

Petrogenesis of Proterozoic Anorogenic Granitoids from the Mazury Complex (NE Poland)

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The crystalline Proterozoic Mazury Complex is situated in northeastern Poland and forms the westernmost part of the large East European Craton (EEC). The basement is covered by Phanerozoic platform sediments whose thickness varies from 420 m in the east to 6,500 m along the Trans European Suture Zone (TESZ), as the crystalline basement is dipping towards the southwest. The Polish part of the EEC consists of several tectono-structural and lithological units, revealing complex Precambrian evolution. The tectonic setting of the Mazury Mesoproterozoic magmatism has been considered as an E-W trending belt of post-collisional provenance, or rejuvenation of older lineaments or a terrane boundary. Several intrusions of anorogenic character and bimodal composition, mostly rapakivi type granites and anorthosite-norite massifs (Suwałki, Sejny, Kętrzyn) have been described within the area. The rapakivi-like granites are rather differentiated with variable density, but mostly with higher density than the anorthosite-norite massifs. In the vector image of the fractional vertical derivative the gravity lineaments, marking density contrasts, are enhanced (Wiszniewska, Wybraniec, 2000). Rapakivi granite plutons, whose compositions range from monzodiorite to leucogranite, are probably multiple intrusions that were emplaced at a relatively shallow level.

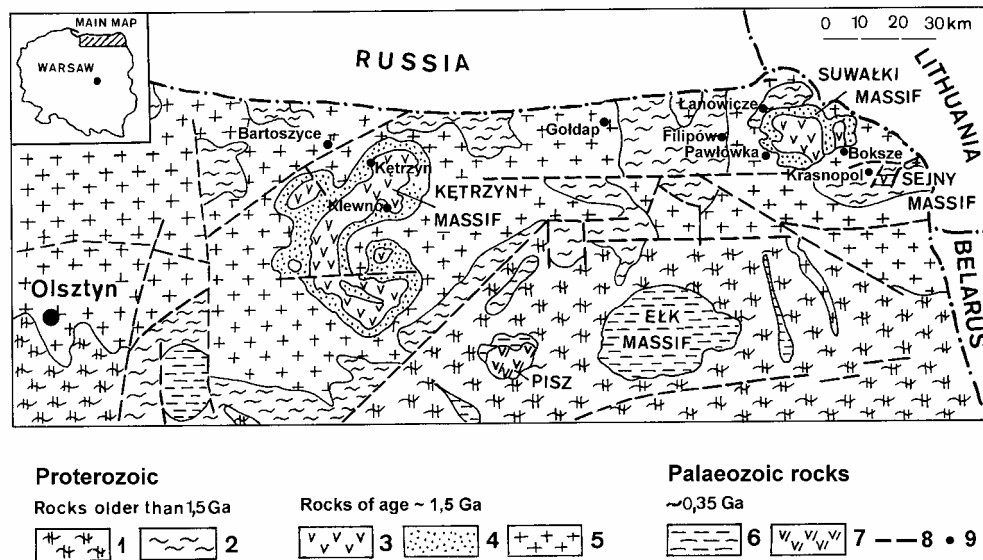


Fig. 1. Geological map of the Mazury Complex, NE Poland, (after Kubicki & Ryka, 1982) 1- granites and migmatites, 2- granulite domains, 3- anorthosites and norites, 4- diorites, 5- rapakivi-like granites, 6- syenites, 7- gabbros, 8- lineaments, 9- borehole location.

