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PETROGRAPHY AND MINERAL CHEMISTRY OF THE GÓRY SOWIE KERSANTITES: PRELIMINARY RESULTS

Abstract: The kersantites of the Góry Sowie (Sudetes, SW Poland) were emplaced as sills and dikes into gneisses and overlying Carbonifeous deposits during the final stages of the Variscan orogeny. These rocks host a suite of inclusions (megacrysts, xenocrysts, igneous enclaves) of variable composition and texture. It is suggested that the kersantite magmas represented poorly homogenised melts derived from a crustal magma chamber undergoing replenishment and mixing of mantle-derived and crustal melts.

Keywords: kersantites, Sudetes, enclaves, xenocrysts, magma mixing

INTRODUCTION

Calc-alkaline lamprophyres represent mafic hypabyssal igneous rocks widely distributed across the Variscan Belt of Europe and typically associated with late- to post-orogenic granitoids and volcanics. The origin of calc-alkaline lamprophyric magmas is generally linked with metasomatised mantle sources but interactions with crustal components are also considered influential. However, the mode of these interactions is variably interpreted, and source contamination, crustal assimilation, as well as hybridisation of mantle and crustal magmas have been suggested (e.g. Rock 1991 and references therein).

Around 200 larger lamprophyric veins are known from the Sudetes region in SW Poland. Kersantites are common there, and a well-recognised suite of such rocks is found in the Góry Sowie (Łapot 1986; Muszyński 1987), where they form thin sills and dikes emplaced within the Góry Sowie gneisses and overlying Lower Carboniferous deposits. In this paper, selected new data on petrography, textures and mineral chemistry of the Góry Sowie kersantites are discussed. 20 representative samples for this study were collected from all major kersantite occurrences in the Góry Sowie area, including Ostrzew, Przygrodna and Koczan hills, and other localities near Srebrna Góra and Walim. The samples were studied using classical petrographic methods and back-scattered electron (BSE) imagery. 280 chemical analyses of minerals in 6 thin sections were obtained using the Cameca SX50 microprobe at Ruhr Universitat, Bochum, Germany.

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RESULTS

The Góry Sowie kersantites represent weakly to moderately porphyrytic and relatively felsic lamprophyres, gradational to semilamprophyres (a leucocratic and silica-rich variety of lamprophyres). Biotite is the dominant ferromagnesian mineral and the most common phenocryst, while plagioclase is the main component of the microcrystalline groundmass. Other components include hornblende, clinopyroxene (both found as groundmass crystals and phenocrysts), alkali feldspar, quartz, apatite and opaques, as well as chlorites and carbonates.

Typical groundmass texture and mineralogy of the kersantites are shown in Fig. 1A. Fig. 2 illustrates the chemical variation of the main minerals. The dark mica is represented by phlogopite gradational to biotite. It is relatively poor in Al and chloritised at rims. Amphiboles are slightly zoned titanian magnesiohastingsites and edenites, partly overgrown by magnesiohornblende gradational to actinolite/tremolite. Groundmass clinopyroxene is usually of augitic composition. Groundmass plagioclase laths are partly replaced with sericite and albite, but relics of Ca-rich compositions (up to An50) are common. Some laths show normal or reverse zoning, while others represent sieve-textured intergrowths of compositionally distinct domains (e.g. An35 intergrown with An8). Interstitial minerals are K-rich feldspars (Or50-99) and minor quartz. Opaque minerals (microphenocrysts and groundmass crystals) comprise ilmenite to manganoan ferri-ilmenite, as well as chromian titanomagnetite to magnetite. Other minerals analyzed included chlorites (usually pennine and diabantite, more rarely pycnochlorite or talc-chlorite), clay minerals (smectites ?) and sphene (Al, Fe and Mg-rich variety).

The kersantites host a suite of inclusions ranging from single crystals and crystal clots to igneous-(and migmatitic?)-textured enclaves. The crystals are up to 15 mm long and the largest enclaves are 3-5 cm long. The enclaves are partly disintegrated and fluidally mingled with the host lamprophyre. The most distinctive inclusions comprise the following:

- diopside megacrysts (partly corroded, rimmed by augite and extensively intergrown with amphiboles, biotite, chlorites, opaques and feldspars),
- feldspar phenocrysts (rounded, sieve-textured and inhomogeneous, composed of andesine intergrown with Ab-rich and Or-rich domains),
- quartz xenocrysts and polycrystalline aggregates (embayed, with reaction rims of augite, biotite, amphiboles and opaques),
- microleucosyenitic enclaves (oval to irregular/embayed in shape, composed of anhedral microperthitic K-feldspar (host – Or50-70, lamellae – Or80-90) and subordinate quartz. The enclaves are surrounded by reaction rims similar to those around quartz xenocrysts),
- biotite microsyenitic enclaves (Fig. 1B; they are composed of euhedral albite laths, euhedral Al-rich phlogopite/biotite and interstitial quartz and K-feldspar of Or95-99 composition),

