Lacustrine archives as records for the input of anthropogenic and geogenic pollutants over the past 50 years: An example from Northrhine-Westfalia, Germany

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Over the past 50 years, policy changes, developments in industrialization, urbanization and technical developments have resulted in a constantly changing input of pollutants into the environment. In order to trace these developments in high temporal resolution, geological archives were utilized. Water reservoirs provide ideal archives to trace the input of geogenic and anthropogenic pollutants into the environment. They are characterized by generally high sedimentation rates and well documented records of water quality and, hence, allow to quantify the changing pollutant input at high temporal resolution.

To monitor the pollutant record of a highly industrialized area of Germany, Northrhine-Westfalia, we study the sedimentary record of 5 water reservoirs from urban areas. Those are compared with areas of low industrialization and population density. The approach of our study is to date water reservoir sediments in high temporal resolution by cesium and lead isotopes. In combination with varve-counting in ideal cases a sub-annual resolution can be achieved. The resultant chrono-stratigraphic framework is used to trace pollutants such as PCBs and PAHs over the past 50 years.

The aim of our study is to provide a basis for policy-makers to evaluate the efficiency of regulations and laws and predict the long ranging effects of environmental legislation.

Basin evolution and hydrocarbon formation in the Timan Pechora Basin (Barents Sea, Russia) – A numerical modelling stndy

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The TPB is one of Russia's most perspective hydrocarbon basins. It is situated in the north-east of European Russia adjacent to the East European Platform (Timan Ridge, Fig.). To the east the basin is bounded by the Uralian mountains and their foreland basin (Pay Khoy Depression). On the north the TPB extends to the Barents Sea to increasingly larger depths in the same direction.

Basin evolution started with two major rifting phases during Ordovician and Silurian times in a continental passive margin setting. The subsequent paleozoic burial history yields a stepwise pattern with alternating increasing and decreasing sedimentation rates. The major part of the sediments has been deposited in a shallow marine carbonaceous platform environment. During the Permian/Triassic sedimentation and tectonics are mainly controlled by the Uralian orogeny and the Europe-Siberia continental collision. Permian and Triassic sediments represent an alternating shallow marine and continental alluvial environment. Maximum burial of the pre-Uralian foreland depression is reached at the Trias-sic-Jurassic boundary. The early Jurassic is considered as a major phase of regional uplift and erosion and the associated formation of structural hydrocarbon traps. Late Jurassic, Cretaceous and Quaternary sediments lay unconformably on top of the Palaeozoic and the Mesozoic basin infill.

Concerning hydrocarbon exploration several potential hydrocarbon source rocks have been detected in Ordovician, Silurian, Lower Devonian, Upper Devonian, Lower Carboniferous, Lower Permian and Upper Triassic sequences. Although the Upper Devonian Domanik shale (Kerogen type II) is considered to be the most important hydrocarbon source, recent oil to source rock correlations (ABRAMS et al. 1999) gave evidence that potential source rocks from older stratigraphic intervals might also contribute to a considerable extent to the charging of already known hydrocarbon accumulations (Gulyaevskoye, Prirazlomnoye, Medynska; all Permo-Carboniferous reservoirs) or even the filling of traps in deeper and still unexplored levels. Potential reservoirs are Ordovician clastics, Silurian reefs and Lower Carboniferous-Lower Permian carbonates.

The basin modelling software PetroMod-2D (IES GmbH; Jülich, Germany) was used to reconstruct the burial history, the hydrocarbon potential and timing of hydrocarbon formation along a 2D seismic line in the southern off-shore part of the TPB. The section covers the Koreyver Depression, the Sorokin (paleo)swell and parts of the Varandey-Adzvin structural zone within the Pechora Platform. The computer software uses a forward modelling approach based on finite element networks. Prior to modelling a specific input data set (structure, stratigraphy, lithology, (paleo)geothermy and (paleo)bathymetry is required. For modelling the source potential of relevant horizons geochemical data like TOC and HI values have been implemented. The models were calibrated using borehole temperatures, vitrinite reflectance data and pressure information gained from production wells.

Modelling revealed that, depending on their stratigraphical and structural position and on the heat flow evolution in the basin, the individual source rocks generated hydrocarbons from the Upper Devonian to recent times (Fig.). With respect to the HC generation zone early Paleozoic rocks are still mature in anticlinal structures. Upper Devonian, Carboniferous and Lower Permian organic-rich sediments still remain within the oil window but have partly reached the stage of gas generation in major depressions with higher depths of burial. Upper Triassic shales are immature in the southern Barents Sea and thus do not contribute to HC accumulation in this area but might be generative towards the north direction where burial depths and formation temperatures increase continuously. A fit between observed and calculated coalification and borehole temperatures was reached when applying low present day heat flows between 45 and 55 mW/m², whereas during early paleozoic rifting strongly elevated heat flows between 80 and 100 mW/m² can be assumed.

Future modelling steps should give insights into the temporal and spatial evolution of HC expulsion, migration and accumulation with relation to structural trap formation.

ABRAMS, M.A. et al. (1999): Oil families and their potential sources in the northeastern Timan Pechora Basin, Russia. - AAPG Bulletin, vol. 83, no. 4: 553-577.

Zementsequenzen in mitteldevonischen Mud-Mounds des südlichen Ahnet-Beckens (algerische Sahara) - Aufzeichnung einer Diagenesegeschichte

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Im Ahnet-Becken (Süd-Algerien) entwickelten sich während des Mitteldevons Mud-Mounds in einem tief-subtidalen Ablagerungsmilieu. Im primären Hohlraumsystem (Stromatactis-Gefüge) dieser Mounds kristallisierte eine Abfolge von Kalzitzementen, die eine Diagenese-Geschichte vom marin-phreatischen bis zum tiefen Versenkungsmilieu nachzeichnet.

Die erste Zementationsphase fand im marinen Milieu durch radiaxial-fibröse Kalzite (RFCs) statt. Diese bilden isopache Säume