystone, 15 – dolomite and dolomitic breccia, 16 – dolomite, oolite, oncolite and marlstone, 17 – dolomite, 18 – bedded limestone and 19 – dark grey bituminous dolomite.

- The lower boundary of the considered formation is transgressive.
- The footwall of the formation is represented by the light grey massive Cordevolian dolomite. The formation passes upwards gradually into the Main dolomite (Hauptdolomit).
- The age of the formation is defined according to the stratigraphic position between the Cordevolian and the Main dolomite, with respect to its lithological composition containing among other several limestone horizons with ooids and oncoids similar to the alga *Spaerocodium bornemanni* Rothpletz, and with the pelecypod *Myophoria inaequicostata* Klippstein.
- According to lithological composition and considering sedimentary textures and fossils we came to conclusion that the sediments of the Julian and Tuvallian age in the Zaplaz at Čatež area originated in a calm marine environment of a shallow shelf, a lagoon respectively.
- The thickness of the sedimentary stratigraphic sequence belonging to the Zaplaz formation amount to about 350 metres.
- From the geotectonic point of view the investigated area belongs to the Outer Dinarides.

## POVZETEK

### Zaplaška formacija, osrednja Slovenija

#### *Splošno*

Zaplaško formacijo smo poimenovali po hribčku Zaplaz (543 m) pri Čatežu, kjer je razgaljen poseben razvoj srednje in zgornjekarnijskih plasti, sestavljen večinoma iz karbonatnih kamnin. Gre za menjavanje laporovcev in glinavcev, ki jih prekinjajo oolitni, onkolitni in dolomitni horizonti. Karbonatne razvoje karnijskih plasti imamo še na območju Velike Loke. Srednje- in zgornjekarnijsko karbonatno zaporedje pri Veliki Loki sestoji iz črnega do temno sivega mikritnega apnenca z vložki biomikrita in zrnatega apnenca, sivkasto črne, drobno- in srednjezrnate, plastnate (10-35 cm) apnenčeve breče, srednje sivega ploščatega in plastnatega (5-25 cm) zrnatega apnenca, rjavkasto in olivno sivega zelo tanko-ploščatega laporovca, plastnate (20-35 cm) drobnozrnate dolomitne breče ter srednje sive srednjezrnate apnenčeve breče s kalcitnim vezivom in organskimi ostanki. Naštete kamnine se med seboj menjavajo.

Glede na litološke značilnosti in stratigrafsko lego je srednje- in zgornjekarnijsko zaporedje Zaplaza pri Čatežu razdeljeno na devetnajst litoloških enot, ki jih opisujemo v vrstnem zaporedju od najstarejše (bazalni oolitno onkolitni apnenec) do najmlajše (temno sivi bituminozni dolomit).

#### *Spodnja in zgornja meja*

Srednje- in zgornjekarnijsko zaporedje karbonatnih kamnin, ki sem ga poimenoval zaplaška formacija, leži diskordantno na svetlo sivem do belem, zrnatem, v vrhnjem

delu mestoma slabo plastnatem, luknjičavem cordevolskem dolomitu.

Dokaj pestro razvite plasti zaplaške formacije prehajajo navzgor postopno v svetlo sivi, plastnati (20-50 cm), značilno drobnolaminirani in stromatolitni glavni dolomit. Tudi v glavnem dolomitu je najden (BUSER, 1974, 1976) okoli 1 m debel horizont svetlo sivega apnenca z izredno številnimi in s kalcitnim cementom trdno povezanimi, dobro sortiranimi onkoidi, ki so podobni algi *Sphaerocodium bornemanni* Rothpletz.

