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THE Nd MODEL AGES OF THE GNEISSIC PEBBLES
FROM GRÓDEK ON ROŻNOWSKIE LAKE - PRELIMINARY DATA

Abstract: Sm-Nd isotopic study of the gneissic pebbles from the Gródek on Rożnowskie Lake (Outer Carpathian flysh) were carried out on whole rock samples. The Nd model ages vary between 1.78-2.52 Ga, which is highly inconsistent. Strongly negative initial $\epsilon\text{Nd}_{(0)}$ values (-13.5 to -16.6) suggest that gneisses protolith, seemingly sedimentary rocks, is pre-Variscan.

Key words: gneissic pebbles, Outer Carpathian flysh, Sm-Nd method, Nd model ages

INTRODUCTION

The nature of the West Carpathian Flysh Belt basement origin is obscure. Geochemical studies on the crystalline "exotics" (granite and gneiss pebbles) have been already carried out in the Moravian flysh (Hanžl et al. 1999, 2000), Magura flysh (Štelcl 1989, 1993), and Pieniny Klippen Belt flysh (Uher, Pusharev 1994, Uher et al. 1994) in the West Carpathians. Granitoid pebbles in Eastern Alps have been investigated as well (Frasl, Finger 1988, Finger et al. 1997). Source of Tertiary flysh pebble material from Magura flysh was found similar to those coming from Brunovistulian terrane basement (Štelcl 1989, 1993). However, geochemical data point to the similarities of granitic pebbles from the Pieniny Klippen Belt flysh conglomerates with granitoids of the Central West Carpathians basement (Hanžl et al. 1999, Uher and Puskarev 1994). The aim of this study was to characterise the gneissic pebbles from Gródek on Rożnowskie Lake in terms of Sm-Nd isotope system and comparing isotopic results with Variscan granitoids from Western Carpathians and with Cadomian granites and gneisses in the Central Europe.

GEOLOGICAL SETTINGS

This study deals with pebbles, which are abundant south of Gródek on Rożnowskie Lake (Silesian Unit, Outer Carpathian Flysh Belt, Poland). Granite and gneiss pebbles occurring in the Tertiary conglomerates probably derived from single source area (vide Szydłak 1980). In the absence of unambiguous geochronological evidence, their age and origin was ascribed to the Variscan orogeny (Wieser 1985).

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MATERIAL AND METHODS

The gneiss pebbles, 10-25 cm in size, are coarse grained and represent augen and/or banded texture. Author selected five samples for detailed Sm-Nd isotopes study; the collected set comprised thirty gneiss pebbles. Some of previous author's investigations suggest they may represent ortogneisses (Michalik, Jacher in preparation). The analytical part of this work was performed at the University of Giessen. Details of analytical techniques used are described by Jolanta Dopieralska (see <http://geb.uni-giessen.de/geb/volltexte/2003/1168/>, pdf), who supervised chemical separation procedures, carried out mass spectrometric measurements of the Sm and Nd ratios, and made important calculations. Repeated measurements of AMES standard gave $^{143}\text{Nd}/^{144}\text{Nd} = 0.512131 \pm 0.8$ ($2\sigma_m$, within-run error), external precision $< 1.5 \times 10^{-5}$.

RESULTS

The results of Sm-Nd studies are listed in Table 1. The Nd isotopic analyses are reported in the standard epsilon notation (ϵ) calculated using today's $^{143}\text{Nd}/^{144}\text{Nd}$ ratio of CHUR (Chondrite Uniform Reservoir) = 0.7219. The $\epsilon\text{Nd}_{(0)}$ of the gneisses are strongly negative (-13.5 to -16.6), which suggest they must be older than crystalline pebbles from other localities in West Carpathian flysh (295-340Ma – U-Th-Pb dating of monazite by Hanžl et al. 1999) or in the flysh of Pieniny Klippen Belt (274 or 294Ma – U-Pb zirkon dating by Uher, Pushkarev 1994) and than it was previously assumed (Wieser 1985). However, similar values of $\epsilon\text{Nd}_{(0)}$ were obtained in NE Bohemian Massif in case of acidic schists (Crowley et al. 2002) and in eastern Bohemian Massif basement for granite-gneisses (Hegner, Kröner 2000) that age was considered as 500 Ma. It is worth indicating that all samples are similar with respect to $^{143}\text{Nd}/^{144}\text{Nd}$ ratio, in spite of fact they have different ϵNd and Nd model ages.

Table 1: The Sm-Nd isotopic composition and calculated $\epsilon\text{Nd}_{(0)}$ parameters of the gneissic pebbles from Gródek on Rożnowskie Lake.