The rocks were studied for major and trace elements (Bagiński *et al.*, 2001a,b) and for Sr and Nd isotopes (Bagiński *et al.*, 2001c). They show a widespread differentiation trend with SiO₂ contents ranging from 46% to 76% and no indication of the classical Daly gap between mafic and felsic rocks. All massifs have very similar patterns in both REE and spider diagrams,

which are interpreted as evidence of their consanguinity. However, each massif has its own characteristics when major and trace element variation diagrams are considered, which possibly reflects variable modes of differentiation from one massif to the other. In addition, all samples plot along a major trend similar to the jotunitic liquid line of descent defined in the anorthosite - mangerite – charnockite - (rapakivi) granite (AMCG) suite from Rogaland (Norway). The Mazury complex belongs chemically to the ferro-potassic alkali-calcic type of rocks and is comparable with rock complexes such as in Veisiejai in Lithuania or Rogaland in southern Norway (Skridlaite *et al.*, 2003). The most felsic varieties of the granites approach the classic rapakivi granites in their petrogenetic characteristics, elevated contents of incompatible elements and REE, and hence have A-type affinities. The granites are assigned to the 'Post-collisional granite' field. The overall evolution from mafic to felsic rocks is characterised by well-defined trends, which most probably represent a liquid line of descent. Fractional crystallisation with or without assimilation and hybridisation can account for the continuous evolution from mafic to felsic compositions.

A recent geochronological study of granites from the Mazury Complex by the U-Pb method on single zircons and titanite fractions allows the recognition of three distinct episodes of igneous activity lasting 35 m.y. (Dörr *et al.*, 2001). The first magmatic episode (I) is represented by monzodiorite (jotunitic) rocks of the Sejny intrusion, dated with a concordant zircon at 1548 ± 7 Ma, which is in accordance with earlier dated Re-Os ages of the ore deposits in the Suwałki anorthosite massif (Morgan *et al.*, 2000). The second episode (II) is dated with a subconcordant zircon at 1525 ± 4 Ma ($^{207}\text{Pb}/^{206}\text{Pb}$ age) and with subconcordant titanite at 1525 ± 25 Ma ($^{207}\text{Pb}/^{206}\text{Pb}$ age) from a monzodiorite-tonalite of Krasnopol 6, which proves a rapid cooling below 550°C . The Bartoszyce quartz monzonite is dated with three concordant zircons at 1522 ± 2 Ma. The youngest (III) episode is represented by the Boksze diorite (east cover of the Suwałki Massif), which is dated with a concordant zircon age at 1513 ± 4 Ma.

The Mazury felsic rocks have depleted mantle Nd model ages $T(\text{Nd})_{\text{DM}}$ of 2.1 to 2.2 Ga (Claesson *et al.*, 1995), while the Suwałki anorthosite-gabbro complex has yielded Nd model ages of 1.7 to 2.3 Ga (Wiszniewska *et al.*, 1999). Titanomagnetite and sulfide ores from the Suwałki massif dated by the Re-Os method have given isochron ages of 1559 ± 37 Ma and 1556 ± 94 Ma (Stein *et al.*, 1998, Morgan *et al.*, 2000, Wiszniewska & Stein, 2000). The ϵ_{NdT} recalculated at 1.5 Ga (age of emplacement given by U-Pb zircon data) ranges from -0.62 to -6.82 , while ϵ_{SrT} ranges from -10 to $+287$. These values indicate that crustal contamination has played an important role in the genesis of these magmas. Moreover, as the data plot along a single hyperbola in a ϵ_{NdT} vs ϵ_{SrT} diagram, it can be proposed that contamination resulted from a single and quite homogeneous crustal contaminant. This later could be the Svecofennian basement that is widespread in this part of Poland.

In conclusion, we adopt the hypothesis that the various components of the Mazury Complex were derived through variable degrees of partial melting of a single and quite homogeneous source. These magmas batches were contaminated to different degrees by the basement in which they were emplaced, and each massif evolved independently by low degrees of differentiation

The 1548 to 1513 Ma protoliths of the Mazury Complex are coeval with those of the other AMCG complexes of western Russia, southern Finland, Estonia, Latvia and central Sweden. The formation of the suite is concentrated in the period covering almost 50 m.y., from 1.55 to 1.50 Ga. A thick crust and a Moho offset on the recent EUROBRIDGE geophysical profiles could indicate that a slab of lower crustal rock has been melted under the Suwałki massif to

produce the AMCG rocks. Recent structural and kinematic observations indicate dominant transpressional/compressional regimes.

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