COMPONENTS – MULTISPECTRAL IMAGE ANALYSIS OF VARVED SEDIMENTS IN THIN SECTIONS

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COMPONENTS is a new method to automatically quantify sedimentary components in thin sections. It is based on a 6-band (multi-spectral) image analysis. First, the thin sections are scanned twice, under polarized and under unpolarized plain light. Then, the two images are stacked to a single multispectral image file, with the first three bands (blue = 1, green = 2, red = 3) resulting from the unpolarized light, and the bands 4 to 6 (blue = 4, green = 5, red = 6) from the polarized light run.

The next step is the discrimination of the major sediment components by their transmission spectra characteristics. We use an approach based on band ratios, also known as indices. By using band ratios, the reflection measured in different bands is normalized against each other and minor illumination variations (e.g. by sample thickness variations) are eliminated. By combining specific ratios we are able to detect all seven major components in the investigated sediments (pyrite, resin, carbonates, quartz, clay, diatoms and plant remains).

The automatic classification and the analogous classification show high concordances, but some systematic errors could be identified. Consequently, the next step is the correction of these systematic errors. Exemplarily, the transition zone between resin and sediment is falsely classified as clay (or fine clastic material) which is the result of the preparation process. During the correction process we identify all clay next to resin using neighbourhood matrices. Then, the fine clastic fringe is reclassified as resin. The description of other reclassifications would exceed the limit of this abstract.

After classification each pixel is attributed to one of the components. To identify seasonal layers or varves we need information on the occurrence and abundance of components in the sub-layers. Thus, we use a filter kernel (low pass filter) based on neighbourhood analysis to integrate the classification data within small horizontal units. Each pixel of the filtered maps now carries the information about the absolute or relative frequency of this component in a defined neighbourhood.

Finally, component occurrences along profile lines can be visualized as diagrams both within the image processing software and as an exported ASCII file to be displayed in common spreadsheet software. The work of the next months is the enhancement of the neighbourhood analysis and the frequency analysis of the components.

In the future, we will develop this method for automatic detection, classification and measurement of varves.

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