Report on the ELUSCSEG field trip to SE-Serbia and W-Bulgaria


The field trip was sponsored by the Stewart R. Wallace Fund of the SEG
Our group was welcomed by the Avala Resources and Medgold companies
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The Balkan Peninsula hosts numerous unexploited mineralizations mostly due to the extensive magmatism the area experienced from the Late Cretaceous until the Pleistocene. After the clouds of war and political instability cleared up above the area in recent times, the governments of most of the countries realized that mineral exploration and exploitation can be a key sector for economic development, therefore they made amendments in favor of these activities. As a result, companies interested in the promising mineral deposits of the area started to show up and make explorations.

Although Hungary is in the neighbourhood, we rarely study the mineralizations of the Balkan Peninsula. We organized this field trip in order to provide students with mineral exploration interest an opportunity to study such mineralizations on the field. Another important point was that mineral exploration companies Avala Resources and Medgold companies kindly hosted our group, therefore we had a chance to take a look into the operation of professional mineral exploration processes including borehole drilling, drillcore investigation and description, data processing and modeling of mineralizations. This part is extremely important, since such fields are only limitedly covered in our university studies.

We organized a five day field trip for the members of our Student Chapter (Eötvös Loránd University SC of the SEG) with two days of company visiting and two days of field studies on our own in Serbia, and one day of museum visiting and cultural trip to Sofia, Bulgaria.
Sunday, 30th of September: The field trip started with a long journey to Donji Milanovac, Serbia about 5-6 hours on the road, so we planned some cultural stops before starting the professional program. First, we had a longer stay about 3 hours in Belgrad, the capital of Serbia. We visited the castle and the fortress of the city, which was an important place in the Hungarian history when the Turkish conquest was stopped here on the 22nd of July 1456. The castle is located on the riverside of the Danube and give a view of the confluence of the Sava and the Danube. After leaving the capital, we made a quick stop in the sunset at the Castle of Golubac, which settles on the side of the Danube as well, and was also a part of the Historical Hungary with the name of Galambóc. Then we continued our travel and finally arrived to Donji Milanovac at 9pm.

Fortress of Belgrad

Monday, 1st of October: On Monday morning we left Donji Milanovac and headed to the town of Bor in Eastern Serbia. Our field stop was at the Bor metallogenic zone in the Timok Magmatic Complex (TMC), which is an 85 km long and 25 km wide N-S striking magmatic zone. It comprises Jurassic to Early Cretaceous clastic sedimentary rocks and limestone (hosting gold, silver and copper mineralizations) overlain by andesitic volcanic and volcanoclastic rocks, further intruded by several generations of high K, calc-alkaline intrusives (diorites, monzonites). Magmatism has been documented over a 12 Ma period from 89 Ma to 77 Ma. The Eastern margin of TMC hosts the HS epithermal Cu-Au and porphyry Cu-Au deposits of the Bor metallogenic zone. We were welcomed by associates from Avala Resources (part of Dundee Precious Metals), running the Timok Au Project.
After a presentation about their current work, some of us also gave a brief presentation of our own projects and we were also invited to lunch. On the afternoon, we were showed the warehouse and had the chance to inspect several showcased drillcores presenting various promising sections of the zone. Au and Ag content averaging more than 1 ppm Au (sometimes over 20 ppm) appeared persistently.

Showcased drillcores containing up to 28 ppm Au

Afterwards, we were taken to a long field trip to Bigar Hill and Korkan and had the chance of inspecting the various layers of mineralized rocks and collecting specimens.

Lastly, we visited the copper mine of Bor and got a presentation about its geology and history as well. The huge pit is used now as a waste dump for the neighbouring Veliki Krivelj copper mine.

Open-pit of copper mine of Bor being filled by the spoil tip of the underground mining facility nearby
Before nightfall we headed for our new accomodation for the next 3 nights at Lake Vlasinsko.

**Tuesday, 2nd of October**: On this day, we visited the Barje Prospect of the Tlamino Gold Project in Bosilegrad (Southern Serbia) run by the Medgold Resources. Szabolcs Orbán, one of the field geologists showed us the lab, where the sample preparations take place and introduced the rock formations and structural features of the area. After the presentation, we split into three groups to practice drillcore description on samples originated from the Barje Prospect boreholes. The local professionals helped our work during the description and evaluated the core logs we made, while we were having lunch together kindly provided by the company.

