The exception to the described outline comes from a sample of chromitite which shares texture at the cm-scale with the other chromitites, i.e., millimetric euhedral spinel grains densely disseminated within a completely serpentinized matrix. Microscope observation shows a complex texture with strong zonation related to alteration of the primary spinel. The spinel crystals perfectly preserved their original shapes in spite of deep alteration and transformation occurred from rim to core. Primary spinel is preserved only as irregular core portions and is an Al-rich chrome-spinel with about 41 wt% Al_2O_3 and 27 wt% Cr_2O_3. The Al-rich core is surrounded by a porous rim of about 200-300 micron in thickness composed of Fe-rich chromite, with about 9 wt% Al_2O_3, 40 wt% Cr_2O_3 and 35 wt% FeO_{tot}. A second alteration rim, closer to the original crystal border, is highly porous and is made up of ferritchromite, with 5-7 wt% Al_2O_3, 30 wt% Cr_2O_3 and 31-35 wt% FeO_{tot}. Finally a thin rim, external and developed also in the fractures cutting the original crystal, consists of very anomalous Cr-magnetite. This Cr-magnetite shows a composition different from any spinels described in literature, with 35-37 wt% Cr_2O_3 and about 45 wt% FeO_{tot}, but still with 4-5 wt% Al_2O_3.

The silicate matrix is mainly fine-grained chlorite that is found also in the porosity within the original spinel crystals. Chlorite Cr_2O_3 content (1-1.5 wt%) is lower than that of kammaererite usually associated to ferritchromite. Relics of serpentine are found only in the matrix.

Tertiary magmatism in SW Bulgaria and Eastern FYR Macedonia: geochemistry, geodynamic setting and relation to mineral resources

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In the frame of an international joint research project SCOPES IZ73Z0-128089 of the Swiss National Science Foundation, we started a collaborative study of the geological processes in SW Bulgaria and Eastern FYR Macedonia and Serbia that are responsible for the Tertiary magmatism and the formation of important copper, gold, iron and lead/zinc ore deposits. The project is leaded by Dr. A. von Quadt and a team of the Institute of Geochemistry and Petrology, ETH-Zurich, Switzerland. It comprises three additional teams from Serbia (Belgrade University), FYR Macedonia (Stip University) and Bulgaria (Geological Institute of the Bulgarian Academy of Sciences).

The planned major tasks of the project are four: i) Fluid processes at the magmatic to hydrothermal transition in porphyry-style Cu-Au-(-PGE) deposits and in meso- and epithermal deposits in Eastern Serbia, FYR Macedonia (e.g. Buchim, Ilovitza, Kadiitza) and Western Bulgaria/Central Rhodopes; ii) Geochronology, magmatism and large-scale metallogeny of the Cretaceous ABTS belt and the Paleogene Serbian-Macedonian-Rhodope zone; iii) Deposit-scale geochronology, magma characteristics and mineralization; iv) Impact of the mining activity on environment and the social life.

Our work as part of the project is concentrated on the second and third tasks and will build the basis of two PhD theses. On the regional scale, together with our Bulgarian supervisors and consultants from the FYR Macedonian team, we want to understand the geodynamic environment and the generation of mineralizing magmas, using extensive radiometric age dating, igneous geochemistry and petrology. We started the sampling of magmatic and volcano-sedimentary rocks along two main E-W transects: i) from the region of Kyustendil in SW Bulgaria trough the whole Kratovo-Zletovo magmatic complex (transect Ruen-Kratovo-Zletovo); ii) from Simitli and Petrich region in SW Bulgaria to Buchim and Alshar in FYR Macedonia (transect Sandanski-Alshar). The sampling aims to include the oldest and the youngest varieties, as well as representative samples for the whole geological

succession. So we can test some existing ideas for the zonation of magmatism and mineraliztion along NW-SE structures and provide new data for a substantiated geodynamic model of the Tertiary evolution of the region.

On the scale of a single ore-forming magmatic-hydrothermal systems we will concentrate on two or three important deposits (e.g. Buchim, Ilovitza) applying mainly the following methods: i) precise age dating (Ar-Ar on magmatic and alteration minerals, Re-Os on molybdenite, U-Pb on zircons from magmatic dykes that bracket the ore formation); ii) stable isotope analyses; iii) isotope-geochemical tracing (Sr, Pb and Nd). They will help us to constrain or to refine the genetical models of the deposits. Analytical works will be performed mostly in the labs of ETH, Zurich and in the new LA-ICP-MS laboratory at the Geological Institute of BAS.

First field results, isotope-geochronological, isotope-geochemical and petrological data will be presented and discussed during the CBGA-Congress.

Reconstructing the rotational landslide near Frixa (Greece, Peloponnese) with a combination of different geophysical methods and terrestrial laser scanning

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After the 2007 wildfires in the western Peloponnese (Greece) we started an investigation in 2009 in this area at different sites, aiming at the reconstruction of different landslide types and to investigate the relation between fire-induced deforestation and landslides. The village Frixa, particularly its southern part, has massive problems with big rotation slides, shallow slides and erosional features. Tertiary Flysch units and Neogene deposits in the Pyrgos area are generally landslide prone. The slopes in the area have the typical morphological features of a “landslide landscape”. Many recent effects from landslides like slope failures, cliff break ups, road failures, destroyed retention walls, and cracks in houses (structural damage) can be observed in the burned areas even 2 years after the great fires. We assume that the intensity and the frequency of shallow landslides and rotation slides are increasing due to the wildfires, since the lack of vegetation results in a lowered retention potential.

In this case study we present our preliminary results of the slide investigations in Frixa near the ancient city of Olympia. For the study we used different geophysical methods (the capacitive coupled DC geoelectrics system “OhmMapper” and Ground Penetrating Radar, GPR) and a remote sensing tool (ground based t-LiDAR). The terrestrial laser scanning (TLS) is an effective remote sensing technology for reconstruction and observation of natural phenomena or geohazards as it is well founded of high spatial and temporal resolution. TLS was used for the reconstruction of the landslide geomorphology. To ensuring the complete recording of the landslide morphology it is necessary to scan the object from different angles. The entire scan sequence in this case study includes six different scan positions with approximate 2.5 million points with around 4 cm point distance. The t-LiDAR data allowed achieving a 0.5 m digital terrain model after the data processing (alignment the different scan windows, data filtering and cleaning, data interpolation).

We used 100 MHz and 270 MHz antennae and the SIR-3000 data collection system (GSSI) for the GPR investigations. Since penetration depth and spatial resolution depend on the antenna frequency, we used two different antennae that cover a depth of up to 7 m and a resolution of up to 7 cm, depending on the underground conditions. Penetration depth is in inverse ratio to conductivity, so clayey and humid materials lead to a high attenuation of the radar waves.