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Late Olenekian-Anisian development of the Tatricum Basin in the Tatra Mts. (southern Poland).

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Research objectives

The project was focused on reconstruction of sedimentary palaeoenvironments and basin evolution of the Tatricum Basin in late Olenekian to Anisian times.

The study encompassed Lower–Middle Triassic succession reaching 150 metres in thickness and arranged in so called Giewont nappe.

The sediments under discussion are poor in age-diagnostic fossils, what makes chronostratigraphy of the Tatric Triassic very general and inaccurate. In order to recognise and refine the stratigraphic framework of the succession several of the methods were being applied. One of them was related to stable isotopic composition.

Research methods

The research project was based mainly on field investigations. The field activity comprised constructions of measured lithological sections of the upper Olenekian to Anisian succession in Zawrat Kasprowy and Giewont massives, rock sampling for laboratory works (thin sections analyses and stable carbon and oxygen isotopes analyses) and photographic documentation of sedimentary and diagenetic structures. Field investigations gathered data on lithology, sedimentary and diagenetic features in terms of their lateral and vertical variety. These data were completed by study of microfabric properties and stable carbon and oxygen isotopes analyses. Field and laboratory data served as a basis for creation of the synthetic lithostratigraphical section of the Lower–Middle Triassic in the investigated unit.

Method of high-resolution dynamic stratigraphy was employed as a method enabling recognition of basin evolution and discrimination of its control factors.

Results

Lithofacies

The studied succession is formed by mixed carbonate-clastic deposits which upward pass to carbonate deposits. On the base of the field study and microfabrics analyses several lithofacies were distinguished:

a.) supratidal facies including:

- karstified dolomites and paleosoils
- dololutites with teepee fabrics and collapse breccias
- dololutites with pseudomorphs after evaporites

b.) intertidal facies including:

- microbial laminated dololutites
- dololutites and calcilutites with pseudomorphs after evaporites

b.) subtidal facies including:

- laminated dark calcisiltites and dark calcisiltites interbedded with calcareous dark mudstones
- banded calcilutites with calcarenites (tempestites) intercalations
- bioturbated calcilutites with calcarenites (tempestites) intercalations
- peloidal and oolitic dolomitic calcisiltites and calcarenites

Sedimentary cycles

The studied succession can be divided into several shallowing-upward cycles.

In the lower part of the succession a complete cycle are formed by limestones or limestones intercalated with dark mudstones (subtidal/intertidal facies), which are replaced by microbial, laminated dolomites and/or dolomites with pseudomorphs after evaporites (intertidal deposits). The boundaries of the cycles are defined by dolomites with teepee fabrics sometimes karstified surfaces, and/or collapse breccias.

In the upper part of the section clastic deposits disappear. Subtidal facies are represented by dolomitic grainstones, banded and bioturbated (vermicular) limestones dominate. These sediments are replaced in turn by laminated dolomites or dolomites with pseudomorphs after evaporites. The top of complete cycle is formed by collapse breccias and/or karstified surface. These cycles are considered as fifth-order cycles. These cycles are arranged in shallowing or deepening trends, which corresponds to the fourth-order sequences (parasequences).

Stable isotope signals

The value $\delta^{13}C$ of the most samples fall in the range 0-3‰, however six samples have distinctly decreased values $\delta^{13}C$, -2,5 to -9,5 ‰ in the range. The $\delta^{18}O$ values range between -4 to -10‰ (three samples gave values about -13 to -14‰). The $\delta^{13}C$ and $\delta^{18}O$ indicate rather stabilized geochemical conditions. Negative signals (both $\delta^{13}C$ and $\delta^{18}O$) reflect meteoric water input and they also correspond to the karst surfaces and/or soil horizons. Positive shifts $\delta^{18}O$ indicate evaporitic enrichment.

Conclusions and final remarks

According to the sedimentological and geochemical results, the studied late Olenekian-Anisian sequence represents transgressive succession. It starts with sediments deposited in the sabkha-lagoon environment and pass upsection into isolated and restricted carbonate platform dominated by shallow-marine carbonate and evaporitic deposits.

The transgression was tightly related to the initial phase of the opening the Western Tethys Ocean. Fifth-order shallowing-upward cycles distinguished in the studied succession are stacking in fourth-order cycles. Recognition of the high-frequency cycles and their correlation with high-frequency cycles from other parts of the High-Tatric Unit should enable construction of the 3rd-order sequence stratigraphy framework for the Tatric Triassic.

I would like to thank the IAS for their financial support of this study. The results of the project will be included in my PhD Thesis. The obtained results will be presented on the scientific conferences and published in Polish as well as international scientific journals.

EXPENSES

- field works (accommodation, boarding.): 203,56€
- materials: total cost – 97,59€
    - writing materials, copy paper, compact discs, diskettes: 34,75€
    - films to camera and photographic service (photographic documentation): 48,06€
    - boxes to rock samples: 14,78€
- lab works: total cost – 572€
    - stable isotopes C and O analyses (44 samples, 13€ per one): 572€

Total expenses: 873,15€ (planned 850€)