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Rafał TYSZKA[1], Ryszard KRYZA[1]

LITHOSTRATIGRAPHIC CORRELATIONS BASED ON HEAVY MINERALS: PRELIMINARY DATA FROM METASEDIMENTARY ROCKS OF THE KACZAWA COMPLEX, SUDETES, SW POLAND

Abstract: Metasedimentary rocks of the Kaczawa Complex, interpreted in recent geological literature as fragments of a Variscan accretionary prism, are often poorly constrained as regards their age and emplacement setting. Our preliminary heavy mineral studies show that apatite, a TiO_2 phase, altered biotite and haematite are the most common components of the heavy mineral fractions. The heavy mineral assemblages of the Kaczawa mélanges and associated metasedimentary rocks display similarities and differences which may prove helpful in lithological correlations and palaeogeographic interpretations.

Keywords: heavy minerals, metasedimentary rocks, lithostratigraphy, Kaczawa Complex, Sudetes

INTRODUCTION

The Kaczawa Complex forms a number of tectonic units composed of Palaeozoic low-grade metamorphic rocks representing: (a) thrust sheets and fragments of nappes made of volcanic-sedimentary successions of Cambrian through Lower Carboniferous age, and (b) sedimentary and tectonic mélanges composed of various fragments of these successions in a predominantly dark muddy matrix; the age of the muddy matrix has been suggested to be Upper Devonian to Lower Carboniferous (Baranowski et al. 1990).

Scarce and often poor age constraints, and commonly unclear relationships between lithological units, limit our understanding of the early stages of evolution of the Kaczawa Complex. Different lithological associations and apparently different PT paths recorded in various tectonic units of the complex indicate that they were emplaced in different palaeogeographic environments, underwent different tectonic histories, and were subsequently juxtaposed in later tectonic movements (Kryza, Muszyński 2003). Given the lack of effective biostratigraphic constraints and the mostly poor quality of palaeoenvironmental indicators, heavy mineral studies potentially offer a means to correlate these rocks and interpret their origin, possible source areas, depositional conditions and later diagenetic and metamorphic processes. Here we present preliminary results of heavy mineral

[1] *University of Wrocław, Institute of Geological Sciences, Department of Mineralogy and Petrology, ul. Cybulskiego 30, 50-205 Wrocław, Poland*

investigations of metasedimentary rocks, representing various lithologies of the Kaczawa Complex.

SAMPLING AND METHODS

Seven samples of metasedimentary rocks from different tectonic units of the Kaczawa Complex were selected for heavy mineral studies.

JA1 – dark grey laminated metamudstone (mélange matrix); Janówek;
ZL1e – grey metamudstone (mélange matrix); Złotoryja;
RY1a – dark grey to black slate (mélange matrix ?); Rząsiny;
KC1 – pale grey metamudstone; Kaczorów;
WO1c – pyrite-bearing black slate; Wojcieszów;
WD1p – pale grey metamudstone (at the base of diabase sill); Wojcieszów;
CHR2 – pale grey metasandstone from the Radzimowice Slates; Chrośnica.

The conventional method of heavy mineral separation in heavy liquid was applied. Further investigations included optical microscopy (transmitted and reflected light) and EDS microprobe analysis (Cambridge M9 at the Institute of Geological Sciences, Wrocław University).

RESULTS

Two samples from the mélange matrix, JA1 and ZL1e, have generally similar heavy mineral assemblages (Fig. 1), with apatite, titanium oxide (rutile ?) and altered biotite (Fig. 2) predominant; the third one, RY1a, is significantly different, being rich in clinopyroxene, sphene and haematite. Specimen KC1, seemingly unrelated to the mélanges, is similar to the former two mélange samples, with apatite, Ti oxide and altered biotite as the main components. In contrast, sample CHR2 from the Radzimowice Slates (arguably related to mélanges), is very different to all the remaining samples, having a specific association of apatite and corundum; however, interpretation based on that single sample should be made with caution.

The two samples of metasedimentary rocks from Wojcieszów (WO1c, WD1p) show some similarity as regards their heavy mineral assemblages. In particular, both contain haematite grains possessing the same morphology as associated pyrite in the same samples, and therefore likely to be of pseudomorphic origin (with some haematite grains preserving pyrite cores). This emphasizes the importance of distinguishing detrital from authigenic/metamorphic phases in assessing provenance.