Drilling core description in the yard of Medgold Resources, Bosilegrad

After the short lunch break we headed to the field to visit some of the different formations and lithologies of the Oligo-Miocene igneous belt (Serbo-Macedonian Massif). Our leader, Szabolcs Orbán showed us from the bottom to the top the amphibolite, greenschist and conglomerate bodies, the strongly altered ore-bearing part of the greenschist and the calc-silicate rock occurrence stop by stop. We finished this day at a drilling site
where Szabolcs presented the mechanism and the setup of the drilling machine and we were lucky enough to observe the machine during operation too.

The drilling machine
Thursday, 3rd of October: After the long and professional days at the companies, we spent the fourth day in Bulgaria. We were supposed to visit Pernik, which is famous of its coal, and the Earth and Man Museum in Sofia this day. We had limited time due to some technical issues of one of the cars, therefore we had to choose which place to visit and our choice was the latter one.

The Earth and Man Museum is one of the biggest mineralogical museum of the world. Here minerals can be found from over the whole world, its collection covers 40% of all known naturally occurring minerals as well as industrial artefacts prepared by Bulgarian scientists and engineers. The museum is famous especially of its pegmatite-collection, we were amused by the gigantic minerals. The layout of mineral exhibition was very good to study mineral taxonomy, and the most common and industrially important mineral parageneses as well. Some detailed exhibitions were also prepared about the transformation of ores into pure elements or oxides then into commodities of industrial or commercial use.

After we finished in the museum we decided to take a short cultural excursion in Sofia because most of us have never been in an orthodox country before. All of us were very impressed when we entered the Alexander Nevski Cathedral which is one of the biggest orthodox churches in Europe. We spent a few more hours in Sofia, then returned home and had a BBQ dinner together in the evening.

Thursday, 4th of October: We started the next day at the Lece mine representing the Lece-Chalkidiki Metallogenic Zone. In the Lece district the mineralization is hosted by Tertiary andesitic rocks. Lead-zinc, gold and, to some extent, copper are the main metals of the ore district. Several ore types occur as a part of the Jezerina-1 Vein zone, which is mainly quartz-breccia cut by quartz and sulphide-bearing veins. Epithermal disseminated gold mineralization of both low and high sulphidation types are identified at the area.
The mine closed in 2001 but there were still some operation, so our visit was restricted only for the mine dump, where we looked for the samples representing the above mentioned ore types. The ore bearing rocks were highly altered, therein we found breccia hosted disseminated and stockwork galena and sphalerite accompanied by pyrite and chalcopyrite, we also found massive ore samples and some amethyst crystals.

Lece mine

After finishing the field work in Lece, we took a long and adventurous journey through the hill to our next destination: Djavolja Varos (Devil’s Town). Here we had a short trip to the famous towers of andesitic pyroclastic rocks, which the fluvial erosion formed after deforestation of the area in the Medieval Times.
Friday, 5\textsuperscript{th} of October: The Kopaonik area consists of metamorphic rocks building up the Adria passive margin overlain by flysch units, overthrust by the Vardar ophiolite and its mélange, and the whole nappe stack was intruded by Cenozoic magmatites.

Before the departure in the morning, we listened to a short presentation about the geology and metallurgy of the area, had a short discussion, then headed to the field.
The first field stop was in the ophiolite succession, which belongs to the Ibar harzburgite-serpentinite massif consisting serpentinized peridotites, basalts, cherts and amphibolites of metamorphic sole-origin. The rock what we investigated was a serpentinized harzburgite in a roadcut. Here we discussed the genesis of such rocks and its similarity with the Hungarian ophiolitic rocks. Then we collected some specimens and headed to the next spot nearby the Kopaonik ski resort.
That was an abandoned open pit iron mine of skarn origin, which is related to the intrusion of a quartz-monzonitic body in the Early Oligocene. The contact between the host rocks and the intrusive body is marked by a thermometamorphic aureole represented by skarns and hornfelses, with thicknesses up to 1500 m along the margin of the intrusion. Both the host and the intrusive rocks can be found in the mine. The skarns are characterized by the occurrence of andalusite, wollastonite and/or garnet, with the latter mineral up to 2-3 cm in size. In the waste heap, we could find many nicely mineralized specimens mostly of the silicate phases, but rarely some sulphide-rich pieces as well. Unfortunately, during the decades of inactivity, the mine has started to fill up with communal waste.

During lunch we summarized what we learned during the week, then traveled back to Hungary.