metabazytów izerskich. *PTMin - Prace Specjalne*, 8, 85-87.
NOWAK I. 1997. Metabazyty izerskie w świetle badań geochemicznych. *PTMin - Prace Specjalne*, 9, 140-142.
PHILIPPE S., HAACK U., ZELAZNIEWICZ A., DÖRR W. and FRANKE W. 1995. Preliminary geochemical and geochronological results on shear zones in the Izera-Karkonosze Block (Sudetes, Poland). *Terra Nostra*, 8/95, 122.
WINCHESTER J. A. and FLOYD P. A. 1977. Geochemical discrimination of different magma series and their different products using immobile elements. *Chemical Geology*, 20, 325-343.
WILSON M. 1994. *Igneous petrogenesis*. Chapman and Hall, 243-374.
ZELAZNIEWICZ A. 1996. The Izera-Karkonosze Block and Main Intra-Sudetic Fault. *Europrobe. Transeuropean Suture Zone*, Książ, 11-17 April 1996.

Detrital Garnets and Chromites from the Ksiaz Formation, Świebodzice Depression: Implications for the Variscan Evolution of Sudetes

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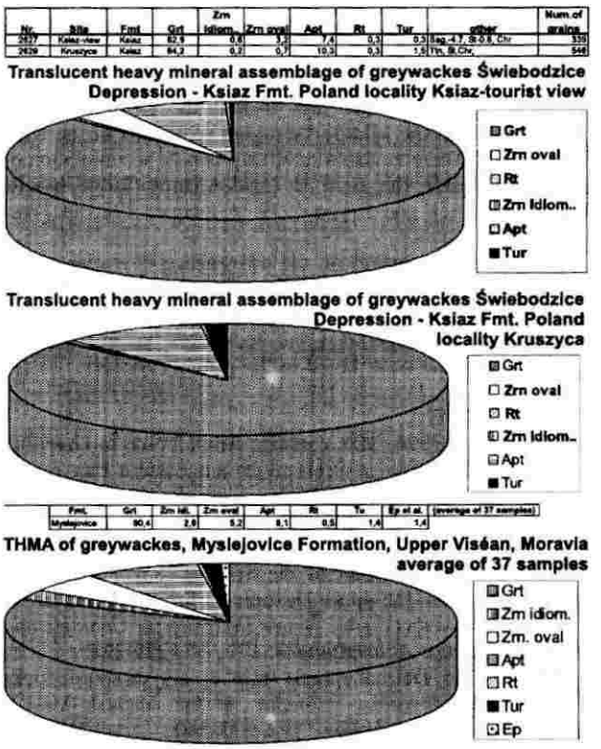

Fig. 1. Comparison of the translucent heavy mineral assemblages

The Świebodzice Depression (60 km ESE from Wroclaw) is a fault-bounded trough filled mainly with a folded clastic succession of a late Devonian - (?) early Tournaisian age. The thickness of sediments is estimated to 4000 m (Porebski 1990). The succession is subdivided into four lithostratigraphic units. The Upper Devonian, mostly flysch-like (mudstone, siltstone, sandstone with sandstone-conglomerate bodies) Pelcznica and Pogorzala Formations rest on the Precambrian gneisses of the Sowie Góry Mts. Both these formations gradually pass upwards into interfingering conglomeratic Chwaliszow (SW) and Ksiaz (NE) Formations which differ by their pebble assemblages. Conglomerates of the Chwaliszów Fmt are polymict, while those of the Ksiaz Fmt are predominantly gneiss-bearing.

