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Ewa KOSZOWSKA[1]

WOLLASTONITE–GARNET–PYROXENE SKARN FROM ZAWIERCIE, SOUTHERN POLAND – A PRELIMINARY REPORT

INTRODUCTION

Several granodiorite and monzodiorite intrusions are emplaced in the contact zone of the Małopolska and the Upper Silesia terranes. Moreover, numerous dykes of subvolcanic rhyodacites occur in this area. Skarn bodies related to the granodiorite intrusion are present within the Ordovician and Devonian carbonate rocks. This study deals with wollastonite–pyroxene–garnet skarn formed in Cambrian metasediment, which was drilled in the borehole RK-1 in Zawiercie.

METHODS

Microscopic study of thin sections was performed using AMPLIVAL petrographic microscope. The morphology of minerals and their chemical composition were examined using scanning electron microscopy (JEOL 5410) equipped with an energy dispersive spectrometer Voyager 3100 (NORAN) with the accelerating voltage 20 kV. According to the “standardless” procedure of calculation (i.e. using standards from the software library supplied by the manufacturer) the data were normalised to the numbers of oxygens per formula unit. The XRD powder patterns were obtained by means of diffractometer PHILIPS using CuKα radiation.

PYROXENE–GARNET–WOLLASTONITE SKARN

A breccia occuring within black Cambrian metamorphosed mudstones and claystones, has been found in the borehole RK-1, in the depth interval from 1285 to 1340m. In black metasediments fine-grained biotite, feldspar (plagioclase), quartz and chlorite are present. Skarn minerals cement fragments of the metasediments.

In strongly brecciated rocks the small originally black fragments of metasediments (several cm in size) were distinctly altered. They are totally decolourised, which resulted in white and pale green colour and are cemented with aggregates of beige-brown garnet and white wollastonite.

[1] *Institute of Geological Science, Jagiellonian University, ul. Oleandry 2a, Kraków 30-063, e-mail: ewa@ing.uj.edu.pl*

In these places, where the rocks are less fractured and larger fragments of breccia occur, only marginal parts of the fragments are decolourised and altered. These parts are pale green in colour and pyroxene is their main component. The cement of breccia consists of successively appearing layers of brown-beige garnets and white wollastonite. Locally, wollastonite is accompanied by creamy, coarse-crystalline sugar-like calcite. The pale green, brown and white layers form a clearly visible zoning. Apart from all the above mentioned minerals, chlorite, epidote, clinozoizite and amphibole subordinately occur in the skarn. In some samples distinct rose-coloured stripes are observed, which are composed predominantly of K-feldspar.

Preliminary investigations have shown significant variability in chemical composition of pyroxenes and garnets. This variability is noticeable not only between different samples but it was also observed within each of them in the distance of several centimetres or even millimetres.

Light-green pyroxenes are the main constituents of pale green zones. These minerals also occur in wollastonite, in the form of small, euhedral crystals up to 0,1mm in size. The composition of pyroxene (Fig. 1) varies from hedenbergite with admixture of MnO up to 4 wt% to diopside containing smaller amount of MnO (1 wt%). Garnets are more diversified in composition (Fig. 1). Their (up to 2mm in size) anhedral, subhedral and occasionally euhedral crystals, are beige, brown or reddish-brown. Garnets with the andraditic composition are in general isotropic, sometimes showing oscillatory zoning on the rims. According to the EDS microprobe analysis the chemical composition of andradites is homogeneous. Contrary to them grandites show birefringence, sectoral twinning and zoning. Their composition sometimes varies significantly even within individual crystals. In the centres they are more andraditic than at the rims.

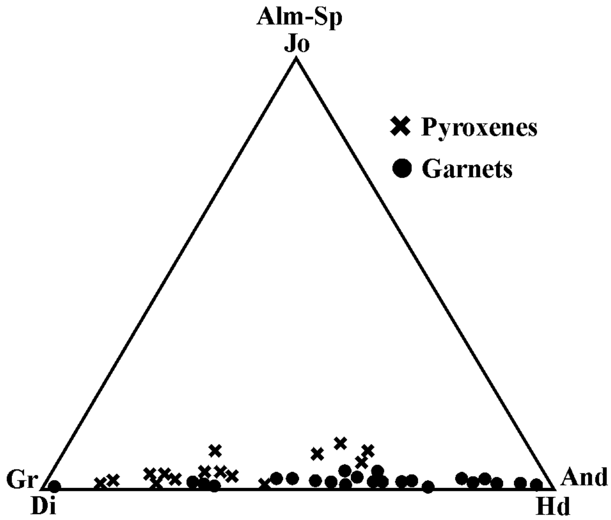

Fig. 1. Composition of garnets and pyroxenes from the studied skarns (plotted in mole percent).

Prisms or fibres of white wollastonite are up to 1 cm in length. Although wollastonite $CaSiO_3$ can accept considerable amounts of Fe (9,5 wt%) and Mn (1,3 wt%) replacing Ca, the contents of FeO and MnO in the studied wollastonite are only up to 1 wt% and 0,5 wt% respectively. In some samples, wollastonite is replaced by pectolite.

Ore minerals are irregularly distributed. In general the skarn is poorly mineralised and only in some samples ore minerals are represented by pyrite, chalcopyrite, pyrrhotite and black sphalerite.

CONCLUSION

Metasomatic pyroxene–garnet–wollastonite skarn was formed in the Cambrian metasediments due to the activity of the H_2O-rich, high temperature fluids in the open system.

Pyroxene could have occurred at temperatures between 430˚C and 535˚C, when the mole fraction of CO_2 in fluid was from 0,02 to 0,75, whereas grandite garnet is stable at $XCO_2 < 0{,}10$ and temperature range 400 to 550˚C (Einaudi et al., 1981).

According to the Gottschalk's (1997) diagram, wollastonite may exist within a wide temperature range, but in the investigated case it probably occurred at temperature below 600˚C, under conditions of CO_2 content lower than 0,2 molar fraction.

The presence of hydrous phases (e.g. chlorite, epidote, amphibole), often connected with retrograde alterations (chloritization of garnets, amphibolitization of pyroxenes) suggests that H_2O-rich fluids (Kerrick, 1974) dominated throughout retrograde the stages.

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REFERENCES

EINAUDI M.T., MEINERT L.D., NEWBERRY R.J., 1981: Skarn deposits. Economic Geology. 75th Anniversary Volume., 317-391.

GOTTSCHALK M., 1997: Internally consistent thermodynamic data for rock-forming minerals in the system SiO_2-TiO_2-Al_2O_3-Fe_2O_3-CaO-MgO-FeO-K_2O-Na_2O-H_2O-CO_2. European Journal of Mineralogy, 9, 175-223.

KERRICK D.M., CRAWFORD K.E., and RANDAZZO A.F. 1973: Metamorphism of calcareous rock in three roof pendants in the Sierra Nevada, California. Journ. Petrology, 114, 303-325.