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GABBRO-DIORITE-GRANODIORITE-GRANITE ASSEMBLAGE IN PRECAMBRIAN OF NW BELARUS

Abstract: The study of gabbro-diorite-granodiorite-granite assemblage in Precambrian of NW Belarus allowed to compare this rock complex with closely space-distributed complexes in N Poland and S Lithuania and to recognize common for these complexes geochemical features assigned to entire AMCG suite in the region.

Keywords: AMCG suit, Palaeoproterozoic, NW Belarus

INTRODUCTION

The major NNE-trending tectonic pattern of the Palaeoproterozoic crust in the western part of the East European Craton is complicated by EW-trending zones of faulting which are clearly offset the pre-existing tectonic pattern and are reflected by a chain of ca. 1.5 Ga intrusions. Intrusions of predominating granitic composition extend eastwards from northern Poland and southern Lithuania into NW Belarus.

The Mazury complex in NE Poland and Veisiejai complex in S Lithuania appear to belong to the same AMCG magmatic suite with all rock varieties ranging from anorthosites and gabbro to rapakivi granites (Skridlaite *et al.* 2003). Several U-Pb zircon datings on the rapakivi granites of the Mazury and Veisiejai complexes have given the same ca. 1.5 Ga age (Dorr *et al.* 2002 and references therein).

In NW Belarus, porphyritic granitoids and related rocks have been recently distinguished through deep drillings. The rocks ranging from mafic to granitic have been treated as the Grodno complex according to their common space appearance and geochemistry (Taran, Varaksa 2005). The aim of the study is to detail petrology and geochemistry of the Grodno complex in regards to comparison with those of the Mazury and Veisiejai complexes.

GEOLOGICAL SETTING AND PETROLOGY

Several massifs have been distinguished within the Grodno complex by geophysics and drillings. The massifs follow W-E trending zones of faulting which extend through northern Belarus to southern Lithuania and northern Poland.

The intrusive bodies are hosted by amphibolite-facies rock of tonalitic- to basaltic in composition (Amph, Bt-Amph gneisses and amphibolites). Relics of country metavolcanics are widespread among the Grodno complex rocks.

The complex compose gabbro, monzogabbro, diorite, quartz monzonite, granodiorite, granite and leucogranite. Granitoids prevail, while intermediate and mafic rocks comprise several minor bodies. In some drillcores granitoids alternate with diorite and quartz

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monzonite. The rocks are massive and slightly deformed, in places milonitised. Porphyritic texture is the feature of granodiorite and diorite. It is defined by large (upto 3 - 4 sm) grains of feldspars (plagioclase and/or K-feldspar) and spots of mafic minerals (Bt, Amph, Spn, Mag) in the fine- to medium-grained groundmass. Mafic members of the suit (gabbro and monzogabbro) forming small separate bodies are massive medium-grained rocks. They are made mainly up pyroxene, hornblende and plagioclase and rich in opaques and apatite, and crosscut by granitic veins.

CHEMICAL COMPOSITION

The studied rocks show a variation of chemical composition from mafic to acidic rocks with SiO₂ ranging from 44 to 79 %. In the Harker diagrams they form well defined trends for (Fig. 1). In the K₂O versus SiO₂ diagram granitoids generally plot in the high-K and shoshonitic fields. It should be point out that the Grodno complex show a good coherence with the Mazury and Veisiejai complexes in distribution of FeO*, MgO, CaO and K₂O versus SiO₂. The alppaitic index, lower than 1, suggest the non-alkaline character.

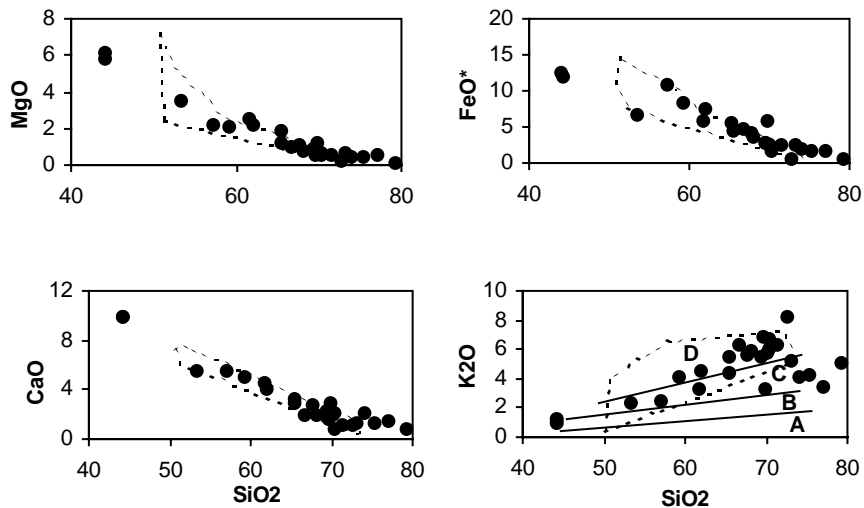


Fig. 1. Harker-type variation diagrams for the Grodno complex. The plot areas for the Mazury and Veisiejai complexes are shown by dashed line. Total Fe is expressed as FeO*. Abreaviations: A, low-K; B, medium-K; C, high-K; D, shoshonite series.

Typical granites of the Grodno complex have an A-type affinity with high Fe, Ba, K, Zr, Nb and Ga and relatively low Mg, Ca at a given SiO₂ content. High FeO*/MgO ratios are very similar to that for Finish rapakivi granites as well A-type granites elsewhere (Nironen *et al.* 2000; Whalen *et al.* 1987). The rocks displaying ferro-potassic alkali-calcic character are very similar to those of AMCS suit of the Mazury and Veisiejai complexes (Skridlaite *et al.* 2003).

