mineral- und Korngrößencharakteristik auch der Chemismus des Glases und einzelner magmatischer Phänokristalle wichtig.
- Der Pauschalchemismus der Tuffe/Tuffite ist aufgrund Alteration, der Sediment-beimengungen und möglicher äolischer Frachtsonderung nur bedingt aussagekräftig.
- C/S-Analytik zur Differenzierung mariner und nichtmariner Schichtanteile unterstützt effizient die Korrelation einzelner Tufflagen.

Am Beispiel einiger näher untersuchter Tuffvorkommen vom W- und S-Rand des Steirischen Beckens und aus der Norischen Senke werden Möglichkeiten einer Tephrochronolgie in diesem Raum angedeutet.

Altersmäßig gut fassbar ist eine Fazies brechende Gruppe von Tuffen, die sich auf das Untere Badenium konzentriert. Im marinen Bereich gehören dazu auch Sedimente, deren Reichtum an magmatischen (idiomorphen) Biotiten auf eine tuffogene Beeinflussung weist. Diese stammen vom Beckensüdrand (Ratsch; Zirkon-Spaltspuren 15,6 ± 0,5 Ma.) und aus dem Bereich der Mittelsteirischen Schwelle (Retznei; biostratigraphisch datierbar). Um Pöls/Weitendorf sind zumindest zwei Tufflagen biostratigraphisch der Lageniden-Zone zuzuordnen (dazu K/Ar-Datierungen zwischen 16,6 ± 0,6 und 15,1 ± 0,5 Ma.; BALOGH et al. 1994). In Weitendorf liegen genetisch mit dem Weitendorfer Vulkanit nicht in Zusammenhang stehende Tuffe unmittelbar im Liegenden und Hangenden des Shoshonitkörpers (letzterer mit K/Ar-Datierungen zwischen 16,8 ± 0,75 Ma und 14,0 ± 0,7 Ma.; Lit. bei BALOGH et al., 1994). Vom Tregistsattel liegt aus der pyroklastischen Lobmingberg SbFm. der limnisch/fluviatilen Stallhofen-Fm. (EBNER et al. 1998) ein unterbadenisches Zirkon-Spaltspurenalter (16,0 ± 0,7 Ma.) vor.

Aus dem Fohnsdorfer Becken (Flatschach) stammt aus einem Glastuff ein weiteres unterbadenisches Zirkon-Spaltspurenalter (14,9 ± 0,7 Ma.). Dieser Horizont ist der hangendste von mindestens 5 Tuffhorizonten der Ingering-Fm. (= ehemalige Fohnsdorfer Hangendschichten). Sie überlagert das einem brackischen Milieu entstammende Fohnsdorfer Kohlenflöz (ebenfalls mit einem Tuffniveau). Ein weiteres Tuffniveau ist aus den Liegendschichten bekannt. Hangend der Ingering-Fm. folgt die Apfelberg-Fm. und mit ihr assoziierte Blockschotter mit mindestens zwei bis drei Tuffniveaus.

Für die Tuffe aus der Seegrabener Kohle bei Leoben ergeben sich folgende Aspekte. Die Tuffe liegen in und unmittelbar über der Kohle ca. 50 - 100 m unter dem Hangendkonglomerat mit einer Vertebratenfauna, die in die MN-Zone 5 (Oberkarpatium/Unterbadenium) eingestuft wird (van der MADE 1989).

Gänzlich aus dem "Schema" fällt eine einige cm-mächtige zu Kaolinit umgewandelte Tufflage im Liegenden des Oberdorfer Kohlenflözes. Sie liegt ca. 75 m unter den von DAXNER-HÖCK (1998) ins Ottnangium (MN-Zone 4) eingestuften Kleinsäugerfaunen in den Oberdorfer Hangendschichten (KOVAR-EDER et. al. eingereicht). Der Tuff liegt unter dem magnetostratigraphischen Polaritätswechsel 5Dr/C5Cn bei 17,6 Ma. (MAURITSCH & SCHOLGER 1998). Damit liegt der erste Nachweis eines prä-karpatischen Tuffes im Steirischen Becken vor. Dies unterstreicht, dass bei einer zumindest teilweisen Herleitung der steirischen Tuffe aus dem Rhyolithvulkanismus des pannonischen Beckens das potentielle Alter der Tuffe auf den Zeitraum Ottnangium – Sarmatium auszuweiten ist.