Sample	$^{147}\text{Sm}/^{144}\text{Nd}$	$^{143}\text{Nd}/^{144}\text{Nd}$	2σ	$\epsilon\text{Nd}_{(0)}$
JR 1	0.1415	0.511946	0.000007	-13.5 \pm 0.3
JR 6	0.1003	0.511822	0.000006	-15.9 \pm 0.3
JR 10	0.1059	0.511787	0.000009	-16.6 \pm 0.3
JR 11	0.1222	0.511931	0.000007	-13.8 \pm 0.3
JR 12	0.1091	0.511799	0.000009	-16.4 \pm 0.3

The Nd model ages were calculated in relation to both CHUR and DM (Depleted Mantle) and presented in Fig 1. A broad range of obtained model ages suggests either a complex or sedimentary protolith. Possibility that they were delivered from several different sources should be rather passed over because of similarities in $^{143}\text{Nd}/^{144}\text{Nd}$ (Tab. 1). Furthermore, the calculated model ages

indicate that gneisses protolith must partly comprise recycled Proterozoic components at least.

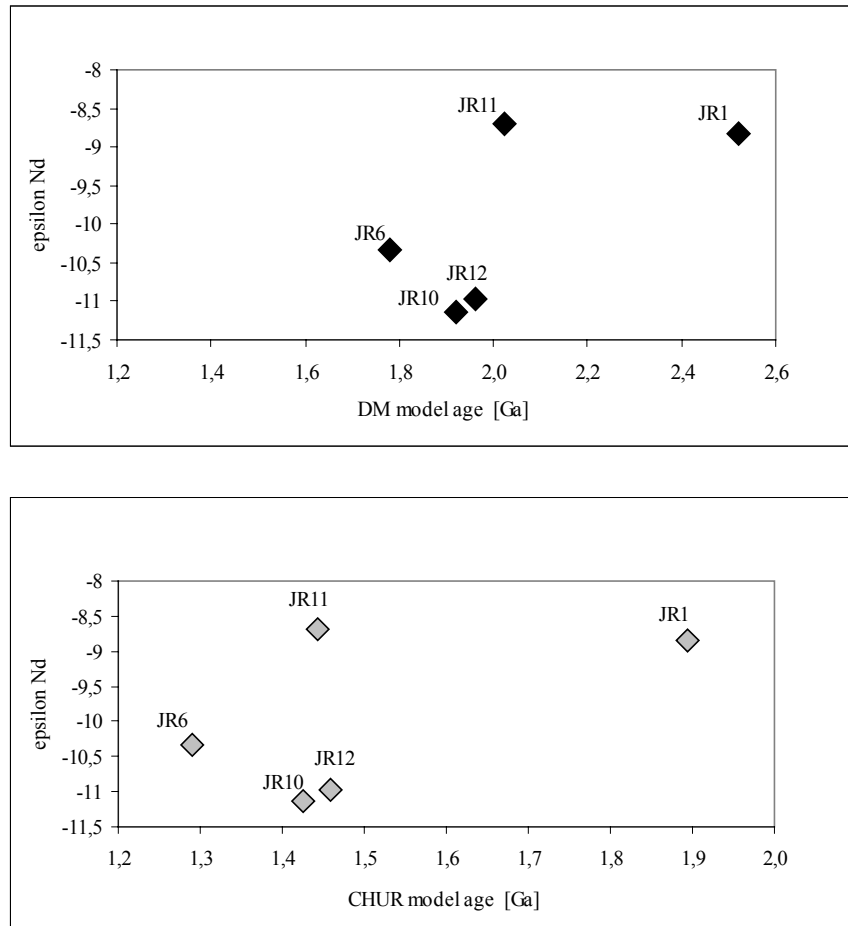


Fig. 1. The Nd model ages of the gneissic pebbles from Gródek on Rożnowskie Lake in relation to DM and CHUR. Maximal error amount 0.03 (2σ).

CONCLUSIONS

Assuming that gneissic pebbles from Gródek on Rożnowskie Lake originated from magmatic rocks they can not belong to the Variscan group of pebbles, which were described in Pienniny Klippen Belt and in the Moravian flysch. Moreover, results of presented study show they are undoubtedly older, what contradicts opinions previously given in the literature about Variscan age. Although the Nd isotopic significance does not deny Cadomian origin, it is impossible to prove a real age solely from Sm-Nd investigations.

The strong divergence in the Nd model ages (Fig. 1) suggests inhomogeneous and complex source with Proterozoic components in the protolith of gneisses. Sedimentary protolith rocks can better explain the origin of gneisses.

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