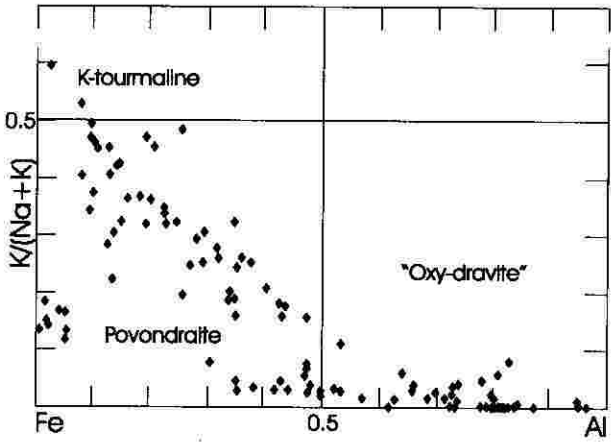

Fig. 2. X_{Fe-Al} vs. X_K diagram for Chapare tourmalines.

1). The most prominent substitution is principally represented by exchange vector $Fe(Al)_{-1}$ being Fe^{3+} (0.28–7.03 apfu) for Al (0.03–5.75 apfu). The amount of Mg is 1.4–2.5 apfu, strongly variable Ti ranges from 0.0 to 0.5 Ti apfu. There is a significant negative correlation between the sum Ti+Mg and the sum $Al+Fe^{tot}$. These tourmalines are sodic, they have low Ca and a low X-site vacancy. The potassium X-site occupancy ranges from 0.0 to 58 %, and increases with growing Fe^{tot} amount but no portions of potential new species (K-dominant tourmaline) larger than several tens of micron were observed (Fig. 2).

The povondraite – "oxy-dravite" solid solutions tend to occur in additional meta-evaporite tourmalines from other localities but all these tourmalines are much more aluminous, ferrian "oxy-dravites" (Henry et al. 1999). The unique geochemistry (highly oxidic, Al-poor, K-, B-, Fe-rich environment) and probably also elevated P-T conditions explain the extremely wide compositional range of Chapare tourmalines. For details see paper by Žáček et al. (2000).

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The CL Study of Feldspars from Durbachites – Genetic Implication

Kateřina ZACHOVALOVÁ and Jaromír LEICHMAN

Department of Geology and Palaeontology, MU Brno, Kotlářská 2, 611 37 Brno, Czech Republic

Cathodoluminescence (CL) technique is commonly used in magmatic petrology to acquire detailed petrogenetic information about the evolution of the feldspar minerals (Stirling et al. 1999; Wenzel and Ramseyer 1992). This technique was used to characterize relations between K-feldspar and plagioclase from durbachite suite in the Jihlava Pluton (JP), Třebíč Pluton (TP) and in pebbles from the Carboniferous Luleč conglomerates.

The gabbro (G), monzogabbro (MG) and more evolved clinopyroxene–amphibole–biotite syenite (CABS) from JP were studied. Mafic minerals from gabbro exhibit systematically higher X_{Mg} relative to monzogabbro (Cpx – 0.75 vs. 0.57, Bt – 0.6 vs. 0.4). Intergranular, anhedral and mostly unzoned plagioclases (violet CL) from G, fill space between Cpx and Bt. Plgs from MG are usually anhedral, euhedral grains are rare. Some large grains display continuous zoning with An-rich core (An_{84}, yellow CL) and more acid rim (An_{47}, brown CL). Unzoned anhedral K-f (blue CL) locally overgrows Plg. Myrmekites (An_{35}, violet-brown CL) were observed at the contact between Plg and K-f.

CABS contain phenocrysts of K-f, and CL observations detected their complex structure. The central part consists of unzoned K-f (blue CL) with enclosed relics of zoned Plg (yellow to brown CL). A mosaic of subhedral, zoned K-f grains (blue CL) together with small graints of Plgs (violet CL) forms the outer zone of the phenocrysts. Both feldspars from the outer zone were identified in the matrix as well.

An inclusion of fine-grained amphibole-biotite syenite (ABS) with K-f phenocrysts, and coarse-grained porphyritic amphibole-biotite granite (PABG) from TP were studied. The feldspars from ABS (inclusions in TP) display the same fabric like CABS from JP.

PABS from TP are coarse-grained rocks with remarkable K-f phenocrysts. These K-fs exhibit commonly oscillatory zoning under CL, indicating polyphase crystal growth. A strongly altered Plgs were identified as inclusions in K-f. The shape of Plg inclusions is irregular, the borders are diffuse, Plgs from matrix are weakly zoned. The evolution from brown-violet CL in the centre to the brown luminescence on the rim documented this weak continuous zoning.

