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PROVENANCE OF ZIRCONS FROM THE UPPER CRETACEOUS AND PALAEOCENE SANDSTONES OF THE MAGURA NAPPE IN THE LIGHT OF CATHODOLUMINESCENCE STUDIES

ANALYSED MATERIAL

The studied samples were taken in the central and southern part of the Polish section of the Magura nappe. They represent Szczawina sandstones (Senonian-Palaeocene), the Ropianka beds (Palaeocene), the Jaworzynka sandstones (Senonian-Palaeocene) outcropping on the southern margin of the Mszana Dolna tectonic window, and Jarmuta (Maastrichtian-Palaeocene) and Szczawnica (Palaeocene-Lower Eocene) formations occurring in the southern part of the Magura nappe.

ANALYTHICAL METHODS

Microscopic features of zircons (crystal forms, colour, inclusions, zoning) were generally described using conventional transmitted light microscopy.

Cathodoluminescence (CL) studies of zircons were carried out in polished thin-sections of separated heavy fractions using hot cathode equipment HC2 – LM, Simon Neuser, Bochum in the Department of Geology and Paleontology of the Masaryk University in Brno (Czech Republic).

RESULTS

Zircon is one of the main minerals occurring in the investigated heavy fractions and comprises 20 to 50 volume %. In terms of colour, using transmitted light microscopy, in all the zircon populations colourless, yellowish and pinkish grains were distinguished. They were mostly unaltered; only very few grains were metamictised. Internal features, especially zoning, were commonly invisible or weakly visible only in several, pinkish grains.

CL analyses allowed seeing detailed zoning patterns as well as internal inclusions, alterations and overgrowths.

CL investigations have revealed that the studied zircons do not vary significantly between samples. In all of them, the following kinds of zircon grains were observed.

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As far as zoning patterns are concerned, five types of them were distinguished. They mostly represent different varieties of magmatic zoning.

The most frequent type was characterised by regular oscillatory zoning with bands parallel to the growing crystal faces (Fig. 1). The banding was in most cases well-defined showing relatively strong contrast in luminescence.

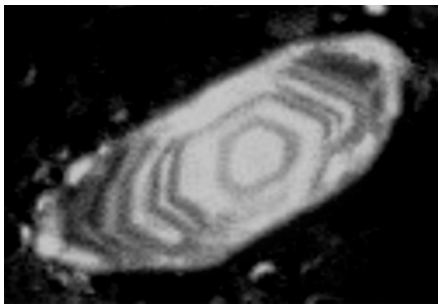

Fig. 1. Magmatic oscillatory zoning in a zircon grain.

The second group comprises zircons in which brightly luminescent oscillatory-zoned cores and dark oscillatory-zoned rims (and vice versa) were noticeable.

To the third less numerous group belong zircons showing oscillatory magmatic zoning with noticeable inner embayments.

To the fourth group belong grains displaying patchy/sector zoning and the last one consists of very complex irregularly zoned zircon grains.

Apart from zoning, the following varieties of zircons were noticed: a) zircons containing inclusions of non-luminescent mineral in the central part of the grain, b) non-luminescent grains, c) grains overgrown with bright yellow mineral, which is probably xenotime.

PROVENANCE OF ZIRCONS

Regular oscillatory zoning is typical for zircons, which crystallised in magmatic conditions. This leads to the conclusion that the majority of the investigated zircons could have crystallised in such environment.

The presence of resorption embayments, visible in the minority of grains, cutting across older magmatic zoning may indicate metamorphic overprinting or just a site of totally resorbed inclusion (Hanchar and Miller 1993).

Highly irregular zones are claimed to be paleometamict zones (Hanchar and Miller 1993), although in such grains no alteration was visible.

A bit debatable is also the origin of zircons displaying patchy zoning. According to literature they could form in magmatic as well as in metamorphic conditions (Rubarto and Gebauer 1998).

Another case constitutes the grains with two CL domains differing in CL intensity. As weak luminescent zones, in comparison to the bright ones, are usually enriched in trace elements, such contrasting areas may reflect a rapid change in chemistry in the crystallisation environment.

The overgrowths visible on numerous zircon grains, which are probably made of xenotime, are likely the result of diagenetic processes.

Considering all features of the investigated zircon grains, it seems that the analysed zircon populations represent mixtures of grains deriving from different kinds of source rocks. This could be the reason for further conclusion of

heterogeneous provenance of sediments from which the investigated samples were taken.

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