Chemical Composition of Heavy Minerals as Indicators of Alimentary Areas Based on a Study of Lower Carboniferous Sediments of the Intra-Sudetic Basin

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Heavy minerals are useful indicators of alimentary areas of sedimentary basins. By comparing the heavy mineral spectra in the sedimentary fill of a basin with the mineral composition of the basement rocks or in the surrounding areas, it is possible to establish the transport directions within the basin. Additionally, very helpful for such research is the chemical composition of some minerals, in particular those displaying significant compositional variation, e.g. garnet, amphibole, pyroxene, chlorite and biotite.

The heavy mineral spectra of the Lower Carboniferous molasse sediments in the Intra-Sudetic Basin comprise mainly apatite, garnet, epidote-clinozoisite, mica, chlorite, amphibole, pyroxene and opaque minerals (Felicka 1997). WDS microprobe analyses were performed on eight samples representing various

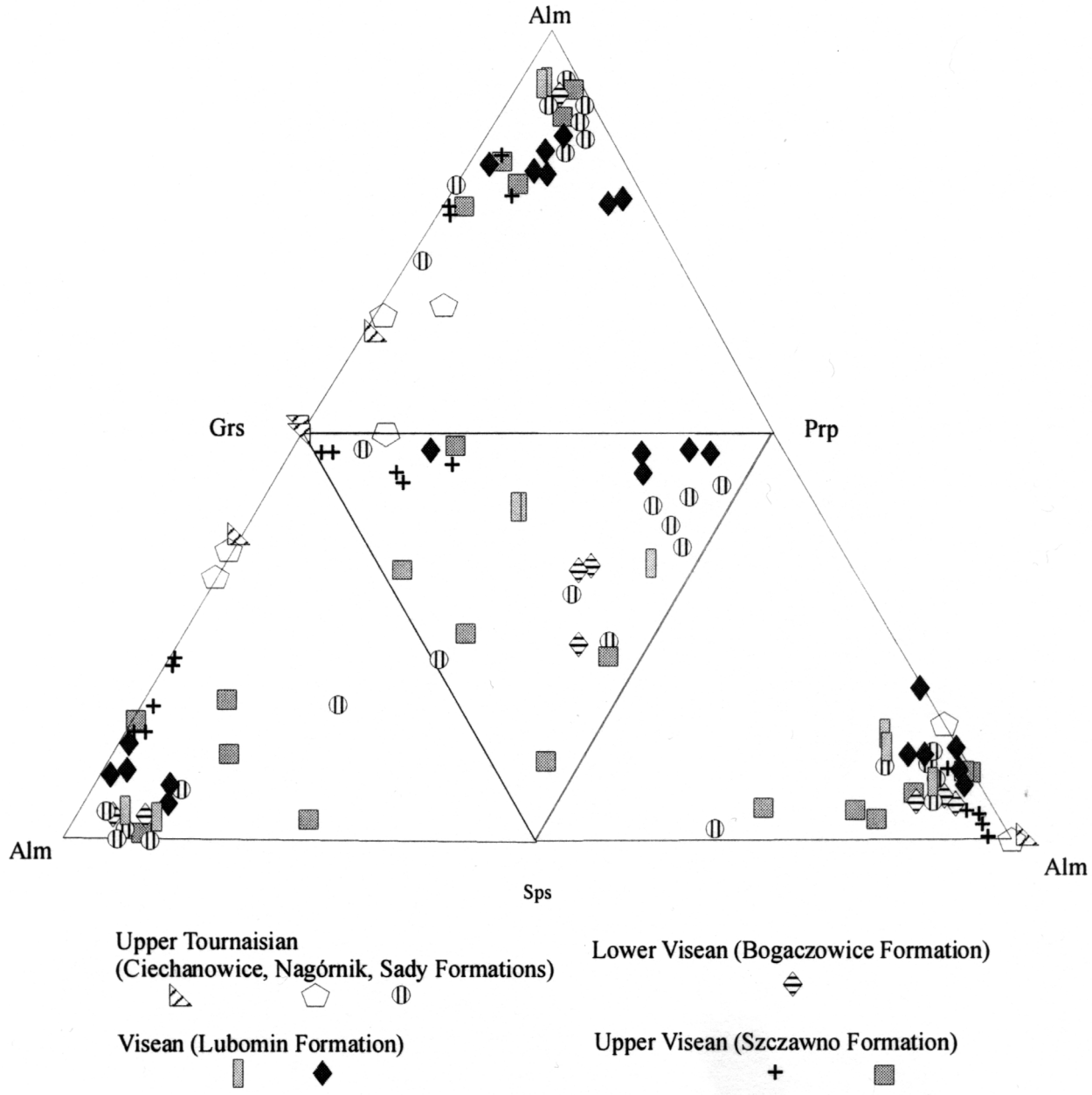

Fig. 1. Garnets from Lower Carboniferous rocks of the Intra-Sudetic Basin.

stratigraphic levels located along two profile lines in the western and eastern parts of the basin.

Garnet - The analyses of garnets (Fig. 1) from the oldest, Upper Tournaisian, formations display high contents of Grs (up to 90%). Their formulae are similar to those occurring in contact-metamorphic basic rocks of the eastern cover of the Karkonosze granite. Garnets representing younger formations contain considerably lower amount of Grs (5-20%) but much more Alm (up to 70%). Such composition is typical of garnets of contact-metamorphic metapelitic rocks, such as those known from the eastern cover of the Karkonosze pluton. There is a notable difference between garnets from the eastern and western parts of the Intra-Sudetic Basin. Those from the eastern part contain more Sps (10-30%) than Prp (5-20%), and resemble garnets of low-grade metamorphic rocks. In contrast, garnets from the western part of the basin display higher Prp/Sps ratios (Prp 10-40%, Sps - max. 15%) and are similar to garnets from mica schists of the Karkonosze - Izera Block (Kryza and Mazur, 1995).

Chlorite - Three chemically different groups of chlorites are found in the Lower Carboniferous sediments: 1) high-Fe chlorites, probably coming from metapelitic rocks, 2) low-Fe chlorites, most likely derived from metabasic rocks, 3) low-Fe and high-Si chlorites typical of igneous basic rocks (products of amphibole and pyroxene alteration). Interestingly, there are two different types of chlorites in most of the examined samples, although it is still difficult to notice any systematic variation.

Biotite - Most of the examined biotites are partly altered and replaced by chlorite. They represent high-Fe types similar to those from metabasites of the Kaczawa Mts.

Amphibole -This mineral is not very common in the Lower Carboniferous sediments. Most often its composition corresponds to actinolitic hornblende which indicates relatively low-grade metamorphic rocks as their source.

Detailed chemical analysis shows that in the studied samples, where amphibole and pyroxene are less common phases, garnet and chlorite appear to be the most useful indicators. The observed chemical variation of heavy minerals within one formation confirms that the material was transported to the Intra-Sudetic Basin from various sources rather than from a single alimentary area. The detrital material for the oldest Carboniferous sediments was mostly derived from the Kaczawa Mts, while that for younger deposits seems to have come from the eastern cover of the Karkonosze massif, in general agreement with the results of previous sedimentological research.

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