### *Opis litostratigrafskih enot*

#### *1. Bazalni oolitno-onkolitni apnenec*

Bazalni oolitno-onkolitni apnenec in druge kamnine julsko-tuvalskega zaporedja Zaplaza leže kot tanka plast na cordevolskem dolomitu (GERMOVŠEK, 1955). Tudi BUSER (1974, 1976) je ugotovil, da na Zaplazu pričenjajo zgornjekarnijske (jul in tual) plasti z do tri metre debelo plastjo temno sivega onkolitnega apnenca. Kamnina sestoji iz mikrosparitnega in sparitnega veziva, onkoidov, fosilnih ostankov (krinoidi, bodice morskih ježkov, moluski), ooidov in redkih zrn kremenca. Kremenova zrna so oglata in slabo zaobljena. Onkoidi so bolj ali manj podolgovati. V jedru so najpogostejši ostanki ehinodermalnih ploščic ali bodic ježkov. Ooidi dosežejo do 3,0 cm velikosti. Na prvi pogled so podobni algi *Sphaerocodium bornemanni* Rothpletz.

Ovita zrna (coated grains) oziroma onkoidi so pri nas najbolj znani iz glavnega dolomita. BABIĆ (1969) je dokazal, da ta zrna ne pripadajo algi *Sphaerocodium bornemanni* Rothpletz. OGORELEC (1988) je opisal zgornjetriasne onkoidne horizonte zahodne

Slovenije. Prištel jih je LOGAN ET AL. (1964) oblikam SS-C (sphaeroidal structures, concentric form), SS-I (inverted form) in SS-R (randomly stacked form). Ovita kroglasta telesa v glavnem dolomitu Kočevske brez sledov organske strukture je opisal in uvrstil med onkoide DOZET (1991). Odkril je 17 nivojev onkolitnega dolomita. Onkoidi so vedno izredno številni in nastopajo tako tesno skupaj, da so kamenotvorni.

#### *2. Laporovec in glinavec*

Konkordantno na bazalnem onkolitnem apnencu leži ploščast, temno siv in redko sivkasto črn laporovec z redkimi tankimi vložki glinavca. Glede na večjo ali manjšo vsebino karbonata je laporovec bolj ali manj trd. Na preperelih površinah obeh kamnin prehaja temna barva v olivno in rjavkasto sivo. Bazalni oolitno onkolitni apnenec ni zvezna litološka enota, saj ponekod leži neposredno na cordevolskem dolomitu laporovec.

#### *3. Drugi oolitno-onkolitni horizont*

Laporovec z vložki glinavca prehaja nazgor v 7,5 metrov debelo skladovnico temno sivega do sivkasto črnega, ploščastega (3-10 cm) lapornega apnenca in apnenčevega laporja z nekaj vložki (0,5 m) gomoljastega apnenca s številnimi ooidi in od 0,5 cm do 1,5 cm velikimi onkoidi.

#### *4. Laporovec in glinavec*

Konkordantno na drugem oolitno onkolitnem horizontu leži ponovno litološka enota, ki jo predstavlja temno siv do sivkasto črn ploščast laporovec z vložki glinavca. V bistvu gre za menjavanje trdih in mehkejših plasti obravnavanega laporovca. Mehkejši laporovec se kroji iverasto, trdi pa v še tanjše plošče in liste. Laporovec z iverasto krojivijo



hitreje razpada kot trdi. Slednji zato marsikje izstopa v reliefu. Debelina druge laporovčeve enote oziroma četrte litostratigrafske enote znaša 15 metrov.

#### 5. *Plastnati dolomit*

Navzgor v litološkem stolpcu sledi enota, ki jo sestavlja srednje in debeloplastnat (20-75 cm) siv do srednje svetlo siv dolomit z drobno paralelepipedsko krojivtijo. Debelina skladovnice plastnatega dolomita znaša okoli 20 metrov.

#### 6. *Laporovec in glinavec*

Med sivim plastnatim dolomitom in tretjim oolitno onkolitnim horizontom leži 7,5 metrov debel litološki interval, ki ga izpolnjuje temno siv, sivkasto črn in če je preperel olivno siv in rjavkasto siv, ploščast, srednje trd laporovec z iverasto krojivtijo, ki se menjava z glinavcem.

#### 7. *Tretji oolitno-onkolitni horizont*

Kot tretji oolitno-onkolitni horizont smo označili 12,5 metrov debelo skladovnico, ki v spodnjem delu sestoji iz sivkasto črnega plastnatega (25-40 cm) oolitno onkolitnega apnenca, v zgornjem delu pa sta temno siv do sivkasto črn laporni apnenec in laporovec, nad katerim leži plast gomoljastega onkolitnega apnenca.