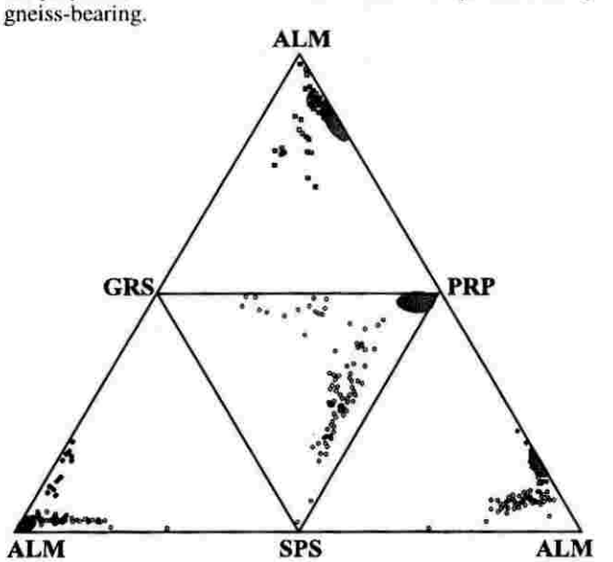

Fig. 2. Composition of detrital garnets from the Ksiaz Fmt, Upper Devonian of the Świebodzice Depression, Poland. Latticed field represents clastic garnets of the Myslejovice Fmt., Upper Viséan, Moravia.

Several samples of psammites from the Ksiaz Formation were picked to complete the detailed and valuable sedimentologic and petrologic studies of Nemec, Porebski and Steel (1980) in Porebski (1990) op.cit. Firstly, an assemblage of translucent heavy minerals was studied. Then over a hundred of microprobe analyses of clastic garnets and chromites from the locality Ksiaz-tourist view above the valley of the Pelcznica River were carried out and interpreted.

Discussion of results

Translucent heavy mineral assemblages (THMA) of grey-

wackes from the Ksiaz Fmt. can be described as garnetic (over 80%) with apatites (around 10%), zircons (1-4%), sagenite (1-5%) with accessory rutile, tourmaline, chromite, staurolite, titanite, alterite. It is worth mentioning a strong similarity of such a suite with an average assemblage of THMA of the Upper Viséan Myslejovice Fmt. (Moravian-Silesian Culmian basin) - see Fig. 1. As follows from the comparison of the detrital garnet assemblages from the Ksiaz and from the Myslejovice Formation (Fig. 2), there is a substantial difference in the provenance of both units. Nevertheless, the similarity in THMA reflects very similar geotectonic and sedimentologic situation during their deposition. The situation should be characterised as highly dynamic, the sediments as very proximal, chemically very slightly weathered, the rate of denudation and deposition should be considered as very high.

