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## THE KOŚCIERZYNA AND ŻARNOWIEC ENDERBITES ( N-POLAND) PETROGRAPHY, MINERALOGY, GEOCHEMISTRY AND P –T RESULTS

### INTRODUCTION

The Kościerzyna and Żarnowiec enderbites have traditionally been included to Kaszuby metamorphic complex within of Precambrian crystalline basement of northeastern Poland. This unit is recognized only by four deep boreholes, with scarce observations relating to the rock relationships. Kubicki and Ryka (1982) and Ryka (1990) presented hypothesis on polymetamorphic evolution of sedimentary rocks and emphasized structural and petrogenetical analogy to Podlasie Complex. In contrast, Bagiński et al. (1999) suggested, that the enderbites formed as multiphase intrusion.

The age of studied enderbites is unknown, but they are interpreted as Palaeoproterozoic (Ryka, 1998). The aim of our study was to give petrographic and preliminary geochemical characteristic of Kościerzyna and Żarnowiec enderbites and reveal their geotectonic setting and relation to the adjacent East European Craton units.

### ANALYTICAL METHODS

Electron microprobe analyses of minerals were performed at Lund University, Sweden and at the PGI in Warsaw. The whole-rock samples from Kościerzyna were analysed for major and trace elements by XRF. Also, whole rock analyses were selected from published studies (Dziedzic, 1982).

### RESULTS

Mineral assemblages observed in Kościerzyna (KOS) and Żarnowiec (ZAR) enderbites are similar to each other: Qtz + Pl + Kfs + Cpx ± Opx + Hb + Bt + Ilm + Mag ± Ep + Ap + Chl. The clinopyroxene composition is in the range Wo<sub>39-46</sub> En<sub>29-37</sub> Fs<sub>20-25</sub> for the KOS and Wo<sub>42-48</sub> En<sub>36-40</sub> Fs<sub>17-19</sub> for the ZAR. The composition of orthopyroxene is in the range Wo<sub>1.4-3</sub> En<sub>35-45</sub> Fs<sub>52-62</sub> and Wo<sub>1.3-1.7</sub> En<sub>42-48</sub> Fs<sub>50-56</sub>, respectively. The amphiboles from KOS are ferropargasite with 6.33–6.43 Si and 1.63–1.83 Al<sub>tot</sub> a.p.f.u. (based on 23 oxygens). The amphiboles from ZAR

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are richer in  $Al_{tot}$  (1.8–2.1 a.p.f.u.) They fall into ferropargasite and magnesiohastingsite fields of Leake classification (1997). Biotite has relatively high  $TiO_2$  contents in the range 6.06–4.24 wt %. The majority of the Mg- and Ti-rich biotite analyses come from the cores of grains. Plagioclases from the ZAR are more calcic ( $An_{48-57}$ ) than those from the KOS ( $An_{38-46}$ ). The coexisting K-feldspar has 92–93 % of the Or molecule.

Thermobarometric results from both KOS and ZAR enderbites are summarized in Fig.1. These were determined from the core compositions of large grains (c) and from the rim (r). Calibrations of pyroxene thermometer: Kretz (1994) and Fonarev and Graphchikov (1991) were applied. Temperatures were also estimated using the hornblende-plagioclase (Blundy and Holland, 1990), two feldspar (Fuhrman and Lindsley, 1988; Elkins and Grove, 1990) and orthopyroxene-biotite (Sengupta et al., 1990) thermometers. Most samples give temperatures of 800–850°C and pressure 6 kbar. For partly chloritized orthopyroxene grains the two-pyroxene and opx-bt thermometers yield temperatures between 490 and 550°C.

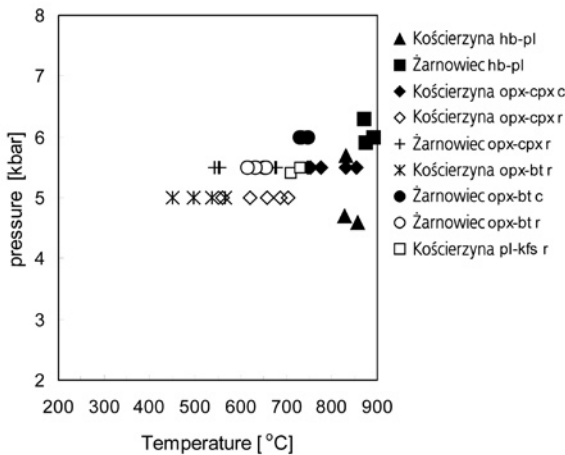


Fig. 1. P –T diagram for Kościerzyna and Żarnowiec enderbites.

The analysed enderbitic rocks have diorite-granodiorite composition. The samples span a wide range in  $SiO_2$  (57.9 to 64.8 wt %). On the Harker variation diagrams, they display fairly distinct trends, analogous with trends presented by rapakivi-like granitoids from the Mazury Complex (Bagiński et al., 2001).

## CONCLUSIONS

Detailed petrographic observations, electron microprobe studies and comparison of bulk-rock chemical analyses of the samples from Kościerzyna and Żarnowiec, yield new insights into the origin of enderbites from the Kaszuby Complex. On the basis of textural observations and p-T results, retrograde origin of amphiboles maintained in the earlier publications must be regarded as questionable. The p-T study demonstrates that rocks formed at relatively higher temperatures than earlier publications assumed.

*Acknowledgements:* This study was supported by BW 1567/16 grant (B.Bagiński) and 6.20.1309.00.0 (E.Krzemińska).

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