Field trip to Croatia, May 3rd–5th, 2008

Participants:

Prof. Ladislav Pálinkáš – local program organiser and guide

Prof. Ferenc Molnár – faculty sponsor

19 ELUSCSEG students (among them 10 are student members of SEG):

Márta Berkesi, Gabriella Császár, Zoltán Fehérvári, Szandra Fekete, Benedek Gál, András Gerinczy, Orsolya Győri, Gabriella Kiss, Péter Kiss, Levente Molnár, Péter Mucsi, Attila Péntek, Zsófia Poros, Tamás Praviczki, Adrienn Szabadi, Beáta Szabó, Richárd Szabó, Ágnes Takács, Györgyi Tuba

5-10 Croatian students (depending on the day and program)

Sponsors: the field trip was supported by the SEG and the GES Ltd.

Detailed program:

May 3rd: After arriving to Samobor (a village in the vicinity of Zagreb) Prof. Pálinkáš gave us a lecture about the local geology. Getting familiar with Samoborska Gora's geology, we went to a hike through the mountains.

The major part of the trail led through occasionally dolomitized Triassic platform carbonate, but at a viewpoint from the top of a hill we could also take a look at the paleozoic rocks, which show up in tectonic windows, under the Triassic carbonates (Fig. 1.). From this point even the Cretaceous mélange was visible.

In the next outcrop spilitized basalt was found, presumably Triassic in age, related to the early rifting of the Tethys. It was a good opportunity to study the texture of such occurences, since the outcrop was in very good condition, even the pillow structure could be seen.

The final locality of the day was the abandoned mine site at Rude, where we searched through the waste dump for interesting hand specimens of the once mined SEDEX deposit. The occurence, which is related to the early rifting of the Tethys, can be found in Permian sandstone, with siderite mineralization in the centre, and massive hematite in the outer zone. In distal localities only hematized sandstone/conglomerate indicates the presence of the deposit. At the site we also

collected epigenetic galena-barite veins, which cut the SEDEX deposit as a later process.

Fig. 1.: Overlooking a tectonic window: Steep cones of Triassic carbonates (in the background) overlying the gently sloping Palaeozoic rocks.

May 4th: On the second day the group got an overview through the Medvednica Mts.. First we were given a lecture about the local geology, than a lecture about the Medvednica Nature Park.

The Medvednica locality is especially interesting, for almost all units of the Dinarides are presented here in nappes: orto- and parametamorphic rocks (phyllite, green schist, mainly Paleozoic in age), Triassic carbonate platform with carstic phaenomena and ophiolites with the connecting mélange (Jurassic, Cretaceous in age).

At the first outcrop, in the vicinity of the Nature Park's visitor centre, metamorphic (sericitic) schist (Triassic or Paleozoic in age), and green schist facies rocks were seen, as well as at Adolfovac, where even deformation structures (such as δ-

clasts) were found (Fig. 2.). We also visited a small marble quarry nearby, where chloritized schist layers occure embedded in the marble.

Our next stop was the historical site of a former underground mine called Rudnik Zrinski, nowadays functioning as a museum (Fig. 3.). Hosted by Paleozoic dolomite, the once mined Mississippi Valley Type deposit consists of galena-sphalerite veins, in which the galena is Ag-rich, while the sphalerite occurs as yellow microcrystals. These features are specific to Alpine Pb-Zn deposits, and a very similar deposit can be found in Szabadbattyán (Hungary), where the MVT ore is hosted by Devonian carbonate.

On the way to Bistra first we visited the outcrops of the Cretaceous ophiolite mélange, then descending to the valley Jurassic obducted ophiolite, dismembered pillows were seen (Fig. 5.). Down in the valley even the gabbro complex (which was originally 2-3 km below the pillows) shows up. The presence of the peridotite is questionable, while sheeted dykes are absolutely missing in this area.

Fig. 2. (left) Deformation structures in the metamorphic schist.

Fig. 3. (right) The historical mine called Rudnik Zrinski (Zrínyi's Mine).

