PalynofAIcies – a new artificial intelligence-assisted tool to analyse palynology slides

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Abstract

Introduction
PalynofAIcies, a new tool for the automatic identification and quantification of organic particles in palynological slides is presented.

Many institutions, both public - Museums, Universities, Surveys - and private - oil and gas companies - have extensive micropaleontological collections. These are not always kept in optimal conditions (risking physical degradation) and generally this is stranded, unused data, despite its enormous value for stratigraphic context, source rock evaluation and paleoenvironmental interpretation.

The observation of palynological slides, and other microfossil groups, is based on the usage of optical microscopes by a specialist, commonly with a dedicated camera. Except for the introduction of digital cameras in the last decades, no significant technological advances have been made in over a century of micropaleontological studies. In recent years high-resolution slide scanners – initially used for cytology and other medical studies – have been introduced, allowing not only digitalization of the observation method, but opening the door to artificial intelligence (AI) applications.

Methods and materials

This new tool is based on the AI-assisted analysis of high-resolution images of scanned palynological slides, which are the inputs of the tool. The specialist-trained AI model is able to segment (isolate from the background), count and measure the area of up to 24 types of particles found in palynological slides:

Spores

Pollen

Bisaccate pollen

Monosaccate pollen

*Speaker

Non-saccate pollen

Acritarchs

Dinoflagellate cysts

Chitinozoans

Amorphous Organic Matter (AOM)

Fungal remains

Filaments

Foraminifera test linings

Other Zooclasts

Freshwater algae

Marine algae

Phytoclasts

Opaque equant (length: width ratio < 2)

Opaque lath (length: width ratio > 2)

Degraded

Translucent cuticle

Translucent structured

Translucent non-structured

Resin

Minerals

Fibres

Air bubbles

Additional particle types can be added. The training data set includes samples from Ordovician to Miocene strata, from diverse sedimentary settings and geographical locations.

Results and applications

The user can have local or remote access to the scanned slides on a computer screen and annotate the slide, measure and count particles and share the image and interpretation. The AI-model results are presented in a user-friendly graphical interface that allows the user to QC the interpretation, easily produce ternary diagrams (e.g. Tyson), and obtain several paleoenvironmental indexes and optical kerogen typing parameters. It can also be used as a tool to ease taxonomic identification, a stepping stone for biostratigraphic interpretation.

Acknowledgements
We would like to acknowledge FundingBox and the StairwAI program (EU-funded) for their

support in the initial stages of the work.

Keywords: Palynology, Computer Vision, Artificial Intelligence, paleoenvironments