#### 8. *Laporovec in glinavec*

Osmo litološko enoto sestavljajo temno siv do sivkasto črn, če je preperel olivno in rjavkasto siv bolj ali manj apnenčev laporovec in redki tanki vložki glinavca. Debelina obravnavane enote znaša okoli 30 m.

#### 9. *Četrta oolitno-onkolitni horizont*

Četrta oolitno-onkolitni horizont predstavlja sivkasto črn, plastnat (10-25 cm), zrnat, bolj

ali manj lapornat apnenec s številnimi do 2 cm velikimi onkoidi.

Debelina četrtega oolitno-onkoidnega horizonta znaša 5 m.

#### 10. *Laporovec, glinavec*

Na četrtem horizontu oolitno-onkolitnega apnenca leži konkordantno in brez znakov prekinitve sedimentacije okoli 25 m debelo zaporedje temno sivega do sivkasto črnega, če je preperel olivno sivega, ploščatega bolj ali manj apnenčevega laporovca in glinavca. Debelina laporovca in skrilavega glinavca nad četrtem horizontom oolitno-onkolitnega apnenca znaša okoli 25 m.

#### 11. *Peti oolitno-onkolitni horizont*

Konkordantno na sivkasto črnem apnenčevem laporovcu s tankimi vložki glinavca leži peti oolitno-onkolitni horizont, ki sestoji iz ploščatega in plastnatega (5-10 cm, 10-20 cm), temno sivega, temno rjavo sivega in sivkasto črnega, gomoljastega, zrnatega in lapornega apnenca s številnimi vložki oolitno-onkolitnega apnenca. Do 3 cm veliki onkoidi so najpogosteje podolgovate in redkeje kroglaste oblike. V jedru onkoidov so najpogosteje odlomki ehinodermov, krinoidov, bodic ježkov, moluskov ali kamnin. Tu in tam je jedro onkoida iz mikrita. Poleg onkoidov nastopajo v kamnini še redki ooidi in intraklasti. Vezivo kamnine je mikrosparitno ali sparitno.

Debelina petega oolitno-onkolitnega apnenčevega horizonta je 10 metrov.

#### 12. *Laporovec, glinavec*

V velikem kamnolomu ob cesti Razbore-Čatež je zelo lepo razkrita dvanajsta litostratigrafska enota, ki jo predstavljajo plastnat (10-50 cm) in ploščast (8-10 cm), črn, sivkasto črn in temno siv laporovec,

apnenčev laporovec in glinavec. Če je preperel je laporovec olivno siv, na površini ploškev in razpok pa je sivkasto rumen, oranžen ter temno rjavo rdeč. Glavna značilnost laporovca je, da je skrilav in da razpada v številne vedno tanjše plošče in liste. Debelina te enote je okoli 35 metrov.

### 13. Bioklastični apnenec

V prej omenjenem kamnolomu je v plastnatem in ploščastem laporovcu za hišo okoli 2,5-3,5 m debel vložek plastnatega (10-25 cm), sivkasto črnega, če je preperel pa svetlo rjavega zrnatega apnenca s številnimi fragmenti lupin moluskov. Poleg nakopičenih skeletov odmrlih moluskov se v kamnini dobijo še do 1 cm veliki onkoidi, redki ooidi in intraklasti.

### 14. Laporovec in glinavec

Nad bioklastičnim apnencem z onkoidi in ooidi je ponovno razvit sivkasto črn do temno siv laporovec z vložki glinavca, ki pa je nekoliko manj apnenčev kot tisti, ki leži pod bioklastičnim apnencem; zato tudi hitreje prepereva. V spodnjem delu te enote je laporovec bolj trd in kompakten. Debelina te litološke enote znaša okoli 35 metrov.

