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MACEDONIAN GEOLOGICAL SOCIETY SKOPJE 1952

5-ти КОНГРЕС / 5-th CONGRESS

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ПРЕДГОВОР

Почитувани гости, колеги геолози и љубопитни души,

Добредојдовте на 5-тиот Конгрес на геолозите на Република Северна Македонија - интелектуално патување кое ги надминува границите, епохите и карпестите формации. Додека сите ние се собираме под знамето на минатата историја на Земјата и нејзината сегашност која постојано се развива, да тргнеме на патување кое ги обединува науката, "чудата" и откритијата.

Љубопитноста е она што не води и во исто време таа е и нашето наследство.

Геолошкиот конгрес е местото каде идеите би можеле да се судрат како тектонски плочи, предизвикувајќи сеизмички промени во разбирањето. Нашиот Конгрес не е само социјално дружење туку во 2024 тој е раскрсница на дисциплини. Момент кога треба да размислуваме не само за старите седиментни слоеви, туку и за итните предизвици на нашето време: климатските промени, недостигот на ресурси и деликатниот танц помеѓу човештвото и природата. Ако порано се трудевме со релативните методи да ги истражуваме и дешифрираме "тајните" пораки врежани во минералите и фосилите, денес во нашите лаборатории зујат спектрометри, а над нас летаат дронови со опции за термичка обработка на податоци, картирање и 3D моделирање. Тоа се денес алатките на модерната геологија.

Нашиот Конгрес не е само за карпи и минерали, туку всушност се работи за луѓе. Геолозите од секое катче на нашата држава и поширокото опкружување, без разлика дали се облечени во теренски чевли или во лабораториски мантили, на ова место се спојуваат и споделуваат. Споделуваме податоци, разменуваме приказни и поттикнуваме соработки. Во светлите

PREFACE

Dear guests, fellow geologists and curious souls,

Welcome to the 5th Congress of Geologists of the Republic of North Macedonia - an intellectual journey that transcends borders, eras and rock formations. As we all gather under the banner of Earth's past history and its ever-evolving present, let us embark on a journey that unites science, "wonders" and discoveries.

Curiosity is what guides us and at the same time it is our heritage.

A geological congress is where ideas could collide like tectonic plates, causing seismic shifts in understanding. Our Congress is not only a social meeting, but in 2024 it is a crossroads of disciplines. A moment when we should think not only about the old sedimentary layers, but also about the urgent challenges of our time: climate change, the scarcity of resources and the delicate dance between humanity and nature. If earlier we tried with relative methods to research and decipher the "secret" messages engraved in minerals and fossils, today spectrometers buzz in our laboratories, and drones fly above us with options for thermal data processing, mapping and 3D modeling. These are the tools of modern geology today.

Our Congress is not just about rocks and minerals, it's really about people. Geologists from every corner of our state and the wider environment, regardless of whether they are wearing field shoes or lab coats, come together and share in this place. We share data, exchange stories and foster collaborations. In the bright halls of the convention center, continents collide and ideas crystallize.

As we gather for fellowship together, remember: The Earth Atlas remains unfinished. There are peaks unclimbed, faults unknown and mysteries lurking beneath ocean trenches. Our task is to fill in those blanks—to map not only

али на конгресниот центар, континентите се судираат и идеите се кристализираат.

Додека се собираме за заедничка дружба, запомнете: Земјиниот атлас останува недовршен. Има врвови неискачени, раседи непознати и мистерии кои демнат под океанските ровови. Наша задача е да ги пополниме тие празни места - да ги картираме не само геолошките форми, туку и нашата издржливост и надеж за опстојување во се покомплексното глобално опкружување. Да се сплотиме во таа долгорочна и постојана експедиција. Без разлика дали сте искусен геолог или само геолог почетник чија љубопитна душа со чудење гледа во планините, овој Конгрес ве поканува. Да истражуваме, да дебатираме и да не оставиме недореченост. Ајде заедно да го напишеме следното поглавје на Земјата. Нека науката и љубопитноста бидат нашиот геолошки компас.
Ве поздравуваме со пораката “Ајде да истражуваме подлабоко и пошироко - заедно**“**

Претседател на Македонско Геолошко друштво:

Академик Проф. д-р Блажо Боев

geological forms, but also our resilience and hope for survival in an increasingly complex global environment. Let's unite in that long-term and permanent expedition. Whether you are an experienced geologist or just a novice geologist whose curious soul gazes at the mountains with wonder, this Congress invites you. Let's research, debate and leave no ambiguity. Let's write Earth's next chapter together. Let science and curiosity be our geological compass.

