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U-Pb AND Ar-Ar GEOCHRONOLOGY FROM THE AMCG ROCK FORMATION IN THE MAZURY COMPLEX

INTRODUCTION

The joint petrological, geochemical as well as U-Pb and Ar-Ar geochronological studies of the crystalline rocks from the E-W trending, magmatic Mazury Complex were performed to constrain the geochemical trends and age of magmatism. Four deep drillings up to 2200 m depth (from the Gołdap, Bartoszyce,

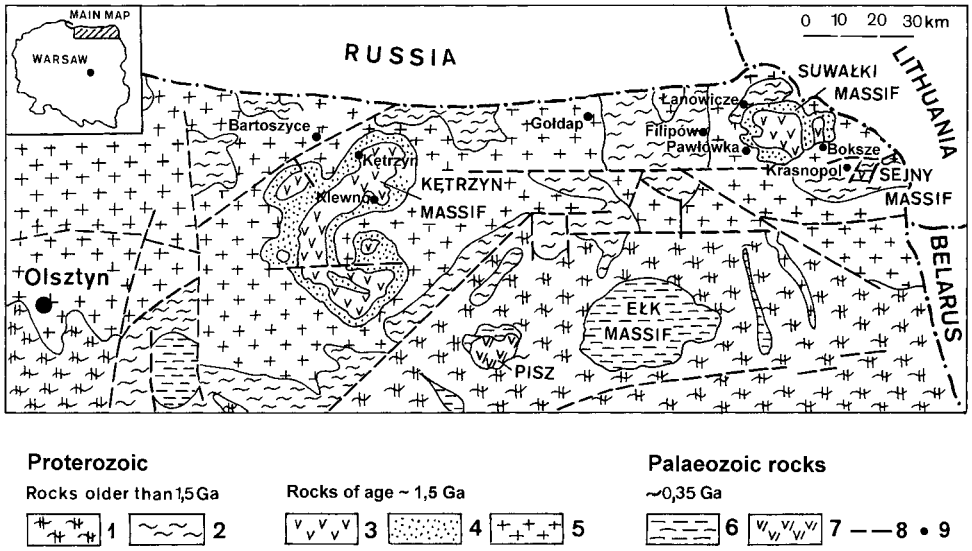

Fig. 1. Geological map of the Mazury Complex, NE Poland, (after Kubicki and Ryka 1982, modified, *vide* Wiszniewska et al. 2000) 1 – granite and migmatite rocks, 2 – granulite domains, 3 – anorthosite and norite rocks, 4 – diorite rocks, 5 – rapakivi-like granites, 6 – syenites, 7 – gabbros, 8 – lineaments, 9 – borehole locations.

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Boksze and Krasnopol regions), located several kilometers one from each other along a linear magmatic structure have been chosen for sampling (Fig.1).

The U-Pb datings ranging from 1525 to 1512 Ma indicate multistage igneous activity. Three stages of distinct magmatic episodes have been documented. It has been shown that the Proterozoic Mazury Complex was composed of slightly chemically and petrologically different intrusions, representing a sequence of magmatic episodes lasting ~ 38 Ma. (Dörr et al. 2001, Wiszniewska 2002)

The Ar-Ar biotite age of ~1425 Ma point to slow cooling rates of ~3°C/m.y. Comparison of obtained, new U-Pb data of Mazury complex to some occurrences of A-type magmatism in Fennoscandia, linked Mazury rocks to Riga-Åland subprovince, Salmi subprovice and also to the Swedish magmatic complexes in Ragunda and Nordingra.

GEOLOGY

The Mazury complex comprises a 200 km long and 40 km wide zone of granitoids and anorthosite-norite massifs that intruded the granulite and amphibolite facies domains. An E–W trending shear zone controls the distribution of the Mesoproterozoic intrusions (Wiszniewska et al. 1999).

The rock types of the complex include leucogranite, quartz-monzonite, monzonite, granodiorite, and monzodiorite (Bagiński et al. 2001). Three anorthosite massifs (Kętrzyn, Suwałki and Sejny) have been also described in this area (Fig. 1) (Wiszniewska 2002).

PETROGRAPHY

The studied granitoid rocks represent petrographically two groups: monzodiorites and granodiorites from the Krasnopol-6 and Boksze-1 boreholes in the southern part of the Suwałki anorthosite massif and quartz monzonites from the Gołdap-1 borehole in the central part of the complex. The Bartoszyce-1 borehole is situated in the western part of the Kętrzyn anorthosite massif (Fig. 1).