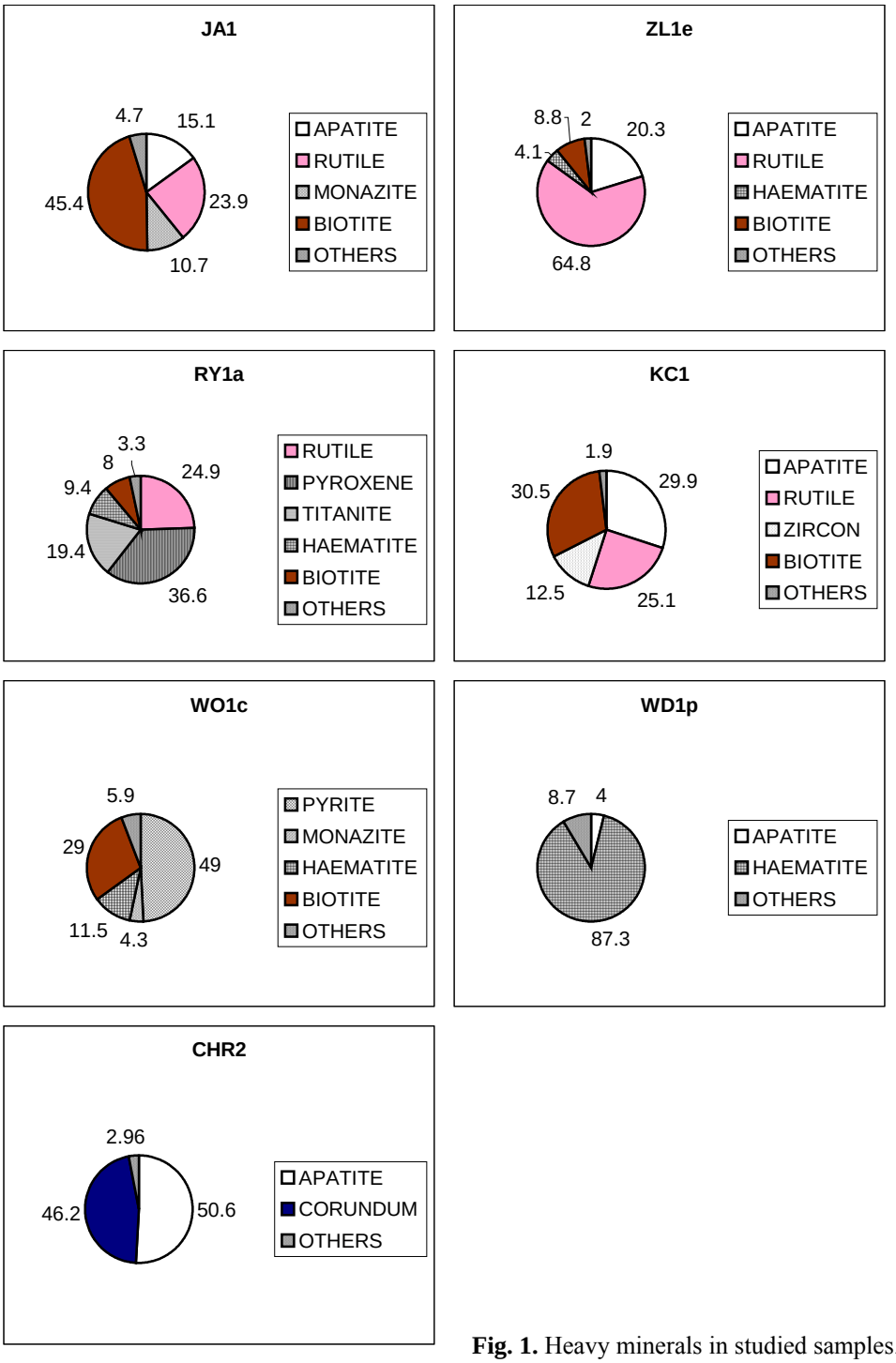
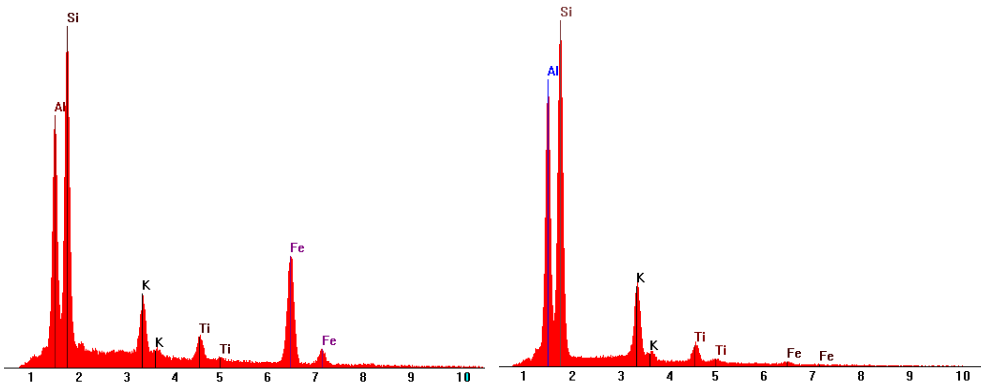


Fig. 1. Heavy minerals in studied samples.



Biotite from sample JA1 Altered biotite from sample ZL1e

Fig. 2. EDS spectra of biotite and its alteration product from selected samples.

CONCLUSION

The observed variation in the heavy mineral assemblages, which is considerable (Fig. 1), shows the potential of this approach, and studies of a larger number of samples are in progress, to more precisely constrain the character and distribution of these assemblages. The chemical composition of the minerals is potentially an additional indicator, though some detrital minerals (e.g. biotite) may show differences caused by various degrees of secondary (including metamorphic) alteration (Fig. 2), thus masking the original features. The approach as a whole, though, promises to provide useful palaeographic and stratigraphic constraints for the complex and poorly understood mudrock units of the Kaczawa Mountains.

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