Fig. 4.: The Cretaceous ophiolite mélange with exotic clasts, such as radiolarite, limestone and ophiolitic rocks.

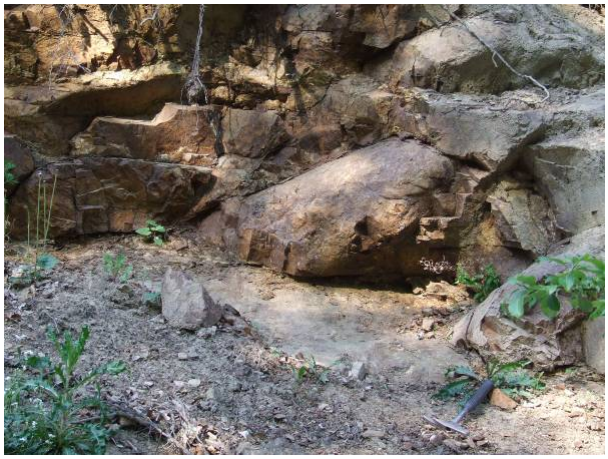

Fig. 5.: Lava lobes in the Jurassic dismembered pillow unit.

May 5th: On the last day we visited two more localities, and, again, Prof. Pálinkáš gave us a very interesting lecture, this time on the Triassic rifting related volcanism.

Our first stop was in Gornje Orešje, at the eastern part of the Medvednica Mts, where an artifical section in a quarry exposes some very interesting rocks. At the bottom of the section harzburgite can be found, followed by serpentinized ultrabasic rocks, while overlying the serpentinite *in situ* laterite shows up (Fig. 6.). A very interesting feature of this laterite is that according to the geochemical data, about 0.5% Ni, 0.01-2 ppm Pt and Pd and a bit less Au is found in it. As the overlying units of the laterite are Cretaceous (Senonian) transgressional sediments (basal conglomerate,

Fig. 6. The section of the altered ultramafic units, with the Ni-laterite on top.

followed by limestone full of rudists), even the age of the lateritization is known.

The final location of our field trip was the Hruškovec quarry in the Kalnik Mts. The quarry exposes a Triassic submarine cryptodome, which is part of the Cretaceous mélange together with Jurassic ophiolites. Since the cryptodome intruded into the sea and partly in the soft sediment, the exact age of the volcanism is determineable with the help of fossils (conodonts, radiolarites). In the section the different facies of the cryptodome are well visible: in the centre zone evidences of coherent lava (this was the feeder zone) can be found, and it is rounded by closely packed pillows (Fig. 7.). Where basalt cooled slowly (in the mud), an excellent geopetal structure, the "pyjamas-type" pillow was formed (Fig. 8.). As distal facies peperitic hyaloclastite breccia, pillow fragmented hyaloclastite breccia (Fig. 9.) and isolated pillow breccia show up. According to the presence of the peperites and the age of the pillows, these Triassic rocks are not ophiolites, their formation is related to the rifting of the Tethys.

Fig. 7. Closely packed pillow facies.

Fig. 8. The „pyjamas-type" pillow in the quarry.

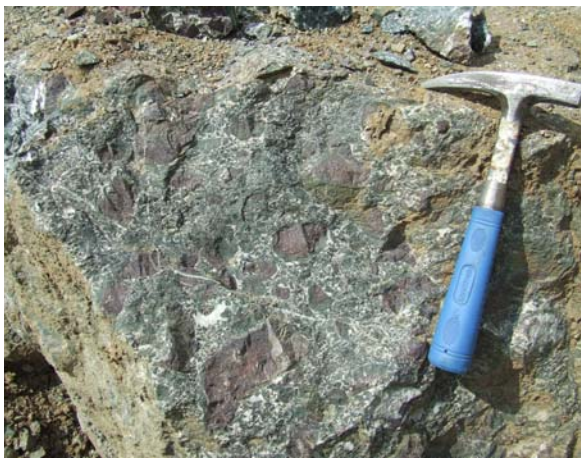

Fig. 9. Pillow fragmented hyaloclastite breccia.