The coarse grained, porphyritic quartz monzonites are petrographically and geochemically similar to the Fennoscandian rapakivi granites, commonly containing K-feldspar megacrysts (microcline and microcline microperthite) often mantled by plagioclase. They are pinkish gray and comprise plagioclase (oligoclase-andesine), K-feldspar, myrmekite, biotite, hornblende, titanite (usually as rims around the opaque minerals), Fe-Ti oxides, and accessory apatite, zircon, monazite and allanite.

The dioritic-granodioritic rocks of Krasnopol-6 and the monzodioritic-monzonitic rocks of Boksze-1 are typically medium grained, grayish and show a slight magmatic foliation. They are composed of plagioclase, K-feldspar, quartz, biotite, amphibole, pyroxene, Fe-Ti oxides, titanite and apatite. This group of rocks generally does not display the textural features of the typical Finnish rapakivi granites.

GEOCHEMISTRY

The rocks in question show a clearly defined geochemical characteristics, typical of the rapakivi granites, with low MgO, CaO, Al_2O_3 and Sr, but high K_2O (4–7,5 wt. %), Rb (64–192 ppm), Zr (412–1316 ppm), Hf, Th, U and *REE*s (Rämö, Haapala 1995). The SiO_2 content in the monzodiorite-granodiorite suite ranges from 50.3 to 53.1 wt. % for the Boksze-1 samples and from 51.6 to 61.1 wt. % for the Krasnopol-6 rocks, while total alkalis for both locations range from 5 to 9 wt. %. The quartz monzonite suite from Gołdap-1 and Bartoszyce-1 boreholes contains 60 to 65 wt. % of SiO_2 and 6 to 9 wt. % $Na_2O + K_2O$. These two suites, including the basic samples, show the major element characteristics of the potassic (shoshonitic) series: $Na_2O + K_2O > 5$ and $K_2O/Na_2O > 1$.

All rocks of the Mazury complex are subalkaline. In the agpaitic index versus 10000*Ga/Al diagram, they generally plot in the field of A-type granites and partly overlap the field of the typical Finnish rapakivi granites.

U-Pb GEOCHRONOLOGY

The U-Pb dating determinations have been performed on single zircons and on titanite fractions. The isotopic ratios were measured with a Finnigan MAT 261 solid-source mass spectrometer in multi-collector static mode simultaneously with ion-counting system for ^{204}Pb at the Justus-Liebig-Universität Giessen, Germany. The U-Pb ages of 1525±4 Ma (Krasnopol), 1522±2 Ma (Bartoszyce), 1512±1.1 Ma (Boksze) reported in this work and the ages of two further quartz monzonites (1499 ± 4 Ma and 1502±2 Ma) imply a ~25 m.y. emplacement history for the felsic and intermediate rocks of the Mazury anorthosite-mangerite-charnockite-granite complex. Any correlation has not been found between the ages and the geochemical and petrographic composition of the granitoids. Apparently diorite, granodiorite, quartz monzonite and monzonite plutons intruded at different time and in various localities into the Palaeoproterozoic crust forming a 200 km long, E–W trending belt.

Ar-Ar GEOCHRONOLOGY

The ~1425 Ma Ar-Ar ages of Boksze and Krasnopol rocks are cooling ages. The time interval between zircon crystallization at 900 °C and the calculated biotite Ar-Ar ages is ~100 m.y.

CONCLUSIONS

The Mazury complex represents a polyphase pluton composed of the anorthosite-norite intrusions and A-type granitoids. Granites of similar age, but with I-type geochemistry, have been encountered in Lithuania (e.g., Kabeliai, Gardasiai) and in Belarus. The Kabeliai complex has been dated at 1505±11 Ma and is probably an eastward extension of the Mazury complex.

Geochronologically, the Mazury complex correlates with the Ragunda (Sweden) rapakivi complex and several smaller complexes in central Sweden dated between 1530 and 1470 Ma (Persson 1999) and the 1547–1530 Ma Salmi (Russia) rapakivi granite-anorthosite complex which also occur in a peripheral position in the Palaeoproterozic (Svecofennian) metamorphic crust of the Fennoscandian Shield.

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