We welcome you with the message "let's explore deeper and wider – together"

President of the Macedonian Geological Society:

Academic Prof. d-r. Blazo Boev

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NEW INFORMATION ON THE AGE OF THE PEGMATITES OF CANISTE (PELAGONIAN METAMORPHIC COMPLEX), NORTH MACEDONIA

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ABSTRACT
The occurrence of pegmats within the Pelagonian metamorphic complex is quite common. They appear within the metamorphic complex of the gneisses and in direct contact with the granitic intrusive bodies. Mainly these pegmatite bodies are made of quartz, feldspars, micas (bioite, muscovite, paragonite, vermuiculite) as well as the occurrence of rare minerals such as tourmalines, epidotes, apatites, garnets and zircons. The paper presents the new information related to the age of two pegmatitic bodies: Alinci and Chaniste. The obtained age is Cretaceous
.
Key words: Alinci, Caniste, cretaceous age,

INTRODUCTION

Pelagonian belt (zone)

The Jadar-Drina-Ivanjica-Pelagonian belt (Pelagonides) is situated between the Sava suture (West of the Vardar zone) and the Dinaride (West Vardar) ophiolite belt. It consists mostly of Precambrian and Paleozoic complexes covered by Triassic and Jurassic carbonates and thrust and imbricated within the whole west-vergent nappe pile west of the Vardar s.s. zone. It was covered by Upper Cretaceous flysch, and involved again in west-vergent thrusting in Palaeogene times (Zagorcev 2020).

The Jadar unit consists of several thrust sheets differing considerably in their facies. A Devonian–Lower Carboniferous flysch borders pelagic carbonates of the same age. Different facies (sandstones, conglomerates, fusunilid limestones) follow in the Upper Carboniferous, and are covered by transgressive Permian siliciclastics and Bellerophon limestones. They are covered by Triassic platform carbonates, similar to those in the Drina-Ivanjica unit, and thin Lower Jurassic limestones and cherts. Studies in the Drina-Ivanjica unit have distinguished several formations of Cambrian to Early Carboniferous age. They consist of arenites to slates with some interbeds of limestones, cherts, and polymictic conglomerates. Thick turbidites are present in some parts of the section. The metamorphic grade varies from very low grade to greenschist facies. The Paleozoic section is covered by a full Triassic section characterized by some typical Alpine-type facies. The Upper Triassic is tectonically covered by ophiolitic mélange and by transgressive Upper Cretaceous (Zagorcev, 2020)

The Pelagonian metamorphic complex or tectono-stratigraphic complex is about 420 km long and about 60 km wide and extends in the NNW-SSE direction as part of the central Hellenides (Palinkas et al 2012).

The Pelagonian massif is the largest unit of the belt. It is situated between the Vardar zone and the Dinaride (West Vardar) ophiolite belt on the territories of North Macedonia and Greece (Florina “terrane”). The high-grade (amphibolite-facies with eclogite relicts) metamorphic rocks may be divided into two parts: a lower complex built of biotite and two-mica gneisses, amphibolites, hornblende and epidote-hornblende gneisses, leucocratic gneisses, migmatites and orthogneisses, and an upper complex of gneisses, micaschists, amphibolites, calcareous schists, and massive marbles (Sivec marbles). Both Rb-Sr determinations in the northern parts of the massif in North Macedonia, and recent U-Pb determinations in Greece (Florina “terrane”) indicate (polymetamorphic) Neoproterozoic ages for these complexes (up to 700 Ma in the metagranites), with one very important Late Carboniferous metamorphic and igneous event at c. 300 Ma. (Zagorcev, 2020).

At the base of this complex is a Precambrian crystalline core built of ortho and paragneisses, micaschists and amphibolites. Granitoid magmatism was embedded in the

