

Oberjurassische Korallenriffe im Niedersächsischen Becken (NW-Deutschland) – ein Überblick

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Der Zeitabschnitt des Oberen Jura stellt erdgeschichtlich einen Höhepunkt der Entwicklung von Riffen dar. Riffe aus der Oberjura-Zeit sind fast weltweit verbreitet. Bedingt durch ein relativ ausgeglichenes Klima entstanden sie auch auf höherer Paläobreite, u.a. während des Oxfordium im Niedersächsischen Becken (NW-Deutschland), einem Nebenmeer N' der Tethys. Die NW-deutschen Korallenriffe bilden ein wichtiges Bindeglied zu den gleichaltrigen und/oder jüngeren Korallenriff-Vorkommen in S-England, dem östlichen Pariser Becken, dem Schweizer Jura, S-Deutschland und Polen.

Im Rahmen geologischer Kartierungen des Korallenooliths (s.u.) wurden seit 1997 zahlreiche Korallenriffe neu entdeckt. Die Aufschlüsse liefern zusätzliche Informationen zum Verbreitungsmuster der Korallenriffe, zu ihrem Aufbau sowie ihrem Faunen- und Floren-Inventar und erweitern das Wissen zur Faziesarchitektur und Entwicklung des Niedersächsischen Becken während des Oxfordiums grundlegend.

Im Niedersächsischen Becken sind Korallenriffe an den sogenannten "Korallenoolith" gebunden, einer durch Oolithgestein dominierten, ca. 50 m mächtigen Abfolge von Plattformkarbonaten. Darin treten sie im wesentlichen in zwei Horizonten auf, der "Basis-Korallenbank" und der "florigemma-Bank", auf die sich die Bearbeitung beschränkt. Die "florigemma-Bank" ist ein weit verbreiteter Leithorizont von wenigen m Mächtigkeit innerhalb des Korallenooliths. Ihr Ausbiß wurde bisher in einer Erstreckung von ca. 35 km in EW und ca. 10 km in NS im Wesergebirge, Süntel, Deister, Kleinen Deister und im Osterwald kartiert. Dabei ergaben sich charakteristische Verbreitungsmuster von unterschiedlichen Riffotypen.

Im Süntel-Gebiet sind auf einer Fläche von ca. 50 km² zahlreiche kleine Fleckenriffe in lagunärem, mikritischem Kalkstein dispers verteilt. Die ramose *Thamnasteria dendroidea* dominiert die ansonsten artenarme Korallenfauna und bildet häufig heckenartige Bestände, welche Substrat für intensive Mikrobialith-Inkrustierung liefern. Weiterhin kommen foliose bis plattige Korallenstöcke (*Th. concinna* und *Actinaraea* sp.) vor, die vereinzelt auch kleine polsterartige Biokonstruktion ohne Beteiligung von *Th. dendroidea* und Mikrobialith aufbauen. In wenigen Fällen weisen die durch *Th. dendroidea* dominierten Fleckenriffe eine "Kappe" von Rotalgenknollen (*Solenopora*) auf.

Im Deister tritt innerhalb des westlichen Bereich ein auf über 2 km Lateralerstreckung erschlossenes Korallenbiostroms auf. Die Korallenfauna umfaßt ca. 15 Taxa, wobei alle Korallenwuchsformen (hemisphaerisch, plattig, folios, fasciculat, solitär, ramos) vertreten sind. Mikrobialith ist ebenso verbreitet. Als Besonderheit fällt das individuenreiche Vorkommen von Chaetetiden (*Ptychochaetetes*) auf. Nach oben schließt das Biostrom mit einer Lage großer *Solenopora*-Knollen ab. Dagegen sind im östlichen Deister Fleckenriffe aus *Stylosmilia*-Gestrüpp mit großen eingewachsenen, halbkugeligen *Stylina*-Stöcken und Mikrobialith-Bewuchs ausgebildet. Solenoporen und Chaetetiden liegen ebenso reichlich vor – allerdings bevorzugt im Zwischenriffbereich.