### 15. Dolomit in dolomitna breča

Temno sivemu zaporedju apnencev, laporovcev in skrilavcev sledi 35 metrov debela skladovnica srednje svetlo sivega, svetlo sivega in zelo svetlo sivega, plastnatega (20-60 cm) dolomikrita in dolosparita s prehodi v drobnozrnato nadplimsko brečo, fenestralni dolomit in stromatolitni dolomit.

### 16. Dolomit, oolitni in onkolitni apnenec

Šestnajsta litostratigrafska enota je najbolj pestra in ima dva različna razvoja.

Ob glavni cesti 1 kilometer južno od Čateža je razkrit prvi razvoj, ki ga predstavlja temno rjavo siv, sivkasto črn in črn, plastnat (15-55) laporni dolomit z interkalacijami temno rjavo sivega do temno sivega peščenega laporovca, zrnatega bioosparitnega apnenčevega dolomita z redkimi drobnimi (0,5 cm) onkoidi ter redkimi tankimi vložki apnenčevo-kremenovega peščenjaka. Našteto zaporedje karbonatnih sedimentov je debelo 10 do 15 metrov.

Drugi razvoj je razgaljen na ovinku glavne ceste na območju Razbor, kjer leži konkordantno na svetlo sivem, zrnatem, masivnem, včasih slabo plastnatem dolomitu okoli 20 metrov debela skladovnica ploščastega (2-10 cm), temno olivno sivega do temno sivega, peščenega bituminoznega dolomita s tankimi vložki črnega, če je preperel temno olivno sivega do rdečega laporovca in glinavca. Na sedmem metru skladovnice je okoli 1 m debel horizont onkolitnega dolomita, ki ga sestavljajo temno siva dolomitna osnova ter do 1 cm veliki izredno močno hematitizirani onkoidi.

### 17. Dolomit

Nad obema razvojema šestnajste litostratigrafske enote leži konkordantno sprva ploščast (5-10 cm) nato plastnat (10-30 cm) svetlo siv do zelo svetlo siv zrnat dolomit. Debelina omenjenega sedimenta znaša 15 do 25 metrov.

### 18. Plastnati apnenec

Nad dolomitom je skladovnica srednje svetlo sivega, sivkasto črnega in črnega, debelo

plastnatega (20-45), mikritnega, biomikritnega in biointrasparitnega (odlomki moluskov) apnenca. Apnenec se lateralno izklinja. Debelina skladovnice plastnatega apnenca ne presega 15 metrov.

#### 19. *Temno sivi bituminozni dolomit*

Plastnati apnenec prehaja navzgor v srednje temno siv do sivkasto črn, debeloplastnat (25-100 cm), zelo drobnozrnat dolomit z drobno paralelepipedsko krojivtviijo, ki ga uvrščamo še v karnijsko stopnjo. Skladovnica temno sivega debeloplastnatega dolomita je debela od 35 do 50 metrov.

Še više sledijo plasti svetlo sivega do zelo svetlo sivega, plastnatega (20-50 cm), mikritnega, zrnatega, drobnolaminiranega in stromatolitnega glavnega dolomita.

#### *Fosili in starost*

Fosilni ostanki so v obravnavanih plasteh dokaj redki, vendar zadostujejo da julsko-tuvalske plasti ločimo od ostalih. Na Zaplazu pri Čatežu je GERMOVŠEK (1955) v najspodnjem delu našel školjko *Myophoria inequicostata* Klippstein in številne bodice morskih ježkov rodu *Cidaris*. Večji del najdene favne iz tega nahajališča pa ni obdelan. V laporovcih in apnencih se dobijo še ostanki alg, foraminifer, ehinodermov in moluskov.

Poleg omenjene školjke kažeta na julsko in tuvalsko starost opisanega zaporedja sedimentov tudi tipična litološka sestava in stratigrafska lega med cordevolskim in glavnim dolomitom.

#### *Okolje nastanka*

Po sedimentoloških značilnostih in fosilnih ostankih sklepamo, da so opisani sedimenti nastajali v dokaj plitvem in mirnem morskem sedimentacijskem okolju. Plasti breč, ki prekinjajo precej monotono sedimentacijo apnencev, kažejo na občasno medplimsko in nadplimsko sedimentacijo. Izsušitvene pore in stromatoliti govorijo za medplimsko in nadplimsko okolje. Ooidi in onkoidi so nastajali na območju medplimskih kanalov.