crystalline core during several epochs, namely: : I) Upper Carboniferous and II) Late Permian – Early Triassic magmatic events (Most et al, 2003). Pelagonian granitoids range from granite to quartz-diorite, but are mainly granodioritic in composition (Dumurdzanov, 1985; Most et al, 2003). The Upper Carboniferous granodiorite (299 ± 1 Ma, U/Pb zircon age dating; Most et al, 2003) underwent compressional deformation and developed a greenschist to amphibolite-grade metamorphic overprint. A Late Permian – Early Triassic granodiorite (~245 ± 1 Ma, U/Pb zircon age dating; Most et al, 2003) is represented by massive intrusive bodies within the Eastern Pelagonian zone, including the Selečka Mts. The investigations of the age of the pegmatites in Alinci (K/Ar method 105.2 Ma) indicate the existence and significant magmatic activity during the Cretaceous period, starting from the Lower Cretaceous (Boev, I et al, 2021). A sedimentary sequence, comprising carbonate and clastic rocks, was deposited during Triassic and Jurassic times. The geological structure of the Pelagonian zone is mostly a consequence of polyphase tectonometamorphic events during convergence of the Apulian and European plates between the Upper Jurassic and Upper Tertiary times (Most et al, 2003).

Local geology

To examine the age of the pegmatites in the Pelagonian metamorphic complex, samples were taken from two localities: Alinci and Čanište, and a microcline sample was taken from the Alinci locality to determine the age (for K/Ar geochronology) (Fig 1), and from the Čanipšte locality zircon was taken (for U/Pb geochronology).

Figure.1 Microcline+albite+arfedsonite from Alinci locality

The Alinci locality is located near the village of Alinci, about 3 km from the Prilep-Bitola regional road. The locality itself is located within the Pelagonian metamorphic complex in a metamorphic beam that separates the Prilep field from the Bitola field. Here, the metamorphic rocks (gneisses) form three elevations that descend from the northern branches of Selechka Mountain in the Pelagonian valley. The locality itself is located on a hill called Crn Kamen (Marić, 1949). The pegmatitic occurrences themselves are considered in the series of alkaline syenites and gneisses. Pegmates occurrences are made up of microcline, arfedsonite, albite, titanite, augite, zircon and apatite (Baric, 1964).

A specific trait of the deposit is its rare mineral paragenesis, which includes uranium minerals. It is important to note that there are frequent nests of several centimeters in size filled with needle-like arfvedsonite crystals. Arfvedsonite is a mineral of the amphibole group occurring as acicular shapes of greenish, dark or blue tinge. It appears as an inclusion in other mineral forms. Albite is also common, appearing as platy white to totally transparent crystals. The largest crystals attain 10 cm in size. Twinned individual grains (as polysynthetically twinned) or Carlbad's twins are common. Arfvedsonite crystals are frequent inclusions in albite. Of note are the well developed quartz crystals, the large titanite crystals (attaining 2 cm in size) as well as the crystals of monazite and macedonite.

There is also the occurrence and specific association of rare minerals with uranium content (davidite) (Damjanovic, 1961, Georges et al, 1988/1989, 1999).

The Čanište pegmatite is one of numerous pegmatite occurrences within the Eastern Pelagonian zone. The pegmatites vary in size from a few decimetres wide and tens of metres long to larger bodies tens of metres wide by hundreds of metres long. They differ according to the mineralogical features, the internal structures and the fractionation degree as well. Beside epidote-bearing ones (Čanište and Dunje localities), the most interesting are those enriched in uranium and thorium mineralization (Alinci and Crni Kamen localities; e.g. Ivanov et al., 1966; Radusinovic & Markov, 1971; Bermanec et al., 1988, 1992;). The Čanište lens-shaped, up to 10 m wide pegmatite body, cuts Precambrian

gneisses (Dumutdzanov, 1985; Most et al, 2003).

In the Caniste locality, the pegmatite vein is up to 15 meters long and up to 50 meters long. It is composed mainly of potassium-sodium feldspar, quartz, a smaller amount of biotite, and epidote that occurs in large crystals. Garnet and amazonite occur less frequently. It should be noted that zircon also appears in Caniste, and it is the only locality in the pegmatites in which zircon appeared.
Zircon in the Chanishpte pegmatite vein occurs in two varieties.

1. Zircon, which appears in the microdig as tiny crystalline aggregates, cream to pale white in color, very cracked, and the cracks are not filled with other minerals, and plagioclase, quartz, and fine-grained muscovite also appear in addition to it,(Fig 2)