Spide diagrams for granitoids (granite, adamellite and granite) demonstrate overall enrichment in incompatible trace elements (Fig. 2). Distribution of trace elements in Grodno granitoids are closely mimic to the Mazury and Veisiejai complexes which is shown for comparison. REE patterns for granitoid rocks are highly similar but they differ (La/Yb)_n (18 - 113) and Eu/Eu* (0.24 - 0.87) ratios that could be an evidence of different

sources and/or various evolution. REE patterns for porphyritic granitoids show weakly-manifested Eu anomalies that appear to be explained by presence of cumulus plagioclase.

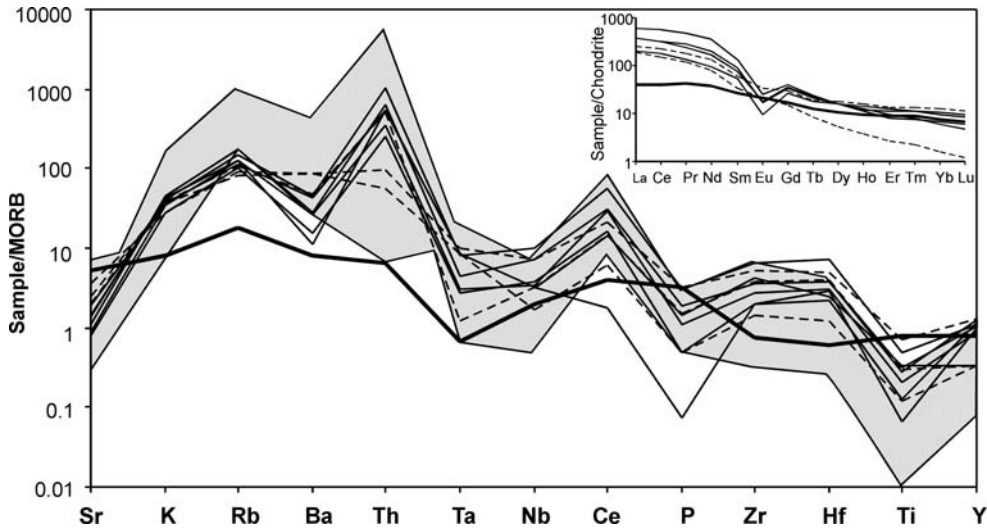


Fig. 2. MORB normalized spider grams and chondrite normalized REE diagrams (inset) for the Grodno complex. The plot area for the Mazury and Veisiejai complexes are shown for comparison by grey colour. The porphyritic granitoid and gabbro are shown by dashed and solid bold lines, respectively.

In terms of distribution of trace elements, gabbroids are slightly fractionated; they are enriched in P, Ti and depleted in Zr and Hf (Fig. 2). They are characterized by low total REE and have no Eu anomaly.

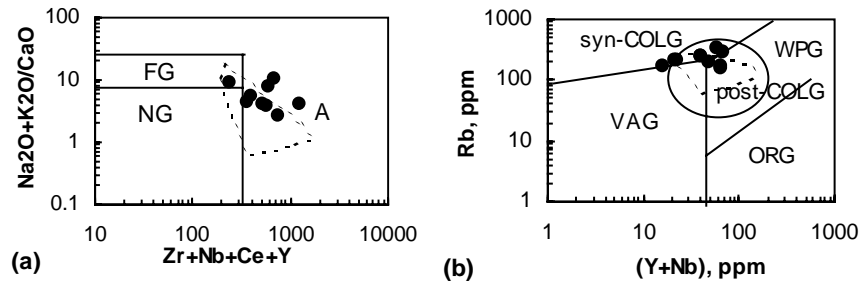


Fig. 3. Discrimination diagrams for the Grodno complex. The plot areas for the Mazury and Veisiejai complexes are shown by dashed line. (a) $(K_2O + Na_2O)/CaO$ vs. $(Zr + Nb + Ce + Y)$ diagram (Whalen *et al.* 1987). Abbreviations: A, A-type granitoids; FG, fractionated felsic granites; NG, normal (unfractionated) M-, I- and S-type granitoids. (b) Rb vs. $(Y + Nb)$ diagram (Pearce *et al.* 1996). Abbreviations: ORG, ocean ridge granites; WPG, within plate granites; VAG, volcanic arc granites; syn-COLG, syn-collisional granites; post-COLG, post-collisional granites.

To discriminate granitic rocks of the Grodno complex in regards to their source and tectonic setting of emplacement, two diagrams have been used. In Fig. 3a, granitoids are mainly plot in the A-type. In the tectonic setting discrimination diagram (Fig. 3b),

granitoids are mostly assigned to the post-collisional granite field with a shift to the syn-collisional field.

CONCLUDING REMARKS

Carried out studies allowed to compare the Grodno complex with closely space-distributed rock complexes in N Poland and S Lithuania and recognize common for these complexes geochemical features assigned to entire AMCS suit in the region.

The major element evolution from mafic to acidic members is characterized by sharply trends which appears represent a liquid line of descent. It can be suggested that fractional crystallization was the dominant mechanism of magma differentiation though it does not exclude partial contamination. The incomplete range of the AMCG suit in NW Belarus may reasonably explained by different levels of erosion. In such a way, only the lower level of the crust was exposed in N Poland (Skridlaite *et al.* 2003).

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