Im Kleinen Deister bildet *Th. dendroidea* korallenwiesenantartige Vorkommen, mit weitständigen, filigranen, vorwiegend nach oben wachsenden Ästen; einzelne, buschförmige Korallenstöcke sind i. d. R. nicht auszumachen. Inkrustierender Mikrobialith fehlt nahezu vollständig, stattdessen ermöglichte hoher Sedimentanfall (Pelioide, Cortoide, Foraminiferen) die in situ-Überlieferung der einzelnen Korallenäste.

Die Korallen-Biokonstruktionen des Osterwald, die – eingebettet in Riffschutt – bis 10 m hohe "Korallenstotzen" aufbauen, sind

zur Zeit am besten aufgeschlossen. Sie werden gesondert dargestellt (REUTER et al. dieser Band).

Insgesamt ergeben die Ergebnisse bereits jetzt neue Einblicke in Korallenriffe und ihre Lebewelt, lokale Differenzierungen der Riffe und Provinzialismus der Rifforganismen während der Oberjura-Zeit. So unterstreichen u. a. die Chaetetiden die engen paläobiogeographischen Beziehungen zu oberjurassischen Korallenriffen der Tethys und ihren Schelfmeeren. Die bisher vorliegenden Beobachtungen sollen über die Riffentwicklung hinaus zu einem Gesamtbild des Ablagerungsraumes und der Bildungsgeschichte des Korallenooliths führen.

Multiproxy-Analysis at the Silurian/Devonian Boundary Stratotype Klonk (Suchomasty, Czech Republic)

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The outcrop Klonk near Suchomasty (Czech Republic) was selected as international Silurian-Devonian boundary stratotype by the International Commission on Stratigraphy at the session of the 24th International Geological Congress in Montreal in 1972 (KRIZ 1992). The Silurian/Devonian boundary within this sequence is defined by the first appearance of *Monograptus uniformis*, as established by CHLUPAC et al. (1972).

The research borehole Klonk-1 was brought down to 57 m parallel to the stratotype to provide unweathered sample material for a multiproxy analysis for both inorganic and organic sedimentary components as well as for the paleoredox-conditions. The cored section consists of alternations of 141 pale grey, micritic limestone beds and 140 grey pelitic layers without major facies changes. The pelitic layers are homogeneously and evenly laminated rocks composed of quartz (mean = 39 %), muscovite+illite (22 %) and calcite (26 %) whereas the micritic limestones consist of calcite (82 %), quartz (9 %) and muscovite+illite (3 %). Subordinated minerals are distributed among dolomite, albite, ankerite, chlorite and pyrite. Both lithologies are characterized by fine laminations with scarce fossil content, limited to planktonic and nektonic genera. The mainly uniform type of lamination, the rare appearance of benthic organisms, the small grain size (<63 µm) and also the absence of cross-bedding structures indicate a relatively distal, hemipelagic, sedimentary environment beneath the storm wave base. In the transition from the Silurian to the Devonian the carbonate content increases. This is caused by short bursts of erosive biotrititic debris occurring in between 18-29 m depth and which are composed of crinoidal fragments, shells of orthoconic nautiloids as well as fragments of bivalves and/or brachiopod shells.

Both Th/U-ratio and Ceranomaly used as proxies for the paleoredox conditions, indicate a transition from dysoxic to oxic across the Silurian/Devonian boundary. The increase in oxygen during the Lower Lochkovian stage is related to the above described biotrititic debris flows. Thus, amount as well as quality of the preserved organic matter decrease accordingly. However, because within the Upper Ludlovian to Pridolian interval there is no obvious relation between organic matter and redox stage, bioproductivity must have varied.