#### *Sklep*

- Karbonatno zaporedje sedimentov na območju Zaplaza pri Čatežu, ki leži med cordevolskim in glavnim dolomitom, smo označili z imenom zaplaška formacija.
- Zaplaška formacija sestoji iz karbonatnih in klastičnih sedimentov. V njeni litološki sestavi močno prevladujejo laporovci. Karakterizira jo menjavanje tanjših in debelejših partij laporovcev, glinavcev, oolitno-onkolitnih apnencev in različnih dolomitov.
- Superpozicijsko in po litološki sestavi je zaplaška formacija razdeljena na 19 litostratigrafskih enot, s tem, da 16. litostratigrafska enota ima dva precej različna razvoja.
- Spodnja meja obravnavane formacije je transgresivna.
- Talnino formacije predstavlja svetlo siv, masiven, luknjičav cordevolski dolomit, navzgor pa ta formacija prehaja postopno v glavni dolomit.

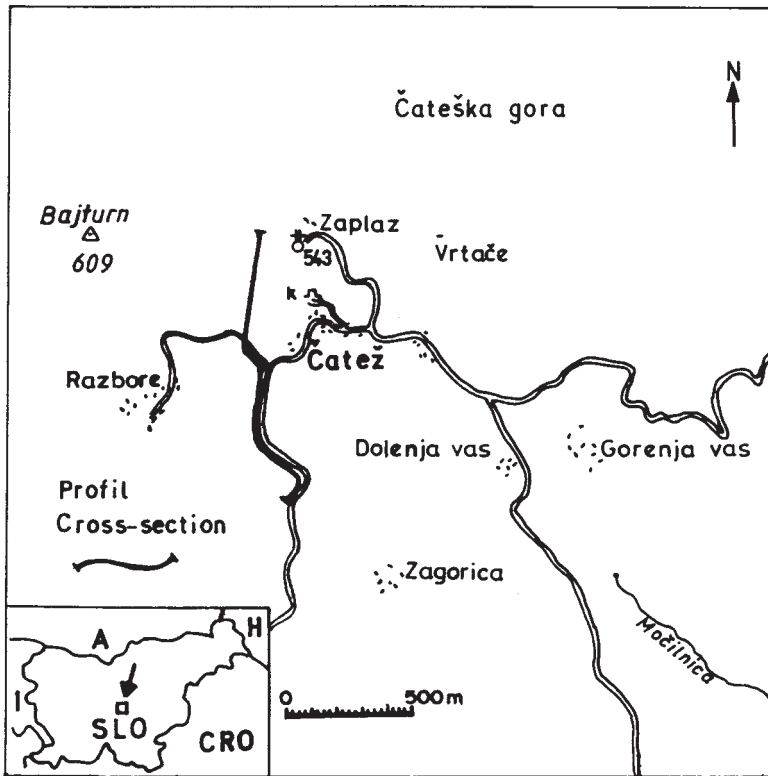
- Starost formacije je določena po stratigrafski legi med cordevolskim in glavnim dolomitom, litološki sestavi (vsebuje več horizontov apnencev z ooidi in onkoidi, ki so podobni algi *Sphaerocodium bornemanni* Rothpletz) ter s školjko *Myophoria inaequicostata* Klippstein.
- Po litološki sestavi zaporedja ter po sedimentnih teksturah in fosilih sklepamo, da so sedimenti julsko-tuvalske starosti na območju Zaplaza in okolice nastajali v mirnem sedimentacijskem okolju plitvega šelfa oziroma lagune.
- Debelina zaporedja sedimentov, ki pripadajo zaplaški formaciji, znaša okoli 350 metrov.
- V geotektonskem pogledu pripada raziskano ozemlje Zunanjim Dinaridom.