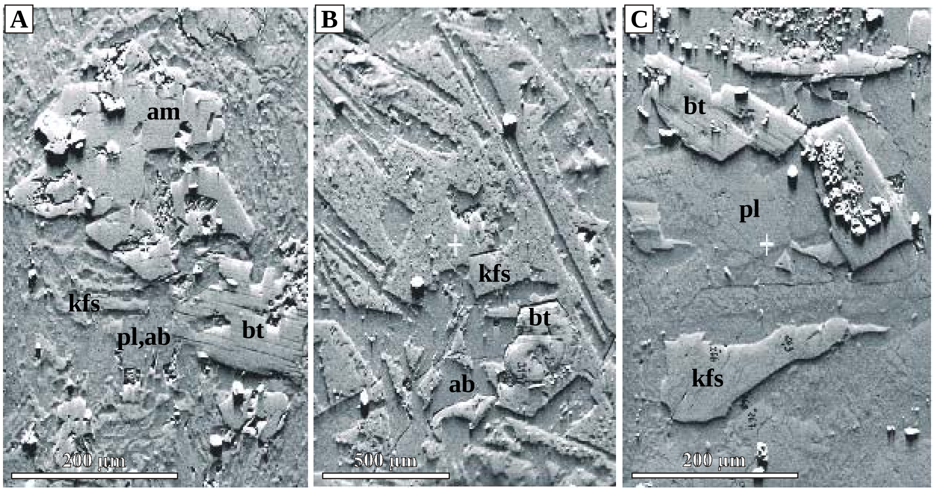

Fig. 1. Back-scattered electron (BSE) images of kersantite (A), biotite microsyenite enclave (B) and microdiorite enclave (C) from Ostrzew Hill. ab - albite, am - amphibole, bt - biotite, kfs - K-feldspar, pl - plagioclase.

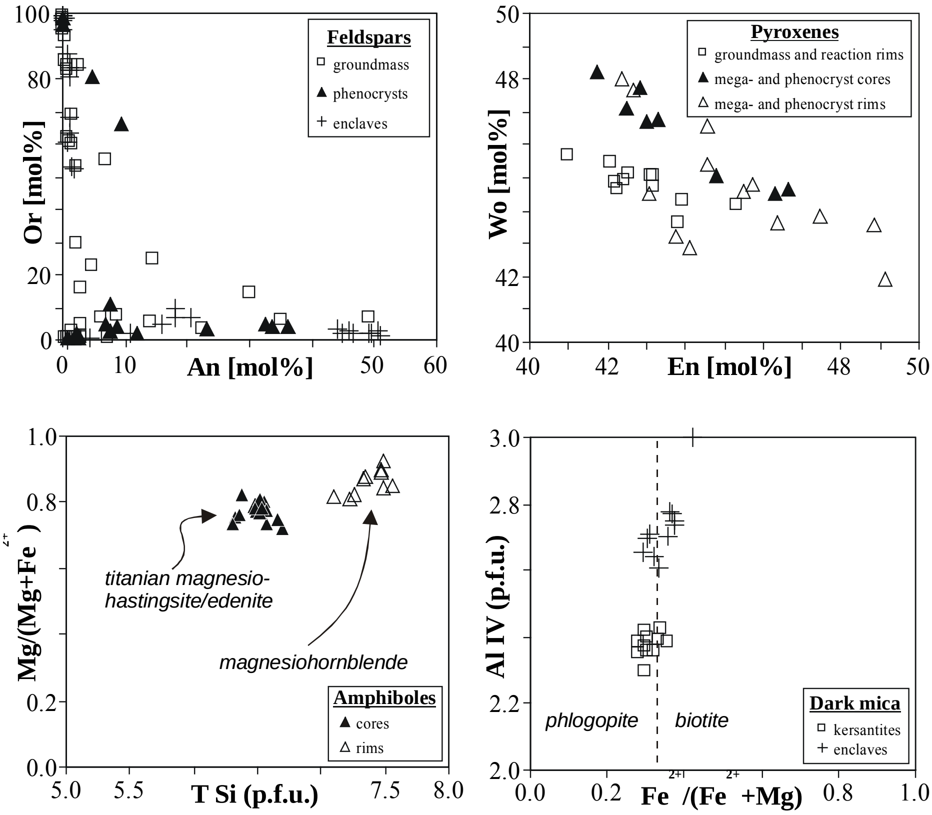

Fig. 2. Selected diagrams illustrating the composition of feldspars, pyroxenes, amphiboles and dark micas of the kersantites and their inclusions (see text).

- microdioritic enclaves (Fig. 1C; these are essentially composed of normally zoned plagioclase ranging from An52 to An10, Al-rich phlogopite/biotite and anhedral (corroded?) K-feldapar (Or>80) with minor quartz. However, plagioclase often shows partly corroded cores and sieve-textured mantles, and many plagioclase and biotite crystals contain abundant inclusions of spinels (hercynite and magnetite), sphene (Al, Fe and Mg-rich), ilmenite, zircon, apatite and various chlorites and white micas).

DISCUSSION AND CONCLUSION

The studied kersantites and the inclusions they host show a wide range of textural and mineralogical variation, characteristic of kersantites worldwide (Rock 1991). Some features (e.g. chloritisation of biotite, albitisation of plagioclase, amphibole zoning) apparently reflect late- to post-magmatic processes. However, the presence of inclusions with clear disequlibrium textures (embayments, reactions rims, sieve textures etc.) together with partly disintegrated igneous enclaves point to a complex origin of the kersantitic magma. It is suggested that this magma represented incompletely homogenised melt, carrying components of various provenance. The diopside megacrysts or Cr-rich spinels were probably derived from a more basic magma, while quartz xenocrysts and some felsic enclaves rather came from intermediate/acidic melts. Al-rich minerals (hercynite, Al-rich micas) in the dioritic enclaves suggest the influence of melts derived from crustal sedimentary sources. Other enclaves may represent cumulate-type rocks (autoliths). This variation may be generally explained as the effect of differentiation in a magma chamber undergoing replenishment and mixing of magmas of mantle and crustal origin. Further studies would put more detailed constraints on the number and origin of the end-member melt compositions, and the processes involved.

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