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Reservoir Evaluation of the Cretaceous Sandstones from the Western Limb of the Abakaliki Anticlinorium, SE-Nigeria

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Three lithostratigraphic units consisting mainly of sandstones were carefully studied and sampled from the western limb of the Abakaliki Anticlinorium. These include: the Agbani, the Owelli and the Ajali Sandstones of Turonian-Coniacian, Campanian and maastrichtian ages respectively. Primary and secondary rock properties were considered in the determination of the reservoir qualities of these sanstone units.

These sandstone units were mesokurtic-leptokurtic indicating primarily a unimodal grain size distribution, fine- to coarse-grained and moderately sorted. The presence of diagnostic heavy mineral suites such as sillimanite, staurolite, zircon, tourmaline, rutile and appreciable amounts of garnet as well as the presence of ubiquitos poly-crystalline and strongly undulose quartz are indications that these sediments were derived from metamorphic and igneous rocks of the adjoining Oban Massif and Jos plateau. The zircon, tourmaline and rutile (ZTR) index percentages calculated for these lithounits show that both the Agbani and the Ajali Sandstones are mature while the Owelli Sandstone is submature.

The probability ordinates and the cummulative plots for these lithounits show very strong similarity, characteristics consisting of the upper two segiments of a normal trisegimented curve which corresponds to the bedload, saltation and suspension loads. These suggest that the lithounits are deposited under fluvial and shallow marine environments.

These sandstone units show an appreciable good properties of porosity and permeability ranging from 19-23.6 % and 3-29 md respectively. Subsurface hydrocarbon indications observed within the Owelli and the Agbani Sandstones put their reservoir capabilities beyond a shadow of doubt.

Geochemical Evaluation and Planktonic Foraminiferal Zonation of the middle Cretaceous Black Shales from Abakaliki Fold Belt, SE-Nigeria

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In this study, organic geochemical analysis specifically Rock Eval pyrolysis, have been used to characterize kerogen type and to determine the level of thermal maturities of the middle Cretaceous black shales from Abakaliki fold belt. Samples from outcrop sections and those from exploration cores were obtained to deduce subsurface information. Lateral and vertical lithofacies variation

maps were constructed from available samples and micropaleontological analysis involving planktonic foraminiferal zonation were used to place depositional environments in time and space. Results of this study indicate that Albian to middle Cenomanian (108-101 my) samples were sparsely fossiliferous and yielded dwarf species such as *Guembelitra cenomana, Hedbergella gorbachikae* and Heterohelix moremani. This interval contains low TOC (<0.5 wt%), poor HI (<150 mg HC/gTOC), high values of Tmax (>465 °C) and kerogen of type III organic matter. The late Cenomanian to early Turonian (100-95 my) samples were characterized by *Rotalipora greenhornensis, Rotalipora cushmani, Whiteinella archeocretacea,* and *Praeglobotruncana stephani.* Within this interval, there is a sharp enrichment in TOC (3 to 12 wt%) with HI fluctuating between 200 and 450 mg HC/gTOC, an average Tmax value of 435 °C and the kerogen is of type I/II indicating exclusively marine condition. *Whiteinella baltica, Marginotruncana sigali* and *Heterohelix globulosa* characterized the middle Turonian to Coniacian (92-86 my) samples. This interval contains moderate TOC (0.5 to 1.5 wt%) with HI less than 250 mg HC/gTOC, an average Tmax value of 427 °C and kerogen is of type II/III indicating marine and continental input.
From these observations, it can be deduced that, there is variation of middle Cretaceous organic matter accumulation in time and space with three depositional cycles delineated. The late Cenomanian to early Turonian organic facies have the highest source-rock potential.