In conclusion, by means of multiproxy-analysis, cyclic patterns of eustatic sea level changes have been determined for the Upper Ludlovian to Lower Lochkovian, a time interval of approx. 8-10

m.y. documented in the core Klouk-1. Within the Upper Ludlovian a regression is indicated by an increase of terrigenous input, a decrease of the autochthonous carbonate fraction and an increase of the amount of organic matter. While the regressive trend continues in the limestone beds until the Middle Pridolian, a transgression is documented in the pelitic layers with the beginning of the Pridolian which was followed by a short-term regressive event in the Middle Pridolian stage. In the Middle Pridolian another transgression starts and ends in the lowermost part of the Lochkovian. Accordingly, the amount of terrigenous matter as well as the amount and the quality of OM decreased and the amount of the carbonate fraction increased.

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Thermal maturity of the Carboniferous and uppermost Devonian rocks of the western European Variscides with special emphasis on the effect of strain on illite crystallinity

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Thermal maturation levels in the Upper Devonian and Carboniferous rocks of the South Portuguese Zone and southern Irish variscides are generally high, with vitrinite reflectance (VR) values ranging from c. 2 % - >6 % R_m . VR determinations from rare coals are more-or-less identical to those from associated mudrocks, proving that reworking of vitrinite is not a significant source of error. Poor correlation between vitrinite reflectance and illite crystallinity (IC) in the extensive dataset from the region is attributed, amongst others, to strain. There is no correlation between VR and stratigraphic position in the surface samples studied, suggesting syn- to post-tectonic maturation rather than simple burial maturation. Thus, IC values can be attributed to regions of different tectonic styles. A similar effect has also been observed on a small scale. Samples which were taken from a 14 m vertical section of sandstones and mudrocks of the latest Devonian Old Head Sandstone Formation at Toc Head, County Cork, showed higher crystallinities for cleaved mudrock samples than for uncleaved.

IC has shown to be controlled by several parameters. Therefore, a new alternative method - CSD (clay crystallite size distribution) - is currently discussed. It is expected to prove a more reliable maturation indicator in mudrocks.

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The Late Cretaceous El Molino Formation: Reconstruction of a terrestrial depositional environment - a sedimentological and palaeoecological approach

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A detailed analysis of the 170 m thick El Molino Formation (Maastichtian to Early Tertiary) in the region of Sucre (Bolivia) indicate an almost continuous continental deposition in this part of the central paleo-Andean Basin. The section can be divided into two depositional periods, a fluvial at the base and a predominantly lacustrine in the higher part.

The basal fluvial episode has been deposited in a delta setting with major floodplain sediments overprinted by pedogenesis, root-marks and bioturbation. Those are sometimes eroded by channels (mature sandstones), the scarce fossil content (insect remains, plant material) indicates a terrestrial environment.

The following lacustrine episode has been deposited in an extensive perennial lake with low gradient ramp-type margins. Three different facies belts can be recognized throughout the section.

The inner marginal lacustrine facies (IMLF) includes oolite- and oncolite-bearing grainstones showing episodic dessication features, thrombolites and calcretes that formed under semiarid climatic conditions.

The outer marginal lacustrine facies (OMLF) consists predominantly of ostracod-packstones and wavy to pillow-shaped stromatolites. More agitated areas are characterized by oolitic grainstones. The diverse fossil content (ostracods, gastropods, fish, characeans) suggests that the water was of low salinity during most of the period.

The open lacustrine facies consists of greenish claystones, wackestones, laminated micrites and coquinas. These lithologies often include reworked clasts from the IMLF and OMLF that was swept into the basin.

Bleached palynomorphs, charophytes and feldspar-dominated altered volcanic products indicate episodic deposition in an alkaline shallow lake during periods with higher evaporation rate (ROUCHY et al. 1993).

Palaeocurrent measurements of orientated gastropods and strike of ripple-crests show a preferred NE-SW trending current patterns. These and the orientation of dinosaur trackways (MEYER et al. 1999) indicate a NW-SE striking paleo-shoreline.

Sedimentation in this terrestrial environment was mainly controlled by variations in hydrology. Small scale lake-level fluctuations are most probably caused by climatic changes. Large scale hydrological changes are related to tectonic movement in the Andean orogenic belt.

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