Two types of durbachites were found in the Carboniferous Luleč conglomerates. The first one can be compared with PABS from TP because of their similar mineralogy and mineral fabric. The second type, leucocratic, biotite-bearing porphyritic granite (LBG) has not been observed in the TP yet. Large phenocrysts of K-f (blue CL) show complex zonal fabric, combined continuous and discontinuous zoning. The K-fs from LBG

contain inclusions of plagioclase, similar to those from TP, but the shape and fabric of these inclusions greatly differ. The Plgs from LBG are accreted on the K-f growth surfaces. Yellow pattern of CL distinctly marked oscillatory zoning. Matrix Plgs manifest similar style of zoning.

The feldspars from mafic members G and MG of the durbachites suite display simple continuous magmatic zoning. Such a style of zoning together with decreasing X_{Mg} from G to MG indicates a substantial role of fractionation in their evolution. The complex feldspar fabric from evolved members PABS, LBG indicate multiple evolution with participation of fraction crystallization, remelting and remixing. The complex fabrics of feldspars from TP, if compared with rather simple fabric from JP, indicate that both plutons underwent different magmatic evolution. The primary fabrics are well preserved in JP, whereas in the TP, the primary fabrics were to a larger extent overprinted by later processes such as remelting (Bowes and Košler 1993).

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Structural Study of the Jílové Cleavage and its Relationship to the Magmatic and Sub-solidus Fabric in the Sázava-type Tonalite – SE Margin of the Teplá–Barrandian Zone (Bohemian Massif).

Jiří ŽÁK and Karel SCHULMANN

Faculty of Science, Charles University, Albertov 6, 128 43 Prague 2, Czech Republic

The study area is situated in the SE margin of the Teplá–Barrandian Zone of the Bohemian Massif. It is composed of three main units: Late Proterozoic volcanic complex of the Jílové Belt with overlying flysch sequence of the Štěchovice Group and Variscan Central Bohemian Plutonic Complex. Several types of rocks occur in the area. Precambrian volcanic rocks of the Jílové Belt contain metabasalts, metaandesites, metarhyolites and metadacites and their volcaniclastic equivalents, flysch sequence of the Štěchovice Group is composed of anchimetamorphosed alternating shales, siltstones, graywackes and conglomerates. The study area extends SE to the marginal part of the Central Bohemian Plutonic Complex, where amphibole–biotite tonalite of the Sázava type is exposed.

The aim of this study was to determine the age of the Jílové cleavage and its geometrical and temporal relationships to the structures in the surrounding rocks. Although the Jílové cleavage is the most remarkable structural phenomenon in the study area, interpretations concerning its age remained controversial. Kodym (1946), Morávek and Röhlich (1971) and Waldhausrová (1984) assume Cadomian age of the cleavage whereas Rajlich (1988) and Rajlich et al. (1988) interpreted the Jílové cleavage as a result of Variscan tectonic processes.

E–W structural cross-sections were documented across the Jílové Belt and the Sázava-type tonalite. Penetrative S_1 cleavage (the Jílové cleavage) in different rock types and its relationships to the preexisting S_0 fabric were investigated. The Jílové cleavage (S_1) is very steeply ESE-dipping spaced disjunctive cleavage superimposed on the pre-existing sedimentary (S_0) or magmatic fabric. Its development depends on rock competence and on the local lithotectonic conditions. The S_1 cleavage is most intensively developed in the sediments of the Štěchovice Group; in volcanic rocks of the Jílové Belt the intensity of cleavage development decreases with increasing content of quartz. Upright large-scale open folds with steep axial surfaces and subhorizontal hinges folded the whole area. The S_1 cleavage is subparallel to axial planes of the folds. NNE-trending subhorizontal stretching lineations L_1 are sub-parallel to fold hinges, implying coeval development of both structures. Progressive compression was also accommodated by longitudinal overthrusting. There is a strain gradient in the study area, marked by increasing intensity of cleavage development towards SE. The last tectonic event is characterized by conjugate normal kink bands with locally developed S2 cleavage that often deform the S1 cleavage in the Štěchovice Group sediments.

Studies in the tonalite of the Sázava type concentrated on geometries of magmatic foliations, syn-cooling S-C structures and shapes of deformed mafic magmatic enclaves. The Sázava-type tonalite represents syn-tectonic intrusion with well-developed sub-vertical foliations nearly parallel to the contact and syn-cooling S-C structures in marginal parts. Fabric analysis and magmatic fabric of the tonalite were studied with the use of AMS method (anisotropy of magnetic susceptibility) and measurements of shapes of mafic enclaves.

The orientation of C-planes and magmatic foliation at the boundary of the Sázava-type tonalite are concordant to the S_1 cleavage developed in the Jílové Belt. Also the kinematics of both fabrics are concordant. This conclusion confirms the syn-tectonic development of these structures and their Variscan age. The increasing intensity of the Jílové cleavage is interpreted in terms of possible thermal weakening due to syn-tectonic heating resulting from syn-tectonic intrusion of the Sázava-type tonalite.