Sedimentological and geochemical evaluation of Lafia-Obi coal, Benue trough, Nigeria

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Seventy-five samples of Lafia-Obi coal, from four boreholes were investigated in the present study to ascertain their sedimentological and geochemical characteristics. These will enahle proper evaluation of their source rock potential and industrial utilization.
Lafia-Obi area is underlain by rhythmic sequences of shale, sandstone and limestone with varying thicknesses of interbedded coal infering deposition under shallow marine conditions. The ash and moisture contents of the coal are high suggesting good potential for steam raising. The relatively low volatiles and high vitrinite/ inertinite content, show that the coal has appreciable coking property. Although, the total organic carbon content exceeded the kerogen threshold of 0.5 wt% for generation of crude oil, the high vitrinite reflectance values (R0 >1.0 %) and several chemical maturity indices indicate mature to „overcooked" facies.
This paper compares and contrasts the geological and geochemical characteristics of the Lafia-Obi coal with those of Enugu coals and with emphasis on the possible economic applications of the former.

Development of the margin of a Middle Triassic atoll-like buildup: the Latemar, Dolomites, Italy

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Most of the studies dealing with the Latemar platform concentrated on the lagoonal interior and the reef (e.g. GOLDHAMMER & HARRIS 1989, SEPM Spec Publ 44; EGENHOFF et al. 1999, Sedimentology 46). Recent investigations of slope successions proved the local development of an escarpment at Corno D'Ega, triggering the collaps of the upper slope after an initial buildup phase. Spectacular breccias crop out, partly in direct contact with lagoonal sediments. Some of the breccia units show rollover structures with inclinations towards the lagoon, probably owing to subsidence along listric fault planes. At the eastern margin of the atoll, at Cresta De Do Peniola, a clear change in the character of the slope was observed, developing from depositional to erosional. Both outcrops are approximately of the same age, they are correlated with the late Tepee Facies to early Upper Cyclic Facies sensu GOLDHAMMER & HARRIS (1989). A possible explanation for these changes might be increased aggradation due to a change of the accommodation rate (from keep-up/progradation to catch-up), causing local over-steepening of the platform and subsequent collapse.
If the passage from the lagoonal interior to the basin is not disturbed, the horizontal sediments of the lagoon pass into upper slope sediments within a few tens of metres. The reef rim, consisting of bound- and bafflestones, is usually extremely small. In a transect at the western platform margin nearby Malga La Mens, talus-breccias of the upper slope follow, passing into lithoclastic grain- to rudstones and microbreccias of the middle slope. Most of the components are derived from the reef rim. In contrast to eastern outcrops (Cresta De Do Peniola), clear indications of biogenic carbonate production were not found. However, growth of cements contributed strongly to the sediment thickness at the Malga La Mens section. Reasons for this difference are not quite clear. Possible explanations could be differences in the distance to the reef, the slope angle, the wind direction and/or currents. Further downslope, stacked turbidites consisting of lithoclastic wacke- to grainstones/rudstones as well as megabreccias/megaconglomerates were found, often encasing sliding megablocks. The facies of the basin margin consists of not seldomly laminated radiolarian wackestones with intercalated carbonate turbidites (lithoclastic pack- to rudstones).
The areal distribution of these facies on the western margin, which are correlatable with the lower 400 m of the about 650 m thick lagoonal succession, outline an obviously complicated paleotopography/paleogeography. Clinoforms clearly indicate the presence of an inlet, bordered by marginal highs in the NW and SW of the atoll. Basin margin facies onlaps the preceding Contrin ramp, early stages of the Latemar carbonates show downlap geometries towards this ramp. In contrast to assumptions of a constantly aggrading atoll (GOLDHAMMER & HARRIS 1989), early stages show progradational features followed by later aggradation. This can lead to the a.m. collaps of the margin because of oversteepening and to its subsequent, local retreat. Backstepping of the entire inner platform was not observed.

Sedimentology and palaeoenvironmental interpretation of the Carboniferous Poggio al Carpino Formation [PaCF] of the Monticiano-Roccastrada Zone [MRZ] (Southern Tuscany, Italy)

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Introduction: The PaCF, first defined by COCOZZA et al. (1978), is element of the Mid Tuscan Ridge - a linear belt of several discretely outcropping metamorphic core complexes, where the S-Tuscan Low Grade Metamorphic Basement is exposed (JOLIVET et al. 1998); it is made up of palaeozoic epicontinental marine sediments, unconformably covered by the ?M -Triassic terrestrial Verrucano.