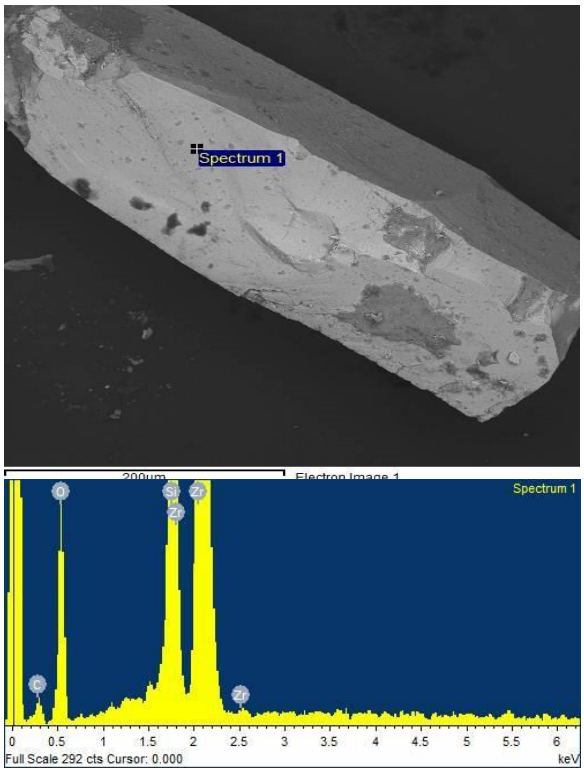

Figure 2. SEM-EDS of cream to pale white zircon from Caniste

2. Zircon which is dark yellow in color and does not show any differences in the microscope compared to the previous variety, this one is also cracked and appears in association with plagioclase, quartz and muscovite.(Fig 3).
In the Caniste locality, the pegmatite vein is up to 15 meters long and up to 50 meters long. It is composed mainly of potassium-sodium feldspar, quartz, a smaller amount of biotite, and epidote that occurs in large crystals. Garnet and amazonite occur less frequently. It should be noted that zircon also appears in Caniste, and it is the only locality in the pegmats in which zircon appeared.

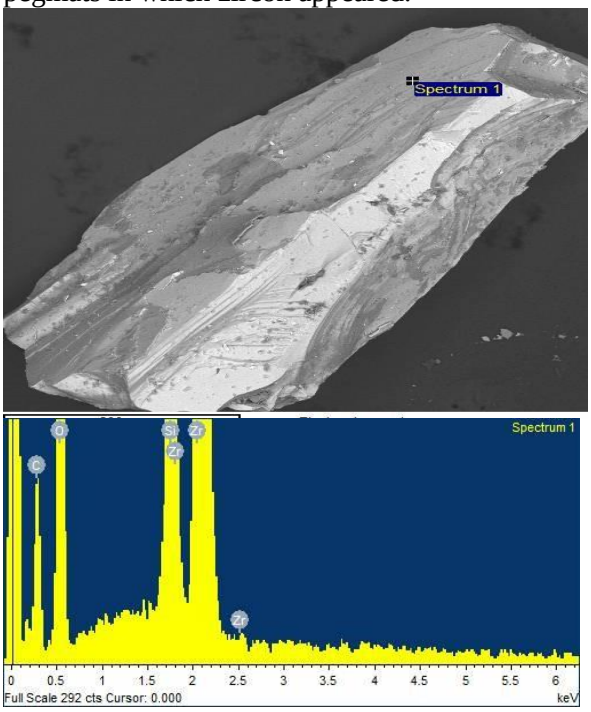

Figure 3. SEM-EDS of dark yellow zircon from Caniste

RESULTS AND DISCUSSION

The Pelagonian metamorphic complex has been exposed to polyphase tectonic deformations and metamorphism for a long time so that its thermal evolution becomes very complex. Based on the investigations of the age of the biotites using the K/Ar method (Most et al, 2001), four tectonic-magmatic phases can be distinguished within the Pelagonian metamorphic complex, which occurred at the pre-Cambrian base. One group of processes occurred in the interval from 447+-17 MA to 267+-10MA, the second group of dynamo thermal metamorphic processes that were followed by partial melting processes occurred in the interval from 148+-6MA to 114+-4 MA , the third group of processes occurred in the interval from 102+-4 MA to 86+-34 MA and the fourth group of processes occurred in the interval from 64 MA to 36 MA. From the above, it can be concluded that the Pelagonian metamorphic

complex has a very complex and versatile thermal evolution over a longer period of time of about half a billion years. The formation of the pegmatite bodies within the Alinci locality occurred as a result of the partial melting that took place in the gneisses during the Cretaceous period (105.2 +-2.3 MA) in the so-called third phase of the thermal evolution of the Pelagonian metamorphic complex. It must be mentioned here that the formation of the pegmatite teals in the Caniste localities occurred in the second phase of the thermal evolution of the pelagonian metamoprphic complex in the interval of 134,9+- 1,8 MA.

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