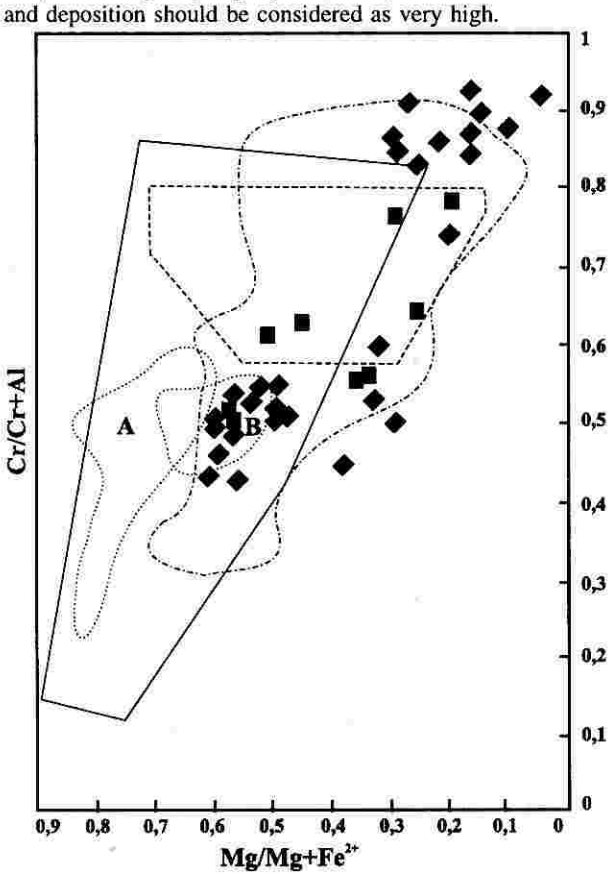

Fig. 3. Composition of the Upper Devonian detrital chromspinels in the Cr/Cr+Al and Mg/Mg+Fe^{2+} diagram. Solid line: field of chromspinels of alpinotype ophiolite complexes, dashed line: field of chromspinels of stratiform intrusions (both after Irvine and Findlay 1972 in Press 1986 op.cit), dotted curve A: Mid-Atlantic Ridge basalts MAR, dotted curve B: Mid-Atlantic Ridge basalts FAMOUS (orig. pap. cit. In Press 1986), dotted and dashed line: field of Middle Devonian chromspinels from the Rhenish Massif (Press 1986). Full squares: chromspinels with chlorite inclusions, turned full squyares: pure chromites.

It is useful to describe shortly main garnet types of the detrital assemblage in the Ksiaz Fmt. All detrital garnets are dominantly almandines. The absolute majority (about 85 % of clasts) presents the following composition: almandine (60-70%), pyrope and spessartite 5-25% each and their contents are reciprocal, their sum being constant (about 30%), grossular about 5% constantly. The most probable explanation of the above described garnet variety is a presumption of a primary garnets with zonality of increasing FeO and MgO end members while decreasing MnO component. It is rather a question for Polish petrologists if such garnets are known within the Sowie Góry Block. A remaining smaller part (about 15 %) of garnet clasts are pyrope-grossular almandines with very small amounts of spessartite component (Alm 50-70%, Prp 20-30%, Grs 15-30% and Sps 1-5%). Garnets of almost identical composition were described by Dziedzic (1996) from the Bielawa metabasites. The difference between the Ksiaz Fmt. detrital garnets and those analysed in the greywacke matrix of the Luleč conglomerates of the Myslejovice Fmt. (Upper Viséan of the Moravian-Silesian flysch Basin) is substantial. The Moravian detrital garnets are a monomict assemblage of pyrope-almandines of probably a granulitic source.

When analysing the garnets, relatively high number of chromite, chromspinel and chrompicotite clasts (about 30) has been found and analysed. The amount of Cr_2O_5 varies between 33 and 60%, most usual values are around 40%. The analyses were placed into a diagram used by Press (1986) where chromites of various geotectonic provenance are considered (see Fig. 3). It could be concluded that the field of detrital chromspinels from the Ksiaz Fmt., Świebodzice Depression is almost identical with (or rather lays inside) the field of detrital chromspinels in the Middle Devonian sediments of the Rhenish Massif. There is also a relatively denser accumulation of Cr-spinels inside the field B (Mid-Atlantic Ridge basalts FAMOUS (Dick and Bryan 1979 in Jacques 1980 in Press 1986 op.cit.).

The final conclusion on the provenance character of the clastic sediments of the Ksiaz Fmt. in the Swiebodzice Depression is that not only metamorphic rocks (mostly gneisses and migmatites rich in garnets) and sediments but also various types of ophiolite contributed to the primary source.

References

DZIEDZIC H. 1996. The Variscan Amphibolite to Granulite Facies Transition at Bielawa in the Eastern Part of the Góry Sowie Block. *Bulletin of the Polish Academy of Sciences, Earth Sciences*, 44, 2, 77-90.

POREBSKI S. J. 1990. Onset of coarse clastic sedimentation in the Variscan realm of the Sudetes (SW Poland): An example from the upper Devonian - lower Carboniferous Świebodzice succession. *Neues Jahrbuch für Geologie und Paläontologie Abhandlungen*, 179, 2/3, 259-274.

PRESS S. 1986. Detrital spinels from alpinotype source rocks in middle devonian sediments of the Rhenish Massif. *Geologische Rundschau*, 75/2, 333-340.