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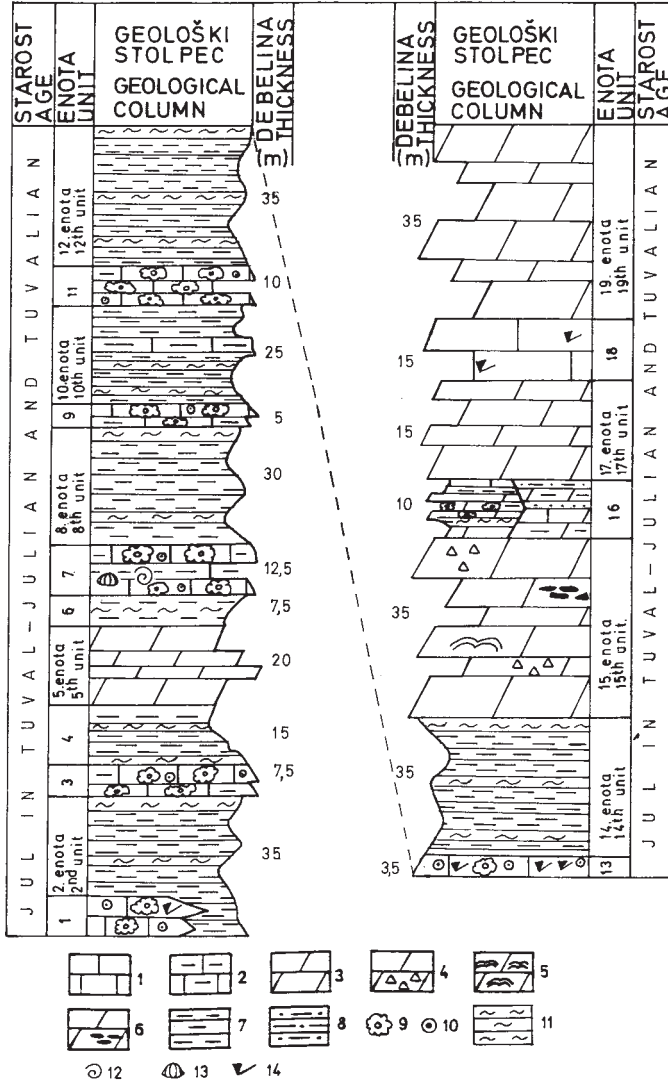
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Slika 1. Položajna skica raziskanega ozemlja.  
 Figure 1. Location sketch map of the study area.



Slika 2. Hribček Zaplaz (543 m) po katerem smo pisano zaporedje sedimentov med cordevolskim in glavnim dolomitom poimenovali zaplaška formacija.  
 Figure 2. The hill Zaplaz (543 m) according to which we denominated the heterogeneous sedimentary succession between the Cordevolian and Main dolomite as Zaplaz formation.



SL. LEGENDA

- 1 - plastnati mikritni apnec, 2 - plastnati laporni apnec,
- 3 - plastnati dolomit, 4 - brečasti dolomit, 5 - stromatolitični dolomit, 6 - fenestralni dolomit, 7 - laporovec, 8 - peščeni laporovec, 9 - onkoidi, 10 - ooidi, 11 - glinavec, 12 - makrofauna, 13 - ehinodermi, 14 - ostanki fosilov

FIG. EXPLANATION

- 1 - bedded micritic limestone, 2 - bedded marly limestone,
- 3 - bedded dolomite, 4 - brecciated dolomite, 5 - stromatolitic dolomite, 6 - fenestral dolomite, 7 - marlstone, 8 - sandy marlstone, 9 - oncoides, 10 - ooides, 11 - claystone, 12 - macrofauna, 13 - echinoderms, 14 - fossil remains

Slika 3. Litostratigrafski stolpec julskih in tuvalskih plasti zaplaške formacije pri Čatežu.  
 Figure 3. Lithostratigraphic column of the Julian and Tuvalian beds of the Zaplaz formation at Čatež.



**Slika 4.** Temno sivi do sivkasto črni, plastnati in ploščasti laporovci in glinavci dvanajste litostratigrafske enote.

**Figure 4.** The dark grey to greyish black bedded and platy marlstones and claystones of the twelfth lithostratigraphic unit.