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**PACZYN GNEISSES (EAST KARKONOSZE COMPLEX, WEST
SUDETES) – TWO METAMORPHOSED SERIES:
1. QUARTZ-BEARING GABBRO TO TONALITE, 2. LEUCOTONALITE;
PETROGRAPHY AND MAJOR ELEMENT CHEMISTRY**

GEOLOGICAL SETTING AND PETROGRAPHY

Paczyn Gneisses and amphibolites constitute the dominating part of the Leszczyniec Volcanic Formation (LVF) – Teisseyre (1973). On the basis of single crystal zircon U-Pb analyses (Oliver et al. 1993) the age of the Formation was determined as uppermost Cambrian to lowermost Ordovician. Except the LVF the rocks like Paczyn Gneisses have never been described in other parts of the Karkonosze-Izera Block.

The rocks called Paczyn Gneisses (Berg 1912) can be subdivided into two varieties clearly differentiated by modal, major element and trace element compositions. They have been distinguished as felsic gneisses and hornblende gneisses. The felsic gneisses are often intercalated with amphibolites and in the currently exploited quarry in Ogorzelec the ca. 50 meter thick intrusion into amphibolites can be observed. The relationship of hornblende gneisses to the surrounding rocks has never been observed directly in the outcrop.

Felsic gneisses are built up of plagioclase (albite with epidote inclusions) – 35-50 modal %, quartz – 38-49%, phengite – 0-14%, chlorite – 3-8%, amphibole (actinolite or actinolitic hornblende) – 0-4%, total of mafic minerals – 3-8%. Judging from the proportion of albite and epidote within plagioclase grains original plagioclase composition was most often albite, exceptionally oligoclase. Protoliths correspond therefore to leucotonalite (colour index <10).

Hornblende gneisses are distinctly darker with total amount of mafic minerals 21-52%. They contain plagioclase with epidote inclusions (Ab+Ep) – 44-65%, quartz – 4-22%, hornblende – 4-22%, actinolite – 2-30% and varying amount of chlorite. Original plagioclase composition was determined as An₃₅₋₈₇ which was also confirmed by its normative composition. According to the IUGS classification the protoliths correspond to quartz-bearing gabbro, quartz-gabbro, quartz-diorite and tonalite. The best and type-locality (Berg 1912) outcrops occur N of Paczyn village. For the same rocks Narewski and Teisseyre (1971) used the name *coarse*

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grained (*Paczyn*) quartz-amphibolites reserving the name *Paczyn Gneisses* for felsic varieties.

MAJOR ELEMENTS

Altogether 21 major-element analyses of *Paczyn Gneisses* are available from the literature – Narebski (1968), Narebski and Teisseyre (1971), Kryza et al. (1995). 12 new analyses were made in the Geochemical Laboratory of the University of Tübingen, 4 in the Polish Geological Institute, Warsaw and 4 by the Activation Laboratories, Canada. 23 analyses belong to felsic and 18 to hornblende varieties. The analyses confirm the clear mineralogical and modal distinction of the two varieties and only a few samples show transitional features (Fig. 1). The trace-element analyses also confirm this distinction. They will be discussed separately.

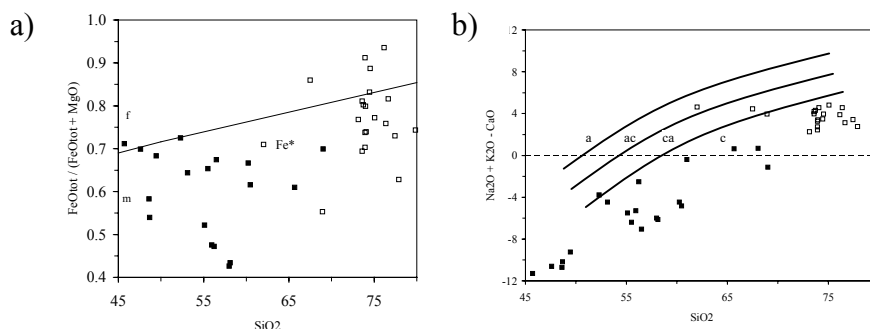


Fig. 1. (a) $Fe^* = FeO^{tot}/(FeO^{tot} + MgO)$ vs weight per cent SiO_2 and (b) $MALI = Na_2O + K_2O - CaO$ vs SiO_2 of the two varieties of *Paczyn Gneisses* (diagrams after Frost et al., 2001). Solid squares – hornblende gneisses, empty squares – felsic gneisses, f – ferroan, m – magnesian, a – alkalic, ac – alkali-calcic, ca – calc-alkalic, c – calcic.

DISCUSSION AND CONCLUSIONS

Generally the chemical composition of felsic *Paczyn Gneisses* clearly corresponds to felsic metavolcanics of LVF. The chemical composition of hornblende gneisses falls within variation range of mafic metavolcanics, mainly amphibolites of the same LVF.

As it appears from Fig. 1(a), practically all hornblende gneisses are magnesian while felsic gneisses are partly ferroan and partly magnesian. The richest in SiO_2 hornblende gneisses from the outcrops N of *Paczyn* village belong to tonalites. The "felsic" transitional gneiss with the lowest SiO_2 content is the fine grained, relatively rich in mafic minerals (chlorite, stilpnomelane, Mg-riebeckite) gneiss from the quarry in Klatka village. When discussing the Frost et al. (2001) parameters one has to bear in mind that part of the hornblende gneisses do not

correspond to granitic rocks but to quartz-diorites and quartz-gabbros. All of them however are exceptionally poor in K_2O .

Most of hornblende gneisses belong to calcic and only a few to calc-alkaline. The majority of felsic gneisses belongs to calc-alkaline and only part of them to alkali-calcic. The aluminium saturation index ($ASI=Al/Ca+Na+K$) is in all the discussed rocks quite uniform and varies between 0.75 and 1.40. The majority of them is peraluminous or metaluminous.

From the geochemical petrogenetic modelling (Martin, 2002) the following preliminary conclusions could be drawn. There was no mixing of the two magma types, corresponding to felsic and hornblende gneisses.

On the diagram of major oxides vs SiO_2 a non-straight-line trend can be observed which may mean that the two groups of rocks are genetically related. The rock corresponding to felsic gneisses could have originated by partial melting from the rocks corresponding to hornblende gneisses.

Preliminary study of some trace elements indicate rather that the fractional crystallisation was not taking place.

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