

Recent riverine input of pollutants into Lake Harkort (Northrhine-Westphalia, Germany) studied by geochemical analysis of surface sediments

WIESENBERG, G.L.B., KAMP, H., REGIER, A., LEYTHAEUSER, D. & SCHWARK, L.

University of Cologne, Institute of Geology, Zülpicher Str. 49a, 50674 Köln, Germany

As a consequence of heavy industrialization since the 19th century, several main rivers within Northrhine-Westphalia became strongly polluted by industrial and urban sewage output and other sources. One of these rivers, the Ruhr, runs through the industrial area of the "Ruhr-region" from east to west and intersects several local industry centers. Over the last decades the economic structure of this region changed severely, with diminishing heavy industry and coal mining. This change in utilisation, the progress in cleaner production techniques and the greater environmental awareness within the population led to an improvement of river water quality. The water quality of the River Ruhr also improved over time, but this river as well as its tributaries in places are still polluted, as documented in continuously published water quality reports.

Along the River Ruhr, several flow-through lakes and reservoirs exist which are utilised for recreational purposes and water management. These lakes act as sediment catchment areas and provide excellent archives to study the long-term, i.e. month to several years, averaged pollution load of the rivers.

The recent input of pollutants into Lake Harkort, a Ruhr-reservoir near the city of Hagen, was determined based on surficial sediment analysis including those of the major tributaries of the catchment area. Geochemical and sedimentological analysis was performed on two grain size classes for 24 sediments, including determination of total amounts of carbon and sulphur, organically bound carbon, and magnetic susceptibility. Following organic solvent extraction by ASE and liquid chromatography separation (two-step MPLC) detection of selected pollutant classes like PCBs and PAHs was achieved by GC/MS.

Distribution patterns and origin of the pollutants from Lake Harkort and its tributaries will be discussed.

New sedimentological aspects of the glaciogenic Al-Khlata-Fomation (Permo-Carboniferous) on the southwestern flank of the Huqf axis (Oman)

WITTE, J.* , SCHÖNICKE, O.** , SATTLER, C.-D.* & KULKE, H.*

*Department for Petroleum Geology, TU Clausthal, **Schlumberger Overseas, Muscat, Sultanate of Oman

On the southeastern Arabian Peninsula (in the Sultanate of Oman) the permocarboniferous Gondwana Glaciation resulted in the deposition of the extremely heterogenous siliciclastic Al-Khlata-Formation (e.g. BRAAKMAN et al. 1982). The glaciogenic formation is of great importance for Oman's petroleum industry since its sandy parts host major oil reservoirs. Particularly in southern Oman many oilfields are producing hydrocarbons from these Al-Khlata reservoirs. The main problem in exploration and production arises from the very sudden lateral and vertical changes of lithofacies. Therefore geological investigations have been carried out recently in a study area on the southwestern flank of the Huqf axis where the best outcrops of the Al-Khlata-Formation are found. Here the formation's thickness of only 70 m (up to 750 m in the adjoining basin (BRAAKMAN et al. 1988)) is due to condensed sedimentation on the Huqf axis.



Fig. 1: The lowermost tillite of the Al-Khlata-Formation (bright rock at back, height of wall 5m) directly overlies intensively striated dolomites of the sedimentary basement (Precambrian). View towards the NE (= ice flow direction). Striation pavement, Wadi Al Khlata South, Oman.

The geological investigations encompassed extensive field work as well as a series of sedimentological methods such as thin section microscopy, SEM, X-ray diffractometry and grain size analysis. The following new aspects concerning sedimentology and depositional environment of the Al-Khlata-Formation have been derived:

Geological surface mapping and columnar profiling are summarized in a type section showing three distinct layers of tillite. These indicate that the permocarboniferous ice sheet prograded over the study area for at least three times. Statistical clast counts in different lithostratigraphic units clearly reveal a changing spectrum of the clastic material over the time.

The percentage of igneous and metamorphic clasts increases towards the younger tillites, revealing a progressing glacial abrasion deeper and deeper into the crust in the derivational area.

The following sedimentological parameters of the Al-Khlata-Formation have been confirmed: An intensively striated basement (see Fig. 1) and the occurrence of tillites containing blocks up to several meters in diameter prove the glaciogenic origin of the formation. Statistical strike-and-dip measurements of cross-bedding and glacial striations give evidence for a NNE to NE oriented palaeogradient. This fact clearly contradicts the theory of AL-BELUSHI et al. (1996) who claimed the ice flow to be SW oriented.

AL-BELUSHI, J.D., GLENNIE, K.W. & WILLIAMS, B.P.J. (1996): Permo-Carboniferous Glaciogenic Al Khalata Formation, Oman: A New Hypothesis for Origin of its Glaciation. - *GeoArabia*, **3**: 389-404, Bahrain.

BRAAKMAN, J.H., LEVELL, B.K., MARTIN, J.H., POTTER, T.L. & VAN VLIET, A. (1982): Late Palaeozoic Gondwana glaciation in Oman. - *Nature*, **299**: 48-50, London.

BRAAKMAN, J.H., LEVELL, B.K. & RUTTEN, K.W. (1988): Oil-Bearing Sediments of Gondwana Glaciation in Oman. - *AAPG Bulletin*, **72**: 775-796, Tulsa.

Palaeocurrent analysis on the glaciogenic Al-Khlata-Fomation (Permo-Carboniferous) on the southwestern flank of the Huqf axis (Oman)

WITTE, J.* , SCHÖNICKE, O.** , SATTLER, C.-D.* & KULKE, H.*

*Department for Petroleum Geology, TU Clausthal, **Schlumberger Overseas, Muscat, Sultanate of Oman

The very heterogeneous Al-Khlata-Formation was deposited during the permocarboniferous Gondwana Glaciation in the southern